MINETA NATIONAL TRANSIT RESEARCH CONSORTIUM

A Study of Factors that Inhibit and Enable Development of Sustainable Regional Transit Systems in Southeastern Michigan

Social Equity, Mobility, and Access

One of seven final reports resulting from this project.

MNTRC Report 12-22

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REPORT 12-22

A Study of Factors that Inhibit and Enable Development of Sustainable Regional Transit Systems in Southeastern Michigan

SOCIAL EQUITY, MOBILITY, AND ACCESS

One of seven final reports resulting from this project.

Alan Hoback, SC.D., PE

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16. Abstract

This report discusses how transportation policies can aggravate or alleviate social equity problems. Current transit systems (Detroit, Atlanta, Cleveland, Denver, and St. Louis) were studied with respect to their strategies and relative success in remediatiating social inequity as compared with Detroit's transit systems. The five cities were studied with respect to the number of employment opportunities available within transit distance. Not surprisingly, Detroit Metro was shown to offer fewer opportunities than elsewhere. A recommendation was made for more effective basic bus service in Metro Detroit as a means of improving job equity for residents.

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EXECUTIVE SUMMARY

Social equity is tied to access to jobs and other destinations. In the past, this has limited employment and other opportunities for low-income residents and others with limited means of travel. This has been especially true for minority residents, as access to jobs has taken racial segregation tones through the 1900s.

The same factors were at play in Detroit as throughout the country to cause sprawl, low-density developments, and lack of opportunities for minority residents. However, those factors were worse in Detroit, partly because the predominant industries and types of employment had weak pressures to cluster in or near downtown areas. This has produced an economic and transportation system with great inequity.

Transit captive residents have very limited choices in where they can work in the Metro Detroit. Transit captive and drivers are certainly not equal in the number of jobs that each can reach.

Bus riders originating in the city of Detroit can reach between three and nine percent of the jobs that someone driving a car can reach in one hour (with an average of six percent of jobs accessible). Using different methodology, Brookings found Metro Detroit job access to be 22 percent.

The scenario is much worse for suburban residents that are transit captive. They can only reach between zero and nine percent of jobs that a driver can reach (with an average of two percent of jobs accessible).

It is unlikely that improvements in transit will be able to make opportunities completely equal, but significant effort should be taken to make it more equitable. Results are presented that show how access will be changed with addition of new transit resources.

I. INTRODUCTION TO THE PROJECT

This report focuses on the social equity and access concerns involved in creating reliable, efficient and affordable regional transit systems and service in the Metro Detroit region. The overall study of *Factors that Inhibit and Enable Effective Regional Transit in Southeastern Michigan* was undertaken by 12 researchers from the University of Detroit Mercy, and was funded by the U.S. Department of Transportation (through the Mineta National Transit Research Consortium) and the Michigan Department of Transportation. The extended team of researchers visited four comparable regions, Atlanta, Cleveland, Denver and St. Louis.

For many years, efforts to develop effective regional mass transit in Metropolitan Detroit have been thwarted by a wide variety of factors. These include conflicting interests of various governmental agencies and individuals, legal barriers, funding issues, labor/jobs issues, perceptions of competing objectives of transit-oriented development and commuter service, public opinion regarding transit and spending priorities, rider concerns (and perceptions) regarding safety, and even ethnic prejudice. For decades, efforts to integrate regional bus services have failed, leaving Southeast Michigan (the Metropolitan Detroit region) with three transit agencies (Suburban Mobility Authority for Regional Transportation (SMART), Detroit Department of Transportation (DDOT) and Ann Arbor Transportation Authority (AATA)), that serve three distinct areas of the region, with poor interfaces between them.

SMART and DDOT systems are struggling financially and have within the last year cut service and considered raising fares. This study sought to learn from Detroit's history and the successes and failures of other regions to better understand the factors that enable and inhibit successful regional transit, and allow our region to move forward to build such systems.

Southeast Michigan has, or can secure, all of the technical tools needed to successfully implement effective regional public transit. However, these resources need to be organized and managed in ways that bring about substantive improvements to the operation of current transit assets and the development and funding of transit expansion.

II. HISTORICAL DETROIT

WHY HISTORY

One factor in how well urban and suburban residents and political systems presently interact is the history they share. If residents see themselves as part of a larger center of economic activity, then they are more likely to coordinate their actions. Likewise, people are more willing to help people with whom they feel a connection. This generally means that suburban residents are less likely to care about equity issues unless they feel that it is necessary for the success of the entire metropolitan region.

The history of equity and economic growth in a region is controlled by what comes before, and it determines the range of possibilities for what follow. The current fate of the city is a result of how power and resources were previously distributed.[1] In other words, the equity mentality of the community as a whole is slow to evolve. An example is, if previous economic and political activity have made groups feel unattached to each other, then they will not suddenly come together to make political decisions that support the whole region.

As mentioned above, having significant disparities in income is currently a strong indicator of previous inequity. It is also a measure of current inequity, because if people had equal opportunities, then they would have more similar educational backgrounds and incomes that are more similar. However, working towards social equity is a long-term effort. There is no fast way to build education, job experience and property ownership. Therefore, there is a tie between history and current social equity, at least because inequity is not a situation that can be resolved in a short length of time.

Resolving inequity is tied directly to changing people's opinions. The history of inequity that produced this cannot simply be neglected, because the people likely still harbor some of the opinions that produced the inequity. Without changing how people think, there will be a predisposition to keep to the old ways of thinking. This is an inhibitor for improving equity. People's opinions determine the range of what is possible, and so control future decisions.

One tool for bringing groups together is to promote community economic identity. Community economic identity is the belief in economic theories that metropolitan areas grow as a whole; therefore, all people benefit when any one person benefits economically. This is supported by economic theories of the multiplier effect; that is, as economic activity occurs in a region, it stimulates other economic activity within the region and becomes a reinforcing loop. Specifically related to transit, access to jobs increases a region's production function. Production (Q) is the total effect of use of capital (K), labor (L), resources (R), and technology (T):

$$Q = f(K, L, R, T)$$

A city has economic growth if one or more of K, L, R, or T changes. By providing access to jobs, economic growth is spurred.[2]

Although employing a principle of economic theory is only one means to bring people together, it is the most relevant to public projects. People associate themselves more

economically than socially with other racial groups.[3] Over time, identifying with a whole region economically can promote more social integration.[4] The history of this region gives the starting point from which planners need to begin work.

HISTORY RELEVANT TO EQUITY, ACCESS AND MOBILITY

The history of equity in a metropolitan area is the history of interactions between people of various incomes. It is closely tied to transportation because access to opportunities through transportation or otherwise is a primary indicator of equity.

From the 1920s through the 1950s, Detroit amassed great wealth. There was greater upward economic mobility. The upwardly mobile were recent immigrants from Europe who worked in industries related to automotive production.

The attainment of wealth caused unique residential development patterns in Detroit.[5] European ethnic groups centered within parish boundaries and worked for the same automobile related companies. African Americans were almost wholly left out of the upward mobility.

With respect to transportation, Detroit's wealth created low-density housing that is atypical of other large cities.[6] Such low-density housing makes Detroit especially difficult to have effective transit. Although Detroit had a history of successful trolley systems and interurban railways, the rapid rise of the middle class in Detroit fueled the adoption of automotive transportation. This influenced planning decisions to make the city look more automotive friendly than transit friendly.

AGGLOMERATION ECONOMIES

The economy generated by the automotive industry began to soften in Detroit after 1953, a trend that has continued to this day.[7] One of the many reasons was mechanization that allowed fewer workers to produce as much as before. Also, changes in assembly line practices made the multi-level automotive factories obsolete. Finally, improved transportation systems brought about by that very industry meant that access to the Great Lakes was less important. The factories began to relocate to the suburbs and U.S. southern states in the decades that followed.

Detroit's major problems after 1953 were partly because automotive production had lower agglomeration economies. Large cities are sustained by the economies of agglomeration, which means that certain types of trades benefit when they are concentrated. For example, it is well known that business and finance activities are centered in cities. Business and finance represent a larger share of employment in certain regions of the country than in others. See Figure 1.

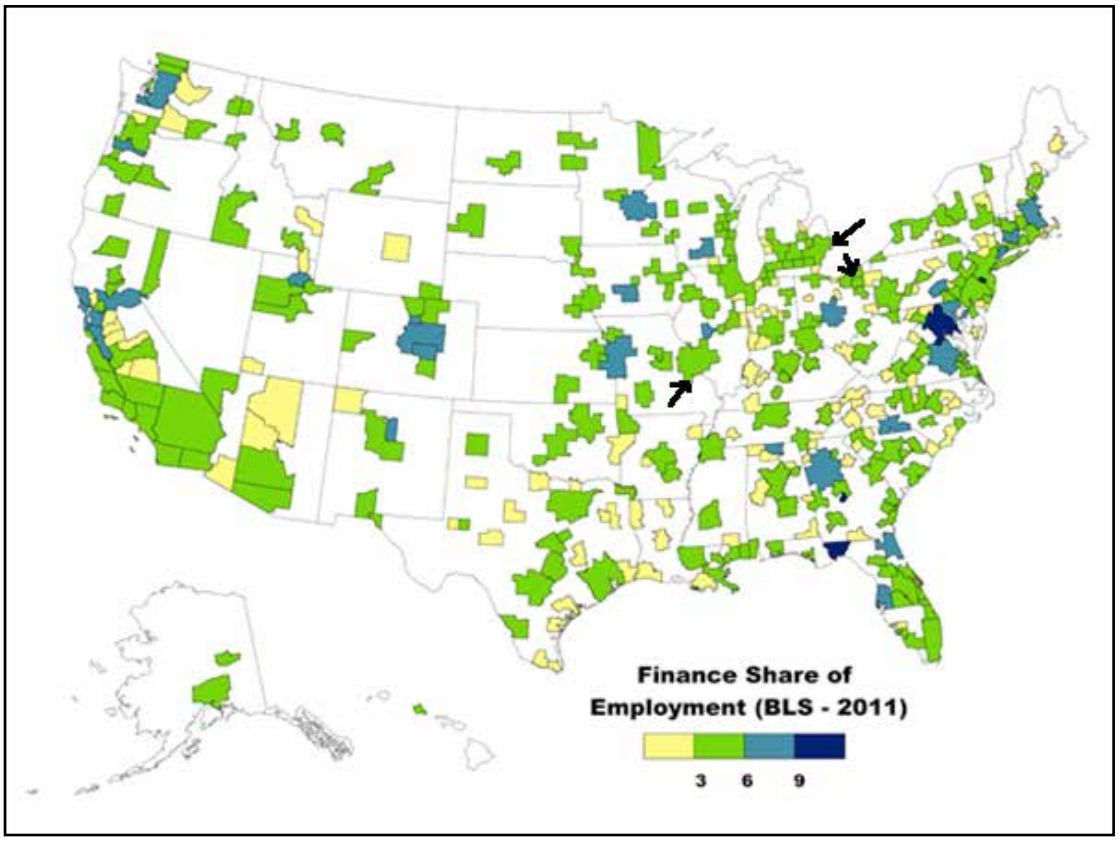

Figure 1. Finance Sector Employment Percentage, 2011

Source: United States Bureau of Labor Statistics, "Occupational Employment Statistics" [Finance Sector Employment Rates], 2011.

Notes: This map displays regions with employment in the finance sector as percentage of all employment sectors, and range from 3% (yellow) to 9% or greater (dark blue).
Black arrows point to:
1. Uppermost arrow: Metro Detroit, Michigan.
2. Middle arrow: Metropolitan Cleveland, Ohio.
3. Lowermost arrow: Metropolitan St. Louis, Missouri.

Note that Metro Detroit (near the topmost arrow) is among the lowest in percent employment in the area of finance compared to other large metropolitan areas. The highest employment areas are centers of import and export. The industrial cities of the Midwest, such as Chicago, St. Louis (lowermost arrow) and Cleveland (middle arrow) have lower finance employment, similar to the level of Metro Detroit.

Industrial, and especially automotive manufacturing, do not support the high levels of employment in fields requiring agglomeration for efficiency. Instead, automotive industries have tended to create their own economies in suburban locations in Southeast Michigan. See Figure 2 and the discussion for further support of this. Being too close to one another could be a detriment to automotive design and production, because closeness could promote the loss of trade secrets.

Ford Motor Company's business and engineering center is located in Dearborn, Michigan. Chrysler's headquarters and technology center is located 35 miles away in Auburn Hills. Until 1996, General Motors had its headquarters in the New Center area of Detroit (which

is inside the city limits), but three miles north of downtown. Their Technical Center remains in Warren, Michigan. Both Ford's and General Motors' engineering centers border Detroit, but Chrysler's is located in the outer parts of the urbanized area of Metro Detroit.

Mechanical engineering is a professional area that is closely linked to the automotive industry. Figure 2 demonstrates that little agglomeration is necessary for mechanical engineering business. In this application, the location quotient is the same as percent of employment. (A location quotient can have many interpretations depending upon use. The goal is to show economic uniqueness of a region.)

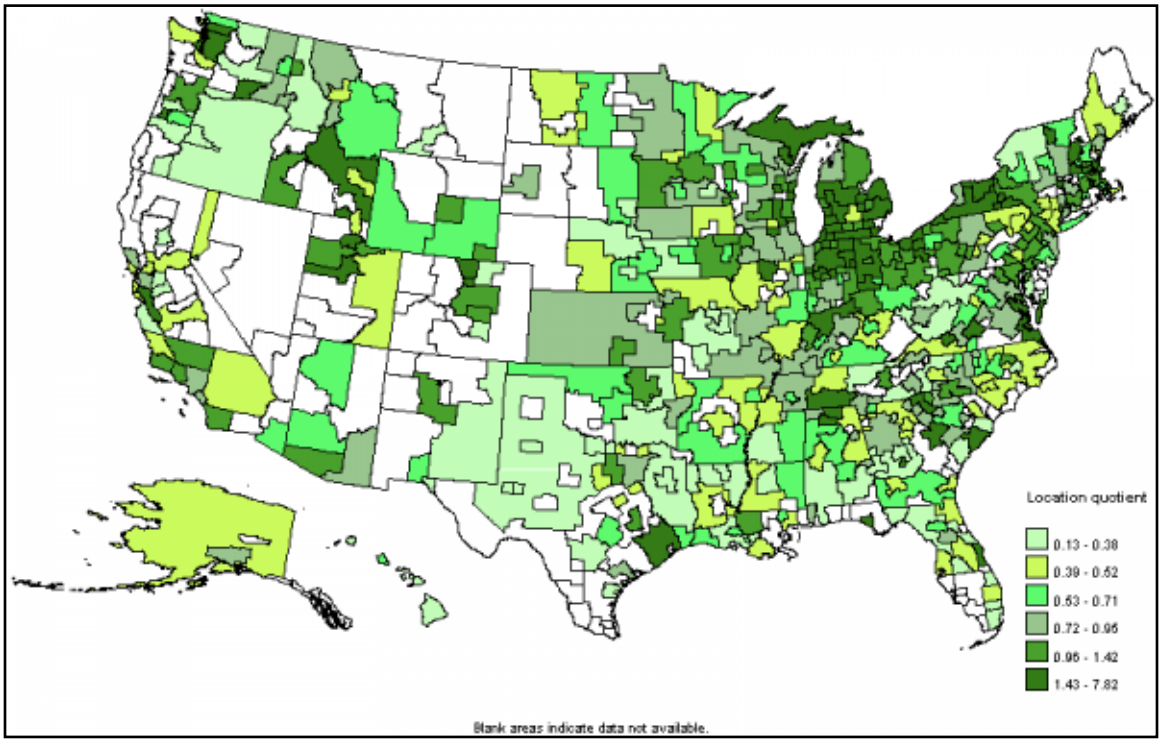

Figure 2. Mechanical Engineering Employment Location Quotient, 2011

Source: United States Bureau of Labor Statistics, "Occupational Employment Statistics" [Mechanical Engineering Title Employment Rates], 2011.

Note that mechanical engineers are not necessarily concentrated in populous metropolitan areas. Instead, they are located in pockets of different industry types throughout the country, especially in the Midwest. For example, Cape Canaveral is among the largest employers of mechanical engineers in Florida by rate of employment. Also, note the white-colored area in Southeast Michigan (representing location quotient less than 0.13). This is Wayne County, which includes Detroit.

Therefore, industrial employment of technical professionals, especially the automotive industry, does not necessarily promote strong core cities. Industrial cities such as Chicago have strong downtowns when they adopt other industries such as retail or finance.

That dynamic changed because of the successes of the automotive and trucking industries. Before the widespread implementation of the highway and freeway systems, agglomeration was a much stronger force earlier than afterwards.[8]

Several factors pushed automotive jobs out of the city of Detroit. Certainly one factor was that there was no need to bear the higher expense of operating in the city.[9] Higher expenses are the push that is outweighed by the pull of agglomeration economies, which creates cities. To some degree, this story is repeated in each metropolitan area in the nation.

The West Side Industrial Area is an example that Detroit city planners did not understand agglomeration economies. The West Side Industrial Area borders the central business district (CBD) of Detroit on its southwest side, and lies between Corktown and the Detroit River. City Planning approved zoning (circa 1960s) so that new industry could locate near the city center.[10] However, the efforts are now largely considered a failure. Concentrating on commercial employment may have been more fruitful. In the last few years, examples of job growth downtown are Compuware, and Dan Gilbert's enterprises such as Quicken Loans. It appears companies related to information technology are concentrating downtown, although General Motor's headquarters remains in the Renaissance Center (in downtown Detroit).

A lack of need for agglomeration has influenced mobility in Detroit. The strong push of jobs to the suburbs because of the very weak pull of agglomeration is one reason for Detroit's poor transit systems and its related need for improvements in social equity. Southeast Michigan has, at times, had the highest disparity in incomes in the country and is now still among the highest.[11]

Caring will increase if a feeling of similarity is developed between suburban and urban residents because people help others similar to themselves.[12] Social equity is more likely to exist when people in a region care about the core city. If their personal economies are weakly tied to the core city, then they have lower personal motivation to care, but increasing shared traits, such as a feeling of a single metropolitan economy, will improve relations. If they do not care, then the people who live there do not matter to them as much, and the transportation infrastructure there does not matter either.

The history of economic and social relations sets the pattern for how groups interact with one another, and their identity as part of the larger city. In order to change, there has to be an image of the core city as being economically important to the entire metropolitan area, and there has to be a valid economic justification for it.

As the opinions about the core city changes, political decisions will start to sway in favor of policies that support core city infrastructure. This will in turn affect the social equity of city residents by providing more transportation and economic opportunities. Both the history and current trends of a metropolitan area influence decisions related to equity.

III. TRANSIT LESSONS FROM FOUR PEER REGIONS

DEFINITIONS

In order to compare transit in Atlanta, Cleveland, Denver and St. Louis, a common basis of measurement must be defined. Social equity and access especially have differing interpretations to different people. Therefore, definitions are needed.

Mobility

Mobility is a measure used in evaluating transportation systems. It is a quantification of how far people can travel. Its primary measurement is speed. Therefore, it neglects other issues that are important to travelers, such as convenience and comfort. In addition, since U.S. cities are automobile-dominant, an increase in traffic travel speeds is considered a success, even if it results in a negative impact on pedestrian and transit travel. Since pedestrian and transit travel modes are used by fewer travelers than automotive travel, they are weighted as less important. In an analysis of transit, mobility should not be neglected, since transit improvements should not adversely affect mobility.

Access

Access is a measure of whether a person can get to their goal destinations. When traveling by transit, access is usually the combined set of destinations reachable through pedestrian and transit travel. Rather than speed, which is the measure of mobility, the number and type of destinations is the measure of access. A time limit is applied to cap the reasonable distance to reach the destinations.

Social Equity

Social equity is a term that is applied to whether benefits and/or detriments of a public project are applied equally among groups of people, regardless of social or economic standing. In transportation, benefits might include where money is spent to expand roads, repave roads, or improve a transit system. The detriments might include how much each person is taxed to pay for the benefits, or it could include impacts, such as worsened air pollution, or reduction of other viable transportation methods for the benefit of another.

Effects are commonly compared between groups of different races or ethnic backgrounds, income levels, and locations. Attempts to analyze social equity can have a wide range of purposes. On the one hand, social equity can be a means to ensure that benefits or detriments of public projects are fairly distributed. For example, some might argue that a fair distribution of impacts means that those who benefit directly or indirectly from a public project should be the ones who pay for it. On the other hand, public projects could be used to remediate historic inequity of public projects. This argument would support using more public resources for those in poverty, even if they do not pay the majority of the cost of the project.

Taxes are the most common measure of detriments of a project, but others are also used. According to the idea of direct benefits discussed above, those paying the taxes should

be the ones who benefit. However, there are several possible rationales for using those public resources to help those with lower incomes. For example, projects that promote higher levels of automotive commuting cause more pollution – negatively impacting all people; but particularly impacting those with fewer health resources. Therefore, since the detriments are spread across all people, then some additional benefits should be found to support innocent bystanders adversely affected by the project.

SOCIAL EQUITY ISSUES IN TRANSPORTATION

At a minimum, social equity is used to make sure that no groups are unequally harmed by a transportation project. However, social equity analysis can be used to distribute fairly all benefits and detriments of a project, or to plan to spur economic development among lower income levels.

Why Social Equity in Transportation

The basic assumptions about how society should function are tied to ways that we think about how we are related to others. In societies that highly value individualist behaviors, people are more likely to make judgments about society based on how it influences them directly.[13] If they do not use a public amenity directly themselves, then they may believe that they do not benefit from it.

Public decisions are made based upon the assumptions about society. In turn, these decisions shape society to fit the predetermined mold and reinforce the assumptions that generated it.

To make substantial change requires new thinking patterns. Transportation is a significant part of the fabric of society because it determines location and types of interactions between people. To change society through transportation requires new types of thought.

In a society that highly values individualism, it is more likely that people would support projects that are paid for only through user fees, and less likely to support public financing. The rationale for this is that the public needs to get value for what they paid. However, our society is filled with examples of projects and resources (implemented for the common good) that we, as citizens, willingly pay for, but may never personally use or need, such as specific roads, fire protection, recreational parks, etc.

Individualist thought more highly supports individual modes of transportation such as automotive travel.[14] Individuals purchase or lease their own vehicles, pay for their own garage and parking fees. They drive themselves to their destinations.

Thinking only with self-interest can neglect indirect benefits. For example, paying for a project that reduces congestion would directly benefit those who would commute more quickly, but would also improve air quality for all people in the area. Even projects that cause economic development have a benefit on everyone because the regional economy improves.[15]

Having a strong community identity makes people more willing to see how indirect benefits from projects will benefit them. When they value everyone in a community, they are less likely to be resentful that someone else is directly benefiting from public projects.[16]

Social equity measures can be used to at least ensure that public projects are not making life worse for any single group. It is especially important to look at the impact on lower income people, because they are less able to adapt to change in economic or social conditions. Whereas a wealthier person is able to "vote with his feet" (or car) when given choices of transportation options, a lower income person does not have the same options. If a wealthier person is adversely affected by transportation options, he is likely to still have multiple options available. However, lower income people frequently have only one option for transportation. For example, bus access strongly correlates to weeks worked per year among lower income people. A person cannot hold a job if he cannot get to work.[17] Therefore, anything that affects this low-income group could have more dire consequences.

Impacts

Direct and indirect impacts from projects affect people throughout a whole region. An indirect impact on someone is also called an *externality* because it is the effect of external decisions upon the individual's quality of life and contributes to what that individual is capable of accomplishing.

An example of an externality commonly mentioned in social equity discussions in transportation is the level of air quality with respect to automobile use. On average, air pollution is much worse in urban areas where lower income people are concentrated, than in suburban and rural areas. This air pollution is largely a contribution from suburbanites commuting to the urban area, because urban residents travel shorter distances and use more efficient means of travel, such as public transit.[18]

The pollution that is generated is an externality upon the urban resident. This pollution causes negative health impacts, such as increased asthma rates in urban areas. This causes urban residents to pay more for health care than they would otherwise, reduces income that they can earn because of sick days, and shortens life spans. In Detroit in 2011, 19 percent of residents were considered disabled.[19] One cause of this was asthma caused by poor air quality. Other causes were poor access to health care and documented discrimination by race and ethnicity in placing certain workers into hazardous jobs.[20] No matter the extent of their contribution to the problem, suburban commuters do not pay the true cost of driving automobiles.

Inequity, in this case negative externalities on urban residents, can also be seen in allocation of transportation funding. Low-income and urban residents are much more likely to walk as a primary mode of transportation. In the U.S., non-motor trips are 20 percent of total trips. However, improvements that facilitate such trips (such as walking paths or sidewalks) account for only two to five percent of transportation funding.[21]

Efforts to improve urban traffic congestion sometimes have unintended adverse effects, such as worsening pedestrian travel. By adding more traffic lanes or increasing traffic

speeds, pedestrian travel can become more difficult, or less safe. It is an inequity to improve transportation for one group at the expense of another, even if the group receiving the benefit is paying for it directly.

Levels of Social Equity

Social equity has many manifestations in public policy. Some have more self-centered motives of getting value, and some are more rigorous and dedicated to impacting minorities and low-income people. In this research, these are arranged into three levels of increasing influence on disadvantaged people.

1. *Layman's Equity:* Fair distribution of benefits and detriments (e.g., getting value for taxes).

2. *Consideration:* Attention to people who are less adaptable to change (e.g. disabled), and to make extra effort to ensure that externalities (e.g., walkability, economic development, environmental impact) do not adversely impact them.

3. *Equality:* Social Engineering to mitigate existing inequities (e.g., remediation of previous inequity, access to jobs).

Environmental Justice

The term Environmental Justice (EJ) has been used in the transit industry to represent social equity efforts. However, EJ has multiple meanings. One authoritative definition comes from the Environmental Protection Agency (EPA):[22]

> Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

Summary of Executive Order 12898:[23]

> It makes achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

The EPA definition of EJ essentially means that pollution and other environmental impacts should affect equally all people. Although this requires the meaningful involvement of all groups, it does not require the special consideration for people with less adaptability to change. Therefore, it fits in the levels of social equity as Level 1: Layman's Equity.

Executive Order 12898 is the regulation that currently applies to operation of federal agencies. Since transit agencies get federal funds, they refer to this form of EJ when dealing with social equity. By requiring evaluation of disproportionate impacts on sensitive populations, it fits the social equity definition as Level 2: Consideration.

The Civil Rights Act of 1964 is another federal policy that influences how agencies deal with social equity. Although it is not termed as EJ, it has the same effect of consideration of impacts of projects on minorities. Title VI is the main section that specifies the work of federal agencies. It requires that agencies not discriminate, but also that their projects not have disparate impacts upon minorities. By disallowing discrimination, Title VI enforces Level 1 of social equity, because it requires that no group be disproportionately affected. However, because the disparate effects clause essentially says that unintentional impacts must be avoided; all federal projects must take the next step to consider the impacts specifically on minorities. Practically speaking, Title VI requires Level 2 of social equity by considering minorities. Transit agencies use Title VI as defined by Urban Mass Transit Agency (UMTA), predecessor to the Federal Transportation Agency (FTA) in 1991.[24]

None of the regulations requires that disadvantaged populations receive more than an equal share of the benefits of transportation projects. There is no requirement to employ social engineering to improve the quality of life of minority or low-income populations. It only requires that they be treated equally, with consideration for their special conditions.

DIFFERENCE BETWEEN MOBILITY AND ACCESS

There are two markets for transit, “transit captive” and “choice” riders. Lower income people are often transit captive or transit dependent riders. This means that their only option for getting to their destinations is transit and modes paired with it, such as walking. Choice riders are those who have other options besides transit but choose to ride transit. They may have other options because their income level supports vehicle ownership.

For someone who is transit captive, the places that are accessible are limited to where the transit lines run. Travel time is a factor for regular destinations, because most people do not travel more than about 1.5 hours to work, school or shopping.[25] However, if they must go to a certain destination, their only question is whether they can get there at all. The availability of transit limits their potential for earning an income, schooling and generally participating in society.

Choice riders are not limited by the availability of transit. They ride transit for many reasons, which could include saving money, environmental concerns, or convenience in congested areas. Choice riders sometimes reside near transit lines for convenience. If transit is not available to a destination that they must go to, then they can choose another travel mode to reach there.

Riders from the suburbs, who commute to the urban area for work, are more likely to be choice riders because of patterns of wealth in metropolitan areas. As well, they are more likely to combine travel modes of commuter rail or express bus with driving to park-and-ride lots. Basic bus service that makes frequent stops is too slow for suburban to urban

travel, so choice riders would not use them, but would use faster modes. If the mode is too slow, they are more likely to choose another mode such as driving. Although choice riders use transit, they think of it more in terms of personal mobility such as how quickly and conveniently they can get to their destination.

Suburban choice riders are more likely to support funding of express or rapid transit systems that take them directly from their nearby residence to their destination, such as workplaces.[26] They are less likely to support basic bus service because they use it less. Combining a ride on rapid transit with a bus ride adds too much time for many choice riders, so existing choice riders are more likely to ride if they reach their destination in one unlinked trip.

Commuter rail usually requires multi-modality when urban residents are reverse commuting to the suburbs. The suburban destinations have much less density of jobs, so those riders need to move around more to their final destination.[27] Without it, commuter rail transit is not as effective for reverse commuting and primarily serves suburban residents. Therefore, urban residents are less likely to support commuter rail because it adds sparse job opportunities for them.

Conversely, transit captive people are limited by the availability of effective basic bus service. Urban residents often have fewer opportunities where to work, so they are often limited to opportunities based on what they can reach at all. For them, they may have little choice but to commute up to two or three hours a day if there are no local alternatives. They often choose their workplaces based on what they can get to within their goal commuting time. Transit captive people think more in terms of access.

Therefore, transit captive people are more likely to support transportation projects that improve basic bus service. They are not as likely to support commuter rail or other modes that do not connect them with jobs.

The suburban residents who want mobility improvements for automotive travel or in rapid commuter transit are in competition for resources with urban residents who need effective local bus service to access all of their destinations.[28] Basic bus service does little except for transit captive riders. The choice riders require reliable, rapid travel options to be persuaded to use transit.

The choice of which types of improvements are implemented can have implications on social equity. It might be argued that new commuter systems should be paid for equally by the city and suburbs because these systems are roughly divided between the two areas. An example of a transit expense that a core city might be asked to bear could be improvements to a large expensive downtown train station. However, if the riders are mostly from the suburbs, the urban residents would see less benefit.

The competition between mobility and access has a strong social equity dimension because of the limited options that low-income people have for dealing with the negative impacts. Therefore, any impact on them should always be considered.

Even though there is a competition for resources, all residents can benefit when a well-rounded public project is proposed that improves all transit services. To do this, a mindset of regionalism should be developed with the goal of shared sacrifice and shared gain.

SOCIAL EQUITY METHODOLOGY

If social equity is to be among the criteria for evaluating transportation projects, then one must have a means to measure it. However, no standard methodology exists.[29]

No one simple measure directly captures the full extent of social equity in a region. For example, income data in a region does not predict inequitable pollution.

The complexity of social equity evaluation makes even a comprehensive tool unworkable. Several potential surrogate measures of social equity offer some useful indication, such as income data in a region (which is readily available).

In addition to being readily available, a surrogate social equity measure should also be predictable. Supporters of any potential public project should be able to predict the impact that the project's implementation would have on social equity.

Several options for surrogate social equity measures were evaluated for this research. Some of these are further discussed in the context of Detroit's history, below.

Economic Situation

Income disparity and/or property ownership are measures of social equity. Differences in economic situation are partly due to unequal distribution of opportunities, but there are many other factors that affect life from personal health to natural disasters.

Considering the vast difference between economic situations of people from different races in the U.S., there is strong evidence that previous inequity has created modern disparity in wealth. The poor are more segregated than in any time in history, and these disparities are not due to different preferences.[30] However, these differences are the sum of generations of differences in opportunities and do not necessarily indicate the present state of equality of opportunity.

Since economic situation is the sum of generations of opportunity, this makes income disparity or property ownership difficult measures of social equity impact from public projects. It could take decades before measurable benefit can be achieved.

Car Ownership

In most U.S. cities, car ownership rates demonstrate wealth.[31] Therefore, it is another measure of economic situation. As such, car ownership is a potential measure of equity because, if 100 percent of the population owned cars there would be a level of economic equity. However, in regions with top-of-the-line transit systems (New York; Washington, DC; Philadelphia), car ownership rates drop.[32] Car ownership is related to transportation,

so is more closely tied to mobility. In addition, car ownership and especially miles traveled have an inverse relationship with externalities upon low-income people, such as air quality. Consequently, it is not a clear indicator of equity.

Transit Trips

Number of bus trips or total transit trips might be a reasonable surrogate measure of social equity, at least as it relates to transportation. As mentioned above, commuter rail is not a clear indicator of equity because of the ridership profile. However, commuter rail can improve equity by reducing externalities of pollution, congestion, and road expansion, as it affects urban residents. Therefore, the total number transit trips do have implications for equity.

The percent of total transit and non-transit trips by bus might be a more direct measure of equity. Since social equity analysis needs to focus more directly on lower income residents, and they are the transit captive riders who rely upon buses, this measure gets right to the purpose of equity.

Using transit as a measure of social equity in transportation aligns with statements by Salci that equity in transit exists when the transit system is implemented correctly. If a region has transit and it is useful, it will be used.[33] If not reliable or if it does not go to places that potential riders need to go, then people will not use it. If bus frequency and reliability are poor, then ridership levels will drop, and social equity will drop.

However, providing mobility to lower income people is not the only measure of equity. Another measure is air quality. Commuter rail systems are more effective at improving air quality than buses. Both are more efficient than driving automobiles.[34] Even though buses fill a useful niche in moving transit captive people to destinations, without transit, those people would not reach their destinations by any means, and so would use no polluting motorized transit (that is, they would walk, only).

The total number of transit trips in all modes does account for improvements in air quality. Using total transit trips as the measure of social equity in transportation has the advantage that it allows choice riders to benefit, too. Distributing benefits makes public projects more likely to get public support. However, transit planners should be vigilant in assuring that funds allocated for basic bus services are not redirected towards newer commuter systems, because providing access to the transit captive is the most important factor in social equity of transportation.

COMPARATIVE REGIONS

To some degree, all major metropolitan areas in the U.S. have seen deindustrialization for the same reasons as Detroit. Among the regions studied (Cleveland, St. Louis, Atlanta and Denver), the two located in the Midwest with strong industrial-based economies make them most likely to have the same severity of deindustrialization as Detroit. While the most legitimate lessons for Southeast Michigan can be learned from regions that have suffered the same problems as Detroit, any city could potentially offer examples about how to develop effective transit systems.

Possible Types of Data

The following data are relevant to mobility, access and social equity in a region. See Table 1 for comparisons of select indicators between the regions. Many other factors could be considered. For example, median commuting time could be seen as a measure of congestion, which limits mobility.

Car Ownership

Car ownership rates are a measure of mobility. Statistics that focus on car ownership neglect the effects of choice riders. This may be a significant factor in regions with highly effective transit systems.

For this study, the data source used for car ownership is the U.S. Census American Factfinder, which is based on the 2011 American Community Survey.[35] This is only for workers. In the metropolitan statistical areas (MSAs) compared in this study, the car ownership seems to be the same within the acceptable margin of error. Most workers in the U.S. (97 percent) use a car to commute to work.

Mobility Gap

Mobility gap is the difference in rates of motorized travel between households with and without automobiles.[36] This measure considers the motorized travel by households with automobiles to be the desired level of travel, and that any difference among groups is likely to be from inadequate abilities to travel.

Pedestrian Expenditures

Spending on bicycle paths, bus shelters and other items that benefit pedestrians is a measure of how highly pedestrian travel is valued. Pedestrian travel is its own mode of travel, but also it is highly connected to access, since bus travel most commonly involves linked walking trips. Unfortunately, due to the high number of agencies that could contribute to pedestrian projects, collecting the data is very difficult. A single composite source of the information was not found. Therefore, this measure was not included in our study.

Network Connectivity Index (CI)

The network connectivity can be applied to automotive, transit, or pedestrian travel. In theory, the more connected a network is, the more likely it is that travelers can find efficient paths to their destinations. In addition, higher connectivity is generally an indicator of the saturation of a system, because the more routes it has, the more connected it would be. An example of lower connectivity index (CI) for pedestrian travel is the case of areas with cul-de-sacs. These have less connectivity, so have less value for walking, and therefore, a lower CI value. Cities usually have good pedestrian network connectivity. Exceptions are cases where freeways divide neighborhoods, or where roads have too many lanes to cross safely. No source for country-wide CI was found, and so CI was not included in this study. A sophisticated analysis would have to be done of each of the comparative regions if this indicator had been chosen as significant.

Transportation Deprivation Index

The transportation deprivation index is a theoretical model.[37] No evidence of its application in practice could be found in researched literature. It measures how frequently a person has access to a car, physical disability, poverty, number of times that person needs to commute per week, and number of dependents. It is a balance of several factors that influence accessibility. Since no applied examples were found, it was not used as a tool in this study.

Bus Trips as a Percent of Total Trips, per Region

The total use of all transit modes is a good measure of the effectiveness of the complete system. In contrast, bus trips alone are a closer measure of access and equity (see Table 1). The source of this transit data is U.S. Census American Factfinder, based on the 2011 American Community Survey.[38] This is only for workers. It is five-year averaged data.

Proportion of Transit Trips that Are Commuter-Oriented vs. Local Bus

The ratio of commuter-based transit (including express buses, light rail, heavy rail, and commuter rail transit) versus basic bus service shows which mode predominates. A very high proportion of commuter-based transit could indicate that basic bus services are not valued or that resources have been rededicated to commuter transit from basic bus service. However, there are no known studies showing ideal ratios of services, therefore there is no accepted means of comparison. Therefore, this evaluation criterion was not used.

City-Only to Metropolitan Area-Wide Trip Ratio

This potential measurement would be nearly the same as the one above. Suburban to city trips are commonly commuter-oriented, and trips within a city are commonly local bus service. Using different data, transit service to urban dweller versus suburban dwellers would be compared, which would give a rating of equity.

Table 1. Work Travel Transit Trips for Peer Regions, 2011

	Detroit	Cleveland	St. Louis	Atlanta	Denver
Transit trips out of total work trips in MSA	1.6% (1.58-1.66)	3.7% (3.58-3.92)	2.6% (2.46-2.67)	3.3% (3.15-3.39)	4.6% (4.39-4.74)
Transit trips out of total work trips in core city	8.6% (7.98-9.21)	11.8% (11.0-12.6)	10.0% (9.36-10.7)	11.5% (10.6-12.3)	7.5% (7.04-7.98)
Transit trips for core city residents out of total work transit trips	65% (59-73)	50% (45-55)	42% (39-46)	28% (26-31)	39% (36-43)

Source: U.S. Census Bureau, American Community Survey, 2011 [data on work-trip travel destinations], http://www.census.gov/acs/www/ (accessed January 8, 2014).

Notes: Data are averaged over the five-year period of 2007-2011.
The core city is the namesake city in the region. (Detroit, Cleveland, St. Louis, Atlanta, Denver.)
All values expressed as percent of total transit-based work trips.
Numbers in parentheses are 90 percent confidence intervals.

Observations

1. Metro Detroit has the lowest transit use for any MSA in this study. Metro Denver has the highest. This is well outside the margin of error at 90 percent confidence.

2. Only 7.5 percent of the work trips in the city of Denver use transit. This is the lowest among the regions studied.

3. Atlanta has only 28 percent of work transit trips originating in the core city. Detroit has the highest (65 percent). This is a very wide range of results in cities that were chosen to be peers.

Conclusions Related to Choice of Equity Measurements

No single tool was a perfect measure of equity in transportation. Therefore, each tool will be applied to the peer regions to the extent that data are available.

The data is available for looking at work trips on transit as shown in Table 1. The data does not explain transit history of the cities. However, certain preliminary conclusions can be made. These conclusions will be revised in the following sections as historical context is considered.

All of the peer regions have roughly the same portion of core city work trips that use transit. Detroit is at the low end, with its share being only one percent higher than Denver. Although this analysis excludes non-work trips, this does show that it can be used as a measure of equity, in that the levels are similar across peer regions.

All of the peer regions have more effective rapid transit for suburban riders than Detroit. Taken with the relative equal number of transit trips for core city residents, this suggests the expansion of transit to the suburbs in Atlanta, St. Louis and Denver may not have spurred improvements in core city bus systems. If suburban commuter transit raised awareness for the need for transit for everyone, and resources were distributed in a fair manner, then it would be expected to find significantly higher basic bus service in the core cities than found in Detroit.

A number of policies could have the effect of preferring suburban residents over core city residents. The peer regions will be carefully evaluated to determine whether any of the following suburban-favoring patterns may be identified:

- Rededication of transit funds from basic bus service to newer rapid transit systems that serve suburban residents.

- Taxing the whole region to pay for systems that mostly serve suburban residents. For example, city funds could be required to make improvements to transit lines or stations in the city that are used for commuter systems.

- Circulator services around a Central Business District (CBD) serve mainly suburban transit commuters. In the peer regions, improvements to basic bus service in core

cities could have been focused on the CBD or other major destinations rather than the city as a whole. Services that distribute transit riders from around a CBD do not benefit urban residents as much. Those residents need collector buses that take them from their residences to the CBD, other major destinations, and to basic services.

The best-case scenario for these concerns is that urban residents are not burdened with paying for new commuter transit lines that are used mostly by suburban-dwellers, and that basic bus service has not been cannibalized to provide circulator services around the CBD. Also, it is possible that the new commuter services have improved basic bus service used by urban residents, and that the bus services for them had much lower ridership rates decades ago.

Peer Regions: Relevant History and Policies

Denver

Rapid transit to suburban areas is a relatively recent addition to transit availability in Denver. One initial light rail transit line in the central corridor has been extended southwest, and then multiple other lines and extensions have been added.

The *2035 Regional Transportation* plan discusses environmental justice and relates it to service for minorities.[39] Environmental justice is federal policy that ensures that minorities, disabled and low-income residents are not disproportionately negatively impacted by improvements, such as air pollution. The Denver transportation plan stipulates that at-risk groups (such as low-income or minority residents) share equally (with higher-income, higher taxpaying residents) the benefits of any new transportation projects.

The FasTracks sales tax was approved November 2, 2004.[40] The defined funding use was 60 percent for expansion and 40 percent for operation. Setting aside 40 percent of funds for operation meant that the operation was funded and that other transit systems would not have to be compromised to support it.

FasTracks is a network of light rail transit improvements in Denver. The first line built was a CBD circulator (see Figure 3). The second line connects to the southwestern suburbs. Subsequent lines have also focused on connecting to the suburbs. The routes mostly follow a single path through the city, and then they branch out when reaching the suburbs. The long-term FasTracks plan is to expand in multiple directions, but the plan to date has been to focus on reaching the southern suburbs. The benefits to city residents are concentrated along a single corridor, and the CBD.

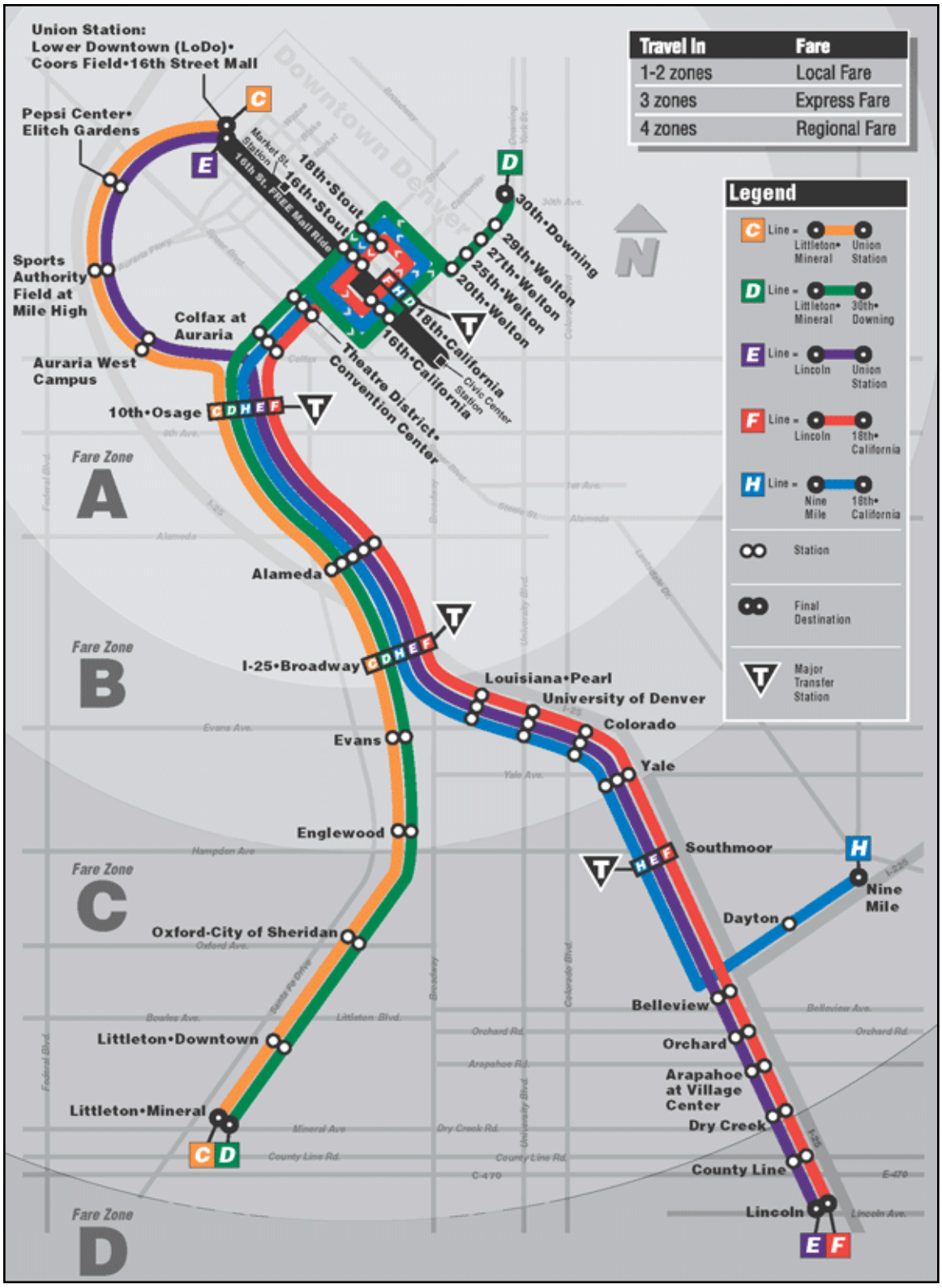

Figure 3. Denver Light Rail Map

Source: Regional Transportation District (RTD), Denver – FasTracks, "RTD: Light Rail System Map" (no date), http://www.rtd-denver.com/LightRail_Map.shtml (accessed January 8, 2014).

There are plans for at least seven corridors and extensions. The West Rail Line, which is expected to open in 2013, goes through an area of Denver (which has lower vehicle ownership) before reaching the suburbs, so there is potential to serve the transit captive.[41]

Many of the northern lines are commuter rail, which are hard to connect to local bus service. Commuter rail is more likely to connect to park-and-ride facilities, because of the lower population density areas that it usually serves. Lower densities are less supportive of local bus service that transit captive riders need.

The funding of the Denver system brings up equity issues, too. Sales taxes are currently a popular means of supporting transit. Sales taxes are known to be regressive, which means that lower income residents pay a larger share of their income to pay the tax. Lower income residents are more likely to use transit in general, but light rail lines have been known to draw in choice riders.

Any transit system has unequal benefits. Those who live nearer the stations get greater benefits. In the case of Denver's FasTracks, the funding structure and system development both favor the wealthy residents. The suburban riders are paying a lower share of their income and receiving more of the benefit.

One advantage of light rail transit (LRT) with respect to social equity for the disabled is that LRT vehicles can be boarded directly from a platform versus local buses that are boarded via a chair lift. The convenience of level-boarding makes the experience more comfortable for people with ambulatory disability. Therefore, LRT provides equity by taking into consideration special needs.

Another issue of social equity concern is that of free parking at Atlanta and Denver park-and-ride facilities. If suburban residents pay for all of the light rail transit expenses, then the parking garages are covered the same way as other transit expenses. The concern is that Denver is subsidizing automotive travel to LRT stops. If lower income people located in the suburbs want to use the LRT system, they might be better served using the parking subsidy for better collector bus service in the suburbs, and then charging a fee for parking.

In summary, it appears that social equity has been a secondary driver in Denver. Among the equity measures defined in the previous section, none points to FasTracks causing a major improvement in equity. More equitable solutions could have been found.

Atlanta

Metro Atlanta's main transit provider is the Metropolitan Atlanta Rapid Transit Authority (MARTA). Its current profile and plans for expansion are the best indicator of equity.

There were many issues related to the recent failed ballot initiative for supporting MARTA.[42] The article by Kyle Winfield discusses how race and equity were factors in the vote, such as through the advertising messages, and the resulting geographic and racial makeup of voting patterns.

The failed initiative is an example of how social equity can become a political issue, and if a proposal is not perceived to be equitable, then it is not supported by urban residents. Some local chapters of the NAACP said that the new transit line was not the good line for them, so should not be supported. The plan would not help the residents of South Atlanta.[43] The new transit was promoted to the public as only congestion relief. This line of reasoning promotes transit as something that suburban residents lopsidedly benefit from.

The rationale for congestion relief was tied to economic justification. That sort of argument does support having transit for low-income people to help them find ways to get to employment opportunities. However, a purely economic justification does not normally support other social equity issues. For example, economic justifications are used mostly for business and job development. It is rare that air quality is considered in economic analyses, although anything that impacts social equity could also be rationalized to indirectly impact economic development.

These issues support the preliminary conclusions above about Atlanta related to work transit trips in Table 1. Atlanta has a very high share of transit originating from the suburbs. Together, it appears that social equity is not a driver for transit in Atlanta. Part of the constraint on this is the 50/50 funding process, where half of all collections must be applied to capital improvements. Indeed, half has gone to roads. However, this high ratio encourages construction of new services for suburban residents over supporting existing services for core residents.

Cleveland

Cleveland has had heavy rail transit (HRT) for several decades, and was the first U.S. City to have rapid transit to the airport. However, not much has changed in Cleveland transit in the last few decades until the HealthLine LRT was created in 2008.

The HealthLine connects Cleveland's downtown to the Cleveland Clinic campus. The HealthLine is typical of CBD circulators that serve downtown office workers. The HealthLine connects the CBD to the clinic through a historic business district that needed improvement. Although downtown and near downtown residents rode the bus lines that were replaced, the primary objectives and successes seemed to have been to improve property values along Euclid Avenue and to get upper income people accustomed to riding transit. According to Joe Calabrese, "Suits don't ride buses,"[44] which illustrates why the buses were made to look more like trains, but also demonstrates the effort they took to get non-traditional riders to use it. According to Calabrese:[45]

> Certainly everyone is concerned about safety, and to make it a first-class ride. The first-class ride was going to do two things. It was certainly going to help attract the choice rider, and it was also going to, in some ways, give the current Number 6 riders something they may have never had. These are people. These are transit kinds of people that live in East Cleveland, one of the poorest cities, if not the poorest city in the state.

> They probably haven't had too much in their life that was first-class. So we thought, even if it doesn't attract the choice rider, wouldn't it be great to give them something first-class? It really was the right thing to do, so we spent a lot of time and effort trying to do that.

Funding for the HealthLine was 50 percent local match, which was raised from a number of sources, including branding rights and congestion mitigation funds. It does not appear that any of these funds would have been otherwise used for improve bus systems.

HealthLine ridership is diverse. The existing riders of the Euclid Avenue bus are largely minority. However, the new ridership is composed primarily of white suburbanites, or new residents who moved to the revitalized Euclid Avenue corridor. Therefore, HealthLine's impact was mostly economic, drawing in new white suburbanite riders. It could be said that the existing Euclid Avenue bus riders were uplifted by improved service. Faster and more reliable service does affect all riders, providing tangible benefit to them. No information was found as to whether people already living in the Euclid Avenue corridor, who had not ridden the bus previously, started riding the HealthLine because it was more effective.

The HealthLine was new and fast, and the appearance of a train branded its appearance to fit the reality that it delivered. Since it was used by a variety of people, everyone benefited from it. Having a mixed group of riders avoids a potential problem. Planners in other regions need to be especially careful to not brand systems as separate, because if the ridership is not mixed, then a feeling of separatism can spur equity concerns.

St. Louis

The research team that visited St. Louis found that their guided tour focused heavily on the new LRT lines. This begs the question of whether St. Louis may be inequitably focusing on suburban commuters.

The research team found that buses were waiting at LRT stations. However, further investigation would be necessary to determine whether these buses had the routes and schedules to help reverse commuting. It appears that in the morning, the buses come from residential areas and drop the riders at the stations in time to be picked up by the train. Then, on the return trip in the evening, the buses wait until riders get off the train, and take them back to their residences. This does not necessarily help reverse commuters, because they need transit connecting them to suburban job centers with the right employment opportunities for their skill levels and experience. Also, the buses need to have 18- or 24-hour schedules to reflect the typical work hours of lower-wage jobs, and need to wait for the train in the morning, too, not just drop off riders then run the next route.

St. Louis does employ some practices that appear to support equity, including fares based on distance and higher peak-hour fares. Peak hour is when most commuting is done by upper income workers. It is the time when transit vehicles have highest occupancy. This peak demand is what determines the designed operating capacity of a transit system. It determines the capital expense, and sets the floor for operating cost throughout the rest of the day, since the same transit operators and vehicles continue to work through the day.

Therefore, to make riders pay more is reflective of the demands that their numbers place on the system, and assume such riders' ability to pay more.

However, there is evidence that St. Louis is favoring commuters. Larry Salci (transit consultant and former president and CEO of St. Louis' Metro system), commented that he felt that when transit budgets had to be adjusted, that cuts were inequitably distributed towards city buses.[46]

The data support this. Table 1 shows that St. Louis focuses heavily on commuter transit for suburban-dwellers, while possibly neglecting basic bus service in the core city. St. Louis does not appear to provide sufficient bus service to attract very many riders in the namesake city. (10.0 percent of trips to work are on transit.)

Conclusions about Peer Regions

Table 1 shows that the regions studied are relatively peers because they have roughly the same number of work trips in the namesake city on transit (7.5 to 11.8 percent), and Detroit is in the middle with 8.6 percent. Access and equity are achieved when the transit system does a good job of providing rides to people who are transit captive. A good transit system could be identified by having a magnitude that is competitive with other transportation modes. Detroit is not considered a model of social equity, as the Detroit Department of Transportation (DDOT) has had to make numerous cuts in funding, routes and frequency over the last decade. Therefore, since none of the peer regions are substantially better than Detroit, none may be a good model of access and equity.

Cleveland had the highest rate of transit use for commuting to work in the core city, and its progress on transit seems to have the most inclusive model. Although the new HealthLine is oriented towards new suburban riders and spurring property development, it has had some positive impact on the riding experience for city residents and the availability of jobs in the city.

The HealthLine, which connects Cleveland's CBD to major destinations, can be an example of how transit can be improved for economic development, yet have positive impacts on existing riders. Funding from multiple sources, including corporate sponsorship, in Cleveland is reminiscent of Detroit's Woodward Avenue light rail project to the New Center area proposal by M-1 Rail.

None of these conclusions is meant to question the motives of transit operators in any of these regions. The operators are limited by structural issues in their organizations and political acceptability of solutions that they present.

IV. CURRENT DETROIT

POLITICAL CULTURE AND SOCIAL CULTURE IMPACTS ON SOCIAL EQUITY AND ACCESS IN TRANSIT

Poor or unaffordable housing, employment and income, educational attainment, social exclusion, and environmental blight cause inequity.[47] However, each of these causes is, to some degree, under the control of political and social culture. Rather than blaming unaffordable housing for inequities, it is more productive to address the root causes, which are the cultural, economic, and social systems.

In Southeast Michigan, there has long been no consensus to support social reform that supports equity.[48] Transit is both a measure of cultural mindset, and a partial remedy to social inequity. The question is whether a continued lack of consensus is still a hurdle that inhibits the improvement of transit.

Local newspapers used to be a gauge of how deeply residents throughout the region felt about social equity, as applied to transit and other things such as low-income housing. Newspapers were an indicator of the level of those feelings.[49] It was common for suburban newpapers to espouse the view that “blacks stole white jobs.” No evidence was found that the local newspapers currently still openly supported those accusations as they had in the past.

However, reader comments on newspaper websites have become part of the voice of the newspaper. In a separate report that accompanies this project, media content, including blogs, are discussed with respect to how they shape opinions and editorial content in newspapers. Reader comments are much more common than in the past, when mailed-in editorials needed to be written. A random sampling of the newspapers in the media report shows that every feature article has multiple comments versus editorial pages of the past that had at most one total page. In addition, the messages are unfiltered posts. Without filtering, some very fringe opinions are posted that likely would not have been printed, and a random sampling shows that they are often more strongly against social equity than the stated editorial opinion. However, being displayed on the newspapers’ web pages, the comments have an impact on the effective message of newspapers. Although society has moved to be more tolerant of social equity, it has also developed a culture to allow diverse voices that are less tolerant.

Political culture has also changed in similar ways. The county executives of the most populous counties regularly meet in public “Big Four” events. Their counterparts thirty years ago did not hold these meetings.

Political culture in Southeast Michigan in the past has been to avoid significant coordination between cities, and promote practices that lead to sprawl. D’Aneiri maintains that there was coordination in the past, but that it was mandated by the State and favored the suburbs.[50] Those practices promoted sprawl. Since those practices led to inequitable development, it takes a change in practices to make development equitable.

There are benefits to working together.[51] The culture of working together has shown some recent success. The Michigan Suburbs Alliance is one of the newest efforts. It is coordinating policy that promotes reinvestment in cities rather than continuous sprawl.

ACCESS IN CURRENT DETROIT

As discussed above, access provided through transit and other modes is a key social equity issue since it provides access to jobs and other services.

Access for those without automobiles is primarily transit because of the wide geographic distribution of jobs and services. However, other modes are important for reaching locally available jobs and services. Other modes are necessary as the first link in a transit trip.

Walking and bicycling are more common alternative modes of transportation. The minimum requirement for these alternative modes is a safe path such as a sidewalk.[52] However, there are other improvements that may attract pedestrians and cyclists, such as having desirable local destinations (transit-oriented development or dense development), and a pleasant, safe atmosphere that helps people feel comfortable walking.

Metropolitan Detroit is like many other metropolitan areas. The city of Detroit, generally speaking, has good sidewalks, but few pedestrian-oriented areas. In suburbs, there are often places without sidewalks. In addition, considering that the suburbs are very low density, there is a low ability to reach goods and services through that mode.[53]

There are many ways to improve these modes of travel in Metropolitan Detroit currently:[54]

> Various smart growth land use reforms include reduced and more flexible parking requirements, support for more compact and mixed land use, public investment practices that favor infill over sprawled development, more accessible and walkable roadway design, location-based utility pricing and tax rates, and encouragement for urban infill development.

However, little evidence was found that the Metro Detroit region is moving away, in any significant way, from automobile-oriented street design.

Access via Transit

Access is about whether a person can reach his destination. Without knowing the destination, we can assume that one wants to reach as many job opportunities and services as possible.

Access is less about time in mobility studies, where driving time is the primary concern. In access studies, the total number of opportunities available in a reasonable time is the concern.

Access to emergency medical services could be important to study. Metropolitan regions typically have dozens of hospitals. Since they are fewer than other services such as fast food, studying access to hospitals could give very different results. However, ambulances

are often used as the transportation mode to emergency services, so the role of transit is moot in that situation.

The Brookings Institution has calculated access to jobs for large U.S. cities.[55] The Brookings Institution results are discussed later in this report. Their assumptions about their methodology will be challenged, and a new procedure will be used to find access in Detroit, and later for the peer regions.

Jobs

Both the Brookings study and this study use jobs as a measure of access. Reaching employment is the primary transportation activity for a majority of transit users, and job data is readily available from the Longitudinal Employer-Household Dynamics survey.[56]

Other services are important too, but generally, services are distributed in similar patterns as other jobs. Restaurants are an example of a goods or service that is distributed somewhat evenly throughout urbanized areas.[57]

The numbers of jobs reachable by a person driving versus a person riding transit are compared later in this report. Such access would be considered equitable or equal if each travel mode reached the same numbers of jobs. Complete access to all jobs may not be practical to obtain. Therefore, favorable comparisons to the best-performing regions are the goal.

Hours worked is an important issue to study in relation to job access. It has been shown that workers with cars work more hours.[58] It is assumed from this that the car provides the opportunity to work more hours, since more opportunities can be reached in a reasonable time.

Brookings finds that 20 percent of all jobs in the region can be reached in 90 minutes via transit for the average Metro Detroit region resident.[59] This is much lower than the national average of 30 percent. Brookings prefers to express this in terms that would interest employers. Denver is an example of a higher ranked city, per the Brookings' analysis. In Denver, 47.6 percent of residents can reach a typical job. As evidenced by further transit plans in Denver, the planning authorities there do not consider their transit system complete. If future plans are achieved in Denver then the Brookings rating will likely go significantly higher than 47.6 percent.

Some methods focus on access to low wage jobs via transit. Brookings reports statistics by industry type so that low wage job access can be found from their work.[60] This type of method implies that the transit captive is a lower income earner and will not need access to higher wage jobs. However, some disabled people are transit captive, but that does not necessarily limit their career potential. Access to jobs among the disabled is a social equity issue; therefore, this report does not focus on low wage jobs only.

Brookings found no significant difference between access to service jobs and manufacturing jobs.[61] However, the pattern was that high skill jobs had better access than low skill jobs. This difference was caused by high skill jobs clustering in areas such as downtowns that have higher transit access, but low skilled jobs tend not to be clustered.

Time and Distance

Access methodologies use a limit on the time it takes to reach a job, goods or service. Walking distance is also important because long distances limit who is willing to walk.

Time equates to a distance, based on travel mode. The Brookings Institution study used 90 minutes, one-way, as the practical limit for daily travel to work via transit.[62] The average commuting time in the U.S. is 27 minutes one-way (or almost one hour per day).[63] This means that the three-hour limit that the Brookings Institution placed on transit is about three times the actual national average.

This brings up an equity issue. If workers were to commute three hours a day, many of them could go from one metropolitan statistical area (MSA) to some other. Commuting between MSAs does not seem realistic for most commuters. Even to spend two hours a day commuting is very unlikely among drivers, but not unheard of.[64] It would require a person to be very motivated, or have unusual conditions such as constantly changing work location. If most drivers do not travel three hours a day, then it is not equitable to expect that transit commuters would do it. Three hours a day of commuting would require extensive sacrifices in quality of life. An implication from the *Zero Vehicle Households* study is that people with cars might be working more because it is possible to do so with greater access to job opportunities.[65]

Although economic models show that people of different employment types and income levels value their time differently, it is not equitable to assume that all jobs are available to someone as long as they can reach them in three hours per day. A limit of one hour each way, or two hours per day was used in this study because it is more equitable to driving hours.

Walking Distance

The Brookings methodology was to assume that a job was accessible to transit if it was within 0.75 miles from a bus stop. It is unknown if they considered true walking distance or straight-line distance.[66] It is also unclear from the methodology whether walking time was considered.

Most community planning initiatives and bus system design specifications assume a walking limit of 0.25 miles. This is shown to be the case for the Detroit bus system (DDOT) during the peak of their service availability in the 1990s. Figure 4 shows buffers of 0.25 miles of a bus stop. When overlaid on population, it is found that 90 percent of the residents of the City of Detroit are within 0.25 miles of a bus stop.

Figure 4. Quarter-Mile Coverage of Bus Stops, City of Detroit, ca. 1990

Source: DDOT route map, ca. 1990.

Notes: The concentration of bus stops in the south-central area is the junction of the stops within the CBD.
Black: Street bus stop.
Gray: 0.25-mile buffer.
Orange: Base map of City of Detroit.

There are several reasons to consider 0.25 miles as a practical limit to walking. First, there are cultural factors that limit walking in modern society.[67] Secondly, as people age or reach the threshold of disability, their walking ability is often limited. According to the U.S. Census American Factfinder that is based on the 2011 American Community Survey, 19.1 percent of Detroit's population has a disability.[68] This is with a 90 percent confidence in a +/-0.4 percent margin of error. This is a significant share of the population that needs special consideration. Third, in northern cities such as Detroit, the winter weather can get down to -10°F. This would cause frostbite in 30 minutes, if there were a 10 mph wind. Frostnip could occur within 10 minutes. Walking, then standing and waiting for a bus is uncomfortable for much of the time, whether or not a person could suffer physical harm from the weather. Fourth, many cities including Detroit are not pedestrian-friendly beyond having mostly well-connected routes of sidewalks. Fifth, practically, most people are not willing to walk more than 0.25 miles. See the graph that shows a large share of people who walked to work did so for less than 10 minutes.[69] Note: walking at a slow amble of 1.5 mph would cover 0.25 miles in 10 minutes.

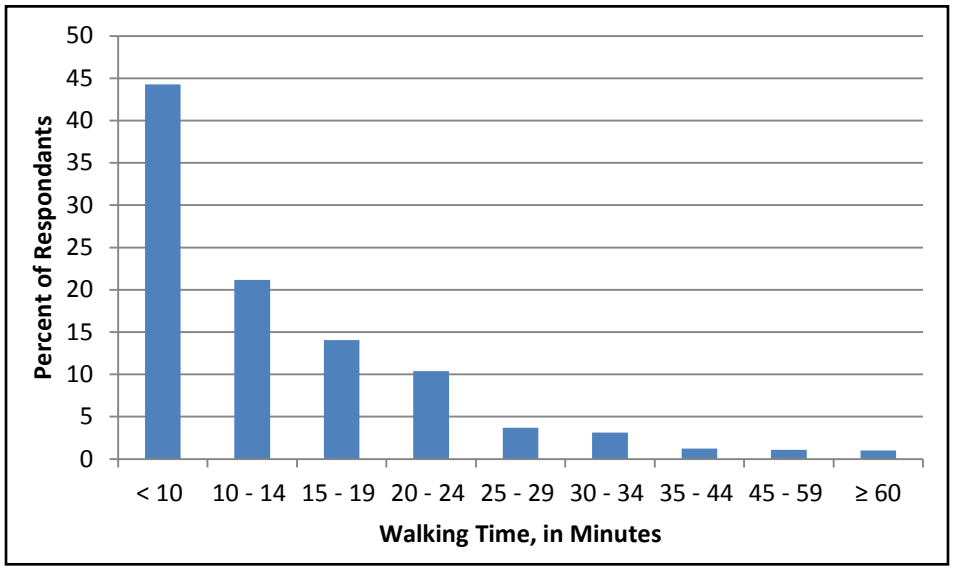

Figure 5. Walking Commute Time in City of Detroit, 2011

Source: U.S. Census, American Factfinder, 2011 American Community Survey, 2011

Methodology

Rather than do a network analysis for all residents, a Monte Carlo simulation was used. This requires selection of a number of random trials. This is continued until additional trials produce no change in the results. Therefore, the results converge on an answer. Previous work with walking to transit in Detroit has shown that as little as six trials (starting point and destination pairs) can reach an answer with no significant error. With only four trials, the answer can be reached within a 10 percent error.[70] This work began with 12 starting points in Metro Detroit; therefore it should give a reliable representation of travel times.

First, six high population areas within the city of Detroit and its suburbs were identified. These were plotted in Google Earth. Then, from scale that the whole region was visible, place marks representing residential starting points were placed. The high altitude meant that the place marks were random within the identified population area. See population density in Figure 6.

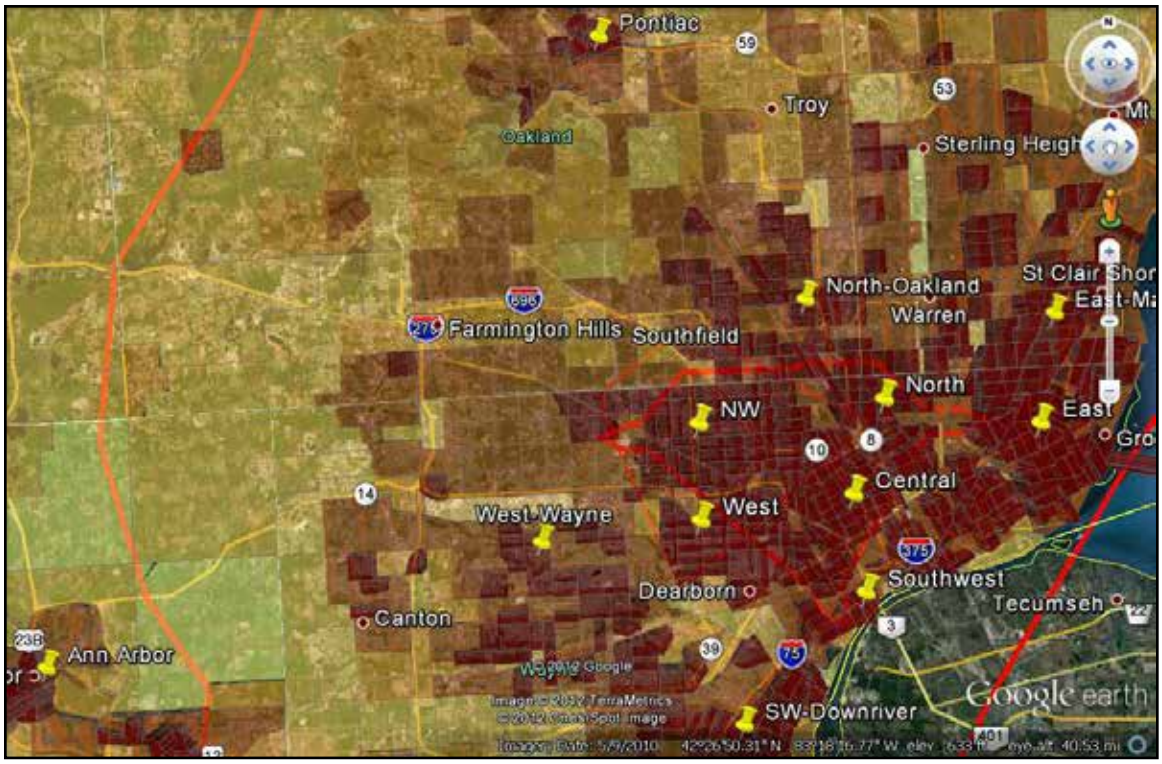

Figure 6. High Population Areas in Metro Detroit

Source: U.S. Census 2010.

Notes: Produced with multiple software programs including Excel, ArcMap GIS and Google Earth from original U.S. Census data. Map dimension is 45 miles east to west, and 30 miles north to south. Pins are the identified residential starting points.
Census tracts are color coded from light brown to dark brown based on population density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)
Red outlines are driving and transit envelopes. (See more description below.)

Next, driving time polygons were made in turn for each starting point (see Figure 7). In the figure, the red outline is the approximate distance that a person could drive to within an hour. The white outline shows the Detroit city limits, for reference. The envelope of driving distances was found with Google Earth's Get Directions tool. The goal was to identify the travel distance reachable within one hour (to within one minute, with 1.7 percent geographic error). In actuality, there may be rural areas away from freeways that have errors up to 4 minutes (or about 6.7 percent geographic error). However, the geographic error is not the same as the error in the number of jobs that can be reached. The driving polygons normally truncate in rural areas that have much lower job density than that of the city. Therefore, an insignificant number of additional jobs are missed if the boundary is slightly inaccurate.

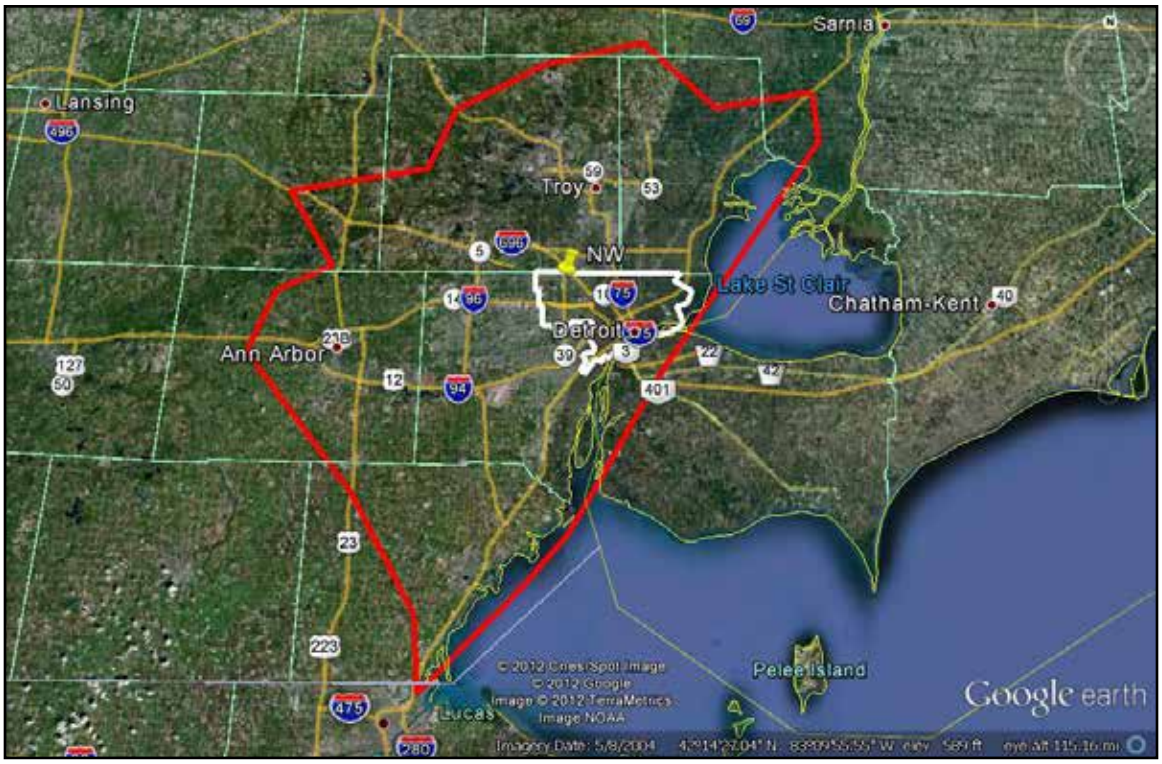

Figure 7. One-Hour Driving Envelope from Northwest Detroit

Source: Produced with Google Earth's Transit Utility, 2013.

Notes: Red is one hour driving envelope from the NW Detroit residential place mark shown.
White is the City of Detroit.
Map dimension is 150 miles east to west, and 95 miles north to south.

Then a different process was used for find transit travel distance envelopes. Google Earth's Get Directions tool was considered for this, but the assumptions did not seem to fit Detroit's actual state of transit service. Until those assumptions could be resolved, a different method was used.

To calculate the transit envelopes by hand, several assumptions had to be made. Many of these assumptions were discussed with Megan Owens of Transit Riders United.[71] The assumptions are:

- *Maximum of 0.25 miles walking distance to bus stop*. If the distance was more than that, then the person could only go to employment locations within 0.25 miles. This was taken as the true walking distance, not straight line. The walking pace was assumed to be 3 miles per hour. Observation shows that many people going to stops walk quickly there. If people walk slower, then it would reduce the number of jobs that they could reach within one hour.

- *Average planned wait time at bus stop of 2 minutes*, based on country-wide statistics.

- *Average late bus wait time of 4 minutes*, based on actual service reliability. (There is a big variation in this number from day to day.)

- *Average wait time at transfers of 6 minutes*. (This also has a big variation.)

- *Maximum of 0.25 miles walking to destination*.

The creation of the polygon for the travel envelope was created graphically. For example, a polygonal shape was positioned along the route that marked off a 0.25-mile buffer that people could walk. This overestimates their ability to walk since it represents a straight line distance. However, many jobs, such as restaurants, retail, etc., are located on main roads, so this assumption is not significant. The graphical shape was the length that a bus could travel at 10 miles per hour for one hour (i.e., 10 miles). This shape tool was shortened whenever walking or transfer time meant that less than 60 minutes of travel time remained for use on the route. Connections were handled by using additional graphical shapes at junctures. Their lengths were equivalent to the time remaining. The last step was to digitize a polygon in Google Earth that represented the total envelope that a person could reach in one hour. Whenever the bus reached a jurisdictional border, the necessity of a transfer between systems was considered. See the example in Figure 8. The red outline represents the envelope of travel with combined walking, waiting, riding and walking again. The white outline is the city limits for reference. In the figure, the west side was limited by time remaining and limited transfer options.

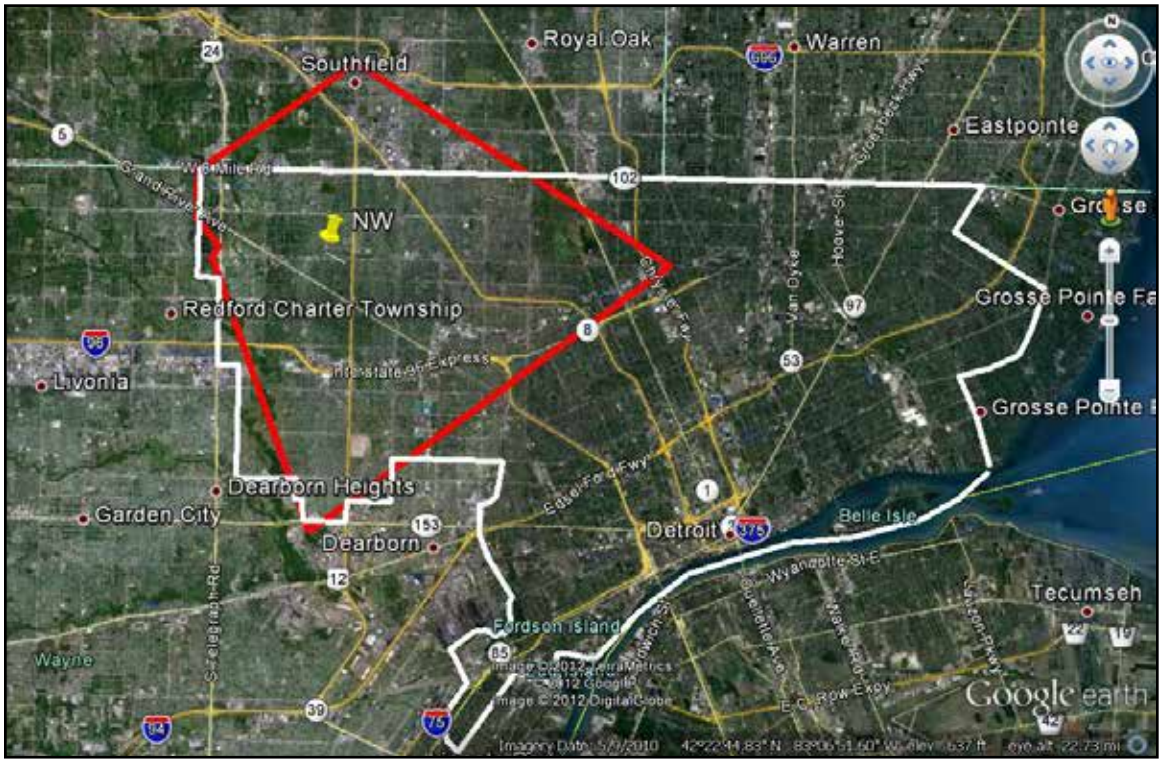

Figure 8. One-Hour Transit (Bus) Envelope from Northwest Detroit

Source: Produced with Google Earth's Transit Utility, 2013.

Notes: Red is one hour transit envelope from the NW Detroit residential place mark shown.
White is the City of Detroit.
Map dimension is 25 miles east to west, and 18 miles north to south.

Then, the polygon envelopes for travel were exported to ArcMap GIS. The polygons were used to select all jobs that fell within them. The jobs were geographically placed by census blocks. If a block center was within the envelope, then its jobs were counted. All jobs are not at the center, but in large analyses this error is compensated for by the random geography of jobs. The same process was used for all of the randomly chosen points in the Metro Detroit region.

Results

For comparison, see both the one-hour transit and driving outlines overlaid in Figure 9. Geographically, there is a great difference. See Tables 2 and 3 for the calculated Metro Detroit region numbers of jobs reachable in one hour from each of the chosen starting points. Some starting points are truncated from the table to fit the page size. The results are tabulated by county in the MSA.

Figure 9. Overlay of One-Hour Driving and Transit Envelopes

Image Source: Google Earth.

Notes: Red outline is one hour driving and transit envelope from NW Detroit residential place mark shown.
White is the City of Detroit.
Map dimension is 150 miles east to west, and 95 miles north to south.

Table 2. Number of Jobs Accessible in One Hour by Car or Transit Starting from Four Points in the City of Detroit (Sample)

Destination County	NW Detroit		East Detroit		North Detroit		West Detroit	
	Bus	Car	Bus	Car	Bus	Car	Bus	Car
Genesee	0	5,185	0	369	0	20,289	0	0
Jackson	0	153	0	0	0	0	0	0
Lapeer	0	0	0	0	0	2,041	0	0
Lenawee	0	0	0	0	0	0	0	0
Livingston	0	24,947	0	17,039	0	36,048	0	24,972
Macomb	0	256,713	24,681	262,157	29,889	262,813	0	260,293
Monroe	0	26,570	0	25,518	0	25,588	0	27,538
Oakland	26,920	598,372	0	602,082	28,968	603,881	0	600,646
St. Clair	0	143	0	3,048	0	3,635	0	1,538
Washtenaw	0	171,881	0	166,230	0	166,108	0	166,136
Wayne	37,289	623,860	35,086	625,462	104,856	624,217	160,013	625,462
Total	*64,209*	*1,707,824*	*59,767*	*1,701,905*	*163,713*	*1,744,620*	*160,013*	*1,706,585*

Source: Geographic data in Figure 9 was applied in ArcMap to longitudinal employment data.

Table 3. Number of Jobs Reached in One Hour by Car or Transit Starting from the Suburbs (Sample)

County	West-Wayne		North-Oakland		Ann Arbor		East-Macomb	
	Bus	Car	Bus	Car	Bus	Car	Bus	Car
Genesee	0	0	0	42,453	0	41,874	0	0
Jackson	0	531	0	0	0	687	0	0
Lapeer	0	0	0	2,291	0	0	0	0
Lenawee	0	2	0	0	0	7,564	0	0
Livingston	0	39,815	0	42,116	0	42,178	0	19,319
Macomb	0	223,707	0	262,024	0	87,314	0	262,793
Monroe	0	27,864	0	21,739	0	32,605	0	19,443
Oakland	0	589,527	116	603,881	0	444,140	0	598,406
St. Clair	0	0	0	4,874	0	0	0	25,759
Washtenaw	0	171,971	0	160,238	112,824	172,871	0	146,707
Wayne	0	591,945	0	605,015	0	589,474	0	625,462
Total	*0*	*1,645,362*	*116*	*1,744,631*	*112,824*	*1,418,707*	*0*	*1,697,889*

Source: Geographic data in Figure 9 was applied in ArcMap to longitudinal employment data. U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

CURRENT DETROIT CONCLUSIONS

There are several patterns found in this work. For example, bus riders originating in the City of Detroit can reach between three percent and nine percent of the jobs that that someone driving a car can reach within one hour. The average is six percent. This is much lower than the 22 percent that Brookings found for the Metro Detroit region using a different method.

The scenario is much worse for suburban residents that are transit captive. They can only reach zero percent to nine percent of jobs that a driver can reach. The average is two percent. Many of the starting points in the suburbs are outside of a 0.25-mile maximum walking distance to a bus stop, so a transit captive commuter can only reach jobs that he can walk to in that distance. For example, The West-Wayne point is not within reach of any jobs on foot. For the Southwest-Downriver point, a hypothetical person could walk to three jobs. This demonstrates that being transit captive is a much more severe problem for someone in the suburbs. Although jobs are more plentiful in the suburbs, there may be no way to get to them if the resident does not live near a bus stop. However, hedonistic principles of economics predict that someone who is transit captive would intentionally attempt to reside near bus stops or places of employment.

Another conclusion is drivers can reach most jobs in the region, and from each point they can reach about 1.7 million jobs. An exception is that people in Ann Arbor have a difficult time reaching jobs on the East Side within an hour.

The Brookings method found significantly higher access to jobs by transit (22 percent) than this study did (four percent). The great difference in results shows the need for further comparison of the methods.

If equality were not the goal, it could be determined whether people had access to a set number of jobs, such as 100,000. By that criterion, some places in the city of Detroit have sufficient access, and this is also true for only one of the suburban trial points. It is not recommended by the researchers to consider transit in Metro Detroit to be sufficient, even in those few areas with relatively higher job access.

Either way, transit captive people have very limited choices in where they can work in Metro Detroit. It is certainly not equal opportunity for people with cars and those without, or for those with physical disabilities. It is unlikely that improvements in transit will be able to make opportunities completely equal, but significant effort should be taken to make it more equitable.

V. COMPARISONS AND RECOMMENDATIONS

FUNDING COMPARISONS

Two of the biggest questions concerning social equity in transit are:

- Who pays for transit versus who uses it?
- Does the transit provide access to an equitable number of jobs?

Funding sources are an important issue for equity because nearly all funding mechanisms redistribute money. That issue is examined in this section.

National Transit Database

The National Transit Database (NTD) information from 2011 was used to find the overall operating and capital funding sources for the peer regions. See Table 4 and Table 5.[72] The agencies studied are:

- Metropolitan Atlanta Rapid Transit Authority (MARTA)
- Greater Cleveland Regional Transit Authority (GCRTA)
- Denver Regional Transportation District (RTD)
- Bi-State Development Agency, St. Louis, MO (Metro)
- Detroit-Total:
    - City of Detroit Department of Transportation (DDOT)
    - Suburban Mobility Authority for Regional Transportation (SMART)
    - Detroit Transportation Corporation (DTC)

Table 4. Transit Operating Funds Allocations, Peer Regions and Detroit, 2011

	MARTA	GCRTA	RTD	METRO	Detroit-Total
Fare Revenues	22%	23%	26%	20%	15%
Local Funds[a]	55%	62%	55%	66%	34%
State Funds	1%	1%	0%	<1%	32%
Federal Assistance	15%	13%	17%	12%	17%
Other Funds[b]	7%	1%	3%	2%	2%

Source: Federal Transit Authority (FTA). "National Transit Data." 2011. http://www.ntdprogram.gov.

Notes:

[a] *Local Funds:* Any funds generated locally or regionally. Traditionally includes regional sales taxes, but can sometimes be reported as State Funds, if the State collects the taxes.
In the case of DDOT, local funds are budgeted City funds.
In the case of SMART, local funds are primarily property taxes in opt-in communities.

[b] *Other Funds:* Any state government or any local government funding sources that are not dedicated to transit at their source or are not included in the budgeting process of general revenue funds. These funds include:

- *Vehicle licensing and registration fees*
- *Communications access fees, surcharges, taxes*
- *Lottery and casino proceeds*
- *Sale of property and assets*

Table 5. Transit Capital Funds, Allocations, Peer Regions and Detroit, 2011

Region	MARTA	GCRTA	RTD	METRO	Detroit-Total
Local Funds[a]	74%	21%	64%	31%	<1%
State Funds	<1%	-	-	2%	4%
Federal Assistance	25%	79%	36%	67%	95%
Other Funds[b]	-	-	-	-	<1%

Source: Federal Transit Authority (FTA). "National Transit Data." 2011. http://www.ntdprogram.gov.

Notes:

[a] *Local Funds:* Any funds generated locally or regionally. Traditionally includes regional sales taxes, but can sometimes be reported as State Funds, if the State collects the taxes.
In the case of DDOT, local funds are budgeted City funds.
In the case of SMART, local funds are primarily property taxes in opt-in communities.

[b] *Other Funds:* Any state government or any local government funding sources that are not dedicated to transit at their source or are not included in the budgeting process of general revenue funds. These funds include:

- *Vehicle licensing and registration fees*
- *Communications access fees, surcharges, taxes*
- *Lottery and casino proceeds*
- *Sale of property and assets*

From this we see several patterns:

- The systems receive nearly proportionate Federal Assistance funds for operating.
- The Detroit systems rely heavily upon Federal Assistance for capital funds. They do not have a significant source of local funds for capital purchases. Cleveland and St. Louis are also relatively high in relying on Federal Assistance.
- The Detroit systems are an exception in receiving significant state funds.

- Among peer regions, 55 percent to 66 percent of operating funds are from local funds, but among the Detroit systems, it is much lower.

One equity issue related to these points is that the Detroit systems over-rely on federal and state funding compared to the other regions. This has implications on level of service. If local sources of funding are not as available, then the systems are not supported financially, and they cannot as effectively do their core duty of providing access to residents of the region. A low-funded system is less equitable than a more funded system.

Even though it appears from a percentage perspective that Detroit is getting high federal aid for transit, in terms of total dollars, it could get much more if it had local sources of funding to match federal funding.

Sources of Local Funding

Local funding, which includes regional funding, is the main source of funds for the comparison regions. Since there is significant variety in the means of collection of these local funds, it is important when examining equity to evaluate each type of funding.

According to the companion report, *Transit Lessons for Detroit from Four Peer Regions* (chapter on Transit Financing), all regions rely most heavily upon regional sales taxes.[73] Other minor sources of income may be found in some of those regions.

Largely because the State of Michigan Constitution does not allow for regional sales taxes, the local systems rely upon other means of collecting local funds. The City of Detroit provides funding to DDOT from collected tax revenue, which is largely from property and incomes taxes. SMART receives local funding from property taxes from opt-in communities.

Analysis of Equity in Local Funding

Levels of equity were defined in an earlier chapter. The levels are:

1. *Layman's Equity:* Getting fair value for direct support such as taxes and fares.

2. *Consideration:* Taking into account that some groups need more help adjusting to change.

3. *Equality:* Remediation of previous inequity.

The first and third equity levels have the most bearing on funding mechanisms. The second level is more about what is done with funding, rather than how it is raised. One significant difference among the first and third levels is that they are opposing views of redistribution of income. Pure layman's equity would require that all local funds come from fares or congestion pricing of tollways. Pure remediation would require that none of the local funds come from fares, but that progressive taxes be used instead.

Redistribution of income can happen in two directions. Commonly, transit is thought of as redistributing tax revenues to lower income people. This is true if wealthier people pay for transit while lower income people use it.

However, there can also be reverse redistribution. In this case, it worsens historic social equity issues. An example of this is the use of regressive sales taxes to support commuter systems where a majority of transit riders are wealthy. The Long Island Railroad (LIRR) runs one-tenth as many trains in reverse commute as it does in towards downtown New York. Bus connections at commuter rail stations are often not configured to handle a reverse commute.[74] The LIRR's primary source of local funding is a payroll tax. However, there have been discussions to consider using congestion pricing of tollways.

Common funding mechanisms are compared in Table 6. A funding mechanism is considered highly redistributive if the fee payers are largely not the same people benefiting from the transit directly by riding or indirectly through congestion mitigation. A funding mechanism is considered moderately redistributive if many, but not all, of the fee payers benefit directly or indirectly.

Table 6. Equity of Local Funding

Funding	Equity Level	
	Funding of Basic Bus Service	Funding of LIRR-Type Commuter Rail
Fare Revenue	Laymen's equity. Not redistributive.	Laymen's equity. Not redistributive.
Tollway Congestion Pricing	Laymen's equity. Moderately redistributive.	Laymen's equity.
Sales Tax	Regressive. Moderately redistributive.	Regressive. Reverse redistributive.
Payroll Tax	Progressive. Highly redistributive.	Progressive. Moderately redistributive.
Property Tax	Progressive. Highly redistributive.	Progressive. Moderately redistributive.
Vehicle Registration Fees	Progressive. Highly redistributive.	Laymen's equity. Moderately redistributive.

From this, it is seen that if a regional authority wants to promote remediation of previous inequity, property taxes and vehicle registration fees will be favored. In practice, funding is more of a function of political expediency, so regressive and mildly redistributive funding mechanisms, such as regional sales taxes, are more common. Relying on property taxes, as SMART does, may reduce political salability and may make it harder to keep communities opted-in to their program. Future studies could determine whether there is more support for sales taxes based on the publically recognized regressive nature of the tax. Although sales taxes would not directly remediate previous inequity, by having a highly supported transit system, the same goals can be indirectly met.

ACCESS COMPARISONS

Brookings Results

The peer regions were analyzed for job access by using a similar methodology to that of the work described above in current Detroit. The Brookings Institution found that a portion of the population could reach an average job.[75] This is shown in the Table 7.

Table 7. Access to Jobs via Transit with Brookings Method

Region	Atlanta	Cleveland	Denver	St. Louis	Detroit
Access (City)	25.1%	44.3%	59.8%	35.8%	33.1%
Access (Suburbs)	10.4%	14.9%	32.9%	16.4%	14.3%
Access (Average)	14.7%	26.0%	45.6%	22.3%	20.0%

Source: Adie Tomer, *Where the Jobs Are: Employer Access to Labor by Transit* (Washington, DC: Brookings Institution Press, 2012).

The Brookings work shows that the suburbs consistently have a much lower access to jobs via transit. This means that someone who is transit captive in the suburbs has a significantly more difficult time reaching jobs. According to Brookings, Denver has the highest access to jobs, and the least difference between the city and suburbs. Percentage-wise, the average suburban resident in Denver has twice or more the job access compared to other cities.

These results will be compared to our own study using different assumptions that were shown in the Current Detroit section above. Among the assumptions by Brookings was that three hours of commuting per day was the upper limit.

New Methodology

Methods

For this study, the methodology used for identifying the amount of access to jobs for people driving was the same as in the previous report on Current Detroit. Roughly, 10 to 12 starting points were mapped for each city using Google Earth's Placemark tool. Again, the focus was on finding how many jobs a random person can reach, instead of on the employer perspective of how many employees can reach the job.

The transit methodology was to use Google Earth's Get Directions tool for transit. This required some corrections:

- Google Transit does not plan for people to arrive at bus stops in advance of the expected bus arrival. Instead, Google Transit provides the latest time that someone could leave from their chosen starting location to arrive at the bus stop just on time to board the bus. Studies show that people plan to be at the stop about two minutes early. Therefore, this time had to be built into the calculation.[76]

- When service is unreliable, such as in Detroit, people significantly vary behaviors, sometimes planning to meet the previous bus just so that if that one does not come, they can still reach work on time. This behavior is not accounted for in Google Earth, but to realistically predict behavior in Detroit, it should be taken into account. It seems to be a more significant problem in Detroit than elsewhere. This irregular schedule must also be considered at transfer points.

- Google Transit does not limit trips to 0.25 miles of walking per segment.

- Google Transit assumes that someone leaves at the time and day that the calculation is done in the software. To have a consistent time and day, it should be set to one value.

In the following sets of figures are displayed for each peer region, the population densities (Atlanta, Figure 10; Cleveland, Figure 12; Denver, Figure 14; and St. Louis, Figure 16) and then the density maps showing the placemarks (Atlanta, Figure 11; Cleveland, Figure 13; Denver, Figure 15; and St. Louis, Figure 17). Each placemark represents a starting point chosen in a high-density area. Each figure has the namesake city outlined in a bold black line.

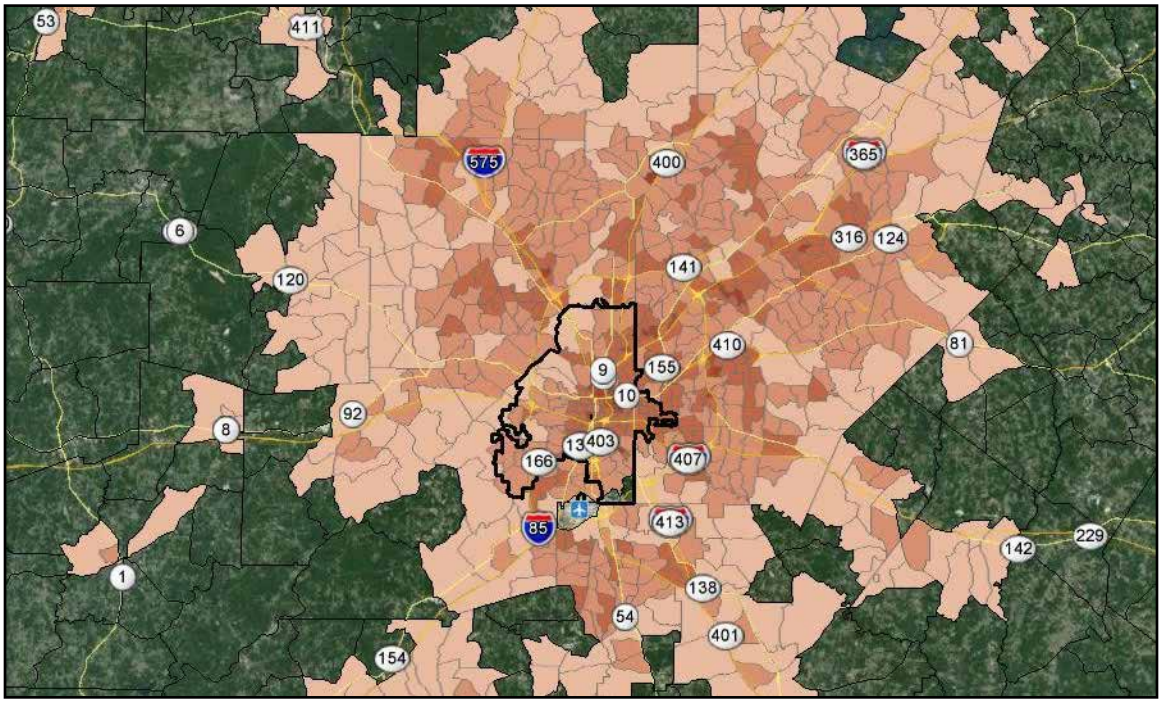

Figure 10. Population Density, Atlanta, 2010

Source: U.S. Census 2010.

Notes: Produced with multiple software programs including Excel, ArcMap GIS and Google Earth from original U.S. Census data.
Map dimension is 90 miles east to west, and 55 miles north to south.
Census tracts are color coded from transparent to dark brown based on population density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

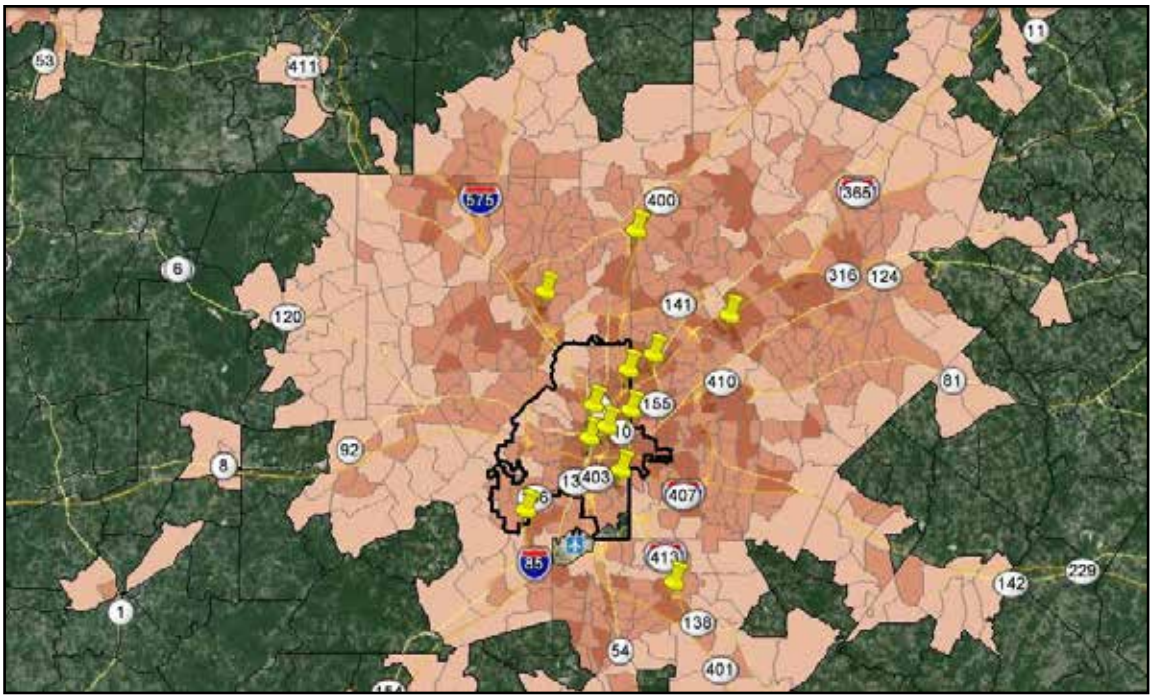

Figure 11. Population Density and Placemarks, Atlanta, 2010

Source: U.S. Census 2010.

Notes: Pins are the identified residential starting points.

Figure 12. Population Density, Cleveland, 2010

Source: U.S. Census 2010.

Notes: Produced with multiple software programs including Excel, ArcMap GIS and Google Earth from original U.S. Census data.
Map dimension is 85 miles east to west, and 50 miles north to south.
Census tracts are color coded from transparent to dark brown based on population density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

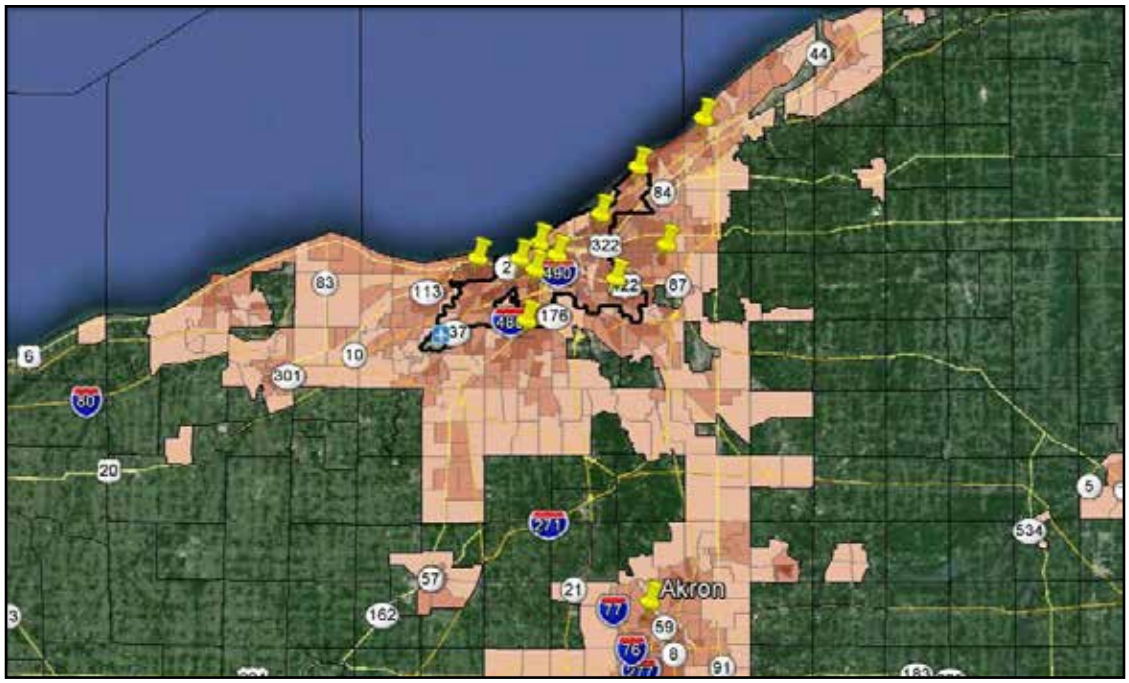

Figure 13. Population Density and Placemarks, Cleveland, 2010

Source: U.S. Census 2010.

Notes: Pins are the identified residential starting points.

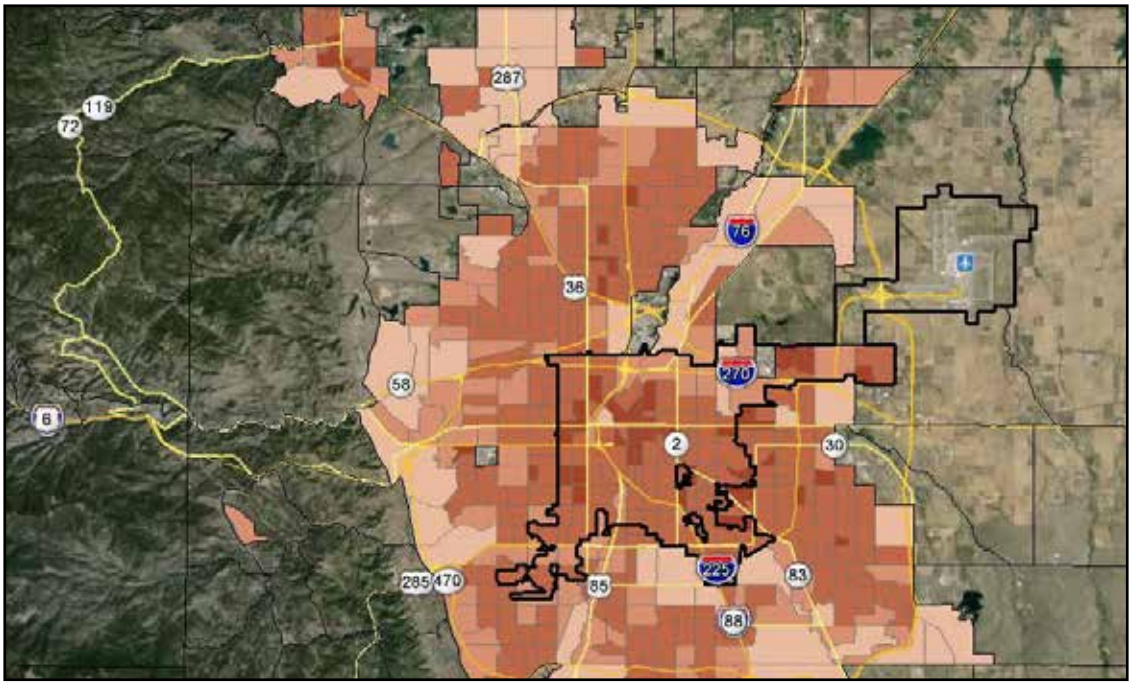

Figure 14. Population Density, Denver, 2010

Source: U.S. Census 2010.

Notes: Produced with multiple software programs including Excel, ArcMap GIS and Google Earth from original U.S. Census data.
Map dimension is 55 miles east to west, and 35 miles north to south.
Census tracts are color coded from transparent to dark brown based on population density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

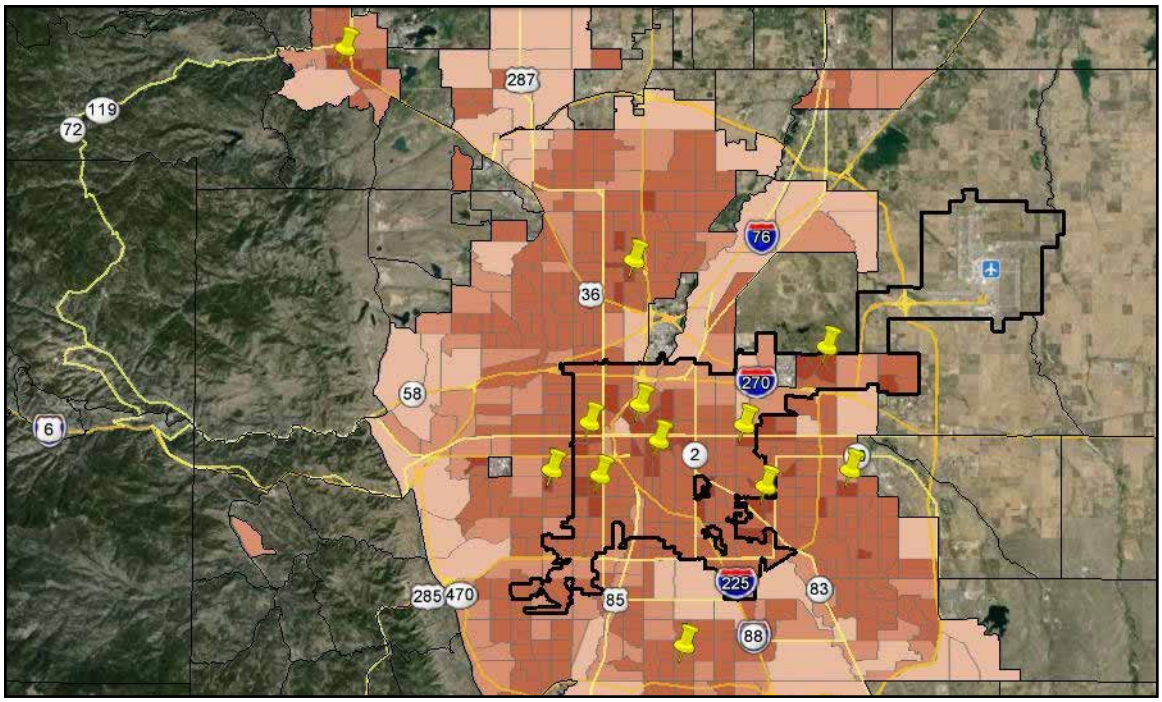

Figure 15. Population Density and Placemarks, Denver, 2010

Source: U.S. Census 2010.

Notes: Pins are the identified residential starting points.

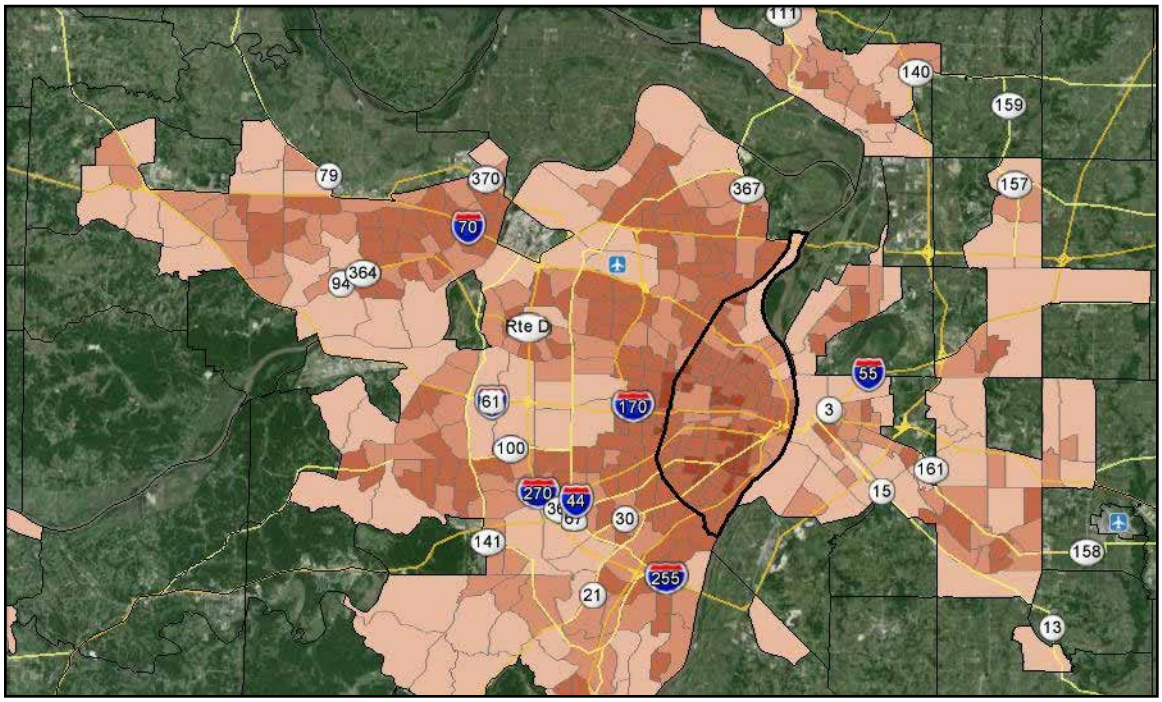

Figure 16. Population Density, St. Louis, 2010

Source: U.S. Census 2010.

Notes: Produced with multiple software programs including Excel, ArcMap GIS and Google Earth from original U.S. Census data. Map dimension is 65 miles east to west, and 40 miles north to south.

Census tracts are color coded from transparent to dark brown based on population density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

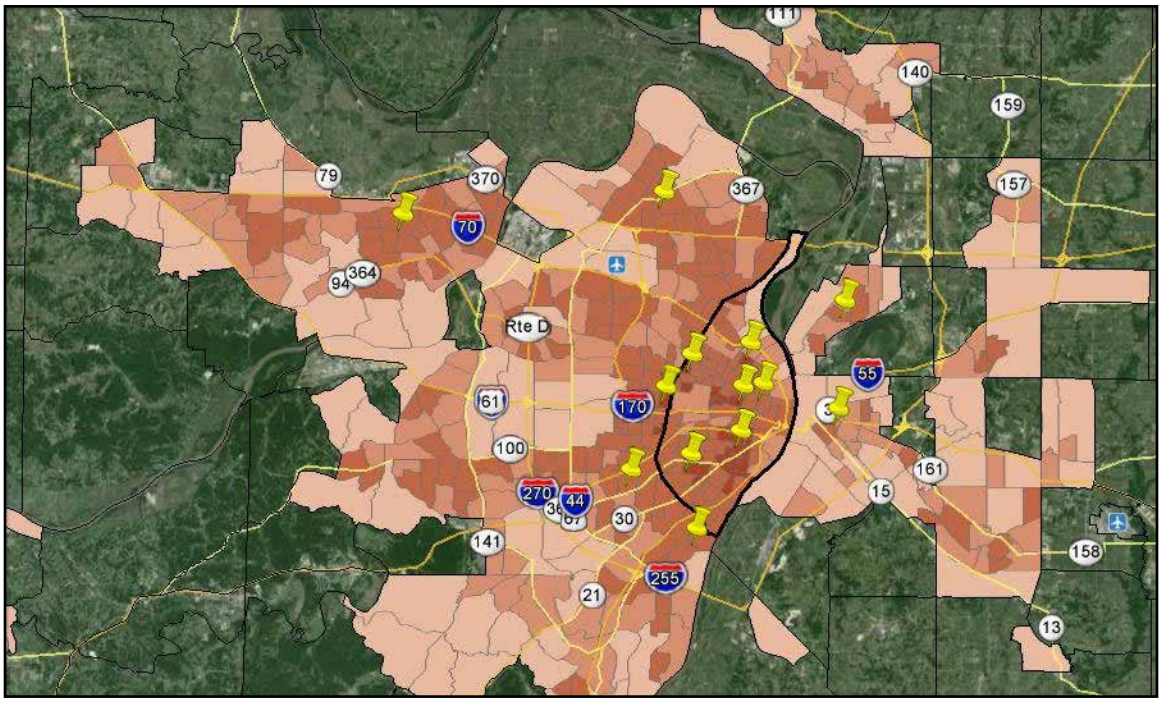

Figure 17. Population Density and Placemarks, St. Louis, 2010

Source: U.S. Census 2010.

Notes: Pins are the identified residential starting points.

Results

Figures 18 through 21 show the job locations within the extended metropolitan area for the peer cities from the Longitudinal Employer-Household Dynamics survey.[77] The numbers of jobs were found for each hypothetical commuter, just as done in the Current Detroit section, by capturing the count of jobs within their transportation envelopes. If a driver could leave the MSA boundary within an hour, those jobs were not considered. See the tables for a listing of the numbers of jobs within one hour of driving and transit (bus) commute time.

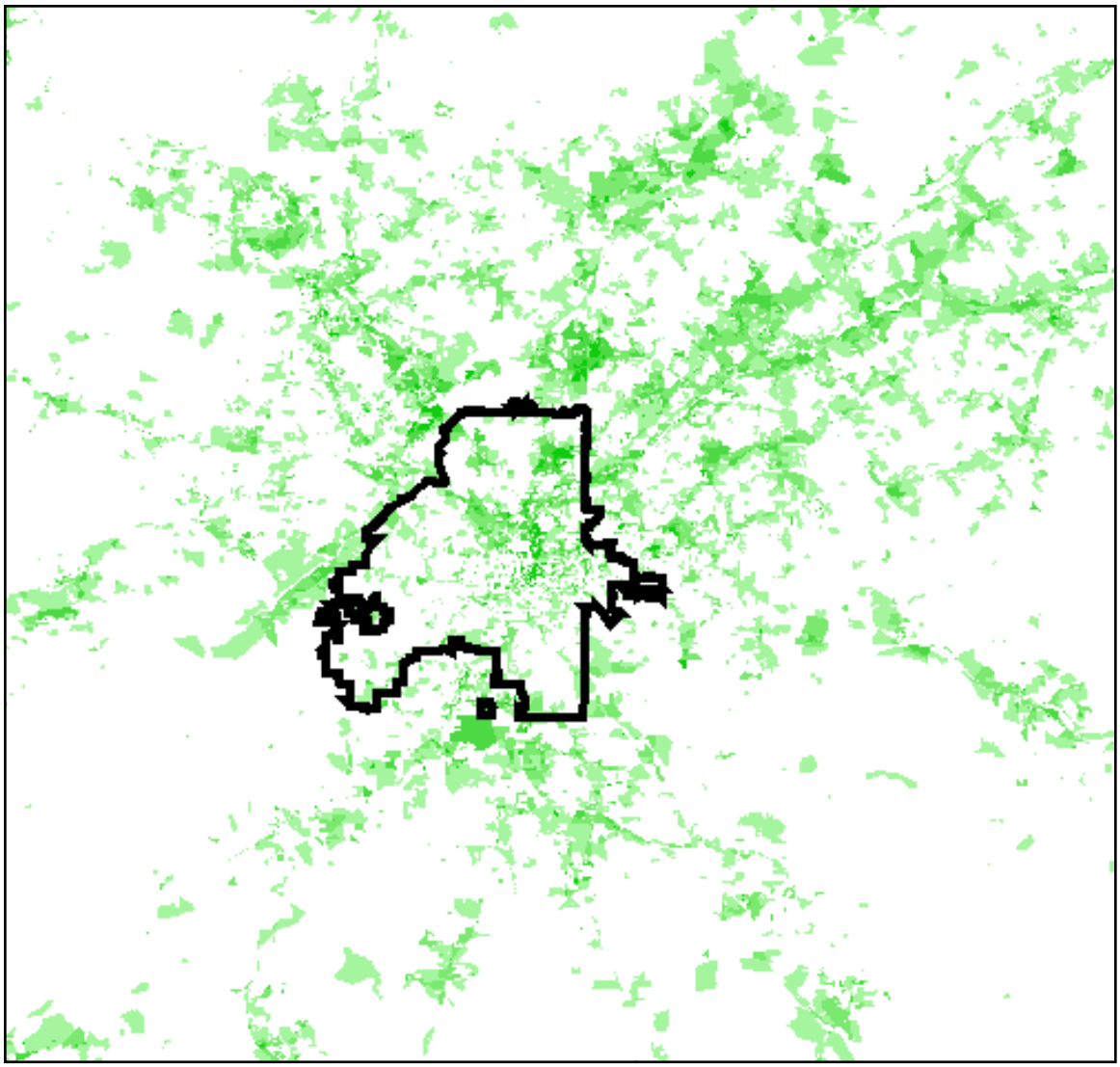

Figure 18. Job Density, Atlanta, No Date

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics* (LEHD). No date. http://lehd.did.census.gov/led/index.php.

Notes: Produced with software programs including Excel, ArcMap GIS from original LEHD data.
Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

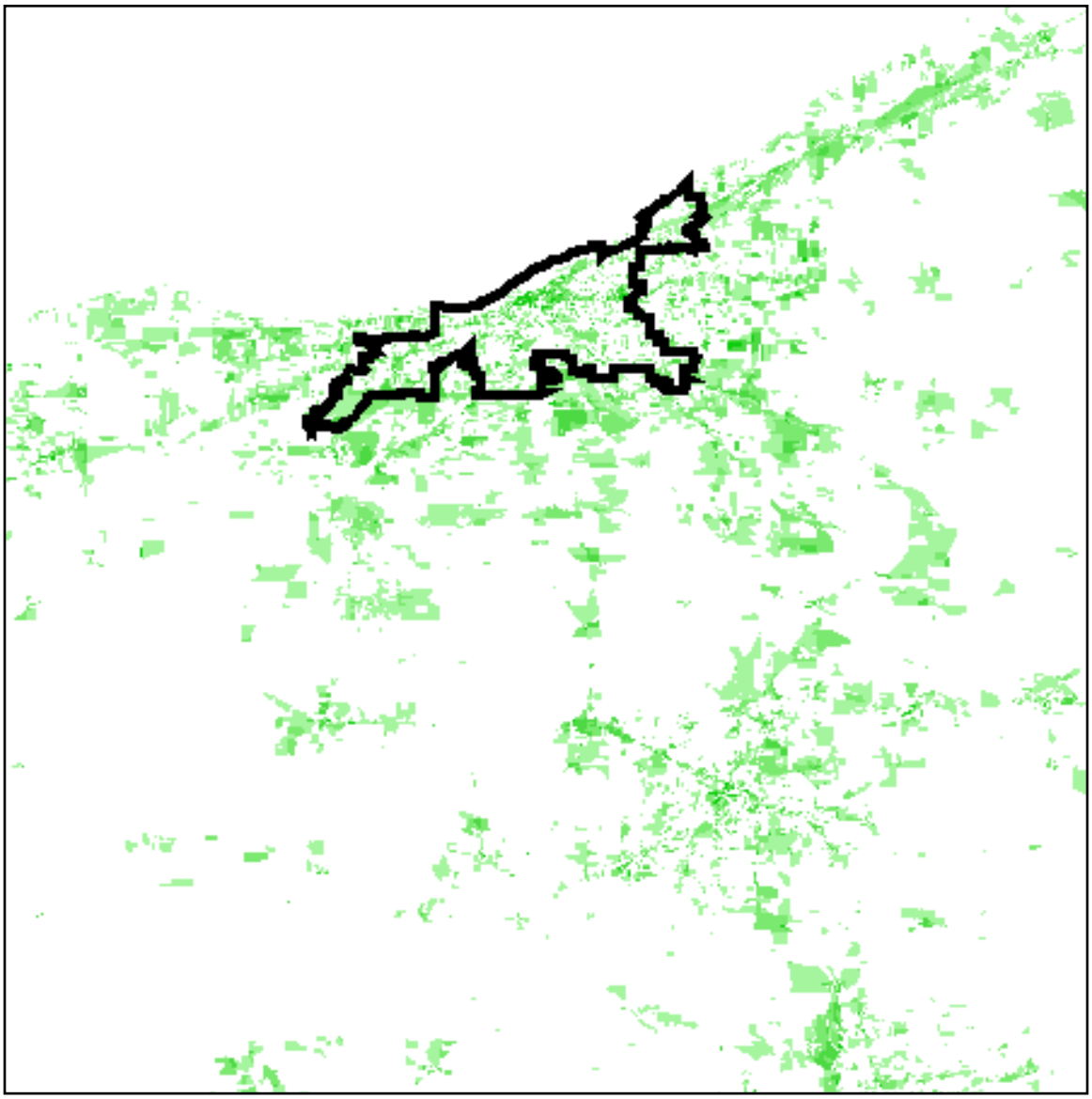

Figure 19. Job Density, Cleveland, No Date

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

Notes: Produced with software programs including Excel, ArcMap GIS from original LEHD data.
Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

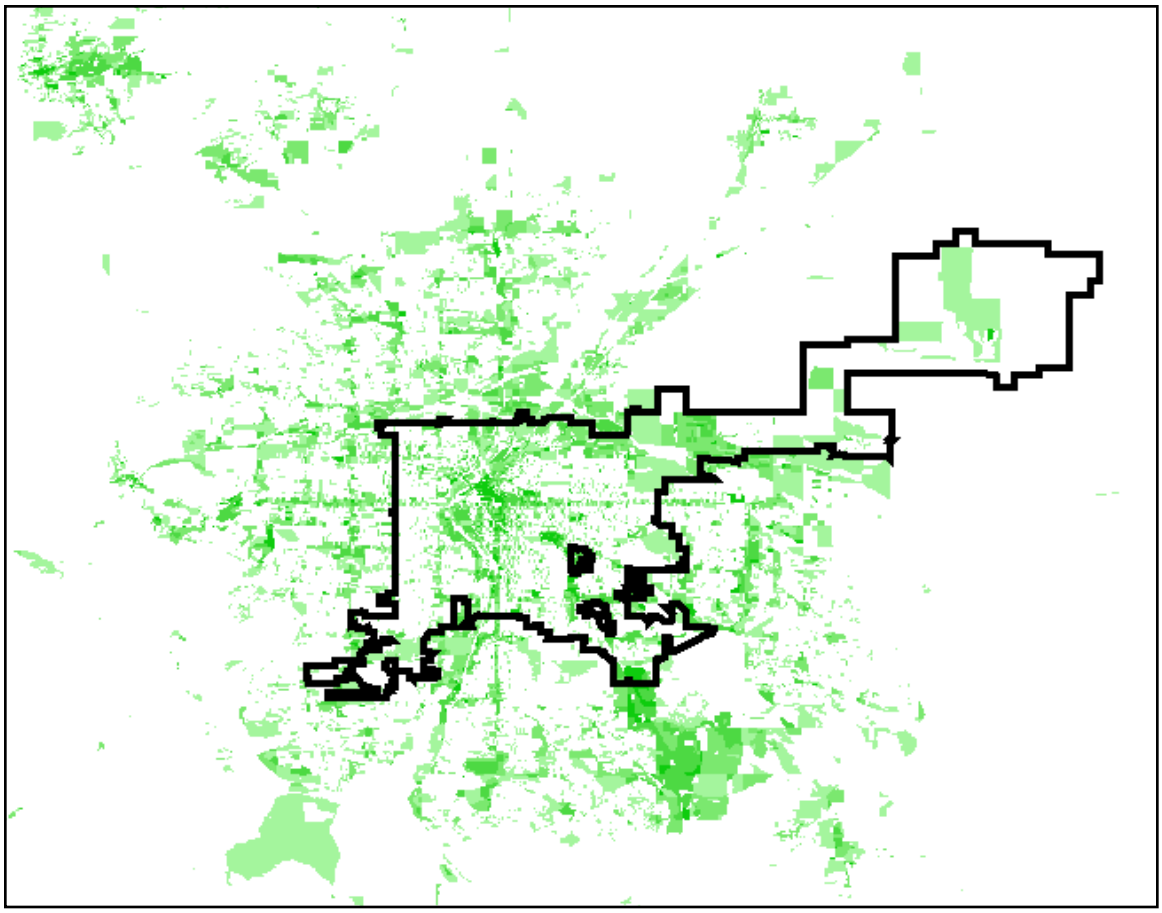

Figure 20. Job Density, Denver, No Date

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

Notes: Produced with software programs including Excel, ArcMap GIS from original LEHD data.

Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

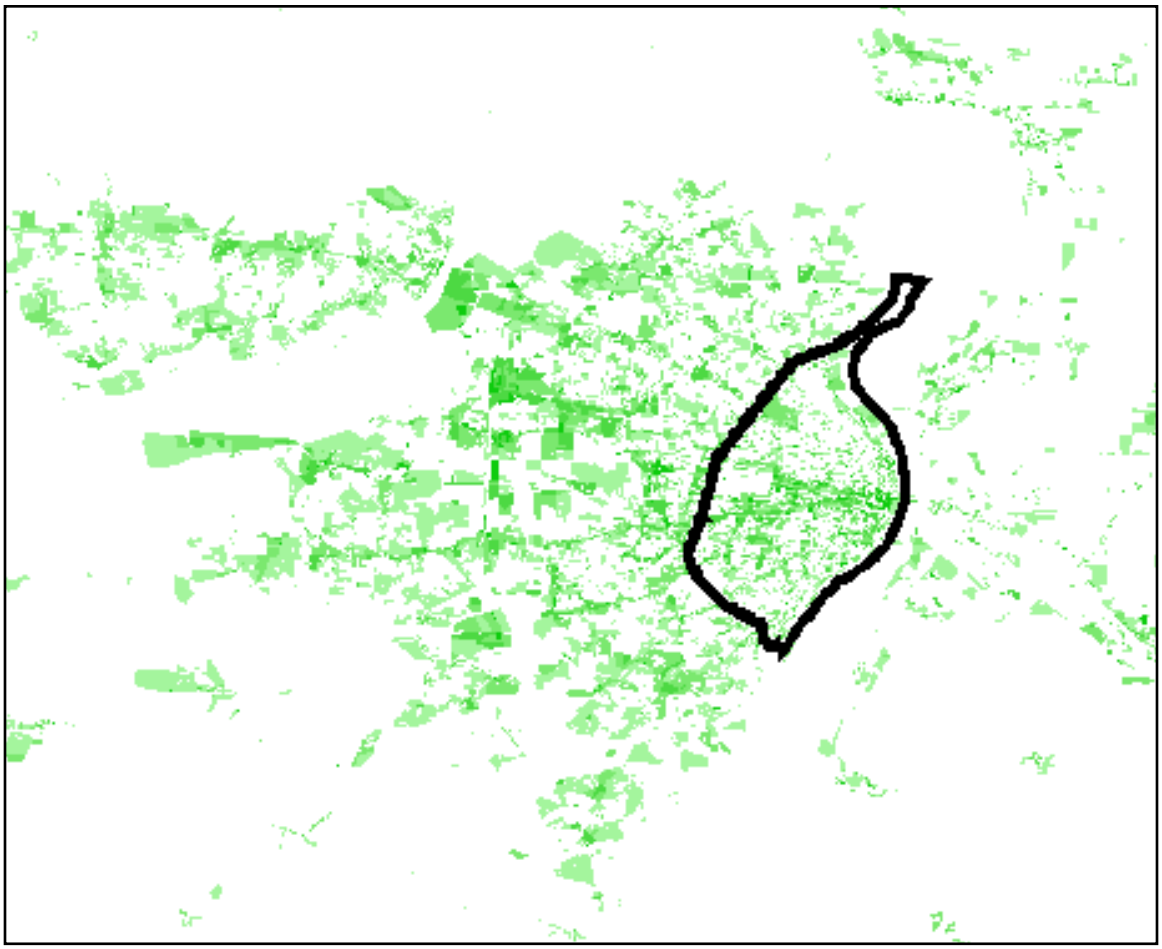

Figure 21. Job Density, St. Louis, No Date

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

Notes: Produced with software programs including Excel, ArcMap GIS from original LEHD data.
Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

The job density figures show similar patterns. There are high job densities in downtown central business districts, and in some other major business districts within each of the cities, but the majority of jobs are located in the suburbs.

Figure 22 shows the sample jobs analysis for Atlanta Downtown. The red polygon represents the distance that a commuter on transit could reach in one hour. The blue polygon represents the same for driving.

The polygons are often roughly oval. In the case of Atlanta, there are two protrusions from the general oval shape. One goes to the northeast, and the other goes south. This reflects light rail service in those directions. In the case of the southern protrusion, it leads to Hartsfield Airport.

Figure 23 shows a transit polygon for Cleveland, starting in Parma. The protrusion follows the 54 bus line to the Cleveland Hopkins Airport.

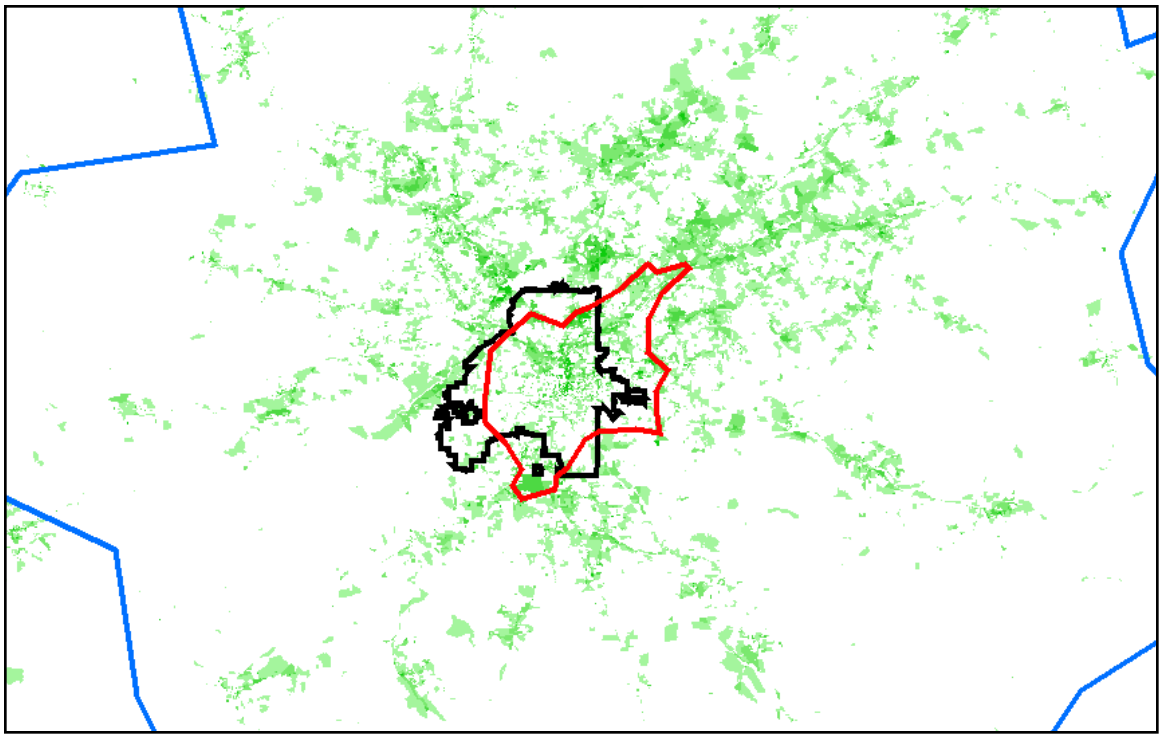

Figure 22. Analysis for Jobs Reachable in One-Hour Commute (by Car or Transit), Atlanta Downtown

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

Notes: Outlines: black is namesake city, red is one hour on transit, blue is one hour in car.

Produced with software programs including Excel, ArcMap GIS from original LEHD data.

Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

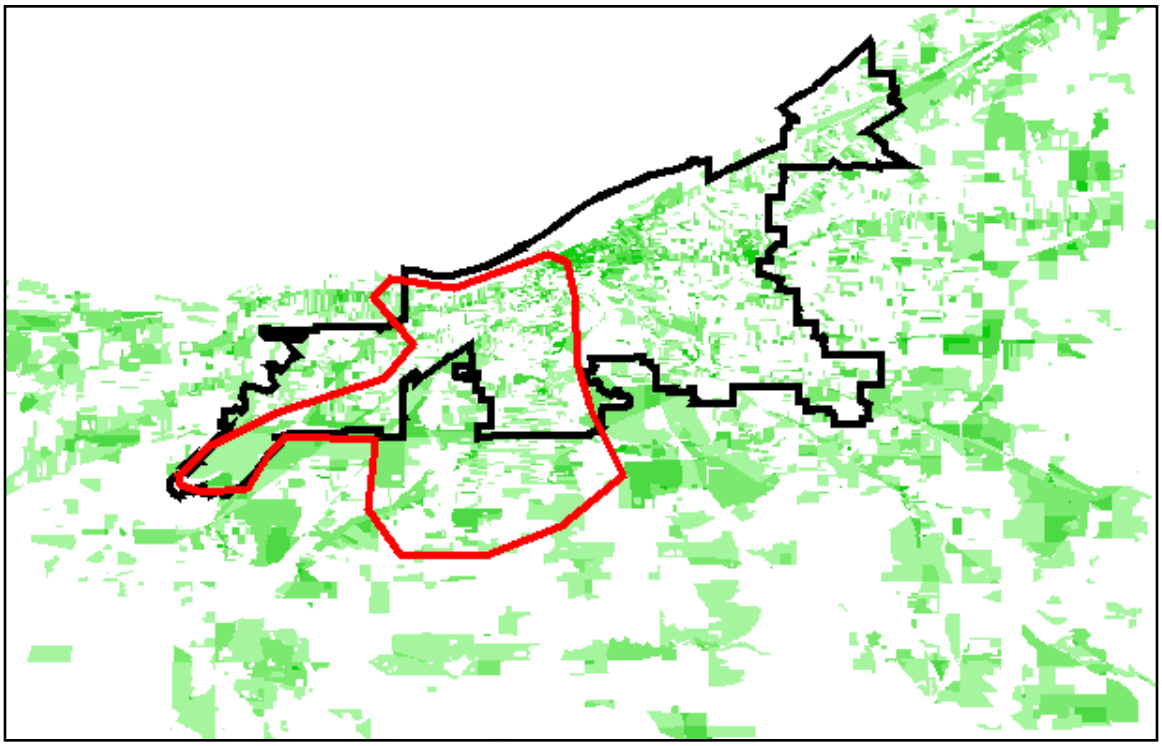

Figure 23. Analysis for Jobs Reachable in One-Hour Commute by Transit, Cleveland-Parma

Source: U.S. Census Bureau. *Longitudinal Employer-Household Dynamics*. No date. http://lehd.did.census.gov/led/index.php.

Notes: Outlines: black is namesake city, red is one hour on transit.

Produced with software programs including Excel, ArcMap GIS from original LEHD data.

Census tracts are color coded from white to dark green based on job density quintiles. (Top one-fifth of tracts in region are coded the same. Tracts are not the same geographic size so the total color balance may not appear as quintiles to the eye.)

Table 8. Numbers of Jobs within One-Hour Commute (by Car or Transit), Atlanta

Location	Car	Transit	Percent (Transit/Car)
City-near SW	2,250,000	281,633	12.5%
City-near NW	2,250,000	224,107	10.0%
Downtown	2,230,000	496,012	22.3%
Roswell	2,130,000	3,719	0.2%
Brookhaven	2,220,000	81,053	3.7%
City-NW	2,220,000	3,274	0.1%
City-near East	2,220,000	101,774	4.6%
Graves	2,160,000	163	0.0%
Marietta	2,210,000	291	0.0%
Rex	1,990,000	51	0.0%
City-SE	2,140,000	196,776	9.2%
East Point	2,110,000	201,765	9.6%

Source: Author's analysis.

Table 9. Numbers of Jobs within One-Hour Commute (by Car or Transit), Cleveland

Location	Car	Transit	Percent (Transit/Car)
Akron	1,510,000	56,857	3.8%
City-West	1,270,000	240,787	19.0%
City-SW	1,270,000	212,776	16.8%
Downtown	1,270,000	172,097	13.6%
City-Near NE	1,270,000	187,980	14.8%
City-near SE	1,270,000	182,666	14.4%
University Heights	1,240,000	223,021	18.0%
East Lake	1,270,000	50,215	3.9%
City-NE	1,280,000	105,241	8.2%
Parma	1,290,000	113,784	8.8%
City-SE	1,260,000	213,018	16.9%
Lakewood	1,270,000	186,140	14.6%

Source: Author's analysis.

Table 10. Numbers of Jobs within One-Hour Commute (by Car or Transit), Denver

Location	Car	Transit	Percent (Transit/Car)
Downtown	1,370,000	386,894	28.3%
City-near East	1,370,000	365,962	26.8%
City-near West	1,370,000	286,798	21.0%
Aurora	1,330,000	33,010	2.5%
Thornton	1,470,000	144,114	9.8%
City-Airport	1,390,000	38,293	2.8%
Boulder	1,400,000	78,671	5.6%
Littleton	1,310,000	75,613	5.8%
S. Aurora	1,340,000	60,034	4.5%
City-East	1,340,000	174,047	13.0%
Lakewood	1,320,000	70,251	5.3%

Source: Author's analysis.

Table 11. Numbers of Jobs within One-Hour Commute (by Car or Transit), St. Louis

Location	Car	Transit	Percent (Transit/Car)
City-West	1,220,000	207,100	17.0%
Clayton	1,220,000	136,810	11.2%
City-near West	1,220,000	193,419	15.9%
City-North	1,220,000	176,185	14.5%
Downtown	1,220,000	186,857	15.4%
City-near SW	1,220,000	195,414	16.1%

Location	Car	Transit	Percent (Transit/Car)
E. St. Louis, IL	1,210,000	137,572	11.3%
Florissant	1,180,000	48,643	4.1%
Granite City, IL	1,200,000	20,343	1.7%
Bella Vista	1,210,000	30,796	2.6%
City-SW	1,220,000	215,204	17.7%
Webster Groves	1,220,000	46,559	3.8%
St. Charles	1,190,000	829	0.1%

Source: Author's analysis.

Table 12 compares average job access of transit users as a percent of the jobs that drivers could reach.

Table 12. Number of Jobs, Comparison Between Cities and Methodologies

	Region	Atlanta	Cleveland	Denver	St. Louis	Detroit (Current)
Brookings	Access (city)	25.1%	44.3%	59.8%	35.8%	33.1%
	Access (suburbs)	10.4%	14.9%	32.9%	16.4%	14.3%
	Access (average)	14.7%	26.0%	45.6%	22.3%	20.0%
This Study	Access (city)	9.8%	14.9%	18.3%	16.1%	6.0%
	Access (suburbs)	2.2%	9.6%	5.6%	5.0%	2.0%
	Access (average)	6.0%	12.2%	12.0%	10.5%	4.0%

Source: Author's analysis.

Time of day is a major factor in these analyses. All analyses represent morning travel behaviors. Observing the same regions in the afternoon or evening often produces different polygons. Therefore, the results above should not be considered to be extremely precise. Instead, the general patterns should be observed, as discussed below.

The job accessibilities found by Brookings are consistently higher than in that calculated for this study, and 290 percent higher, on average. Part of the reason for this is that the Brookings study used 90 minutes instead of 60 minutes as the upper limit for one-way commute time. In addition, it is thought that the Brookings work did not adjust the Google Earth assumptions to represent reality, and they limited walking time to a 0.75-mile distance instead of 0.25-mile. It appears that the Brookings analysis did not account for walking times, so that the total one-way commute time could conceivably be two hours. Another factor that could have affected this was that the Brookings report phrased the research question from the viewpoint of the employer rather than the commuter. Rather than finding how many jobs a person could get to, they found how many employees could get to a job. That method could be flawed in that it neglects equitable distribution of access to jobs.

One big difference between the methodologies is that the method used in this work looked only at high-density residential areas. An inspection of the combined SMART and DDOT

bus routes in Metro Detroit shows that the farther from the city the routes are, the residential areas have lower population densities and the more spread out the routes become. Since bus service is sparser in lower density residential areas, the access is likely lower. Job density is also lower, so the numbers of jobs reached in 60 minutes would be less from suburban areas.

Transit captives who live in the suburbs consistently have fewer opportunities than those transit captives who live in the cities. On average, these suburban dwellers have only 40 percent of the job opportunities that someone living in the city has. The situation is worst for people living in suburban Detroit. These transit captive suburban residents can reach only two percent of the total jobs in the region in one hour. Among the comparison regions, the average is 4.9 percent, with Atlanta at 2.2 percent and Cleveland at 9.6 percent.

Satellite cities are defined as cities 25 to 35 miles away from a core city that has areas of high population density, and significant total population. For this study, the areas are Ann Arbor (Detroit), Akron (Cleveland), Boulder (Denver), and St. Charles (St. Louis). No satellite cities were identified around Atlanta that met all of the criteria. Atlanta has significant centers of suburban population, but not in the range of 25 to 35 miles away.

The results for satellite cities showed no clear patterns. Compared to Detroit (Ann Arbor), some other satellite cities showed higher jobs access by car (Boulder), or less (St. Charles), or essentially the same (Akron). All suburban locations had lower jobs access via transit than the average for core cities, but compared to other suburban locations, the satellite cities had varying jobs access. The key seemed to be whether the satellite city has its own significant bus system.

SCENARIOS

The effects of two scenarios were considered in Detroit. One was to improve the reliability of the existing bus service. The other was to find the impact on access to jobs from adding bus rapid transit (BRT) along transportation spokes.

Basic Bus Service Enhancements

With the current (2013) DDOT bus reliability, it was found that city residents were only able to reach six percent of possible job locations, on average, in one hour. This is because of severe operational problems in the system that throw service off of schedule. However, if the system were operating effectively, it is projected that the same residents could reach as many jobs as those calculated for the peer regions (10 percent). This represents about a 66 percent improvement in jobs access.

Bus Rapid Transit

Detroit is an exception among large cities in its lack of rapid transit. Several models of BRT in the region have been proposed. One key aspect of most is a spoke-like system of transit route lines. Another common aspect is the outer loops connecting the counties in the region. For the purpose of making scenarios, a spoke system was assumed.

Adding rapid transit will affect access to jobs. Faster systems increase access because more jobs may be reached more quickly. The primary questions about this are: Who benefits? and How much do they benefit? It may also be possible to develop design guidelines from this to maximize use of new resources. These are important questions for equity concerns, because equity is related to how people benefit.

The only means to estimate this impact at this time is to look at other cities. Cleveland and Denver were highlighted above for how transit lines created protrusions in the general oval shape of transit access. For this analysis, the Cleveland-Parma polygon was truncated to make it more oval in shape. That reduced the number of accessible jobs to about 100,000. Therefore, under these conditions, adding an express route might increase job access by 14 percent.

The Parma Placemark evaluation showed the most dramatic protrusion. The other polygons viewed often had one or two protrusions. This is because there are some transit lines that are better for different residents. In order to improve the job access of all residents living in high-density areas, many new transit lines would have to be added. Then, it becomes likely that each resident would have one transit line that improves their job access, just as Parma had.

Until better numbers for Metro Detroit are available, this could be used as a guideline. BRT and other express services could be generalized as improving job access by 10 to 20 percent.

VI. CONCLUSIONS

There are several patterns found in the work on access. For example, bus riders originating in the core cities can usually find transit available to them and use it to reach a small share of jobs in a reasonable time. Across five cities the average was 13.2 percent. Denver fared better with 18.3 percent, but Detroit fared worse with six percent.

Transit captive residents living in the suburbs, even living in high-density residential areas, often have difficulty reaching transit within a reasonable walking distance. However, transit captive individuals may locate in areas that have better transit.

Either way, transit captive people have very limited choices for where they can work. It is certainly not equal opportunity between people with cars and those without, or for those who have physical disabilities. It is unlikely that improvements in transit will be able to make opportunities completely equal, but significant effort should be taken to make it more equitable.

Scenarios were considered to enhance transit in Metro Detroit. Improving the reliability of basic bus service may improve reach to jobs by 66 percent. Adding a new spoke BRT may improve job access by 10 to 20 percent, but more research is needed to further quantify this. These results depend upon many variables such as connection to other modes; for example, BRT connected to collectors.

Related to funding, there are numerous funding mechanisms available. Most funding mechanisms in use are not highly redistributive. For example, regressive sales taxes are preferred for funding bus systems that serve lower income people. Income taxes are used to fund systems serving higher-income people, such as in the LIRR. Detroit is an exception in that a progressive property tax is used to fund both the SMART and DDOT systems. Although progressive taxes meet the goals of equity focused on remediation, the lack of a sales tax may be limiting the political viability for additional transit services. The legislation that created the Detroit Regional Transit Authority suggests two funding mechanisms: a vehicle registration fee or a property tax.

RECOMMENDATIONS

Recommendations related to social equity need to be tempered with considerations for political acceptability. Generally, solutions are politically acceptable when the number of perceived winners is more than the number of perceived losers.[78] Even if someone does not intend to use transit, it could be of value to him if many others might use it or if he perceives indirect benefits, such as improvements in the economy, congestion or environment throughout the region.

The issue is larger than just who rides and who pays. The reality is that issues, such as spurred development, mean many people are impacted in many positive and negative ways by these decisions. The goal then of social equity analysis of transit plans is to be sure that those who have been inequitably treated in the past are not continued to be treated unfairly. For example, they should not be taxed to pay for a system that will give rides primarily to affluent suburban residents.

Previous efforts in Metro Detroit to bring transit, such as in the era of SEMTA (1967-1989), were careful about weighing where growth would occur. Light rail plans were said to bring development, and this caused suspicion that suburban taxes would support development in Detroit. SEMTA was very careful to say that growth in Oakland County would continue there, despite transit bringing development to the city of Detroit. This sort of solution is equitable to Oakland County because they get their money's worth. It is also equitable to Detroit because they get development.

Why Buses Are a Priority

Bus access strongly correlates to weeks worked per year.[79] It is to be determined whether this means: 1) that access to buses helps people find jobs, or 2) people locate closer to bus routes so that they can get to work faster, or 3) property near transit is valued higher, so working people can afford it better. It is probably a complex interaction between all of these factors. However, the point is the same: buses get people to work.

Another issue that needs consideration for bus use is that gentrification arises around rail lines.[80] Since rail lines are more permanent and, generally, a faster means of travel, people and businesses prefer to be located near rail line stops. It is an ideal location for consciously planned transit-oriented development (TOD). This causes property values to rise, and makes it less affordable for lower income people to live there. However, it can bring new jobs.

Regular buses do not cause the same increase in property values. If lower income residents have been pushed away from rail lines by gentrification, then buses are a means to bring them in.

If TOD is implemented correctly, it can minimize the gentrification impact. For example, if parking expenses can be unbundled from rent, then those of lower income can more likely afford it.[81]

Why Reliable Service Is a Priority

It has been shown by service in Atlanta that reliable service is the key to maintaining ridership. After the MARTA services became less reliable, they lost ridership.[82] However, this is likely from a reduction in choice riders. The transit captive riders are still likely captive to the less reliable service.

There are several reasons why reliable service is an equity issue. First, employees that rely on transit may lose their jobs if they are not on time to work. This means that people who ride unreliable transit could be consigned to hopping between jobs, each time they are fired for lateness. It is inequitable that they should be relegated to types of employment that have rapid turnover.

Related to this, because of unreliable service, people cannot reach as many jobs in one hour. Since DDOT buses are on average four minutes late, the average rider waits an extra four minutes for the bus.[83] This limits the number of jobs that a person can practically

reach within one hour. Other factors, such as buses that never arrive, mean that some riders have to take an earlier bus just in case their preferred bus never arrives.[84] This results in wasted time being too early for a work shift. Again, this limits how far a person can travel in an hour.

Some people leave for work earlier so that they are guaranteed to reach work on time, to guard against the case where the regular bus is cancelled or late.[85] Another study could be done to see the impact on this behavior.

Charging More for Peak Hour Service

Peak hour service is the time when the most riders use the system. That time and those riders determine the amount of capital funds that have to be spent to construct the system, and they create an overhead for operating the system during the rest of the day. It is a common practice to charge these customers more for the service. This can be done with posted fees at ticketing stations.[86] This practice positively affects equity because many lower income workers have shift schedules and do not commute during peak hours.[87] Therefore, they should not have to pay the higher costs necessary to make the system work properly in peak hours.

Balancing Commuter Systems for Reverse Commute

Many lower income workers live in core cities and commute outward to service jobs in suburbs while suburban dwellers commute inward to the downtown. Rapid transit systems are often designed to deliver suburban commuters downtown. This is because such commuters are a large share of the ridership. One thing that is done to help them is to have the collector buses coordinated to drop them off at the rapid transit station just before the morning train arrives. Then, the buses leave right after the train drops off the riders in the evening. Care should be taken so that this type of schedule works for reverse commuters, too, who arrive at non-standard times of day. According to tours by the research team, it appears that at least one of the comparison cities (St. Louis) does this. However, the current bus system in Metro Detroit is not configured for an off-peak reverse commute, since resources do not allow the current bus systems to coordinate service.

Avoid Redirecting Resources away from Buses

Financial pressure sometimes means that sacrifices are made. Systems that serve more politically perceptive groups (such as suburban riders) receive favoritism. This was the case in St. Louis, according to Larry Salci, when the bus system was disproportionately defunded compared to the Metrolink.[88]

SUMMARY RECOMMENDATIONS

Examine Social Justice Issues, and Follow Through with Action

Recommendation #1: Regional transit authorities should come to an understanding about how to address social justice types of issues.

Attention needs to be paid to doing more than talking about social justice, to action, and then results. For example, a conflict can arise between trying to provide fair value to those people who are taxed for supporting the transit system versus providing it to those who need it as a bridge out of poverty.

Make Reliable Basic Service a Top Priority

Recommendation #2: Regional transit authorities should place reliable basic bus service at the top of their agendas.

Reliable basic bus service has the greatest impact on providing access for low-income residents. Reliability is important because, without it, planning a bus ride is unmanageable for most people. Bus service is essential, because in most cities it is the collector system that is the most important link. Other modes of transit can have an impact, depending on how well integrated “feeder” and “dispersal” systems support reverse commuting. In addition, reliability has a practical impact on mainline commuter routes, in that reliability makes those systems technically possible.

Fund and Implement Reverse Commute Schedules

Recommendation #3: It is most equitable to have suburban commuters pay for the overwhelming majority of the expenses for systems that serve them only. Vehicle registration taxes represent a funding mechanism that supports social equity in this way, as well as provides congestion mitigation for car owners.

Recommendation #4: If providing new commuter systems brings efficiencies in service offerings, other bus routes should receive the benefit from those efficiencies through redistribution of resources to them.

Some commuter-oriented systems, especially commuter rail, primarily benefit commuters going towards the city center. Hours of operation, schedules, and coordination with basic bus service are all normally set up to benefit the commuter to downtown. It is difficult for someone living in the city to reverse commute to a service job that has hours that are not 9 a.m. to 5 p.m., and to have buses ready at the right times to drop them at those disperse jobs.

Design BRT to Be Accessible to All, Including the Physically Challenged

Recommendation #5: When BRT is implemented, level boarding is should be used.

A segment of the population that is mobility disabled finds level boarding more equitable for them. In addition, it helps to maintain schedules. Level boarding is required for fixed rail systems, but not for bus systems. Express bus systems such as BRT are not required to have level boarding, but most BRT systems employ it. It improves equity and maintaining schedules to do so. Level boarding helps all riders, not just the disabled.

Expand Transit Choices

Recommendation #6: Expand transit choices through offering additional modes.

Although reliable basic bus service has the greatest impact on access for low-income people, access is improved somewhat by providing new commuter systems. In addition, some modes, especially CRT, will likely benefit higher-income residents more, but there is potential for low-income residents to benefit through changing externalities such as reduced air pollution.

ABBREVIATIONS AND ACRONYMS

AATA	Ann Arbor Transportation Authority
ACS	American Community Survey
BRT	Bus Rapid Transit
CBD	Central Business District
CI	Connectivity Index
DDOT	Detroit Department of Transportation
DRTD	Denver Regional Transportation District
DTC	Detroit Transportation Corporation
DTOGS	Detroit Transportation Options for Growth Study
EJ	Environmental Justice
EPA	United States Environmental Protection Agency
FTA	Federal Transit Administration
GCRTA	Greater Cleveland Regional Transit Authority
GIS	Geographic Information System
HealthLine	Bus Rapid Transit System in Cleveland
HRT	Heavy Rail Transit
LIRR	Long Island Railroad
LRT	Light Rail Transit
M-1 Rail	Streetcar line along Woodward Avenue in Detroit Michigan
MARTA	Metropolitan Atlanta Rapid Transit Authority
Metro	Bi-State Development Agency in St. Louis, MO
MSA	Metropolitan Statistical Areas
NAACP	National Association for the Advancement of Colored People
NTD	National Transit Database
SEMTA	Southeast Michigan Transportation Authority
SMART	Suburban Mobility Authority for Regional Transportation
UMTA	Urban Mass Transit Agency
EPA	United States Environmental Protection Agency
US DOT	U.S. Department of Transportation

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