Ford Site

Appendices

January 2017

Appendices

Appendix A-1

Calibrated Trip Generation Model

Saint Paul Minnesota
The most livable city in America

ITE Trip Generation

Proposed Program

ITE CODE	Land Use	Sqf	Unit
	Civic	300,000	
	Industry	200,000	
	Retail	250,000	
	Office	250,000	
	Residential	5,000,000	4,000

assuming office use

220 Apartment
221 Low Rise Apartment
222 High Rise Apartment
223 Mid Rise Apartment
230 Residential Condominium/Townhouse
231 Low-Rise Residential Condominium/Townhouse
232 High-Rise Residential Condominium/Townhouse
233 Luxury Condominium/Townhouse

820 Shopping Center
826 Specialty Retail Center
710 General Office Building
76 Research and Development Center

110 General Light Industrial
120 General Heavy Industrial
130 Industrial Park
140 Manufacturing
150 Warehousing

TRIP GENERATION - RETAIL

ITE Class **Shopping Center (820)**
rate per 1000 sf GLA
"...an integrated group of commercial establishments that is planned, developed, owned and managed as a unit."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	42.7	63.95	50%	50%	10675	5338	5338
Saturday	49.97	72.59	50%	50%	12493	6246	6246
AM Peak Hour*	0.96	2.27	62%	38%	240	149	91
PM Peak Hour*	3.71	6.45	48%	52%	928	445	482

*peak hour of adjacent street traffic

ITE Class **Specialty Retail Center (826)**
rate per 1000 sf GLA
"...an integrated group of commercial establishments that is planned, developed, owned and managed as a unit."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	44.32	59.84	50%	50%	11080	5540	5540
Saturday	42.04	56.01	50%	50%	10510	5255	5255
AM Peak Hour	6.84	10.39	48%	52%	1710	821	889
PM Peak Hour*	2.71	4.54	44%	56%	678	298	379

*peak hour of adjacent street traffic

TRIP GENERATION - OFFICE

ITE Class **General Office Building (710)**
rate per 1000 sf GLA
"...may contain a mixture of tenants...a restaurant/cafeteria..."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	11.03	17.18	50%	50%	2758	1379	1379
Saturday	2.46	4.67	50%	50%	615	308	308
AM Peak Hour*	1.56	2.96	88%	12%	390	343	47
PM Peak Hour*	1.49	2.86	17%	83%	373	63	309

*peak hour of adjacent street traffic

ITE Class **Research and Development Center (76)**
rate per 1000 sf GLA
"...facilities devoted almost exclusively to research and development activities..."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	8.11	13.95	50%	50%	2028	1014	1014
Saturday	1.9	3.71	50%	50%	475	238	238
AM Peak Hour	1.22	2.53	83%	17%	305	253	52
PM Peak Hour*	1.07	2.25	15%	85%	268	40	227

*peak hour of adjacent street traffic

TRIP GENERATION - RESIDENTIAL

ITE Class **Apartment (220)**
rate per Dwelling Units

"Studies included in this LU did not identify whether the apartments were low-rise, mid-rise, or high-rise"

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	6.65	9.72	50%	50%	26,600	13300	13300
Saturday	6.39	9.38	50%	50%	25,560	12780	12780
AM Peak Hour*	0.51	1.24	20%	80%	2,040	408	1632
PM Peak Hour*	0.62	1.44	65%	35%	2,480	1612	868

*peak hour of adjacent street traffic

ITE Class **Low Rise Apartment (221)**
rate per Occupied Dwelling Units

"Low rise apartments (rental dwelling units) are units located in rental buildings that have one or two levels such as garden apartments."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	6.59	9.43	50%	50%	26,360	13180	13180
Saturday	7.16	10.09	50%	50%	28,640	14320	14320
AM Peak Hour*	0.46	1.16	21%	79%	1,840	386	1454
PM Peak Hour*	0.58	1.35	65%	35%	2,320	1508	812

*peak hour of adjacent street traffic

ITE Class **High Rise Apartment (222)**
rate per Dwelling Units
more elevators"

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	4.2	6.52	50%	50%	16,800	8400	8400
Saturday	4.98	7.34	50%	50%	19,920	9960	9960
AM Peak Hour*	0.3	0.85	25%	75%	1,200	300	900
PM Peak Hour*	0.35	0.94	61%	39%	1,400	854	546

*peak hour of adjacent street traffic

ITE Class **Mid Rise Apartment (223)**
rate per Dwelling Units

"Mid rise apartments (rental dwelling units) are uapartments (rental dwelling units) in rental buildings that have between three and 10 levels."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	*none given*						
Saturday	*none given*						
AM Peak Hour*	0.3	0.86	31%	69%	1,200	372	828
PM Peak Hour*	0.39	1.02	58%	42%	1,560	905	655

*peak hour of adjacent street traffic

TRIP GENERATION - RESIDENTIAL

ITE Class **Residential Condominium/Townhouse (230)**
rate per Dwelling Units

"Rental condominium/townhouses are defined as ownership units that have at least one other owned unit within the same building…low rise or high rise."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	5.81	8.92	50%	50%	23,240	11620	11620
Saturday	5.67	8.77	50%	50%	22,680	11340	11340
AM Peak Hour*	0.44	1.13	17%	83%	1,760	299	1461
PM Peak Hour*	0.52	1.27	67%	33%	2,080	1394	686

*peak hour of adjacent street traffic

ITE Class **Low-Rise Residential Condominium/Townhouse (231)**
rate per Dwelling Units

"Units located in buildings that have one or two levels"

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	*none given*						
Saturday	*none given*						
AM Peak Hour*	0.67	1.5	25%	75%	2,680	670	2010
PM Peak Hour*	0.78	1.71	58%	42%	3,120	1810	1310

*peak hour of adjacent street traffic

ITE Class **High-Rise Residential Condominium/Townhouse (232)**
rate per Dwelling Units
"Units located in buildings that have three or more levels"

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	4.18	6.26	50%	50%	16,720	8360	8360
Saturday	4.31	6.42	50%	50%	17,240	8620	8620
AM Peak Hour*	0.34	0.93	19%	81%	1,360	258	1102
PM Peak Hour*	0.38	1	62%	38%	1,520	942	578

*peak hour of adjacent street traffic

ITE Class **Luxury Condominium/Townhouse (233)**
rate per Occupied Dwelling Units

"Units located in buildings that have three or more levels"

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	*none given*						
Saturday	*none given*						
AM Peak Hour*	0.56	1.31	23%	77%	2,240	515	1725
PM Peak Hour*	0.55	1.29	63%	37%	2,200	1386	814

*peak hour of adjacent street traffic

TRIP GENERATION - INDUSTRIAL

ITE Class **General Light Industrial (110)**
rate per 1000 sf GLA
"...empahsis on activities other than manufacturing and typically have minimal office space..."

Time	ITE Rate	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	6.97	50%	50%	1394	697	697
Saturday	1.32	50%	50%	264	132	132
AM Peak Hour*	0.92	88%	12%	184	162	22
PM Peak Hour*	0.97	12%	88%	194	23	171

*peak hour of adjacent street traffic

ITE Class **General Heavy Industrial (120)**
rate per 1000 sf GLA
"...limited to the manufacturing of large items..."

Time	ITE Rate	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	1.5	50%	50%	300	150	150
Saturday	*none given*					
AM Peak Hour	0.51	*none given*		102		
PM Peak Hour*	0.68	*none given*		136		

*peak hour of adjacent street traffic

ITE Class **Industrial Park (130)**
rate per 1000 sf GLA
"...a mix of manufacturing, service and warehouse facilities ..."

Time	ITE Rate	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	6.83	50%	50%	1366	683	683
Saturday	2.49	50%	50%	498	249	249
AM Peak Hour*	0.82	82%	18%	164	134	30
PM Peak Hour*	0.85	21%	79%	170	36	134

ITE Class **Manufacturing (140)**
rate per 1000 sf GLA
"...conversion of raw materials or parts into finished products ..."

Time	ITE Rate	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	3.82	50%	50%	764	382	382
Saturday	1.49	50%	50%	298	149	149
AM Peak Hour*	0.73	78%	22%	146	114	32
PM Peak Hour*	0.73	36%	64%	146	53	93

ITE Class **Warehousing (150)**
rate per 1000 sf GLA
"...devoted to the storage of materials, but may include office and maintenance areas..."

Time	ITE Rate	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	3.56	50%	50%	712	356	356
Saturday	1.23	50%	50%	246	123	123
AM Peak Hour*	0.3	79%	21%	60	47	13
PM Peak Hour*	0.32	25%	75%	64	16	48

*peak hour of adjacent street traffic

TRIP GENERATION - CIVIC (OFFICE)

ITE Class **General Office Building (710)**
rate per 1000 sf GLA
"...may contain a mixture of tenants...a restaurant/cafeteria..."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	11.03	17.18	50%	50%	3309	1655	1655
Saturday	2.46	4.67	50%	50%	738	369	369
AM Peak Hour*	1.56	2.96	88%	12%	468	412	56
PM Peak Hour*	1.49	2.86	17%	83%	447	76	371

*peak hour of adjacent street traffic

ITE Class **Research and Development Center (76)**
rate per 1000 sf GLA
"...facilities devoted almost exclusively to research and development activities..."

Time	ITE Rate	Plus 1 Std. Dev.	Entering	Exiting	ITE Est. Trips	Entering	Exiting
Weekday	8.11	13.95	50%	50%	2433	1217	1217
Saturday	1.9	3.71	50%	50%	570	285	285
AM Peak Hour	1.22	2.53	83%	17%	366	304	62
PM Peak Hour*	1.07	2.25	15%	85%	321	48	273

*peak hour of adjacent street traffic

Saint Paul Minnesota
The most livable city in America

TRIP GENERATION - RESIDENTIAL

	Min	Max	Min Entering	Max Entering	Min Exiting	Max Exiting
Weekday	16,720	26,600	8,360	13300	8,360	13300
Saturday	17,240	28,640	8,620	14320	8,620	14320
AM Peak Hour*	1,200	2,680	258	670	828	2010
PM Peak Hour*	1,400	3,120	854	1810	546	1310

TRIP GENERATION - INDUSTRIAL

	Min	Max	Min Entering	Max Entering	Min Exiting	Max Exiting
Weekday	300	1,394	150	697	150	697
Saturday	246	498	123	249	123	249
AM Peak Hour*	60	184	47	162	13	32
PM Peak Hour*	64	194	16	53	48	171

TRIP GENERATION - RETAIL

	Min	Max	Min Entering	Max Entering	Min Exiting	Max Exiting
Weekday	10,675	11,080	5,338	5540	5,338	5540
Saturday	10,510	12,493	5,255	6246	5,255	6246
AM Peak Hour*	240	1,710	149	821	91	889
PM Peak Hour*	678	928	298	445	379	482

TRIP GENERATION - CIVIC (OFFICE)

	Min	Max	Min Entering	Max Entering	Min Exiting	Max Exiting
Weekday	2,433	3,309	1,217	1655	1,217	1655
Saturday	570	738	285	369	285	369
AM Peak Hour*	366	468	304	412	56	62
PM Peak Hour*	321	447	48	76	273	371

TRIP GENERATION - OFFICE

	Min	Max	Min Entering	Max Entering	Min Exiting	Max Exiting
Weekday	2,028	2,758	1,014	1379	1,014	1379
Saturday	475	615	238	308	238	308
AM Peak Hour*	305	390	253	343	47	52
PM Peak Hour*	268	373	40	63	227	309

JOBS & HOUSING BALANCE	Low	High
Included in analysis	Yes	Yes
Housing Units within a half mile	4,590	4,590
Housing Units in project	4,000	4,000
Employees within a half mile	2,117	2,117
Employees in project	1,800	1,800
Job/Household Ratio	0.46	0.46
IDEAL Job/Household Ratio	1.50	1.50
Reduction Credit	2.60%	2.60%

Calculation

Trip Reduction Credit =

$$\frac{1-\left(\frac{ABS(1.5\times(h-e))}{1.5\times(h+e)}\right)-0.25}{0.25}\times 0.03$$

Where:

h = study area households (or housing units)

e = study area employment

Source: Ewing, R. & Cervero, R., 2010. Travel and the Built Environment: A Meta-Analysis. Journal of the American Planning Association, 76(3), pp. 265-294.
Criterion Planner/Engineers and Fehr & Peers Associates, 2001. Index 4D Method. A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes, s.l.: US EPA.

LOCAL SERVING RETAIL	Low	High
Included in analysis	Yes	Yes
Local Serving Retail Presence	Yes	Yes
Reduction Credit	2%	2%

Calculation

Trip Reduction Credit =

2%

Source: Parsons Brinckerhoff Quade & Douglas, I., Cervero, R., Howard Stein-Hudson Associates & Zupan, J., 1996. Influence of Land Use Mix and Neighborhood Design on Transit Demand, Washington, DC: TRB
National Transit Institute, 2000. Coordinating Transportation and Land Use Course Manual, New Brunswick, NJ: Rutgers University.

BELOW MARKET RATE HOUSING	Low	High
Included in analysis	Yes	Yes
Percent of housing units below market rate	12%	12%
Reduction Credit	0.6%	0.6%

Calculation

Residential Trip Reduction Credit =

$$\%\ units\ that\ are\ BMR \times 0.05$$

Where:

BMR = Below Market Rate

Source: Holtzclaw, J. et al., 2002. Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles and San Francisco. Transportation Planning and Technology, 25(1), pp. 1-27.

$$Maximum\ Trip\ Reduction\ for\ Affordable\ Housing =$$
$$(-0.0565 \times \$41{,}663) \times \left(\frac{0.25}{11{,}915}\right) = 5\%$$

Reduction Credit		Context
depends on the proposed project job & housing balance		
MIN	-3.0%	0 balance - all housing or all jobs
Low	2.6%	Approximately 0.46 jobs for each household within a half mile
High	2.6%	Approximately 0.46 jobs for each household within a half mile
MAX	9.0%	IDEAL Job/Household Ratio=1.5

Reduction Credit		Context
literature research		
MIN	0.0%	no local retail presence
Low	2.0%	less than 20% local retail
High	2.0%	less than 20% local retail
MAX	8.0%	80% ore more local retail

Reduction Credit		Context
depends on the % of affordable housing in the proposed project		
MIN	0.0%	no below market-rate housing
Low	0.6%	Percent of housing units below market rate=0.12
High	0.6%	Percent of housing units below market rate=0.12
MAX	5.0%	calculated based on the source

TRANSIT SERVICE FREQUENCY	Low	High
Included in analysis	Yes	Yes
Average daily weekday buses within 1/4 mile	465	605
Average daily weekday trains / rapid transit within 1/2 mile	216	432
Dedicated shuttles that serve the project	0	0
Transit Service Index	1.00	1.00
Reduction Credit	7.47%	7.50%

Calculation

Tip Rate Reduction = $t \times 0.075$

Where: t = Transit service index

Transit Service Index = $\frac{b + 2 \times (r + s)}{900}$

Where:

b = average daily weekday Buses stopping within ¼ mile

r = average daily weekday Rail or rapid transit trips stopping within ½ mile

s = average daily weekday dedicated Shuttle trips

Notes: Transit trips should be based on bus stops located within a 1/4 mile and rapid transit stopping at stations within 1/2 mile.
The number of transit trips must include both directions to calculate the average daily buses, rapid service, shuttles, etc. (e.g., 1 northbound route A + 2 southbound route A buses = 3 bus trips)

A "transit trip" is one route traveling in one direction, counting as 1 trip.

Developments larger than 1/2 mile across must be broken into smaller units for determining the average transit service index.

Reduction Credit		Context
depends on the proposed transit system frequency		
MIN	0.0%	no transit service within 1/2 mile
Low	7.5%	existing service
High	7.5%	project proposed to add transit service
MAX	7.5%	Ideal Transit Service "Trips" (buses + 2x rapid transit trips)=900

WALKING ENVIRONMENT - Connectivity an	Low	High
Included in analysis	Yes	Yes
Mix of uses within 1/2 mile	Yes	Yes
Intersections legs per square mile	590	886
Sidewalk completeness	100%	100%
Sidewalks on both sides	100%	100%
Sidewalks on one side	0%	0%
Existing average block size (mile)	0.41	0.41
Future average block size (mile)	0.11	0.08
Block Size Reduction	-73%	-80%
Walking Environment Index	0.73	0.83
Reduction Credit	6.56%	7.46%

Calculation

Tip Rate Reduction = $9\% * \frac{i + s + b}{3}$

Where:

i = Intersection density

s = Sidewalk completeness

b = (-1)*block size reduction

Intersection density = intersection legs per square mile / 1300 (or 1.0, whichever is less) - including alleys

Sidewalk completeness = % streets with sidewalks on both sides + 0.5 * % streets with sidewalk on one side, Trails and walkways should be included in the intersection measure.

Reduction Credit		Context
depends on the proposed street network and sidewalk infrastructure plan		
MIN	0.0%	single use within 1/2 mile walk
Low	6.6%	mile=590.47619047619, Sidewalk completeness=1 & block size reduced by 0.731707317073171
High	7.5%	mile=885.714285714286, Sidewalk completeness=1 & block size reduced by 0.804878048780488
MAX	9.0%	Ideal intersection density of 1,300 legs per smile, 100% sidewalk and extreme block size

BICYCLE FACILITY		Low	High
Included in analysis		Yes	Yes
Additional (separate) bike lane mileage per square mile (a)		15	21
Bike parking (b)	*outdoor bike parking*	Yes	Yes
	indoor secure bike parking	No	Yes
	Indoor secure bike parking with showers/lockers/changing facilities	No	Yes
Bike share infrastructure (c)		No	Yes
Winter maintenance of bicycle lanes/paths and sidewalks (d)		No	Yes
	Months w. average temperature below freezing in Saint Paul	3	3
	*Additional increase in bike+walk trips**	8%	8%
	Bike Mode Share Increase	5.84%	14.77%
	Reduction Credit	2.92%	7.38%

Calculation

Tip Rate Reduction = bike mode share increase/2   assuming bike mode share increase shifts from transit and driving equally

Notes: (a) Bicycle network – 1% increase in bicycle mode share for each additional mile of bike lane per square mile.
SOURCE: Dill, Jennifer and Theresa Carr (2003). "Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them – Another Look." TRB 2003 Annual Meeting CD-ROM

(b) Outdoor bike parking - 8.6% increase; Indoor secure bike parking - 13.8% increase; indoor with amenities - 22.4% increase
SOURCE: Wardman, Tight, and Page – 2007 as summarized in Pucher, Dill, and Handy (2010) (Referenced in TCRP Report 95, Traveler Response to Transportation System Changes Handbook, Third Edition; Chapter 16, Pedestrian and Bicycle Facilities)

(c) bike share will increase bike mode share by 5~8%
SOURCE: Victoria Transport Policy Institute (2008), Public Bike Systems: Automated Bike Rentals for Short Utilitarian Trips, http://www.vtpi.org/tdm/tdm126.htm. Note: this research does not state if the shift from automobile trips to bicycle trips is for commute or non-commute trips, nor does the research state at what time of day these trips occur, i.e. peak or non peak trips.

(d) Based on Tahoe's model (baseline 7 months) SOURCE: Tahoe Region Bicycle and Pedestrian Use Model, developed by LSC Transportation Consultants and Alta Planning as part of the Tahoe Basin Bicycle/Pedestrian Master Plan (2009)

Reduction Credit		Context
depends on proposed bicycle infrastructure		
MIN	0.0%	no bicycle infrastructure
Low	2.9%	some bicycle infrastructure improvement
High	7.4%	significant bicycle infrastructure improvement
MAX	9.0%	maximum bicycle infrastructure improvement

PARKING SUPPLY	Low	High
Included in analysis	Yes	Yes
Parking supply allocation	Fully dedicated	Mixed
ITE Parking Generation "required" supply	6,916	6,916
Project parking supply	7,500	4,000
Shared parking supply	0	2,000
Parking supply reduction	-8%	42%
All non-parking supply reduction combined		
Residential	22%	28%
Non-residential	22%	28%
Reduction Credit		
Residential	0.00%	7.31%
Non-residential	0.00%	7.31%

if "fully dedicated", credit only applied to the uses with a supply below ITE
if "fully shared', credit applied to all land uses;
if "mixed", credit only applied to land uses that share parking supply

Calculation

Tip Rate Reduction = $\frac{p-(m+t+b)}{2}$

Where: p=parking supply reduction

m+t+b=all non-parking supply reduction combined

Reduction Credit		Context
depends on parking supply and its associated land use		
MIN	0.0%	parking supply fully dedicated and all above ITE requirements
Low	0.0%	parking supply fully dedicated, applied only to uses with a supply below ITE
High	7.3%	parking supply fully shared, applied to all uses
MAX	50.0%	no parking is provided and there are measures in place to manage overspill such as residential parking permits, parking time-limits, parking pricing, etc.

To avoid double counting with other trip reduction measures, the impacts of parking supply are proposed to be assessed in conjunction with all other non-residential trip reduction measures as follows:

- If the percentage reduction from all other non-residential trip reduction measures is equal to or greater than the parking supply reduction, no additional credit is granted. For example, if parking supply is reduced 10% from ITE levels, and transit, mixed use and pedestrian/bicycle trip reductions amount to 20%, the 20% figure would be used.
- In effect, the parking supply reduction is only used if it is greater than the impact from other trip reduction measures, and the difference is discounted by 50%. For example, if parking supply is reduced 20% from ITE levels, and transit, mixed use and bicycle/pedestrian trip reductions amount to 10%, the parking supply reduction impact of 5% = ((20%-10%)/2) is used.
- The Parking Generation handbook covers most common land uses; however, for some land uses no parking generation rates are available. In these cases, the ITE parking supply would be lower than if ITE had rates, making it harder for the project supply to be lower than the ITE supply (making it harder for this measure to be applied).

SOURCE: NELSON\NYGAARD TRIP GEN STUDY

PARKING PRICING	Low	High
Included in analysis	Yes	Yes
Residents pay	No	No
Average Daily parking price	$ -	
Parking unbundling	No	Yes
Resident Parking Price Reduction Credit	0.00%	0.00%
Resident Unbundling Bonus Credit	0.00%	0.00%
Employees pay	No	Yes
Daily parking price	$ -	$ 2.50
Parking cash-out	No	Yes
Employee Parking Price Reduction Credit	0.00%	8.33%
Employee Cash-out Bonus Credit	0.00%	4.17%
Customers pay	No	Yes
Daily parking price	$ -	$ 5.00
Customer Parking Price Credit	0.00%	16.67%
Residential Parking Cost Reduction Credit	0.00%	0.00%
Non-Residential Parking Cost Reduction Credit	0.00%	9.72%

Calculation

Parking Pricing

$$\text{Employee and / or Customer Trip Reduction} = \left(\left(\frac{\text{daily parking charge}}{\$7.50}\right) * 25\%\right)$$

Cash-Out Bonus

$$\text{Employee Trip Reduction} = (\text{parking pricing reduction}) \times 50\%$$

Reduction Credit		Context
depends on proposed parking price & cashout programs		
MIN	0.0%	no priced parking, no unbundled parking, and no cash-out program
Low	0.0%	Residents pay $0, Employees pay $0, Customers pay $0 & no unbundled parking & no cash-out
High	9.7%	Residents pay $, Employees pay $2.5, Customers pay $5 & Parking unbundling & Parking cash-out
MAX	24.6%	pay more than $7.5/day on parking. Unbundling resident parking and employee cash-out program exist

A maximum trip reduction of 25% should be applied to projects that commit to introducing parking pricing. This is based on the approximate midpoint of observed reductions, which range from 15% to 38% (see SOURCE below). Note that most of these studies apply to before-after or with-without comparisons, with no increase in transit service or other measures to reduce vehicle trips.

This maximum reduction should apply to prices of $7.50 per day or greater (in 2012 dollars).If the parking charge is more than $7.50, the 25% reduction is taken. If parking charges do not apply to all trips to a site (e.g. customers are exempt), the reduction is pro-rated by the percentage of trips that the charges apply to. If little or no on-site parking is provided, the parking charges should be the average of those of surrounding public facilities.

SOURCE: Shoup & Willson, Federal Tax Policy and Employer-paid Parking: The Influence of Parking Prices on Travel Demand, 1990; Comsis Corporation, 1993; Valk & Wasch, 1998; Pratt, 2000; Kumzyak, Evans, IV, & Pratt, 2010

FREE TRANSIT PASSES	Low	High
Included in analysis	Yes	Yes
Resident Free Transit Pass Program	No	No
Employee Free Transit Pass Program	No	Yes
Free Transit Pass Reduction Credit		
Residential	0.00%	0.00%
Non-residential	0.00%	1.88%

Calculation

$$\text{Resident and / or Employee Trip Reduction} = (t) \times 25\%$$

Where: t = Transit reduction impact

SOURCE: Nelson\Nygaard research

Reduction Credit		Context
depends on proposed transit pass programs		
MIN	0.0%	no transit pass program
Low	0.0%	no resident program & no employee program
High	0.0%	no resident program & employee free pass offered
MAX	3.8%	free transit pass program offered with full 15% transit service reduction

TDM PROGRAMS	Low	High
Included in analysis	Yes	Yes
Car sharing/short-term car rental	Yes	Yes
Carpooling/vanpooling	Yes	Yes
Ride/carpool matching programs	No	Yes
Preferred carpool/vanpool parking	No	Yes
Telecommuting/alternative work schedule	No	Yes
Guaranteed Ride Home	No	Yes
Transportation/commuter informational materials	No	Yes
Dedicated employee transportation coordinator	No	Yes
# of TDM Programs	2	8
TDM Program Reduction Credit	0.00%	4.23%

Assuming that half the people that bike/walk would otherwise have driven, and the other half would have taken transit

Calculation

Major TDM Program (5 or more elements)

$$\text{Employee Trip Reduction} = (2\% + (10\% \times t) + (10\% \times b))$$

Minor TDM Program (3 to 4 elements)

$$\text{Employee Trip Reduction} = (1\% + (5\% \times t) + (5\% \times b))$$

Where: t = Transit reduction impact

b = Bicycle & pedestrian reduction impact

SOURCE: URBEMIS trip gen model

Reduction Credit		Context
depends on proposed TDM programs		
MIN	0.0%	no TDM programs
Low	0.0%	2 TDM programs offered
High	4.2%	8 TDM programs offered
MAX	4.4%	offered with a full 15% transit service credit and 9% bike & ped credit

TRIP GENERATION ANALYSIS

Standard ITE Vehicular Trip Generation

TOTAL Vehicle Trips		Min Total	Max Total	Min Entering	Max Entering	Min Exiting	Max Exiting	Average Total	Average Entering	Average Exiting	Factored Entering	Factored Exiting
Weekday	Residential	16,720	26,600	8,360	13,300	8,360	13,300	21,660	10,830	10,830	10,830	10,830
	Non-Residential	15,436	18,541	7,718	9,270	7,718	9,270	16,988	8,494	8,494	8,494	8,494
	Total	32,156	45,141	16,078	22,570	16,078	22,570	38,648	19,324	19,324	19,324	19,324
AM Peak Hour*	Residential	1,200	2,680	258	670	828	2,010	1,940	464	1,419	478	1,462
	Non-Residential	971	2,752	753	1,738	207	1,035	1,862	1,245	621	1,242	619
	Total	2,171	5,432	1,012	2,408	1,035	3,045	3,802	1,710	2,040	1,720	2,081
PM Peak Hour*	Residential	1,400	3,120	854	1,810	546	1,310	2,260	1,332	928	1,332	928
	Non-Residential	1,330	1,941	402	637	928	1,333	1,636	520	1,130	515	1,120
	Total	2,730	5,061	1,256	2,447	1,474	2,644	3,896	1,852	2,059	1,847	2,049

Context Input

Average vehicle occupancy for Saint Paul (4 Census block groups, 2000 data)	1.08	*Source: ACS 2014*
		Note: For Highland neighborhood 80.5%, Saint Paul 80.6%. Source: ACS 2013.
Vehicular Mode Split	80.5%	*http://www.mncompass.org/profiles/neighborhoods/st-paul/highland*
Transit Mode Split	9.0%	*Note: ACS data only includes work trips*
Nonmotorized (Walk/Bike) Mode Split	10.5%	

Trip Gen Reduction Factors

		NEW	MXD model	
Internal Capture Reduction				*source: G. Tian, et al.(2015) Traffic Generated by Mixed-Use Developments: 13-region study using conistent*
	Weekday	18.7%	9.9%	*measures of built environment*
	AM Peak	14.2%	7.5%	
	PM Peak	17.9%	9.5%	
		LOW	HIGH	
Residential Reduction Factors combined		22.1%	39.1%	*see tab "REDUCTION CALCULATION"*
Non-residential Reduction Factors combined		22.1%	50.7%	*see tab "REDUCTION CALCULATION"*

Trip Gen Adjustments and Reductions

		Daily	AM Entering	AM Exiting	PM Entering	PM Exiting
ITE Vehicle Trips (Average of Min and Max)	Residential	21,660	478	1,462	1,332	928
	Non-Residential	16,988	1,242	619	515	1,120
	Total	38,648	1,720	2,081	1,847	2,049
Person Trips (Average Vehicle Occupancy applied)	Residential	23,393	516	1,579	1,438	1,002
	Non-Residential	18,347	1,341	669	556	1,210
	Total	41,740	1,858	2,248	1,995	2,212
External Person Trips (Internal Capture applied)	Residential	19,018	443	1,355	1,180	823
	Non-Residential	14,916	1,151	574	456	993
	Total	33,934	1,595	1,929	1,637	1,815
External Vehicle Trips (AVO applied again)	Residential	17,610	410	1,255	1,093	762
	Non-Residential	13,811	1,066	532	423	919
	Total	31,421	1,477	1,786	1,515	1,681

		Daily	AM Entering	AM Exiting	PM Entering	PM Exiting	Daily	AM Entering	AM Exiting	PM Entering	PM Exiting
		Low					High				
Reduced External Vehicle Trips (with reduction factors)	Residential	13,710	320	977	851	593	10,727	250	764	666	464
	Non-Residential	10,753	830	414	329	716	6,812	526	262	208	453
	Total	24,463	1,150	1,391	1,180	1,309	17,539	776	1,027	874	917
TOTAL EXTERNAL VEHICLE TRIPS		**24,463**	**1,150**	**1,391**	**1,180**	**1,309**	**17,539**	**776**	**1,027**	**874**	**917**

Trip Gen Outputs: Vehicular Trips

	Low	High
Total External Daily Vehicular Trips	24,463	17,539
Total External AM Peak Vehicular Trips	2,540	1,802
Total External PM Peak Vehicular Trips	2,489	1,792

Transit Trips 8.50%

	Low	High
Total External Daily Trips	6,167	10,675
Total External AM Peak Trips	640	1,121
Total External PM Peak Trips	627	1,081

Walk/Bike Trips 5.60%

	Low	High
Total External Daily Trips	4,063	7,033
Total External AM Peak Trips	422	738
Total External PM Peak Trips	413	712

Trips	Low	High
External Vehicle Trips	24,463	17,539
External Transit Trips	6,167	10,675
External NMT Trips	4,063	7,033
TOTAL EXTERNAL TRIPS	34,692	35,246

Mode split	Low	High
Auto	71%	50%
Transit	18%	30%
NMT	12%	20%

Appendices

Appendix A-2

Pedestrian and Bicycle Level of Service

The level of service provided to pedestrians and bicycles can affects the likelihood that these alternate modes of travel may be used. Higher non-motorized mode shares can be achieved by providing infrastructure that increases the level of service experienced.

Several methods have been used to estimate multi-modal level of service (MMLOS). Quantitative measures such as the Highway Capacity Manual (HCM) typically estimate the delay experienced by users. For this project, an alternative set of measures were used to incorporate an element of quality-based level of service as well. This level of service methodology was adopted by the City of Charlotte, North Carolina in its Uniform Street Development Guidelines[1].

Each factor is scored and weighted in a point-based system. The factoring is based on signal-controlled intersections, but for the purpose of this study stop-controlled intersections were included where necessary, with scoring based on interpolation of the values and characteristics. Factors were developed for the existing configuration of the intersections, and for a build condition assuming necessary intersection improvements necessary to increase the pedestrian/bicycle levels of service within the current public right-of-way.

Level of Service Factors: Pedestrian

Table 1	Crossing Distance
Table 2	Signal Phasing and Timing Features
Table 2A	Left Turn Conflicts (LT into pedestrian crossing path)
Table 2B	Right Turn Conflicts (LT into pedestrian crossing path)
Table 2C	Pedestrian Phase Signal Display
Table 3	Corner Radius
Table 4	Right Turns on Red
Table 5	Crosswalk Treatment

Level of Service Factors: Bicycle

Table 8	Bicycle Travel Way and Speed of Adjacent Traffic
Table 9	Signal Features Left Turn Signal Phasing and Timing Features and Stop Bar Location
Table 10	Right Turn Conflict
Table 11	Right Turns on Red
Table 12	Intersection Crossing Distance

[1] Pedestrian & Bicycle Level of Service Methodology for Crossings at Signalized Intersections (http://charlottenc.gov/Transportation/PlansProjects/Documents/USDG%20Full%20Document.pdf, last accessed December 15, 2016)

RECOMMENDED EXTERNAL ROADWAY SYSTEM AND PEDESTRIAN AND BICYCLE IMPROVEMENTS

Intersection	Recommended Improvements (Ped/Bike, Auto)
Ford Parkway/ Mississippi River Boulevard Access Ramps (N. and S. ramps at Ford Pkwy)	• Ladder-type or textured/colored crosswalk treatment • Promote through movements on Mississippi River Blvd. • Add Enhanced shared bicycle/auto lane on Ford Parkway
Ford Pkwy/ Mount Curve Blvd	• Signalize intersection • Provide NB/SB Left-turn lanes • Extend WB left-turn lane • Ladder-type or textured/colored crosswalk treatment • Enhanced pedestrian signal features • Bike boxes at intersection approaches • Add enhanced shared bicycle/auto lane on Ford Parkway • In-street bicycle lanes within site, shared bike lanes on north approach
Ford Pkwy/ Cretin Ave.	• Add NB left- and right-turn lanes, * • Extend WB left-turn lane, Remove part of median, EB right-turn lane* • Ladder-type or textured/colored crosswalk treatment • Enhanced pedestrian signal features • Bike boxes at intersection approaches • Enhanced shared bicycle/auto lane on Ford Parkway **May impact pedestrian/bicycle environment and will require additional review*
Ford Pkwy/ Finn Street	• Ladder-type or textured/colored crosswalk treatment • Enhanced pedestrian signal features • Bike boxes at intersection approaches • Enhanced shared bicycle/auto lane on Ford Parkway • In-street bicycle lanes within site
Ford Pkwy/ Cleveland Avenue	• Ladder-type or textured/colored crosswalk treatment • Bike boxes at intersections • Enhanced shared bicycle/auto lane on Ford Parkway • In-street bicycle lanes south of Ford Parkway
Cleveland Ave./ St. Paul Ave.	• Reconfigure intersection and traffic control • pedestrian signal features • Ladder-type or textured/colored crosswalk treatment • Bike boxes at intersection • Add in-street bicycle lanes on St. Paul Ave. • Enhanced shared bicycle/auto lane on Ford Parkway

Pedestrian and Bicycle Level of Service Summary[2]

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

[2] Level of Service A-F and points as estimated from Pedestrian & Bicycle Level of Service Methodology for Crossings at Signalized Intersections, (http://charlottenc.gov/Transportation/PlansProjects/Documents/USDG%20Full%20Document.pdf, last accessed December 15, 2016)

Appendices

Appendix A-3

Vehicle Traffic Operations/Level of Service

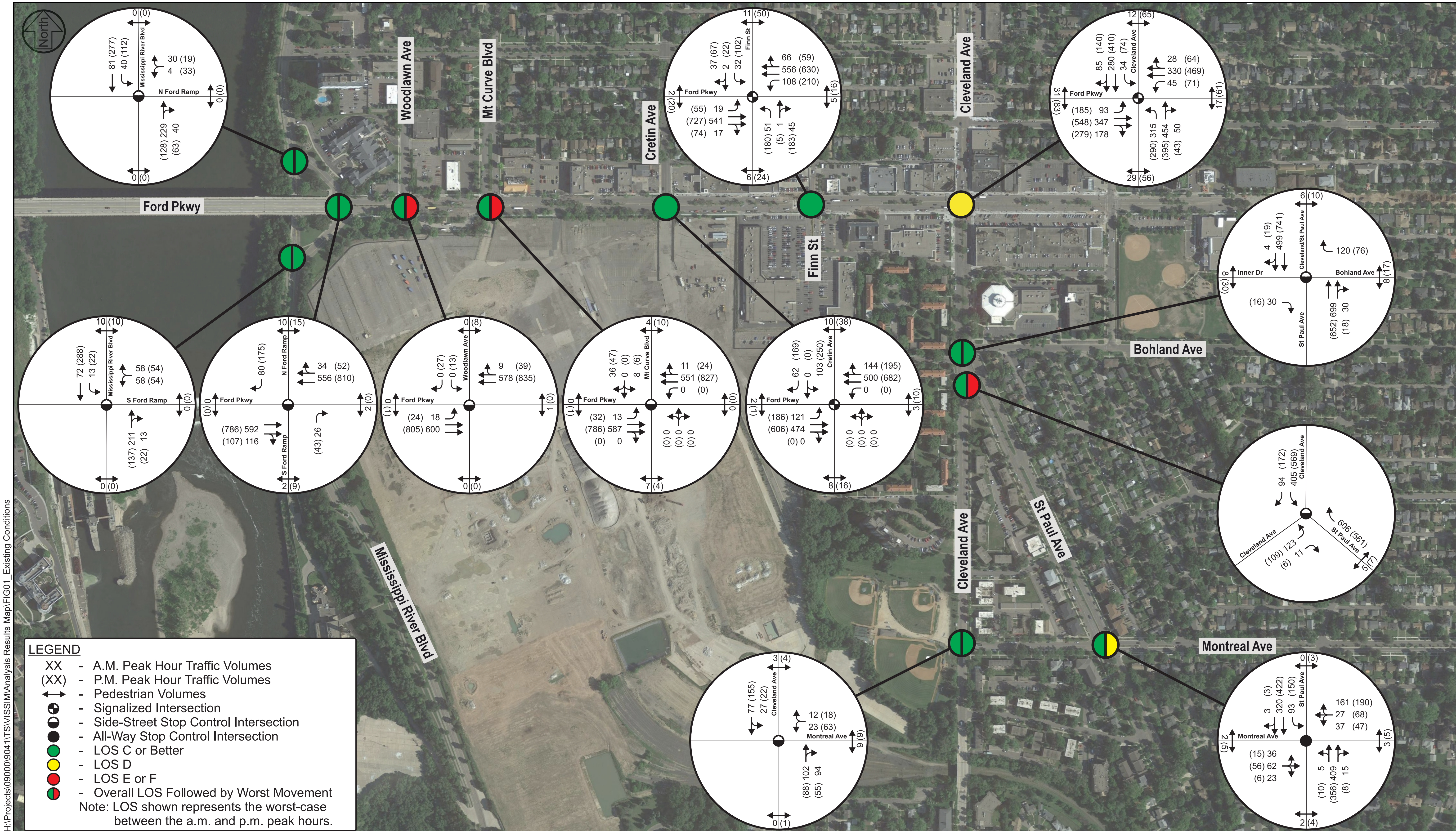
Vehicle Traffic Operations/Level of Service

Traffic levels of service and additional analysis was conducted using Synchro/Simtraffic and VISSIM software packages. This appendix documents the data collected, assumptions, and analysis.

Data Collection

Figure A-1 shows the AM and PM traffic counts for the project, collected September 11 through September 14, 2015. Counts were supplemented in the analysis by information for other locations provided by the City of St. Paul and the Minnesota Department of Transportation. Traffic signal timing and roadway geometrics included information form the City of St. Paul and other traffic studies in the area. And reviewed for quality control. No seasonal adjustments were used because September is a near-average month for traffic volumes.

Table A-1 provides a summary of existing signal timing used in the initial analysis.



H:\Projects\09000\9041\TS\VISSIM\Analysis Results Map\FIG01_Existing Conditions

SRF Consulting Group, Inc.

015 9041
January 2016

2015 Existing Conditions

Ford Site Redevelopment

City of Saint Paul

Figure A-1

Table A-1 Traffic Signal Timing Data and Assumptions

Intersection	Parameter	AM																					PM																			
		Cycle	Offset	Sequence	Normal								TSP								Cycle	Offset	Sequence	Normal								TSP							
					1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Ford and 46th Ave	Direction	-	-	-	WBL	EB	SWB	SB	EBL	WB		NB	-	-	-	-	-	-	-	-	-	-	-	WBL	EB	SWB	SB	EBL	WB		NB	-	-	-	-	-	-	-	-
	Split	110	2	1	24	37	18	31	15	46		31	-	-	-	-	-	-	-	-	120	110	1	29	41	16	34	13	57		34	-	-	-	-	-	-	-	-
	Min Green	-	-	-	5	10	7	7	5	10		7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Yellow	-	-	-	3.5	3.5	3.5	3.5	3.5	3.5		3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Red	-	-	-	2.5	3	3	3	2.5	3		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Extension	-	-	-	3	3	3	3	3	3		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Walk	-	-	-		7		7		7			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FDW	-	-	-		26		22		26			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Recall/TSP Ph	-	-	-		C				C				X				X			-	-	-	-	C	-	-	-	C	-	-		X				X		
	Max Reduction	-	-	-	-	-	-	-	-	-	-	-	6	9	5	8	4	12		8	-	-	-	-	-	-	-	-	-	-	-	7	10	4	9	3	14		9
	Min Green	-	-	-	-	-	-	-	-	-	-	-	18	28	13	23	11	32		23	-	-	-	-	-	-	-	-	-	-	-	22	31	12	25	10	43		25
	Max Extension	-	-	-	-	-	-	-	-	-	-	-	255	255	255	255	255	255		255	-	-	-	-	-	-	-	-	-	-	-	255	255	255	255	255	255		255
Ford and Cretin	Direction	-	-	-	EBL	WB		NB/SB		EB			-	-	-	-	-	-	-	-	-	-	-	EBL	WB		NB/SB		EB			-	-	-	-	-	-	-	-
	Split	80	47	1	15	32		33		47			-	-	-	-	-	-	-	-	110	66	1	16	64		30		80			-	-	-	-	-	-	-	-
	Min Green	-	-	-	8	10		10		10			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Yellow	-	-	-	3	4		3.5		4			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Red	-	-	-	1	1		1		1			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Extension	-	-	-	3	3		3		3			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Walk	-	-	-		7		7		7			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FDW	-	-	-		9		17		7			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Recall/TSP Ph	-	-	-		C				C				X				X			-	-	-	-	C	-	-	-	C	-	-		X				X		
	Max Reduction	-	-	-	-	-	-	-	-	-	-	-	4	8		8		12			-	-	-	-	-	-	-	-	-	-	-	4	16		8		20		
	Min Green	-	-	-	-	-	-	-	-	-	-	-	11	24		25		35			-	-	-	-	-	-	-	-	-	-	-	12	48		22		60		
	Max Extension	-	-	-	-	-	-	-	-	-	-	-	255	255		255		255			-	-	-	-	-	-	-	-	-	-	-	255	255		255		255		
Ford and Finn	Direction	-	-	-	WBL	EB		NB/SB		WB			-	-	-	-	-	-	-	-	-	-	-	WBL	EB		NB/SB		WB			-	-	-	-	-	-	-	-
	Split	80	43	1	14	34		32		48			-	-	-	-	-	-	-	-	110	64	1	23	42		45		65			-	-	-	-	-	-	-	-
	Min Green	-	-	-	7	16		8		16			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Yellow	-	-	-	3	3.5		4		3.5			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Red	-	-	-	1	1		1		1			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Extension	-	-	-	3	3		3		3			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Walk	-	-	-		7		7		7			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FDW	-	-	-		15		17		9			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Recall/TSP Ph	-	-	-		C				C				X				X			-	-	-	-	C	-	-	-	C	-	-		X				X		
	Max Reduction	-	-	-	-	-	-	-	-	-	-	-	4	9		8		12			-	-	-	-	-	-	-	-	-	-	-	6	11		11		16		
	Min Green	-	-	-	-	-	-	-	-	-	-	-	10	25		24		36			-	-	-	-	-	-	-	-	-	-	-	17	31		34		49		
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Ford and Cleveland	Direction	-	-	-	EBL	WB	SBL	NB	WBL	EB	NBL	SB	-	-	-	-	-	-	-	-	-	-	-	EBL	WB	SBL	NB	WBL	EB	NBL	SB	-	-	-	-	-	-	-	-
	Split	80	45	1		34	12	34		36	15	31	-	-	-	-	-	-	-	-	110	86	1	13	40	12	45	12	41	19	38	-	-	-	-	-	-	-	-
	Min Green	-	-	-	7	10	7	10	7	10	7	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Yellow	-	-	-	3	3.5	3	3.5	3	3.5	3	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Red	-	-	-	1	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Extension	-	-	-	3	3	3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Walk	-	-	-		7		7		7		7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	FDW	-	-	-		15		17		20		17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Recall/TSP Ph	-	-	-		C		Max		C		Max		X				X			-	-	-	-	C	-	Max	-	C	-	Max		X				X		
	Max Reduction	-	-	-	-	-	-	-	-	-	-	-		9	3	9		9	4	8	-	-	-	-	-	-	-	-	-	-	-	3	10	3	11	3	10	5	10
	Min Green	-	-	-	-	-	-	-	-	-	-	-		25	9	25		25	11	23	-	-	-	-	-	-	-	-	-	-	-	10	30	9	34	9	31	14	28
	Max Extension	-	-	-	-	-	-	-	-	-	-	-		255	255	255		255	255	255	-	-	-	-	-	-	-	-	-	-	-	255	255	255	255	255	255	255	255

Notes:

1) Signal Timing from A-Line Vissim (Project # 7939)_Vissim/4_RB_TSP/12 Vissim Files

2) Min green, yellow, red, extension, walk, and FDW will remain the same as existing models since those timings are from the signal timing project. Implementation of TSP won't change those.

3) Existing timing will only change for phase splits and TSP

4) No delay on TSP and no minimum reservice cycle

	Distance from detector to signal	800	ft
	Bus Speed	30	mph
Phase 2	Bus Speed	43.998	fps
	Travel Time	18	s
	Travel Time Slack	10	s
	Distance from detector to signal	800	ft
	Bus Speed	30	mph
Phase 6	Bus Speed	43.998	fps
	Travel Time	18	s
	Travel Time Slack	10	s
	Distance from detector to signal	515	ft
	Bus Speed	30	mph
Phase 2	Bus Speed	43.998	fps
	Travel Time	12	s
	Travel Time Slack	10	s
	Distance from detector to signal	806	ft
	Bus Speed	30	mph
Phase 6	Bus Speed	43.998	fps
	Travel Time	18	s
	Travel Time Slack	10	s
	Distance from detector to signal	580	ft
	Bus Speed	30	mph
Phase 2	Bus Speed	43.998	fps
	Travel Time	13	s
	Travel Time Slack	10	s
	Distance from detector to signal	580	ft
	Bus Speed	30	mph
Phase 6	Bus Speed	43.998	fps
	Travel Time	13	s
	Travel Time Slack	10	s
	Distance from detector to signal	580	ft
	Bus Speed	30	mph
Phase 2	Bus Speed	43.998	fps
	Travel Time	13	s
	Travel Time Slack	10	s
	Distance from detector to signal	343	ft
	Bus Speed	30	mph
Phase 6	Bus Speed	43.998	fps
	Travel Time	8	s
	Travel Time Slack	10	s

Existing Conditions Analysis

Also shown in Figure A-1 (and summarized below in Table A-2) are the roadway levels of service for the intersections under review for the Ford site area. Figure A-2 shows examples of the various levels of service corresponding to typical conditions. Table A-3 shows the standards for intersection delay used to assign letter grade levels of service.

Table A-2: Existing Levels of Service

	AM (PM) Peak Hour Delay (average sec.)*	**AM (PM) Peak Hour Level of Service***
46th Ave/46th St	12 (15)	B (B)
Ford Pkwy/Mississippi River Blvd	1/7 (2/8)	A/A (A/A)
Ford Pkwy/Woodlawn Ave	1/1 (1/1)	A/A (A/A)
Ford Pkwy/Mt Curve Blvd	1/11 (1/12)	A/B (A/B)
Ford Pkwy/Cretin Ave	11 (16)	B (B)
Ford Pkwy/Finn St	8 (16)	A (B)
Ford Pkwy/Cleveland Ave	22 (44)	C (D)
St Paul Ave/Cleveland Ave/Bohland Ave/Inner Dr	6/46 (5/59)	A/E (A/F)
Montreal Ave/Cleveland Ave	4/9 (4/10)	A/A (A/A)
Montreal Ave/St Paul Ave	12 (14)	B (B)
Mississippi River Blvd/N Ford Ramp	1/7 (2/16)	A/A (A/C)
Mississippi River Blvd/S Ford Ramp	3/9 (3/11)	A/A (A/B)

*For unsignalized intersections, delay and LOS are shown as overall/worst approach.

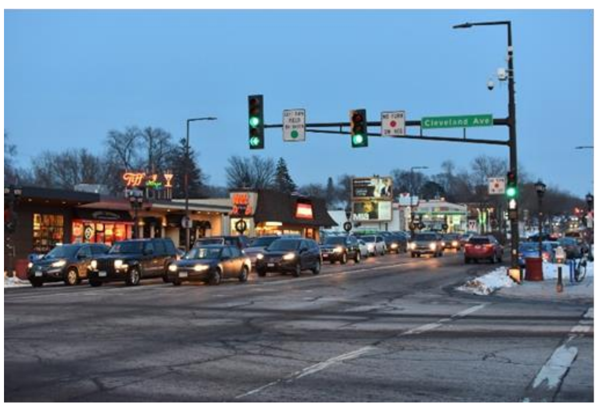
Figure A-2: Level of Service Examples

Level of Service A:
Majority of through traffic doesn't stop

Level of Service B:
Minimal waiting at traffic signal

Level of Service C:
Increased number of stops and queueing

Level of Service D:
Majority of vehicles have to stop and may have to wait through more than one green light



Level of Service E:
Majority of vehicles have to stop and wait through more than one green light. Significant queueing occurs.

Level of Service F (Side-Street):
Vehicles typically queued waiting for a safe opening in traffic

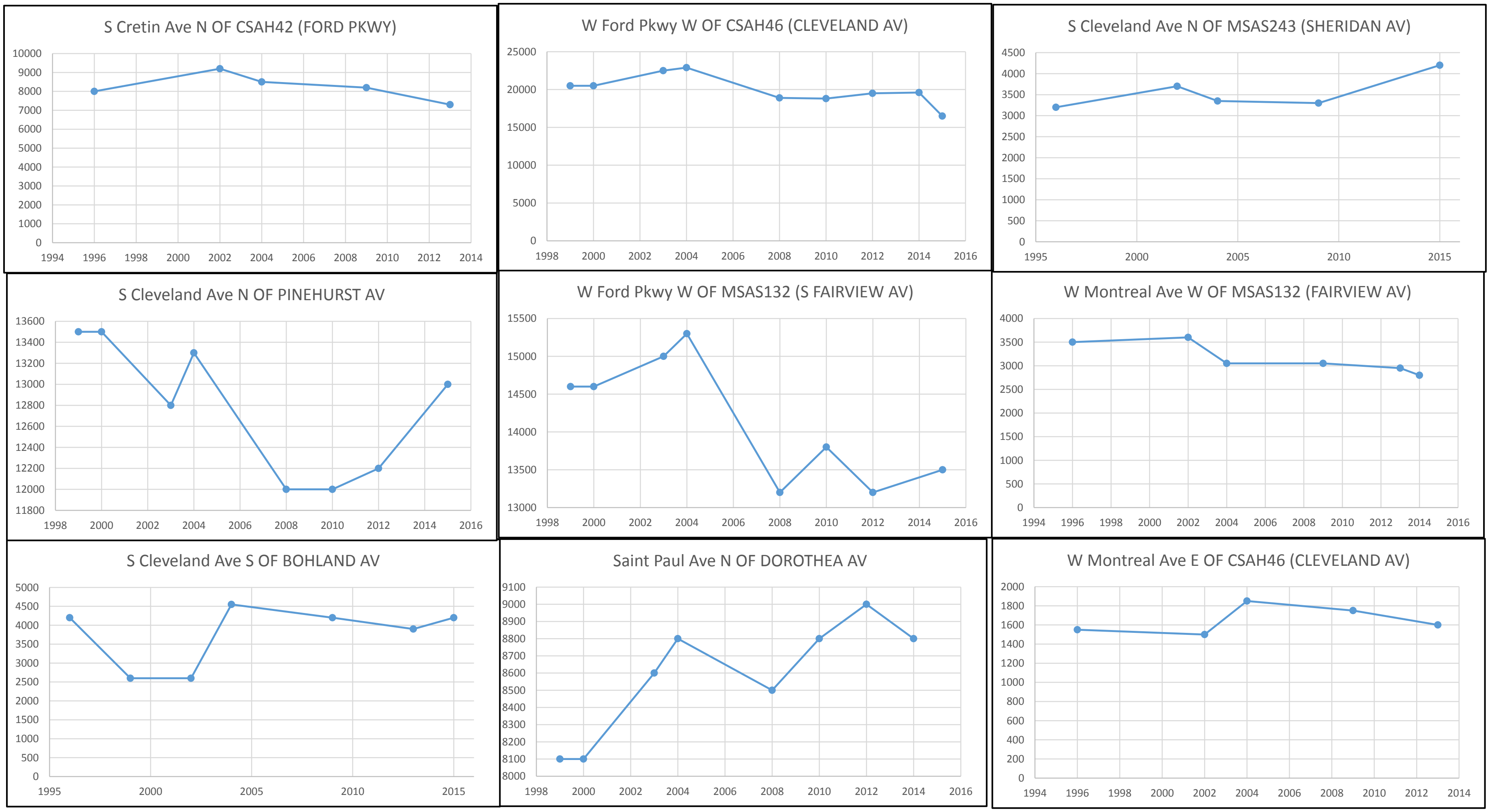
Table A-3: Delay Standards for Level of Service

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

Background Traffic Growth

Daily traffic volumes on key roadway segments in the region have remained relatively stable over time (Figure A-3). For this reason, this analysis assumes that, absent development of the Ford site and other sites currently under construction, no background traffic growth would occur.

Figure A-3: Historical Counts



Cretin Avenue/Montreal Avenue Diversion Analysis

Traffic modeling for the project estimates that a through-connection of extended north/south routes (such as Cretin Avenue, Finn Avenue, or Mount Curve Blvd.) and extended Montreal Avenue would reduce the amount of background traffic through the Ford Parkway/Cleveland Avenue intersection. The diversion would range from 29 to 38 percent, or 178 to 315 vehicles, depending on the direction and time of day as conceptually shown in Figure A-4. The diversion of traffic has minimal impacts on these three intersections in the a.m. peak, but the overall intersection delay decreases by five seconds at the Ford Parkway/Cleveland Avenue intersection with the diversion of traffic in the p.m. peak (Table A-4).

Figure A-4: Potential Diversion of traffic from Ford Pkwy. /Cleveland Ave. Intersection

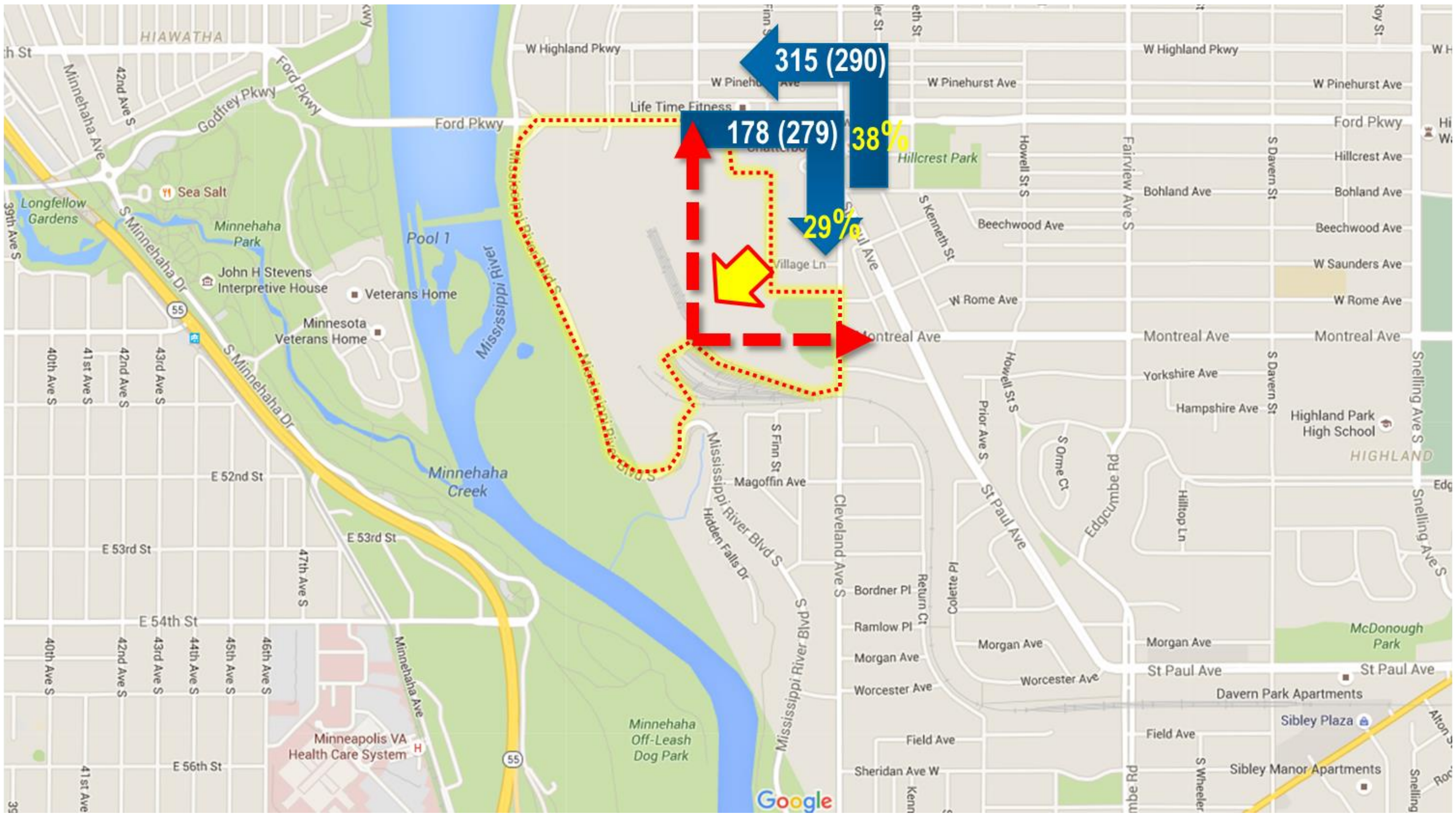


Table A-4 Ford Parkway/Cleveland Avenue Diversion Effects[1]

	AM		PM	
	Without Diversion	With Diversion	Without Diversion	With Diversion
Ford Pkwy/Cretin Ave	11 (B)	14 (B)	16 (B)	19 (B)
Ford Pkwy/Cleveland Ave	22 (C)	22 (C)	44 (D)	39 (D)
Montreal Ave/Cleveland Ave[2]	4 (A)/9 (A)	9 (A)/13 (B)	4 (A)/10 (B)	9 (A)/15 (C)

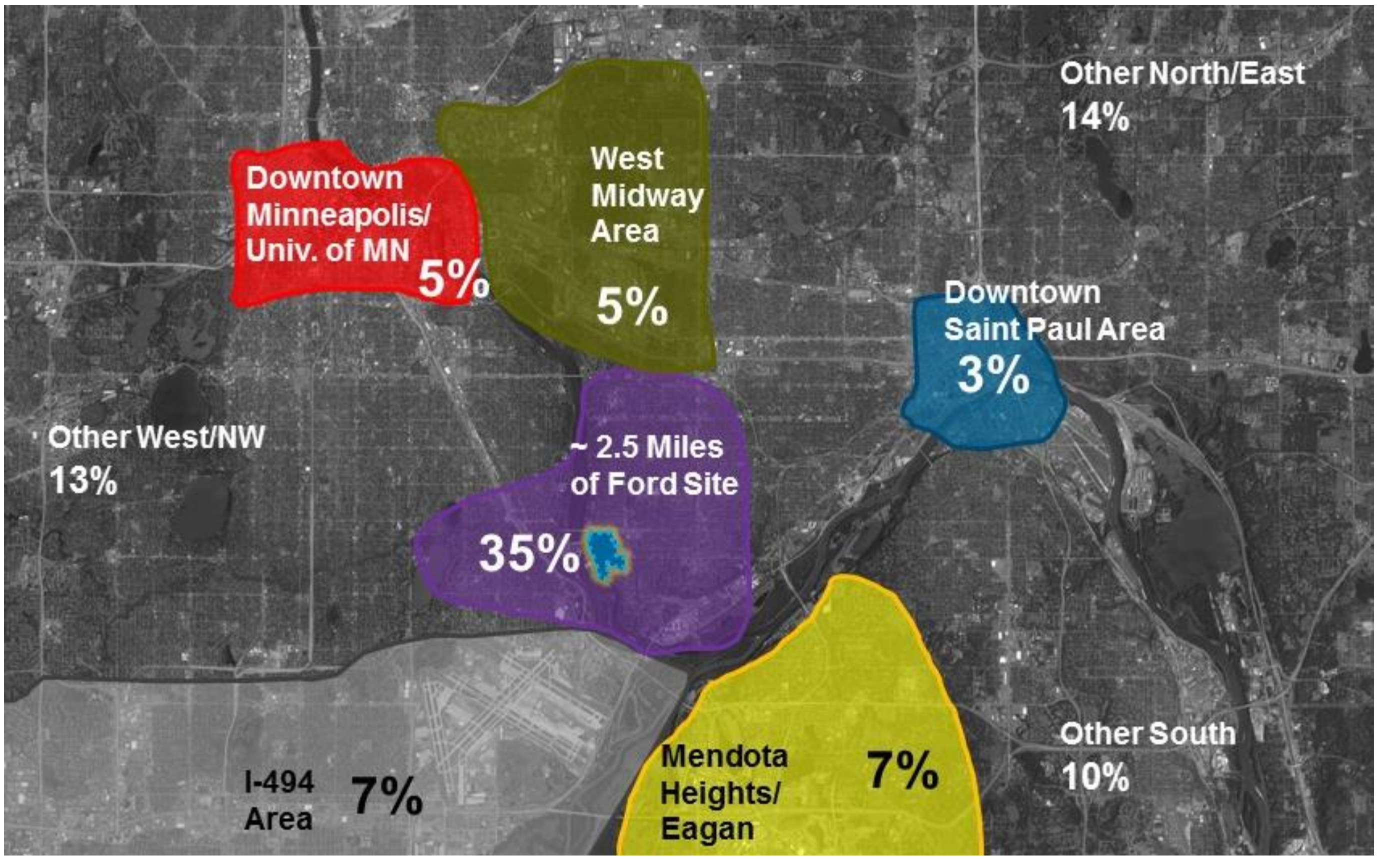
Notes:

(1) Average delay, in seconds, and level of service
(2) Intersection is side-street stop control. The LOS is shown for the intersection followed by the LOS of the worst approach. Delay shown was calculated using the HCM 2010.

Direction of Approach Analysis

The Ford site redevelopment presents a significant change in the levels and mix of land uses and activities in the Highland Park area. Standard traffic analysis techniques are not sufficient to reflect the changes in travel patterns (origins, destinations, modes and routes) that may occur. A high-level run of the Metropolitan Council's travel demand model was used to estimate the likely origin and destination patterns of the Ford site activities; the model considers the magnitude of activities, typical willingness to travel, and competing opportunities. As shown in Figure A-5, the Ford site is centrally located in the region, and can be expected to have a dispersed pattern of travel. For example, downtown Minneapolis, downtown St. Paul, and the I-494 area are the three major job concentrations in the region, and are the Ford site is centrally located among them. An estimated 35 percent of the trips are expected to be generated within 2.5 miles of the Ford site (including those that stay on the site.

Figure A-5: Distribution of travel to/from Ford Site



Vehicle Traffic Operations/Levels of Service

Figure A-6 translates the travel distribution, in combination with the mode shares, to estimate the general flow of vehicular traffic. Specific roadways used may depend on the locations of land uses and parking within the site.

Figure A-6: Vehicle Trip Directions of Approach

Vehicle Traffic Operations/Levels of Service

Build Alternative Analysis

Figure A-7 and A-8 show the schematic traffic volumes estimated for the base condition, which forms the worst-case for the traffic analysis. These are the input volumes for the traffic analysis.

Table A-5 shows the resulting traffic simulation/level of service results for the area intersections with the development of the Ford site. Included in the analysis are assessments of both the overall intersection and the worst approach of the intersection.

Based on the results of the simulation, as series of potential modifications to the intersections have been identified that could provide improvements to the level of service (Table A-6). It should be noted that detailed implementation of any of these should be considered in concert with modifications to better serve pedestrian and bicycle levels and quality of service.

Figure A-7
Base Scenario AM Peak Hour Traffic Volumes

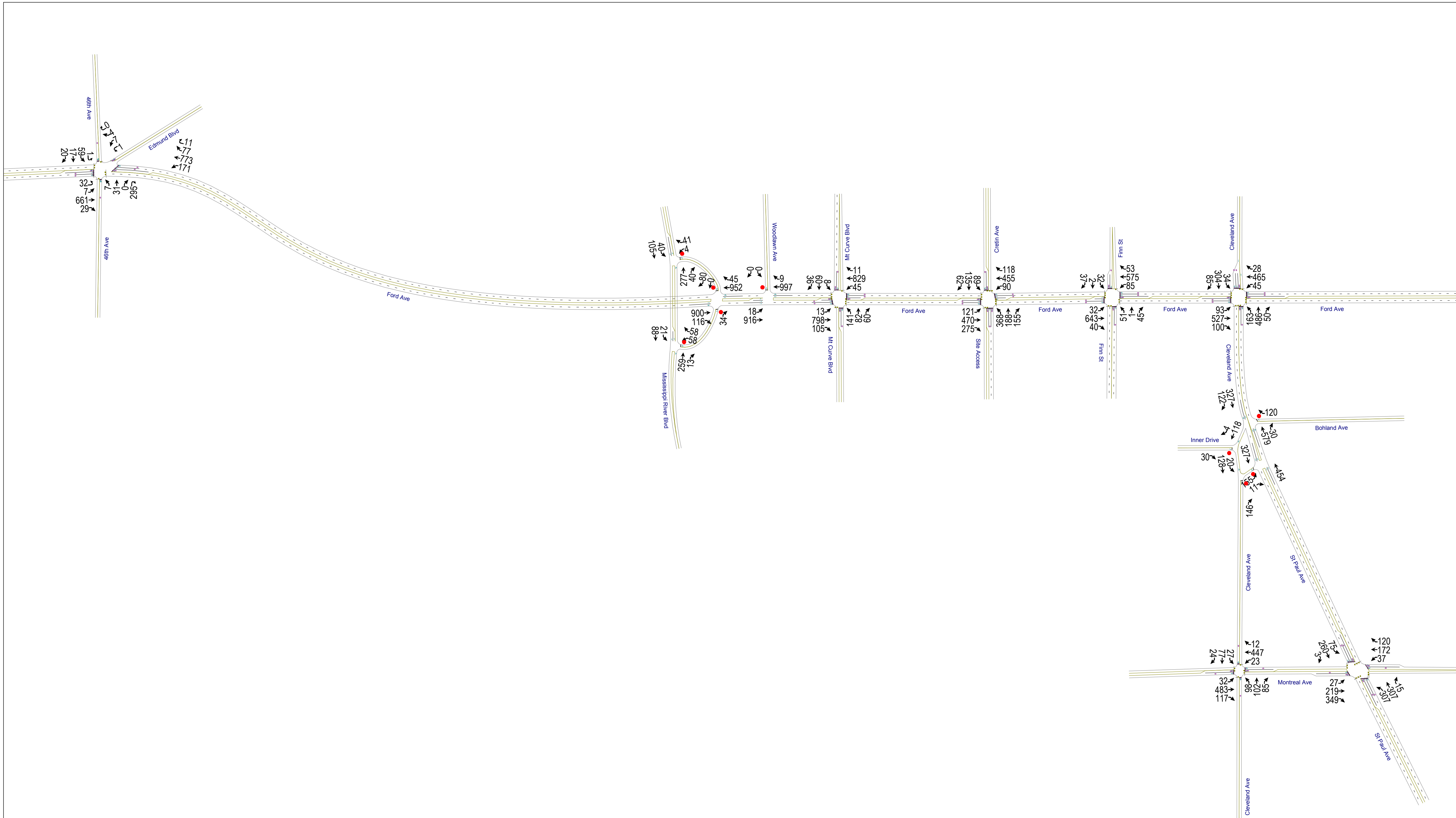


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Figure A-8
Base Scenario PM Peak Hour Traffic Volumes

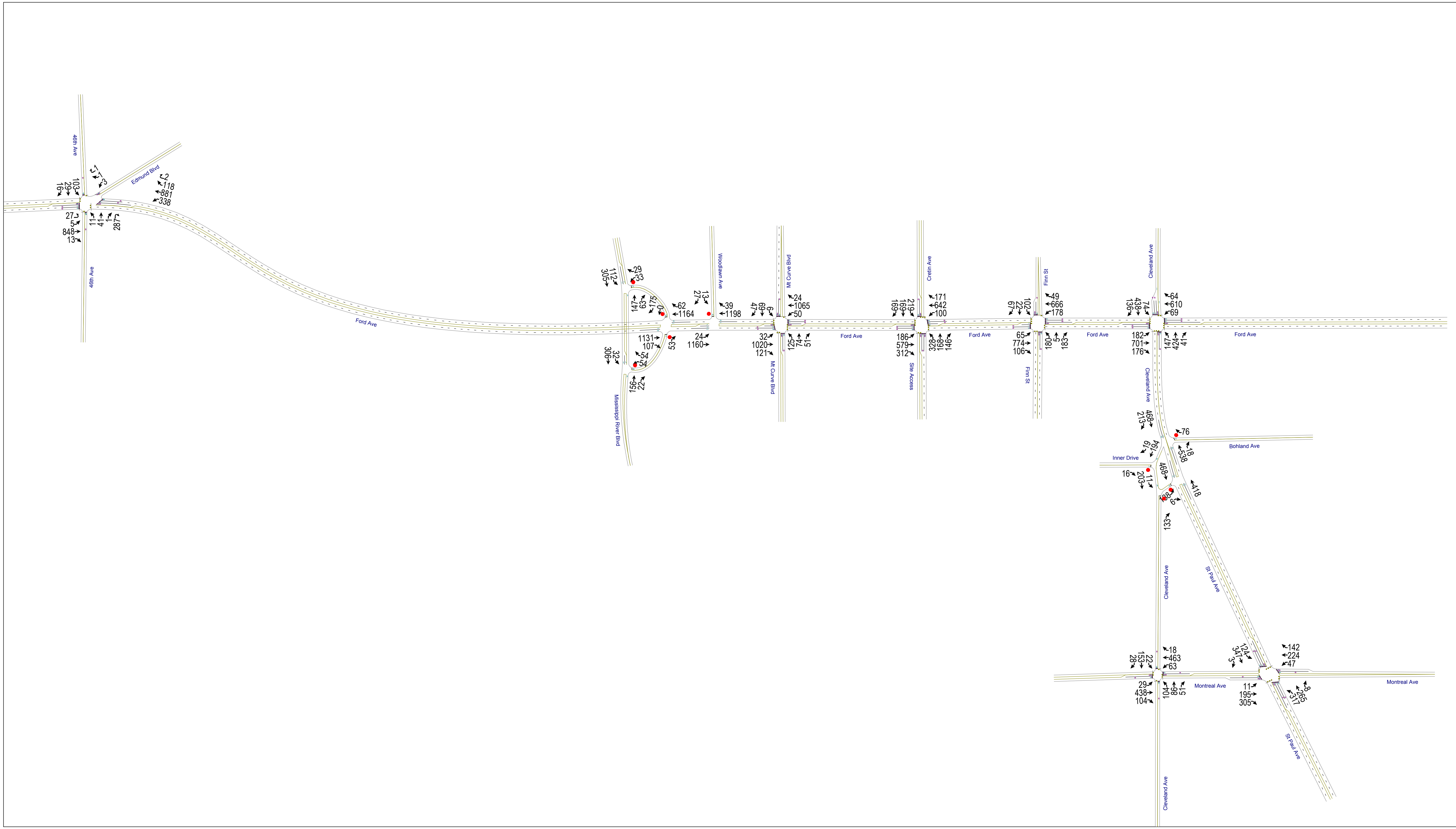

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Table A-5: Build (site) Levels of Service with and Without Mitigation Changes to Roadway System

Intersection[1]	Existing		No Changes		With Mitigation [2]	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
46th Ave/46th St	12 (15)	B (B)	14 (15)	B (B)	12 (14)	B (B)
Ford Pkwy/Mississippi River Blvd	1/7 (2/8)	A/A (A/A)	1/7 (2/9)	A/A (A/A)	1/8 (2/9)	A/A (A/A)
Ford Pkwy/Woodlawn Ave	1/1 (1/1)	A/A (A/A)	1/1 (2/1)	A/A (A/A)	1/1 (2/2)	A/A (A/A)
Ford Pkwy/Mt Curve Blvd	1/11 (1/12)	A/B (A/B)	39/830 (19/1063)	E/F (F/F)	12 (13)	B (B)
Ford Pkwy/Cretin Ave	11 (16)	B (B)	30 (72)	C (E)	17 (27)	B (C)
Ford Pkwy/Finn St	8 (16)	A (B)	6 (18)	A (B)	10 (19)	A (B)
Ford Pkwy/Cleveland Ave	22 (44)	C (D)	23 (32)	C (C)	21 (38)	C (D)
St Paul Ave/Cleveland Ave/Bohland Ave/Inner Dr	6/46 (5/59)	A/E (A/F)	5/28 (5/33)	A/D (A/D)	6/30 (6/45)	A/D (A/E)
Montreal Ave/Cleveland Ave	4/9 (4/10)	A/A (A/A)	127/247 (128/246)	F/F (F/F)	14 (16)	B (B)
Montreal Ave/St Paul Ave	12 (14)	B (B)	105/175 (172/351)	F/F (F/F)	14 (17)	B (B)
Mississippi River Blvd/N Ford Ramp	1/7 (2/16)	A/A (A/C)	1/8 (2/15)	A/A (A/C)	1/7 (3/16)	A/A (A/C)
Mississippi River Blvd/S Ford Ramp	3/9 (3/11)	A/A (A/B)	3/10 (3/12)	A/B (A/B)	3/10 (3/12)	A/B (A/B)
Segment	**Travel Time (sec)**		**Travel Time (sec)**		**Travel Time (sec)**	
Travel Time: EB Ford Pkwy	192 (237)		198 (216)		203 (247)	
Travel Time: WB Ford Pkwy	186 (204)		183 (219)		201 (222)	
Travel Time: SB Cleveland Ave/St Paul Ave	97 (115)		113 (188)		104 (141)	
Travel Time: NB Cleveland Ave/St Paul Ave	98 (110)		147 (198)		107 (132)	

Notes : (1) Accounts for diverted traffic through site;
(2)vehicle traffic mitigations -- does not include changes needed to maximize pedestrian/bicycle quality of service

Table A-6: Potential Mitigations to Improve Roadway Geometrics

Intersection	Recommended Improvements
Ford Pkwy/ Mount Curve Blvd	• Signalize intersection • Provide NB/SB Left-turn lanes • Extend WB left-turn lane
Ford Pkwy/ Cretin Ave.	• Add NB left- and right-turn lanes, • Extend WB left-turn lane, Remove part of median, EB right-turn lane
Cleveland Ave/ Montreal Ave	• Add west approach, • Add traffic signal (or possible roundabout) • If traffic signal, EB, WB, NB, and SB left-turn lanes should be considered Likely requires removal of on-street parking on approaches near intersection

Montreal Ave/ St Paul Ave	• Traffic signal or roundabout
	• If traffic signal, NB left-turn lane should be considered
	  ○ Requires removal of part of the median
	  ○ Likely requires removal of on-street parking on eastbound approach near intersection
	• If traffic signal, EB/WB left-turn lanes
	• Optional: EB/WB right-turn lanes

Cleveland Ave./ St. Paul Ave.	• Consider reconfiguration and traffic control change (see Figure A-9)

Figure A-9: Potential Mitigations to Improve Roadway Geometrics: St. Paul Avenue at Cleveland Avenue