Saint Paul Ford Site: Multimodal Transportation Study and Report

Prepared for the City of St. Paul

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The Ford Site Multimodal Modeling and Design work presented here is based on the valuable effort of numerous individuals and stakeholders who collaborated to create a vision for a 21st century community that ensures access for all people using all modes of transportation. The City of Saint Paul would like the acknowledge the valuable input, time spent, and dedication of numerous City Departments, public organizations, and private stakeholders who participated in the study, particularly the Technical Steering Committee that reviewed the project scope, ongoing analyses, drafts, and final materials that led to the creation of this final report.

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Introduction

The Ford site is a once in a lifetime opportunity to benefit the City of Saint Paul and the Twin Cities region by creating a 21st century community that ensures access for all people using all modes of transportation.

The Transportation Study was undertaken to understand how the transportation system can and will function as related to Ford site redevelopment. Further, it sets goals for how infrastructure and public facility design can and should affect its performance. The critical component of this effort is to develop a transportation system that accurately captures the aspirations and challenges of this opportunity and reconnects the Ford site to the neighborhood and the region.

Figure 1-1: Ford Site multimodal modeling and design community meeting in Saint Paul

The *Ford Site Multimodal Modeling and Design* process began in August 2015 by synthesizing existing travel data, characterizing current transportation, parking, and traffic conditions in Saint Paul's Highland Park neighborhood, identifying transportation system needs and gaps, and initiating an extensive engagement effort with community stakeholders.

At the core of the *Ford Site Multimodal Modeling and Design* study is a set of recommendations designed to make it much safer and easier for the growing population of Highland Park and the emerging population at the Ford site to walk, bike, and take transit, while leaving their cars at home.

Report Structure

This year of transportation conversations has resulted in the *Ford Site Multimodal Modeling and Design* study. The study determines the ability of the a new transportation network within the Ford site and the existing surrounding transportation system to accommodate redevelopment, while providing guidance on both necessary improvements and future analytical process and transportation targets. This report has five parts.

Chapter 1, which you are reading now, is the introduction to the rest of the report.

Chapter 2 describes the history of the Ford site and outlines the issues and opportunities faced by the Highland Park transportation system today. Traffic, parking, walkability and streetscape design are important issues in this community and its business district. A transportation network that works is essential to the feasibility of the redevelopment and ultimate livability of the overall area.

The *Ford Site Multimodal Modeling and Design* process is intended to operationalize the community's vision for the redeveloped Ford site as a mixed use and multi-modal community by informing the Site layout and program. **Chapter 3** introduces the goals for the Ford site and the associated transportation analysis required to ensure that desired targets can be achieved. Performance measures are also proposed to track progress over time.

Chapter 4 describes the innovative multimodal modeling process used to study the expected traffic impacts of development at the Ford site and the analysis done to understand impacts for non-auto transportation modes, including pedestrian, bicycle, and transit quality. The study modeling is based on a high level redevelopment scenario for the site, prepared by the City of Saint Paul. Combined, these help all understand if and how multi-modal transportation would function with the presumed level of housing, commercial, employment and recreational uses proposed for the Ford site. This chapter helps outline how site design and redevelopment decisions have been quantified and how these choices might impact travel decisions and transportation performance.

The **Appendices** include the technical documentation of the modeling process, including trip generation rates, trip reduction factors, bicycle and pedestrian levels of service, and vehicle levels of service at intersections surrounding the Ford site. They further show the details on the goal-based multimodal performance measures and the target measures designated as desired, acceptable, and unacceptable.

Chapter 2 - Project Description

Ford Site History

The Ford Motor Company operated an assembly plant next to the Mississippi River in the Highland Park neighborhood of St. Paul from 1924 to 2011. The Ford plant was built on an empty field, before other development in the area occurred. Henry Ford was attracted to the site by the opportunity to derive energy from a new hydropower dam being located along the Mississippi River, by access to barge shipping, by a potential rail line, and by a bridge from Saint Paul to Minneapolis. As the next decades passed, a neighborhood of single-family housing, small apartments and retail grew in around the site.

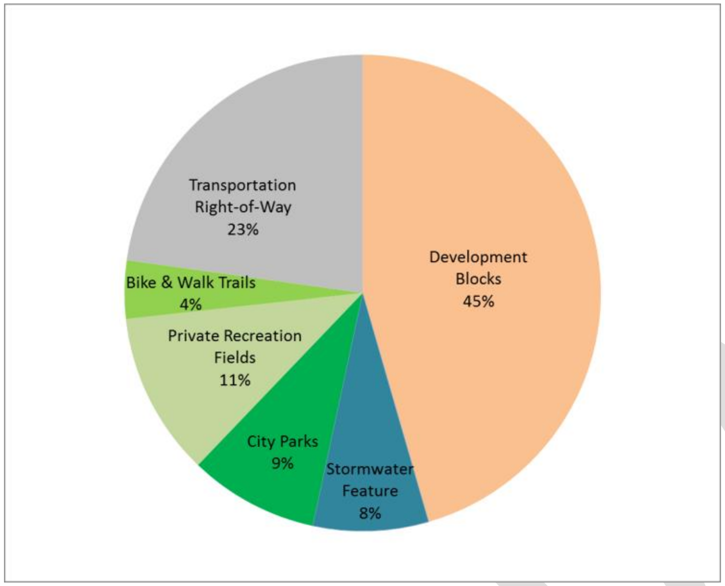
During its years of operation, the Ford plant provided as many as 2,000 well-paid manufacturing jobs in the heart of the Twin Cities region, with minimal disruption to the community that grew up around it. Today, the nearly 125-acre site is bounded by the Mississippi River, single and multi-family residential, and a vibrant commercial corridor that is the center of the Highland business district. The surrounding community boasts some of Saint Paul's highest valued housing and commercial properties. Traffic, parking, walkability and streetscape design are important issues in this community business district.

The former Ford site offers an unprecedented redevelopment opportunity in the center of the Twin Cities region. Ford Motor Company closed its Twin Cities Assembly Plant in December 2011 and has been decommissioning and cleaning up the property in preparation for sale to a master developer in around 2018.

Figure 2-1: The Ford Site under factory operations

Figure 2-2: The Ford Site today

Figure 2-3: Proposed land use mix for the future redeveloped Ford Site



Ongoing Planning Processes at the Ford Site

Since 2007, when Ford Motor Company announced its plans to close the Saint Paul plant, the City of Saint Paul has explored options for the future of the property. The City, with partner agencies and philanthropic partners, has overseen fifteen studies to examine the site's potential, including future employment, renewable energy systems, stormwater management, and transit oriented design. The studies and other project information can be found at www/stpaul.gov/ford. The City has also hosted over 40 public meetings in the past 10 years to engage the community and stakeholders in planning for the site's future.

Currently, the City of Saint Paul is preparing new zoning for the site and a master plan with the location of future streets, trails and parks, to provide a framework for private redevelopment. Future development proposals will conduct further transportation and traffic studies on the specific program proposed – with this analysis providing a basis to start from and a framework by which it will be evaluated.

Table 2-1: Transportation studies for the Ford Site

What	**Traffic Modeling Study**	**Traffic Impact Study**
When	2015/2016	2018/2019
Why	To inform Ford site zoning and public realm plan	To examine viability of proposed development
How	High level analysis - based on POTENTIAL transportation network and connections	Detailed Analysis - based on PROPOSED transportation network and connections
Wher e	Examines on-site, adjacent, and more distant impacts	Examines on-site, adjacent, and more distant impacts
Who	City pays for study	Developer pays for study

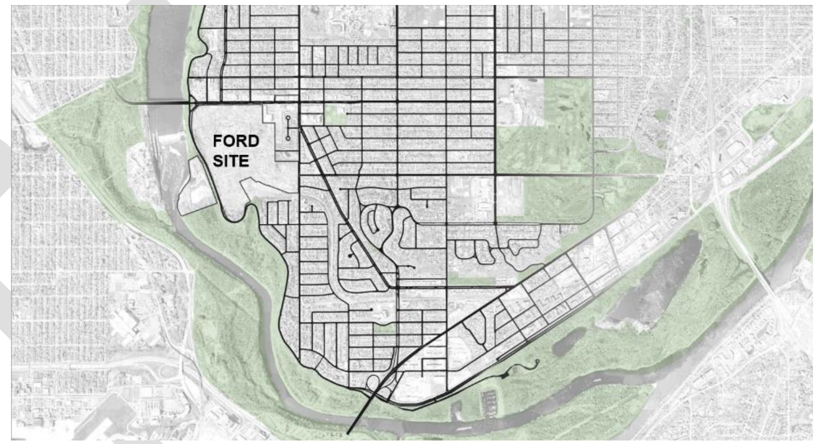
Ford Site and the Highland Park Neighborhood

The Ford site is bounded on the west and south by Mississippi River Boulevard, an attractive local street running north-south, with trails and outlooks over the Mississippi River Valley, and lined primarily with high value, single-family homes. The northern edge of the Ford site is Ford Parkway, an arterial street that connects west across a bridge to the City of Minneapolis and east through the Highland Park neighborhood.

Ford Parkway is one of two commercial corridors that form the heart of the Highland business district, one of the City's most successful business areas. A variety of retail uses and offices occupy primarily one- and two-story buildings, some older and some new. Banks, restaurants, coffee shops, a major grocery, a theater, gift stores and many other businesses make the Highland business district a neighborhood-serving and destination shopping area. Traffic, parking, walkability and streetscape design are important issues in the business district. The eastern edge of the Ford site is adjacent to a retail mall, a cluster of low-rise apartments, a high-rise apartment, and Cleveland Avenue with single-family residential across the street.

The City of Saint Paul envisions the redeveloped Ford site as a mixed use and multi-modal community. It will be a place where high-quality transportation design allows residents, employees, and visitors to meet their daily needs through walking, biking and transit. A place where, as a result, cars are optional. However, cars and commercial vehicles will be a part of the transportation mix, and must be carefully planned for.

Figure 2-4: Existing street network in the Highland Park neighborhood surrounding the Ford Site



A transportation network that works is essential to the feasibility and livability of the project. In order to advance a master plan for the site that has the backing of the public and the confidence of the elected officials, the City of Saint Paul commissioned this Study. Broadly, this Study is intended to operationalize the community's vision by informing the Site layout and program. Further, it has determined the ability of the transportation system to accommodate it, while providing guidance on both necessary improvements and future analytical process and transportation targets.

At an overall level, this effort is directly capturing transportation concerns as relate to urban density and assumed traffic generation from the redevelopment. Traffic is one of the top issues in the Highland Park neighborhood, with particular concern about congestion on Ford Parkway and in the Highland business district. The type and level of vehicular traffic - where it enters and leaves the site - is a key criterion for acceptability of envisioned redevelopment at the Ford site.

Sophisticated, multimodal traffic modeling for the anticipated Ford Site development is essential to demonstrate new ways that transportation can effectively and efficiently move people and goods, shape urban form, affect economic vitality and impact quality of life.

Transportation planning for a redeveloped Ford site is essential to create a place where people can move easily between living, learning, working and recreating in the community. Supporting a strong network for all types of movement, be it walking, biking, using transit or driving, will manage traffic, improve air quality, create a livable place for people of all ages.

This study was tasked with quantifying and evaluating how site design and redevelopment decisions might impact travel decisions and the transportation performance of the site. The study and modeling is based on a high level redevelopment scenario for the site, prepared by the City of Saint Paul, to understand if and how multi-modal transportation would function with a presumed level of housing, commercial, employment and recreational uses at the future Ford site.

Table 2-2: Land use program for the Ford Site – at maximum buildout (as proposed Fall 2016)

Land Uses	Quantity	# of Jobs
Civic	150,000 GFA	
Employment	450,000 GFA	1,500
Retail	300,000 GFA	
Residential	4,000 Units	

Travel in Saint Paul

Saint Paul commuters overwhelmingly drive alone to work. Across the city, 81% of workers drive to work, with an additional 4.5% participating in carpools. However, these rates are higher than the rest of Minnesota, and the United States at large. Figure 2-5 compares transportation mode share for work trips for each. For reference, a comparison to Copenhagen, Denmark – which has aggressively built out its' transit and bicycle network – is shown to see what ultimately may be possible.

The Highland Park area surrounding the Ford site is a walkable neighborhood and has strong transit options. In mixed-use environments, like the existing neighborhood and proposed development at the Ford site, many overall trips will be for non-work purposes. Trips to shop, visit, school or for any other purpose are the bulk of all trips, and differ for age groups as shown in Figure 2-6.

Figure 2-5: Commuting mode share comparison

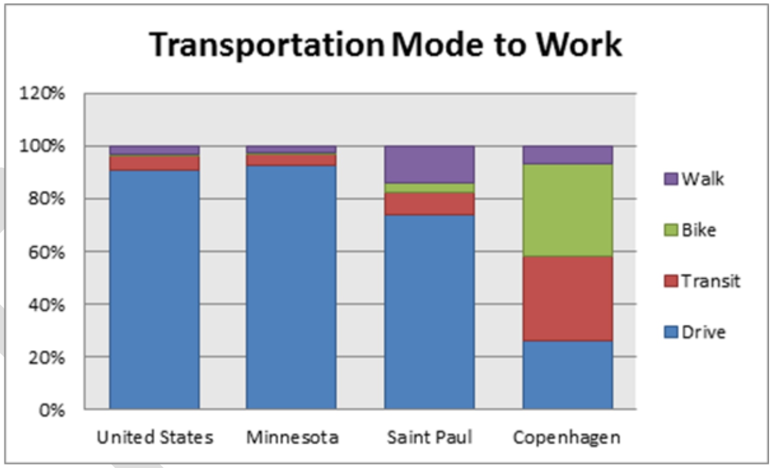
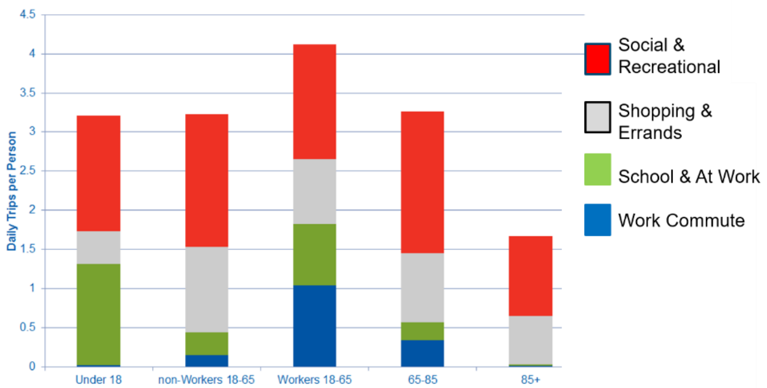


Figure 2-6: Trip purpose percentages by age group in the Saint Paul region



Ford Site Transportation Issues and Opportunities

For nearly a century, the Ford site has been a barrier for all. Drivers, bicyclists, and even pedestrians must go around the site using Ford Parkway, Cleveland Avenue, or Mississippi River Boulevard. This elongates trips, concentrates traffic and causes additional congestion.

Existing traffic is concentrated along Ford Parkway and Cleveland Avenue, with much of Cleveland Avenue traffic diverting to and from Saint Paul Avenue throughout the day. Vehicle experience substantial delays at the intersection of Ford Parkway and Cleveland Avenue, producing a level of service C in the morning peak hour and a D in the evening peak hour.

Figure 2-7: The Ford site as a barrier today

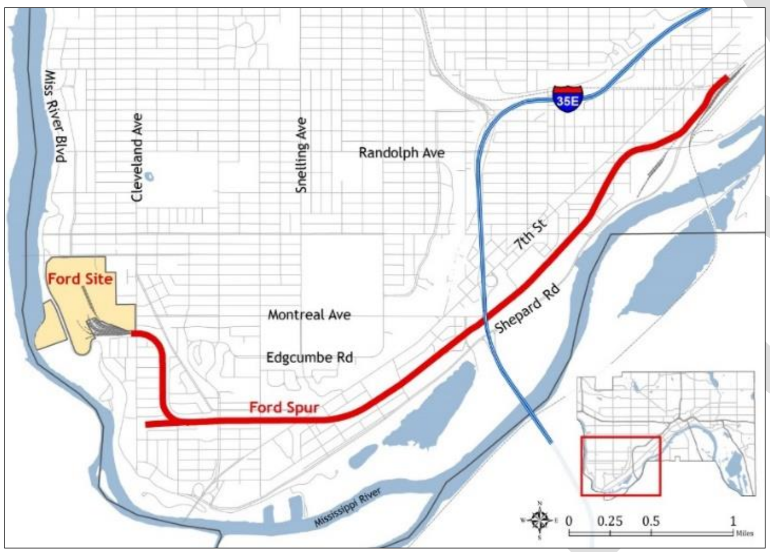
Figure 2-8: Existing daily vehicle volumes on adjacent roads

Extending existing roadways into the Ford site, especially Montreal Avenue and Cretin Avenue, will create new pathways for the neighborhood. This reduces travel distances and alleviates existing neighborhood congestion. It will also provide more street frontages on which the developing retail cluster on Ford Parkway can expand, adding opportunities for new local-serving retail and restaurants to locate.

The Ford site already has robust public transportation access, and can take advantage of the new A Line Metro Transit service launched in June 2016. The rapid bus line connects the Metro Green Line to the Blue Line by operating frequent service (10 minute headways) along Snelling Avenue and Ford Parkway with specialized vehicles and enhanced stations. The A Line local service already has solid and growing ridership. Final transit routes and modes will be determined by Metro Transit with input from the City and other stakeholders.

Figure 2-9: Public transportation access to the Ford site

Figure 2-10: Canadian Pacific Rail Corridor



The Canadian Pacific Rail Spur is a unique opportunity for additional access to the site. The rail corridor has the potential to connect this new neighborhood to many other thriving neighborhoods in St Paul, complementing the Ford Site development goals to decrease traveler dependency on the automobile for everyday use and support the community's goals for sustainability, equity, and connectivity. As a multimodal corridor and multiuse trail, it would provide an important pedestrian and bicycle link through the Study Area, while creating opportunities to knit back together areas long divided by the barrier created by the rail line.

The existing bicycle network near the Ford site extends along Mississippi River Boulevard with a dedicated lane and on Ford Parkway east of Howell Street that connects with Fairview Avenue. North of Eleanor Avenue, Cleveland Avenue has been striped with bicycle lanes. Connecting these main routes through the Ford site in the future will promote bicycle trips from the surrounding neighborhood, supporting the goal to increase non-motorized trips and reducing automobile dependency.

Figure 2-11: Future Ford Site pedestrian and bicycle connections (Fall 2016 Draft)

Figure 2-12: Missing sidewalk alongside Cleveland

Pedestrian access to the site is limited at the moment, with fences blocking the site on Mississippi Boulevard, Ford Parkway, Village Lane, and behind the Highland Crossing retail center. Nevertheless, Ford Parkway and Cleveland Avenue north of Saunders Avenue have adequate sidewalks on both sides of the street. The sidewalk on the west side of Cleveland Avenue disappears next to Ford Little League Field until reestablishing on the bridge over the rail spur, creating a potentially dangerous situation for pedestrians.

Chapter 3 - Goals, Targets and Performance Measures

This section describes the steps taken to establish a vision for the Ford site as an integrated mixed-use, multimodal neighborhood. The Ford Site will further provide economic access to benefit the Highland neighborhood, Saint Paul, and the Twin Cities region. For the transportation analysis, our purpose was to:

- Develop an understanding of how travel will work to from, and within the Ford Site
- Review land use and transportation network designs that maximize the value of, and minimize the negative impacts of, Ford site development.

Working with the technical steering committee, a detailed process was established to determine how to measure the success of the Ford Site in achieving its aims. The technical committee examined leading state-of-the-practice transportation analysis procedures to determine which were most applicable to measuring the Ford Site's impacts and informing its design.

Undertaking the redevelopment of a large, complex site, and integrating it into an existing well-established neighborhood is a complex, multi-faceted exercise. It was quickly evident, as the City reviewed ways to measure impacts, that simple review would not be sufficient. The Ford site will develop over time and an analysis respecting the neighborhood and City desires must, of necessity, be forward thinking. Moreover, multimodal and sustainability analysis were major themes that needed to be incorporated, requiring a more complex approach.

In this Chapter, the approach to operationalizing the transportation plan at the Ford Site is outlined. The report will further show how the analysis was carried out, and demonstrate the resulting impacts. The transportation process largely involves establishing goals, targets and performance measures (PMs). Simply, these are meant to describe how we measure success.

- **Goals** are the high level aims of the Ford Site, and broadly speaking, what the Site is intending to achieve
- **Targets** are how the goals are assessed, and are designed to show potential tradeoffs
- **Performance Measures** are specific data points or metrics used to evaluate the transportation system relative to the targets and goals.

Each of these are meant to be both long-term and fluid. Goals should not change, but stand as the long term aims of the

Ford Site and surrounding neighborhood. As the Site builds out, the metrics and targets may fluctuate, but are designed to show progress towards the goals. Full build out analysis, while critical, would not allow for the intervening need for improvements. Where results are falling short of expectations, additional investments in design solutions, transportation management and/or policy shifts may be necessary to more closely align resulting transportation patterns with the original intended goals. Moreover, incorporating measures directly into the Site Planning and Program are the most beneficial ways to achieve the ultimate goals. Appendix B, at the end of this report shows the full complement of Goals, Targets and Performance Measures.

Formalize Transportation Goals

The Ford site project team collaboratively developed a series of key goals to guide the transportation analysis and move the project forward on a defined path. These transportation goals are necessary to incorporate the community values laid out for the Ford site. In essence, these goals reflect the evolving global, regional, and community desires to create a more sustainable Ford development.

The Ford site is a once in a lifetime opportunity to benefit the city of St. Paul and the Twin Cities region. This significant endeavor carries many hopes and challenges. For transportation, the goals are all about ensuring the creation of a well-integrated plan that extends the existing neighborhood, while minimally altering the character that its residents have spent generations building.

The Ford site is at the forefront of the region's multimodal future, and is continuing St. Paul's transition to the economy of the next century. For it to be successful, the Site will employ national best practices for transportation, sustainability and livability, while incorporating leading design and operation.

Goals were defined for the transportation elements of the Ford Site. These were derived from ongoing community input and reflect neighborhood, city and regional aims. Goals are multimodal, but also speak to the specific transportation elements and user experience for the Ford Site and surrounding neighborhood. Appendix B shows each of the goals, but below is a sample of goals focused on select modes.

Pedestrian Access—This should be preeminent. Whether walking from the neighborhood, to transit, or from the parking garages, paths should be safe, close, and well-defined.

Parking—Spaces should be shared between complementary uses, and contained onsite. Space should be sufficient for proposed uses, but organized and operated to achieve larger purposes.

Vehicle Travel—Cars should be minimized, on and to the site, to reduce impacts to the surrounding area, the space dedicated to roadways, and to the larger environmental footprint of the region.

Set Targets

Where goals are the overarching desires of the transportation plan for the Ford site, the targets put specific criteria to them. Targets provide each of the goals with meaning and measurability. Targets were set both to be measured immediately and to be tracked over time.

The targets should be used by the city of Saint Paul to visibly track progress towards goal achievement. Targets should be used by the neighborhood to assess the success of the Project and its benefits to the area. Targets would also be used by the Developer, as the specific levels of transportation performance to be achieved.

The best practices review and the establishment of multimodal transportation principles by the Technical Steering Committee have helped to define the goals and targets. However, inevitable tradeoffs may need to occur between goals. For example, pedestrian improvements at an intersection may have ancillary impacts to vehicular delay. Therefore, for each goal, targets have been separated into three major categories:

Desired, Acceptable, and Unacceptable.

Desired Targets

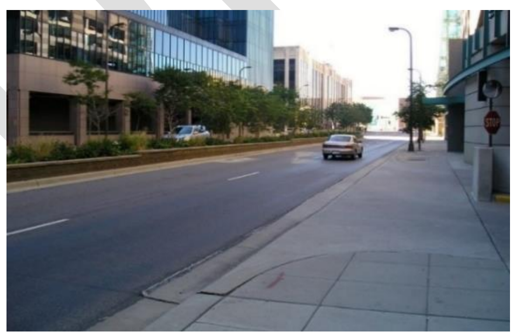
Desired targets represent optimal achievement of goals and are the ultimate aim for the Ford site. Meeting a desired target results in the highest level of multimodal and sustainability for the Ford site. Desired targets may not always be fully reachable due to tradeoffs, cost, or physical restrictions, but progress should always be made towards this level.

Acceptable Targets

Acceptable targets meet most of the objectives of the Ford Site and represent substantive achievement and progress. Acceptable targets should primarily occur when the need arises to compromise between multiple desired results. When a goal meets acceptable targets, the Ford site's development will continue to provide a positive impact on the community and the surrounding area. While still substantive, acceptable levels should be the minimum at which a goal is achieved.

Unacceptable Targets

Unacceptable targets represent substandard levels of operation or layout of the Ford site. Where occurring, these



should require some intervention on the part of the city or the developer.

Each of the targets must be monitored over time in order to evaluate the effectiveness of implementation toward creating a more multimodal and sustainable site. This will enable planners to monitor underperforming targets and adjust the Ford site's design incentives, operations or programs until they meet more acceptable levels.

Performance Measures

Performance Measures (PMs) are the indicators of the characteristics or operations related to the Ford site targets. Through the study, all stakeholders determined that it is important to define these metrics at their initial stage. Agreeing to the exact metric to be used will minimize confusion and clarify analysis.

Performance measures were specifically chosen for each goal and target so that they could be easily captured, monitored, and duplicated over time. These measures are specifically intended to evaluate initial goals and ongoing achievement of desired targets.

While specific measures are shown in Figure 3-1, it is important to note that some can be defined on a block by block basis or at an intersection level, while others are more regional in nature. Performance measures are easily quantifiable and based on information that is already typically collected on an ongoing basis or easily could be. These performance measures also may vary by type, depending on how best to measure the goal, and can be:

- Physical – having to do with the site layout (block length) or presence of amenities (sidewalks)
- Operational – defining level of service for vehicles or even pedestrians at particular intersections
- Policy-oriented – related to sharing or pricing (of parking, for example) or to incentives to using non-auto transportation
- Use-based – looking at numbers or percent of users on transit or walking

Figure 3-1: Examples of performance measures used for the Ford Site analysis

Performance measures, such as United States Census Information and Regional Model information, need only be extracted from online sources. However, the Ford site's physical elements need to be monitored as site layout decisions are approved. Others, such as traffic levels or intersection operations, may need to be tracked as the development grows.

Monitoring Frequency

To ensure the Ford site develops toward the end goals, targets need to be monitored and evaluated periodically. As the overall rules for the development and monitoring of the Ford site are established, the monitoring frequency and responsible parties will be more firmly established.

In Figure 3-2, a proposed frequency of the monitoring for each target is proposed. Goals and targets monitored at this frequency are intended to keep track of the local changes anticipated to occur as the site evolves. Goals and targets with review periods of three years or longer are intended to track the development of the Ford site's buildings.

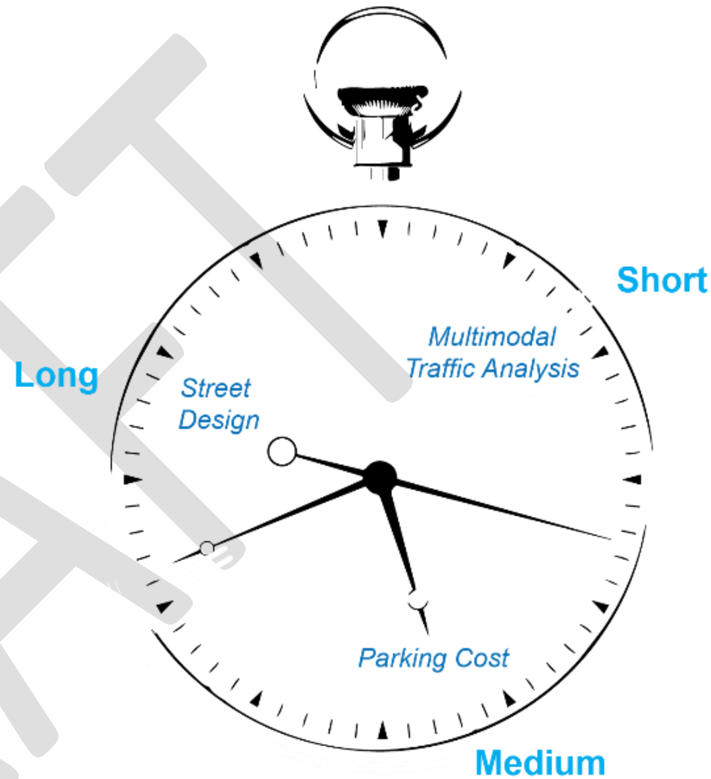
Ultimately, the monitoring frequency can be adjusted based on the need, cost, and utility of tracking the targets. However, the City and developers should work together to decide upon appropriate monitoring frequency of targets.

Responsibility

The last component of the multimodal performance measures includes responsibility for tracking the targets. While most of the targets and performance measures have been identified as likely to be part of the developer's responsibility, this should be evaluated to see if other entities may be more appropriate.

Lastly, the developers, the City, and the surrounding neighborhoods need to provide feedback on the effectiveness of the tracking efforts. The performance measures that monitor flexibility of targets also reflect Saint Paul's public process, which may continue to evolve as the neighborhood, city and region change.

Figure 3-2: Performance measures and example monitoring frequency



Chapter 4 - Measuring Transportation at the Ford Site

The most important part of this effort is to develop a transportation model that accurately captures the aspirations and challenges of this once in a generation opportunity to create a place that respects the Ford site history and reconnects it to the region. Measuring the goals set to reach the site's potential accurately and intelligently is critical to the success of this effort.

Based on location, size, and proximity to regional and city infrastructure investments, the Ford site is one of the greatest development opportunities in the Midwest. More importantly for Saint Paul, it represents an iconic transformation from the industrial economy of the 20th century to the creative economy of the 21st. While integrating with the existing stable neighborhood, the Ford site will be designed to minimize impacts. All aspects of the site, from its program to layout to transportation improvements and policy will be aligned to encourage non-auto travel and create a lively, dynamic, and integrated place to live, work, and play.

A Different Approach

Saint Paul recognizes that national standards for trip generation and local procedures for development review are simply not sophisticated enough to effectively evaluate and guide the desired program for the Ford site. Therefore, this

effort is designed to use guidelines that more accurately capture all the ways in which development at the Ford site will function and interact internally, with the surrounding neighborhood, and with the whole Twin Cities region.

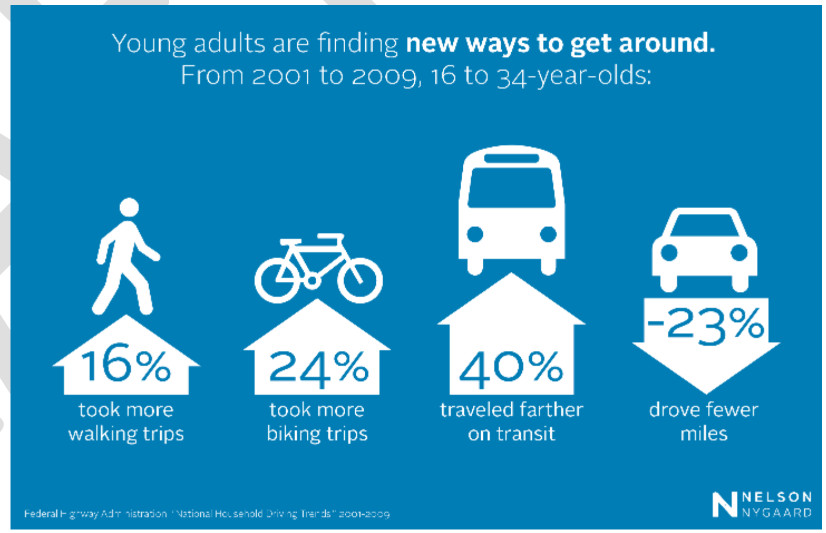
The ultimate end, laid out in the goals and targets of the previous section, requires a unique manner of assessment. Traditional transportation analysis and modeling does not capture all the ways people travel, as the Ford site is designed to embody the latest state-of-the-practice thinking about the interaction between transportation and land use. Multimodal, integrated thinking attempts to capture the totality of how individuals move and make choices about their modes of transportation (whether to walk, bicycle, drive, take transit or even live closer to their ultimate destinations). The model developed and described in this section is designed to more accurately reflect transportation principles, as evidenced in similar places and developments around the country.

A complementary mix of uses produces shorter, more efficient trips.

When multiple building types are located close to one another in a neighborhood—offices, homes, restaurants, pharmacies, post offices, dry cleaners, and grocery stores—many trips and errands can take place almost entirely in the same area. These trips are not only shorter, but are often combined into one multi-purpose trip, especially when the area has pedestrian amenities and shared parking areas. These internal trips can be made by walking, biking, or taking transit, which avoids adding vehicles or congestion to roads outside the neighborhood.

People—especially young people—are driving less than ever.

This is a growing trend nationally, even when accounting for the state of the economy and for household income. The average number of miles driven by people aged 16 to 34 fell by 23 percent between 2001 and 2009 as a result of people taking fewer trips, making shorter trips, and using alternative means of transportation[1]. Young people are also less likely to possess a driver's license: the percentage of people aged 16 to 44 with a license has been declining steadily since 1983. In 2014, 69 percent of 19-year-olds had licenses, a 21 percentage point decrease from 1983[2]. The reasons for this pattern can be attributed partly to young people moving to cities where mixed-use neighborhoods exist to encourage walking or biking and where mass transit is a convenient and attractive option.

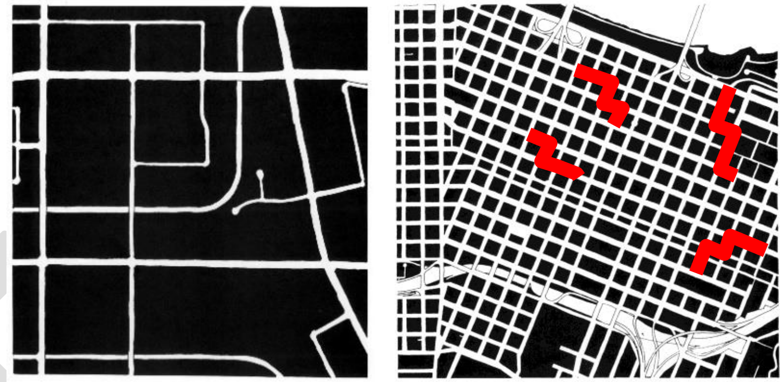


[1] http://www.uspirg.org/reports/usp/millennials-motion

[2] https://www.washingtonpost.com/news/wonk/wp/2014/10/14/the-many-reasons-millennials-are-shunning-cars/

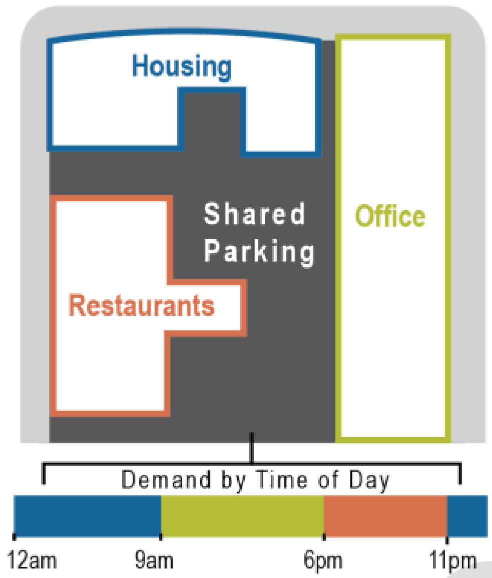
Connected street networks distribute vehicular trips.

Connected street networks are typified by a grid where there are many intersections and alternative routes to get from one destination to another. Rather than funneling the majority of traffic onto one major thoroughfare where disruptions and delay can cascade, connected networks allow vehicles to travel on multiple paths. This reduces congestion, disperses trips amongst routes, and encourages non-motorized travel, thereby increasing capacity across the whole network. Connected networks work for all users, as multiple choices for bicyclists and pedestrians further shorten trips.



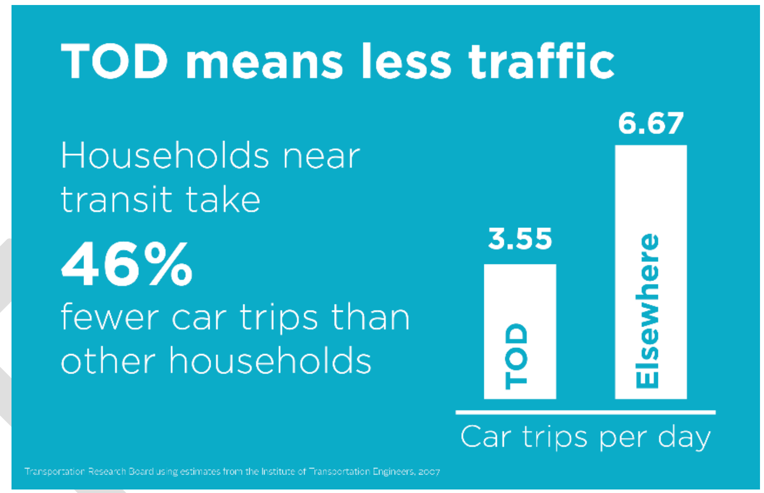
Shared parking facilities minimize overall parking need.

Because residences and businesses often need parking spaces during different times of day, shared parking use can reduce the total demand for and need to build spaces. Resident parking spaces can be allowed overnight so as not to conflict with the daily demand for the same parking spaces needed by employees and patrons. Similarly, nearby restaurants and retail businesses could utilize parking spaces from places of worship when there are no services being held. Intentionally planning for shared parking optimizes the space for development.



A diversity of transportation options minimizes car ownership.

Frequent users of public transportation or shared transportation services own cars at a much lower rate than those who must regularly commute by automobile. Even without living or working in a mixed use neighborhood, having the option to travel by transit, walk, or bike reduces the reliance on single-occupancy vehicle trips. Car sharing, Car2Go, Uber, and other new transportation options are accelerating these trends.



People are more willing to walk and walk farther in safe, interesting environments.

Sidewalk users are more exposed to their environments than automobile users. Pedestrians travel slower than cars and take in more of their surroundings. As a result, walking along a four-lane highway is not as desirable as walking in a downtown shopping district or on a tree lined path. If pedestrians contend with inadequate sidewalks, uneven surfaces, and heavy road traffic, they are less likely to walk. Connected environments, with multiple street options, and shorter block sizes (250-400 feet) have been proven to encourage walking.

Sidewalks in mixed-use environments provide more visual interest. Windows in restaurants or retail stores provide a view of activity inside; street trees provide beauty, shade, and separation from vehicles; street lighting creates easier navigation and safety at night; and benches give a place to rest and allow for socializing.

Public transportation should be frequent, reliable, and convenient.

Above all, commuters want to get where they need to go in the shortest amount of time possible. With recent technology enabling people to summon a ride on command, transit service needs to be predictable and minimize waiting time to attract ridership. With more frequent service, the variability of travel times is reduced, making commuting easier, improving connections to other transit lines, and enabling a spontaneous trip without a car.

Protected bicycle facilities attract more riders.

Creating safe, travel-friendly, bike paths that allow for greater use, improve the quality of the area. Cyclists that are forced to ride in traffic without a designated lane or physical separation experience more stress, are more susceptible to injury, and use more mental energy to navigate, which deters frequent bike commuters. Providing smooth, protected and convenient pathways for cyclists, encourages and increases the likelihood of cycling as both a means of transportation and recreation, thus reducing the need to use a vehicle to commute or run errands.

Typical Modeling Process

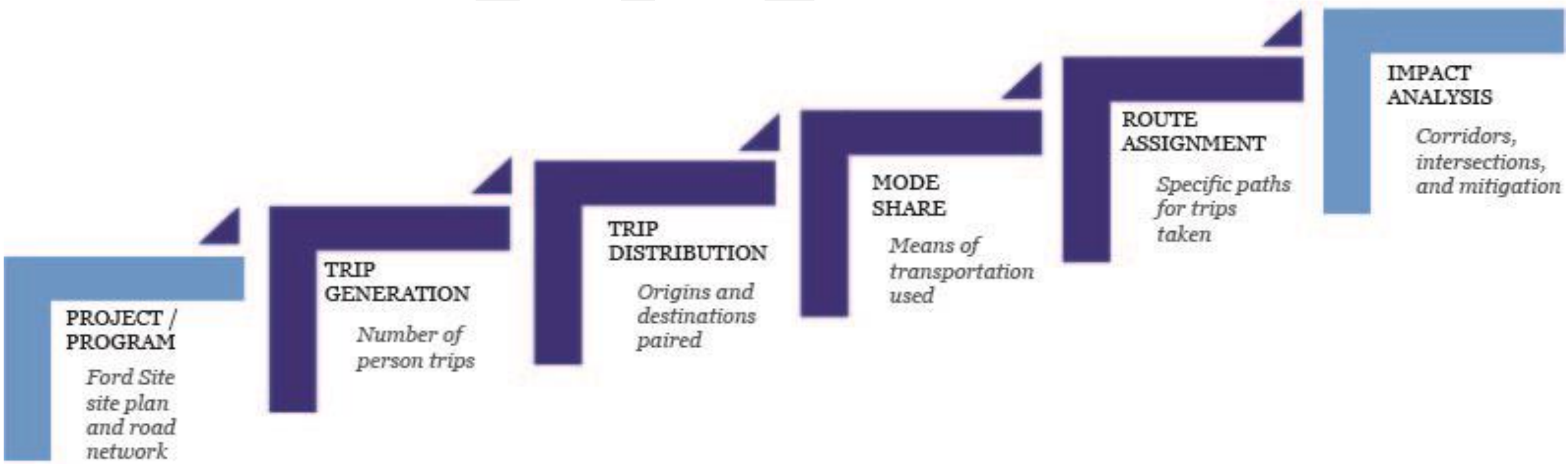
How do we know if the transportation system works? Measuring expected transportation use of the Ford site and overlaying it on the existing transportation system is ultimately the task of this effort. This process follows the steps already used by Saint Paul (and most other cities or permitting agencies) to document expected use and impacts.

Traditional transportation analysis focuses on vehicle trips and impacts only, but the Ford site effort is trying to minimize and assess the impacts on all aspects of the transportation system. This requires broadening the analysis and introducing tools at each step of the modeling process. In the subsequent sections, we identify the choices made and analysis completed to capture all transportation factors. Nevertheless, the process still generally follows the steps shown below.

For Saint Paul and the Ford site, this study has developed a customized model, building on national best practices. The inputs are described in each of the sections below. The outputs are related to the goals and are shown throughout this report.

The Ford Approach

In this effort, we are ultimately trying to understand and measure the number of trips EXTERNAL to the Ford site. External trips (from anywhere to or from the Ford site) are ones that use surrounding streets, neighborhood sidewalks, or public transit facilities. Since the Ford site is proposed as a mixed-use, integrated environment, a significant number of the trips generated will be internal–people will live and work here, or work and shop here. Trips within the site itself never reach the surrounding transportation system.



The integration of the internal design (the street network) of the Ford site and the surrounding neighborhood helps to create a place that encourages and allows movement both within, from and to the Ford site. Moreover, proposed street networks and the policies and programs around the development of the Ford site will further serve to reduce vehicle demand and encourage walking, bicycling, and the use of transit for all travelers both internal and external.

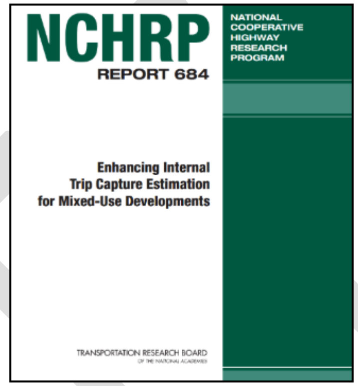
The City and the Technical Committee have charged this effort with reviewing all existing, state of the practice models to capture the complex aspects of this proposed mixed-use site. As a first step, site programs were tested using the following approaches:

Other Models Evaluated

EPA-MXD model

The project team tested the Environmental Protection Agency's (EPA) MXD process to test trips at the Ford site. The MXD process is a spreadsheet tool that incorporates several different inputs of mixed use areas. These are used to modify the overall trips generated for the proposed development land use mix. A quantity of vehicular daily, AM peak hour, and PM peak hour trips are outputted and can be used to tease out the anticipated mode splits further.

National Cooperative Highway Research Program Report 684



The National Cooperative Highway Research Program (NCHRP) Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments was also investigated. This model refines the EPA-MXD model by adding extra mitigating factors such as vehicle occupancy, mode split by land use, and time of day to find even more accurate trip estimates.

MXD+ Trip Generation Methodology

The MXD+ Trip Generation model was developed in 2014 and synthesizes trip generation estimates from earlier EPA-MXD and NCHRP 684 models to produce more detailed results for urban environments. This model specifically corrects some of the ITE Trip Generation outputs that have been infamous for being overestimated. This refined methodology also includes other factors influencing travel behavior, such as the Average Vehicle Occupancy (AVO), Transit Trip, Non-Motorized trips, and addresses "Internal Capture" trips.

Summary of Other Models

We note that each of these models show promising results but are still relatively untested and non-localized. In addition, each model reports final results only, aggregating cumulative factors through a complex series of calculations. The Ford site presents an essentially blank slate on which to layer transportation improvements that would best and most proactively reduce vehicle trips and integrate with the surrounding area. None of the models allowed for the ability to evaluate the impacts of interval changes to the Ford Site program, layout, plan, or level of investment, and were thus used only as reference.

The Calibrated Model

For the Ford site, the team has prepared a detailed, traceable, localized, and comprehensive multi-modal trip generation and mode choice model to measure and demonstrate the impacts of the Ford site. While applying many of the same measures and factors intrinsic to the previous models, the calibrated version went further. In it, the team developed and referenced the latest research for multiple, proven trip-reduction factors applied to similar sites around the nation. Critically, this approach further allows for the City to align its goals, targets, and metrics with the factors proven to reduce vehicle trips and achieve larger goals for site use, operation, and integration. As importantly, these factors can be measured and improved over time.

The transportation analysis process has been designed in two major parts. The first is to focus on external trips, that is trips from the neighborhood, surrounding area, or greater Twin Cities region to or from the Ford site. With the proposed model, many of these will occur by walking, bicycling, or transit (non-auto) modes. The more the Ford site—and the surrounding neighborhood—includes facilities to attract and allow this travel, the greater the use of multi-modal transportation will be. It is understood, however, that vehicle travel will still be an important component of Ford site access. The analysis developed here shows how the Study has arrived at aggregate numbers of external trips by mode.

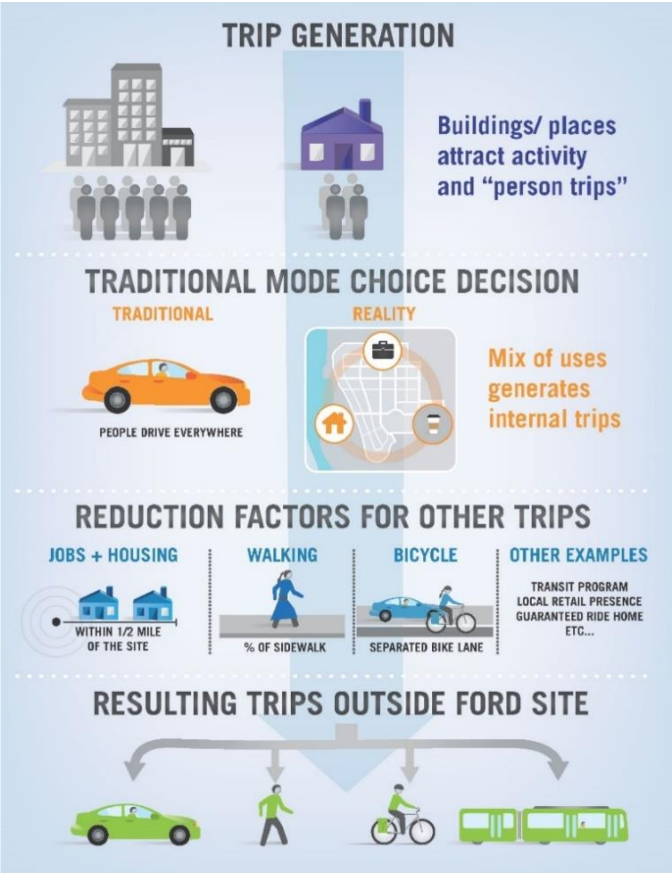
The second part, discussed later in this chapter, measures how those additional trips influence or affect the existing or proposed transportation network. Multiple paths and entries will help to disperse this travel to the surrounding roadway network. Later in this Chapter we measure how those additional trips influence or affect the existing or proposed operations of the transportation network.

External Trips

This is the critical task of the Study and the one where the current state of the transportation practice is least complete. Simply put, trip generation is the term used to match land use to expected travel generated. An office, apartment, coffee shop, or any other building will generate different levels of travel activity with people coming and going at levels roughly calibrated with the prevailing use.

The calibrated model is a custom trip generation model intended to incorporate the unique trip generation types and vehicle trip reductions anticipated from the Ford site development. Note that the detailed calculations, formulas,

Figure 4-1: Process to develop the Ford Site trip generation numbers



and spreadsheets are included as Appendix A[3]. Simultaneously, this model will encapsulate the development's multimodal and sustainability related goals through trip generation modifications, given the latest research.

Comprehending the Ford site's goals and translating them to vehicle trip reduction factors has also been a key innovative component of this overall project. The final trip generation estimates followed a cohesive trip generation process, which is depicted in Figure 4-1.

Trip Generation (Step 1)

Trip generation, as typically measured, refers to the number of trips generated from the size of a building corresponding to a type of land use. The Institute of Transportation Engineers (ITE) has surveyed dozens of land uses (single-family homes, offices, retail spaces, etc.) in hundreds of locations across the United States. These surveys provide transportation planners a good indication of the number of (vehicle) trips generated from a development. However, the building sites are typically surveyed in suburban and auto-oriented areas, which typically overestimate the number of vehicle trips, especially compared to more urbanized areas.

The first step of the Ford Site Trip Generation process starts with the breakout of the land use types and quantities. The actual land use areas proposed represent current thinking on the part of the City and the Ford Site planning effort. Further

[3] The actual formulas used are outlined in the spreadsheet in Appendix A. Using existing formulas and approaches often results in an acceptable range of results, which are shown in the Appendix A. For purposes of summary and analysis, many of the results shown here are either averages, the conservative estimate, or are rounded slightly for ease of understanding.

refinements may occur over time by the City, community, or the developers based on the market and other evolving needs. However, the initial land use mix has developed to enable a mixed-use environment while meeting housing, employment, and retail needs. Table 4-1 indicates the general land use program used for evaluation of the Ford Site program.

Table 4-1: General land use program at the Ford Site

Land Use	Quantity
Civic	150,000 GFA*
Employment (Office, etc.)	450,000 GFA
Retail	300,000 GFA
Residential	4,000 Units

Total Vehicle Daily Trips (Per ITE)	38,648 Vehicles Trips
Vehicle Trips X Average Vehicle Occupancy	38,648 X 1.08 = 41, 740 Person Trips
* Gross Floor Area, in square feet	

Typical ITE rates are based on observed vehicle trips to and from a use. While not always capturing all aspects of mixed-use areas, as a starting point, ITE rates are used for most models and processes including those tested and described previously. Here, we convert ITE generated (vehicle) trips to person trips using a vehicle occupancy rate (VOR) factor of 1.08 (persons per vehicle) taken from the US Census for the Twin Cities region. When tallied, this results in almost 42,000 potential daily person trips at the Ford Site.

From this number, a series of reduction factors are applied to more accurately demonstrate expected external trips at the Ford Site.

Internal Capture (Step 2)

Based on the land use type and quantity, the number of people making trips to, from, and within the Ford Site has been calculated. Transportation professionals generally recognize two types of trips: internal and external. The Ford Site is 135 acres and is planned as a mixed-use area, with a complementary mix of buildings. Residential buildings will offer places to live; offices will attract new workers; and all will benefit from the shops, restaurants, parks, and open space being built on the Ford Site.

A fair number of the "trips" at the Ford Site will simply be people travelling between one use and another within the site. Residents may work at the offices. Office workers will shop at the stores or eat at the restaurants. Therefore, a separate calculation has been made to quantify the internal vs. external trips.

This step in the modeling process uses an internal capture factor, based on leading national research, coordinated with the Technical Committee. Internal capture rates (as a percentage of trips) are higher during non-peak (e.g. midday) than during commuting times. This is because more of the internal trips occur throughout the course of the day (an office worker going to the coffee shop). Typical analysis focused on peak commuting times, resulting in conservative (higher external trips) estimates. Note also, that the internal capture rates were benchmarked with observed behavior and trip making in the Twin Cities region even though they are above what other models tested showed.

Table 4-2: Internal trip capture by the Ford Site

Model Steps	Results
ITE vehicle trips	38,648
Person trips (1.08 AVO applied)	41,740
Person trips (with 18.7% internal capture)	33,934
Vehicle trips (with 81% auto mode share)	27,317
Reduced vehicle trips	20,297 (LOW reduction) 15,467 (HIGH reduction)
# of Vehicle Trips (Divided by 1.08 AVO)	18,794 (LOW reduction) 14,322 (HIGH reduction)

Source: G. Tian, et al.(2015) Traffic Generated by Mixed-Use Developments: 13-region study using consistent measures of built environment

Internal Trips are typically non-motorized

Almost all "Internal" trips are anticipated to be non-motorized trips. The Site Plan, and the goals that support it are designed to create a built environment that encourages walking, bicycling, or even transit use for these local trips. Internal trips are not included in our analysis of impacts on surrounding streets, as they will not use these streets. The resulting analysis shows

$$\textit{Overall Person Trips} - \textit{Internal Trips} = \textit{External Person Trips}$$

and then leads to the next step in our modeling effort.

External Trip Reduction Factors (Step 3)

The standard ITE Trip Generation manual assumes all people arrive at their destination driving an automobile. The reality is that people arrive to a place via transit, biking, or walking based on the environmental characteristics of the City. As a vibrant, walkable, connected area, the Highland Park neighborhood already has a robust share of these (non-motorized) trips. The goals for the Ford site, and associated investments, are poised to deliver greater connectivity, attract different types of users, and greatly expand on the connectivity of the Highland Park neighborhood.

Each of these factors have been detailed to show specific intentions required to achieve greater benefits. These are also tied back to goals, targets, and metrics defined in Chapter 3. Working with the Technical Committee, a series of additional, specific factors, which have been proven to reduce vehicle travel and encourage alternative use, were developed and tested to evaluate their ability to impact (reduce) vehicle trips to and from the Ford site. These factors are shown and briefly described below. Appendix A includes the details, sources, and calculations, used to measure each factor.

For each of these factors, a low and high level of investment were assumed. This reflects the range of results observed nationally in developing these factors and shows a differentiation between a base (low) level of provision and a more intense (high) level of investment.

While the calculations for each were shown, the low level of investment was used as the trip reduction factor—again to show more conservative (more vehicles) results. The summary of these factors was applied to the external trips resulting from Step 2. As shown in Table 4-3, these

factors show an additional potential reduction of 22% to 49%.

Each of these factors is grounded in national research, as described and included in Appendix A. Further, for purposes of evaluation, the project team described in some detail the levels of investment or adopted policies required for both the low- and high-investment scenarios. A summary of each is provided:

Jobs and Housing Balance

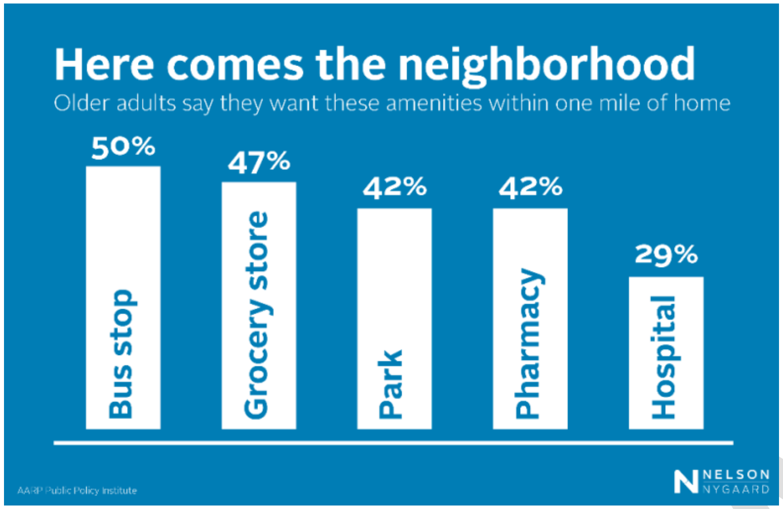
Neighborhoods, not just the Ford site but the surrounding area, that have a mix of jobs and housing, naturally have fewer long vehicle trips as some folks live and work in close proximity. An analysis of the proposed Ford site plan and existing jobs/housing balance in the immediately surrounding area was completed for this factor.

Local Serving Retail

Similarly, local serving retail, as opposed to destination retail, primarily draws local customers. Drug stores, coffee shops, cafes, dry cleaners, or other types of retail easily fit this bill and are both abundant in the Highland Park neighborhood and anticipated for the Ford site.

Table 4-3: Summary of the vehicle trip reduction factors

Vehicle Trip Reduction Factor	Low Multi-Modal Scenario	High Multi-Modal Scenario
Mix of Uses		
Jobs & Housing Balance	2.6%	2.6%
Local Serving Retail	2.0%	2.0%
Below Market Rate Housing	0.6%	0.6%
TOD & Transit Services		
Transit Service Frequency, Transit Stop Location	7.5%	7.5%
Walking Environment		
Intersection Density, Sidewalk Completeness, Block Size	6.6%	7.5%
Bicycle Infrastructure		
Separated Bike Lanes, Indoor Bike Parking, Outdoor Bike Parking, Winter Maintenance of Bike Paths	2.9%	7.4%
Parking Management and Transportation Demand Management		
Parking Supply	0.0%	7.3%
Parking Pricing	0.0%	9.7%
Free Transit Passes	0.0%	1.0%
TDM Programs	0.0%	4.2%
Total	**22.1%**	**49.8%**



Below Market Rate Housing

An assumed percentage of affordable housing for the Ford site is included in this analysis, with affordable housing occupants typically less likely to own vehicles and more likely to walk or take public transportation.

Transit Service Frequency

The general presence of frequent, convenient public transportation attracts riders and minimizes vehicle use. Calculations showing the A-Line and some potential transit changes to meet the ultimate demand from the Ford site are calculated for their potential trip reduction benefits.

Walking Environment

As indicated in the principles of multimodal transportation, a pleasant and safe walking environment is key to enable people to make their trips on foot. Specific factors such as block size, intersection density, and percent of streets with sidewalks were used as determining features of this factor for the Ford site and surrounding neighborhood.

Bicycle Facilities

Similarly, the presence of bicycle-friendly facilities attracts bicyclists and reduces demand for auto travel. To truly maximize bicycle use, a series of physical and policy measures would be required. These range from dedicated and separated pathways for bicyclists, to ensuring adequate indoor and outdoor bicycle parking. In wintry places like the Twin Cities, ensuring that bicycle facilities are plowed and maintained in all weather is critical.

Parking Supply

As described in the Principles, shared parking between uses more efficiently allocates parking and encourages trip-chaining and reduced auto use. Low levels of sharing have minimal benefit, but more aggressive measures could yield greater trip reductions.

Parking Pricing

Paying for parking is one of the most effective ways to minimize driving. Making the cost of parking visible to the user makes the results of their choices evident. If parking is free, we assume little trip reduction, while pricing similar to other destinations (such as ½ of downtown Saint Paul pricing) would have substantive reductions.

Free Transit Passes

Transit costs are typically visible to the user. If employers covered these costs, by providing free (or reduced) passes, use would rise and vehicle use would decline. No reduction was taken for this measure at this time.

Transportation Demand Management Programs (TDM)

The project team has identified a series of TDM programs which work collectively to incentivize non-auto travel. The more programs put in place, the more likely the cumulative resulting reduction. TDM programs are most easily implemented throughout the course of development.

External Person Trips by Mode (Step 4)

The reduction factors in Step 3 are shown as reductions to external vehicle trips. The City and Technical Committee are also highly interested in understanding the overall trip making to the Ford site, and answering questions about expected use by mode. External vehicle trips are the results of Steps 1 through 3. The resulting vehicle trips are then detailed by approaching direction and path and evaluated later in this chapter.

Displaced external vehicle trips are those affected by the reduction factors described in Step 3. These displaced trips represent the projected external pedestrian, bicycle, and transit trips. Using information from the 2010 Travel Behavior Inventory (TBI) prepared by the Metropolitan Council, these displaced vehicle trips were converted back to person trips, and then reallocated into pedestrian/bicycle (40%) and transit (60%) trips.

These non-auto trips are captured and described more broadly. Pedestrian and bicycle trips will most likely come from the surrounding neighborhood (within 0-5 miles of the site) and will be widely dispersed. For transit, the overall level and layout of public transportation that will serve the Ford site is driven by larger processes, such as the Riverview Corridor Study, and will evolve over time. Therefore, this analysis is simply trying to understand the level of external pedestrian, bicycle, and transit trips that will access the Ford site, rather than their specific geographic distribution.

External Trip Generation by Mode Summary

As described, the analysis in Part 1 results in final numbers of expected external trips by mode to the Ford site. These are shown for low and high scenarios, based on the reduction factors. Trips are further shown for daily (24 hour) and for AM and PM peak hours, which represent typical commuting times. While specific, these numbers still represent the result of our calibrated modeled analysis and should be expected to fluctuate and improve over time, as multimodal trends and levels of investment and policy directives continue to raise non-auto travel at the Ford site, in Highland Park, and the greater Twin Cities region.

Table 4-4: Total external trip generation for the Ford Site

Mode		Total External Trips	Low	High
Vehicular Trips		Daily	24,463	17,539
		AM Peak Hour	2,540	1,802
		PM Peak Hour	2,489	1,792
Transit Trips		Daily	6,167	10,675
		AM Peak Hour	640	1,121
		PM Peak Hour	627	1,081
Non-Motorized Trips		Daily	4,063	7,033
		AM Peak Hour	422	738
		PM Peak Hour	413	712

Transportation Impact Analysis

The Ford site transportation impact analysis is intended to understand how well the proposed street network will serve vehicle, pedestrian, bicycle, and transit trips, as well as the overall planning goals of the Ford site. Neighbors, area businesses, and the City itself all want to understand how the "traffic" from the Ford site will impact their street, the kinds of neighborhood uses that exist in Highland Park and proposed for the Ford site. Short trips are also those most likely to be walk or bicycle trips.

Trips to and from the Ford site will disperse across the transportation network, because there is no concentrated destination. Downtown Saint Paul is only a destination for 3% of trips, while the combined University District/Downtown Minneapolis only represents an additional 5%. The proposed Ford site network of streets is intended to provide a means for all roadway users to safely and seamlessly travel to and from the Ford site.

Furthermore, the street network should adhere to the multimodal and sustainability goals the project team has established. The following sections describe in detail the assumptions underlying the transportation impact analysis of the Ford site in the City of Saint Paul and the surrounding Highland Neighborhood. The sections include:

- Trip Distribution
- Site Plan and Street Network
- Vehicular Trip Assignment
- Vehicular Traffic Conditions
- Multimodal Trips

Trip Distribution

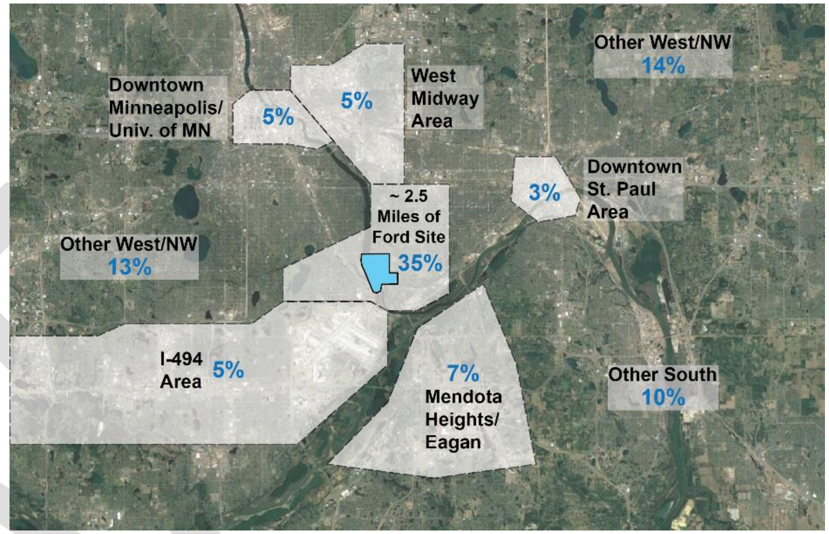
People make trips to fulfill various purposes, such as to work, to shop, for entertainment, and even return to home. Ford site future residents, employees, and retail patrons will tend to make travel decisions to arrive at their destination in the decisions are quantified for the purposes of a transportation impact analysis, in a process called "trip distribution."

On a regional level, a transportation demand model is used to assess travel patterns to and from areas in the "Twin Cities" region. Figure 4-2 presents the results of these assessments. By looking at the patterns in the existing Highland Park neighborhood, and accounting for the proposed Ford site use, we can see where trips are likely to come from.

Trips are relatively evenly spread throughout the Twin Cities region, owing to the centrality of the Ford site and surrounding neighborhood. Two items in particular stand out. First, thirty-five (35%) percent of all trips are likely to be from within only 2.5 miles of the Ford Site. This reflects the kinds of neighborhood uses that exist in Highland Park and are proposed for the Ford Site. These shorter trips are for all uses, and represent those with the greatest potential to b walk or bicycle trips.

The trip proportions are important to recognize because the Ford site is anticipated to draw a variety of users from across the region. This includes Ford site residents who will work throughout the region. Lastly, trips are not just commuting trips, but must cover all the activity (shopping, school trips) generated by the mix of uses at the Ford site. The proportion of their origin-destination travel patterns informs the assignment of those trips to the internal Ford site street network.

Figure 4-2: Trip distribution to and-from the Ford Site (Fall 2016 Draft)



The Ford site plan is intended to serve a diverse set of users and adhere to the goals and objectives established through the ongoing planning processes. The street network is designed to integrate with the surrounding neighborhood and provide multiple points for all users.

Today the Ford site is a barrier for all. Drivers, bicyclists, and even pedestrians must go around the site using Ford Parkway and Cleveland Avenue. This elongates trips and causes additional congestion. Extending existing roadways into the Ford site, especially Montreal and Cretin, creates new pathways. This reduces travel distances and existing neighborhood congestion.

Figure 4-3 illustrates the proposed street network indicating the functional classification of each roadway. The Ford site is specifically planned to have multiple points of entry enabling users to penetrate the internal street network from a variety of approaches. The intersections proposed to link the Ford site with the adjacent roadway network will disperse multimodal trips, thereby minimizing the impact of the Ford site's total trip generation onto the surrounding Highland neighborhood street network.

Figure 4-3: Ford Site functional classification (Fall 2016 Draft)

Trip Assignment

Vehicle trips can be assigned to the individual streets and intersections in the street network. This is a process called "trip assignment." For the purposes of assessing transportation impacts, the AM and PM peak hour trips are assigned to the street network. In the AM peak hour, more residents of the Ford site are anticipated to exit the site, as opposed to employees who are anticipated to enter the Ford site.

Figure 4-4 shows how the proposed street network and its multiple entries to the Ford site will carry trips. Streets like Ford Parkway carry all trips (20-25%) to the West, while trips to the North are dispersed on multiple streets.

Figure 4-5 and 4-6 illustrate the roadways anticipated to carry additional numbers of vehicle trips in the AM and PM peak hour time periods, respectively.

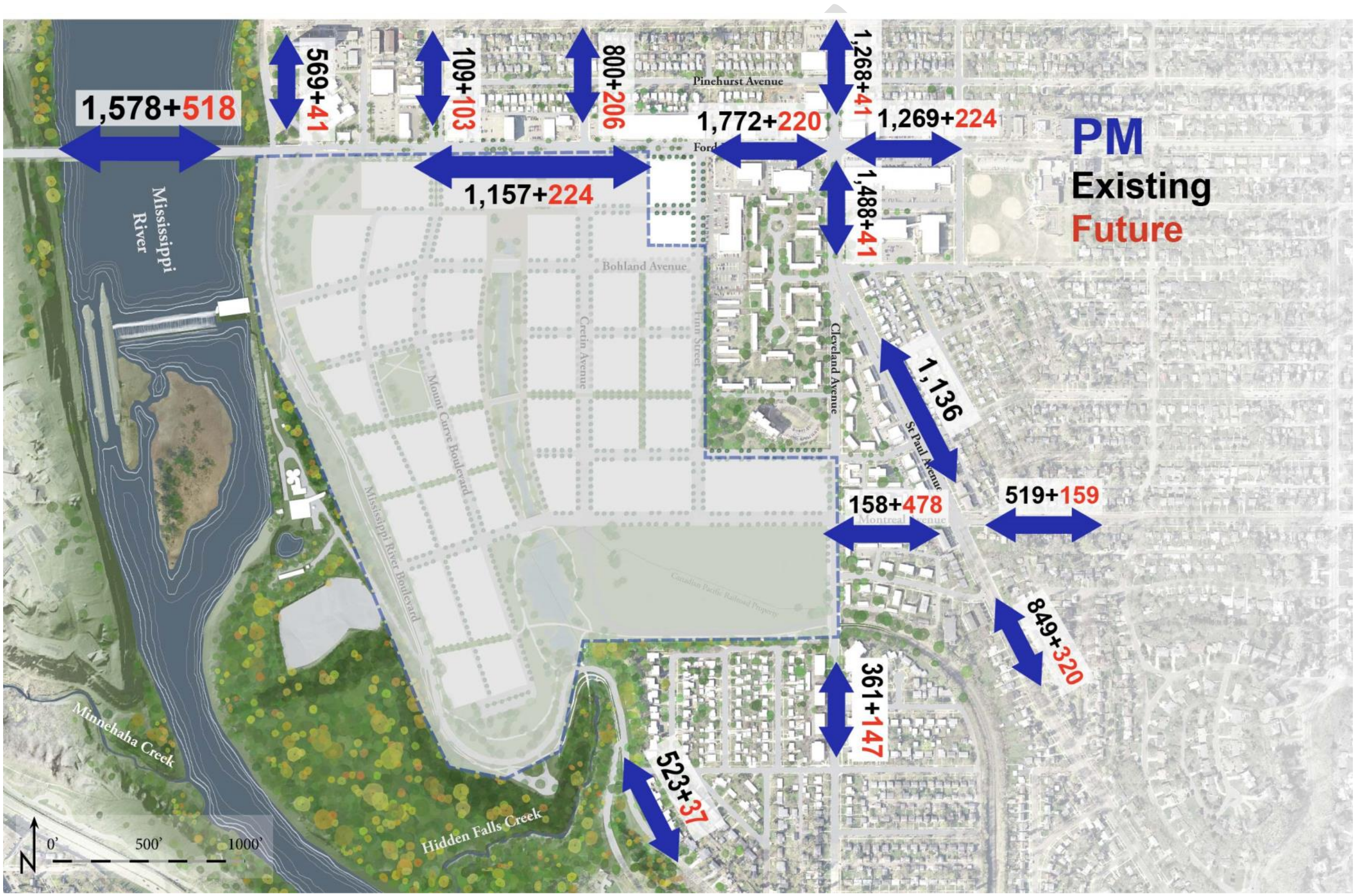
As shown in Figure 4-6, a majority of the vehicle trips are anticipated to be generated on the major arterial- and collector-type streets, such as Ford Parkway, St. Paul Avenue, and Montreal Avenue. The proportion of additional trips added to the street network are small as compared to the overall traffic volumes traveling through those corridors. Thus, the intersections along these roads are not generally anticipated to experience negative impacts of vehicular traffic.

Figure 4-4: Trip distribution to/from the Ford Site (Fall 2016 Draft)

Saint Paul Minnesota
The most livable city in America

Figure 4-5: AM peak hour trip assignment

Figure 4-6: PM peak hour trip assignment



Level of Service

"Level of service" (LOS) is a term used by traffic engineers and planners to quantify traffic performance. LOS is separated into different "grades," which quantify congestion from the highest LOS, "A" (free flow traffic), to lowest LOS, "F" (heavy congestion). The National Academy of Sciences finances research that determines these peer-reviewed LOS thresholds for transportation professionals to use in their transportation analyses. A final outcome of this research allows practitioners to perform existing and future conditions analyses to ensure that the intersections can maintain acceptable traffic flows now, with a proposed development, and in the future.

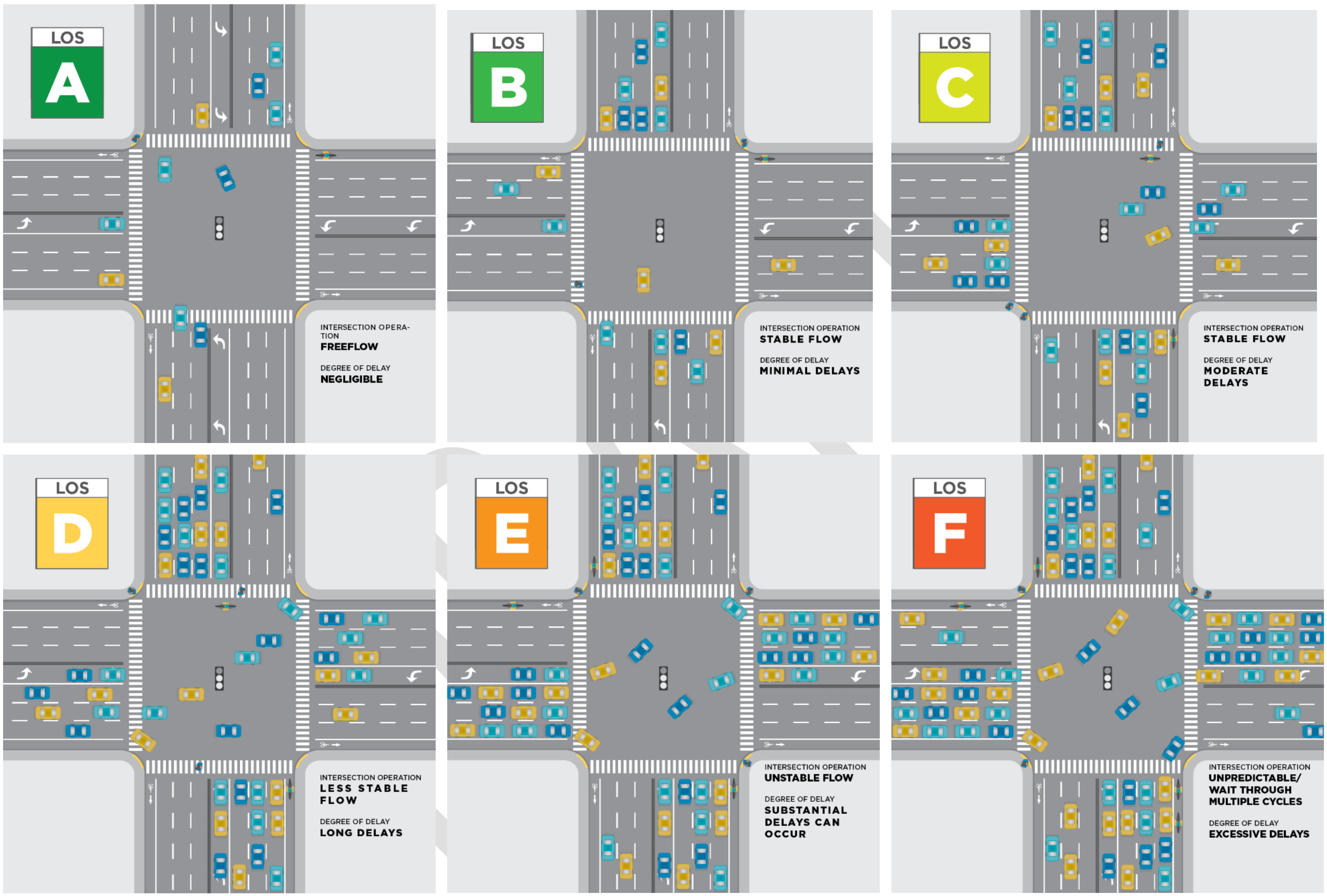
For added perspective, understanding what are "acceptable" and "unacceptable" levels of service can be done by using actual traffic conditions on streets in Saint Paul. The following figures illustrate various traffic conditions depicting LOS A-F.

- Level of Service A: A majority of traffic doesn't stop
- Level of Service B: Minimal waiting at traffic signals
- Level of Service C: Increase number of stops and queuing
- Level of Service D: A majority of vehicles have to stop at the traffic signal and may have to wait through more than one green light
- Level of Service E: A majority of vehicles have to stop and wait through more than one green light. In addition, significant queuing exists.
- Level of Service F: Vehicles typically queued waiting for a safe opening in traffic

When trying to identify traffic patterns in the previous figures, it is important to recognize that there are also two main types of traffic congestion: recurrent and non-recurrent. Recurrent traffic congestion is what everyday commuters experience during typical morning and evening peak hours. This traffic is also devoid of congestion anomalies such as crashes, stalled vehicles, and traffic signal power outages. Recurrent traffic congestion is the most measureable and repeatable form of congestion, which is easy to translate into levels of service. Non-recurrent traffic congestion events are analogous to hour-long traffic jams on the highway or event/stadium traffic. As the project team analyzes the Ford site's trip generation and impacts on the surrounding street network, recurrent traffic congestion will be discussed.

Lastly, the City of Saint Paul has LOS standards to ensure that intersections operate acceptably throughout the street network. Intersections operate acceptably with LOS "D" or better.

To understand vehicular traffic conditions in the future, the study team analyzed existing traffic conditions and the impacts of future vehicle trips developed through the trip distribution and assignment process. The results of this process allow the City and region to understand the level of impact that the Ford site may have on vehicle delay.


LOS
A
INTERSECTION OPERATION
FREEFLOW
DEGREE OF DELAY
NEGLIGIBLE
LOS
B
INTERSECTION OPERATION
STABLE FLOW
DEGREE OF DELAY
MINIMAL DELAYS
LOS
C
INTERSECTION OPERATION
STABLE FLOW
DEGREE OF DELAY
MODERATE DELAYS
LOS
D
INTERSECTION OPERATION
LESS STABLE FLOW
DEGREE OF DELAY
LONG DELAYS
LOS
E
INTERSECTION OPERATION
UNSTABLE FLOW
DEGREE OF DELAY
SUBSTANTIAL DELAYS CAN OCCUR
LOS
F
INTERSECTION OPERATION
UNPREDICTABLE/ WAIT THROUGH MULTIPLE CYCLES
DEGREE OF DELAY
EXCESSIVE DELAYS

Existing Conditions

Analyzing the existing traffic conditions of the intersections adjacent to the Ford site is necessary to create a baseline understanding. Traffic counts were collected at intersections in the Ford site vicinity for the AM and PM peak hours, which generally occur from 7-9 AM or 4-6 PM. The same traffic congestion principles described previously were applied to analyze the LOS for the study intersections. Figures 4-7 and 4-8 illustrate the AM and PM peak hour vehicular levels of services.

As shown in Figures 4-7 and 4-8, the existing LOS for the study intersections are “D” or better, and the majority are “A.” The intersections adjacent the Ford site are currently operating within acceptable levels of service.

Figure 4-7: Existing conditions AM peak hour LOS

Figure 4-8: PM peak hour LOS

Planned Intersection Improvements

When construction begins in the Ford site, a number of different intersection improvements will be necessary to effectively connect the Ford site to the Highland neighborhood and the rest of Saint Paul. These identified improvements are scoped to augment traffic flow and even enhance the pedestrian/bicycle environment. The following intersection improvements have been identified:

The result of these improvements also assumes that traffic volumes will be stable from the existing conditions to the time of improvement and into the future. Historic traffic volumes in Highland have been stable over the past decade, indicating that new trips from urban infill have been displaced by a general reduction in vehicle travel by individuals. This pattern mirrors what’s happening in cities across the nation and is anticipated to continue in the future.

Therefore, these planned intersection improvements are assumed to be reasonable and will be incorporated into the future build-out intersection analysis.

Table 4-5: Ford site proposed intersection improvements

Intersection	Improvements
Ford Parkway/ Mount Curve Boulevard	Signalize intersection Provide NB/SB left-turn lanes Extend WB left-turn lane
Ford Parkway/ Cretin Avenue	Add NB left- and right-turn lanes Extend WB left-turn lane Remove part of the median EB right-turn lane
Cleveland Avenue/ Montreal Avenue	Signalize intersection Add west leg
Montreal Avenue/ St. Paul Avenue	Signalize intersection Requires removal of part of the median EB/WB left-turn lanes
Cleveland Avenue/ St. Paul Avenue	Optimize signal timing

Full Maximum Density Build-Out Vehicular Traffic Conditions

The full build-out of the Ford site will generate trips that can be analyzed for an entire day or AM/PM peak hours. The full build-out of the site is anticipated to include the 95% occupancy of the previously described building square-footage and land use types. Both a conservative trip generation scenario and the “low” multimodal scenario have been used for the purposes of this analysis.

To analyze the future impact of these trips, the results of the trip distribution and assignment process are applied at an intersection-by-intersection level to the Ford site study area. This analysis includes the planned intersection improvements described above. Figures 4-9 and 4-10 illustrate the AM and PM peak hour future traffic conditions, respectively.

As indicated in Figures 4-9 and 4-10, all intersections operate within acceptable levels of service as described in the Ford site goals and targets. Note that the “desired” targets are being met for the intersections adjacent to the Ford site. The vehicular level of service target is simply one of many goals to a successful multimodal and sustainable Ford site.

Figure 4-9: Proposed build conditions AM peak hour LOS

Figure 4-10: Proposed build conditions PM peak hour LOS

Multimodal Analysis

Because the Ford site is designed with the goals of enhanced pedestrian access, minimized vehicle travel, and shared parking in mind, thousands of trips to and from the Ford Site will be completed by people taking transit, walking, and biking. As shown in the trip generation section, the Ford site can expect a range of 30% to 50% of trips to use non-auto modes of travel, with most of this accounted for by short, local trips within the site.

The intersection capacity analysis reflected in Vehicle Level of Service (LOS) is limited, and captures only one aspect of the transportation system. To evaluate the transportation service of the roadways near the Ford site from a multimodal perspective, the level of service methodology was applied differently. The process for measuring network and intersection performance better accounts for other trip types.

Multimodal Methodologies

The project team analyzed the existing and future conditions of the Ford site with the state of the practice multimodal methodologies. However, we note that there are relatively few reliable and tested multimodal analysis tools available to be able to readily quantify an equivalent "level of service," as compared with vehicular travel. Therefore, in consultation with the Technical Oversight Committee, we reviewed several approaches before using the methodologies described below.

Transit Service Quality

Many different factors can be used to calculate an equivalent LOS for transit users. Some example primary factors influencing transit LOS taken from the multimodal LOS are:

- **Availability**: what is the proximity of transit stops to buildings within the Ford site? "Good" transit service often has transit stops within a ¼ mile or less from buildings.
- **Frequency**: how frequent buses arrive per minute. Areas served with "good" transit often have buses arriving in 15-minute intervals or less.
- **Automobile LOS**: Buses generally flow in normal automobile traffic, so traffic congestion also impacts multimodal LOS.

There are many other factors influencing multimodal LOS such as transit reliability, boarding speed, safety, and price, but these factors are difficult to quantify when planning for a future transit service. For the purposes of this analysis, **availability** and **transit travel time** were calculated and incorporated into the Transit Service Quality assessment for the Ford site.

Pedestrian and Bicycle LOS via the Charlotte Methodology

The Charlotte Department of Transportation developed a methodology to analyze the pedestrian and bicycle LOS[4], which was chosen for use to quantify anticipated non-motorized conditions for the Ford site. The advantage of this method is that the concept of LOS is familiar to transportation planners. However, where vehicle LOS is based on delay, pedestrian/bicycle geometric features are the main inputs for Pedestrian and Bicycle LOS. This process is more intuitive as it helps to conceptualize a better walkable or bikeable environment. For example, calm and narrow streets are generally better pedestrian/bicycle environments than six-lane arterial streets. The following pedestrian and bicycle features primarily impact LOS:

- **The number of lanes pedestrians must cross at crosswalks:** Minimizing the size of the roadway is key to creating a "good" pedestrian environment.
- **Providing a bicycle facility (bike lane):** At a minimum, striping a bike lane provides a place for bicycles to travel through an intersection. Better bicycle facilities (protected bicycle facilities) further improve the bicycle LOS.

Additional factors include how traffic signals are designed to prioritize pedestrian movements. Those with plenty of "walk time" or that provide protected pedestrian movements generally rate better. In summary, the Charlotte pedestrian/bicycle methodology takes a design and operations oriented approach to quantifying a pedestrian/bicycle user experience. Because it is based on physical improvements, this methodology will also be relatively easy to track over time.

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[4] https://www.smartgrowthamerica.org/app/legacy/documents/cs/impl/nc-charlotte-pedbikelos.pdf

Ford Site Pedestrian and Bicycle LOS Results

Table 4-6 gives the existing bicycle and pedestrian conditions for intersections near the Ford site. The internal streets of the Ford site have not been analyzed for performance because final design details for the street cross sections or intersections are not complete.

The current bicycle and pedestrian LOS scores are substantially worse than current vehicle LOS scores. The AM peak sees the following LOS grades at the 11 intersections.

Table 4-6: Existing pedestrian and bicycle level of service performance

Intersection	Bicycle Level of Service	Pedestrian Level of Service
Ford Parkway/Mississippi River Boulevard Access Ramps (North and South Ramps at Ford Pkwy)	C (55)	B (88)
Ford Parkway/Woodlawn Avenue	D (52)	C (69)
Ford Parkway/Mount Curve Blvd	D (52)	C (69)
Ford Parkway/Cretin Avenue	D (48)	C (68)
Ford Parkway/Finn Avenue	E (30)	C (68)
Ford Parkway/Cleveland Avenue	D (49)	C (73)
Cleveland Avenue/Saint Paul Avenue	D (50)	C (68)
Cleveland Avenue/Montreal Avenue	C (55)	B (90)
Saint Paul Avenue/Montreal Avenue	D (49)	C (70)
E. 46th Street/46th Avenue S. (Minneapolis)	D (40)	C (72)
Davern Street/Montreal Avenue	D (53)	B (80)

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Given these unequal scores, it is not surprising most people choose to travel by car in this neighborhood. These scores also explain why so few people travel in this area by foot and by bicycle, when so much of the neighborhood is at a scale and mix that otherwise supports people walking and biking

In response to these low scores, the project team recommends the individual intersection improvements shown in Table 4-7, developed to maximize pedestrian and bicycle LOS. Table 4-7 identifies the specific improvement for each intersection, which were then provided as inputs to LOS analysis. The multimodal analysis methodologies were applied to the future build analysis, and improved network of streets. Table 4-8 illustrates the existing and future build multimodal conditions analysis for the Ford Site. When applied, the results for Existing and Build are illustrated in Tables 4-9 and 4-10. Note that in all cases the physical interventions would result in improved levels of service for pedestrian and bicyclists. The improvements would move all intersections into at least a “C” LOS.

Table 4-7: Pedestrian and bicycle intersection improvements

Intersection	Recommended Improvements (Pedestrian/Bike)
Ford Parkway/ Mississippi River Boulevard Access Ramps (North and South Ramps at Ford Pkwy)	Ladder-type or textured/colored crosswalk treatment Promote through movements on Mississippi River Blvd. Add enhanced shared bicycle/auto lane on Ford Parkway
Ford Pkwy/ Mount Curve Blvd	Ladder-type or textured/colored crosswalk treatment Enhanced pedestrian signal features Bike boxes at intersection approaches Add enhanced shared bicycle/auto lane on Ford Parkway In-street bicycle lanes within site; shared bike lanes on north approach
Ford Pkwy/ Cretin Ave	Ladder-type or textured/colored crosswalk treatment Enhanced pedestrian signal features Bike boxes at intersection approaches Enhanced shared bicycle/auto lane on Ford Parkway
Ford Pkwy/ Finn Street	Ladder-type or textured/colored crosswalk treatment Enhanced pedestrian signal features Bike boxes at intersection approaches Enhanced shared bicycle/auto lane on Ford Parkway In-street bicycle lanes within site
Ford Pkwy/ Cleveland Ave	Ladder-type or textured/colored crosswalk treatment Bike boxes at intersections Enhanced shared bicycle/auto lane on Ford Parkway In-street bicycle lanes south of Ford Parkway
Cleveland Ave/ St. Paul Ave.	Ladder-type or textured/colored crosswalk treatment Bike boxes at intersection Add in-street bicycle lanes on St. Paul Ave. Enhanced shared bicycle/auto lane on Ford Parkway
Cleveland Ave/ Montreal Ave	Enhanced pedestrian signal features Ladder-type or textured/colored crosswalk treatment Bike boxes at intersections Extend in-street bicycle lane on Montreal Ave. Enhanced shared bicycle/auto lane on Cleveland Ave.
Montreal Ave/ St. Paul Ave	Enhanced pedestrian signal features Ladder-type or textured/colored crosswalk treatment Bike boxes at intersection Add in-street bicycle lanes on St. Paul Ave. Enhanced shared bicycle/auto lane on Ford Parkway
E. 46th Street/ 46th Ave S. (Minneapolis)	Enhanced pedestrian signal features Ladder-type or textured/colored crosswalk treatment Bike boxes at intersections
Davern Street/ Montreal Ave	Enhanced pedestrian signal features Ladder-type or textured/colored crosswalk treatment Bike boxes at intersection Add in-street bicycle lanes on St. Paul Ave.

Table 4-8: Pedestrian/bicycle level of service performance

	Bicycle Level of Service		Pedestrian Level of Service	
Intersection	Existing Configuration	With Recommended Improvements	Existing Configuration	With Recommended Improvements
Ford Parkway/Mississippi River Boulevard Access Ramps (North and South Ramps at Ford Pkwy)	C (55)	C (68)	B (88)	A (98)
Ford Parkway/Woodlawn Avenue	D (52)	C (58)	C (69)	B (76)
Ford Parkway/Mount Curve Blvd	D (52)	B (75)	C (69)	B (78)
Ford Parkway/Cretin Avenue	D (48)	B (74)	C (68)	B (75)
Ford Parkway/Finn Avenue	E (30)	C (60)	C (68)	B (81)
Ford Parkway/Cleveland Avenue	D (49)	C (71)	C (73)	B (83)
Cleveland Avenue/Saint Paul Avenue	D (50)	C (67)	C (68)	B (79)
Cleveland Avenue/Montreal Avenue	C (55)	B (75)	B (90)	A (94)
Saint Paul Avenue/Montreal Avenue	D (49)	B (79)	C (70)	B (87)
E. 46th Street/46th Avenue S. (Minneapolis)	D (40)	C (60)	C (72)	B (75)
Davern Street/Montreal Avenue	D (53)	B (75)	B (80)	B (89)

Table 4-9: Existing vehicle, pedestrian, and bicycle level of service performance during AM Peak

Intersection	Vehicle Level of Service	Bicycle Level of Service	Pedestrian Level of Service
Ford Parkway/Mississippi River Boulevard Access Ramps (North and South Ramps at Ford Pkwy)	A	B	C
Ford Parkway/Woodlawn Avenue	A	B	C
Ford Parkway/Mount Curve Blvd	A	B	D
Ford Parkway/Cretin Avenue	A	C	D
Ford Parkway/Finn Avenue	A	C	D
Ford Parkway/Cleveland Avenue	A	C	D
Cleveland Avenue/Saint Paul Avenue	A	C	D
Cleveland Avenue/Montreal Avenue	A	C	D
Saint Paul Avenue/Montreal Avenue	A	C	D
E. 46th Street/46th Avenue S. (Minneapolis)	A	C	D
Davern Street/Montreal Avenue	C	C	E

Table 4-10: Proposed build vehicle, pedestrian, and bicycle level of service performance

Intersection	Vehicle Level of Service	Bicycle Level of Service	Pedestrian Level of Service
Ford Parkway/Mississippi River Boulevard Access Ramps (North and South Ramps at Ford Pkwy)	A	A	B
Ford Parkway/Woodlawn Avenue	A	A	B
Ford Parkway/Mount Curve Blvd	A	B	B
Ford Parkway/Cretin Avenue	A	B	B
Ford Parkway/Finn Avenue	A	B	B
Ford Parkway/Cleveland Avenue	A	B	C
Cleveland Avenue/Saint Paul Avenue	A	B	C
Cleveland Avenue/Montreal Avenue	A	B	C
Saint Paul Avenue/Montreal Avenue	A	B	C
E. 46th Street/46th Avenue S. (Minneapolis)	A	B	C
Davern Street/Montreal Avenue	C	B	C

While conditions for people walking and biking will have improved, they will still be worse for walking and biking than for driving.

In general, the project team does not recommend bicycle or pedestrian "C" level of service for a neighborhood like Highland, with so many businesses and community institutions that are reached on foot or bike. As one speaker noted at the Community Meeting about the site at Summit Brewing, the more iconic to the neighborhood the business is, the less likely it is to have attached parking, instead being reachable only on foot or bike. Ensuring safe, convenient access to those places for all ages is both official City policy and will be central to ensuring that Highland, including the Ford site, is as successful as possible.

Nor does the project team recommend prioritizing vehicle LOS over pedestrian LOS, which would be the result if only the recommendations above were implemented. Such recommendations are contrary to both our experience with what produces successful projects, and they are contrary to the goals adopted by the City for site outcomes.

As such, the recommended infrastructure improvements for people traveling by foot or by bike are only minimums. To minimize the impact of new vehicle traffic, and to maximize the economic and quality of life benefits to the neighborhood and to the new development, we recommend bringing more intersections up to or closer to LOS A and B for people walking and bicycling in this area. The more detailed intersection designs that would accomplish this is beyond the scope of this report.

In sum:

The proposed development plan for the Ford Site is able to add substantive new housing, jobs, open space, retail and connections to the Highland Park neighborhood, while maintaining transportation operations at acceptable levels. Extending roadways into the Ford Site, improving adjacent intersections and building out the pedestrian, bicycle and transit networks all serve to better integrate the surrounding neighborhood and provide transportation choices for current and future users. Detailed analysis reflects that even if overall numbers of users increase, operations will remain roughly equivalent for drivers and substantively better for all others.