**Appendix G:
Corridor Crash Rates**

G.1 Overview

The number of crashes along a corridor is a good indicator of safety. A lower number of crashes usually indicates a safer environment than a location with a higher number of crashes. However, the number of crashes alone does not account for bicyclist exposure along a particular corridor. For example, a corridor with 1,000 bicyclists per day has a higher exposure index than a corridor with only 100 bicyclists per day. Developing crash rates for a location provides context and allows for better comparison across corridors of varying magnitude.

For motor vehicles, Vehicle Miles Traveled (VMT) has served as an exposure index for many decades. There is quality and consistent data available to determine VMT. However, data for Bicycle Miles Traveled (BMT) is lacking and the demand is high for improved data and modeling of bicycle trips.[1] Fortunately, there is localized bicyclist trip data for many corridors in Minneapolis.

G.2 Exposure Model

Since 2007, Minneapolis Public Works has conducted annual bicyclist and pedestrian counts to gain a better understanding of non-motorized traffic. Two and 12-hour counts are conducted on September weekdays and Estimated Daily Totals (EDT) are made based on traffic models. Over 400 locations have been counted since the count program began, including most major bicycling corridors in the city. A map of bicyclist traffic and count locations can be found in Appendix D.

To extrapolate daily estimates to the 11-year period examined in this report, additional models developed by the National Bicycle and Pedestrian Documentation Project (NBPDP) were used.[2] NBPDP collects bicyclist counts from across the U.S. and develops daily, weekly, monthly and annual estimation models. The following factors were used to develop 11-year estimates for the number of trips past a certain point.

- Daily (EDT) to Weekly: 7.69
- Weekly to Monthly: 4.29
- Monthly to Annual: 9.09
- Annual to 11-year: 11.0
- Daily to 11-year: 3,298.6801

To calculate BMT, the 11-year trip total is multiplied by the length of the corridor in miles. This way, shorter corridors have lower exposure rates than longer corridors with similar traffic volumes and a similar number of crashes. The total number of crashes is then divided by the BMT to calculate crash rate. The equation used is as follows:

$$\text{Crash Rate} = \text{Total Crashes}/[\text{EDT} \times 3{,}298.6801 \times \text{Length}]$$

The crash rate is expressed as the number of crashes per million bicycle miles traveled.

G.3 Assumptions and Caveats

This model is speculative and is only designed for simple comparison across local bicycling conditions in Minneapolis. The following assumptions were made when developing the exposure and crash rate model:

1. The 2007-2011 bicyclist traffic counts are representative of the 2000-2010 period. No adjustment was made to account for the increase in bicycling over time because the annual rate of change is not known for each corridor.
2. The number of bicyclists counted at one point is equally distributed across the entire length of the corridor.
3. Bicycle traffic travels along the corridor rather than across the corridor. This may be problematic for corridors such as Hiawatha Avenue South where bicycle traffic likely crosses the corridor more frequently than travels along the corridor.

It should also be noted that the exposure index does not account for levels of motor vehicle traffic along a corridor.

G.4 Comparison Models

The calculated crash rates range from 7.7 to 68.5 crashes per one million BMT. While this model was developed for the specific purposes of this report, comparison to similar models is of interest.

A 2006 Wisconsin study combined BMT and VMT to develop a combined crash rate using data from the National Household Transportation Survey.[3]

---

1 U.S. Department of Transportation. Bicycle and Pedestrian Data: Sources, Needs, and Gaps. 2000. BTS 00-02.
2 Alta Planning and Design and the Intstitute of Transportataion Engineers. National Bicycle and Pedestrian Documentation Project. www.bikepeddocumentation.org

3 Amsden, Michael and Thomas Huber. Bicycle Crash Analysis for Wisconsin using a Crash Typing Tool (PBCAT) and Geographic Information System (GIS). Wisconsin Department of Transportation. June 30, 2006.

The study found that the average crash rate for Milwaukee County (home to the City of Milwaukee) was 15.61 crashes per BMT/VMT. The average of the 28 Minneapolis arterials in this analysis is 25.4 crashes per BMT. The Minneapolis rate is likely higher because the data only represents arterials, not all streets. Because crashes are over-represented on arterials, the Minneapolis *arterial* crash rate is higher than the Milwaukee *county-wide* rate. Also, the Milwaukee County rate includes a factor of VMT, which may influence the results.
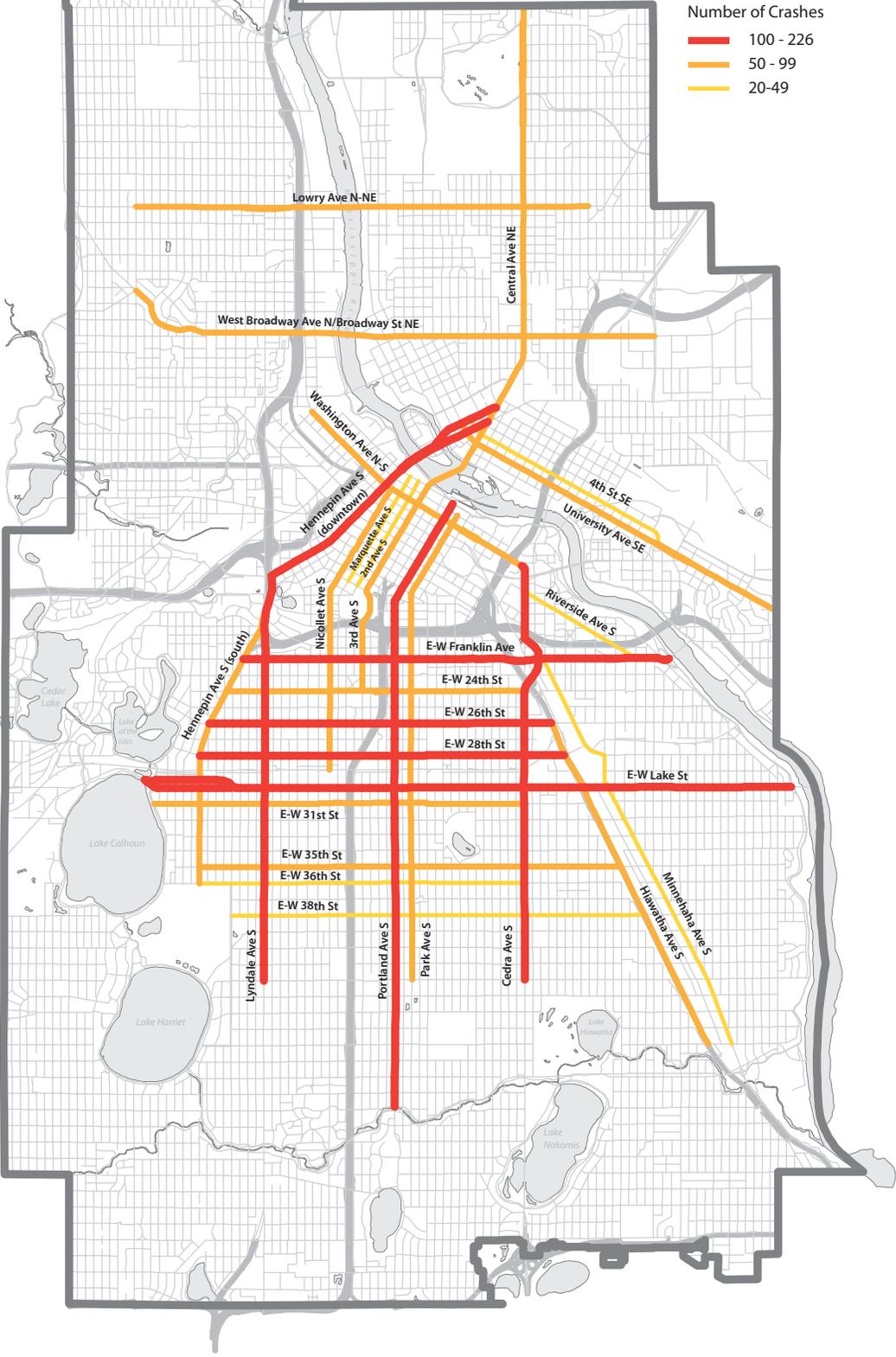
Table: G.1 - Corridor level crash rates: 2000-2010

Rank	Corridor	From	To	Bicyclist EDT	Annual Traffic	11-Year Traffic	Length (mi)	BMT (millions)	Crashes	Crash Rate
1	E-W 28th St	Hennepin Ave S	Hiawatha Ave S	170	50,980	560,776	2.8	1.56	107	68.5
2	Lowry Ave N-NE	Penn Ave N	Johnston St NE	100	29,988	329,868	3.4	1.14	63	55.4
3	Marquette Ave S	1st St S	Grant St S	300	89,964	989,604	0.9	0.94	37	39.5
4	E-W 26th St	Hennepin Ave S	Hiawatha Ave S	320	95,962	1,055,578	2.6	2.78	109	39.2
5	West Broadway Ave N - Broadway St NE	Penn Ave N	Stinson Blvd NE	210	62,975	692,723	3.5	2.45	96	39.1
6	E-W 35th St	Hennepin Ave S	Hiawatha Ave S	150	44,982	494,802	3.2	1.59	59	37.0
7	Hennepin Ave S	Vineland Pl	W 36th St	350	104,958	1,154,538	1.3	1.47	54	36.9
8	Washington Ave N-S	Plymouth Ave N	Cedar Ave S	540	161,935	1,781,287	1.2	2.19	76	34.7
9	Cedar Ave S	Washington Ave S	E 42nd St	320	95,962	1,055,578	3.3	3.48	110	31.6
10	E-W 38th St	Kings Hwy/ Dupont Ave S	Hiawatha Ave S	140	41,983	461,815	3.1	1.45	44	30.3
11	3rd Ave S	1st St S	E 24th St	470	140,944	1,550,380	1.3	2.02	57	28.3
12	E-W 36th St	Hennepin Ave S	Cedar Ave S	150	44,982	494,802	2.5	1.24	32	25.9
13	E-W Lake St (Lagoon)	Calhoun Pkwy	West River Pkwy	500	149,940	1,649,340	5.4	8.97	226	25.2
14	E-W Franklin Ave	Hennepin Ave	West River Pkwy	760	227,909	2,506,997	3.3	8.17	205	25.1
15	E-W 31st St	Calhoun Pkwy	Cedar Ave S	300	89,964	989,604	2.8	2.81	67	23.8
16	Hiawatha Ave S	E 26th St	E 46th St	290	86,965	956,617	2.7	2.63	55	20.9
17	E-W 24th St	Hennepin Ave	Cedar Ave S	490	146,941	1,616,353	2.3	3.67	68	18.5
18	2nd Ave S	1st St S	12th St S	370	110,956	1,220,512	0.9	1.11	20	18.0
19	Riverside Ave S	Cedar Ave S	E Franklin Ave	700	209,916	2,309,076	0.8	1.79	31	17.3
20	Central Ave NE	37th Ave NE	2nd St SE	410	122,951	1,352,459	2.7	3.61	61	16.9
21	Portland Ave S	2nd St S	Minnehaha Pkwy	650	194,922	2,144,142	4.7	10.11	127	12.6
22	Park Ave S	Washington Ave S	E 42nd St	620	185,926	2,045,182	3.0	6.08	72	11.8
23	Lyndale Ave S	Oak Grove	W 42nd St	1,060	317,873	3,496,601	3.0	10.33	111	10.7
24	Nicollet Mall/Nicollet Ave S	Washington Ave S	Midtown Greenway	1,310	392,843	4,321,271	1.9	8.21	88	10.7
25	Hennepin Ave S (1st Ave NE)	Dunwoody Blvd/I-94	Central Ave NE	1,500	449,820	4,948,020	2.6	12.74	126	9.9
26	Minnehaha Ave S	E Franklin Ave	E 46th St	460	137,945	1,517,393	3.4	5.09	49	9.6
27	University Ave SE	1st Ave NE	Emerald St SE	1,000	299,880	3,298,680	2.8	9.25	83	9.0
28	4th St SE	1st Ave NE	Oak St SE	740	221,911	2,441,023	1.8	4.39	34	7.7

Red - From 2000-2010, there was a bicycle facility for most of the corridor. For others, the majority of the corridor did not have a bicycle facility.

Crashes by Corridor

By Number of Crashes
2000-2010

Number of Crashes

- 100 - 226
- 50 - 99
- 20-49

Lowry Ave N-NE

Central Ave NE

West Broadway Ave N/Broadway St NE

Washington Ave N-S

4th St SE

University Ave SE

Hennepin Ave S (downtown)

Marquette Ave S

3rd Ave S

Nicollet Ave S

3rd Ave S

Riverside Ave S

Hennepin Ave S (south)

E-W Franklin Ave

E-W 24th St

E-W 26th St

E-W 28th St

E-W Lake St

E-W 31st St

E-W 35th St

E-W 36th St

E-W 38th St

Minnehaha Ave S

Hiawatha Ave S

Lyndale Ave S

Portland Ave S

Park Ave S

Cedra Ave S

Cedar Lake

Lake of the Isles

Lake Calhoun

Lake Harriet

Lake Hiawatha

Lake Nokomis

Crashes by Corridor
By Crash Rate
2000-2010

Crash Rate*

━━━ 30.0 - 68.5
━━━ 15 - 29.9
━━━ 7.7-14.9

*Crash rate is expressed
as crashes per one million
bicycle miles traveled (BMT)

Lowry Ave N-NE

West Broadway Ave N/Broadway St NE

Central Ave NE

Washington Ave N-S

Hennepin Ave S
(downtown)

Marquette Ave S

3rd Ave S

4th St SE

University Ave SE

Riverside Ave S

Nicollet Ave S

3rd Ave S

Hennepin Ave S (south)

E-W Franklin Ave

E-W 24th St

E-W 26th St

E-W 28th St

E-W Lake St

E-W 31st St

E-W 35th St

E-W 36th St

E-W 38th St

Lyndale Ave S

Portland Ave S

Park Ave S

Cedra Ave S

Minnehaha Ave S

Hiawatha Ave S

Cedar Lake

Lake of the Isles

Lake Calhoun

Lake Harriet

Lake Hiawatha

Lake Nokomis