Appendix A: List of Maps, Figures, and Tables

Chapter 1 INTRODUCTION

Maps – Chapter 1

Figures – Chapter 1

Chapter 2 STAKEHOLDER INPUT

Maps – Chapter 2

Figures – Chapter2

Tables – Chapter 2

Chapter 3 EXISTING CONDITIONS & ANALYSIS

Maps – Chapter 3

Figures – Chapter 3

Tables – Chapter 3

Tables – Chapter 4

Figures – Chapter 7

Tables – Chapter 7

Chapter 8: INTEGRATION & SAFETY

Maps – Chapter 8

Figures – Chapter 8

Appendix B: Methodologies

The following pages contain descriptions of various assessments in this study that were not explained in detail in the main body of the document. Explanations are provided for how or where the various data were collected and what processes were used for deriving results from those data.

TRANSIT SCORES (Chapter 6)

To help assess the characteristics and quality of public transit service within the Lincoln Park neighborhood, an indexing method was to derive two scores: a "transit service" score for each route, and a "transit demand" score for each of the neighborhood sub-areas defined in the study. The first was used to compare levels of service among the routes within the neighborhood, the later to compare the relative levels of demand for transit service. In both cases, values were indexed to each other (using the lowest and highest values to create a bounded range) and combined to create composite scores. How those scores were generated is described below.

Service Scores:

There are two priority factors that determine the service quality of public transit from the rider's perspective: 1) the hours of service and 2) the frequency of buses. Using these parameters, the seven routes were indexed and compared against each other. The results of this approach are shown in Table A.1.

Routes 1,2, and 3 were also assessed as one route because they share the same street segments in the Lincoln Park study area and essentially act as a combined service in those corridors.

Table A.1 | Indexing tables used for deriving "transit service" scores

The different transit routes in the study area were compared according to the indexed value (from 0 to 10) of their average frequency and hours of service.

Weekcay Service					
Route	Avg frecuency	I	Hours of service	I	CI
1,2,3	0:16	10	18:00	9	19
1	0:41	4	16:20	7	11
2	0:53	2	18:21	10	12
3	0:52	2	15:30	6	7
4	0:46	3	13:00	2	5
5	1:00	0	12:00	0	0
9	0:46	3	14:00	3	6
16	0:41	4	13:00	2	6

Saturday Serv'ce					
Route	Avg frequency*	I	Hours of service	I	CI
1,2,3	0:33	10	17:00	10	20
1	2:00	0	0:00	0	0
2	0:59	7	17:15	10	17
3	1:00	7	12:42	7	14
4	2:00	0	8:00	5	5
5	1:00	7	8:00	5	12
9	1:00	7	10:00	6	13
16	1:00	7	11:00	6	13

Sunday Service					
Route	Avg frequency*	I	Hours of service	I	CI
1,2,3	0:36	10	15:00	10	20
1	2:00	0	0:00	0	0
2	0:58	7	15:00	10	17
3	1:00	7	8:45	6	13
4	2:00	0	0	0	0
5	2:00	0	0	0	0
9	1:00	7	9:00	6	13
16	0:59	7	8:00	5	13

When done this way, the combination of Routes 1, 2, and 3 stand out as having a high level of service compared to the others in the neighborhood. This process of comparing the routes was done for the weekday, Saturday, and Sunday route schedules. In situations were a route was not running on a Sunday, for example, an arbitrary max 2-hour frequency was applied for simple indexing purposes (which turned into a zero value in the final summation). The resulting "service" score was entered into a geographic information system (GIS) in order to do conduct the overlay analysis shown in Map 6.2 in Chapter 6 of the study document.

Demand Scores:

A similar indexing method was applied to the demand-side of the transit equation in the study area. As shown in Table A.2, the thirteen neighborhood sub-areas were assessed using six metrics that were indexed to a scale of 0 to 100. Those metrics are identified in Table A.3 below. The sub-areas were then ranked according to the combined index scores, and the ranking was used to help evaluate how well matched the "service" scores of the previous assessment matched the "demand" scores of the sub -areas (as illustrated in Map 6.4 in Chapter 6).

Table A.2 | Indexing table used for deriving "transit demand" scores

Six metrics were indexed across the 13 geographical sub-areas analyzed for this study. The indexed values were combined in a single score to determine the relative degree of potential demand for transit service within those sub-areas.

Sub-area	NoCar Density	Index Score	Seniors Density	Index Score	Pop_Dense	Index Score	MED_INC	Index Score	AMB_ DENSE	Index Score	SLOPE_AVG	Index Score	area	Composite Score	RANK
1	0.05	36	29	0	232	0	24,138	65	10	0	2.0	3	460,490.83	103	12
2	0.13	100	40	3	749	8	22,474	69	13	2	1.6	0	450,834.05	182	11
3	0.13	100	40	3	749	8	22,474	69	13	2	1.6	0	430,714.63	183	10
4	0.13	100	403	98	6,416	100	29,514	52	13	2	1.7	1	268,720.76	353	1
5	0.13	100	38	2	371	2	9,375	100	13	2	6.1	30	260,291.67	237	7
6	0.05	36	413	100	3,841	58	51,563	0	10	0	4.1	17	464,623.99	211	8
7	0.03	22	394	95	5,690	88	31,964	47	71	44	5.7	27	508,416.36	324	3
8	0.03	22	403	98	6,416	100	29,514	52	13	2	6.5	33	248,774.88	307	4
9	0.13	100	38	2	371	2	9,375	100	13	2	16.5	100	242,327.59	307	4
10	0.03	22	159	34	1,732	24	35,245	39	31	15	9.9	56	1,145,460.53	190	9
11	0.03	22	394	95	5,690	88	31,964	47	71	44	8.2	44	263,426.07	341	2
12	0.00	0	283	66	3,538	53	51,667	0	148	100	7.3	38	320,377.59	258	6
13	0.00	0	283	66	3,538	53	51,667	0	148	100	9.2	51	474,003.43	271	5

Table A.3 | Metrics used for deriving "transit demand" scores

The metrics used in deriving the "demand" scores included a mix of demographic characteristics, as well as a measure of difficulty to pedestrian travel in the area (i.e. slope).

Field ID	Metric	Data Source
NoCarDensity	Percent households with no vehicle ownership	2013 American Community Survey
SeniorDensity	Percentage of population age 65 or older	2010 Census 100SF
Pop_Dense	Population per square mile	2010 Census 100SF
MED_NC	Median household income	2013 American Community Survey
AMB_DENSE	Percent population with ambulatory difficulties	2013 American Community Survey
SLOPE_AVG	Average slope of the streets	MIC generated: 2011 MN Lidar data; 2013 St. Louis Co. centerline road file.

Table A.4 | Factors influencing LOS scores

Measures of the following factors were used in calculating the four individual modal LOS scores, which were then used collectively as an assessment of a multimodal Level of service (mmLOS).

Auto LOS
• Demand (volumes) and available capacity
• Number of lanes
• Posted speed
• Number of stops per mile
• Interference from other users (modes)
Transit LOS
• Frequency of service
• Average wait time
• Pedestrian LOS scores
• Passenger load
• Number of bus stops per mile
Pedestrian LOS
• Traffic volume and speed
• Buffer separation
• Presence and width of sidewalk
• Crossing difficulty
• *Pedestrian density*
Bicycle LOS
• Traffic volume and speed
• Lateral separation
• Percent of traffic that is heavy trucks
• Pavement quality
• Number of driveways per mile

TRANSIT SCORES (Chapter 6)

In transportation planning, level of service (LOS) has traditionally been a measure of the vehicle capacity of a roadway. However, with the increasing understanding that roadway environments serve the movements of a variety of different users, the 2010 Highway Capacity Manual (HCM) was been expanded to include a collection of LOS measures for cyclists, pedestrians, and transit riders. These new measures go beyond the notion of capacity to also reflect the safety, ease, and comfort of using a roadway from the perspectives of these other user groups. They are meant to be combined as a measure of multimodal level of service (mmLOS) to help evaluate "complete streets" or context sensitive design alternatives for a particular roadway.

For this study specifically, the mmLOS methodology developed from the NCHRP 03-07 research effort and outlined in NCHRP Report No. 616: *Multimodal Level of Service Analysis for Urban Streets* was used to derive individual LOS scores representative of conditions found in each of the six context zones being studied. These measures are identified in Table A.4.

Six locations were selected within the key multimodal corridors identified in this study for which mmLOS "samples" were calculated for those corridors. To help calculate these scores, a spreadsheet template developed by Richard Dowling Associates was used to calculate LOS scores per one half of the roadway. Therefore, each of the six locations were first evaluated qualitatively in order to determine which side of the corridor would be most representative in terms of a single mmLOS evaluation. Generally, if sidewalk was present on just one side of

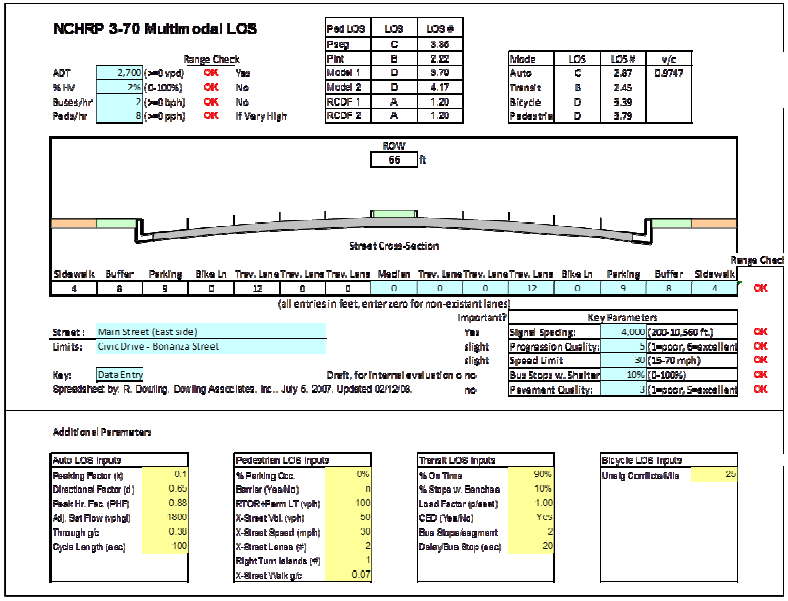
the corridor, that side was chosen for evaluation. Figure A.1 shows an example template for Location 1 (24th Avenue W - between W 7th Street and W 6th Street).

CRASH RATES and SEVERITY RATES (Chapter 8)

Crash rates and severity rates were used to help evaluate areas of poor multimodal integration within the Lincoln Park study area. To do this, MnDOT's Crash Mapping Analysis Tool (MnCMAT) was used to help identify areas of high-crash locations and segments in the study area. Once identified, crash– and severity rates were calculated for those locations and segments using the Equation A.1 and Equation A.2 on the following page.

Figure A.1 | Template for mmLOS calculations

The methodology outlined in NCHRP Report No. 616: *Multimodal Level of Service Analysis for Urban Streets* was used to generate mmLOS scores, and the spreadsheet template developed by Richard Dowling Associates based off of the NCHRP report was used to calculate LOS scores for the six locations assessed for mmLOS.



The rates were calculated by using all crashes that occurred within a segment in the years 2009 through 2013, or any crash within a 50-foot radius of an intersection in those years. Those three years represented to most recent years of data available at the time of the study, and were also likely to be the most indicative of transportation patterns that reflected existing conditions, infrastructure, and development patterns. Three years of data were used in order to compare the crash calculated with averages for MnDOT District 1 reported on the 2011 "green sheets" found at: http://www.dot.state.mn.us/stateaid/sa_traffic_safety.html.

Equation A.1 | Intersection crash rate

The following equation measures the number of crashes per 1 million vehicles entering the intersection. It is used as an expectation for future crashes at a location if all other factors remained the same.

$$\text{Crash rate} = \frac{1{,}000{,}000 \times \text{number of crashes}}{\text{years} \times 365 \times \text{AADT [x miles]}}$$

AADT = average annual daily traffic

[x miles] = modifier used to calculate rates for a highway segment

Equation A.2 | Intersection crash severity rate

Weighted values can be attributed to crashes based on the severity of resulting injuries, which can then be summed up and used in the crash

$$\text{Severity rate} = \frac{1{,}000{,}000 \times [(10)K + (8)A + (6)B + (3)C + PD]}{\text{years} \times 365 \times \text{AADT [x miles]}}$$

K = total number of fatality crashes

A = total number of incapacitating injury crashes

B = total number of non-incapacitating injury crashes

C = total number of possible injury crashes

PD = total number of property damage only crashes

AADT = average annual daily traffic

Appendix C: Summary notes from open house meetings

COMMUNITY INPUT

LICOLN PARK SMALL AREA PLAN OPEN HOUSE

September 17, 2014: 5:00PM-8:00PM

Harrison Community Center

Comments received at the "Multi-Modal Transportation" table

General:

Trash accumulation is a big issue in Lincoln Park. It is especially bad in the areas around and underneath the freeway ramps. Interest in seeing a more coordinated clean-up effort between the City of Duluth and the neighborhood associations, such as the Seaway Tenants Assoc.

DTA service is great in the Lincoln Park neighborhood, but there should be garbage cans and benches at major bus stops.

Take a look at the quantity and quality of street lighting in the neighborhood - along main roads, especially 3rd Street.

Take a look at the City's current sidewalk-use permit policies and procedures. Are they designed in a way that impedes or dis-incentivizes the installation of benches and bike racks?

The City should inventory and prioritize the cul-de-sacs in Lincoln Park. They should look for opportunities to remove some for the purpose of better circulation and access, especially for emergency response vehicles.

There needs to be stronger political efforts to get the Sault Ste Marie Locks widened in order to allow for larger ships and help revitalize the shipping industry in Duluth-Superior, especially some of the lands along the water front in Lincoln Park.

The City should look explore opportunities to re-use the vacant ore dock for recreation and historical-education in the area.

Cross City Trail:

The new trail is great. I've changed my walking route just so I can use it.

The City should seek ways to connect the trail to the waterfront in Lincoln Park.

Superior St:

There is poor sidewalk on Superior St. between 27th Ave W and 30th Ave W. This is a bus route (Rt No. 9) and is a path that people walk along between the commercial area at Michigan St. and 27th Ave W. and the neighborhoods above Superior St.

Vegetation or streetscaping treatments should be considered along the south side of Superior Street – especially along the few blocks approaching 27th Ave W. This would help buffer pedestrians from the "industrial" character of the uses in that area. This is a bus route. Benches for waiting transit riders should be placed along this corridor.

Michigan St:

Adequate snow removal is a BIG problem on Michigan St. between 21st Ave W and 23rd Ave W (underneath the freeway). There is a lot of pedestrian movement in that area. And now with the Cross City Trail…

There is poor sidewalk on Michigan St between 18th Ave W and 22nd Ave W.

W 3rd St:

Should improve lighting along 3rd Street.

W 4th St:

Snow removal is difficult on W 4th St. Parking used to be on the north side only, but it was changed to alternate-side parking. This has created more problems than it solved.

W 10th St:

The City should consider extending W 10th St to Anson Ave to create a more direct link to the new middle school from Piedmont Ave**.**

Skyline Pkwy:

Vegetation has become so overgrown that it is impacting many of the views from the road. Some of that stuff should be cut back in places.

Hwy 53 / Piedmont Ave:

There are a lot of intersections with poor visibility along Hwy 53. These are very dangerous, especially after the speed limit was raised from 30mph to 40mph on Hwy 53. The intersection of W 7th St. is particularly hazardous.

The center medians on Hwy 53 are not wide enough to allow for sufficient refuge for vehicles trying to make left turns. These vehicles have to enter the spaces in the medians at an angle, which creates sight-distance challenges for those drivers.

The intersection of Piedmont Ave & 24th Ave W needs a traffic signal. Take a look at the crash data for this intersection - I bet you will see a lot of weather-related crashes… slush, ice.

Atlantic Ave:

Sidewalks are in poor condition. The school was in discussions about sharing snow removal responsibilities with the City, if the City would address the sidewalk conditions. The City should really pursue this.

20th Ave W:

There is a blind pedestrian area on 20th Ave W at the off ramp. This spot could use some safety improvements to make it more visible. It could use better lighting.

20th Ave W is probably one of the major pedestrian corridors in Lincoln Park because of its direct connection between the Little Store at 19th Ave W and the residential areas further up the hill. The sidewalk is in poor condition along this avenue.

21st Ave W:

The street and sidewalk along 21st Ave W are in rough shape up the hill, which gets pretty steep. 21st Ave E gets a lot of pedestrian traffic because of its connection to the bus stops/shelters between W 3rd St and Superior St.

The pavement condition on 21st Ave W between W 3rd St and Superior St is so bad that you can't even snow plow it. It should be redone and, when it is, the sidewalks should be brought to the curb.

24th Ave W:

They removed an LED crossing for pedestrians on 24th Ave W (at the corner of 5th St) when the middle school moved. However, there is still the park, the Boys and Girls Club, and services for seniors in the area. They shouldn't have taken that safety device away from there.

24th Ave W:

26th Ave W has some significant gaps in sidewalk. It is a street that could provide easy, direct access to Lincoln Park from Superior Street.

There might be some opportunities to consolidate lots along 26th Ave W for the purpose of creating an enhanced pedestrian corridor between Lincoln Park and Superior St (or even to the waterfront).

The short segment of 26th Ave W between Superior St and Michigan St is not paved. It gets a lot of pedestrians cutting through there, many of whom are using it to avoid having to cross the busy intersections at 27th Ave W. This small segment is owned by the city. The City should enhance it as a pedestrian corridor, possibly even daylight the creek here and create access to the waterfront.

27th Ave W:

Parking on 27th Ave W can be a problem during winter months (when snow piles up) because it is narrow, and the residents don't have off-street parking. Creative solutions to parking should be sought for this corridor because it is a major artery up and down the hill.

There are narrow sidewalks at the intersection of 27th Ave W and Superior St. The sidewalks are also in poor condition. This is a busy intersection both in terms of cars and pedestrians. Things should be done to make pedestrian crossings safer and more comfortable here.

37th Ave W:

Parking on 27th Ave W can be a problem during winter months (when snow piles up) because it is narrow, and the residents don't have off-street parking. Creative solutions to parking should be sought for this corridor because it is a major artery up and down the hill in Lincoln Park.

COMMUNITY INPUT

LICOLN PARK SMALL AREA PLAN OPEN HOUSE

March 26th, 2015: 6:00PM-8:00PM

Harrison Community Center

<u>Comments received at the "Multi-Modal Transportation" table</u>

Requests for increased DTA service:

Could the DTA provide even just one trip per day up to the Lincoln Park Middle School? The school is discovering that a number of parents are

having difficulty getting to the school for meetings and other things. If the DTA could provide just one trip a day, the school could work to schedule things around that trip.

Is there any way the DTA could increase the frequency of service in the neighborhood?

Response to the Devonshire Trail Recommendation:

Is the recommendation to pave the Devonshire Trail feasible? There is an exposed rock bed there, and it goes really close to a house.

Grievance regarding the intersection near the M&H gas station:

The intersection of Superior Street, Michigan St, and Lower Michigan is a mess. It's dangerous and the design of it isn't achieving its intended purpose: to move the traffic to Lower Michigan. All the vehicles are going up onto Superior St regardless. When MnDOT was re-routing traffic during the reconstruction of I-35, they installed temporary traffic signals at the intersection and it worked better than it does now under typical conditions. They should put those traffic signals back.

Response to the Recommendation for repaving/repairing 27th Ave W:

27th Ave W has, and will continue to, experience increases in traffic. The last time it was redone, its width was shortened, making everything tighter. Drivers are flying up and down it, and it's not a good situation. They really should re-widen to better fit the traffic volumes there.

There is parking on only one side of the street, and don't I think you could widen it by removing the parking because there are some residences on the street that don't have off-street parking. I think that the residences along 27th Ave W should be surveyed about what types of improvements are needed there.

Could more stop signs be put along 27th Ave W, wouldn't that slow traffic down and make it safer?

Regarding the recommendation to repave/repair Wellington Ave:

That street does need to be redone, and it makes sense that it should be a secondary access to the Middle School. But its narrow, and is there even enough room to get two buses passing through there?

Regarding the recommendation to convert W 1st St back to 2-Way:

This street was narrowed (from 27th Ave W to 30th Ave W) when last reconstructed. This was done at the neighborhood's request in order to dissuade heavy trucks from using it. The recommendation to turn it back to a two-way street won't work because there is not enough room for two lanes of travel on it.

Regarding the recommendation for a paved trail connection between Anson Ave and 27th Ave W:

Part of this proposed alignment is where the Superior Hiking Trail goes through. You don't want to pave over that, do you?

Reported concern about the intersection of 27th Ave W & W 3rd St:

This is a bad intersection, very dangerous for pedestrians. It is now a 4-way stop, but drivers are tending not to fully respect them. The intersection could really use a traffic signal instead. I would argue that it has as much traffic as the intersection of Superior St & 27th Ave W does.