TRANSIT-ORIENTED DEVELOPMENT IN DETROIT

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ABSTRACT: Working with the Detroit Department of Transportation, this project outlines a Transit-Oriented Development (TOD) plan in conjunction with the impending Woodward Avenue Light Rail Train (LRT). Three separate stations and their surrounding areas have been planned from a TOD perspective, incorporating proven design elements from other examples (e.g. an increase in pedestrian amenities and accessibility), while still incorporating the unique characteristics and composition of the local neighborhoods. Each plan is different, yet all promise to promote ridership and growth in tandem with the new train. Ideally the new train would be carbon-neutral, and current technologies and prices are reviewed to highlight the challenges facing a zero-emissions train. However with 22,000 daily passengers expected, the train will largely subtract from overall emissions. With each station smartly designed around TOD principles, we demonstrate how the Woodward Avenue LRT can grow in turn with the Detroit for decades to come.

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Chapter 1: Introduction and Goals of this Project

DDOT's Expectations

The Detroit Department of Transportation (DDOT) asked us to develop a Transit-Oriented Development (TOD) plan for Light Rail Transit (LRT) along the Woodward corridor, a major street spanning from downtown Detroit all the way to the city's northern boundary at 8 Mile Road. DDOT wanted station designs for three of the proposed eleven stops along Woodward, and a TOD plan to encourage growth in Detroit both now and in the future, when LRT will expand to other transit spokes in neighboring communities on streets such as Jefferson, Gratiot, Grand River, and Michigan. DDOT did not need us to look into financing or technical details such as ridership predictions because it hired consultants to do that level of analysis. Instead, we were encouraged to be creative and think big.

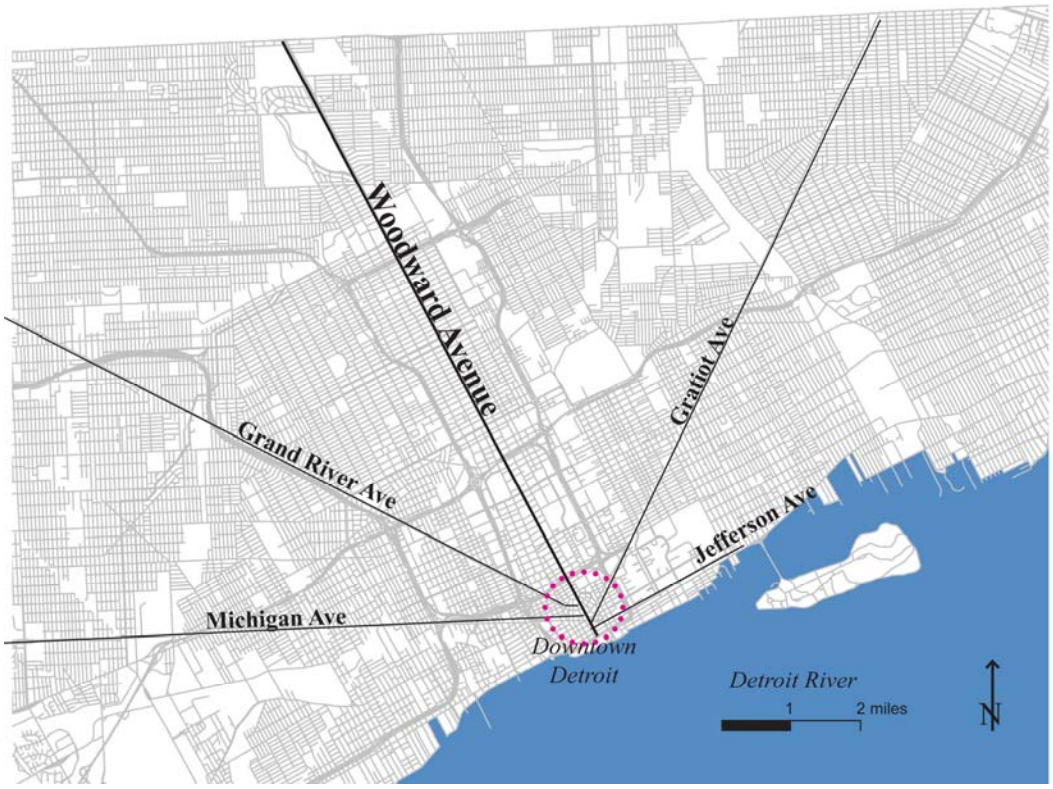

Figure 1.1: Map highlighting the major arterial roads in the City of Detroit. Data from DDOT (Lee 2010)

Woodward Avenue is a main artery connecting downtown and the greater metro area (City of Detroit 1992). The work we do to visually communicate the light rail system can be used to gain public support and contribute to the dialogue of cultural sustainability in developing urban transit systems. DDOT brought this project to the University of Michigan after already laying out the station plan along Woodward Avenue. Many general aspects of the light rail planning have been done, and funding has been and continues to be secured. Our task is to design the stations and surrounding areas so that community members will understand, visually, what Sustainable TOD (STOD) can mean for them. Awareness of cultural traditions and expectations is essential to inspiring local support for and acceptance of a new system, especially when the community may remember disappointing failures of previous city planning efforts. While the scope of our project prevents us from covering issues of racial tensions and the history of social and economic injustice, we realize we must consider this background in order to design spaces residents will accept and support.

Our Approach

Light rail is coming to Detroit, but some current conditions will not support extensive use of the train. For example, the roadway configurations are not conducive to high ridership, Detroit's population and physical footprint are shrinking, municipal zoning is outdated, and prolific vacant spaces have untapped potential for production. We provide recommendations that create a mutually beneficial relationship between the train and the Woodward corridor. We aim to ensure that the train not only functions as a mover of people, but also strengthens the spine of the city and puts Detroit on the road to a sustainable future.

The overarching goal of this project is to make sustainable transportation a viable component of Detroit, Michigan. We believe this TOD plan can be the cornerstone of a revitalized city, tying together the fragments of a disconnected urban landscape. Our city's fabric is rich with different neighborhood pockets, some of which have active community groups. However, the lack of community cohesion

at a city-scale has led to a generally weak local identity. STOD will stitch different segments together into a legible network of dense, active, livable spaces. This new urban matrix will take its cues from the ecological and cultural histories and characteristics of Detroit as a basis for sustainable design.

The Woodward Avenue corridor is a central location in which the fragments of Detroit's urban landscape can come together. Our goal is to strategically organize the functioning pieces of the city so that they become accessible within the highly visible and walkable spaces surrounding the city's main arterial road. This will enable travelers along the Woodward corridor to appreciate the vitality that the city once had and continues to strive for, despite its declining economy and prosperity. Visible signs of vitality and activity will invigorate interest in the city in residents, visitors, and potential residents. Utilizing street space as public space will allow the community to form assets and incorporate them into the urban fabric.

The design applications that will appeal to viewers will also address the problematic landscapes that now document Detroit's decline. Vacant lots and the management they require represent opportunities for STOD applications to take physical shape. Wide, underused streets designed to accommodate heavy automotive traffic are now opportunities for implementing multiple uses such as non-motorized travel and ecological patches. A TOD plan that addresses its context can transform a look of abandonment to an appearance of care, purpose, and service to the community.

While economic growth is a key component of successful urban centers, certain realities of Detroit contribute to urban decay. To incentivize development, the advocates of TOD have traditionally emphasized economic improvement and growth, but our project seeks a definition of TOD that emphasizes social connections. By focusing on the personal experience of transit, we hope to develop guidelines for the city that can overcome social stigmas faced by the remaining population of Detroit.

The five members of our team—three landscape architects, one urban planner, and one environmental policy student—have each tackled different aspects

of this project. Although we address our specific content areas individually, our recommendations are unified by key themes that weave throughout the report:

Theme: Zoning for a Better Future

Chapter 5 argues that in order for transit to work within the auto-centric City of Detroit, planning practices should attempt to reconfigure the population to create a more cohesive network of expected travel. Detroit's population loss and the resulting low-density settlement make it very costly for the city to provide services to residents. Low-density settlement also necessitates travel by automobile and harms water quality. Rail transit provides an excellent opportunity to build up density along transit corridors.

Zoning is a key planning tool for redistributing the city's population by encouraging or requiring high densities near transit lines and deemphasizing parts of Detroit that have high vacancy rates and are far from transit lines. Zoning can help bring about a future Detroit that has rail transit along the major streets, high densities near transit lines, and very low densities and creative uses in areas that are not transit-accessible. Chapter 5 recommends zoning changes that will encourage this pattern of development.

Theme: Dead Zone Mitigation

Chapter 7 explores the idea that in order for the train to be successful, we must mitigate the effect of dead zones. Dead zones are spaces in the city that are underused by the intended user, have not adopted a new or productive reuse, and are visually unappealing. Dead zones can elicit perceptions of danger, discomfort or abandonment, which might discourage the vibrant street life to which TOD aspires. Common dead zones include surface parking lots and junctions of freeway and road. TOD will fit better in downtown Detroit if we decrease the impact of dead zones along major routes of access to the train and to downtown. If bikers and pedestrians have a more comfortable experience in reaching the train, they will be more inclined to use it, a key strategy of TOD. This will be done by making the spaces that create this effect safer, more diverse, and more legible.

Theme: Breaking the Parameters of TOD

Chapter 8 discusses how community planning and design surrounding the Woodward LRT train stations should not be confined to the half-mile radius typically used in TOD. This practice aims to promote dense communities within a walkable area to the train station. It is not, however, a reasonable model for Detroit and would not facilitate the success of the Woodward light rail line. First, this model assumes that the half-mile radius surrounding the train station is the ideal place for redevelopment, but Detroit has amenities and active communities scattered throughout the city, with much vacant land in between. Detroit is a shrinking city. Rather than ignoring currently successful areas and trying to force redevelopment into a new area, planning and design should focus on connecting and strengthening all areas to form a more cohesive network. To succeed, the Woodward light rail train cannot rely solely on pulling riders from the typical half-mile radius; rather, the circle must be broken to promote movement between activity hubs surrounding the train.

Theme: Extending Natural Spaces to Strengthen Community Connections

Chapter 9 argues that the strengthening of communities will help ensure use of the new light rail train in the City of Detroit. If residential areas are located at cultural and ecological amenities that foster public use and social interaction, Detroit residents can maintain a sense of character, pride, and group ownership of their surroundings. Light rail will promote the development of natural spaces that fulfill transit functions while simultaneously providing ecological services for the urban landscape. By utilizing the underused space of public streets as a starting point, the transformation of empty city hardscape to vibrant, living gathering nodes can change the current Detroit aesthetic into a case for sustainable urbanism through social and ecological development.

Theme: Alternative Energy Sources

Chapter 10 argues that if transit is to succeed, we must plan and build a foundation for energy production. Operating the light rail on Woodward will require a tremendous amount of electricity, but we should take every measure to reduce the environmental impacts of the train. By incorporating renewable energy production into station design, focusing on energy efficiency, and calculating a comprehensive carbon footprint for the total system (complete with arboreal offsets), we will demonstrate how the train can run on as little fossil fuel as possible.

Each individual built upon these themes by exploring possible applications that respond to the current context of Detroit. To begin imagining appropriate solutions, however, each theme needed a uniform base of information to react to. Detroit's current conditions, transit history, and TOD background, presented in chapters 2, 3, and 4, describe the unique characteristics of the city that are pertinent to the implementation of a new light rail system.

Chapter 2: Challenges Facing Detroit

The population changes Detroit has experienced in the last fifty years define it as a shrinking city (one with continual population loss within its borders). Over the last half century, Detroit's population has dropped from 1.8 million to just over 900,000, a loss of roughly 50% (Higgins 2009). This trend of decline continues. In the 2000 census, Detroit's population was counted at 951,270, and the U.S. Census Bureau estimates the current population to be under 912,000. Interestingly, the shrinkage cannot be tied to people leaving Detroit for other Michigan cities because the state itself is also losing population (U.S. Census Bureau 2000).

This consistent decline in population has led to an abundance of available land in the form of vacant and abandoned properties. A recent article in *Fortune* estimated that Detroit has more than 40 square miles of vacant land—roughly 30% of the entire area of the city (Whitford 2008). This creates many problems: a loss of revenue for the city, a loss of community strength, and a loss of aesthetic appeal in neighborhoods. However, it also provides many opportunities for land redevelopment or land reuse to support ecological services.

The racial demographics indicate that Detroit's remaining population includes 81.6% African Americans, 12.3% whites, and 5% Latinos, with the remainder divided between small, diverse subsets of minority populations (U.S. Census Bureau 2000). These demographics contrast starkly with those of the surrounding cities in the Detroit Metropolitan area. Detroit lies in Wayne County, adjacent to Livonia and Ferndale. In Livonia, 93.4% of the population is white; in Ferndale, along the northwestern border of 8 Mile Road in Detroit, 86.7% of the population is white (U.S. Census Bureau 2000).

Education levels in Detroit are low compared to those of the rest of the state. Only 69.6% of Detroit residents have graduated high school, and only 11% have obtained a bachelor's degree or higher. These education levels are much lower than the 83.4% and 21.8%, respectively, of residents throughout the state of Michigan (U.S. Census Bureau 2000). Education levels in Detroit are also lower than those in Chicago, according to the 2000 census.

Perhaps the most surprising statistic is the total number of people living below the poverty level. In Detroit, 26.1% of the population lives below the poverty line, far more than in Chicago where 19.6% of the population lives below the poverty line (U.S. Census Bureau 2000). The Detroit statistic is also grossly higher than that of neighboring communities, such as Livonia, where only 4% of the population lives in poverty. This shows that there is economic as well as racial segregation between Detroit and the surrounding communities.

Low incomes are problematic not only for those experiencing poverty, but for all city residents. The city pays for its infrastructure and services with tax money. When the majority of the city's residents have low incomes, the city also has lower income, which leads to cuts in services. Low city revenues also lead to higher property taxes, which makes some higher-income residents move out of the city to suburbs with lower tax rates, exacerbating the situation.

Simply put, Detroit is a shrinking city with high rates of poverty and relatively low education levels. It has a great deal of vacant land, which may represent opportunities for redevelopment or differing land use scenarios.

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Chapter 3: Context: History of Transportation in Detroit

Woodward—A Brief History

"The Motor City, and in particular, Woodward Avenue, put the world on wheels" (NSBP 2010). Nationally recognized as the first paved road in the US, Woodward (also known as M-1) connects Detroit to Pontiac, the main artery of commerce, arts, and of course, the automobile. But Woodward's history is rooted in disaster (GCI 2010; Detroit News 1999).

After a devastating fire in 1805 that destroyed most of Detroit, Judge Augustus Woodward was selected to redevelop the city (Austin et al. 2006). Mimicking the L'Enfant patterns of Washington D.C., Woodward designed large boulevards radiating from central gathering areas that were crossed by other large boulevards, with a block in each larger block reserved for civic buildings. Woodward Avenue was named either for Woodward himself or for the direction of the road, which ran toward undeveloped forests. The true story behind the name is unknown and contested.

The Cycling Lobby

Accompanying the increase in bodies and commerce in Detroit, in 1879 the Detroit Bicycle Club was born (m-bike.org 2010). Although membership was small at first, in 1891 the League of American Wheelmen held its annual meeting in Detroit—a sign of the city's increased interest in cycling. Throughout the last decade of the 19th century, several cycling records were set in Detroit, one of America's first "Bicycle Cities" (Detroit News 2000).

These new groups of cyclists spoke in a united voice against the bumpy, unpaved streets that made cycling difficult. The call to pave the streets ultimately led to the success of the automobile, especially on Woodward Avenue with its relatively smooth surface.

The Birth of Public Transit in Detroit

While Detroit is known for the meteoric rise of the automobile in the past century, public transportation also had a big impact early on. Public transportation in Detroit has a long history, much older than the iconic People Mover or the electric trolleys that once crossed our streets. In the mid-19th century, with the Civil War still raging and horse-drawn carriages still providing locomotion, the city covered 12.7 square miles. Today it covers 138 square miles—almost eleven times the area. Because Detroit was a thriving and growing metropolis, the Detroit Common Council passed an 1862 ordinance allowing private companies the exclusive right to build, operate, and maintain horse-car rail lines on the city's busiest streets. A 30-year franchise was issued to a Syracuse, New York-based company, and the Detroit City Railway Company was born. On August 27 of 1863, service along Woodward Avenue began, running from Jefferson to Alexandrine.

In October of 1872, an epidemic affecting horses swept through Detroit, stopping services for several days. This prompted the city to look elsewhere for locomotive means. The Detroit Electric Railway Company began operating electric streetcars in 1886, but public complaints about the noise—and fears about electricity, which was not well understood at that time—caused the line to be converted to a horse rail line. The public soon began to understand the gifts electricity offered, and by 1892, electrification on Woodward Avenue had begun. Historian H.B. Craig, II notes: “With longer routes now possible, several lines were combined to form cross-town routes, including Jefferson & Grand River, and Michigan & Gratiot. By November of 1895, electrification was completed on all of the city lines, and the last of the horse-drawn cars ceased operations on November 9, 1895” (Detroit Transit History 2010).

Electric transit had arrived in Detroit, but it wouldn’t last long.

Unforeseen Impacts of the Auto Industry

Historian J. H. Kuntsler explains the rapid growth in Detroit that accompanied the automobile: “From 1900 to 1930, Detroit’s population ballooned from 285,000 to nearly two million, a sixfold increase. [Henry] Ford alone expanded

[his workforce] from 31 employees in 1904 to 56,000 in 1920. These workers needed homes."

This led to the quick adoption of mass-produced bungalows for single families, giving rise to whole neighborhoods that only branched farther and farther out from downtown. The age of the car meant a decrease in density, despite the overall population increase. However, Kuntsler notes that in the late 1920s, "no more than 30 percent" of Ford's workers commuted to work via automobile—the vast majority still used public transportation (Kuntsler 1993).

However, in 1922, Sidney D. Waldon conceived of a pro-automobile transportation scheme for Detroit's future. Appointed by the mayor to chair a special commission, Waldon aimed to supplant conventional forms of mobility with the car, which he considered "The magic carpet of transportation for all mankind" (Kuntsler 1993). His plan called for the removal of all streetcars and the construction of over 200 miles of superhighways connecting Detroit with two nearby counties.

Detroit's low-density housing did not provide the level of tax revenues enjoyed by high-density cities with more apartment buildings than single-family units, and the streetcars were eventually removed. This—combined with the massive highway infrastructure constructed during World War II—changed the face of Detroit transit. But Detroit's neighborhoods were also scarred by this shift towards auto-centric mobility. Kuntsler's words are profound:

> *When the war was over, Detroit's old grid of coherent city blocks was webbed with limited-access superhighways, built below street grade so they acted like great concrete moats that could only be crossed by infrequent overpasses. They were like stakes driven through the hearts of old neighborhoods, killing whatever life they touched, and erasing thousands of houses and small businesses from the tax rolls. The interchanges became gigantic wastelands of on-ramps and off-ramps.* (Kuntsler 1993)

Electric rail was the foundation of public transportation in Detroit, though eventually the City of Detroit gained control of transit with the formation of the Detroit Department of Transportation (DDOT). Under pressure from the auto companies, the DDOT adopted diesel buses, and the last electric trolley was eliminated in April of 1956. Electric rail provided transportation for Detroiters for over 60 years and played an integral role in establishing Detroit as one of America's premier cities. At this pivotal time in Detroit's history, light rail along Woodward Avenue embraces the best aspects of our past. Our reliance on public transit has been, and can be, the foundation of our beautiful future.

Chapter 4: TOD Background

Accessibility is a major transportation goal that our plan addresses and promotes. The term often refers to access of places by people with disabilities; however, in recent transportation planning literature, accessibility also refers to the planning goal of connecting people to their destinations (Levine and Garb 2002). Traditionally, these connections have been made with roads and automobiles. The traditional approach that focuses only on ease of movement is now referred to as *mobility*, which is but one component of accessibility (Levine and Garb 2002).

Proximity, a component of accessibility addressed in TOD, is accomplished through land use decisions that place destinations near people. High-density development and mixed-use development both place destinations closer to people, thereby increasing proximity. Traditional transportation planning has focused almost exclusively on mobility, neglecting the benefits of proximity. In contrast, TOD helps increase proximity. Although automobility is still the dominant method of connecting people to their destinations in the United States, TOD helps balance mobility and proximity by increasing proximity.

Transit-oriented development is a tool that seeks the ideal interface between transit and land use. When employed successfully, TOD increases ridership on transit and raises the property values of nearby land (TDM Encyclopedia 2010a). TOD brings a variety of socially desirable results, such as reduced automobile emissions, reduced automobile congestion, lower demand for roads and parking spaces, increased human health, and increased community interaction (TDM Encyclopedia 2010a). These goals are achieved through a variety of strategies collectively known as TOD.

The first strategy of TOD is to create high-density, mixed-use development around a transit station (TDM Encyclopedia 2010a). High densities are necessary because they increase ridership on transit. High-density living also produces ecological benefits by virtue of its lower per-capita environmental impacts relative to low-density living. Mixed-use development helps to create a walkable environment, one of the primary goals of TOD. When an area has both residential

and commercial uses, people can walk to a much higher percentage of their destinations. TOD's development area is usually a radius ranging from a quarter-mile to a half-mile around a transit station. This radius represents the maximum distance people are generally willing to walk to a transit station (TDM Encyclopedia 2010a).

A second strategy of TOD is to design a neighborhood for walking and bicycling (TDM Encyclopedia 2010a). Walking and bicycling complement transit because they are ideal methods for people to get to a train from their home or to a destination from the train station. Walking and bicycling also have advantages over automobile travel in that they require less infrastructure, produce zero emissions, and promote health and social interaction.

To create a walkable neighborhood, planners and developers try to calm traffic and increase connectivity (TDM Encyclopedia 2010b). Traffic calming reduces the speeds of vehicles on the street as well as the number of automobiles, because most drivers will move to a street that does not employ traffic calming. Promoting connectivity ensures that pedestrians can walk from one place to another on a fairly direct path, often connecting to roads via pathways that cars cannot drive on.

Parking management is also crucial to TOD (TDM Encyclopedia 2010b). Parking spaces in urban environments take valuable land away from productive use and spread destinations farther apart. Reducing the amount of parking available frees up land for other uses; it also promotes transit indirectly by making driving slightly more difficult and/or expensive.

TOD also aims to create a comfortable environment for transit riders (TDM Encyclopedia 2010b). The basics include safety and shelter from the weather while waiting for the train. Bathrooms and food and beverage vendors can also increase feelings of comfort (TDM Encyclopedia 2010b).

While not as crucial as the strategies listed above, wayfinding tools are also extremely beneficial for TOD (TDM Encyclopedia 2010b). Maps of the city that show where transit routes go, timetables for these transit routes, and key destinations and landmarks help tourists and new transit users feel comfortable riding transit.

Wayfinding tools can also include street signs pointing out destinations and landmarks, creating a sense of place around transit stops, and technological tools such as smart phone-oriented transit websites and live train tracking telling riders exactly when the next train will arrive.

Many transportation planners consider the metropolitan region of Portland, Oregon to be one of the best examples of a community that has successfully implemented the principles of TOD. In fact, planners in Portland take TOD one step further by working with developers to create development patterns that will increase transit feasibility. When developers have proposals for such projects, planners calculate how many additional transit riders the project is expected to bring and calculate the resulting additional transit revenue (Gibb 2010). The metropolitan council then gives the developer a grant equal to the amount of the expected additional transit revenue to build the project (Gibb 2010). This is funded by external grants, which come primarily from the federal government (Gibb 2010). This strategy gives TOD planning an extra financial boost, which helps the development process move faster and in a transit-oriented direction.

TOD is considered an economic development tool because it increases property values, residential density, and commercial intensity (TDM Encyclopedia 2010a). These effects create jobs, increase commercial activity, and increase property taxes. While TOD offers many environmental and social benefits, the economic benefits are often the most attractive to those whose primary concern is the bottom line.

Chapter 5: Zoning for a Better Future

Zoning is the primary tool used to create specific land use patterns. To create mixed-use and/or high-density development in a certain area, the first step is to zone for mixed use and for high minimum densities. However, it takes more than just zoning to accomplish these goals. For high-density, mixed-use buildings to be built, a developer must be willing and able to build them. Developers will build only if they think they can get a high enough return on their investment to make the project worth its risk. For developers to get a return on their investment, people must be willing and able to buy or rent space in these buildings. If zoning is enacted to require high-density, mixed-use development but nobody wants it, the land will just sit empty, which would be the worst possible outcome. This scenario is one risk of implementing TOD in a shrinking city.

TOD is traditionally implemented in cities that are experiencing growth. In growing cities, traditional TOD tools can be implemented, and economic growth along transit corridors will happen easily (TDM Encyclopedia 2010a). In these situations, TOD is used more to shape growth than to create growth. In a shrinking city, TOD may not automatically bring growth to transit corridors as it does in growing cities. Other steps should be pursued to attract people from other cities, from other parts of Detroit, or both.

Cities can use two general strategies to deal with population loss—urban islands and de-densification (Hollander et al. 2009). With de-densification, the population would become less dense all over the city. Residents could take over neighboring vacant properties and incorporate them into their own properties. De-densification can be encouraged and implemented in a way that benefits the city. For example, Flint, Michigan allows residents to buy neighboring vacant property for $25, provided they meet certain criteria ("Side Lot Transfer" 2004). This benefits the City of Flint by reducing the number of unkempt properties in the city and allowing the land to generate property taxes again, despite the low current values.

In Detroit, however, de-densification is happening without planning. Residents are moving out, and others are taking over neighboring property illegally.

Detroit benefits from having people care for these properties, but it does not gain property tax revenues from this use. Meanwhile, other properties are sitting empty and neglected, which makes neighborhoods less attractive.

De-densification is not recommended for Detroit for several reasons. Low-density areas have stronger per-capita environmental impacts, low-density development makes automobile travel the only feasible mode of transportation, and low-density development increases infrastructure costs. Low-density land use patterns are common in wealthy areas; wealthy residents can afford automobiles and high infrastructure costs. However, Detroit residents are not wealthy (U.S. Census Bureau 2000). De-densification is not a good strategy for Detroit because the environmental and economic costs of low densities are too high.

The urban islands option is much better suited to Detroit. This strategy focuses development into dense nodes and allows the remaining land to revert back to a natural landscape (Cepl 2005). The urban islands strategy retains most of the benefits of dense development because it actually results in dense development in parts of the city. The areas that lose development bring environmental benefits and reduce infrastructure and service costs. The zoning strategy we propose improves upon the urban islands concept.

Rather than "islands," we propose to zone for dense transit corridors. Transit corridors would have high densities on and near roads with high accessibility, creating lines of density rather than islands. These corridors should be about a mile wide, with a half-mile on each side of the transit line. Figure 5.1 shows transit corridors laid over the current densities in Detroit. Corridors of density provide all the benefits of dense islands but also connect people to other communities, rather than isolating them. Building along a transit line is also much more efficient than having transit travel through empty land between stops.

Figure 5.1: Potential transit corridors and population density (U.S. Census Bureau 2000).

The ideal transit corridor would have high densities right at the transit stops in order to maximize accessibility. Many people can access the transit stops in these dense corridors, so many high-volume destinations should be within a short walk of the stops. It is also important for many people to live within walking distance; these people will be the primary customers of the businesses in the corridor. Densities should get progressively lower as distance from a transit stop increases.

If these transit corridors succeed, then areas far from the transit corridors will likely have high vacancy rates. Many parts of Detroit already have high vacancy rates; this would probably become even more extreme with dense transit corridors. Mayor Bing is considering adopting a policy to reduce infrastructure and services, such as refuse collection, snow and ice removal, curbs, sidewalks, and streetlights, to blocks with high vacancy rates in order to save the city money (Aslesen 2010). Moving people from low-density areas to dense transit corridors would make this cost-saving plan even more effective.

Simply zoning for dense transit corridors is not enough to convince people to move there. People need incentives to move to transit corridors, particularly if they

are moving from areas of high vacancy. Direct incentives could take the form of paying for moving expenses, and/or temporary reductions of property taxes. Indirect incentives could include providing high levels of infrastructure and service investments in the transit corridors and decreasing infrastructure and service investments in areas with high vacancy rates.

Rather than let these vacant areas revert back to natural landscape, as Oswald Mathias Unger proposed in the urban islands model (Cepl 2005), we propose a new zone for these areas called "productive." This zone could include any productive land use that would not create a nuisance to neighbors. Examples of land uses in the productive zone could include residential, commercial, agriculture, recreation, or ecological services such as water treatment and management or carbon sequestration by right. Other uses, such as energy production or other light industrial uses, could be allowed with a permit, provided that they will not create a nuisance for neighbors. The philosophy behind the productive zone is that any productive use is better than no use at all, provided that it does not interfere with neighboring land uses. This zone would allow people flexibility to do creative things with the land that might not be allowed under traditional city zoning. Some people will like this flexibility and be attracted to these areas. Others will dislike it because they want the order and uniformity of separated land uses. However, since only certain parts of the city will be zoned for productive, those who don't like it can choose to live in other parts of the city. Chapter 8 provides some examples for the productive zone.

Summary

For TOD to be successful, Detroit needs to create transit corridors with zoning for high densities and mixed-commercial/residential use. These corridors should encompass a regional transit system, including streets such as Woodward Avenue, Gratiot Avenue, Grand River Boulevard, Michigan Avenue, and Jefferson Avenue/Fort Street. Ideally, rapid transit on these corridors would continue into neighboring cities, rather than ending at the edge of Detroit.

Building up density along these corridors will be challenging in a shrinking city. Detroit should seek out policies that will help incentivize people to move from highly vacant areas to transit corridors. If successful, this will leave some land with extremely high vacancy rates, which we propose re-zoning to a new zone called “productive.” The productive zone is a highly flexible zone that allows any land use that would not be considered a nuisance to neighbors.

Chapter 6: Site Selection Process

DDOT asked us to recommend visions of how TOD can best fit in Detroit. In order to do this, we chose three stations along the proposed transect to illustrate different concepts that address how TOD might best fit the half-mile area around those stations. We could not analyze and apply concepts at all of the twelve proposed station sites, so we selected these three stations because of the different city typologies they represent. The downtown site represents the part of the city with the highest intensity of buildings and infrastructure. Downtown is also is the symbolic center of the city. The New Center site represents an area of focused revitalization within the city that is countered by vacancies and disrepair in the direct vicinity. The 8 Mile/State Fairgrounds Station represents a large-scale vacated landscape. In addition, these three stations offer a comprehensive sequence of the experience of riding the train through the city: entrance/exit, middle, entrance/exit.

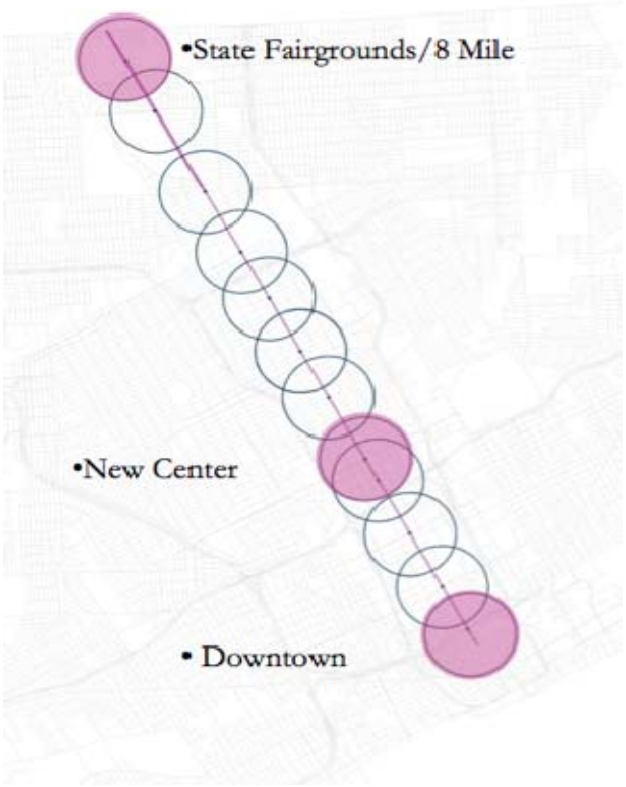

Figure 6.1: Selected Sites along Transect . Data from DDOT(De Silva 2010)

Chapter 7: Downtown Stations

Design Concept: Dead-Zone Mitigation

Whereas other cities' downtowns share a certain set of problems – congestion, crowding, and a high cost of living – Detroit's downtown feels quite the opposite. The core of the city is empty, desolate, and unsafe feeling. However, the city has advantages that stem from the same set of conditions: housing is more affordable, the automobile congestion is tolerable, and the pace of life is slower and more comfortable (Fishman 2005). Downtown already embodies some of the principles of TOD; it has some of the highest intensity and densest infrastructure in the city (TDM Encyclopedia 2010, Roseboom personal interview 2010). However, it is physically more marked by the prominence of dead zones.

Dead zones are spaces in the city that are underused by the intended user, have not adopted a new or productive reuse, and are visually unappealing. Dead zones can elicit a perceived sense of danger, discomfort or abandonment, which might discourage the vibrant street life to which TOD aspires. Common dead zones throughout the city include vacant lots, surface parking lots, and the roads themselves. TOD will fit better in downtown Detroit if we decrease the impact of dead zones along major routes of access to the train and to downtown. If pedestrians and bikers have a more comfortable experience in reaching the train, they will be more inclined to use it, a key strategy of TOD. This will be done by making the spaces that create the dead-zone effect safer, more diverse, and more legible.

Figure 7.1: Downtown Parking Diagram – Downtown features an abundance of surface parking lots, which commonly translate to dead zones (De Silva 2010)

Downtown Site: Context and Analysis

History

In 2006, Detroit hosted the Super Bowl XL. Amongst $50 million worth of downtown investments were $20 million in street improvements. They included sewer and utility updates, and a significant amount of streetscaping. Washington Boulevard, Broadway, and Woodward Avenue at the Cobo Center all received improved lighting, sidewalks, and signage as well as added on-street parking and benches ("Rejuvenating Detroit" 2006). Award-winning park and city center Campus Martius opened after a long history of underuse that had resulted in a dead-zone effect (Gallagher 2010). Campus Martius now offers year-round entertainment and acts as a physical and metaphorical center of the city. The Detroit Economic Growth Corporation (DECG), a private non-profit in the city that has tasked itself with "actively strengthening Detroit's economic base," was in charge of the street renovations ("Welcome to Detroit!" 2010). Mark Denson, director of the Detroit Regional Economic Partnership in 2006, noted that with the investments, downtown "Detroit has really re-invented itself as a destination point" (MBR 2006). While these improvements bandaged some scars downtown, the street improvements missed some opportunities to functionally assist the creation of downtown as a destination. First, the improvements did not include bike facilities, a recommendation of the 2006 Detroit Non-Motorized Plan, nor did the improvements occur at all important access points into the city. As a result, dead zones are still prominent from major access points into the city along the arterials of Michigan Avenue, Grand River, Gratiot Avenue, and even Woodward Avenue.

Image 7.1: Campus Martius (Jazz Festival at the Park 2010)

Light Rail Transit Plans

During the course of this project, the M1 light rail has taken a couple different forms downtown. Some of the early plans included the "downtown loop" and the "hockey stick." The loop was the early preferred route but was rejected due to obstacles on Jefferson Avenue that would make its engineering difficult (Roseboom email 4/24/2010). Instead, the route that will probably be carried into preliminary engineering is the "hockey stick." This layout will deviate from Woodward Avenue in the same manner as the loop, turn east onto Larned, north on Randolph, west on Congress, and then backtrack on Washington (Roseboom email 4/24/2010). Although URS Corporation, the consulting firm brought in to help with the project, has not decided on a final option, we base our analysis on the "hockey stick" layout. We also assume that the M1 rail will be located to the sides of the street downtown, whereas it will switch to the center of the road north of the New Center Station (*Downtown Alternative B* 2008).

Site Selection

Downtown is served by a number of major arterial roads. Michigan Avenue has been selected as the place to develop the design strategy of "Dead Zone Mitigation" because this street is a targeted growth corridor that links two of Detroit's more robust areas, Downtown and Corktown. Michigan Avenue also embodies many of the land use relationships that create dead zones that are common to the experience of reaching the train. These relationships include Michigan Avenue as a freeway overpass; Michigan Avenue passing by a large number of surface parking lots, which cease to define space as well as encourage the automobile as a means to

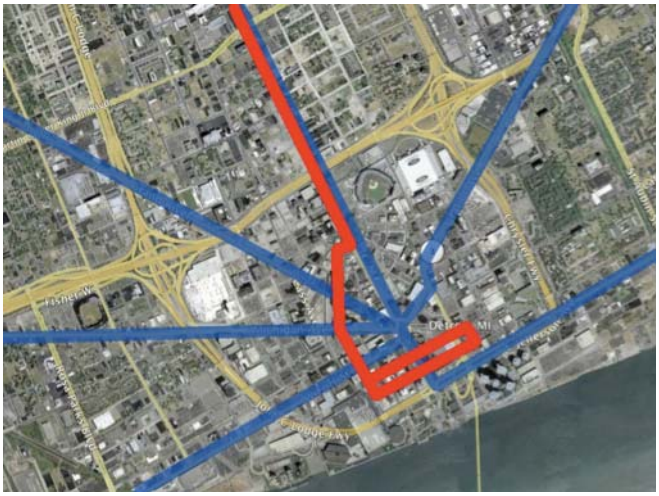

Figure 7.2: Hockey Stick Route for LRT (De Silva 2010)

reach downtown; and Michigan Avenue as it relates to existing and proposed public transportation including the Detroit People Mover, Rosa Parks Transit Center, and the new LRT, all of which are not currently speaking to each other.

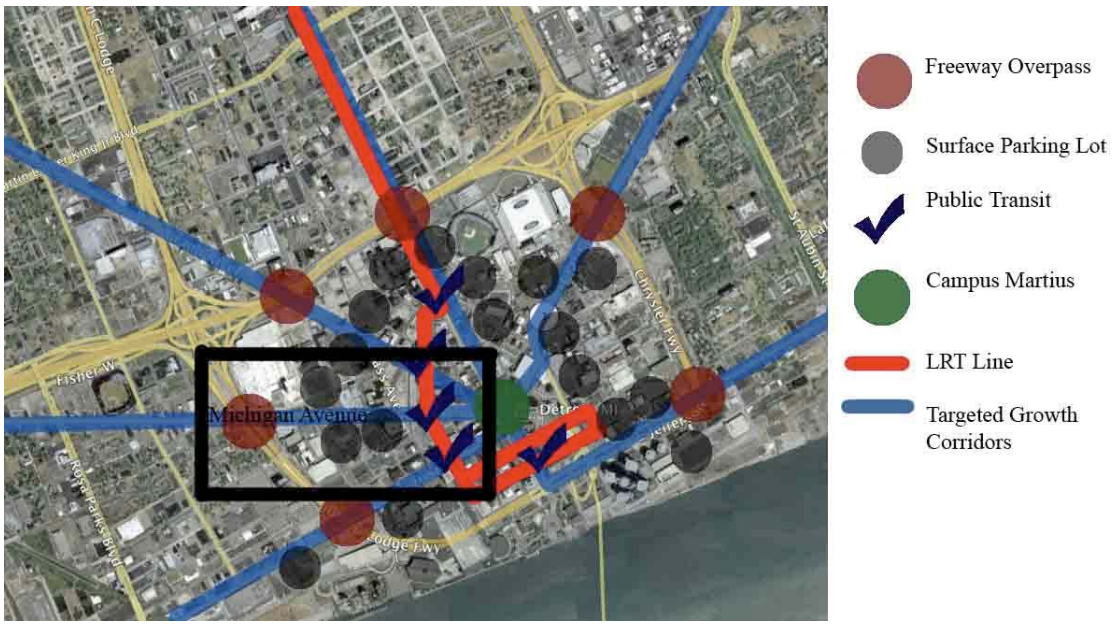

Figure 7.3: Types of Downtown dead-zone experiences, with Michigan Avenue highlighted (De Silva 2010)

Design Solutions: Dead Zone Mitigation

Michigan Avenue: The Street as a Dead Zone

Image 7.2: Michigan Avenue as a dead zone (De Silva 2010)

The street itself is the most common type of dead zone throughout the City of Detroit. So many of the roads are oversized relative to the low volumes of automobile traffic they accommodate (City of Detroit Non-Motorized 2006). Although non-motorized uses such as walking and biking do occur on some roads, there are not always proper or safe facilities, and gaps in the road network of perceived safe streets discourage their use (City of Detroit Non-Motorized 2006). Trends indicate that Detroiters are driving less and less, which will only exacerbate dead zones if alternative uses are not

implemented on the street (Helms 2010). The streets must be more inclusive and considerate of populations that do not drive cars. If the streets can attract alternative and diverse users, they will cease to act as dead zones.

Michigan Avenue is no stranger to these dead-zone conditions. It alternates between seven and nine empty lanes from Corktown into downtown Campus Martius. Street lights tower overhead at a non-human scale. The street is targeted for improvement in the *City of Detroit Non-Motorized Urban Transportation Master Plan,* and the plan offers many suggestions for creating safe bike and walking facilities. This includes removing gaps between facilities, clearly demarcating facilities, and decreasing the chance for conflict with cars (City of Detroit Non-Motorized 2006). It recommends that bikes lanes utilize colored pavement treatments and line striping when there is room. And while it is true that "a large portion of the population perceives walking or bicycling in dense urban areas such as Detroit inherently dangerous" and the lack of proper facilities reinforces this perception, street safety might improve if the city can get a critical mass of people on the streets performing these activities (City of Detroit Non-Motorized 2006). For this reason, the length of Michigan Avenue between Corktown and the street's termination at Michigan Avenue should receive improved non-motorized facilities, including improved sidewalks with human-scaled lighting, separate parking lanes, separate bike lanes with identifying blue striping, safety medians for wide road crossings, and dedicated public transit lanes that reserve space for future public transit such as LRT or BRT along Michigan Avenue. The diversification of uses along this road leading into downtown will encourage the non-motorized uses of transport downtown and towards the train that TOD desires and re-define the street as a used space and not a dead zone.

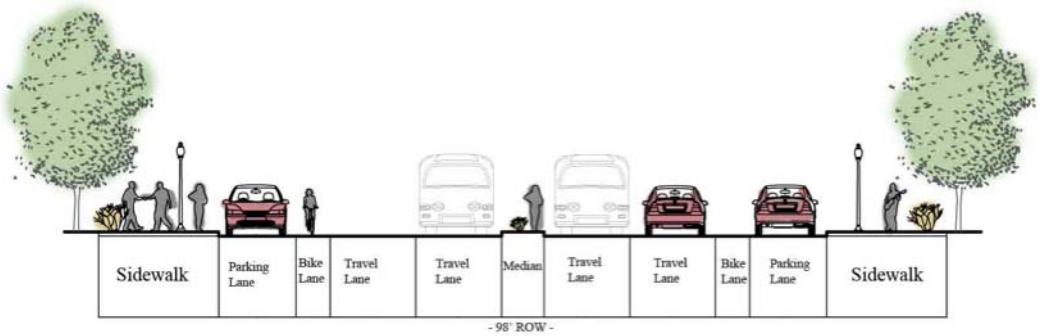

Figure 7.4: Section describing street improvements to Michigan Avenue (De Silva 2010)

Michigan Avenue to Freeway Overpass

The downtown central business district of Detroit is encircled almost completely by sunken freeways: the Fisher Freeway, the Chrysler Freeway, and the John C. Lodge Freeway. The effect is of a sort of moat surrounding downtown, holding those without personal automobiles out, and in effect holding the light rail and its positive influence inside. Access points do exist in the form of freeway overpasses, but these access points are long, unprotected, and uncomfortably empty. The freeway overpass is a dead zone that needs to be addressed in order to give periphery residents access to the downtown TOD.

On Michigan Avenue, the overpass occurs just east of Corktown, a viable and historic Detroit neighborhood (Bugbee 1996). Prior to the overpass, colorful buildings line the street, which is paved with bricks However, once the freeway overpass approaches, the brick paving and color of Corktown end abruptly, as if wanting nothing to do with this dead zone. The overpass itself is over 400 feet long and nine lanes wide. This is scaled much larger than recommended 200-foot blocks of a comfortably walkable cityscape (Duany et al. 2010). The freeway overpass is a "no-mans land," but should take a cue from historic bridges. Besides traditionally offering views over bodies of water, a much more romantic notion than threads and tangles of automobile lanes and entrance ramps of today's bridge, historic bridges acted as more vital place. For example, the Ponte Del Vecchio in Firenze features market stalls and stores all alongside it (Boddy 1992). The freeway overpass creates a very uncomfortable space for non-auto users by being featureless and very long. The Michigan Avenue overpass needs more human-scaled features, protection from the elements, and more diverse uses. In addition, speeding should be controlled on what is essentially a long and empty racetrack.

Image 7.3: Rail Underpass at Tourcoing (Intégral Ruedi Baur Et Associés 1999)

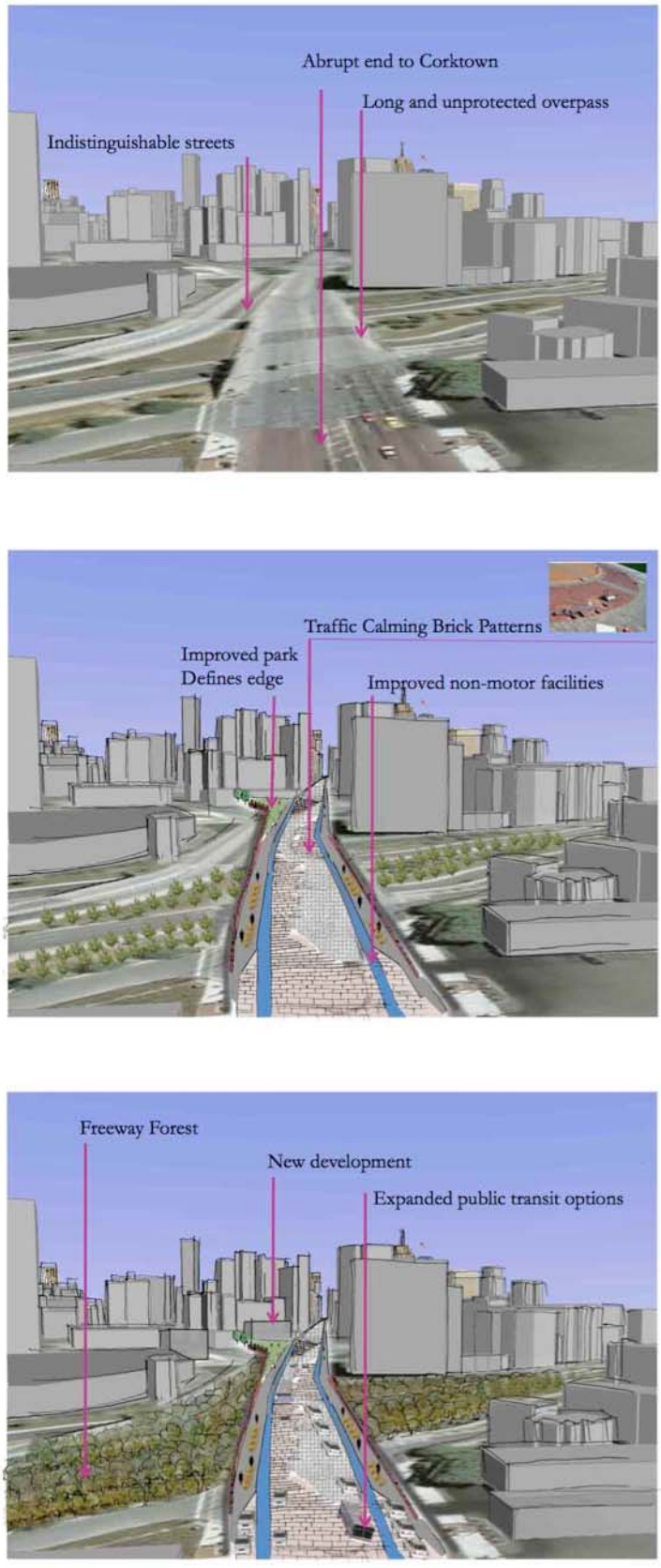

Figure 7.5: Phasing of Michigan Avenue Freeway Overpass Improvements (Current, Improved, Future Potential) (De Silva 2010)

Creating a comfortable and inviting overpass is important to get peripheral residents of downtown into the city and onto the train. They are potential users of downtown – and the train. The Michigan Avenue users would be approaching from the west and would not be directly serviced by the Woodward train alignment. Consideration for the overpass includes giving the freeway identity. Although it is unlikely to be filled with shops such as the Ponte Del Vecchio in the near future, the idea of a freeway as a dead zone can be eliminated.

One precedent of a reformed underpass dead zone is in Tourcoing, France. An overhead railroad created a perceived barrier on the road that ran underneath and divided two districts in town. A design intervention created a

stronger perceived connection between spaces by using lighting, color, paving, and graphic text to give ownership and life to a prior dead zone and to "visually detract from the impression of [the bridge] being a barrier" (Intégral Ruedi Baur et associés 2005).

An improved streetscape builds on the aforementioned Michigan Avenue street redesign and uses the additional two lanes of space to incorporate more plantings over the freeway. Low, shallow-rooted plants will provide protection from the wind and provide a color and softness that the hardscaped space needs. A wavy brick pattern provides a transition between Corktown and Downtown and will also act as a traffic-calming feature. An improved park just past the overpass defines the Michigan Avenue park edge where it previously had morphed in a confusing way with the MGM service drive. Long-term potential includes improved public transportation along Michigan Avenue, increased use of non-motorized facilities, and a relationship between Corktown and Downtown using the overpass as a connector. This will signify Michigan Avenue as a transit corridor and the overpass as an important access point, which will prioritize the area for development. Additionally, the overpass will begin to see more interaction with the freeway forest, which will be addressed next. The resulting space is safer, as traffic speeds are controlled and the overpass is more protected from environmental conditions. The bridge also more comfortably accommodates more users. Lastly, the road is more legible as a transition zone between Corktown and Downtown.

Michigan Avenue to Freeway Underpass

The freeway itself is a dead zone. Its singular use eats up much space in the city, yet Detroit freeways are receiving less use and the city does not suffer the congestion of other cities (Helms 2010, Fishman 2005). Freeways, especially grade-separated freeways such as the ones surrounding downtown Detroit, are known to "sever long-standing neighborhoods, form barriers and visual blight, cast shadows and inflict noise, fumes and vibrations on surrounding areas" (Kang and Cervero 2009). The John C. Lodge Freeway at the Michigan Avenue overpass is an example of the freeway as a dead zone. The freeway lanes end at Jefferson in less than a mile and

are divided by an extremely wide berm. The berm is sparsely planted, but the trees appear robust. The extra space and lack of heavy use and congestion on the Lodge at Michigan Avenue offer an excellent opportunity to perform dead-zone mitigation.

Image 7.4: Freeway to Greenway Conversion in Seoul (*The Transformation from Elevated Freeway to Urban Greenway 2003, 2008)*

One way to mitigate the dead zone of the freeway and to create a productive landscape is to perform a freeway-to-greenway conversion. The Cheonggycheon freeway in Seoul, South Korea is an example of this type of conversion. This project replaced a congested freeway with a city amenity – a public park that also restored a previously buried river. The impact of the project was an improved human environment, a park that also provided ecological services, and increased land values around the linear park (Kang and Cervero 2009). Seoul also introduced expanded rapid-bus transit to relieve any congestion problems that might result from the closed freeway lanes (Kang and Cervero 2008).

While Detroit does not need the space or maintenance of a linear city park such as in Seoul, the city could still benefit from a space that serves ecological services and has the potential to become a public amenity. We are recommending that the large berm be planted heavily with native forest species appropriate for the ecology of the upland berm. The resulting freeway forest will act as a carbon sink and can offset some of the emissions of the LRT. This will contribute to the goal of creating zero-emissions transit in Detroit (see Chapter 10, Alternative Energy Sources).

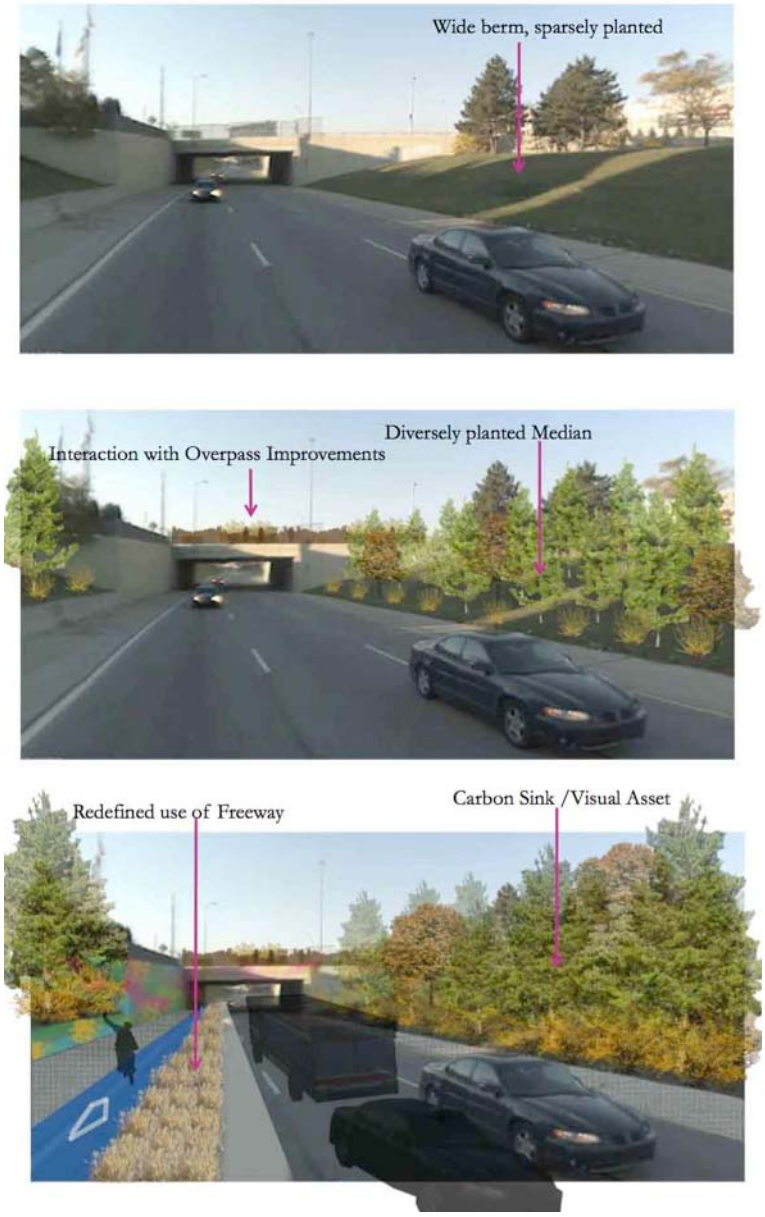

Figure 7.6: Phasing of Freeway Forest at Michigan Avenue (Current, Improved, Future Potential) (De Silva 2010)

The freeway is also a practical and safe option for a forest within a city. Green buffers can be placed in public urban spaces with the best of intentions and still suffer from crime and vandalism. An example is a green buffer in Reston, Virginia. A new development project sought to incorporate green space into the city in the form of green buffers separating housing spaces. This public space was prioritized for wildlife, and the result was an area in which the surrounding homeowners did not feel a sense of ownership or safety. The result was an invisible space with security issues (Crowe 1991). Planting the forest on the berm of a freeway that is still functioning as a freeway – and not immediately allowing foot traffic or other uses – will initially make the forest a visual rather than physical connection. This forest in a freeway would be enjoyed from the overpass – a safe way to experience a forest within the city. Ownership would derive from seeing the forest, and viewers would understand that a physical connection was not possible or necessary. In this way, flora and fauna could also be prioritized and left in peace. The

canopy-level views would offer a unique perspective on a forest feature, allowing residents to embrace the reestablishment of nature in the city.

The ongoing discussion of the appropriate shape and structure of Detroit present opportunities to question the role of the freeway, which has potential to evolve from a dead zone to a productive landscape. In our long-term vision for the freeway, we see the forest filling out as new types of transit and uses take the place of the automobile.

Michigan Avenue to Parking Lots

Surface lots are omnipresent in downtown Detroit, and this is problematic to the goals of TOD for numerous reasons. For example, they encourage the use of the automobile and they do not assist in wayfinding, as the parking lot is an anonymous and featureless space. Surface parking lots are also underutilized, as visits to Detroit and studies of aerial photographs have revealed. For these reasons, parking lots are considered a dead zones that greatly impair the success of TOD downtown.

Image 7.5: Surface parking lot downtown (De Silva 2010)

Michigan Avenue intersects many superfluous parking lots through downtown. Figure 7.8 shows the corner of Michigan Avenue and Third Street, near the MGM Grand Casino and possibly soon the new Detroit Police headquarters ("Big Plans for the Future Detroit" 2010). This is an important corner in the city, but its importance is hardly apparent from the presence of large surface parking lots on three of four corners of the intersection. To mitigate this dead zone, we consider a couple of temporary and permanent strategies, including street improvements, space-holding public art, and community gardens.

First, the standard street treatments will be performed on Michigan Avenue: bike lanes, improved sidewalk facilities, and narrower vehicle lanes. Additionally,

street paving is used to indicate that the corner of Michigan Avenue and 3rd Street is a shared-street – no longer the domain of the automobile. Temporary public art is placed to alert people to the corner; this is just one example of how sculpture can demonstrate how spaces are underused and begin a conversation about how that space could be better held and used.

Image 7.6: Verdant Walk in Cleveland (2008)

The sculpture treatments in the parking lot at Michigan Avenue and Third Street were inspired by a public art project in Cleveland, Ohio, another industrial city that has experienced significant population loss (see Figure 7.4). The Verdant Walk is a temporary installation project that uses native grasses and sculptures to break up a massive space, the green of Mall B (The Verdant Walk 2010). Sculptures are designed to "refer to Cleveland's relationship to industry, craftsmanship, and innovation" – a message that surely resonates for Detroit ("The Verdant Walk" 2010). Detroit already has its own example of public art incubating a prior dead zone. Tyree Guyton's Heidelberg Project is a grassroots community art project that draws attention to an area with high vacancy and disrepair. A much-talked-about project, the Heidelberg attracts attention in a way that we hope to replicate at this crucial corner in Detroit (Kraus 2010, The Heidelberg Project 2010). Art is a great way to achieve identity in traditional dead zones and give them a sense of public ownership.

Sculpture is not the only answer – community gardens or tree farms could also hold the space. Either use is intended to catalyze interaction and conversation about a previously anonymous corner. Other communal spaces should also be created to foster such interactions, and these should take place at the street level. A study of community gardens in urban areas found that the garden provided an avenue for new and positive racial relationships to develop. The shared space also fostered an increased sense of community (Shinew et al. 2004). Community gardens are just one

type of community-held land. The City of Cleveland, which like Detroit is shrinking, has successfully started a program that promotes community ownership in neighborhoods, offering communities the chance to adopt vacant land and reuse it for spaces such as parks. The city has provided a design guidelines book to showcase how such vacant spaces could be used. Examples include neighborhood pathways, streets edge improvements, pocket parks, market gardens, natural parks, raingardens and water treatments, bioretention and phytoremediation lots, and new development such as geothermal wells and building infill (Kent State University's Cleveland Urban Design Collaborative 2009). “These are ideas that you can use as a starting point for designing community spaces that are unique to your neighborhood’s personal interests, creativity, and the appropriateness of the site” (Kent State University's Cleveland Urban Design Collaborative 2009). They all also turn dead zones into productive landscapes and achieve a sense of community ownership.

Our long-term vision for Detroit de-emphasizes the role of the car in this landscape and involves transitioning from temporary means of incubating space into more permanent features that embody more traditional TOD – including a mix of multi-use space and streets as public places. However, an important means of catalyzing this effort is getting the community involved in large spaces such as surface parking lots, where their work can have a significant visual, physical, and social impact. Renewed community ownership of dead-zone corners can encourage positive social mixing and create eyes on the street – which will result in a safer and more identifiable space (Jacobs 1992).

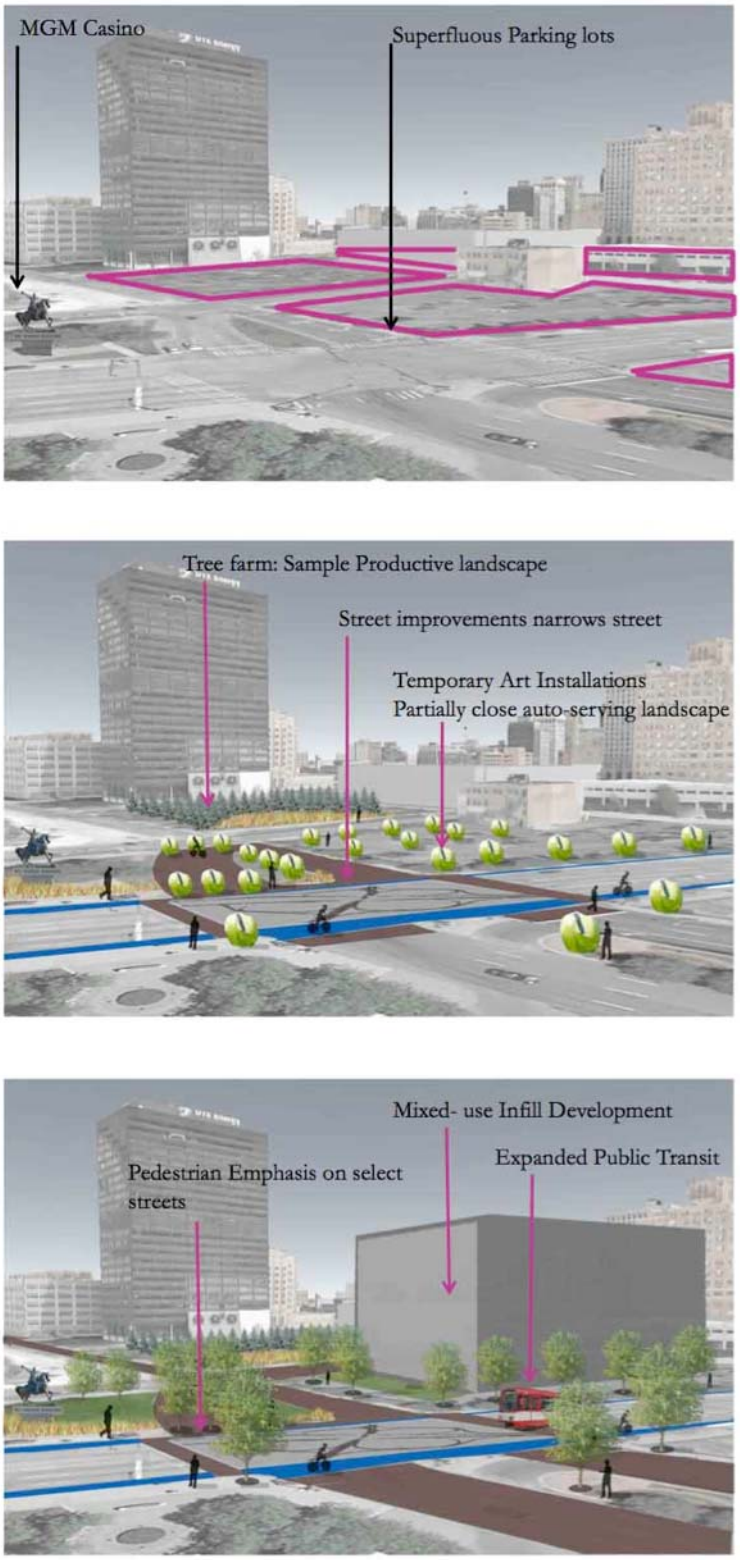

Figure 7.7: Phasing of Michigan Avenue Parking Lots (Current, Improved, Future Potential) (De Silva 2010)

Michigan Avenue to Public Transit

Image 7.7: Viewing Michigan Avenue from the People Mover (De Silva 2010)

The last target of dead-zone mitigation involves the relationship between road, the new light rail, and the old downtown public transit option, the People Mover – all three which are currently not speaking to each other. This relationship qualifies as a dead-zone creator because segregated and singularly focused transportation systems result in a lack of people presence in the street. A main culprit is the People Mover, an elevated, one-way light rail system that loops around in the central business district in downtown Detroit. The system opened in 1987 and operates in a clockwise loop around the central business district. The People Mover has been heavily criticized for its singular direction and use, as well as its racist undertones (Boddy 1992). It also uses outdated technology and represents a considerable cost to the city (Roseboom 2009).

Figure 7.8: People Mover Use Breakdown (www.thepeoplemover.com 2010)

Trevor Boddy argues in his essay "Underground and Overhead: Building the Analogous City" that elevated pedestrian and transit systems in cities "accelerate a stratification of race and class, and paradoxically degrade the very conditions they supposedly remedy – the amenity, safety, and environmental conditions of the public realm" (Boddy 1992). Indeed, the People Mover seems to cater to tourists, picking them up from a surface parking lot, to which they drove in a protected car, traveling too quickly on high-speed freeways to encounter any danger. They then rise to a safe height in the city, and hop on the People Mover, observing the city below but not contributing to its character or vitality, until they are safely dropped off at the doors of (or sometimes even right inside) their destination.

Destinations include the Renaissance Center, a place designed to be "a private space that could easily be controlled and monitored to fashion a safe, crime-free place for shopping, work, and nightlife" (Desiderio 2009). The resulting place relies on exclusion, rather than natural surveillance, to create safety (Crowe 1991). Whereas the light rail will provide a human presence at street level, the People Mover does not, and if people continue to have the option to hide above ground in fear, it might diminish the train's chance of success. The People Mover must discontinue its use as an incubator of people above the city, because this use reinforces the existence of other dead zones, including freeways, auto-centric streets, and parking lots.

Image 7.8: Highline NYC, before redevelopment (Sternfield 2001)

Initially, the city should discontinue use of the People Mover. This will eliminate the redundancy of the two rail systems in Detroit and reintroduce transit-users to the street level. This will start to encourage the critical mass of people to the street and increase the perceived sense of safety downtown. It will also be an opportunity to build on a common visual motif in the city. Over time, the rail can be expected to revert to nature, much as the Highline in New York City did. This is a visual motif that is common in Detroit, and the reclaimed land and elevation differences will mimic the freeway forest on a small scale.

Over time, reuse of the People Mover could be reconsidered. An elevated park or walking path, similar to the newly renovated Highline Park in NYC, could provide more green space within the dense downtown. This will be especially valuable if downtown Detroit continues to increase in density and build upwards. The park could be observed from above, on, and below and provide a place for locals and tourists alike.

Figure 7.9: Imaging Reuse for the People Mover (De Silva 2010)

Summary

The strategy of dead-zone mitigation has strategically looked at land use relationships in the city that create the dead-zone effect. By addressing dead zones at overpasses, at vacant and large parking lots, and on targeted growth corridors leading into and through downtown, Detroit can begin to build a safer and more legible city. Overall, a combination of permanent and temporary small designs in strategic places, linked by improved street conditions, will expand and contribute to a more unified city-scene: one that is not interrupted by dead zones but rather connected by place. This is one strategy to get people reinvested in the experience of the city and the train.

Figure 7.12: Master Plan of dead-zone targets and projected growth (De Silva 2010)

Chapter 8: New Center Station

Design Concept: Breaking the Parameters of TOD

Many cities have been attracted to TOD planning for the lure of redevelopment that often follows transit service and station placement, and TOD planning will occur in Detroit as well. In Detroit, though, the current situation is not conducive to standard practices in TOD planning. Detroit's landscape includes scattered amenities and destinations, massive vacant land accumulation, community disintegration, and an infrastructure that promotes individual automobile use. TOD must acknowledge and respond to these issues in order to create successful communities that support the Woodward LRT. This work identifies a major fault in current TOD planning and provides an alternative solution with design interventions for implementation. This design maintains TOD priorities in creating walkable, multi-use, transit-driven communities but responds to the current landscape scenario through an alternative planning strategy for TOD.

The opportunity for a new planning strategy allows an emphasis on future sustainability in the proposed design. Given the complexity of creating sustainable communities, this work aims to raise the sustainable outlook of New Center through the promotion of ecological services in the neighborhood. Ecological services are measurable benefits produced through ecosystems and include improved air and water quality, maintaining natural resource availability, and food production (SSI 2009).

Due to the incredible resources of the surrounding Great Lakes, all designs prioritize protecting water quality and managing stormwater runoff. Stormwater management is key for two reasons: 1. Management of stormwater through vegetated groundcover will promote better water quality for the local and regional community. 2. Alternative stormwater management techniques will reduce the amount of water traveling into Detroit's aging sewer system, which could reduce pricey sewer infrastructure costs (SSI, 2009). A combination of low-impact designs such as rain gardens and bio-infiltration swales will promote storage and treatment

of stormwater runoff while also enhancing the aesthetic experience throughout the neighborhood.

New Center Station: Context and Analysis

The New Center Station will be located either north or south of the intersection of Grand Boulevard and Woodward Avenue (*Downtown Alternative B* 2008). The station is the fifth stop on the Woodward LRT traveling northwest from downtown. To the south is the Midtown Neighborhood and to the north lies the Boston Edison District.

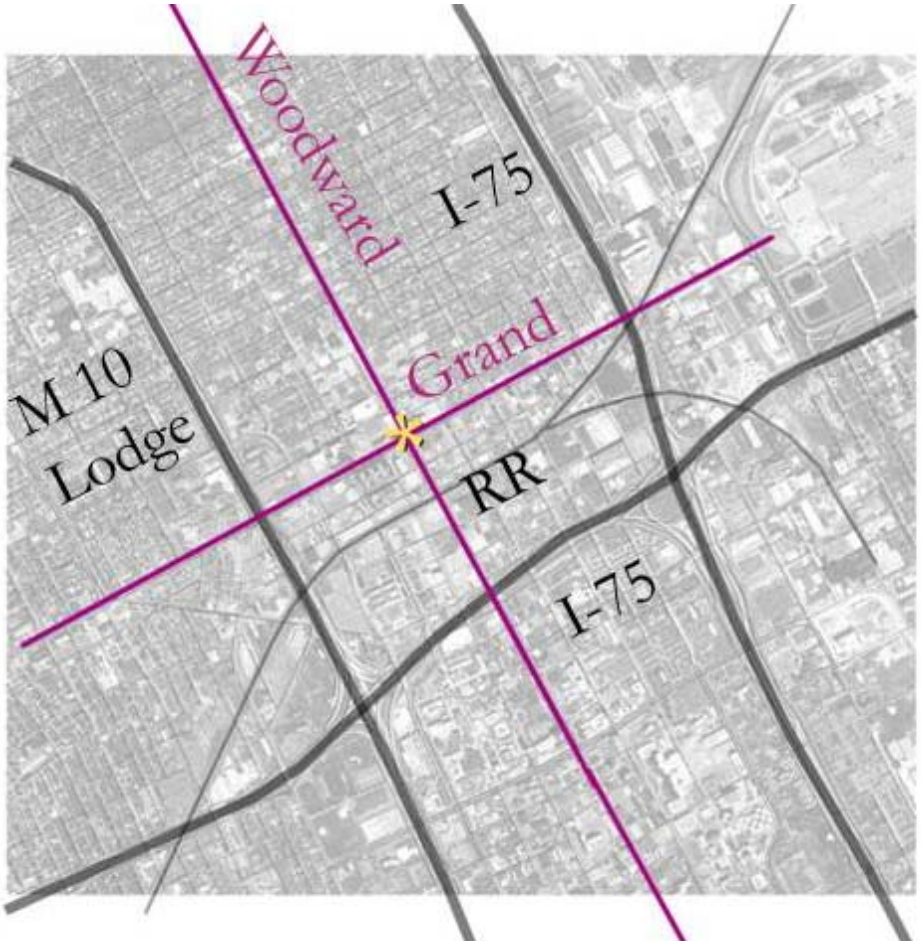

Figure 8.1: Location of the New Center Station at the intersection of Grand Boulevard and Woodward Avenue (Krueger 2010)

New Center claims significant historic sites including the Fischer Theater and the Cadillac Place, the original GM headquarters. It is an active community with economic interests, historic neighborhoods, and cultural amenities. Like many other

Detroit communities, New Center is an isolated mecca of activity in a landscape surrounded by vacant neighborhoods and desolate industrial sites.

New Center has many active current amenities in proximity to the proposed LRT station. Current community amenities are defined as community destinations and include commercial centers, neighborhoods, schools, parks, and cultural sites (City of Detroit: Non-Motorized Plan 2006). Referring to these amenities as *current* reinforces their relevance to existing and potential residents. The Fischer Theater and Cadillac Place lie just west of the proposed LRT station. The City of Detroit still has an economic interest in these iconic buildings, which house active business offices, and New Center is considered a job center (City of Detroit: Non-Motorized Plan 2006). As such, it will be an active stop on the proposed Woodward LRT.

Figure 8.2: Location of current community amenities around New Center Station (Krueger 2010)

Also in proximity to the station, within three-quarters of a mile from it, are the Russell Industrial Complex, Henry Ford Hospital, and the Cass Corridor. The Russell Industrial Complex (RIC) is an artist community of loft studios that also holds a daily market bazaar in a historic Albert Kahn factory that was abandoned years ago. The RIC supports cultural, economic, and educational programs, including small business incubator space and educational seminars on small business management. The Henry Ford Hospital is a major healthcare provider and employment center for metro Detroit. The Cass Corridor is home to restaurants and bars and is a nightlife destination for many visitors and residents of Detroit. It also connects New Center to Wayne State University and Midtown to the south, both active neighborhoods in Detroit. These amenities are currently successful, and TOD planning should acknowledge and strengthen the connections to these destinations.

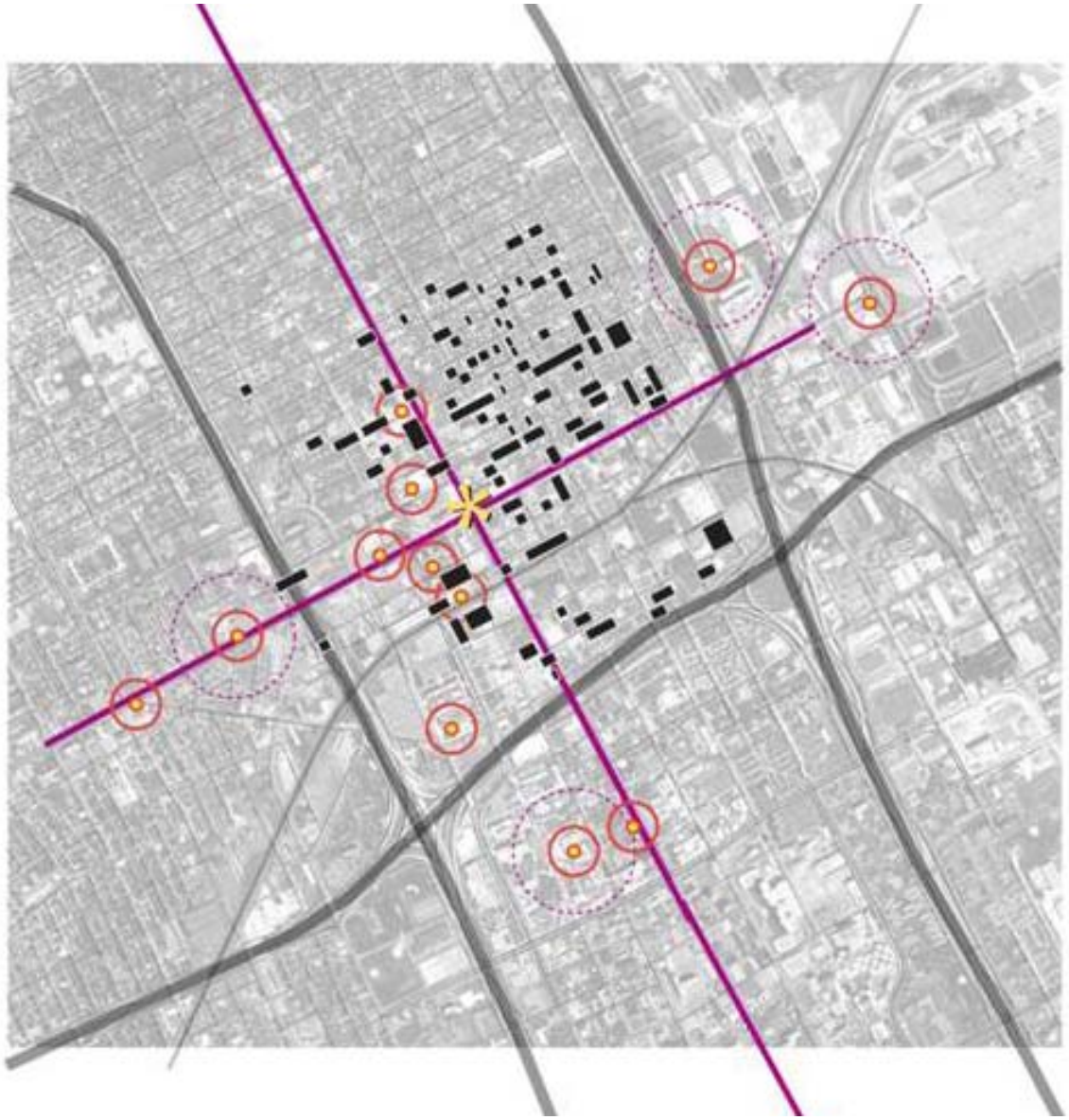

Figure 8.3: Location of vacant holes among the scattered amenities (Krueger 2010)

Between these amenities lie many vacant parcels, creating holes in the landscape. Vacancies comprise both lands without any structures and lands with abandoned buildings left to fall in on themselves. Both situations create an environment of fear and indifference, ultimately reducing interest in walking or traveling between destinations. Vacancies help to create the unique landscape of the entire city, and New Center likewise has many vacancies, with large vacant areas occurring in close proximity to the proposed New Center Station.

Image 8.1: Vacant landscapes: Empty landscapes (Krueger 2010)

Image 8.2: Vacant landscapes: Empty home (Krueger 2010)

In recent months, the city government has begun to acknowledge Detroit's status as a shrinking city. The city is starting to understand that areas with high vacancy rates might never return to the residential or commercially viable landscapes that once existed (Hackney 2010). Thus Detroit has begun the controversial process of designating certain areas to receive fewer (or less frequent) city services (Hackney 2010). This is a first step in the long-term work of reconfiguring Detroit's population for more efficient service distribution.

Consolidating the population would lead to large tracts of land with no activity, and the management of these large tracts of land must be determined. Although New Center will not lose services, areas in proximity to the train stop do exhibit some of the worst vacancy rates of the city. These areas exhibit vacancy rates of 30-70% (Detroit Residential Parcel Survey 2010). High vacancy rates, combined with the lagging economy, make incentivizing redevelopment very difficult even with the proposed transit improvement.

Breaking the Bubble: Concept

In typical TOD planning, a 'bubble' is used to address transit accessibility and define the area to target specific TOD planning strategies (Reconnecting America 2010). The bubble is based on a half-mile radius from the train station, as this is considered a reasonable walking distance. The goal is to create a walkable environment that reduces auto-dependency and increases reliance on transit (Calthorpe Associates 1992). Walkable neighborhoods are designed to be densely populated with multipurpose zoning to encourage the development of close local amenities (Calthorpe Associates 1992).

TOD aims to reduce reliance on the automobile, and the half-mile 'bubble' has become a standard approach in designating areas for TOD (www.reconnectingamerica.org). The bubble is drawn on the landscape, with the expectation that the area within the bubble will attract high-density development. This scenario is common in many cities with great potential for redevelopment.

The bubble defines areas to be redesigned and planned, but what happens outside the bubble? This approach does not acknowledge the current landscape scenario or the existing community amenities. Rather, it focuses all attention on the areas within the bubble, rarely acknowledging areas, or people, who fall beyond this line and who might be important members of the community – or, in this case, supporters of the Woodward LRT.

If the typical TOD bubble is centered on the New Center Station, several issues become obvious. The bubble does not include the local amenities of the RIC or the Henry Ford Hospital. Also lost is the connection to the Hamtramck Assembly Factory. Recently GM has announced that this factory will be used in manufacturing the Chevy Volt, making it a potentially strong economic force in the near future of New Center (Higgins 2009). The bubble weakens these current amenities by not acknowledging them as potential destinations for Woodward LRT users or New Center residents.

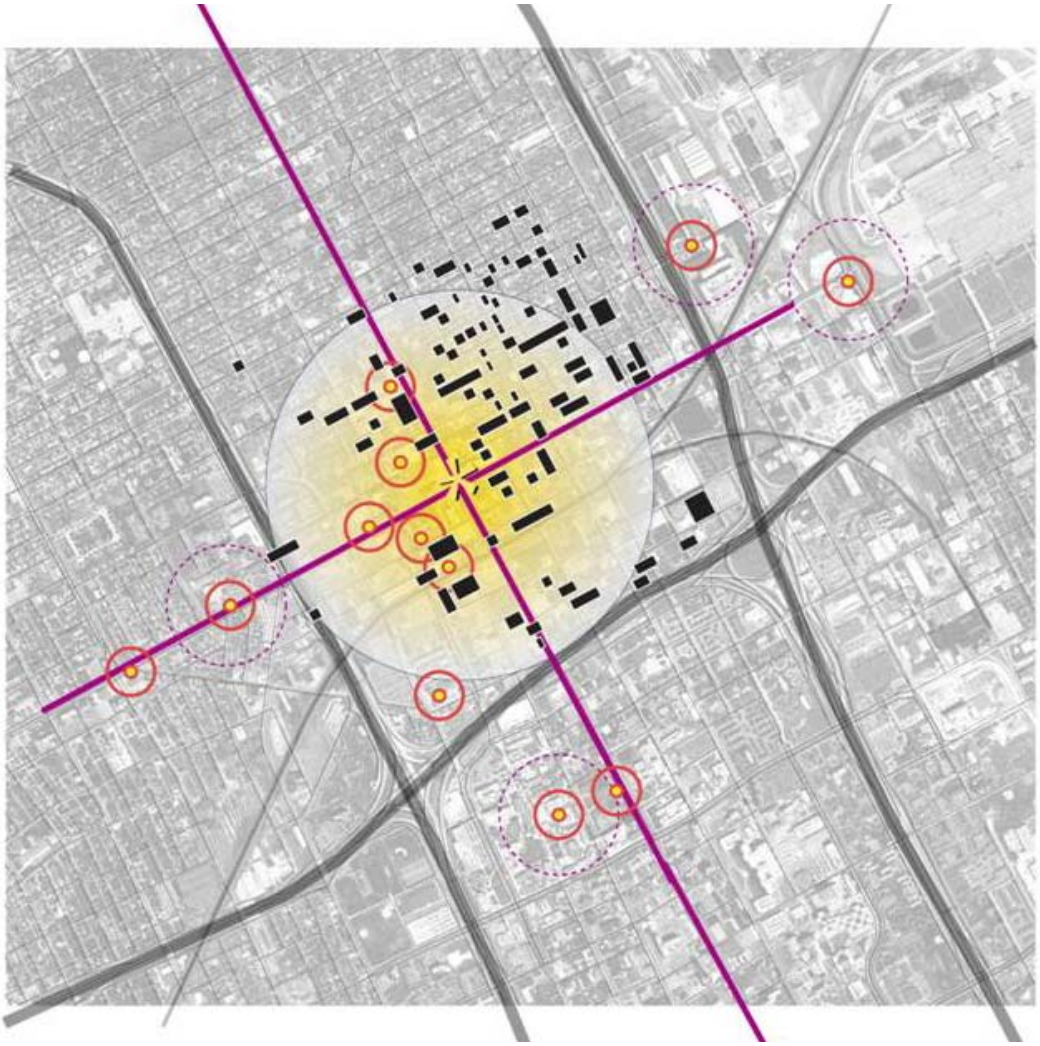

Figure 8.4: The typical TOD bubble (Krueger 2010)

The bubble also completely disregards the availability of vacant land. Detroit, as a shrinking city, has an abundance of land available. Created by the combination of economic and residential loss, these vacant parcels create an interesting situation in Detroit. As an acknowledged shrinking city, Detroit is beginning to conceptualize reducing city services to reflect the shrinking population. This means that large tracts of land in the future could be reconfigured for uses other than residential development. Areas with high vacancy rates can be reconsidered for productive land use. Residential use is one possibility, but to promote the sustainable future of this neighborhood, productive zones should also be created to support ecological services.

Zoning areas with numerous vacancies for productive landscapes, specifically agricultural or sustainable energy production, would create productive areas near population centers. Why limit redevelopment to only residential and commercial redevelopment? Residential and commercial activities are a foundation in modern community planning, but to create sustainable neighborhoods, zoning productive landscapes near population centers is vital. The productive landscape would supply the community with locally provided services such as food and energy production and open space preservation.

The bubble should be disregarded for TOD planning in Detroit. Instead, we recommend using a density gradient that supports and strengthens current community amenities. Similarly, TOD planning should use areas of high vacancy to create productive landscapes that become meaningful to the surrounding community while providing ecological services to support a sustainable future.

Breaking the Bubble: Solution

To reflect the current landscape, we break the typical TOD bubble and recommend a linear density gradient. The linear density gradient radiates outward from major connecting corridors leading to and from the train station. This gradient corresponds to more current community amenities than the typical TOD bubble; it also correlates with vacancy. Areas with higher vacancy are outside the zones for dense development. This leads to a new opportunity: Areas with the highest vacancy rates do not need to be developed as residential space and can be used to create productive zone for a productive landscape.

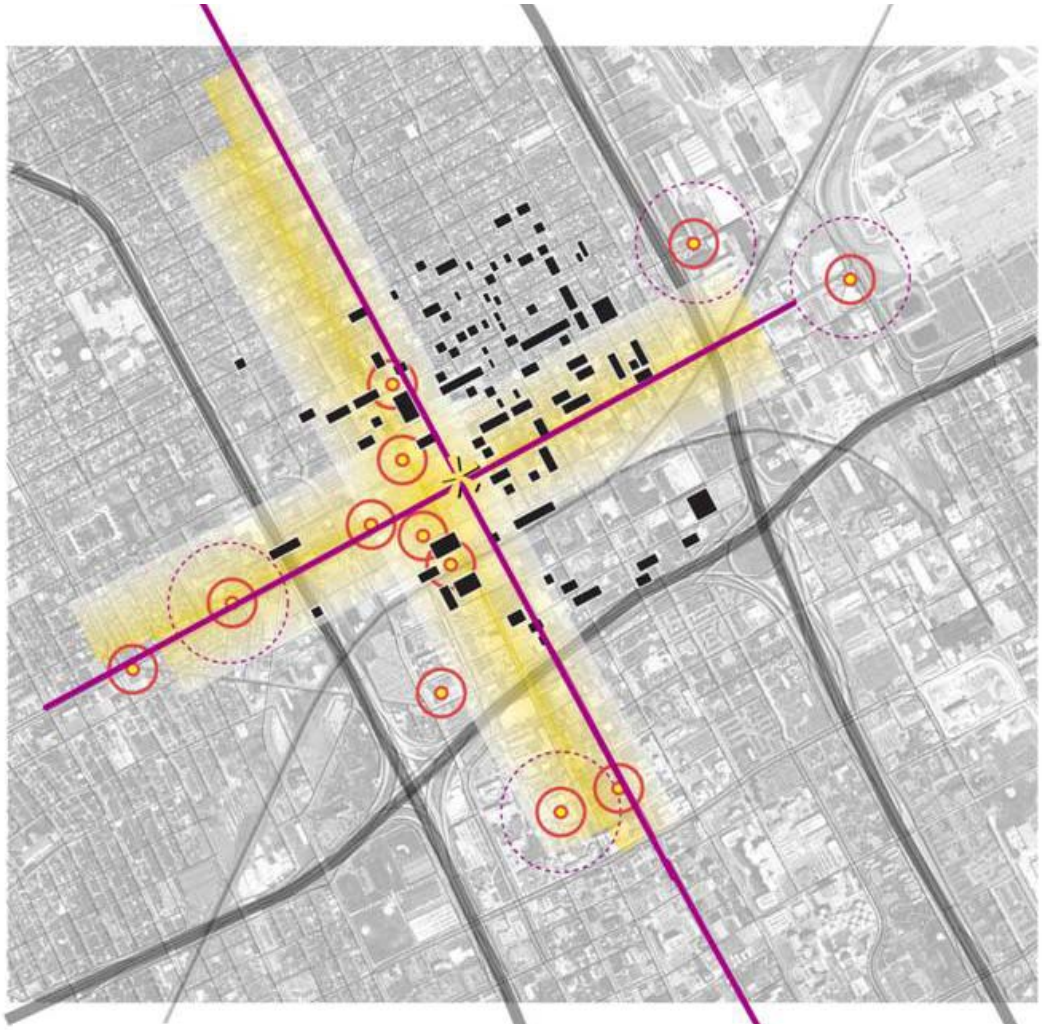

Figure 8.5: Proposed linear density gradient (Krueger 2010)

This new TOD plan will create active, dense corridors with opportunities for multi-use and residential development. These corridors become a foundation for Detroit TOD planning, both reflecting the current situation and guiding future transit-oriented growth. The streets are now designed to be destinations, bringing people to and from amenities and the LRT station. Creating dense corridors rather than dense points, or singular districts, could also theoretically increase overall accessibility within the environment. The neighborhoods gain proximity to other areas not only through a single transit point, but also along corridors that connect multiple transit options. Currently, a bus line runs down Grand Boulevard creating a strong east/west connection throughout the city. People can live along the Grand Boulevard corridor while experiencing a dynamic neighborhood with accessibility to the Woodward LRT and the Grand Bus Line.

Corridors depend on street design. To promote greater use, roads must be designed to be more equitable for different users. In this design, we remove the singularly focused automobile dominant lanes common to many Detroit streets. Dedicated bus and bike lanes, planted easements, and pedestrian-inviting sidewalks then take priority. Welcoming different types of users to the streets is paramount in conceptualizing these corridors as destinations and connectors throughout the city.

As important as the corridors connecting current community amenities along the Woodward corridor, the linear gradient also encourages a large area to become a non-residential based productive landscape. Through the linear density gradient, areas can be developed with high density near the corridors, with the gradient diminishing laterally into lower-density mixed-use communities. As this mixed-use gradient continues to diminish, productive landscapes focusing on ecological services become more prevalent. In the typical TOD bubble, this landscape would be primarily developed, but through the linear gradient, human-intensive development exists along with and in close proximity to ecologically focused productive landscapes. The result is a landscape serving both the needs of urban communities and the ecological needs for a sustainable future.

Breaking the Bubble: Creating the Productive Landscape

The neighborhood design describes what could happen if areas with high vacancy rates are consolidated and used for agriculture through the productive zoning concept. John Hantz, a Detroiter and investment banker worth millions, is currently proposing a sophisticated urban farm for commercial production. Hantz Farms would be roughly 50 acres and would use the most cutting-edge technology for food production (www.hantzfarmsdetroit.com). The response from the mayor's office is positive, but negative feedback comes from skeptical community members involved in small-scale food production (Whitford 2008). They have valid concerns: will large-scale agriculture in Detroit support local labor or even the local food system? To address these concerns and to visualize a different landscape pattern, this work proposes incorporating differing scales of agriculture production to form a complete network that supports local residents and the city's food supply.

The community garden plot is the smallest form of urban agriculture, and commercial production is the largest. In between these two extremes are incubator farms. These are mid-sized farms that share resources (similar to a cooperative) and bridge the learning gap between hobby gardeners and business farmers (Hubbard 2006). There are numerous approaches to incubator farms. In one system, the Intervale Farms program in Vermont, farmers buy their own land but can cheaply rent equipment through the shared cooperative (www.intervale.org). Intervale also promotes mentoring between new and experienced gardeners, thus emphasizing education (Cook 2008). In another system, an incubator farm cooperative in Maine, George Christopher owns land that he rents to prospective farmers, who then share equipment and knowledge (Cook 2008). Incubator farms promote both community and economic development.

Figure 8.6: Redesigned New Center Neighborhood, an urban environment to an agricultural center (Krueger 2010)

The diversity of possible agricultural uses allows us to conceptualize the area north and south of Clay Street through a designed agricultural gradient. Playing off the land use and residential gradient, urban agriculture 'grows' from small community plots to variously sized incubator farms to large-scale production. This farm network could support diverse production methods, including orchards, greenhouses, and crops, given the varying scales of available land.

In this new landscape, small plots (.5-1 acre), medium plots (1-2 acres), and large plots (2+ acres) fit into a newly revamped residential landscape. The variety of plot scale reflects the ability of individual or family groups to maintain the land for agricultural production. In this scenario, the plots could be privately owned or collectively managed by individuals or groups of people. This makes the production

and management of agricultural plots accessible to many different people. The plots could support a single family or community; they could be for individual use or for-profit sale. The gradient of the plots corresponds also to the density gradient radiating from the main corridor of Grand Boulevard, as more intensive residential land use changes to more intensive agricultural use.

The agricultural plots are nestled within residential surroundings closer to Grand Boulevard to maintain visible activity and population density on the linear gradient. To place primarily agricultural land as if it were an island in the middle of urban infrastructure would likely re-create the current situation of vacant land – a desolate landscape unwelcoming to the community. Rather, this design incorporates the residential and agricultural uses by creating immediate and active edges between smaller-scale agricultural plots and dense residential development. Farming families live adjacent to residents, creating a landscape where the two can interact through visual and social connections.

An affordable means of processing food is just as important as farmland and harvesting equipment. In this plan, an industrial kitchen could support farming by processing food grown on these properties. Ultimately, the incubator kitchen can encourage small-scale processing in an educational and relatively inexpensive environment. Kitchen incubators have sprung up recently in Boston, New York, and Philadelphia, all with the aim of promoting local food production and small business development (Micheli 2002; Petrucci 2009).

Ecological principles are strongly maintained in this new landscape. Native planted hedgerows define boundaries between individual farms. To signal the change in landscape use, street tree placement becomes more reflective to the hedgerow pattern, as the agricultural gradient increases plot size. The new pattern of street trees supports wildlife movement between hedgerows and ultimately throughout the neighborhood. The street tree pattern is organized to group trees at the base of hedgerows, rather than the typical 35’ street tree offset found on major corridors. New Center is a major flyway for migratory birds, and the tree arrangement helps support continuous connectivity for habitat crossings. Native plantings will further enhance habitat and ultimately wildlife crossing. Small trees

and native fruiting shrubs are recommended to help feed the migratory birds passing over this neighborhood.

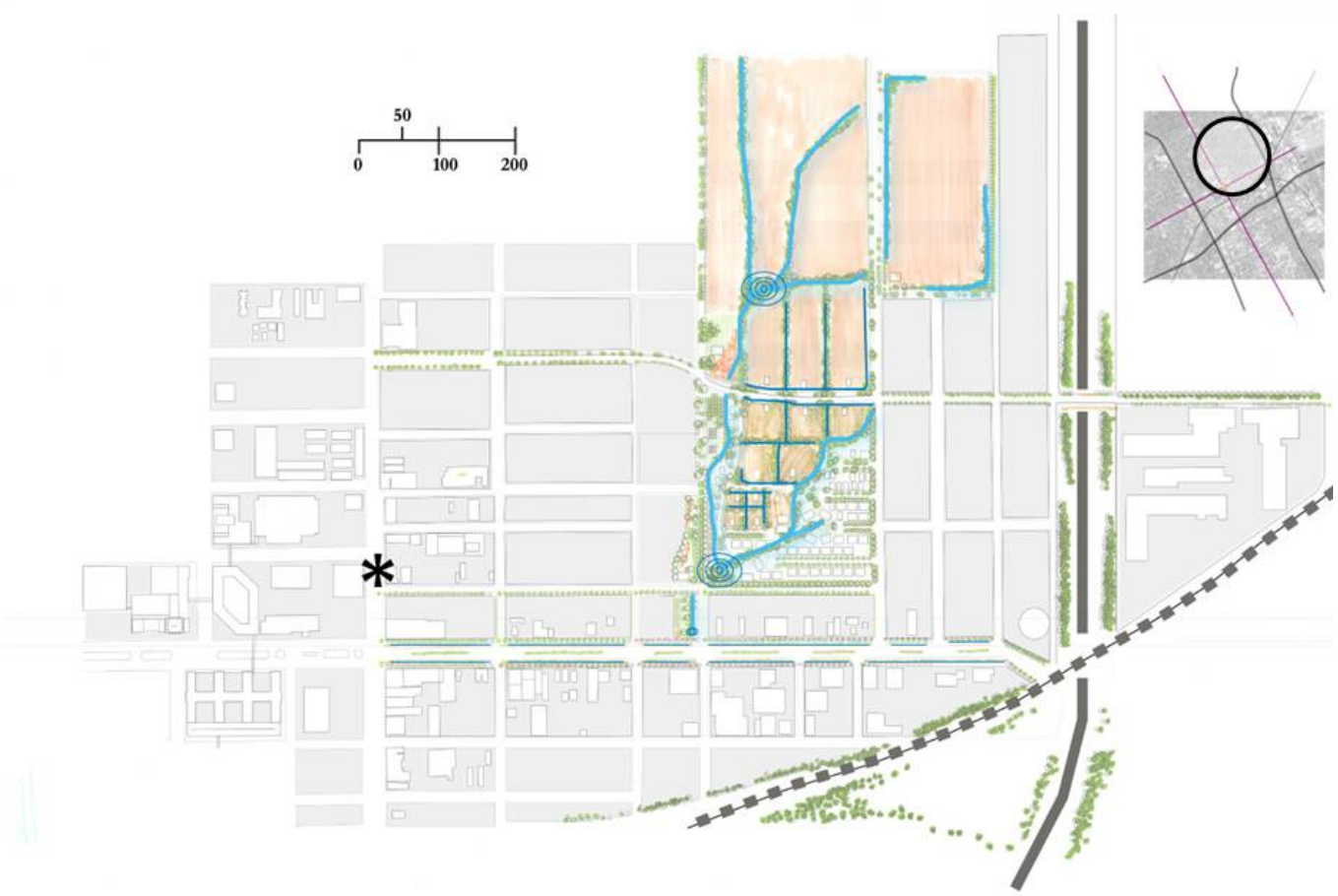

Figure 8.7: Diagram of neighborhood showing water flow and connectivity (Krueger 2010)

Another ecologically important aspect of this design is in the water movement through the agricultural and residential development. Crop edges are designed to collect water and treat agricultural runoff. Swales run through both the agricultural and residential landscapes so that stormwater can be managed. The use of swales does reduce land available for food production but also provides a more sustainable water management strategy. Swales promote water treatment, infiltration, and holding capacity so that polluted runoff does not overburden sewer lines or outflow directly to major water bodies (Nassauer 2007).

The swales, like the hedgerows, create habitat and promote connected habitats for wildlife movement. Similarly, these swales also provide a visual connection to humans. The swale design flows from the agricultural landscape through the residential neighborhood and ultimately to Grand Boulevard. This visual connection creates connectivity and conformity in this new landscape. A linear park at Grand Boulevard first introduces visitors and residents to the new landscape, then follows and guides them to different land uses throughout the neighborhood.

Planting design recommendations for swales would include a diverse array of native forms, grasses, shrubs, and trees, allowing adjacent owners to determine the aesthetic appearance of any area. This does not mean that the swales would be considered only private. Pedestrian trails or sidewalks could follow the swales farther, enhancing accessibility through the neighborhood while promoting interactions between neighbors.

Features of the cohousing movement, such as shared space and isolating parking, are repeated throughout the neighborhood south of Clay Street in order to build community relationships. In addition, defensible space is created through areas where neighbors feel ownership and therefore care for the landscape either through direct management or secure watch. Defensible spaces are more successful when the number of people per place is minimized. This design enhances the concept of ownership by placing only a few families proximate to shared spaces.

Figure 8.8: Bird's-eye perspective of swale connection from Grand Boulevard to the neighborhood (Krueger 2010)

Breaking the Bubble: Street Design Interventions

Grand Boulevard: A New Active Corridor

The design of streets is at the heart of this concept. Streets need to be active, safe, and legible. Careful consideration of the desired uses and experiences of the streets is paramount in design decisions. An explicit street hierarchy will promote the legibility of this environment. As an actively used street, Grand Avenue is important for all forms of mobility. The design for Grand Avenue was inspired by research into corridors like Avenue Foch in Paris. Avenue Foch showcases vehicle movement in the center while quieting the edges for a more comfortable pedestrian experience. The linear nature of the road is emphasized by an alee of trees, a common design move used in emphasizing the linear alignment in the landscape.

The expansive 150 linear feet of Grand Boulevard have been reclaimed for a more equitable distribution of uses. The street is not designed solely for car travel;

rather, the center lanes of auto traffic change to dedicated bus lanes and bike lanes toward the edges. The sidewalk is greatly expanded to include ample room for pedestrians. The sidewalk width will vary depending on the given offsets of the building entrances on Grand Boulevard and are expected to range from 20'-35'. This provides room for sidewalk café space, benches, and large street tree planters, all enhancing the aesthetic experience and increasing activity on Grand Boulevard.

Between the dedicated bus and bike lanes lie median strips serving dual purposes. First, these medians act as bus stops for waiting passengers or as pedestrian cut throughs to the shops and residences on Grand Boulevard. When these medians do not require hardscaping for these uses, the medians are planted with ornamental grasses. Ornamental grasses, such as Sorghastrum nutans or Sporobulus heterolepsis, are highly tolerant of urban conditions and provide a clean, modern, planting structure to the street layout. When planted, these medians also accept water runoff from the street, through the use of curb cuts. Using vegetation to accept stormwater runoff helps reduce treat and store runoff. Increasing vegetation cover for water storage reduces sewer overflows, decreasing untreated discharge into our waterways (SSI 2009).

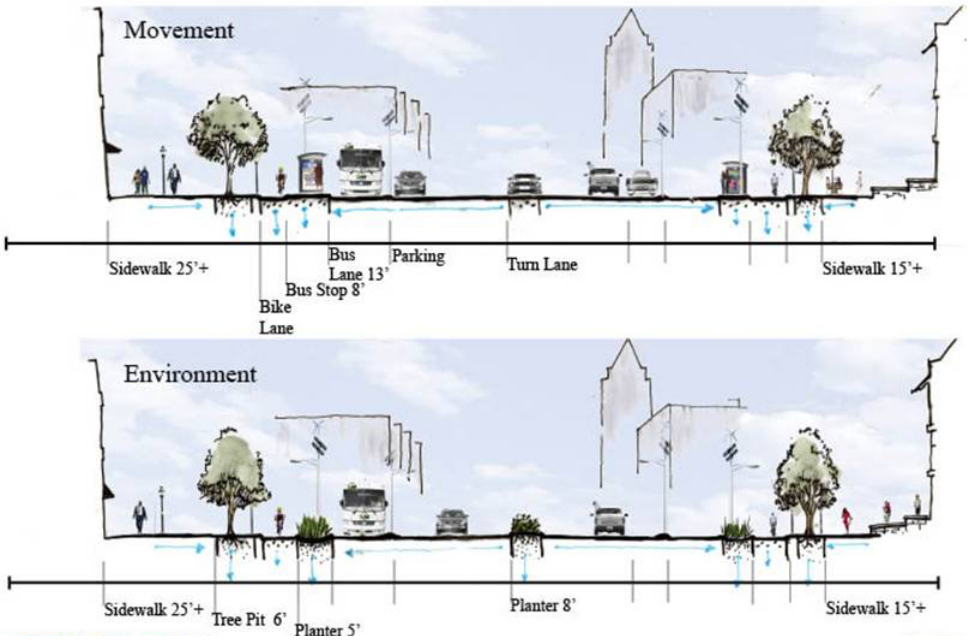

Figure 8.8: Newly designed Grand Boulevard (Krueger 2010)

In this redesign, Grand Avenue becomes a corridor promoting continual activity. Buildings stand a minimum of 3-4 stories tall and include multi-use amenities and residential living options. The intent is to create a dynamic, commercial, enterprising district that supports shoppers and sellers. The activity on Grand Avenue will create an interesting experience for pedestrians while also ensuring accessibility to amenities for businesses and residents alike.

This district is tailored to nurture small businesses by making space available for business incubators. Detroit's current economic scenario is bleak. High unemployment and the loss of the industrial economy have left many skilled trade laborers without work. Creating space for small-business incubators encourages both economic growth and a greater sense of community through shared space and resources (www.nbia.org). Incubator space can be at a variety of scales and can support varying industries (www.nbia.org).

The enterprise district created on Grand Avenue transforms the area to the north into a peaceful residential neighborhood that accommodates different ages, incomes, and family sizes through various housing options. Detroit has a significant bias towards single-family housing, which encompasses over 80% of the city's total residential parcels (Detroit Residential Parcel Survey 2010). In this neighborhood, single-family housing is included within an intricate pattern of multifamily housing that includes duplex and apartment-style homes. This will increase density in proximity to the New Center Station. By using multifamily housing, we hope to create a more resilient neighborhood that will be less threatened by home vacancies.

Grand Boulevard, in this redesign, is now an active, densely populated corridor supporting both the Woodward LRT and the Grand Boulevard Bus Route. By supporting two routes of transit, the linear gradient increases accessibility for residents of the New Center neighborhood. Grand Boulevard is legible, comfortable, and useful to residents of New Center.

Clay Street: A newly extended, meaningful connection

Clay Street holds the main entrance to the Russell Industrial Complex and provides a highway crossover to connect the RIC to the New Center Neighborhood. Currently, Clay Street dead ends at Oakland, eliminating a direct connection to Woodward from the RIC, and vice versa. In the redesign, Clay Street connects directly to Woodward and provides a dividing line between residential and agricultural land uses, since the experience of Clay Street is meant to be more bucolic than urban.

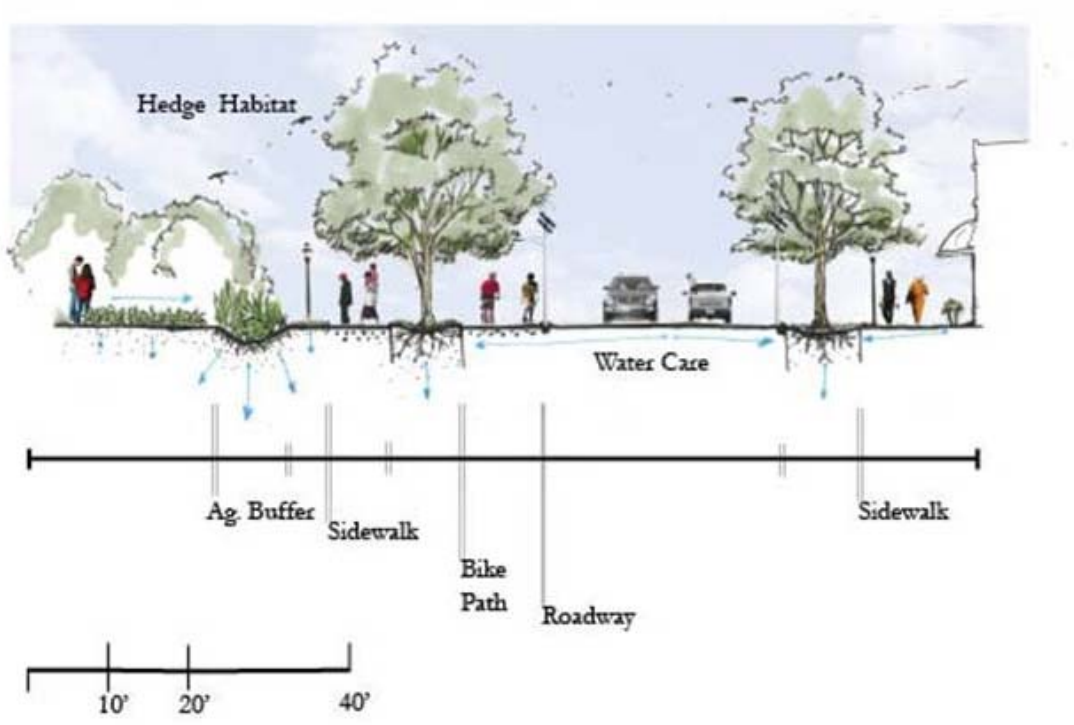

Figure 8.9: The New Clay Street (Krueger 2010)

Like pathways created in the garden at Stowe, Clay Street is curvilinear, emphasizing a naturalistic experience through captured vistas (Barlow 2001). Captured vistas occur into the agricultural landscape through openings in tree plantings. Unlike the urban Grand Boulevard, Clay Street avoids a linear

arrangement of trees. Rather, the tree plantings correspond to hedgerows in the agricultural landscape to create habitat connectivity for wildlife. As the trees break, views into the agricultural landscape open for passersby.

Because Clay Street is secondary to the corridors created on Grand and Woodward, car travel is minimized to two lanes. Bike travel is encouraged through a dedicated lane that is 12' wide. There is a small bump out in the road, similar to a speed bump, distinguishing bike lane from car lane. Bike lanes are also painted a bright blue to further communicate the intended use. Adjacent to the bike lane and car lanes are wide (8') easements. Easements protect pedestrians from other traffic and provide ample area for street tree or other plantings.

When an agricultural land use is adjacent to sidewalks, a buffer swale connects the agricultural field to the turfed edge of the sidewalk. This transition serves both ecological and cultural functions. Ecologically, the buffer swale captures and treats runoff from the agriculture landscape. Agricultural runoff can include sediment and fertilizers; without proper management, runoff will contaminate local and regional water bodies and harm water quality and wildlife habitat. Vegetated swales trap sediment and take up excess nutrients found in the agricultural runoff. These swales include native plantings that will also promote habitat and biodiversity in the landscape.

Culturally, this transition helps to visually communicate the change in landscape for local residents and visitors to the area. The agricultural landscape could be considered public or private, depending on ownership. If it is deemed private, the agricultural buffer swale will create an edge to the landscape that will discourage crossing through the combination of graded edges and thick vegetation. Furthermore, the agricultural landscape is not always conducive to pedestrian traffic, so swales can be used to direct people to public entrances throughout the farm.

Also important to the newly extended Clay Street is the redesigned highway crossover. Currently, the highway crossover holds four lanes of traffic bounded by small raised concrete medians. These medians provide a boundary for two additional lanes of traffic meant to route automobiles on and off the highway. It is a

confusing system for drivers in that the two additional lanes on either side of the median place the driver against the expected flow of traffic. Furthermore, with the current layout the only pedestrian area lies on the concrete medians. It is an exposed, uncomfortable experience for pedestrians, and too many lanes are dedicated to automobiles.

Figure 8.10: Clay Street Crossover (Krueger 2010)

The goal in redesigning the Clay Street highway crossover is to enhance the pedestrian and bike experience while also maintaining sightlines to the RIC. Like the extended Clay Street, the highway crossover includes a dedicated bike lane of 10-12'. Car lanes are reduced to two active lanes. The two additional lanes of traffic used for directing highway traffic are removed and replaced with space dedicated to the pedestrian. On the north side of this crossover, the redesign adds a high metal wall. Rusted metal is used to reflect the industrial history of the site. The placement on the north side of the highway will also provide a break to the strong northwest winds that often blow in Michigan. Leading down from the metal wall is a tiered planter of grasses and sedums. Similar to a green roof, the tiered planting structure is meant to create a more enclosed, protected experience for the pedestrian.

On the south side of the new crossover, the pedestrian sidewalk now expands to 10'. The area includes a straight low planter of grasses to protect the pedestrian from the car traffic. There is no fence on this side of the street to maintain the views to downtown Detroit. Trees are planted only at the edges of the crossover, so as not to block views to the RIC. Trees were also avoided so that the structural integrity of the crossover can be maintained in the redesign.

In the standard TOD bubble approach, this intersection would not have been acknowledged for planning or redesign. Including this area in our neighborhood planning strategy has allowed us to include residents and visitors of the RIC as potential users of the Woodward LRT.

Summary

Accepting the linear gradient for planning and design results in neighborhoods that both reflect the current landscape scenario and allow for a sustainable future. The new pattern of redevelopment works to connect current active amenities and strengthens these destinations though legible street connectivity.

The streets become the backbone of the community, bringing residents and visitors through the neighborhood and to destinations. On the corridors, dense, multi-use development is encouraged. The development should include varying activities to support different users and make the streets into active corridors, destinations for residents.

Productive landscapes exist for urban development and ecological services, all within good proximity for residents. Areas showing high vacancy rates are encouraged to redevelop as agricultural landscapes, able to support the food supply for the community as a whole.

Overall, the opportunities are great for Detroit. With modifications like the linear gradient suggested, TOD planning becomes less arbitrary and more related to the current land use scenario. Detroit is not like other cities, so this work aims to create a unique future for a unique city.

Chapter 9: Eight Mile Station

Design Concept: Extending Natural Spaces to Strengthen Community Connections

In Detroit, vacant and underused land forms a pervasive pattern in the city fabric. Some lots have been cleared of debris and now resemble a wild landscape of weeds and wildflowers, but others still have remnants of structures that once occupied the space. The interplay of declining urbanism and resilient nature may be intriguing from an outsider's perspective, but for those who inhabit this terrain, it can have a negative impact on community identity. The identity of Detroit is both tragic and appealing. The city that built itself up and outward so quickly is now shrinking and must face the next stage of its evolution in landscape planning. The remaining population is resilient and dedicated to staying in Detroit (Gallagher 2010b), and community empowerment will help residents to begin collaborating in the redevelopment of functional spaces with integrity. Natural spaces can be used as a focal point for empowering communities to engage in their surroundings. The resilience of nature should not have to imply vacancy or abandonment of properties, but instead can become a signifier of longevity and vitality in an urban setting.

Image 9.1: Wildflowers and grasses at a vacant residential lot in Detroit (Lee 2010)

Image 9.2: Natural space in the context of a neighborhood community in Detroit (Lee 2010)

Community design offers a useful conceptual framework for designing the 8 Mile Station transit center. The primary goal of community design is to create everyday environments that address the unique needs of the people who reside in them (Hester 1990). The underlying assumption is that underserved communities require a design strategy that not only brings much-needed services to the people but also allows the community to sustain those services with its available resources. This approach acknowledges the conditions of a shrinking city. In the absence of equitable services, it is necessary to design revitalization efforts to involve existing communities and draw upon their resources. Though the population may be small relative to the capacity of the city's infrastructure, community design focuses on finding the "hidden marketable resources in local landscapes" (Hester 1990). In Detroit, one such resource is the city's residents who are dedicated to their homes and want to see their city improved. By empowering these individuals with opportunities to carry out positive change, this social economy becomes the means by which to make productive use of currently underused space.

Nature in the city provides a variety of benefits for community design. By performing ecological and cultural functions that make places restful and useful,

natural spaces can improve health and quality of life for residents of struggling neighborhoods in Detroit. Important benefits are the basic comfort of shade from a tree on a hot day, or the capacity to grow fresh food in healthy soils near the home. These two benefits are necessary in an urban setting such as Detroit, where streets and sidewalks lack pedestrians, and neighborhood staples such as grocery stores are located outside city limits. These observations generally communicate urban decline, but from an optimistic standpoint Detroit's current conditions are opportunities to reinstate natural systems in the urban fabric.

The community's perception of nature is a critical component in reinstating natural areas in the city. While picturesque views of rolling landscapes and gentle woodlands generally elicit positive reactions, this depiction of nature is generally perceived to be part of an agrarian context rather than an urban city. Dense vegetation or open fields in an urban context could be negatively perceived as dangerous or abandoned places. Charles Lewis, a horticulturalist, researcher and consultant, recounts an experience at the Morton Arboretum in Illinois where visiting children from the inner city were terrified by a patch of woodland; they believed dangerous things were hiding in the trees. The appearance of a natural area prospering with minimal human impact was foreign to the children's idea of a place they would want to go (Lewis 1990). Since urban areas are by definition areas populated and shaped by human presence, places that exhibit nature in the city must fit the needs and expectations of the urban resident.

Detroit's landscape reflects the urban perception of nature in unique and complex ways. In the 19th century, the City of Detroit planted over 400,000 elm trees on neighborhood streets for their lofty beauty and ability to shade streets and homes (Baulch 2001). Then known as the City of Trees, Detroit was perceived by its residents as a wonderful place to live. "Homes surrounded by the shade trees seemed not to need air conditioning. The leaves allowed filtered sunlight to attract the eye heavenward, and indeed most that recall the trees, described the arches of the elm branches in terms of cathedral vaults used by medieval church architects to lift the spirit" (Baulch 2001). Natural elements, in the form of orderly lined elm

trees, became an integral part of the urban experience and were a symbol of community identity.

Image 9.3: Elm trees grace the streets of Detroit in the mid 20th century (*The Detroit News* 2001).

A variety of factors resulted in the destruction of the city's elm trees during the mid 20th century. Dutch elm disease, a fungus carried by beetles in the overseas transportation of furniture and goods, decimated elms all over the city. The large size of the trees, which grew to heights of up to 120 feet, proved too big for the limited space between plantings as well as between curbs and sidewalks. Cracks and heaves in the pavement required constant maintenance and repairs of city infrastructure. Additionally, the fast growth of the numerous elm trees required large amounts of watering to achieve the ideal street appearance. The desire for this particular form of nature in the city ironically reveals the conundrum inherent in adapting natural elements to thrive in the urban context.

Similar problems involving ecologic and cultural health remain today in the landscape of Detroit. Cracked sidewalks and streets reveal weeds and grass growing where unintended. Deteriorating houses in neighborhoods are overrun with vines or new trees breaking through the roofs. Vacant lots are filled with wildflowers and weeds, attracting the dumping of trash and litter. This form of nature, unwelcome and unplanned, is defining the places Detroiters interact with on a daily basis. Furthermore, the large number of such places throughout the city exposes the lack of city management and resources to maintain pleasant appearances.

The image of nature is continuing to change in the context of Detroit. The wildness of plants overtaking formerly functioning urban places and structures reveals a sense of vitality and hidden potential in spite of city decline. As land in the form of vacant and underused lots cultivates persistent growth of plants and wildlife, these spaces begin to intimate ways in which nature and people might coexist and possibly thrive. The introduction of the light rail train provides a unique opportunity to change the appearance of Detroit. Although the train is an additional piece of city infrastructure to operate and maintain, public transportation will help bring services and amenities closer to Detroit residents. New forms of natural elements in the city can become places that foster public use and social interaction. The integration of the train into the surrounding urban fabric whose materiality is evolving from city to nature is both challenging and promising. By combining well-designed natural space with new urban infrastructure, this synergistic relationship will inspire Detroit communities to feel a renewed identity and connection to the city.

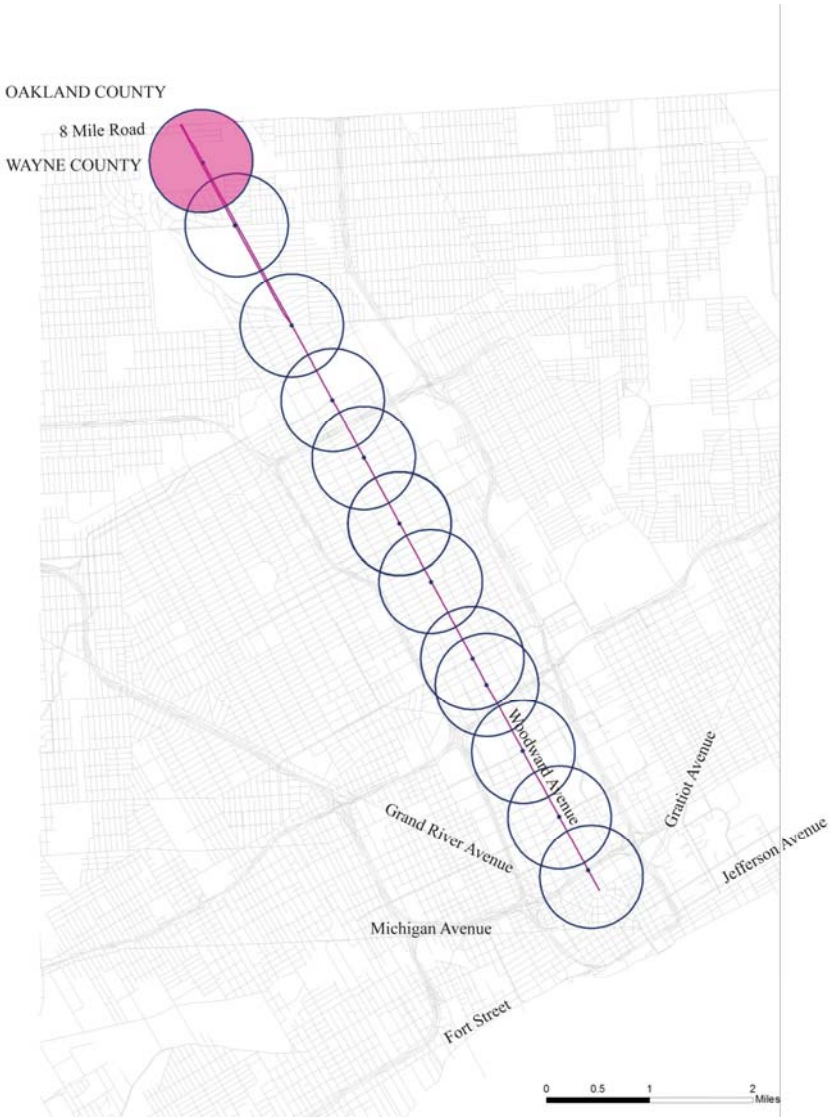

Figure 9.1: Location of 8 Mile Station on the new Woodward light rail train line. Each circle represents the half-mile radius around each station stop (Lee 2010)

8 Mile Station Site: Context and Analysis

One example of how vacant and underused land is affecting community identity is the intersection of Woodward Avenue and 8 Mile Road. Best known for housing the State Fairgrounds, this intersection provides the edge and gateway to the City of Detroit. To the north of 8 Mile, the City of Ferndale in neighboring Oakland County is a thriving community with active, dense streets populated with

storefronts, gathering spots, and attractive gardens in public spaces. Known by the city slogan of “Good Neighbors,” Ferndale involves its citizens in the civic planning process by giving residents regular opportunities to make their city a better place to live (“Community of Ferndale” 2010).

To the south of 8 Mile where the City of Detroit begins, residents have a very different experience. Woodward Avenue is expansive, comprising eight lanes of traffic, four in each direction. A large median extends the width of Woodward; the only vegetation is turf and a thin line of struggling trees. The street is not approachable at a human scale but rather serves the transportation preferences of motorists coming into and going out of the city. Woodward is daunting to cross, either by foot or automobile. Sporadic U-turn lanes and breaks in the median allow the only opportunities for vehicles to cross to the other side, and only by yielding to prevailing moving traffic.

The physical environment reflects the character of community at this intersection. Woodward is a dividing line that does not encourage integration or crossing over. To the west of Woodward Avenue, large plots of land dominate the city fabric. Recognized as national historic places, Woodlawn and Evergreen Cemeteries are located here, with the highly exclusive upper-class neighborhoods of Palmer Park and Sherwood Forest farther south. Recreational space comprises golf courses and parks along curving, pastoral roads. Moving across Woodward to the east, one notes the absence of the forms and character of space seen on the west side. The former State Fairgrounds now resemble a 180-acre paved lot, fenced on all sides from public entrance. A small transit station currently conducting bus service only creates a small dent in the fenced perimeter. The station has several covered structures and benches at bus stops, and the area has no trees. On a warm day, this station is uncomfortable and unpleasant, as the pavement that covers the entire area absorbs and retains heat.

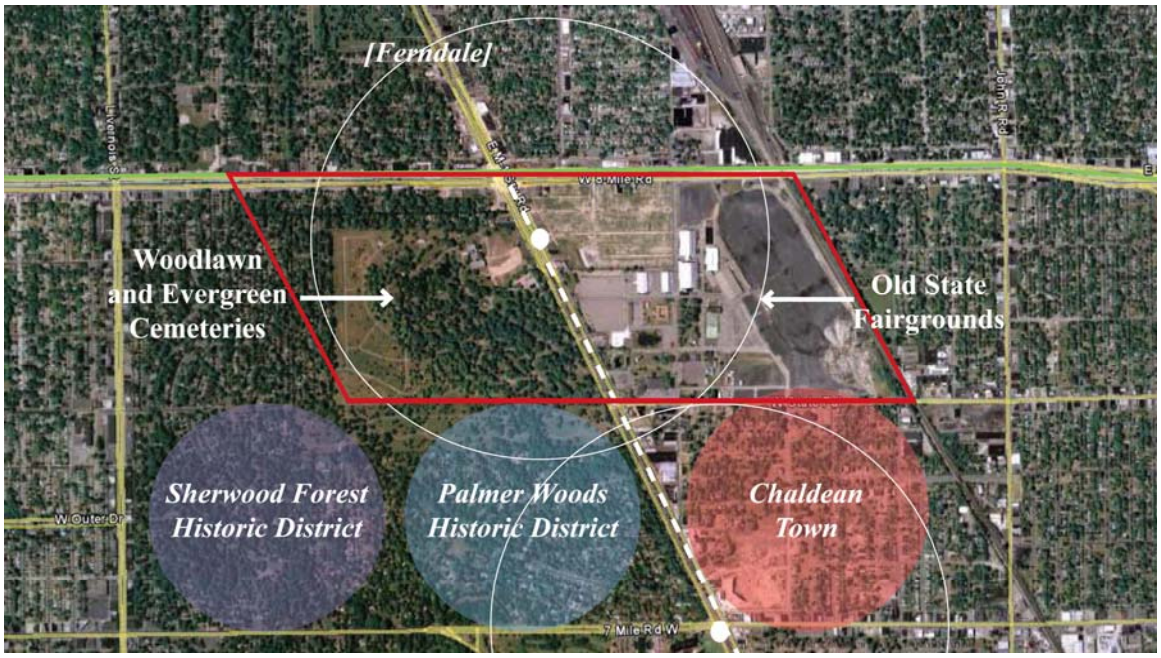

Figure 9.2: Map of Detroit's communities surrounding 8 Mile Station. The area outlined in red shows the immediate potential amenities a train passenger will encounter at the train stop (aerial photograph acquired from GoogleEarth 2010).

The heat felt at the bus station at the State Fairgrounds is a human-scaled experience of urban heat island effect. The EPA defines the urban heat island as developed areas with higher temperatures than surrounding rural areas, which result when "buildings, roads and other infrastructure replace open land and vegetation" (EPA 2010). Heat island effect is not only uncomfortable for people living in urban areas; the increase in heat negatively affects environmental resources as well. As temperatures warm, water in urban soils can evaporate faster, increasing quantities of water needed for gardens and lawns while decreasing the infiltration of water into soils for the natural recharge of aquifers. Water conservation strategies, which are key to preserving our natural resources, have strong potential to transform Detroit's vacant and underused lots into environmentally productive places.

Reinstating vegetation to break up large expanses of impermeable, hardscaped areas is a strategy to capture water runoff and encourage infiltration

into the ground. The adjacent cemeteries at the site are currently providing this ecological service, with sizeable tree stands that have inhabited the area for over a century (Northrup 2003). Trees of this maturity are ecologically valuable. In addition to capturing and infiltrating rainwater, trees improve air quality by capturing particulates in the air from spreading into the wider atmosphere and sequestering carbon through photosynthesis. In conjunction with Detroit's abundance of underused space, integrating more trees into the urban landscape to expand upon existing areas of productive vegetation makes sense. As the city's prior demand for urban growth paved over natural landscapes, natural elements and the important services they provide for a healthier environment should reclaim Detroit in the absence of full urban utilization.

Wide, expansive streets provide a focal area for extending natural spaces in Detroit. Main arterial streets, such as Woodward Avenue, were made excessively wide to accommodate high volumes of cars. This level of automobile traffic does not exist today. The spatial voids the streets now resemble are not conducive to pedestrian use, and the new light rail train needs pedestrians to make up its ridership. Trees and other vegetation can be integrated into Woodward Avenue to welcome pedestrian use. The street widths previously made to enhance the use of cars can be scaled down to encourage human comfort. Simultaneously, extensions of natural space will reinstate ecological services and remodel urban infrastructure.

The character of the natural space can set the tone for the image of the city. 8 Mile Road represents the edge of Detroit and Wayne County. While the Woodward light rail is planned to run the length of the city, the train is the first stage of a wider plan for regional commuter rail. The Woodward light rail train will at first be a service for City of Detroit residents, but in the future it will connect outer suburbs and cities in southeast Michigan to the urban core of downtown Detroit. The area at 8 Mile will be the gateway into the city. Placing trees into public street space will recall the aesthetic of the former "City of Trees," a title Detroit claimed for itself a century ago. Riders of the train will recognize where they are by the iconic character of an urban street forest at the edge of the city.

Design Goals for 8 Mile Station:

1. Create an identity at the gateway of the City of Detroit.
2. Design ecological services as a means to engage the community with place.
3. Integrate the train into the cultural urban fabric.

Design Solutions: Treating the Train as an Urban Park

The first design challenge is to scale down the experience of Woodward Avenue to be more conducive for pedestrian use. Measuring 170 feet wide (ten feet wider than a football field), Woodward currently carries ten lanes of traffic and has a wide median with a turning lane. There is ample room to incorporate a train and station platform in the center of the street. The train line bisects the street length into two smaller throughways. To avoid compounding the feeling of separation between the two sides of the street, we propose a new station park to expand the width of the train line. With long, linear park space running along the outer edges of the train tracks, a welcoming sight invites pedestrians visually with native trees creating an open woodland in the middle of the street. Walkers and bicyclists have more options of where to travel on the streetscape. Once on the train, riders will enjoy the experience of riding through the trees, a unique experience to have while in an urban city.

Figure 9.3: Plan view of a linear park along the light rail line on Woodward Avenue. The linear park provides ample width to accommodate the healthy growth of native trees within the pubic space of the city street (Lee 2010)

Each of the two linear parks measures thirty feet wide. With the train infrastructure in the center, this expanded version of the train line takes up around eighty feet total of the 170 foot wide public street. The remaining ninety feet of urban asphalt can still accommodate six lanes of traffic and two parking lanes. The automobile can still use this major arterial route efficiently. Mixing multiple modes of transit on Woodward increases the types of users of the space. A variety of users increases the likelihood that more people will use the street. The more use the street gets, the more safe and appealing it will appear. Detroit's current tendency to feel empty of people will reverse if public street corridors gain diversity in congruence with new light rail.

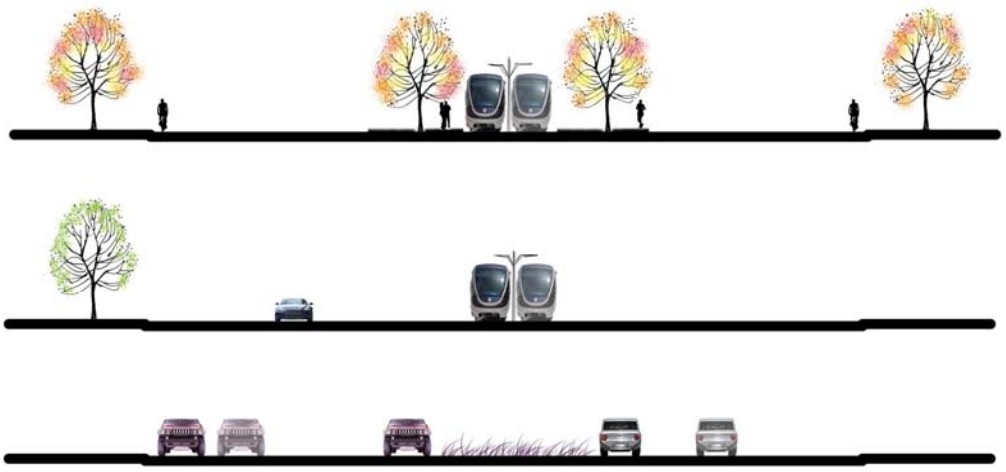

Figure 9.4: Section drawings of Woodward Avenue, showing the spatial transformation that can happen with the implementation of the light rail. Bottom: Woodward Avenue as it currently exists—ten lanes of traffic and a grassy median in the center—is unwelcoming to any user but the motorist. Middle: The train line bisects the wideness of Woodward. Top: A station park on either side of the train completes the transformation of Woodward into a human-scaled space (Lee 2010)

Figures 9.5 and 9.6: Perspective views of the station design model (Lee 2010)

The second design challenge is to vivify ecological services in a public space. The new station park provides a development opportunity to implement natural spaces on Woodward Avenue. Native tree species such as red maples, sugar maples, white oaks, red oaks, American elm (resistant to Dutch elm disease), tulip trees, basswoods and sycamores recall historic vegetation prior to colonization (Albert and Comer 2008). The use of native species at the gateway of the city suggests authenticity by representing the local character of the landscape. In addition to re-creating the natural aesthetic, native species are adapted to local climate and conditions. Rain, wind, and soil are appropriate to foster plant growth.

A diverse mixture of tree species provides for a stronger, healthier habitat. Planting only one type can result in the wide decimation of a species, as Detroit has already experienced after Dutch elm disease killed the city's beloved trees. A variety of species helps guard against disease, as well as support the habitation of wildlife such as songbirds. Differences in coloration and texture provide visual interest. Changes in the seasons will capture beautiful transitions residents and visitors can enjoy. Flowers will bloom, leaves will fall, shade will reflect dappled sunlight, and shadows will lengthen in winter. The passing of time will be punctuated by the natural cadence of growth and dormancy.

The 8 Mile Station will house a progressive train platform and shelter, which will support the linear park's functional use and ecological health. The platform will consist of permeable pavers that allow water to move down through the platform. In absorbing the water runoff, the surface of the platform will not flood or create slippery surfaces. Storage containers placed below the platform can capture water for more productive use for the surrounding community. For instance, heat from the train could heat the water, which could be used by nearby residential units. The forms of the pavers can also channel water for tree growth. Taking inspiration from the Highline, an urban park on an elevated railway in New York City, the new 8 Mile Station Park will incorporate thin gutter systems in the permeable pavers to guide water directly into planting beds. Rainwater will not be wasted by flowing into

street gutters directly into sewer systems, but intercepted strategically to advance plant growth and eventually infiltrate the ground.

The station shelter will also conduct water flow in a similar manner. Taking aesthetic cues from Detroit's industrial past, the structure will take a geometric form with monochromatic coloring. Circles will be punched out of the shelter, creating skylights and openings for tree canopies to rise through. The openings for the trees will be constructed at the depressions in the undulating shape of the shelter. Rain falling on the shelter will naturally flow towards the depressions, allowing efficient distribution of water to feed the trees rather than flow to a drain.

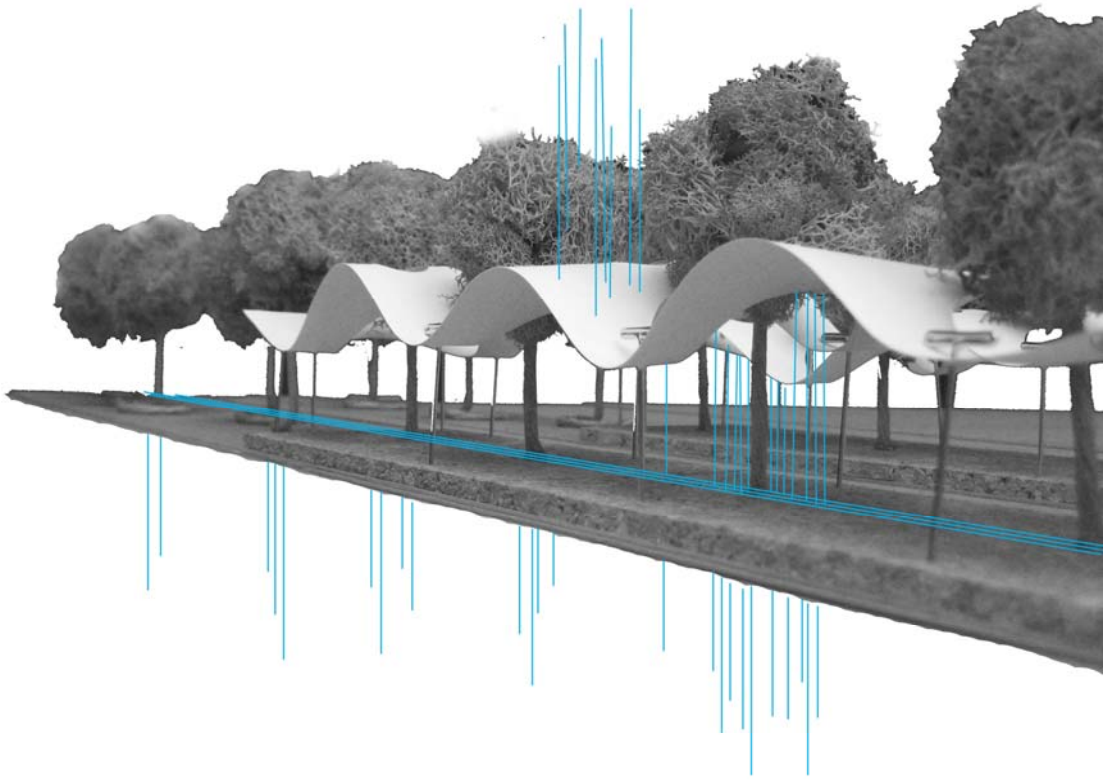

Figure 9.7: Water capture for the purpose of encouraging urban tree growth is facilitated by the station structure and linked gutter system on the ground surface (Lee 2010)

The skylights will provide visual interest for riders waiting at the train stop. During sunny days, light bursts down into the shade of the structure. Waiting passengers can choose to stand in the sunlight or the shade. When looking upward,

one can catch glimpses of moving clouds in the sky. At night, waiting passengers can catch framed views of stars that may be more visible at 8 Mile than at more lighted areas closer to the downtown core.

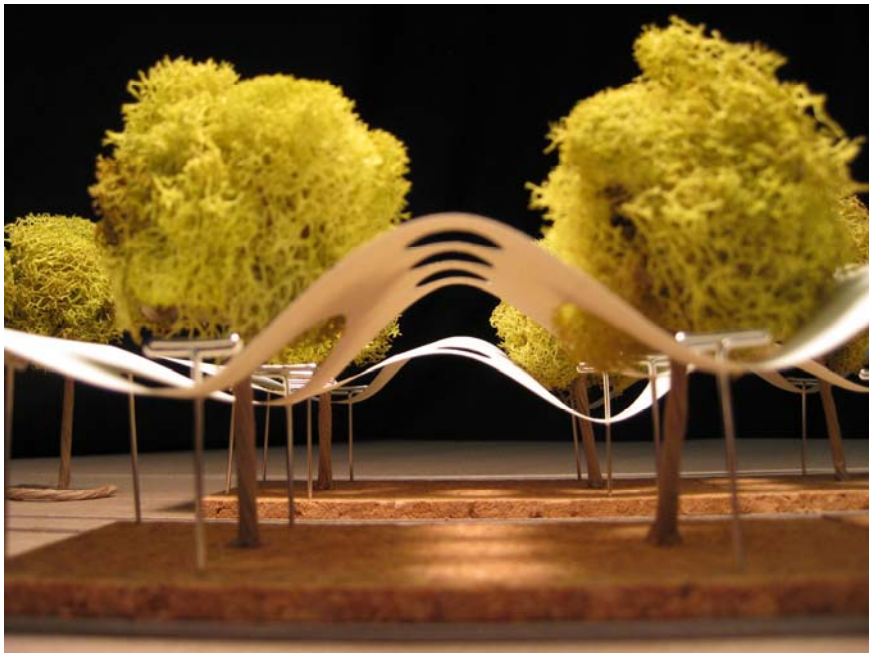

Figure 9.8: Industrial forms inspire patterns of light and shadow, openness and shelter in the new 8 Mile Station (Lee 2010)

The pattern of the skylights creates a gathering experience for train riders by encouraging people to gather in various ways. At different places in the station, skylights are arranged singly, doubly, or triply. The variation in the number of skylights suggests how people might interact with the open view. Where there are more skylights in one area, people might separate and take each one singly. Collectively, all participants will interact with nature, but each will do so as an individual. Where there is one skylight, two or more people might share the view together. Strangers may begin a conversation. People who hardly know each other but recognize each other from the neighborhood may find a reason to talk. A parent going out with a child might begin a ritual of naming clouds as they wait for the train. Should it rain, people might comment on the spectacle of the waterfalls

created by the openings. When it snows, people can playfully interact with the snow mounds created on the platforms.

Highlighting natural features through the train structure creates experiences that connect people to both nature and place. The station becomes a destination. Incentives for using public transit are achieved by design aimed at enhancing the human experience of space.

Implications for the Community of the City: Streets as Natural Spaces

The extension of natural space into Woodward Avenue as part of the light rail train presents an interesting pattern in the urban landscape. Detroit built its road and highway infrastructure according to the preferences of the motorist. Woodward Avenue, as wide as it is around 8 Mile Road, is not the only expanse of street not being used by automobiles at capacity. The intervention of natural space in the form of an urban street forest could be replicated in many other areas of the city. Where pedestrian use is encouraged, these urban street forests could perform traffic-calming functions that limit automobile use. Community ties can be strengthened as public spaces for social gathering become available. As residents meet and establish relationships, conversations about additional ways to improve community and livelihood can lead to action.

Ecological design complements community design in the context of Detroit. The shrinking of the city and the resulting surplus of land require a new strategy that counteracts the consequences of the industrial past. The importance of water quality and conservation to the state of Michigan and the Great Lakes underscores the need to ensure that ecological services are integral to new city infrastructure. Detroit inhabitants have the opportunity to make advances in transitioning impermeable urban hardscape into a living, productive component of a greener city life. Changing public streets to meet the needs of communities, the environment, and city planning will put Detroit at the forefront of more sustainable urbanism.

Summary

Improvements for the 8 Mile Station site culminate in the creation of a positive identity for the city and the communities that reside in the vicinity. The loss of the State Fairgrounds did not leave the area without a focal point, but rather established a negative character of neglect and uselessness. By focusing on the train as the catalyst for implementing new development in the area, our design draws upon Detroit's history with a station park that recalls the City of Trees and industrial forms. Additionally, making the Station sculpturally unique within its context makes a reference to the Rosa Parks Transit Center in downtown, the new headquarters for the Detroit Department of Transportation. In establishing an identity at the gateway of the city, the 8 Mile Station not only announces itself but also creates a visual connection down Woodward Avenue with the city core.

Image 9.4: Architectural similarities between downtown and 8 Mile transit stations will strengthen community identity at the city scale (detroittransit.org 2010).

Chapter 10: Alternative Energy Sources

In this chapter, we examine the environmental impacts of running the train with fossil fuels (coal), juxtaposed against the costs and restrictions inherent in various renewable energy forms. Lastly, we suggest infrastructural measures for station design that will facilitate the LRT's transition into the future as renewable energy becomes more cost effective.

Energy Costs and the Carbon Footprint

Operating the Woodward light rail will require a tremendous amount of electricity. We have estimated a requirement of 9.8-14.7 MWh of energy *per day*, resulting in annual pollution of 3,446.73-6,224.58 metric tons of CO_2. (See Appendix A for more details.) However, even using energy produced entirely from coal, with an (expected) average ridership of 22,000 passengers per day, the train will drastically reduce the total amount of carbon released into the atmosphere (See Appendix B). By simply existing the WLRT will offer environmental benefits—nevertheless, we investigate ways to reduce its ecological footprint.

Station Energy Costs and Carbon Sequestration

Without concrete plans for the design of the actual stations or the amenities, services, or electrical requirements needed at each stop, there isn't any meaningful estimate of station energy expenditures. However, we can give a brief estimate of how much carbon may be captured by arboreal plantings around each site. Using the New Center stop as an example, with a rough estimate of 175 large trees, and 250 small trees (under 35'), we can establish rough parameters of carbon sequestered.

Total carbon captured is highly dependent on the species of tree and growing conditions, but using data collected from a New York City neighborhood tree survey, we can give a ballpark figure. For large urban trees over 35' tall, carbon sequestration is usually in the 180g/year to 320 g/year range (OasisNYC.net 2010). For small trees, that range is reduced to 1g/year to 85g/year. So at the New Center

stop, 175 large trees would be expected to harbor between 31.5 and 56kg/carbon per year. 250 small trees would sequester anywhere between 0.25 and 21.25 kg/carbon per year. These are only rough estimates based on similar urban trees from New York City, but according to these estimates the New Center Station could sequester between 31.75 kg and 77.25 kg of carbon per year. It is only a drop in the bucket in terms of overall pollution, as the trees don't even come close to absorbing the carbon released by the burning of coal to power the train. However, every bit counts, and the more stations that include arboreal plantings as part of their design, the smaller the train's carbon footprint becomes.

Alternative Energy Methods

Because of space and cost considerations, there is no way that alternative energy alone can provide enough energy to run the train and/or stations in an economically realistic way. Thus, the train will rely on energy generated from DTE, which comes primarily from polluting coal. In this section we examine various generating methods, weigh their potential against their drawbacks, and explain why they are currently unsuitable for this project. Note, however, that as renewable technologies become more efficient and productive, they can be seamlessly integrated into the stations; we are planning for the more distant as well as the near future.

Solar Energy

Detroit's direct solar radiation ranges from 2.5kWh/m^2/day to 5.5kWh/m^2/day, depending on the angle and direction of the sun (tilt and azimuth), annually An average square meter of space in Detroit receives—at best—average solar penetration. (See Figure 10.1.) As you can see, Detroit is among the regions with the lowest solar potential in the US.

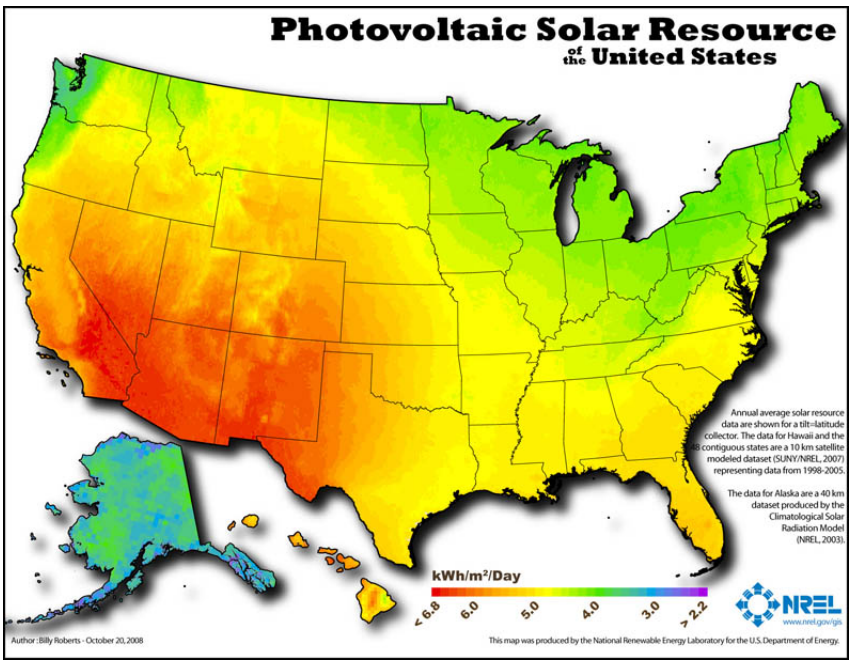

Figure 10.1: Michigan clearly doesn't have the same potential for solar power as other regions of the country (Energy Information Administration 2010)

Passive Solar Heating

If the stations were enclosed, station orientation and design would focus on absorbing and utilizing the greatest possible amount of solar radiation to allow for reduced heating costs in the winter. However, according to the specifications provided by DDOT, the stations will be open and exposed to wind and the elements, making passive solar heating a moot point.

Photovoltaic (PV) Cells

At current prices and physical configurations, if PV cells were to provide 100% of the train's energy requirements, an area of nearly ½ mile^2 would need to be covered with cells, at an estimated cost of $1,000 million (Find Solar 2010). This exorbitant price is due both to the relatively inefficient nature of current PV technology, and the vast spatial resources necessary to provide enough energy. Solar technology may one day be able to provide sufficient electricity for the train, but that day is not yet here.

If PV cells were installed only on the roofs of stations, they would provide only a small amount of energy. Estimating a realistic surface area of 100 ft^2 per

station roof (allowing for other rooftop objects), we can conclude that each station roof could accommodate seven Sanyo 215W pallets (Green Eco Savers 2010). Each unit costs $30,000 and measures roughly 13.5 ft^2. The total cost would be $210,000 per station, and the energy output would be 1.5kW per station. If placed at a 15^0 tilt, the cells would produce 2,362kW/year/station, at a cost of 3.8 cents/watt for PV solar. Buying the equivalent power from DTE's coal would cost 1.3 cents/watt, making it much less expensive. However, it may be worthwhile to invest partially in solar. The cells would require minimal maintenance, they would work through Detroit's weather and climate, and the symbolism of solar cells on each station roof may be worth the price.

Concentrated Solar Thermal (CST)

Any CST system for Detroit would have to withstand freezing temperatures (Southface 2010). CST systems based on Stirling engines are not yet commercially viable on a small scale—the only commercial systems sold are those that heat water, mainly for residential use. Stirling engines that boil water to move a turbine are still expensive to produce on a small scale. If the stations had indoor plumbing and bathroom amenities for riders, water could be heated by the sun, but current station designs do not incorporate running hot water.

While CST systems may not factor into station design, they may play a role within the half-mile radius around the New Center station. A large plot of amalgamated land may provide enough land with minimal shadow cover to make CST cost effective, despite Detroit's slight solar radiation.

Wind Power

Wind is not a viable solution for the energy needs of the LRT, based on the wind speed through Detroit and the cost of wind turbines. Southeastern Michigan has only marginal wind speeds (NREL 2010). For present turbine dynamics, these speeds aren't strong enough to warrant wind generators, but there are other factors limiting wind's adoption as well.

There are two main types of turbines—a traditional design (the tri-blade image common offshore), or Vertical-Axis Wind Turbines (VAWTs). Traditional wind turbines exceed World Health Organization limits on harmful noise pollution, and a 2003 Dutch study found that residents complain about noise up to 1,900 meters away from the turbines (WHO 2010; van den berg 2003). This is a distance of over a mile, meaning that turbine noise would affect all residents, commuters, and commercial interests near the stations. Traditional turbines also need to be atop tall towers in order to harness optimal wind, which not only would violate ordinances governing height but also would impede sightlines and cast shadows across communities.

VAWTs remove many of the barriers traditional wind turbines face when entering a dense urban area. VAWTs are quieter than their traditional counterparts, and since they can be sited much lower to the ground, they do not require towers (Leuthi 2010; AWEA 2010). However, they have a relatively low energy output (AI 2010). Considering Detroit's relatively moderate wind speeds, they are not cost competitive with coal, even on a 30-year basis (DTE 2009).

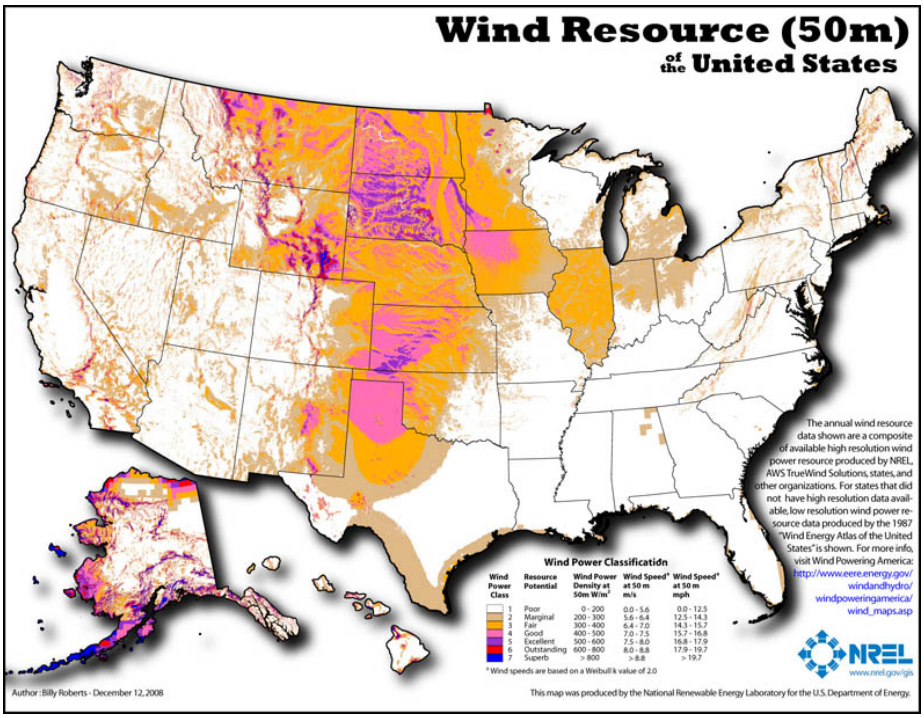

Figure 10.2: Detroit has relatively mild wind speeds, making current wind technologies not financially viable (Energy Information Administration 2010)

Recommendations

Although on-site alternative energy measures have not been shown to be cost-effective, technologies will undoubtedly increase in efficiency and competitiveness with hydrocarbon-based generation. One of the main recommendations we can make—outside of the inclusion of arboreal species well-adept at carbon sequestration—is to install efficient invertors at each station. Electricity comes in two forms, Alternating Current and Direct Current (AC/DC). Some alternative forms of energy generation produce AC, some DC. Invertors are necessary to convert one form to another and—with switches—would allow any excess station-generated electricity to be fed back into the main grid.

Wiring and setting up each station to be a potential energy generator/distributor would be an excellent choice at this stage, since the additional costs would be minimal. This would also help "future-proof" the electrical aspect of the stations by laying the necessary groundwork for any future power generators.

Summary

Overall, the LRT will reduce the carbon impact of transit by removing busses and attracting riders who would normally rely on automobiles, but there is still a significant impact from using coal to power the train. Even though alternative forms of energy are not cost-effective *yet*, their eventual adoption is almost guaranteed. We are positioning the LRT to function long into this greener future.

Chapter 11: Conclusion

The Woodward LRT is coming to Detroit. Along with the train line, Detroit can also expect TOD planning strategies aimed at promoting transit use and redevelopment. Although conventional approaches to TOD have succeeded in some cities, the current landscape, culture, and economic situation of Detroit demand innovative thinking. Detroit is a shrinking city that exhibits high vacancy rates, a dispersed population, scattered amenities, and a strong presence of underused spaces that are convincingly characterized as dead zones. In this project, we refused to see these issues as a deterrent to redevelopment; rather, they inspired a unique TOD strategy for Detroit.

A unifying theme in all our recommendations has been to create zones of productive land use in Detroit. These productive zones are intended to benefit the current and future community of Detroit. Productive zones are not limited by zoning regulations; rather, these areas can create places for ecological services or community engagement. Gone is the assumption that the only suitable redevelopment near transit is for high-density residential and commercial services.

Throughout our recommendations, we focus on opportunities to increase environmental benefits and decrease environmental harms. All TOD brings environmental benefits in the form of reduced automobile emissions and decreased impervious surface per capita. However, we seek additional environmental benefits through productive landscapes because improving the natural environment is crucial to providing a more sustainable urban future. The train provides the opportunity to implement new ideas for incorporating environmental health into new urban infrastructure. Detroit was a leader in industrial development in the past; now is the time to position Detroit as a leader in sustainable practices and renewable energy technology for the future.

We hope the ideas we have pursued provide additional material with which to engage the local community with the introduction of the light rail train. Detroit has undergone drastic changes that currently call for truly progressive responses. Integrating ecological services in ways that empower communities will be the best

way for Detroit to obtain the variety of benefits that can be created by city improvements.

Appendix A

Vehicle Energy Cost Calculations

According to DDOT, the train will run from 04:00 to 24:00, a twenty-hour window. LRT is replacing the Woodward Express Bus Route 73 and is expected to have two-car train sets. Assuming that either two or three train sets will be running in each direction (depending on variable peak ridership numbers), we can predict that between eight and twelve train cars will be running at any given time.

Each train set will traverse the entire 9.1 mile stretch of the Woodward corridor several times a day, most likely once per hour based on (expected) passenger density and average speed. That means that a given train leaving the 8 Mile stop will return in two hours. With a twenty-hour operation window, and 9.3 miles covered per hour, each car will travel 186 miles/day, or a total of 1,488-2,232 miles/day for eight to twelve cars.

With generous assistance from DDOT and the consultancy LTK, we have estimated an average of 6.59 kwh/car mile. Multiplying this estimate by the expected miles traveled per day means that each car will require slightly over one MWh each day, or from 9.8 MWh to 14.7 MWh per day for all cars, depending on the number of actual cars in service. These totals are for the vehicles alone—they do not include lights, signals, or station energy costs. Those costs will vary from station to station.

Energy from Fossil Fuels

Various compositions of coal have different energy densities, but most of the coal burned in the US has an energy density of about 6.67 kWh/kg. Typical coal plants have a thermodynamic efficiency of around 30%, meaning that a kilogram of coal produces about 2 kWh of electricity. There are additional transmission and distribution losses that depend on distances from power stations and other efficiency expenditures, usually on the order of 5-10%, but we're using a standard of 2 kWh/kg of coal.

The EIA quotes an emission factor of 0.963 kg CO_2/kWh. Producing 9.8-14.7 MWh per day from coal will add 9,443.1-17053.65 kg of CO_2 to the atmosphere per day. This is equivalent to 3,446.73-6,224.58 metric tons of CO_2 pollution annually, or roughly the emissions of 700 automobiles (Time 2007). Our team has examined multiple alternative energy proposals, but—unfortunately—present technologies do not yield enough production.

Appendix B

Woodward Light Rail Fact Sheet

- **22,200 daily riders** are estimated for the Woodward line.

- The estimated cost to build **9.3 miles** of the LRT on Woodward is **$371 million** in 2007 dollars.

- 13-15 stations are proposed from downtown to the Michigan State Fairgrounds near Eight Mile Road.

- Light rail on Woodward would create over **12,000 jobs** in Detroit.

    - For every $10 million in transit capital investment, 314 jobs are created. Light Rail on Woodward ($371 million), would create 11,600 jobs. 50% of these jobs are in Services and Construction.

    - For every $10 million in transit operations spending, 570 jobs are created. Light rail on Woodward ($7.4 million per year) would create 420 jobs. 50% of these jobs are in Transit Operations.

- Light rail on Woodward translates to sales in gains of **$130 million**.

    - For businesses, $10 million in transit capital investment would realize a three-fold gain in sales ($30 million). This means that light rail on Woodward would yield a sales gain of over $110 million.

    - For businesses, $10 million in transit operations spending would realize a similar gain ($32 million), or $24 million due to light rail on Woodward.

- Woodward LRT line would generate **$933 million** in economic development after opening based on MDOT's studies.

- For every $10 million invested in transit, over $15 million is saved in transportation cost to both highway and transit users. This includes **$2,000 or 200 gallons of gas** per year and an estimated **$150/month for parking** downtown.

- Woodward light rail transit will reduce carbon monoxide (co) emissions by nearly **4180 tons** annually.

  Provided courtesy of DDOT

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