DISTRICT COUNCILS COLLABORATIVE
of Saint Paul - Minneapolis

# Audit Tool for the Central Corridor Pedestrian Environment

Prepared for the District Councils Collaborative

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## Introduction

The District Councils Collaborative (DCC) is interested in making University Avenue a more pedestrian friendly place as the corridor is prepared for the Central Corridor Light Rail Transit (LRT) line. Research from the Metropolitan Council has shown that as much as 97% of the riders on the LRT line will get to the stops by walking, biking, or another form of transit. It is therefore important that those residents be able to walk to the LRT stations.

The DCC commissioned a researcher from the Center for Urban and Regional Affairs at the University of Minnesota to create pedestrian audit tool that could be used by the neighborhood groups along University Avenue. The goal of the tool presented here is to enable the residents of the University Avenue to assess the condition of the pedestrian environment in their neighborhood. That information will allow each neighborhood to determine how they would like to improve their pedestrian environment.

This report surveys research into characteristics of good pedestrian environments. Much has been written bemoaning that streets are designed for cars and not for pedestrians. However, the goal of the research discussed here is to understand what makes a good pedestrian environment.

To develop the audit, simple ways to measure the features of pedestrian environments identified in the literature were sought. It was a priority to create an audit that is accessible to the residents. The resulting audit is a combination of a simple walking survey and GIS and Sketch-Up analysis. Any community group can conduct the walking survey, and someone with basic GIS experience can do the computer analysis. When available, performance standards for the criteria identified in the audit are given in the literature review.

This audit was tested on two future LRT stations, the Dale and Fairview station areas. The findings help to understand the conditions of the pedestrian environment in those areas. Additionally, the test runs help create recommendations for how to improve the audit for future use. This research as a whole can provide rough suggestions of how to improve the pedestrian environment along University Avenue and increase the number of people who walk to the future LRT.

Appended to this report are the materials necessary to carry out the walking survey and gather all the audit data. Additionally, all GIS and Sketch-up files necessary for the Audit are on a data CD accompanying this report.

## Review of the Literature

Research into urban pedestrian activity originated from a public health and active living concern and has been incorporated into urban planning research. Many studies of pedestrian environments are hedonic models that use regression analysis to find certain environmental features favored by pedestrians. Hedonic regression models attempt to measure how attractive a certain environmental feature is to people. For example, how much do freshly paved sidewalks attract people to walk? Other studies are comprehensive pedestrian audits that evaluate and compare pedestrian environments using landscape architecture criteria. These studies group evaluation criteria in categories defined by urban design terms. For the purposes of this study, the evaluation criteria are grouped into five categories:

- Comfort: The effect of physical dimensions of space on a pedestrian's preference to walk there.
- Security: Pedestrian's actual level of safety and ability to be aware of potential dangers.
- Attractiveness: Amenities in the landscape that draw pedestrians.
- Accessibility: The capacity and ammenity of pedestrian infrastructure to move people from point to point.
- Coherence: Pedestrians ability to understand the geography and navigate in the area.

Research that has been done in each of these categories is summarized below.

**A Note of Performance Standards**

Many studies cited in this review do not address best available practices. They simply seek to measure what factors influence pedestrians. Additionally, some studies will simply identify that certain features are good, like a buffer between the road and the sidewalk, but not identify what the best dimensions of such a buffer are. One lesson to learn from this is that performance standards may be the product of local preferences and are often regionally specific. This report may help neighborhoods generate some performance standards along University Avenue.

A few studies survey existing pedestrian environments and use them to come up with some standards. In one such study, Sarkar (1993) created a service level scheme for pedestrian areas in which service level A describes pedestrian-only areas and service level F has no pedestrian environment; a pedestrian in such an environment must walk amongst the cars. Level B is the highest service level in which pedestrians interact with the cars. When possible, this report suggests performance standards identified in Sarkar's Level B service area.

**Comfort**

Comfort describes how the dimensions of the street and sidewalk affect the safety the pedestrian feels from traffic, and generally, how at ease the pedestrian is while walking.

Possibly the most important feature of the pedestrian environment is the sidewalk. In his classic work, Pedestrian Planning and Design (1971), John Fruin explains that the optimal width for walkways depends on the expected average daily flow volume and desired level of service. Appendix A contains Fruin's descriptions of his levels of service and prescribes flow volumes for each. A city must choose a service level for a particular sidewalk (how crowded the city wants the sidewalk to be) and then predict the rate at which people will use that sidewalk in order to determine how wide the sidewalk should be. Keep in mind that there are some instances where crowded walkways are desirable. Higher service levels prevent conflict points; reducing conflict points is the primary goal of traffic engineers. However, the human interaction that happens in pedestrian environments is valuable and therefore while the level of service model is effective for automobiles, it is limited in its application to pedestrian environments. Fruin explains that in places like metro stops and stadiums, where many people are walking the same direction at the same time, crowded streets are preferable. Additionally, sidewalks with high levels of service may seem empty leave people feeling vulnerable and lonely.

In addition to width and flow capacity, other features of the sidewalk affect its comfort. Several studies have shown that driveway curb cuts interfere with sidewalks, creating turbulence in the pedestrian traffic flow and a safety hazard as well (Moudon and Lee 2003). Landis et al. (2001) show that pedestrians have no preference for sidewalks with fewer curb cuts, putting into doubt the notion that curb cuts are a nuisance. (One possibility is that the aspect of curb cuts that are actually unpleasant to pedestrians are the interruptions in the building façade.) The Massachusetts Highway Department explains that sidewalks must be maintained in a condition that does not limit access to pedestrians with limited mobility. Sidewalks need frequent service to repair hazardous cracks that form, and to apply salt or sand to combat icy conditions.

The degree to which interaction with cars can impede the pedestrian's experience is another feature of the comfort of pedestrian environments. Landis' (2001) model of roadside walking environments shows that vehicle speed is inversely related to pedestrian comfort. Leslie et. al. (2005) found that pedestrians do not prefer roads that have fast moving vehicular traffic. Wide roads are not only designed to move traffic quickly, but to deter pedestrians from crossing the street. Roads that contain six or more lanes of moving traffic are seen as a barrier to pedestrians (Day 2005). Noise from cars is another hazard that deters pedestrians and puts them on edge. Sarkar suggests that 55 to 65 dba (weighted decibels, this is about the volume of loud talking or a running refrigerator) is an appropriate range for noise levels on sidewalks that are close to roads.

Buffers are an important element to protect pedestrians from the noise and fast moving cars of the street. Landis' (2001) model shows a strong correlation between a roadside buffer and pedestrian's perception of safety. A row of parked cars, a line of trees, or a grass swale can be effective at buffering the sidewalk from the road. A high percentage of roadsides with on-street parking and high total buffer width were more favorable to pedestrians. Figure 1 shows examples of roadside buffers.

An aspect of streets that landscape architects espouse is the enclosure of the streets. "Enclosure refers to the degree to which public spaces are visually defined by buildings, walls, trees, and other elements. Spaces where the height of vertical elements is proportionally related to the width of the spaces between them have a room like quality" (Ewing and Clemente 2005, 6). The proportionality to which they are referring is a ratio between road width to building height of approximately 3:1. Roads that are too wide leave the space undefined and awkward. Buildings that are too tall reduce the amount of open sky and give the street a cold, dark and possibly cramped feel. Figure 2 contains two-dimensional diagrams of enclosure ratios. Another important aspect of enclosure that has been shown to be particularly important to people is the percentage of the street that contains a building wall (Ewing and Clemente 2005). As noted before, this issue may also be related to curb cuts.

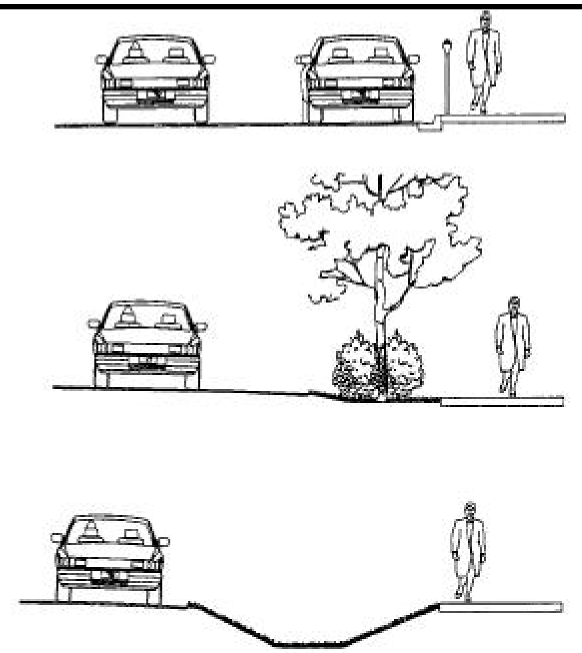

Figure 1: Some Roadside Buffers
Source: Landis et. al. 2001

**Security**

Security addresses the issue of how safe people actually are when walking on the street. It is sometimes difficult to separate the security concept from the comfort concept, because when people feel they may be subject to crime they feel uncomfortable. Security can be defined however by a combination of two things. The first is the actual history of crime and vehicular accidents in the area. The second is the idea of Crime Prevention Through Environmental Design (CPTED), that is how spatial form can help a pedestrian feel safe.

Transparency is an important concept of urban design with two applications to the pedestrian environment. CPTED's standpoint is that windows in buildings help people at work keep an eye on the street (Casteel and Peek-Asa 2000). Landscape architects define transparency as a measure of pedestrian's perception of "human activity beyond the edge of a street or other public space" (Ewing and Clemente 2005, 6). Land uses that activate the street, like retail and restaurants, also contribute to transparency.

Sightlines measure how far a person can see in a certain direction before a building or topographic feature interrupts the view of the horizon. Sight lines have been credited with improving pedestrians' ability to orient themselves in their environment. They can also increase a pedestrian's safety by allowing the pedestrian to see what is going on around him at all times.

**Attractiveness**

Attractive pedestrian environments go a step beyond making the pedestrian feel safe and comfortable. Attractive streets draw people to them, with beautiful features and active public spaces that declare that, "this is a place for pedestrians".

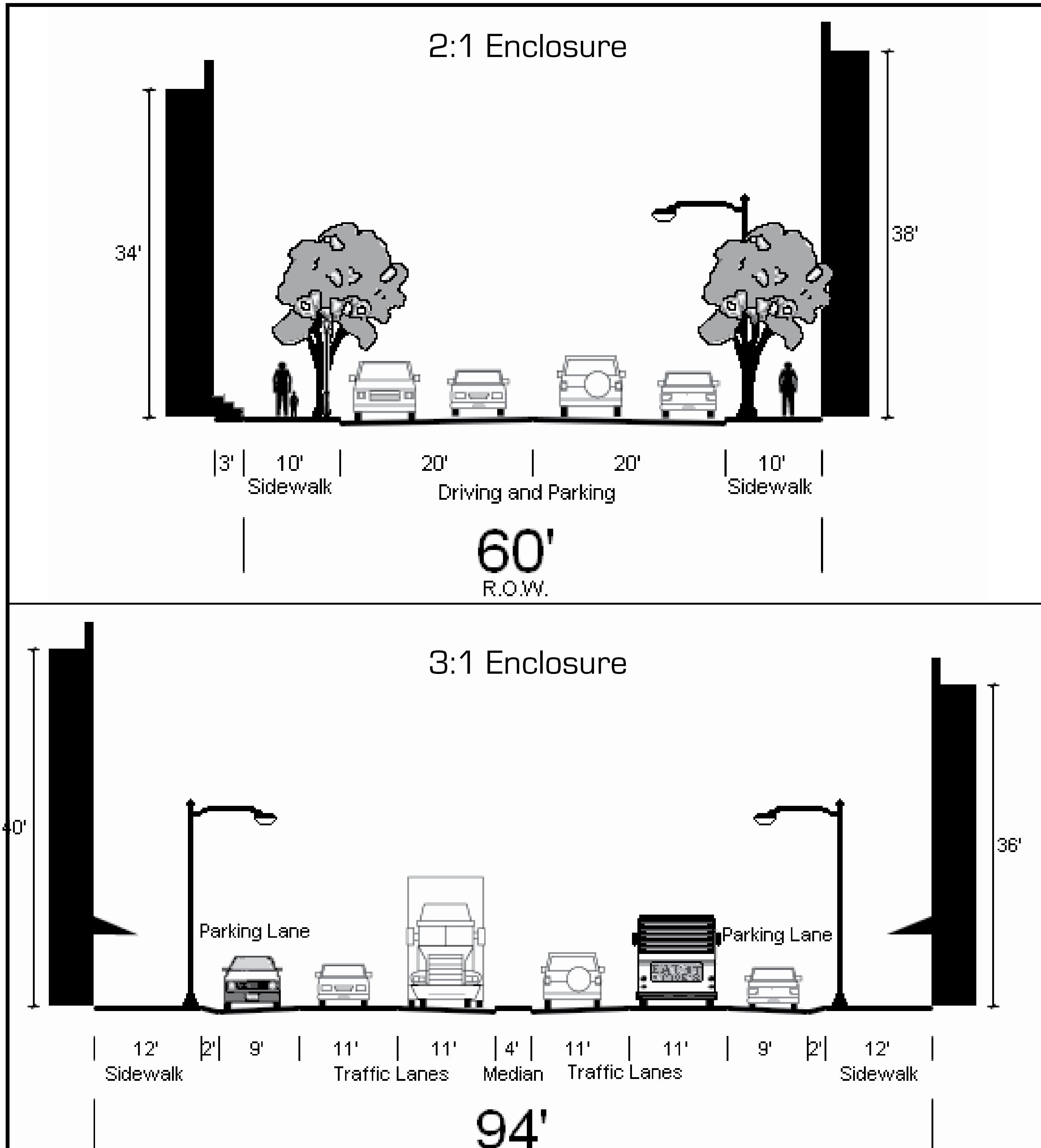


Figure 2: Sample street width to building hight ratios. (width:hieght)
Source: www.streetsections.com

"Complexity refers to the visual richness of a place. The complexity of a place depends on the variety of the physical environment, specifically the numbers and kinds of buildings, architectural diversity and ornamentation, landscape elements, street furniture, signage and human activity" (Ewing and Clemente 2000, 6). Sarkar explains that an attractive area creates a positive visual experience by using elements of scale, color, shape and street character. It can be hard to create such attractiveness within roadside environments however level B should include some patterned pavement treatments and small pieces of art. Tasteful passive street furniture, including benches and trees, should also be included but should be separate from active furniture such as mail boxes and telephone booths in order to preserve privacy (Sarkar 2004). Ewing and Clemente found that a mix of public uses and a strong combination of dominant and accenting building colors, as well as many small buildings (rather that a few massive buildings) contribute to complexity.

Other characteristics of attractive roadside environments include: local architectural styles; garden maintenance; pedestrian scale lighting; street trees; shade trees; and lack of litter. Each of these characteristics affects the attractiveness of the pedestrian environment (Moudon et. al. 2007). Activity on the street, provided by things like outside dining and markets, contributes heavily to the attractiveness of the area. People like to be around other people so there is a positive feedback loop: the more pedestrians a street has, the more pedestrians the street will attract.

**Accessibility**

Accessibility is the feature of walkability that transportation planners use most frequently. A large volume of research has shown that the two most important parts of accessibility are land use and network quality. Land use describes what activity happens on the land and typically consists of categories like residential, commercial and industrial. Network quality describes how effectively sidewalks systematically move people from point to point. The accessibility question also addresses design features that cater to the elderly, the handicapped, and the transit dependent.

Land use data explains why people would want to walk to a certain place. Common accessibility gravity models relate the attractiveness of going to certain places with the cost of traveling to them. Places that are more desirable and easier to get to are highly accessible. Accessibility therefore studies land use measures including: the amount of activity, the number of jobs and the number of residences in certain places. Other land use variables recently examined include total retail and service employment, grocery stores, pharmacies, and restaurants and well as health care locations. It is believed that locating next to such activity centers may be attractive to home owners and small business owners (Levinson and Krizek 2008). Song and Knapp's (2003) prominent hedonic model relates land value to measure land use and urban design characteristics. Their study finds that more new urbanist type traditional neighborhood designs that are highly accessible are more valued on the real estate market.

Creating a land use mix conducive to walking is a goal of Transit Oriented Development (TOD). However TOD's primary focus is making transit stops accessible to transit users (Schlossberg and Brown 2004). A large mix of uses and high-density development creates an environment with destinations that are within walking distance of each other. Studies show that half the population is willing to walk distances of up to half a mile to access light rail transit (Mineta Transportation Institute 2007).

Street grid analysis is an interesting field within accessibility research. "Pedestrians believe that their primary consideration in choosing a route is minimizing time and distance (Mineta Transportation Institute 2007, 4)." Urban street grids provide many route choices, many of which are equally direct (Arlinghaus and Nystuen 1991). Desallyes et. al analyzed street networks in two ways. One analyzed the number of destinations visible from each street segment. The other determined the number of destinations reachable with a given number of turns. Other authors have looked at the connectivity and continuity of the street grid as whole, the fineness of the grid (distance between intersections), the density of intersections (number of intersections per square mile), and the difference between actual distance (as the crow flies) and on-street distance between an origin and a destination. Fine-grained grid patterns are a common theme in accessibility. Studies also advocate fine-grained land use patterns, which means small lots sizes with a mix of differing uses and a minimum of parking lots. Geometricians advocate to more diagonal cut-throughs in grid systems because they will shorten trips and separate pedestrians from cars while increasing the number of route options for pedestrians (Arlinghaus and Nystuen 1991).

Accessibility for the handicapped is an important issue that also falls under the accessibility category. The Americans with Disabilities Act has new construction standards that help to make intersections safe for the handicapped. Crossing signals should allow 1 second for every 3.5 feet of road width. Crosswalks should be signaled with tones and well as lights. Textured road treatments are suggested in the crosswalks as well. Curb cuts should have ramps to the street at a slope of no greater than 1:20. Additionally, it is preferable for the curb cut to point in the direction the pedestrian needs to go when crossing the in the crosswalk so that no turning is necessary once on road level. This means that the standard four-way intersections need to have two curb cuts at each corner (see figure 3) (Champaign County Regional Planning Commission 2002).

A successful pedestrian area also caters to transit users. Studies have measured the ability to see and walk to transit stops (Desallyes et. al 2003). Other studies have noted the importance of shelters, benches and other amenities for transit riders (Handy 2001). Of course, the quality of transit service (route and station location appropriateness and frequency) is also an important factor in attracting transit riders (Moudon and Lee 2003).

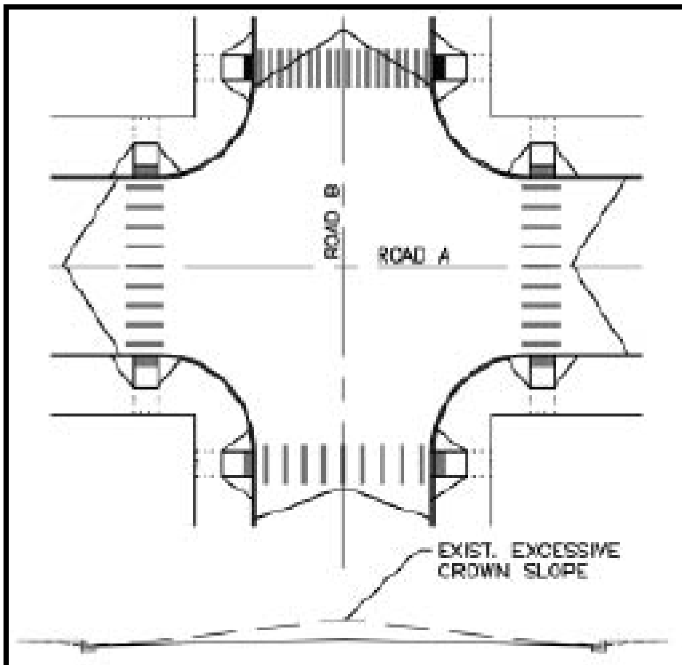

Figure 3: Diagram of ADA compliant street crossings and curb cuts.
Source: Champaign County Regional Planning Commission 2002

**Coherence**

"Coherence refers to a sense of visual order" (Ewing and Clemente 2005, 6). A coherent pedestrian environment fits together well and is easy for the pedestrian to navigate. A coherent area has a few easily recognizable landmarks, however it is more important that most of the buildings fit into the urban fabric and don't stand out too much. Everything needs to fit together. Landscaping and architecture go hand in hand to achieve this goal. The idea of sense of place, in which each part of the city has its own image, is part of the coherence factor. In that way, easily identifiable buildings, courtyards and parks can help explain coherence (Ewing and Clemente 2005). Coherence is generally the hardest category to measure.

## Audit Development

This audit, a combination of a walking survey, GIS, and Sketch-Up evaluation techniques, is designed to provide a tool for neighborhood groups along University Avenue in St. Paul and Minneapolis, Minnesota. The tool will enable these groups to determine the actions needed to ensure that their streets are walkable once the Central Corridor Light Rail Transit (LRT) is built. Additionally, this tool may be modified and enhanced so that it can be used by St. Paul's bicycle and pedestrian planning process to evaluate the pedestrian infrastructure of the entire city. The academic literature lends valuable precedent for evaluating pedestrian environments; thus the five categories presented in the literature review form the framework of the audit.

The goal of this audit is to evaluate the pedestrian environment along University Avenue as a step towards improving the pedestrian accessibility to light rail stations. Studies differ in how far acceptable walking distances for pedestrians are. Some studies show that LRT stops support the largest pedestrians areas, supporting a half-mile pedestrian shed (Mineta Transportation Institute 2007). This study chooses to focuses on a half-mile radius around each station area because using the largest possible pedestrian shed may help spur the largest amount of streetscape improvements. The audit will only evaluate University Avenue and the major north-south streets at each station (i.e. Dale, Snelling, etc.). Data is divided into quarter-mile segments along each road. A quarter-mile is used because it is commonly seen as the maximum distance pedestrians will readily walk (particularly the handicapped and elderly population) and it seemed like a reasonably sized unit of analysis. The quarter mile segments are numbered as follows: Dale 1st Quarter-Mile North, Dale Second Quarter-Mile North, Dale first Quarter-Mile South, Dale Second Quarter-Mile South, University and Dale 1st Quarter-Mile East, etc. Appendix A contains a diagram showing the section breakdown scheme. In total each station area is composed of eight quarter-mile segments. Only the major roads were considered because they are thought to carry the most pedestrian traffic due to the large amount of commercial use on them. Additionally, the residential streets are thought to be relatively uniform compared to the major commercial roads.

The walking survey is the qualitative piece of the audit. As part of the audit development, the researcher tested the first and second drafts of the survey at two different station areas. The second draft of the survey changed the way data is gathered on some elements in an attempt to create the most effective and user-friendly survey. The survey is designed to be conducted by various residents of the neighborhood. The survey is of a combination of counting elements (how many trees?), existence elements (are there pedestrian scale lights?), and qualitative evaluation elements that rank features on a scale of 1 to 3, 1 being the best (such as building texture). Appendix B contains a sample of both the first and second drafts of the pedestrian survey and a suggested third draft of the survey.

As many neighborhood residents as possible are encouraged to participate in the survey portion of the audit. Surveyors should be trained by being presented with examples of what each item of the survey means in order to obtain some degree of uniformity among surveyors. Inter-rater Reliability of Content Analysis (ICC) can be used to control for systematic variation between different surveyors who may evaluate with different biases (Ewing and Clemente 2005). Neighborhood residents' participation in the survey will help create some consensus of what the neighborhood's preferences are for pedestrian environments.

The quantitative piece of the audit is done using GIS data from the city of St. Paul Department of Public Works, Ramsey County and the Lawrence Group. Some analysis is done using Sketch-Up files created by Urban Strategies for St. Paul's station area planning process. Neighborhoods can seek help from U-Plan community planning studio (a program of University United) or University of Minnesota outreach services (such as the Center for Urban and Regional Affairs) to carry out this portion of the pedestrian audit. Appendix C contains a map that demonstrates some of the GIS data that is used for the audit.

Survey data is collected at each block. And then aggregated to quarter-mile sections. GIS data is recorded at the quarter-mile section when initially recorded. There have been two drafts of the walking survey to date and the distinctions between the two are noted. The methods for recording the data for this pedestrian survey are described below. Some variables that the researcher wished to address but could not due to time constraints are noted along with suggestions of how the researcher wished to evaluate them. Appendix D contains a table summarizing all the measurements.

**Comfort**

Condition

The quality of the sidewalk is addressed in the walking survey by ranking the *sidewalk condition* on a scale of 1 to 3. A ranking of 1 is a completely smooth and level sidewalk with no or minimal cracks. A ranking of 2 is a sidewalk with moderate cracks that may be hazardous to a pedestrian who isn't watching where they are going or have limited mobility. A ranking of 3 is a sidewalk with severe cracks that creates significant obstacles for the pedestrian.

Curb Cuts

The number of *driveway curb cuts* that interrupt the sidewalk is counted in the pedestrian survey. Additionally, the *percentage of the sidewalk that is a driveway* is evaluated using GIS sidewalk and curb cut shape files. This measurement is taken by adding the length between all sets of curb cuts on both sides of the road in each quarter mile segment, and dividing that by the total length of all the sidewalks on both sides of the road in each quarter-mile segment.

Widths and Buffering

Average *sidewalk width* is measured in GIS by recording the sidewalk width at the beginning, middle and end of each block on both sides of the road in each quarter mile segment and taking the mean of those measurements. The average *buffer width* is recorded in the same way; buffer widths are only noted for places where a grass buffer between the sidewalk and the road is present. Places with no grass buffer are *not* recorded as a zero because the presence of a grass buffer is addressed by the second draf of the walking survey. Additionally, both walking surveys further evaluate sidewalk buffers by recording the presence of a *parking lane* at each block. The parking lane question allows for the parking lane to be 'conditional' if parking is only allowed during certain hours.

The study intended to evaluate the *number of traffic lanes*, however GIS data was not available as expected, and the variable was not addressed in the walking surveys.

Enclosure

GIS is used to determine the *percentage of the street that is enclosed with a building wall*. This is done with building footprint shapefiles from Ramsey County. The shapefiles are considerably dated and newer buildings are not present on them. This measurement is done by drawing the skinniest possible rectangle, parallel to the street, that crosses through the fronts of those buildings that are in close proximity to the sidewalk. This is done at quarter-mile intervals for both sides of the street at the same time. Buildings that have large setbacks from the sidewalk are not included. The percentage of building footprints that overlap this rectangle are recorded as the *percentage of the street that is enclosed with a building wall*.

Enclosure is further evaluated with the *street cross section* variable, which is recorded from Sketch-Up files. Urban Strategies created three-dimensional Sketch-Up files of a quarter-mile radius around each proposed LRT station area. Due to the limitations of the data, only the first quarter-mile in each direction from each station area is available. This measurement is taken by finding the proportional average building height for each quarter-mile segment. The proportional average is the sum of the product of each building's height and width, divided by the sum of all building widths. Then the average street width is found in each quarter-mile segment, excluding those buildings that are set back very far from the road. The ratio of the road width to the proportional average building height is reduced to its simplest form.

<u>Noise</u>
The researcher sought to evaluate the noise level on the sidewalk however no accessible metric was identified.

**<u>Security</u>**
<u>Transparency</u>
The number of *windows* per block on each side of the road is recorded in the walking survey, and then averaged into quarter-mile sections. Glass surfaces that do not allow vision into the building do not count as windows. For series of very narrow windows, every 4 to 5 windows count as one window. *Sight Lines* are measured in the walking survey by determining from how many blocks away the LRT station and corresponding intersection could be seen.

<u>Other People</u>
The number of people passed on each block were counted in the walking survey and then summed at the quarter-mile section. In the trial runs, walking surveys were not all administered at the same time of day or day of the week, so this measurement is extremely crude.

<u>Previous Crime</u>
The researcher hoped to identify previous incidents of reported crimes and traffic accidents in order to determine the actual level of safety from crime and cars on the street. This analysis was not performed in the test run, but data might be available from the City of St. Paul Police department.

**<u>Attractiveness</u>**
<u>Building Characteristics</u>
*Building texture* is evaluated on a 1 to 3 scale on the block level and then averaged at the quarter-mile section. A rating of 1 is a building that uses several colors that seem to fit well together and uses brick, possibly in combination with some other surface treatments. It is clear that property owners pay attention to the detail and trim of the building. A rating of 2 is a building with brick facades but without great detail, or another appealing non-brick façade texture that is not as appealing as a rate 1 building. A rating of 3 is for buildings that are of a solid unattractive color, or have a harsh texture or feel industrial. The presence of windows may impact the attractiveness of the building texture. While they may impact the survey's rating of the building, they are not explicitly observed in this part of the audit.

*Building Maintenance* is evaluated on a 1 to 3 scale in the first draft of the walking survey. In the second draft of the survey, *Overall Maintenance* replaces *Building Maintenance* because of a concern that *Building Texture* and *Building Maintenance* were redundant. *Overall Maintenance* simply extends the purview of

*Building Maintenance* to include items of the streetscape such as landscaping elements, streetlights, signs, etc. Maintenance scores of 1 are brand new or extremely well cared for construction. Maintenance scores of 2 are older places that have been maintained to respectable standards. There may be some noticeable blemishes but on a whole it is not an eyesore. Maintenance scores of 3 are in disrepair with and with severe cracks and crumbles. There may be rotting wood and cracking paint.

*Vacant Buildings* are counted in the walking survey at the block level and summed at the quarter-mile section. This study also sought to count the number of *historic buildings* in the corridor, however, no buildings were on the National Register of Historic Places and no other suitable list of historic buildings in St. Paul was found.

<u>Vegetation</u>

Trees were counted in both the walking survey and using GIS and summed at the quarter-mile section. The first draft of the walking survey tallied *canopy trees* and *ornamental trees*. Canopy trees have branches that start well above head level and provide ample shade while ornamental trees can be fruit or dwarf trees or young trees that may one day become canopy trees. The second draft of the survey tallied trees based on what side of the sidewalk they were on, either *yard side trees* or *street side trees*, which eliminated the judgment call of canopy or ornamental. Trees were also counted using GIS data from St. Paul's Department of Public Works. This database does not identify what type of tree it is and only includes trees owned by the city so yard trees are not counted.

The quality of the landscaping along the sidewalk is characterized in the walking survey as either *none*, *potted plants* or *landscaped*. Each block was put into one of those three categories and the percentage of blocks in quarter-mile section of *potted plants* and *landscaped* is reported. In blocks characterized as *potted plants* the majority of the vegetation is in planters or in small, contained boxes next to the sidewalk. In blocks characterized as *landscaped*, the majority of the vegetation is part of an intentional landscape design that usually includes a mixture of native grasses, wildflowers and bushes. Blocks are only categorized with *none* if they have no vegetation other than trees and lawn grass.

<u>Sidewalk Environment</u>

The walking survey records the presence of *graffiti* at each block and then transforms that into the percent of blocks with *graffiti* in each quarter-mile section. The first survey draft ranked *litter* on a scale from 1 to 3. However, because the distinctions between levels seemed unclear the second draft of the survey records the presence of *litter* in the same way *graffiti* is recorded. Any instance of graffiti on the block is recorded as graffiti. Litter is only recorded if it is an easily noticeable element of the street because the University Avenue corridor has much litter.

The number of *benches*, of any kind, on each block is recorded and summed into quarter-mile sections.

On each block the dominant character of the *lighting* fixtures is recorded as being auto-scale, pedestrian-scale, or none. A few blocks have equal pedestrian-scale and auto-scale lighting and are recorded as both. Then the dominant form at the quarter-mile section is determined.

The number of *parks* in the entire half-mile radius is found from GIS files from the Lawrence Group that contain all the places of interest in the city. The researcher also intended to record the plazas and courtyards in the study of the ½ mile radius, but no data is available.

The researcher also intended to record the presence of *outdoor dining* in the corridor. However, the study was conducted in late fall when outdoor dining is no longer happening in Minnesota.

**Accessibility**

Network

The Lawrence Group's roads shapefile in GIS Network Analyst is used to evaluate the network along University Avenue. The number of junctions in the GIS network is used to determine the number of *intersections* in the half-mile radius. This is a crude measurement because it really measures the number of turning points for vehicular traffic.

The network analyst Origin-Destination Matrix tool is used to determine the average *difference between distance as the crow files and distance on the network*. A circle with a half-mile radius is drawn around each station area. Then origin points are placed at each intersection of an east-west street and the half-mile circle. Care is taken to make these points symmetrical around the circle. A destination point is put at the proposed LRT station intersection. The Origin-Destination evaluator will determine the distance along the network from each origin to the destination. These distances are averaged and .5 miles is subtracted from the mean to find the average *difference between distance as the crow files and distance on the network*

Crosswalks

The percentage of intersections in each quarter-mile segment with *painted crosswalks* is recorded in the walking survey. The percentage of *textured crosswalks* was sought, however no such crosswalks exist in the study area. Roads that have *medians* in the intersection, which may serve as islands for pedestrians, are shown on GIS curb shapefiles. The presence of such medians is recorded at the quarter-mile section.

The walking survey records the percentage of intersections with *no curb cuts*, *any curb cuts* and *ADA regulation curb cuts* in each quarter-mile section. The second draft of the walking survey split *any curb cuts* into *good curb cuts* and *poor curb cuts*. The percentage of intersections with electronic *pedestrian crossing signals* and with *timed or sound alerted crossing signals* was recorded at the quarter-mile section in the walking survey. Any signs alerting drivers of pedestrians were tallied in the walking survey and summed at the quarter-mile section.

Slope

The number of two-foot contour lines crossed by the road is analyzed using Ramsey County contour line shapefiles and tallied at the quarter-mile segment.

Transit

This study sought to examine the quality of distribution of current and future mass transit stops as well as the frequency of mass transit service. Time was not available to devise such an analysis framework. Data for current mass transit routes and schedules may be available from Metro Transit and data for future mass transit routes and schedules may be available in the draft EIS for the Central Corridor LRT project.

**Coherence**

The number of *landmarks* in the entire half-mile radius is found from GIS files from the Lawrence Group that contain all landmarks in the city. The GIS file identifies school, government, institutional and other such buildings as landmarks.

## Audit Testing

### A Land Use Pattern Spectrum

The audit was tested on the half-mile station areas around the future Central Corridor LRT stops at the Dale Street and University Avenue intersection and the Fairview Avenue and University Avenue intersection. Dale and Fairview were chosen because they have widely differing land use and building footprint patterns. Appendix E and F show land use maps and aerial photos of the half-mile radius around the Dale and Fairview stations. Dale has a fine-grained pattern with small lots and building footprints and a mix of commercial and residential uses. The Rice and potential Western and Victoria station areas have similar land use patterns to that of the Dale station area. Fairview has a bulky land use pattern with large lots and building footprints. The Fairview station area has industrial, commercial and residential uses, however they are not mixed to the degree they are in the Dale station area. The Gateway and 29$^{th}$ Avenue station areas have land use patterns similar to Fairview. Raymond, Snelling and the potential Hamline station area's land use patterns lie in the middle of this spectrum.

While fine-grained land use patterns are regarded as more pedestrian friendly, the spectrum is not used to evaluate the pedestrian environment in this study. It is simply used only as a rationale for selecting the Dale and Fairview station areas for study. However, the fine-grained land use pattern makes Dale perform better in Accessibility criteria.

### Dale and Fairview Observations

Appendix G and H show the pedestrian audit data summary. These charts can help evaluate the methodology of the audit and partially reveal the conditions of the pedestrian environment in the Dale and Fairview half-mile station areas. As a part of the process of calibrating the audit, these findings must be combined with firsthand local knowledge of what the conditions along the University are like. This will create a better understanding of what the numbers in the audit really mean.

#### Comfort

The study shows that while Dale is more comfortable in some ways, Fairview is more comfortable in others. Fairview and the southern portion of Dale have quite narrow sidewalks. While the narrowness might reflect lower pedestrian volume, it also may make pedestrians feel cramped at times. In general the north-south collector roads (Dale and Fairview *collect* traffic from the neighborhood streets to provide access to University, the *arterial*) have older sidewalks that are in worse condition than those on University. The age of the north-south sidewalks may account for those sidewalk's narrowness. It was expected that curb cuts and driveways in sidewalks would be more common in places with finer grained land use patterns such as Dale, however, curb cuts do not seem to differ between the two areas.

The width of University Avenue reduces its comfort of the enclosure. The north-south roads have better enclosure ratios, near 2:1, while University has a ratio of 4:1. While the optimal ratio is 3:1, a smaller ratio than 3:1 is usually preferred over a larger one. Dale Street has the best percentage of building coverage along the sidewalk. This might show that finer grained building footprints actually increase the sidewalk coverage percentage. It might also be due to smaller building setbacks in the Dale area.

The Dale station area has fewer sections with a grass buffer than does the Fairview station area. Additionally, the grass buffers in the Dale area are narrower on average than in Fairview. Of the few grass buffers along University Avenue in the Dale station area, most are in front of buildings that are former homes.

Security

The Dale station area has more windows than the Fairview area with the exception of the area south of University on Dale. Additionally, the Dale area has longer sightlines because University turns onto an angle near Fairview. In both station areas, Interstate-94 reduces the sightlines to the south. This condition is even worse in the Fairview area because Fairview passes under Interstate-94 while Dale passes over it.

Attractiveness

The texture and maintenance ratings vary greatly across all sections of both half-mile station areas. This shows that the texture is specific to architecture of individual buildings and maintenance is specific to individual building owners. The lack of any discernable differences among these 1 to 3 rating scales may indicate that such a rating system is too arbitrary and not an effective means of measuring.

Fairview has many more vacant buildings. The large industrial lots and big box commercial stores in the area are bad for the small businesses and cause significant vacant storefronts.

Graffiti is not a significant issue on the University Avenue Corridor. Litter however seems to be everywhere and is often blown around by strong winds. There are very few benches on University, and most are at bus stops. The Dale station area has a significant amount of pedestrian scale streetlights while the Fairview area has none.

Vegetation is well developed and attractive on Dale and along University in the Fairview station area. Vegetation is sparse on Fairview and along University in the Dale station area. There are many trees spread across the entire University Avenue corridor, however there are more in the Dale station area than in Fairview. The fewest trees are on Fairview north of University. The small numbers of sidewalk trees and large numbers of yard trees in the second draft of the walking survey suggest that the ornamental/canopy tree distinction may be more useful than the street/sidewalk tree distinction.

Accessibility

The Dale and Fairview station areas contain similar numbers of turning points. The difference between distance as the crow flies and distance via the grid is shorter in the Dale station area, which confirms that regular grid patterns provide more direct routes.

The entire University Avenue corridor has crosswalk curb cuts, however most of them do not meet ADA standards, and some are very old and in disrepair. The few curb cuts that are ADA compliant are in areas with new construction. Additionally, the corridor has many unpainted crosswalks and no crosswalks with a textured treatment. University Avenue has medians in the middle of the road that can be islands for pedestrians while the north south streets do not. Medians are more necessary on University because it is such a wide street.

The Dale station area has more crossing signals than the Fairview station area. The entire corridor lacks signs alerting drivers of pedestrians.

Coherence

There is not sufficient data to evaluate coherence with this audit. Both areas have the same number (7) of landmarks. However, it is unclear whether or not the buildings identified as landmarks on Lawrence Group's landmark file accurately represent what pedestrians will perceive to be area landmarks. The well-developed street grid in the Dale station area makes Dale easily navigable.

## Recommendations

### Audit Improvements

The strength of this audit tool is that it is accessible to the average resident and therein can educate the public in how to understand and talk about their pedestrian environment. This report gives the DCC and other neighborhood groups the language of pedestrian environments that will enable them to create more compelling grant applications and develop more effective neighborhood street design standards.

The measurement techniques used in the initial runs of the audit are somewhat imprecise. More exact and quantitative measurements may be useful if the organizational capacity for such measurements exists. However, the researcher firmly believes that the tool may be effective without any highly scientific measurements.

Each time the tool is used to evaluate a pedestrian environment, there is an opportunity to improve the tool. All measurements should be recorded, and every set of numbers should be accompanied by a qualitative description of what the place actually feels like and why the audit team likes or dislikes that place. Before each implementation of the tool, all previous quantitative and qualitative data should be reviewed. Over time this ground-truthing will refine the audit.

No acceptable GIS data was found for some pieces of the survey, so alternative measurement techniques may be added in the future. To evaluate the issue of unattractive parking lots that are an obstacle to pedestrians, a tally of parking lots abutting the sidewalk could be added to the walking survey. Additionally, the walking survey could count the number of driving lanes at each block to evaluate road width. Alternatively, parking lots and road lanes are big enough that they may be counted using Google Earth images. Finally, The Urban Strategies! team working on the LRT Station Area planning for St. Paul may be able to provide a list of historic buildings in the University Avenue Corridor.

In addition to finding ways to measure the elements this audit identified but failed to measure, there are several improvements can be made on those elements that were measured. Counting trees using the canopy/ornamental technique seemed to be more useful that the street/yard distinction. The GIS tree file counts street trees, so counting street/yard trees in the walking survey may be redundant. Keep in mind that counting trees in this way is difficult because it is both a qualitative and quantitative measurement. Trees must be qualitatively put into categories but then counted quantitatively. Because street parking is conditional on all major roads, the conditional category can be merged with the yes category for street parking. The average widths of the sidewalks and curb cuts may be measured more precisely. One solution would be to find the area of the entire sidewalk (which is in essence a long skinny rectangle) with the GIS area calculator, and then dividing the calculated area by the measured block length. The window counting technique, which is a proxy measure of transparency, may also be refined. For one, counting series of long skinny windows often got messy. A better solution may be to estimate the percentage of each building façade that is a window that provides a view inside the building.

Some pieces may be removed from the walking survey. GIS data can find grass buffers and curb cuts effectively so removing these from the walking survey is advisable. Additionally, the building height estimation in the walking survey is not very useful because it can be measured with sketch-up effectively. Simplifying the walking survey as much as possible will help the accuracy of those elements that are measured in the walking survey.

In order to most accurately evaluate the findings of this audit each neighborhood must determine their preferences in their pedestrian environment. This may be done with a visual preference survey. In a visual preference survey, a group of neighborhood residents will be shown a series of pictures depicting features of pedestrian environments. One series may be of different types of landscaping and street vegetation. Another series will depict different kinds of sidewalk dimensions, another building façades, and another street furniture etc. In this way the neighborhood residents will set the standards for the pedestrian environment. Not until such standards have been created can the result of the pedestrian audit be accurately measured.

**Improvements in the Dale and Fairview Station Area and on University in General**

Even without the visual preference survey, there are some common best practices that can be recommended for University Avenue. University has strengths that can make it a natural area for pedestrians. It's historic architecture, diverse population, traditional street grid system and existing commercial areas all have positive impacts on the pedestrian environment. To improve University Avenue's pedestrian environment the following four goals should are proposed.

Improve the Enclosure

University is a very wide street. In places with low-rise buildings, wide streets create an uncomfortable enclosure in which people feel exposed. White the installation of the LRT tracks down the middle of the corridor may help the enclosure, one-story buildings should be prohibited because they leave the pedestrian space feeling undefined. Additionally, University has many car dealerships, big box retail stores and other buildings with large setbacks. Large setbacks also are detrimental to the sense of enclosure on University and should be prohibited. Finally, many buildings in the University corridor use uncomfortable, industrial-feeling building façades. These make pedestrians uncomfortable and should be prohibited along University.

Become ADA Compliant

Many improvements can be made along University to make it more accessible for disabled and elderly populations. Most crosswalk curb cuts on University are not compliant with the American Disabilities Act. Converting single curb cuts to split curb cuts that point in the direction the pedestrian needs to walk should be pursued. Textured crosswalk treatments should be installed at the busiest intersections. Some intersections already have beeping crosswalk signalization and more should be installed. Finally, a street maintenance program should be started. It would surface old sidewalks on a regular interval and ensure that all sidewalks are adequately shoveled and salted in the winter.

Activate the Street

Creating more active pedestrian areas is also an important goal. Pedestrian traffic volume should be monitored to determine if sidewalks should be widened in order to maintain appropriate service levels on the street. Street furniture such as benches and public art should be installed. More active uses should be encouraged in the commercial areas, including outdoor dining, street vendors and public markets.

Design for Entire Community

The University Avenue Corridor has many schools and many kids with working parents. University needs to provide for the entire community by making the pedestrian environment friendly to children by providing them safe access to their school and after school activities. In addition to serving the elderly population with ADA compliant sidewalks, the pedestrian environment can serve as a gathering place for the elderly.

**Concluding Remarks**

The neighborhoods along University need to make a clear powerful statement that their primary commercial corridor is a place for pedestrians, and actions speak louder than words. Signs, alerting drivers that the street is a place for pedestrians as well as cars would be a big first step towards giving pedestrians equal rights as cars. Design features that are clearly for pedestrians are a logical next step. These design features would involve any number of the suggestions made above, and be prioritized by the community going through the pedestrian audit process. The motivation for this report is that increased pedestrian traffic will ensure success of the light rail project and invigorate commercial areas. However, if funds for pedestrian infrastructure projects cannot come from the federal LRT New Starts funding, it can come from grants for neighborhood revitalization or active living projects.

Many studies have shown that the one of the most important pieces to increasing pedestrian travel has nothing to do with the physical infrastructure. Building a positive perception of walking within the community must be part of any effort to increase walking in a neighborhood. The University Avenue community's work to build better pedestrian infrastructure must be paired with citizen education efforts that will create a neighborhood culture valuing sustainable modes of transportation. Furthermore, building better pedestrian spaces will provide visual examples of neighborhood stewardship. These constant visual reminders will help create more pedestrian values in the community. Community building efforts must work in concert with architectural design to help our culture throw down the car and relearn how to get around using public transit and their own two feet.

This paper provides a vocabulary for describing pedestrian environments. Additionally, the pedestrian audit will allow the DCC and other neighborhood groups to analyze the pedestrian environment along the University Avenue Corridor. This process is best accompanied by a visual preference survey to collect the neighborhood preferences for their pedestrian environment. The pedestrian audit may be improved and expanded for broader use across the entire City of St. Paul. The results of the pedestrian audit will allow Central Corridor LRT planning efforts to adequately address the issue of pedestrian access to stations. This audit can help create better plans for any other pedestrian environment as well.

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Appendix A: Fruin's Levels of Service for Pedestrian Areas

## LEVEL-OF-SERVICE DESCRIPTIONS FOR WALKWAYS

### Level of Service A

**Average Pedestrian Area Occupancy:** 35 square feet per person, or greater.
**Average Flow Volume:** 7 PFM, or less. *

At walkway level-of-service A, sufficient area is provided for pedestrians to freely select their own walking speed, to bypass slower pedestrians, and to avoid crossing conflicts with others. Designs consistent with this level-of-service would include public buildings or plazas without severe peaking characteristics or space restrictions.

### Level of Service B

**Average Pedestrian Area Occupancy:** 25-35 square feet per person.
**Average Flow Volume:** 7-10 PFM.

At walkway level-of-service B, sufficient space is available to select normal walking speed, and to bypass other pedestrians in primarily one-directional flows. Where reverse-direction or pedestrian crossing movements exist, minor conflicts will occur, slightly lowering mean pedestrian speeds and potential volumes. Designs consistent with this level-of-service would be of reasonably high type, for transportation terminals and buildings in which recurrent, but not severe, peaks are likely to occur.

### Level of Service C

**Average Pedestrian Area Occupancy:** 15-25 square feet per person.
**Average Flow Volume:** 10-15 PFM.

At walkway level-of-service C, freedom to select individual walking speed and freely pass other pedestrians is restricted. Where pedestrian cross movements and reverse flows exist, there is a high probability of conflict requiring frequent adjustment of speed and direction to avoid contact. Designs consistent with this level-of-service would represent reasonably fluid flow; however, considerable friction and interaction between pedestrians is likely to occur, particularly in multi-directional flow situations. Examples of this type of design would be heavily used transportation terminals, public buildings, or open spaces where severe peaking, combined with space restrictions, limit design flexibility.

**PFM = Pedestrians per foot width of walkway, per minute.**

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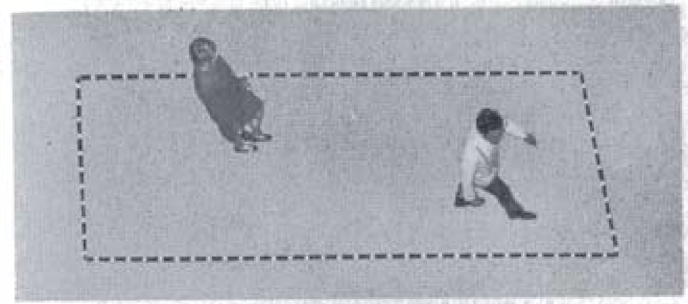
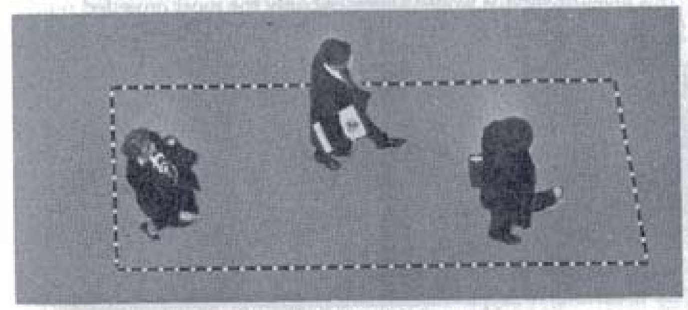
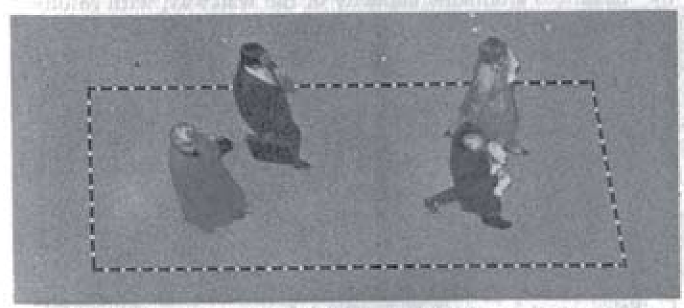
## LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS



Level of Service A



Level of Service B



Level of Service C

75

Appendix A: Fruin's Levels of Service for Pedestrian Areas, continued

### Level of Service D

**Average Pedestrian Area Occupancy:** 10-15 square feet per person.
**Average Flow Volume:** 15-20 PFM.

At walkway level-of-service D, the majority of persons would have their normal walking speeds restricted and reduced, due to difficulties in bypassing slower-moving pedestrians and avoiding conflicts. Pedestrians involved in reverse-flow and crossing movements would be severely restricted, with the occurrence of multiple conflicts with others. Designs at this level-of-service would be representative of the most crowded public areas, where it is necessary to continually alter walking stride and direction to maintain reasonable forward progress. At this level-of-service there is some probability of intermittently reaching critical density, causing momentary stoppages of flow. Designs consistent with this level-of-service would represent only the most crowded public areas.

### Level of Service E

**Average Pedestrian Area Occupancy:** 5-10 square feet per person.
**Average Flow Volume:** 20-25 PFM.

At walkway level-of-service E, virtually all pedestrians would have their normal walking speeds restricted, requiring frequent adjustments of gait. At the lower end of the range, forward progress would only be made by shuffling. Insufficient area would be available to bypass slower-moving pedestrians. Extreme difficulties would be experienced by pedestrians attempting reverse-flow and cross-flow movements. The design volume approaches the maximum attainable capacity of the walkway, with resulting frequent stoppages and interruptions of flow. This design range should only be employed for short peaks in the most crowded areas. This design level would occur naturally with a bulk arrival traffic pattern that immediately exceeds available capacity, and this is the only design situation for which it would be recommended. Examples would include sports-stadium design, or rail transit facilities where there may be a large but short-term exiting of passengers from a train. When this level-of-service is assumed for these design conditions, the adequacy of pedestrian holding areas at critical design sections, and all supplementary pedestrian facilities, must be carefully evaluated.

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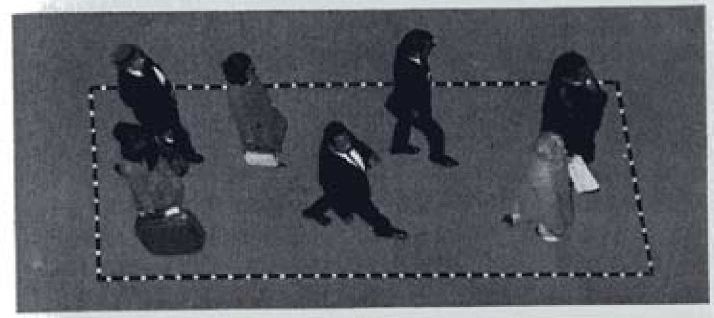
## LEVEL OF SERVICE ILLUSTRATIONS FOR WALKWAYS



Level of Service D

Level of Service E

Level of Service F

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Appendix A: Fruin's Levels of Service for Pedestrian Areas, continued

## Level of Service F

**Average Pedestrian Area Occupancy:** 5 square feet per person, or less.

**Average Flow Volume:** Variable, up to 25 PFM.

At walkway level-of-service F, all pedestrian walking speeds are extremely restricted, and forward progress can only be made by shuffling. There would be frequent, unavoidable contact with other pedestrians, and reverse or crossing movements would be virtually impossible. Traffic flow would be sporadic, with forward progress based on the movement of those in front. This level-of-service is representative of a loss of control, and a complete break-down in traffic flow. Pedestrian areas below 5 square feet are more representative of a queuing, rather than a traffic-flow situation, and this level-of-service is not recommended for walkway design.

**LEVEL OF SERVICE STANDARDS FOR WALKWAYS**
Volume (P) vs. Module (M)

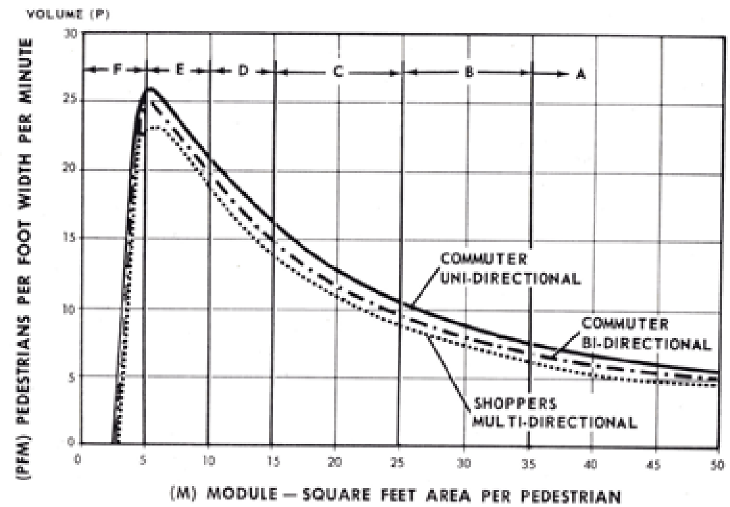


Figure 4.1

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Appendix B:

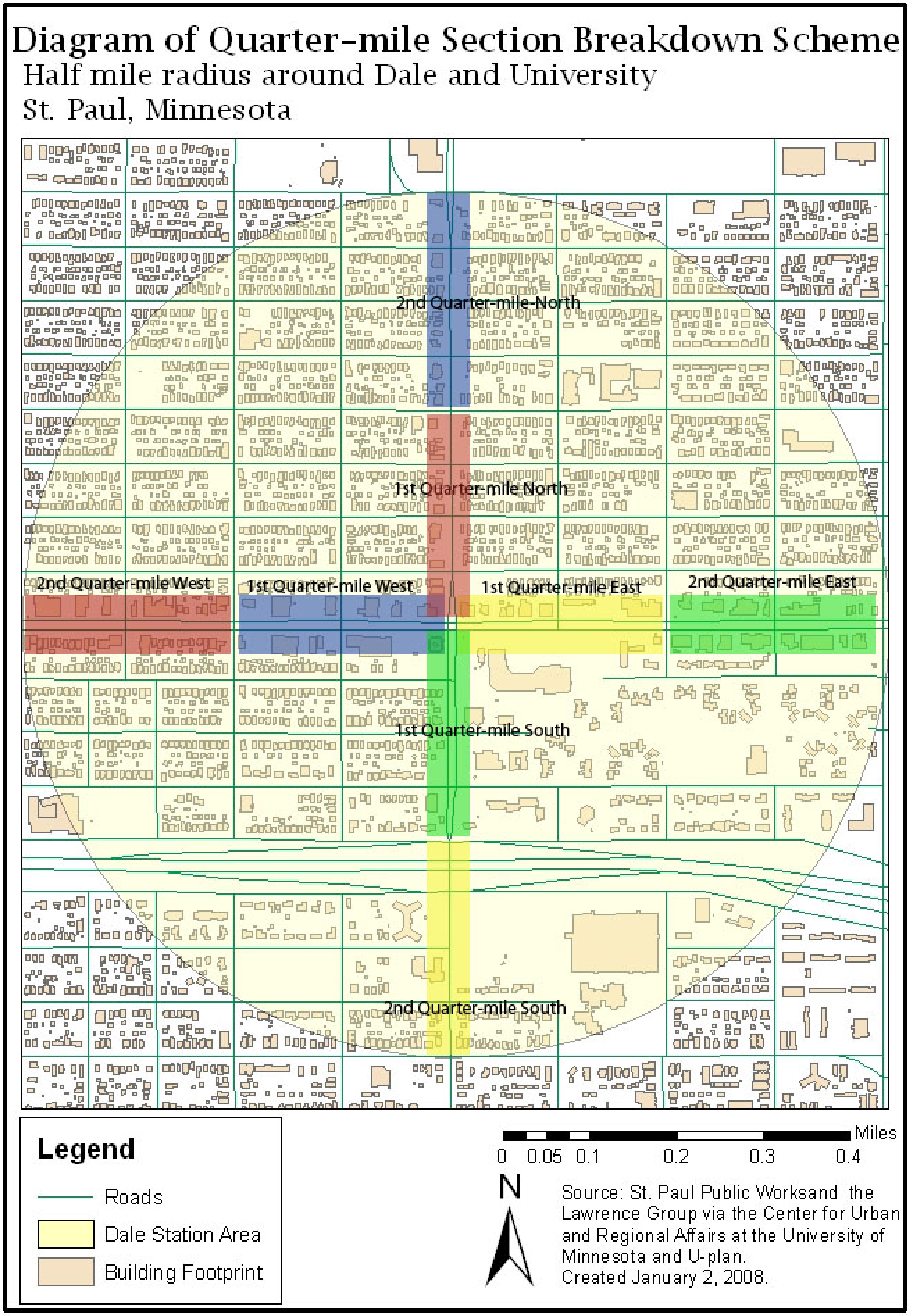


Diagram of Quarter-mile Section Breakdown Scheme
Half mile radius around Dale and University
St. Paul, Minnesota
2nd Quarter-mile-North
1st Quarter-mile North
2nd Quarter-mile West
1st Quarter-mile West
1st Quarter-mile East
2nd Quarter-mile East
1st Quarter-mile South
2nd Quarter-mile South
Legend
Roads
Dale Station Area
Building Footprint
Miles
0 0.05 0.1 0.2 0.3 0.4
N
Source: St. Paul Public Worksand the Lawrence Group via the Center for Urban and Regional Affairs at the University of Minnesota and U-plan.
Created January 2, 2008.

Appendix C: Walking Surveys

1st Draft

Block Section Numer ______________________ Side of Street

______________ From __________ to ______________ N S E W

Street Lights Ped. Scale Auto Scale

Vegetation None Potted Plants Landscaped

| | | | | | Tally |
|---|---|---|---|---|---|
| Graffiti | Present | | Not Present | | |
| Building Texture | 1 | 2 | 3 | Driveway Curb Cuts | |
| Side Walk Quality | 1 | 2 | 3 | Windows (ground level *) | |
| Building Maint. | 1 | 2 | 3 | Vacant Buildings | |
| Litter | 1 | 2 | 3 | Ornamental Trees | |
| Parking Lane | Y | C | N | Canopy Trees | |
| Average Hieght | 1 | 2 | 3 | Persons Passed | |
| | | | | Benches | |

***At end Of Block***

Cross Walk Type None Paint Texture Cross Walk Curb Cuts Y ADA N

Signal Type None Light Only Light with Timer or Beeps Sight Line to Station

Pedestrian Signage ______________________ Y N

*arrays of very skinny windows will county as only one window, or two windows if they cover the entire building face

Appendix C: Walking Surveys continued

2nd Draft

Block Section Numer ____________________ Side of Street
__________ From ______ to ______________ N S E W

Street Lights Ped. Scale Auto Scale

Vegetation None Potted Plants Landscaped Grass Buffer?

Graffiti Present Not Present

| | | | | | Tally |
|---|---|---|---|---|---|
| Building Texture | 1 | 2 | 3 | Driveway Curb Cuts | |
| Side Walk Quality | 1 | 2 | 3 | Windows (ground level *) | |
| Overall Maint. | 1 | 2 | 3 | Vacant Buildings | |
| Litter | Y | | N | Street Trees | |
| Parking Lane | Y | C | N | Yard Trees | |
| Average Hieght | 1 | 2 | 3 | Persons Passed | |
| | | | | Benches | |

***At end Of Block***

Cross Walk Type None Paint Texture

Cross Walk Curb Cuts ADA Good Bad None

Signal Type None Light Only Light with Timer or Beeps

Sight Line to Station Y N

Pedestrian Signage ______________________

Appendix C: Walking Surveys continued

Suggested 3rd Draft

Block Section Numer ____________________ Side of Street

____________ From ________ to ______________ N S E W

Street Lights Ped. Scale Auto Scale

Vegetation None Potted Plants Landscaped

| | | | | | |
|---|---|---|---|---|---|
| Graffiti | Present | | Not | | Tally |
| Litter | Present | | Not | Parking Lots | |
| Parking Lane | Present | | Not | Vacant Buildings | |
| Building Texture | 1 | 2 | 3 | Ornamental Trees | |
| Side Walk Quality | 1 | 2 | 3 | Canopy Trees | |
| Overall Maint. | 1 | 2 | 3 | Persons Passed | |
| Approx. Window Area (%) ________ | | | | Benches | |

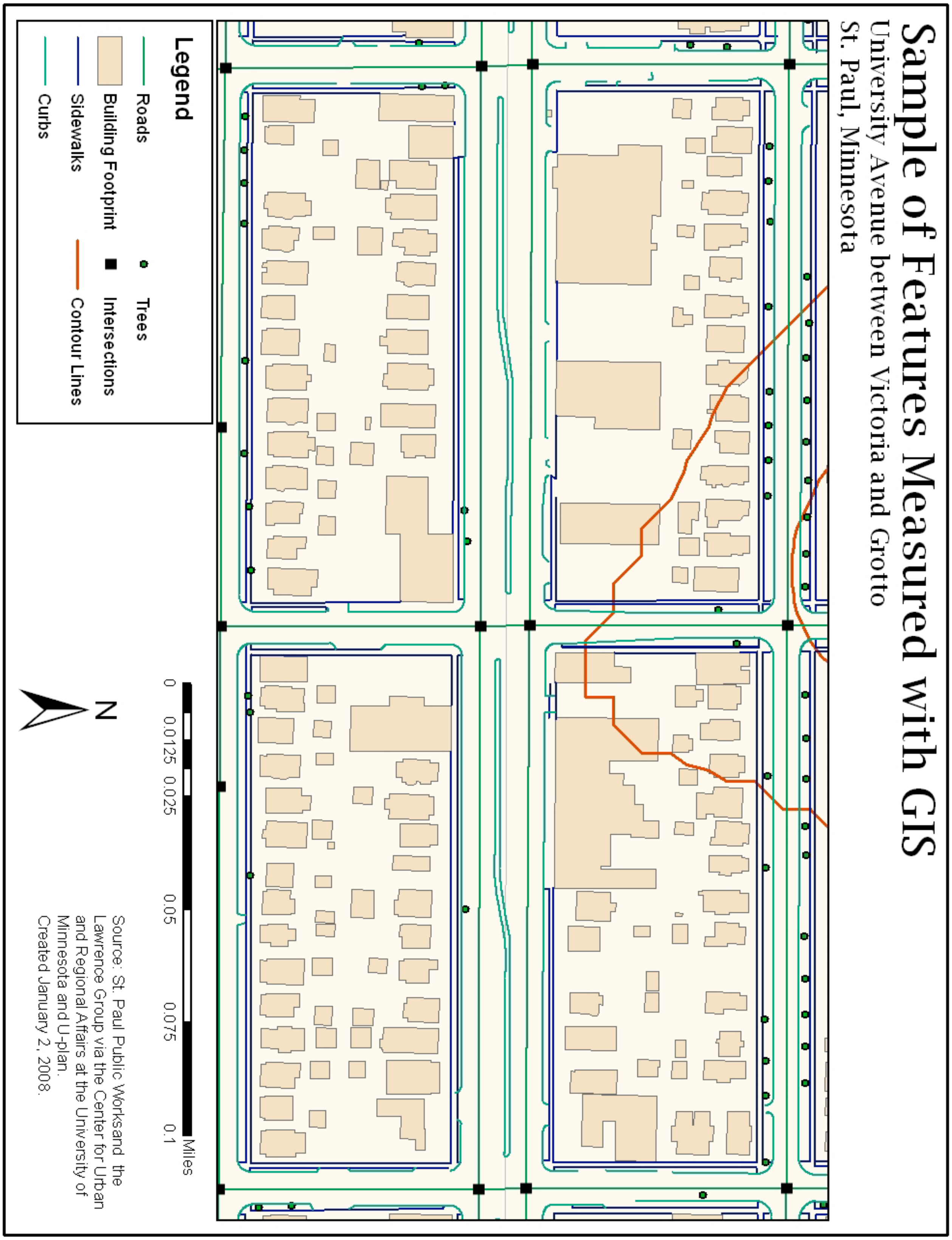
***At end Of Block***

Cross Walk Type None Paint Texture Cross Curb Cuts ADA Good Bad None

Signal Type None Light Only Light with Timer or Beeps Sight Line to Station

Pedestrian Signage ______________________ Y N

Appendix D:


Sample of Features Measured with GIS
University Avenue between Victoria and Grotto
St. Paul, Minnesota
Legend
Roads
Building Footprint
Sidewalks
Curbs
Trees
Intersections
Contour Lines
N
0 0.0125 0.025 0.05 0.075 0.1 Miles
Source: St. Paul Public Worksand the Lawrence Group via the Center for Urban and Regional Affairs at the University of Minnesota and U-plan.
Created January 2, 2008.

Appendix E: Table of Variables Measured

| Factors/Characteristics | Unit | Measure | Source |
|---|---|---|---|
| **Comfort** | | | |
| Number of traffic lanes | count | | |
| Sidewalk width | meters | average per quartermile | GIS, St. Paul Public Works |
| Sidewalk condition | scale | rank 1 to 3 | walking survey |
| Sidewalk that is driveway | percent | Percentage of Block | GIS, St. Paul Public Works |
| Driveway curb cuts | count | Number per block | walking survey |
| Street cross section, enclosure | ratio | compare to 3 to 1 standard | Sketch up |
| Street that is a building wall | percent | sidewalk edge that in covered with building wall | GIS, Ramsey County |
| Building height (stories) | average | number of stories | walking survey |
| Buffer width | meters | average per quartermile | GIS, St. Paul Public Works |
| Parking lane | presence | dominant type per quartermile | walking survey |
| Grass buffer | percent | blocks per quartermile | walking survey |
| Noise level | | | |
| **Security** | | | |
| Transparency (number of windows) | average | number of windows on block | walking survey |
| Number of people | count | rough count | walking survey |
| Safe from crime | | | |
| Safe from traffic | | | |
| Site lines | blocks | # of blocks from station is visible from | walking survey |

Appendix E: Table of Variables Measured, Continued

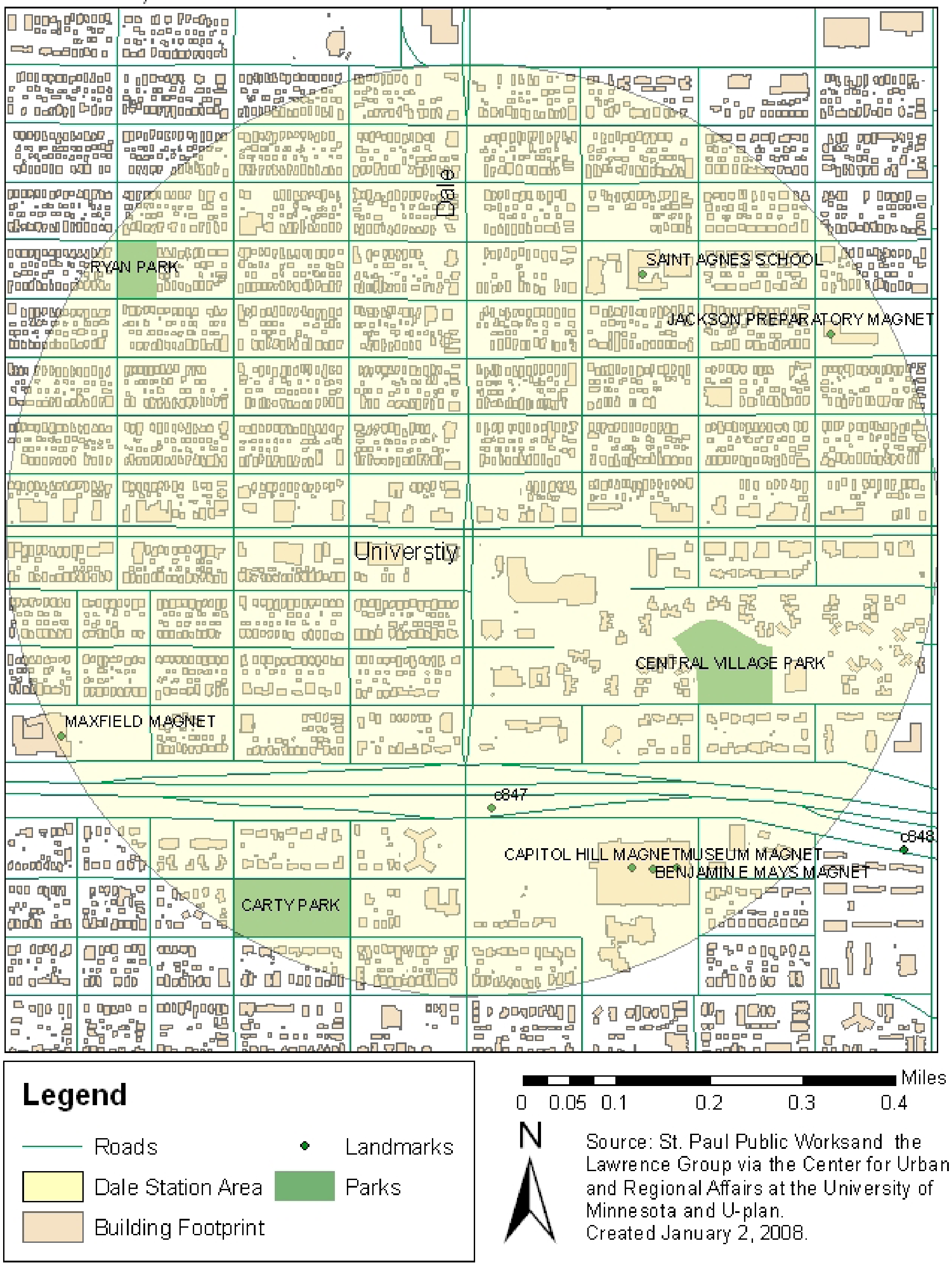
| Factors/Characteristics | Unit | Measure | Source |
|---|---|---|---|
| **Attractiveness** | | | |
| Number of historic buildings | count | | |
| Presence of outdoor dining | presence | | |
| Number of parks, plazas, etc. | count | parks in halfmile radius | GIS, Lawrence |
| Texture (colors, texture, etc) | scale | rank 1 to 3 | walking survey |
| Overall maintenance | scale | rank 1 to 3 | walking survey |
| Vacant buildings | count | count per block | walking survey |
| Graffiti | percent | blocks with presence | walking survey |
| Litter (Dale) | scale | rank 1 to 3 | |
| Litter (Fairview) | percent | blocks with presence | walking survey |
| Benches | count | count per block | walking survey |
| Potted plants | percent | blocks with dominant type | walking survey |
| Landscaped | percent | blocks with dominant type | walking survey |
| Number of yard trees | count | rough count on block | walking survey |
| Number of sidewalk trees | count | rough count on blck | walking survey |
| GIS trees | count | public trees | GIS, St. Paul Public Works |
| Street lighting | type | dominat typeon block | walking survey |
| **Accessibility** | | | |
| Slope (countour lines) | count | countour lines | GIS, Ramsey County |
| Parking lots | | | |
| Bus/LRT stops | | | |
| Bus/LRT frequency | | | |
| Number of Intersections | count | #4 turning points | GIS, Lawrence Group |
| Adtl. distance on street network | miles | Difference between average distance on netework from points on halfmile radius and .5 miles | GIS, Lawrence Group |
| Intersections with timer or beeps | percent | type at intersection | walking survey |
| Intersections with light | percent | type at intersection | walking survey |
| Pedestrian crossing signs | presence | on block | walking survey |
| Good crosswalk curb cuts | percent | type at intersection | walking survey |
| Poor crosswalk curb cuts | percent | type at intersection | walking survey |
| ADA crosswalk curb cuts | percenet | type at intersection | walking survey |
| Crosswalks | percent | painted crosswalk at intersection | walking survey |
| Median | presence | blocks with in middle of road | GIS, St. Paul Public Works |
| **Coherence** | | | |
| Points of interest | count | schools and public buildings | GIS, Lawrence Group |

Appendix F: Dale Land Use Maps

# Dale Station Area Land Use Map

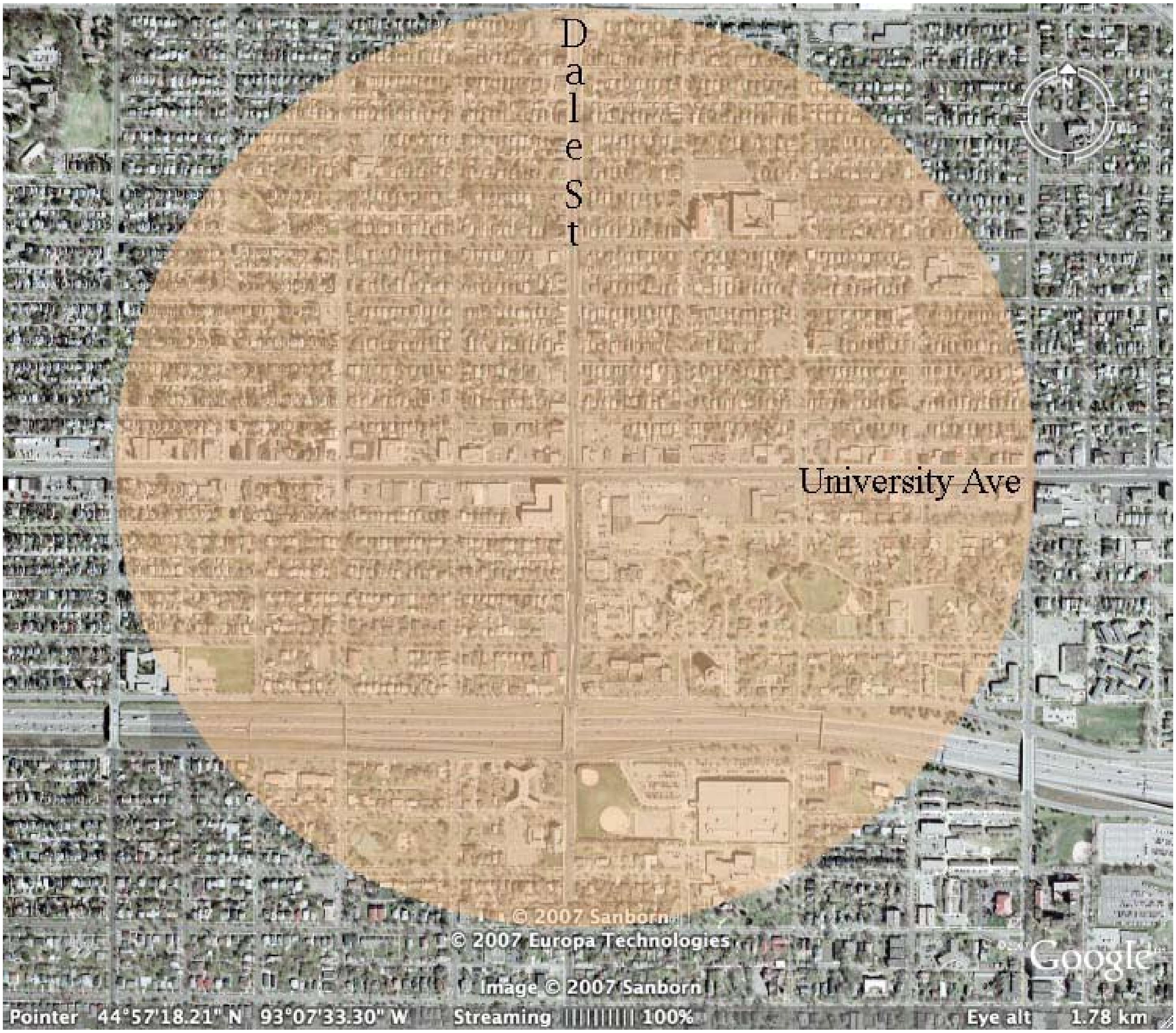
## Half mile radius around Dale and University

## St. Paul, Minnesota

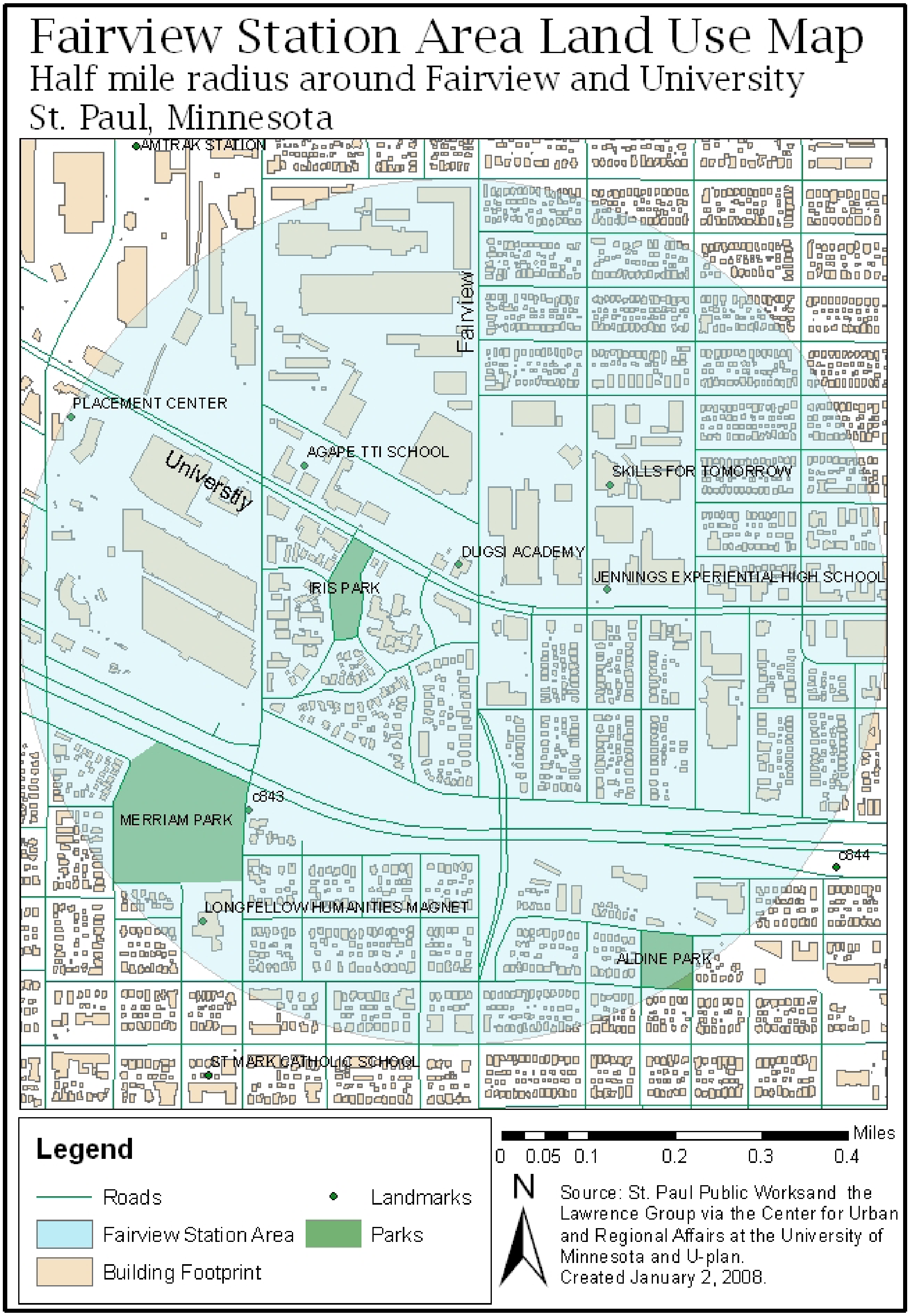



Source: St. Paul Public Worksand the Lawrence Group via the Center for Urban and Regional Affairs at the University of Minnesota and U-plan.
Created January 2, 2008.

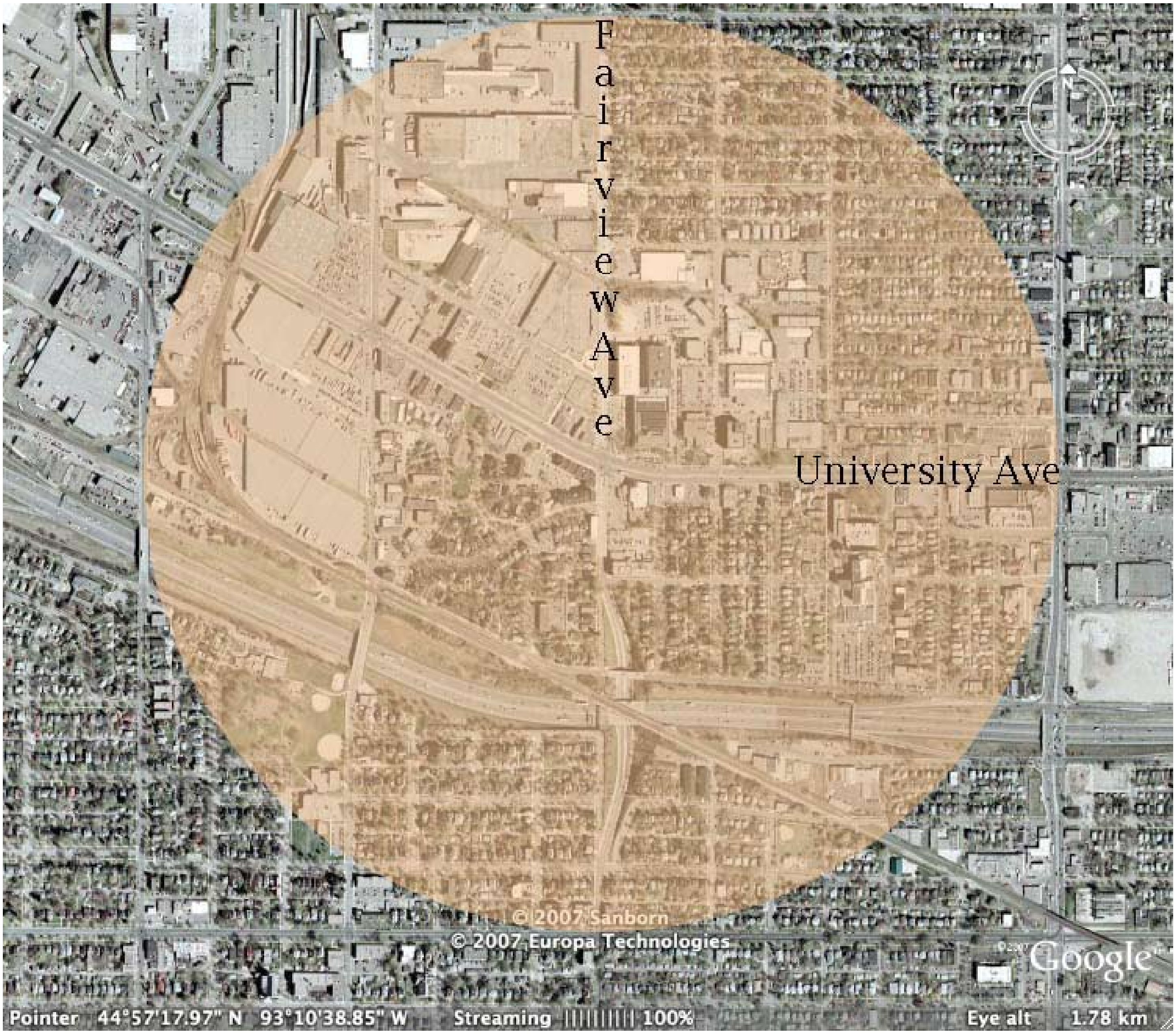
Appendix F: Dale Land Use Maps Continued



Appendix G: Fairview Land Use Maps



Appendix G: Fairview Land Use Maps Continued



Appendix H: Dale Pedestrian Environment Data Table

| | | Dale and University Station Area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dale | | | | | University | | | | | |
| **Factors/Characteristics** | **Unit** | 1st Quartermile North | 2nd Quartermile North | 1st Quartermile South | 2nd Quartermile South | Dale Entire | 1st Quartermile West | 2nd Quartermile West | 1st Quartermile East | 2nd Quartermile East | Entire Universtiy | 1/2 Mile Radius |
| **Comfort** | | | | | | | | | | | | |
| Number of traffic lanes | count | | | | | | | | | | | |
| Sidewalk width | meters | 2.12 | 2.53 | 1.54 | 1.88 | | 2.75 | 2.67 | 2.57 | 3.16 | | |
| Sidewalk condition | scale | 1.75 | 1.38 | 0.70 | 2.17 | | 2.75 | 2.00 | 2.33 | 2.50 | | |
| Sidewalk that is Driveway | percent | 16% | 15% | 13% | 5% | | 17% | 8% | 11% | 7% | | |
| Driveway curb cuts | count | 11 | 12 | 7 | 4 | | 15 | 10 | 15 | 11 | | |
| Street cross section, enclosure | ratio | | | | | 2:1 | | | | | 4:1 | |
| Street that is a building wall | percent | 25% | 22% | 7% | 10% | | 41% | 54% | 22% | 55% | | |
| Building hieght (stories) | average | 2 | 1.88 | 1.63 | 2.6 | | 1.75 | 1.75 | 1.67 | 1.5 | | |
| Buffer width | meters | | | | | 2.00 | | | | | 1.84 | |
| Parking lane | presence | condi | condi | no | no | | condi | condi | condi | cond | | |
| Grass buffer | percent | 0% | 0% | 38% | n/a | | 0% | 25% | 0% | 0% | | |
| Noise level | | | | | | | | | | | | |
| **Security** | | | | | | | | | | | | |
| Transparency (windows per block) | average | 4.13 | 3.88 | 1.88 | 1.13 | | 10.5 | 16 | 26 | 67 | | |
| Number of people | count | 29 | 14 | 16 | n/a | | 9 | 16 | 16 | 20 | | |
| Safe from crime | | | | | | | | | | | | |
| Safe from traffic | | | | | | | | | | | | |
| Site lines | blocks | 8 blocks | | 6 blocks | | | 4 blockls | | 4blocks | | | |

Appendix H: Dale Pedestrian Environment Data Table, continued

| | | Dale and University Station Area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dale | | | | | University | | | | | |
| **Factors/Characteristics** | **Unit** | 1st Quartermile North | 2nd Quartermile North | 1st Quartermile South | 2nd Quartermile South | Dale Entire | 1st Quartermile West | 2nd Quartermile West | 1st Quartermile East | 2nd Quartermile East | Entire Universtiy | 1/2 Mile Radius |
| Number of historic buildings | count | | | | | | | | | | | |
| Presence of outdoor dining | presence | | | | | | | | | | | |
| Number of parks, plazas, etc. | count | | | | | | | | | | | 3 |
| Texture (colors, texture, etc) | scale | 1.75 | 1.14 | 1.88 | 1.80 | | 1.50 | 1.25 | 2.67 | 1.50 | | |
| Building maintenance | scale | 2.13 | 1.50 | 1.63 | 1.40 | | 1.25 | 2.75 | 2.33 | 1.50 | | |
| Vacant buildings | count | 1 | 1 | 2 | 0 | | 0 | 7 | 2 | 2 | | |
| Graffiti | percent of | 0% | 0% | 13% | 0% | | 0% | 25% | 0% | 0% | | |
| Litter | scale | 2.71 | 2.00 | 2.00 | 1.50 | | 2.00 | 1.75 | 2.33 | 2.25 | | |
| Benches | count | 2 | 1 | 0 | 0 | | 1 | 1 | 1 | 0 | | |
| Potted plants | percent | 0% | 0% | 0% | 0% | | 50% | | 67% | 0% | | |
| Landscaped | percent | 50% | 38% | 63% | 100% | | 50% | 50% | 0% | 38% | | |
| Number of canopy tress | count | 9 | 5 | 14 | 21 | | 3 | 9 | 8 | 6 | | |
| Number of ornamental tees | count | 43 | 45 | 14 | 27 | | 13 | 21 | 19 | 10 | | |
| GIS trees | count | 2 | 13 | 15 | 3 | | 36 | 3 | 27 | 0 | | 1904 |
| Street lighting | type | Ped | Ped | Auto | Auto | | Auto | Auto | Auto | Combo | | |
| **Accessibility** | | | | | | | | | | | | |
| Slope (countour lines) | count | 0 | 2 | 5 | 2 | | 0 | 0 | 1 | 1 | | |
| Parking lots | | | | | | | | | | | | |
| Bus/LRT stops | | | | | | | | | | | | |
| Bus/LRT frequency | | | | | | | | | | | | |
| Number of intersections | count | | | | | | | | | | | 125 |
| Adtl. distance on street network | miles | | | | | | | | | | | 0.15 |
| Intersections with timer or beeps | percent | 0% | 0% | 0% | 0% | | 0% | 0% | 0% | 0% | | |
| Intersections with light | percent | 40% | 40% | 44% | 57% | | 33% | 33% | 40% | 33% | | |
| Pedestrian crossing signs | presence | none | none | none | none | | none | none | none | none | | |
| Crosswalk curb cuts | percet | 100% | 100% | 100% | 100% | | 100% | 100% | 100% | 100% | | |
| ADA crosswalk curb cuts | percent | 0% | 0% | 22% | 29% | | 0% | 0% | 17% | 0% | | |
| Crosswalks | percent | 40% | 40% | 44% | 57% | | 33% | 33% | 33% | 33% | | |
| Median | presence | no | no | yes | no | | yes | yes | yes | yes | | |
| **Coherence** | | | | | | | | | | | | |
| Points of interest | count | | | | | | | | | | | 7 |

Appendix H: Fairview Pedestrian Environment Data Table

| | | Fairview and University Station Area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fairview | | | | | University | | | | | |
| **Factors/Characteristics** | **Unit** | 1st Quartermile North | 2nd Quartermile North | 1st Quartermile South | 2nd Quartermile South | Fairview Entire | First Quartermile West | 2nd Quartermile West | 1st Quartermile East | 2nd Quartermile East | Entire Universtiy | 1/2 Mile Radius |
| **Comfort** | | | | | | | | | | | | |
| Number of traffic lanes | count | | | | | | | | | | | |
| Sidewalk width | meters | 1.66 | 1.73 | 1.78 | 1.76 | | 3.5 | 3.26 | 2.49 | 2.93 | | |
| Sidewalk condition | scale | 1.8 | 1.33 | 2 | 2.13 | | 2.14 | 2.5 | 2 | 1.5 | | |
| Sidewalk that is driveway | percent | 29% | 22% | 8% | 7% | | 10% | 1% | 10% | 10% | | |
| Driveway curb cuts | count | 7 | 4 | 8 | 15 | | 15 | 1 | 9 | 10 | | |
| Street cross section, enclosure | ratio | | | | | 2:1 | | | | | 4:1 | |
| Street that is a building wall | percent | 27% | 45% | 24% | 22% | | 33% | 2% | 13% | 47% | | |
| Building height (stories) | average | 1.83 | 2.5 | 2 | 1.71 | | 2.14 | 2 | 2.14 | 1.67 | | |
| Buffer width | meters | 1.71 | 1.45 | 0.87 | 1.76 | | 0 | 0 | 1.87 | 2.1 | | |
| Parking lane | presence | 0.5 | 0 | 0 | 0.88 | | 0.43 | 0 | 0.63 | 1 | | |
| Grass buffer | pecent | 67% | 50% | 0% | 100% | | 13% | 0% | 50% | 0% | | |
| Noise level | | | | | | | | | | | | |
| **Security** | | | | | | | | | | | | |
| Transparency (number of windows) | average | 3.83 | 2 | 8 | 1.88 | | 5.57 | 12 | 5.13 | 4.83 | | |
| Number of people | count | 3 | 0 | 4 | 1 | | 10 | 3 | 13 | 15 | | |
| Safe from crime | | | | | | | | | | | | |
| Safe from traffic | | | | | | | | | | | | |
| Site lines | blocks | 3 blocks | | 8 blocks | | | 2 blocks | | 4 blocks | | | |

Appendix H: Fairview Pedestrian Environment Data Table, continued

| | | Fairview and University Station Area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fairview | | | | | University | | | | | |
| Factors/Characteristics | Unit | 1st Quartermile North | 2nd Quartermile North | 1st Quartermile South | 2nd Quartermile South | Fairview Entire | First Quartermile West | 2nd Quartermile West | 1st Quartermile East | 2nd Quartermile East | Entire Universtiy | 1/2 Mile Radius |
| **Attractiveness** | | | | | | | | | | | | |
| Number of historic buildings | count | | | | | | | | | | | |
| Presence of outdoor dining | presence | | | | | | | | | | | |
| Number of parks, plazas, etc. | count | | | | | | | | | | | 3 |
| Texture (colors, texture, etc) | scale | 1.5 | 2 | 2.5 | 2 | | 1.43 | 2.5 | 1.88 | 2.17 | | |
| Overall maintenance | scale | 1.8 | 2 | 1.5 | 1.88 | | 1.71 | 1.5 | 2.13 | 1.67 | | |
| Vacant buildings | count | 0 | 0 | 0 | 0 | | 2 | 0 | 1 | 0 | | |
| Graffiti | percent | 0% | 0% | 0% | 0% | | 20% | 50% | 0% | 0% | | |
| Litter | percent | 50% | 0% | 100% | 38% | | 86% | 100% | 71% | 100% | | |
| Benches | count | 0 | 0 | 0 | 2 | | 2 | 0 | 1 | 3 | | |
| Potted plants | percent | 0% | 0% | 0% | 13% | | 0% | 50% | 25% | 33% | | |
| Landscaped | percent | 67% | 50% | 0% | 13% | | 63% | 50% | 25% | 17% | | |
| Number of yard trees | count | 23 | 10+ | 9 | 44 | | 43 | 3 | 29 | 33 | | |
| Number of sidewalk trees | count | 2 | 6 | 12 | 32 | | 3 | 12 | 24 | 11 | | |
| GIS trees | count | 14 | 20 | 1 | 15 | | 2 | 0 | 19 | 3 | | 1003 |
| Street lighting | type | auto | auto | auto | none | | auto | auto | auto | auto | | |
| **Accessibility** | | | | | | | | | | | | |
| Slope (countour lines) | count | 2 | 1 | 2 | 8 | | 0 | 5 | 1 | 1 | | |
| Parking lots | | | | | | | | | | | | |
| Bus/LRT stops | | | | | | | | | | | | |
| Bus/LRT frequency | | | | | | | | | | | | |
| Number of Intersections | count | | | | | | | | | | | 112 |
| Adtl. distance on street network | miles | | | | | | | | | | | 0.184 |
| Intersections with timer or beeps | percent | 0% | 25% | 50% | 0% | | 10% | 50% | 25% | 25% | | |
| Intersections with light | percent | 17% | 3% | 0% | 0% | | 30% | 50% | 13% | 38% | | |
| Pedestrian crossing signs | presence | none | none | none | none | | none | none | none | none | | |
| Good crosswalk curb cuts | percent | 25% | 50% | 50% | 60% | | 20% | 50% | 25% | 25% | | |
| Poor crosswalk curb cuts | percent | 25% | 0% | 50% | 0% | | 80% | 50% | 50% | 25% | | |
| ADA crosswalk curb cuts | percenet | 0% | 50% | 0% | 20% | | 0% | 0% | 0% | 25% | | |
| Crosswalks | percent | 25% | 50% | 50% | 20% | | 43% | 100% | 25% | 38% | | |
| Median | presence | no | no | no | no | | yes | yes | yes | yes | | |
| **Coherence** | | | | | | | | | | | | |
| Points of interest | count | | | | | | | | | | | 7 |