



MINNESOTA STATE TRAIL USER COUNT

2018 REPORT



Trails Included:
Brown's Creek
Gateway
Harmony-Preston
Paul Bunyan
Root River

Acknowledgments

This project would not have been possible without the ongoing commitments of the Minnesota Department of Natural Resources and the Minnesota Department of Transportation to study non-motorized traffic and maintain permanent trail counting sites across Minnesota.

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Vector artwork courtesy of FreePik.com.

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Introduction

THE MINNESOTA STATE TRAIL USER COUNT is an ongoing project of the Parks & Trails Council of Minnesota (P&TC), a statewide non-profit organization dedicated to acquiring, protecting and enhancing critical land for the public's use and benefit. We started counting trail users on Minnesota state trails in 2015 to provide useful data to managers, legislators, and the public. Gathering information on trail use and demand is essential for answering a broad set of policy questions, ranging from planning new trails, prioritizing maintenance, assessing safety, and quantifying benefits.

The data in this report was collected during 2017 on five state trails: the Gateway State Trail and Brown's Creek State Trail in the Twin Cities Metropolitan Area, the Paul Bunyan State Trail between Brainerd and Walker, and the Root River State Trail and Harmony-Preston State Trail in southeast Minnesota. Together, these five trails total 166 miles. In future years, in collaboration with the Minnesota Department of Natural Resources (DNR), we hope to continue counting on other state trails in the system to estimate total statewide traffic and monitor trends over time.

Methodology

The state trail traffic estimates in this report are based on short-duration counts conducted by P&TC at 30 different counting sites. Short-duration counts ranged in length from 7 days to 25 days and took place between May 12, 2017 and October 24, 2017. All counts were conducted using automated trail counting equipment that differentiated users as bicyclists or pedestrians (including equestrians and inline skaters). Additionally, the DNR and Minnesota Department of Transportation (MnDOT) conducted counts at another 3 locations on the trails included in this report; those counts are reported alongside P&TC's to provide a full overview of each trail system. Observed traffic at each counting site is assumed to be representative of traffic along a specified trail segment; segments varied in length between 1.9 miles and 9.1 miles, with an average length of 5 miles.

All traffic estimates are for non-winter, non-motorized use. Non-winter is defined as April through November to synchronize with the snowmobiling season, which is statutorily defined as December through March. While our estimates are limited to non-winter, non-motorized use, state trails remain open during the winter and, depending on location, are used by skiers, snowmobiles, pedestrians, and bicyclists. The DNR started monitoring winter use on the state trail system, including snowmobile traffic, during the 2017-2018 winter.

All traffic estimates were estimated by extrapolating short-duration counts using the day-of-year factoring method, which is the method recommended by MnDOT and used by the Arrowhead Regional Development Commission for their Gitchi Gami State Trail traffic estimates.¹⁻² Miles traveled were estimated by multiplying non-winter traffic volumes by segment length. Our estimates are specific to the five trails studied in 2017, and should not be assumed to be representative of other trails in the state trail network. Estimates are subject to a margin of error of approximately 10-15%. Additional details on our methodology are provided in Appendix A.

Key Findings



5.8 million miles traveled

Bicyclists and pedestrians, in sum, traveled nearly 5.8 million miles during the non-winter months on the five trails studied in 2017. That's a distance equivalent of circling the earth at the equator 233 times. Non-winter traffic volumes varied across each trail, ranging from a low of 5,563 (average non-winter daily traffic = 23) on the Paul Bunyan State Trail between Pine River and Backus, to a high of 135,949 (average non-winter daily traffic = 557) on the Brown's Creek State Trail between Duluth Junction and Coldspring Trailhead.



Bicycling is the primary trail activity

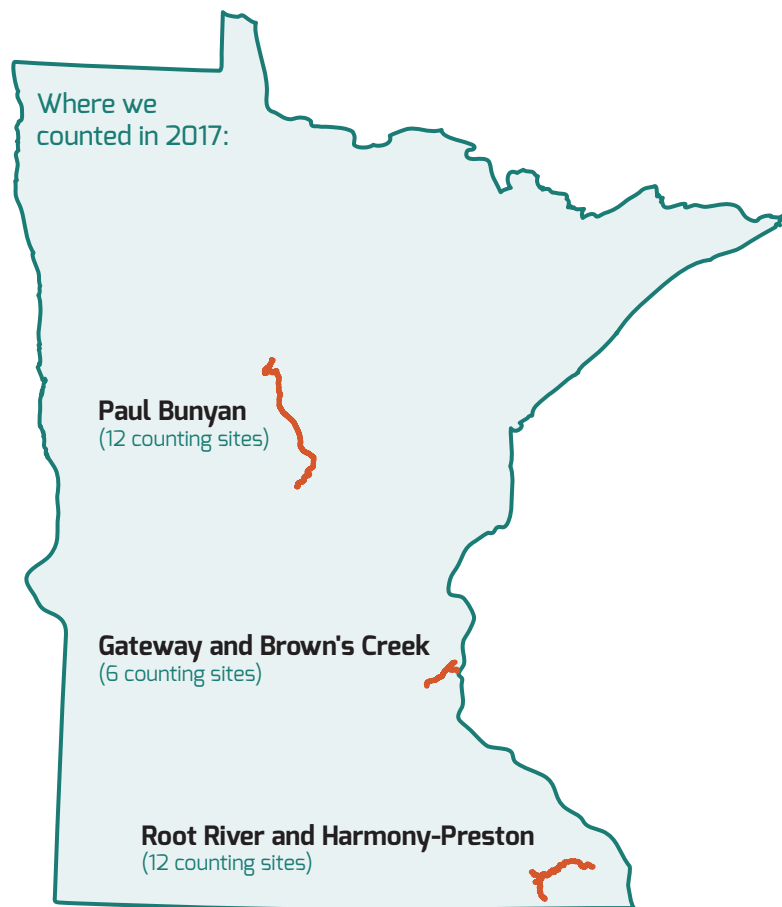
State trails are predominantly used by bicyclists, which accounted for 71% of the non-winter traffic on the trails studied in 2017. Pedestrians, however, are a sizable minority. And in numerous locations, especially near urban areas and parkland, pedestrians account for half of non-winter trail traffic.



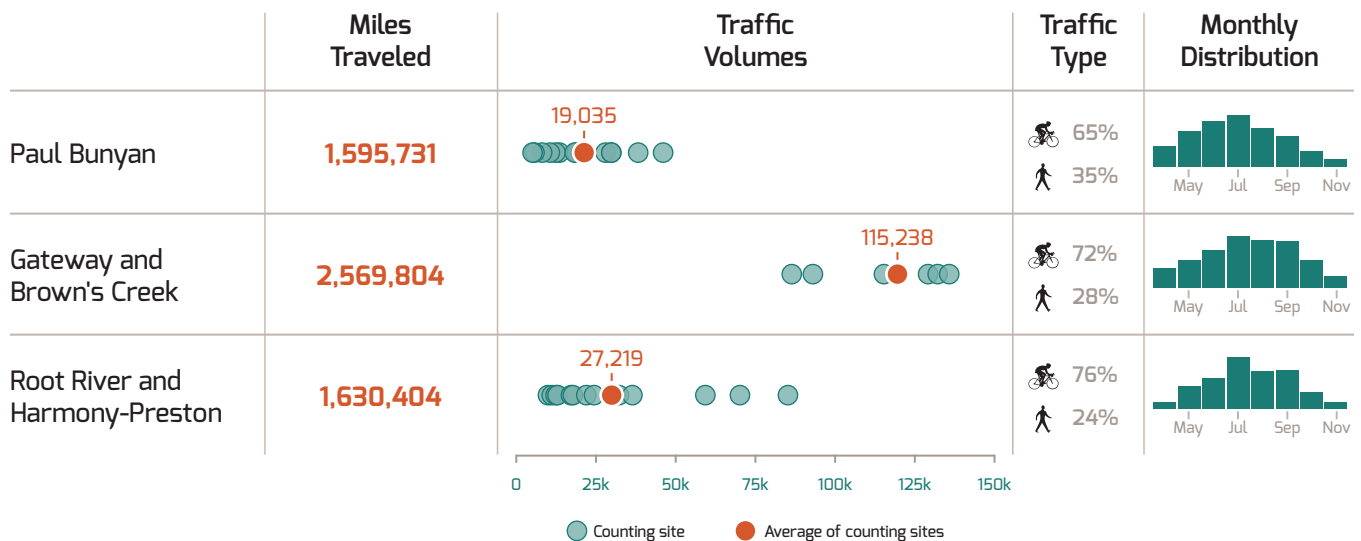
Peak season

The DNR has long defined their summer season as Memorial Day through Labor Day, and indeed the majority of non-winter traffic - between 57% and 69%, depending on the trail - occurs between the two holidays. The trail season, however, appears to extend well past Labor Day through the end of September; trails were as busy in September as they were in August in many locations. Additional years of data are needed to know if this seasonal pattern is typical or unique to 2017.

Summary of Results



Estimated Non-Winter Trail Use (2017 data, April - November)



Gateway and Brown's Creek State Trails

The **Gateway State Trail** starts in St. Paul and travels 17 miles northeast to Pine Point County Park. The Brown's Creek State Trail splits off the Gateway State Trail at Duluth Junction and serves as a 6-mile spur trail into downtown Stillwater.

Non-winter traffic on the Gateway and Brown's Creek state trails is characterized by high traffic relative to other state

trails, with volumes varying between 86,874 and 135,949. The majority - 57% - of non-winter use occurs during the summer season (Memorial Day through Labor Day), though summer-level traffic volumes extend through September before dropping off in October. Cumulatively, bicyclists and pedestrians traveled an estimated 2.5 million miles on the Gateway and Brown's Creek state trail system during 2017.

Estimated Trail Use (Non-winter months, April - November)

Total Miles Traveled

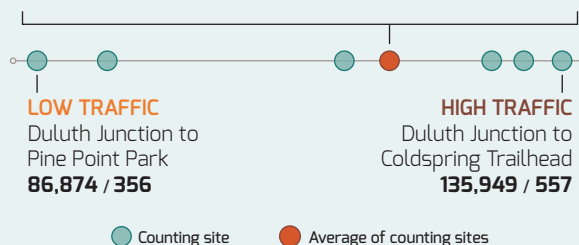
2,569,804

Traffic Volumes

115,238 / 472

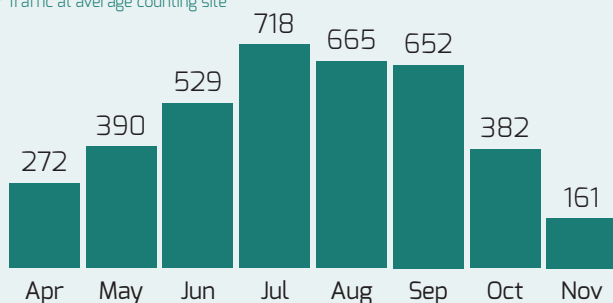
NON-WINTER
TOTAL TRAFFIC

NON-WINTER
DAILY TRAFFIC



Monthly Average Daily Traffic

* Traffic at average counting site



Monthly traffic pattern based on MnDOT reference site (Minneapolis, West River Parkway)

Type of Trail Use



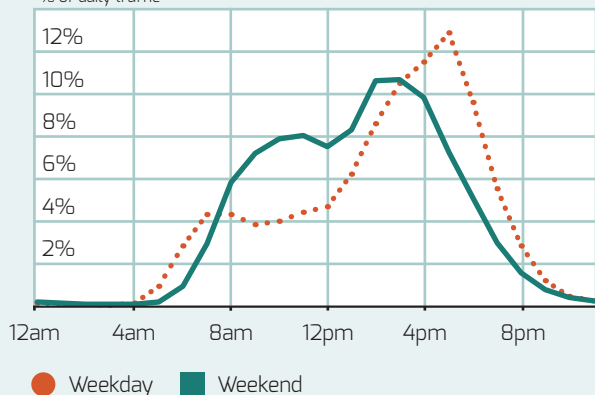
72%



28%

Average Hourly Traffic

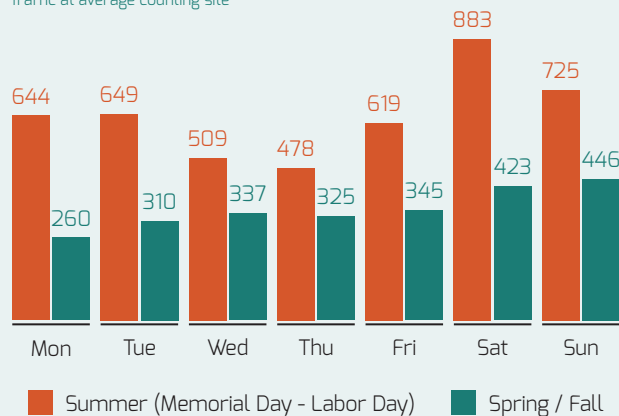
% of daily traffic



Hourly traffic pattern based on MnDOT reference site (Minneapolis, West River Parkway)

Day-of-Week Average Traffic

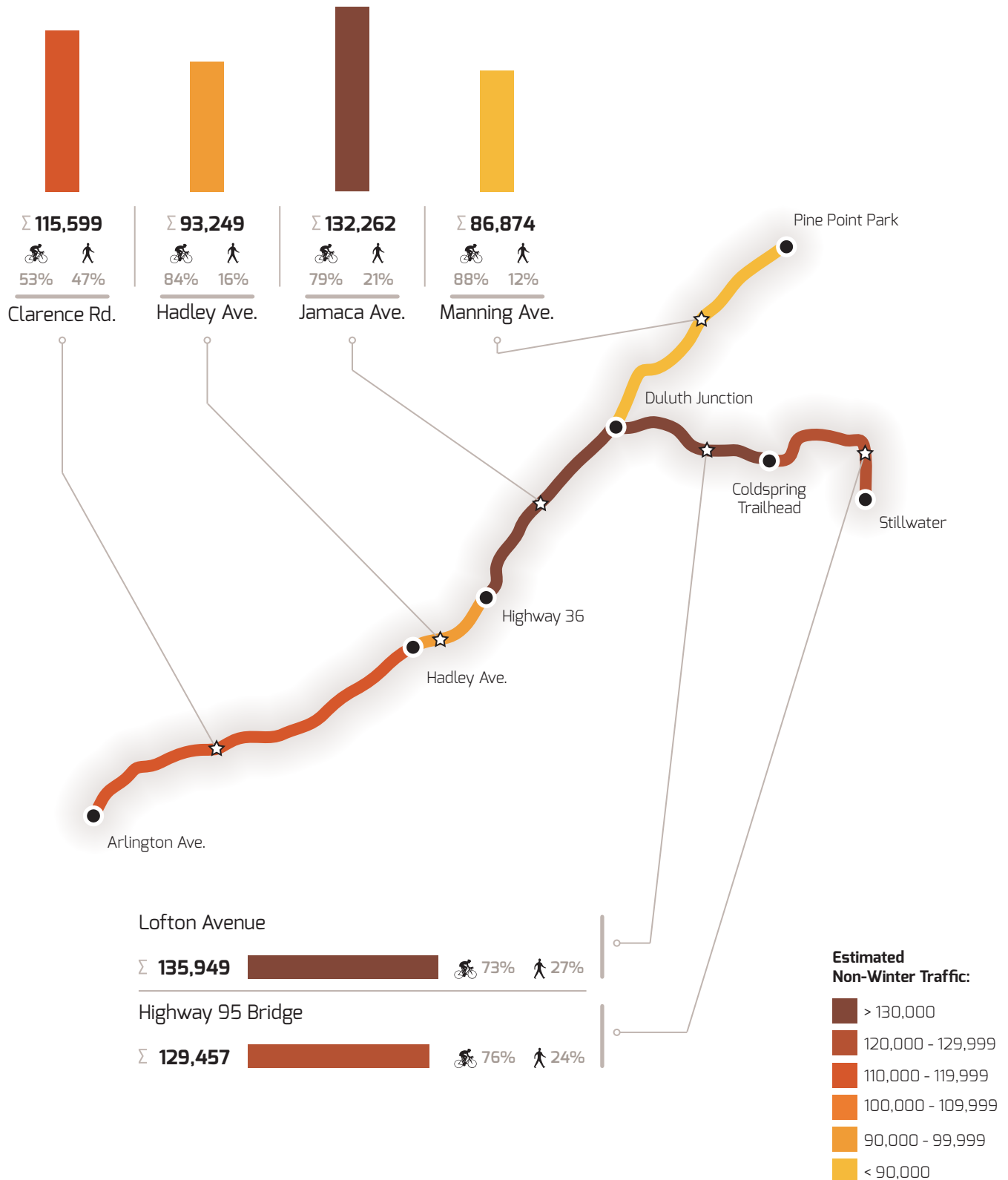
* Traffic at average counting site



Daily traffic pattern based on MnDOT reference site (Minneapolis, West River Parkway)

GATEWAY - BROWN'S CREEK STATE TRAILS

Key: ● City / Junction ☆ Counting Site Σ Estimated Non-Winter Traffic 🚲 Bicyclists 🚶 Pedestrians



Paul Bunyan State Trail

The Paul Bunyan State Trail starts in Crow Wing State Park and travels 115 miles north to Lake Bemidji State Park. Counts in 2017 were limited to the southern 84 miles of the trail, between Crow Wing State Park and Walker.

Non-winter traffic on the Paul Bunyan State Trail varies between 5,563 and 46,261. Trail use is concentrated near the Brainerd Lakes Area, particularly between Pequot

Lakes, Nisswa, and Merrifield. The majority of use - 61% - occurs in the summer season between Memorial Day and Labor Day. Pedestrians are a sizable minority of trail users on the Paul Bunyan and account for half of the traffic near Crow Wing State Park and the Chippewa National Forest. Cumulatively, bicyclists and pedestrians traveled an estimated 1.6 million miles on the Paul Bunyan State Trail during 2017 between Crow Wing State Park and Walker.

Estimated Trail Use (Non-winter months, April - November)

Total Miles Traveled

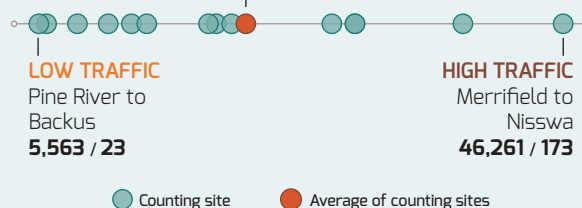
1,595,731

Traffic Volumes

19,042 / 78

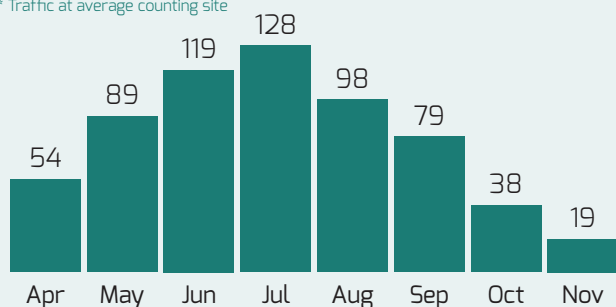
NON-WINTER
TOTAL TRAFFIC

NON-WINTER
DAILY TRAFFIC



Monthly Average Daily Traffic

* Traffic at average counting site



Monthly traffic pattern based on MnDOT reference site (Brainerd)

Type of Trail Use



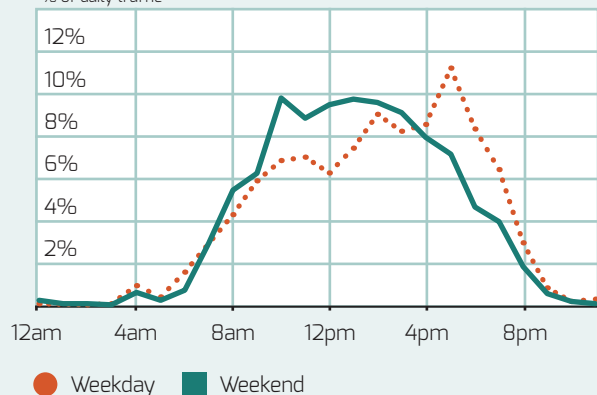
65%



35%

Average Hourly Traffic

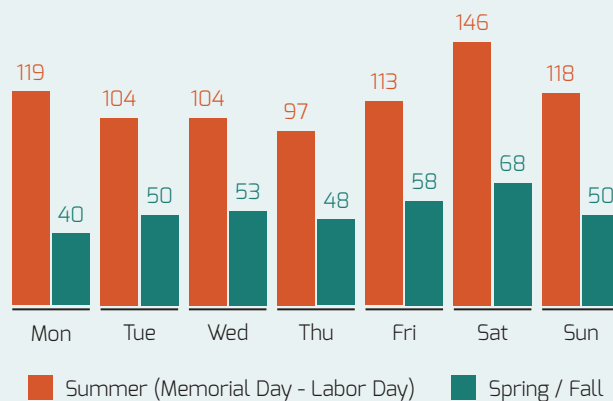
% of daily traffic



Hourly traffic pattern based on MnDOT reference site (Brainerd)

Day-of-Week Average Traffic

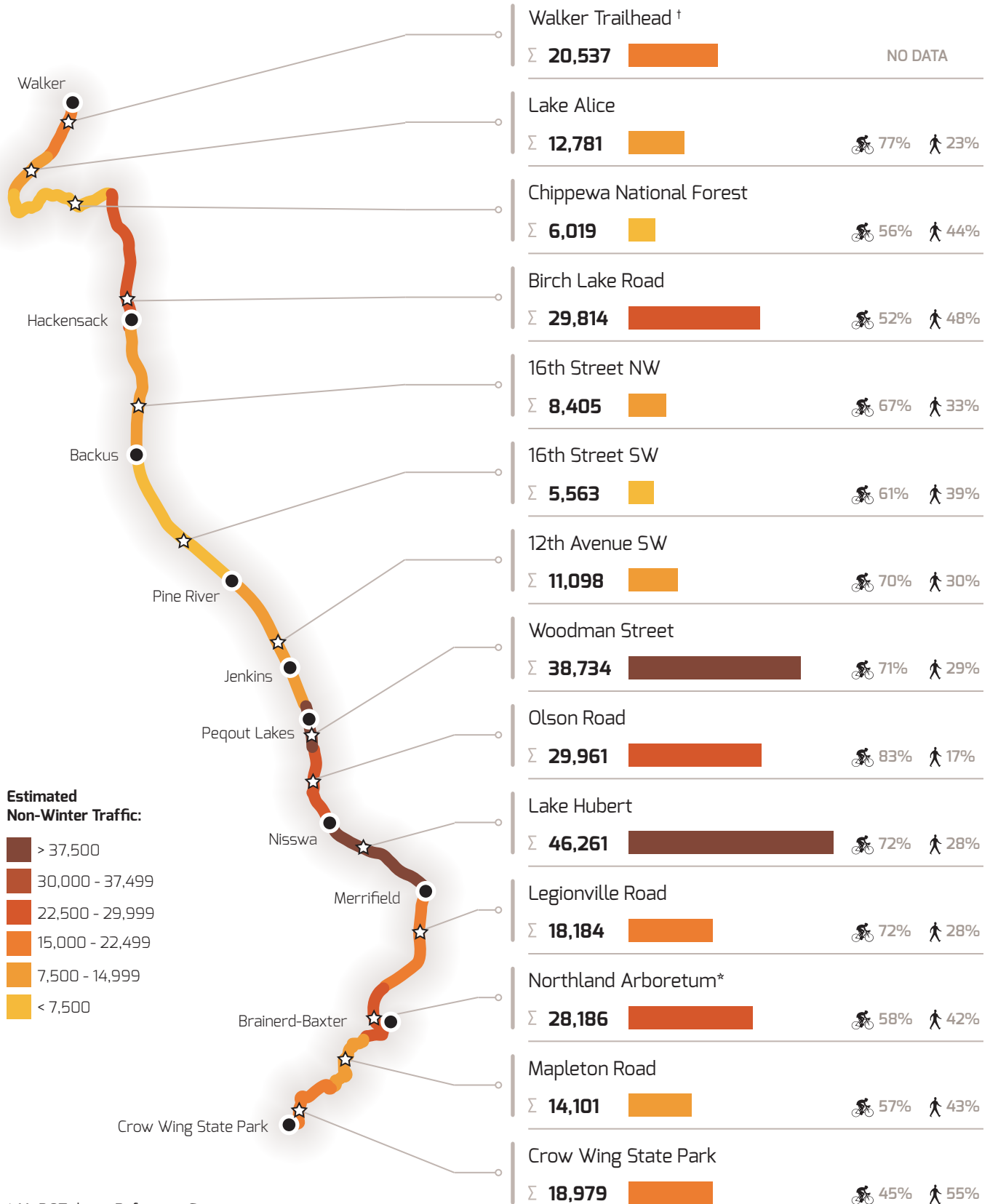
* Traffic at average counting site



Daily traffic pattern based on MnDOT reference site (Brainerd)

PAUL BUNYAN STATE TRAIL

Key: ● City / Junction ☆ Counting Site Σ Estimated Non-Winter Traffic 🚲 Bicyclists 🚶 Pedestrians



Root River and Harmony-Preston State Trails

The Root River State Trail and Harmony-Preston State Trail form a 59-mile trail system in southeastern Minnesota, connecting Fountain, Lanesboro, Whalen, Peterson, Rushford, Houston, Preston and Harmony.

Non-winter traffic on the Root River and Harmony-Preston state trail system varies between 10,332 and 85,308, and is characterized by high weekend use. In areas of concentrated

use, near Lanesboro, weekend traffic during the summer typically exceeds 1,000 users per day. The majority of use - 69% - occurs during the summer season (Memorial Day through Labor Day), though fall remains busy as September traffic was slightly higher than August traffic. Cumulatively, bicyclists and pedestrians traveled an estimated 1.6 million miles on the Root River and Harmony-Preston state trails during 2017.

Estimated Trail Use (Non-winter months, April - November)

Total Miles Traveled

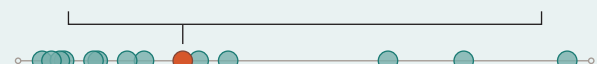
1,630,404

Traffic Volumes

27,219 / 112

NON-WINTER
TOTAL TRAFFIC

NON-WINTER
DAILY TRAFFIC



LOW TRAFFIC

Preston to
County Road 16
10,332 / 42

HIGH TRAFFIC

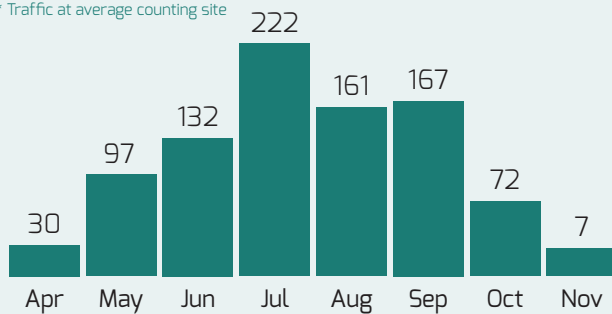
Lanesboro Dam to
Root River Confluence
85,308 / 350

● Counting site

● Average of counting sites

Monthly Average Daily Traffic

* Traffic at average counting site



Monthly traffic pattern based on MnDOT reference site (Lanesboro)

Type of Trail Use



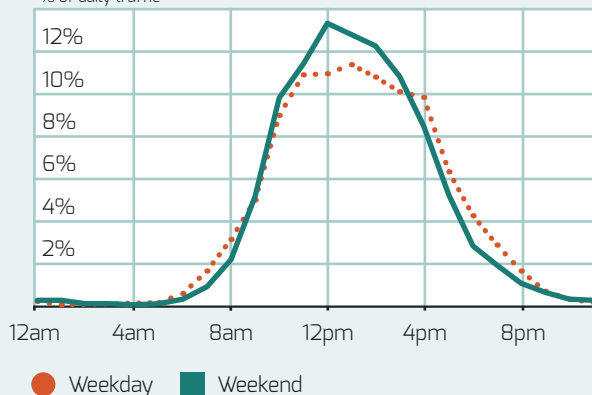
76%



24%

Average Hourly Traffic

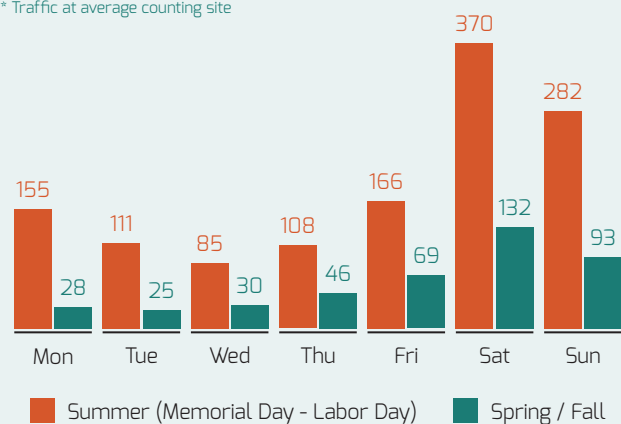
% of daily traffic



Hourly traffic pattern based on MnDOT reference site (Lanesboro)

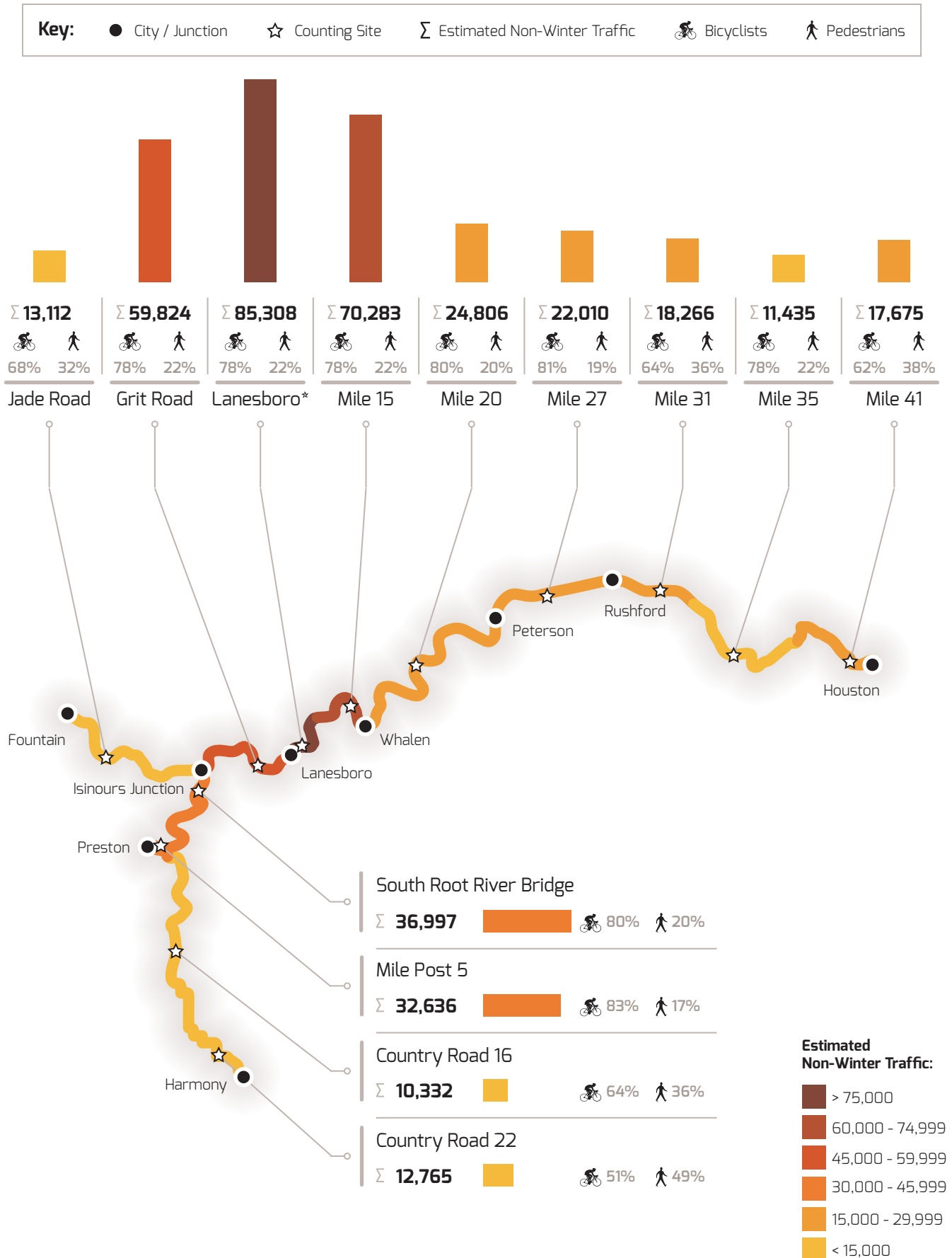
Day-of-Week Average Traffic

* Traffic at average counting site



Daily traffic pattern based on MnDOT reference site (Lanesboro)

ROOT RIVER & HARMONY-PRESTON STATE TRAILS



* MnDOT data - Reference Site

Appendix A: Detailed Methodology

Automated Counting Equipment

All counts were recorded using two types of automated counters: passive infrared and pneumatic tubes (Figure 1).

Passive infrared counters detect changes in radiant temperature as a person moves through the detection zone. Passive infrared sensors count all trail users and do not distinguish between bicyclists and pedestrians. The passive infrared sensors also count equestrians, though the calibration and limited range of the infrared beam necessitated that equestrians were counted with less accuracy than pedestrians and bicyclists. Of the trails included in this study, parallel horse trails were only present on the Gateway State Trail and Brown's Creek State Trail.

Pneumatic tube counters detect pulses as wheeled vehicles pass over a set of parallel rubber tubes. Pneumatic tubes only count bicycles; a computer algorithm in the data recorder filters out singular pulses caused by pedestrians. Using both types of counters in tandem was necessary to estimate both total traffic and mode split. To ensure our data is comparable with other counting initiatives, we used Eco-Counter counting equipment, which is the same manufacturer used by the DNR and MnDOT.

Adjusting for Occlusion Error

Automated trail counters are not 100% accurate and typically undercount traffic due to "occlusion error."

Occlusion error occurs when two or more people pass through the detection zone of a counter simultaneously; when this happens, only the person nearest to the sensor is detected (Figure 2). Passive infrared counters are generally more prone to occlusion error than are pneumatic tube counters.

We tested for occlusion error through a series of field validation tests, during which manual counts were compared to automated counts in one-hour intervals. Testing indicated our passive infrared counters undercount traffic by approximately 10%. In contrast, our pneumatic tube counters undercount bicycle traffic by only 0.4% (Figure 3). The difference in error rates between counters resulted in pedestrians being systematically undercounted relative to bicyclists. This issue was particularly problematic at locations with high bicycle use and low pedestrian use; in multiple instances bicycle counts were higher than total traffic counts. To account for this phenomenon, passive infrared counts were adjusted by a factor of 1.1. Pneumatic tube counts were left unadjusted.

Day-of-Year Factors

Traffic estimates are based on extrapolating short-duration counts using the day-of-year factoring approach. Day-of-year factors are the ratio of day-of-year traffic to total annual traffic, and are calculated with data collected at "reference sites" where traffic is monitored 365 days a year.

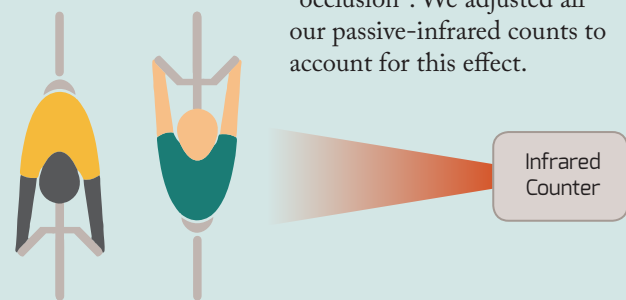
FIGURE 1 Counting equipment field installation



1. Passive infrared counter, counts all users without differentiation
2. Pneumatic tube counter, counts only bicycles

FIGURE 2 Understanding occlusion error

When two or more people cross the detection zone of a trail counter simultaneously, an undercount occurs because the person nearest the sensor shields the other user(s) from detection. This type of error is referred to as "occlusion". We adjusted all our passive-infrared counts to account for this effect.



APPENDIX A: DETAILED METHODOLOGY, CONTINUED

This approach is the preferred method for extrapolating non-motorized traffic because it captures the effects of local conditions such as weather, festivals, and/or holidays.³ When using day-of-year factors, short-duration count locations are paired with nearby reference sites where daily traffic variations are presumed similar; the amount of traffic observed during a sampling period is assumed to represent the same proportion of annual traffic at the sample site as at the reference site. For example, if traffic between September 15 and September 28 accounted for 6% of non-winter traffic at MnDOT's permanent counter located in Minneapolis, we assume a short-duration count on the nearby Gateway State Trail during the same time frame also accounted for 6% of non-winter traffic on the Gateway State Trail.

All extrapolation factors were calculated using data collected at permanent counting sites maintained by MnDOT. Factors used to extrapolate short-duration counts on the Gateway and Brown's Creek state trails are based on MnDOT's permanent counting site on the West River Parkway in Minneapolis. Factors used to extrapolate short-

duration counts on the Paul Bunyan Trail are based on MnDOT's permanent counting site in Brainerd. And factors used to extrapolate short-duration counts on the Root River and Harmony-Preston state trails are based on MnDOT's permanent counting site in Lanesboro. Extrapolation factors were developed independently for pedestrian traffic and bicycle traffic (Figure 4). Pearson correlation coefficients of daily traffic between short-duration sites and reference sites varied but were generally greater than 0.8, indicating traffic patterns at each reference site are generally representative

FIGURE 3 Field validation tests for passive-infrared and pneumatic tube counters

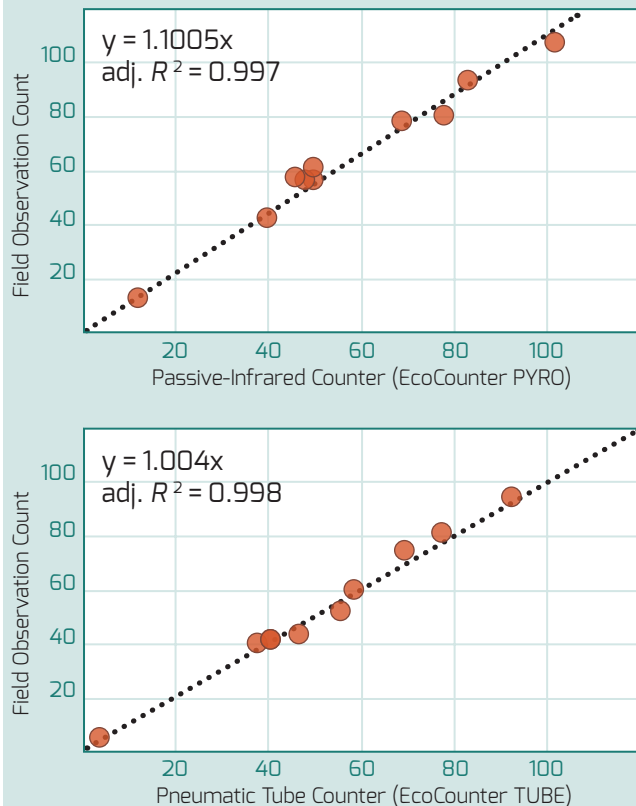
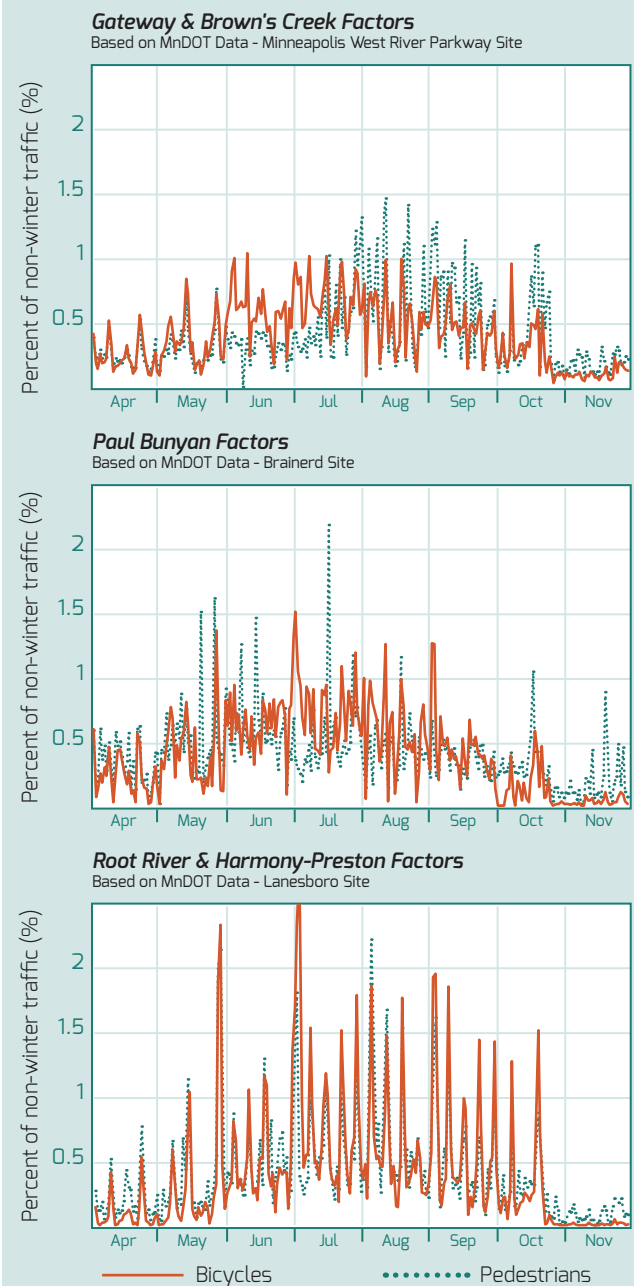


FIGURE 4 Day-of-year extrapolation factors (2017)



of each short-duration location. An example of how daily traffic varied on the Gateway State Trail relative to its reference site is provided in Figure 5; correlation coefficients for each sample site are provided in Appendix B.

Imputing Missing Data

Calculating day-of-year extrapolation factors requires a full dataset at each reference site. Unfortunately, each of MnDOT's permanent counting sites malfunctioned for varying periods during 2017. Traffic estimates for missing days were imputed using an established traffic model incorporating a statewide traffic index, daily temperature, daily precipitation and day-of-week to predict daily traffic.⁴ All models and imputations were estimated by MnDOT.

Limitations

Margin of Error: All traffic estimates involve uncertainty and are subject to error. Our study followed the recommendations of other researchers to reduce extrapolation error by (1) using day-of-year factors, (2) conducting counts between April and October and (3) using short-duration count lengths of at least 7 days.⁵ For counts taken during the spring and fall, when traffic volumes are typically lower, we extended the length of our short-duration counts to at least 14 days. Based on our methodology, our estimates are subject to a margin of error of approximately 10-15% (Figure 6).

Availability of Reference Sites: Day-of-year factors should ideally be based on a network of nearby counters rather than a single site. Our choice of reference sites was constrained by the current network of permanent counters across Minnesota, and in some instances our sample sites correlated poorly with their reference site. We anticipate this will become less of a challenge in future years, as the DNR plans to begin installing a network of permanent counters across the state trail system.

Segments and Counting Sites: Our estimates assume that traffic at each counting site is representative of its respective segment. Trail segments and counting sites were determined using our best judgment, and were based on input from our project partners and the best available data on the state trail system. Trail segments were demarcated using natural break points and a trail typology based on land-use characteristics.⁶ Break points for each segment were assigned to trailhead facilities, junctions, towns and/or parks. Within each segment, potential counting sites were limited by the availability of, and access to, trail posts that could accommodate our counting equipment. Counting sites were ultimately chosen by evaluating each potential location, with a preference given to sites near the midway point of each segment. Our segments and counting sites may need to be updated in future years as our understanding of state trail use continues to evolve.

FIGURE 5 Daily traffic variation at short-duration sample site and reference site

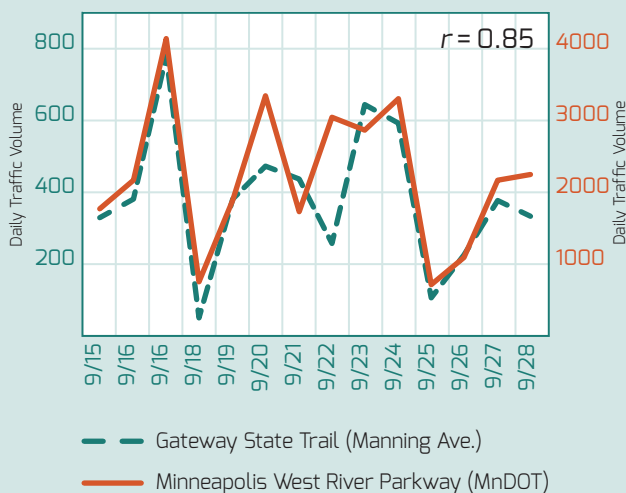
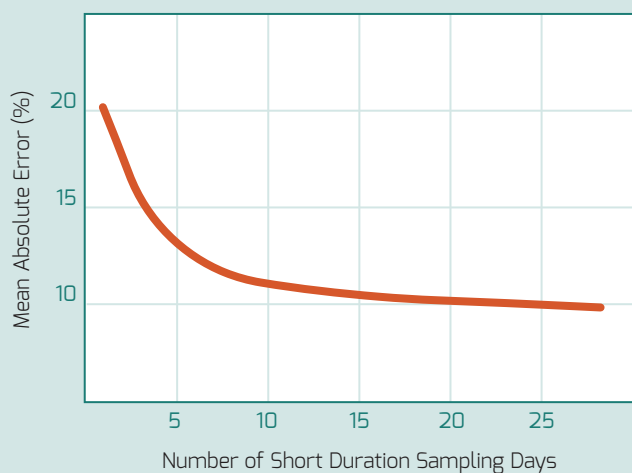


FIGURE 6 Mean absolute error using day-of-year extrapolation factors (Data and chart adapted from Hankey, Lindsey, & Marshall, 2014)



Appendix B: Sample Statistics

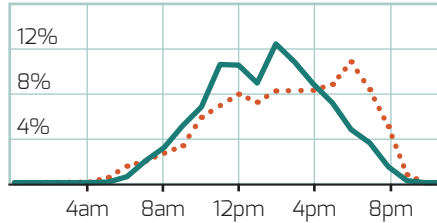
BROWN'S CREEK STATE TRAIL

Segment: Duluth Jct. to Coldwater Stop
Segment length: 3 miles
Count Location: Lofton Avenue

Sample dates: 5/12/17 - 5/25/17
Counting days: 14
Observed traffic: 6,066
Correlation with Reference Site: 0.94 *

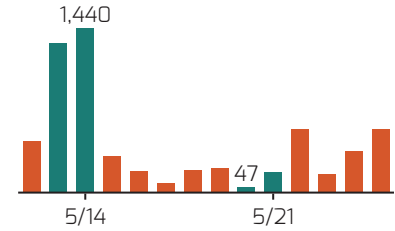
HOURLY TRAFFIC

● Weekday ■ Weekend
 (% of average daily traffic)



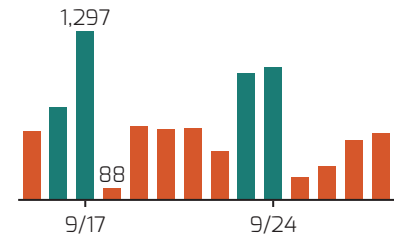
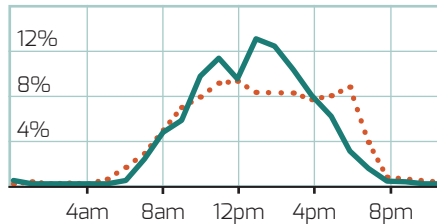
DAILY TRAFFIC

■ Weekday ■ Weekend



Segment: Coldwater Stop to Stillwater
Segment length: 2.8 miles
Count Location: Highway 95 bridge

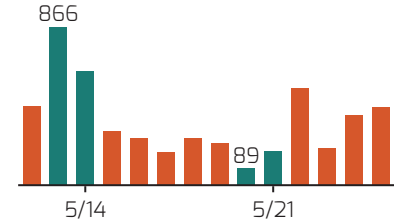
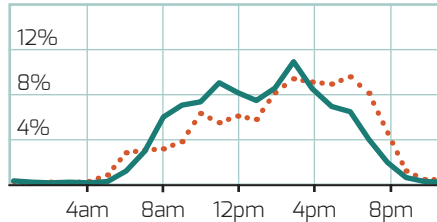
Sample dates: 9/15/17 - 9/28/17
Counting days: 14
Observed traffic: 8,059
Correlation with Reference Site: 0.82 *



GATEWAY STATE TRAIL

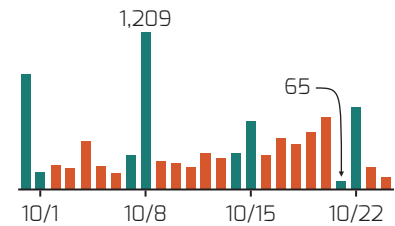
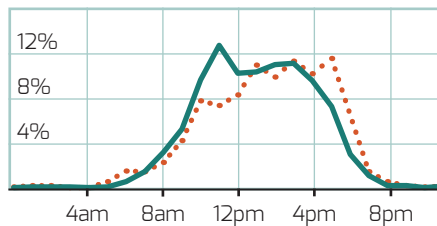
Segment: Arlington Ave. to Hadley Ave.
Segment length: 6.7 miles
Count Location: Clarence Street

Sample dates: 5/12/17 - 5/25/17
Counting days: 14
Observed traffic: 4,952
Correlation with Reference Site: 0.95 *



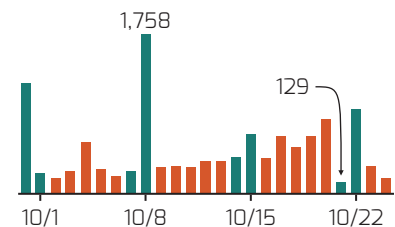
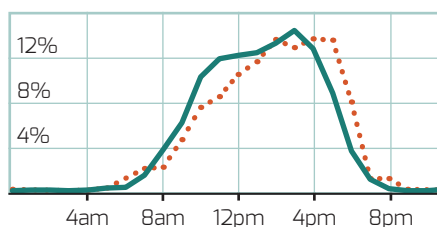
Segment: Hadley Ave. to Highway 36
Segment length: 1.6 miles
Count Location: I-694 Underpass

Sample dates: 9/30/17 - 10/24/17
Counting days: 25
Observed traffic: 8,417
Correlation with Reference Site: 0.79 *



Segment: Highway 36 to Duluth Jct.
Segment length: 3.6 miles
Count Location: Jamaca Avenue

Sample dates: 9/30/17 - 10/24/17
Counting days: 25
Observed traffic: 12,078
Correlation with Reference Site: 0.82 *



* $p < .05$

Appendix B: Sample Statistics, continued

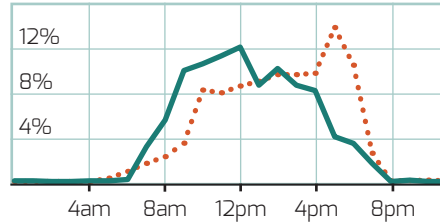
GATEWAY, CONT'

Segment: Duluth Jct. to Pine Point Park
Segment length: 4.6 miles
Count Location: Manning Avenue

Sample dates: 9/15/17 - 9/28/17
Counting days: 14
Observed traffic: 5,281
Correlation with Reference Site: 0.85 *

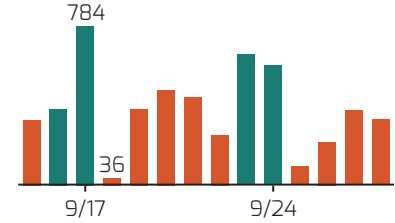
HOURLY TRAFFIC

● Weekday ■ Weekend
 (% of average daily traffic)



DAILY TRAFFIC

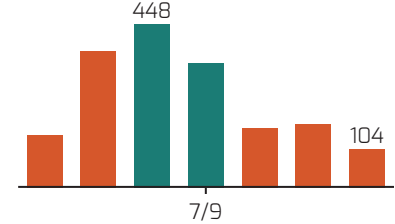
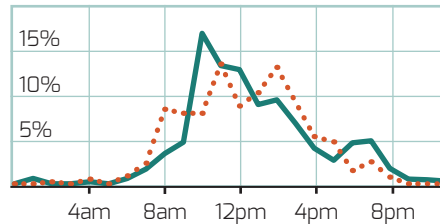
■ Weekday ■ Weekend



HARMONY-PRESTON STATE TRAIL

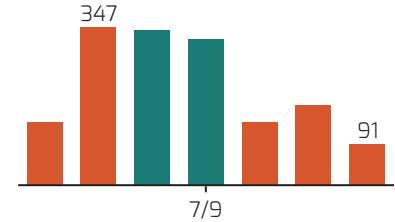
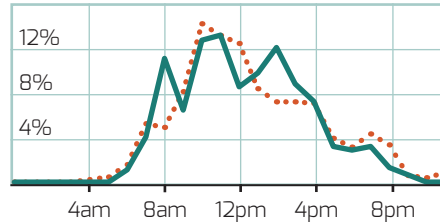
Segment: Isinours Jct. to Highway 52
Segment length: 4.6 miles
Count Location: South Root River Bridge

Sample dates: 7/6/17 - 7/12/17
Counting days: 7
Observed traffic: 1,749
Correlation with Reference Site: 0.80 *



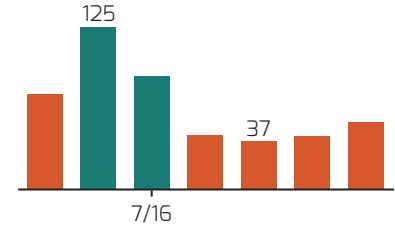
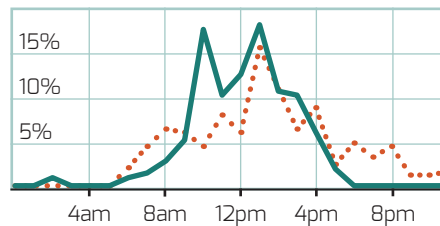
Segment: Highway 52 to Camp Creek
Segment length: 1.9 miles
Count Location: Mile Post 5

Sample dates: 7/6/17 - 7/12/17
Counting days: 7
Observed traffic: 1,553
Correlation with Reference Site: 0.68



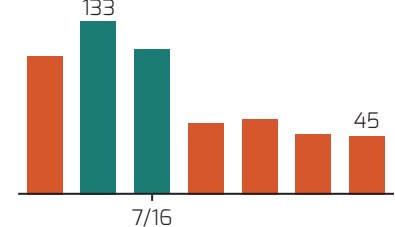
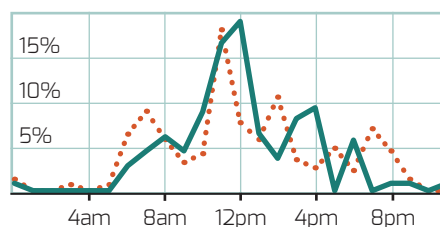
Segment: Camp Creek to County Road 16
Segment length: 6 miles
Count Location: County Road 16

Sample dates: 7/14/17 - 7/20/17
Counting days: 7
Observed traffic: 457
Correlation with Reference Site: 0.95 *



Segment: County Road 16 to Harmony
Segment length: 5.2 miles
Count Location: County Road 22

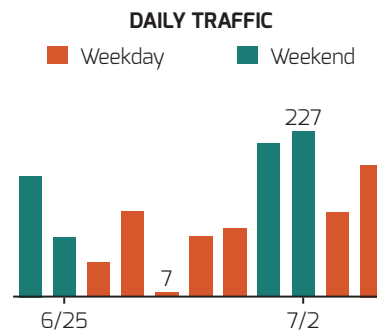
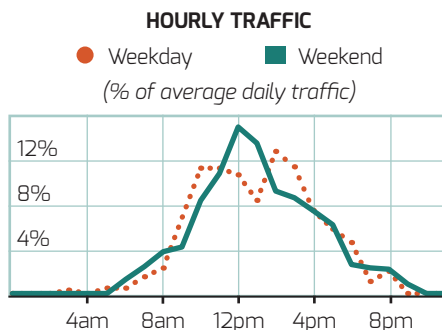
Sample dates: 7/14/17 - 7/20/17
Counting days: 7
Observed traffic: 554
Correlation with Reference Site: 0.99 *



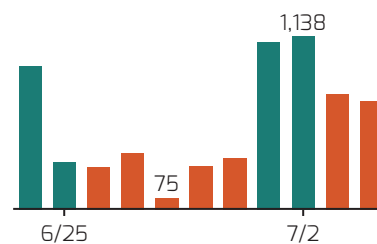
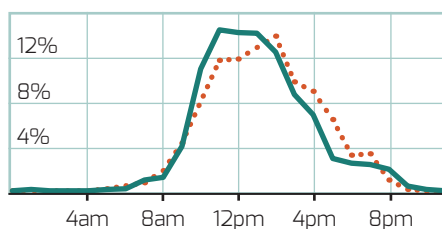
* $p < .05$

Appendix B: Sample Statistics, continued

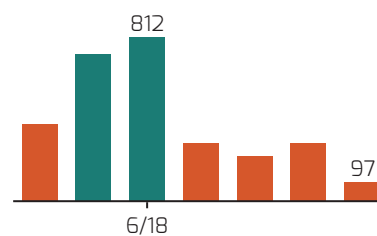
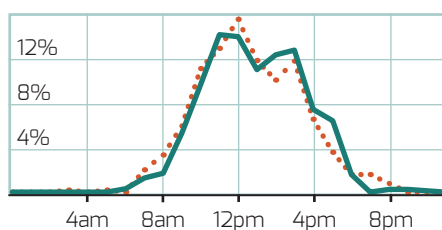
Segment: Fountain to Isinours Jct.
Segment length: 6.3 miles
Count Location: Jade Road
Sample dates: 6/24/17 - 7/4/17
Counting days: 11
Observed traffic: 1,331
Correlation with Reference Site: 0.63



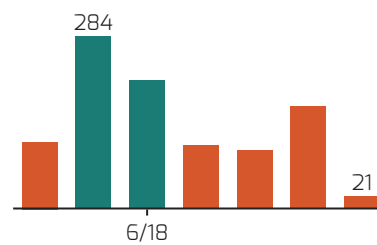
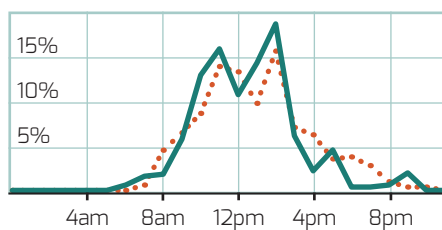
Segment: Isinours Jct. to Lanesboro Dam
Segment length: 4.6 miles
Count Location: Grit Road
Sample dates: 6/24/17 - 7/4/17
Counting days: 11
Observed traffic: 6,311
Correlation with Reference Site: 0.72 *



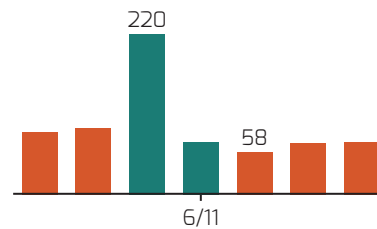
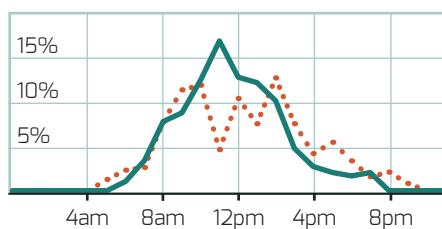
Segment: Root River Confluence to Whalen
Segment length: 2.9 miles
Count Location: Mile Post 15
Sample dates: 6/16/17 - 6/22/17
Counting days: 7
Observed traffic: 2,816
Correlation with Reference Site: 0.96 *



Segment: Whalen to Peterson
Segment length: 8.8 miles
Count Location: Mile Post 20
Sample dates: 6/16/17 - 6/22/17
Counting days: 7
Observed traffic: 996
Correlation with Reference Site: 0.91 *



Segment: Peterson to Rushford
Segment length: 4.7 miles
Count Location: Mile Post 27
Sample dates: 6/8/17 - 6/14/17
Counting days: 7
Observed traffic: 668
Correlation with Reference Site: 0.95 *



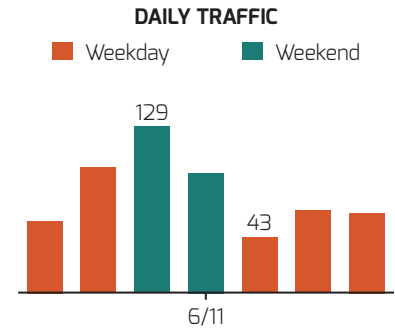
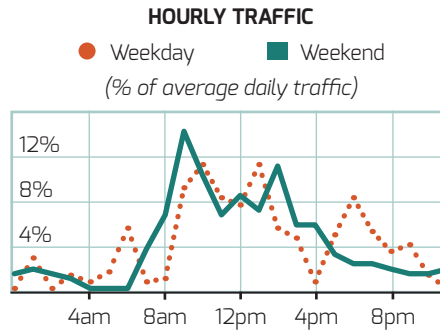
* $p < .05$

Appendix B: Sample Statistics, continued

ROOT RIVER STATE TRAIL, CONTINUED

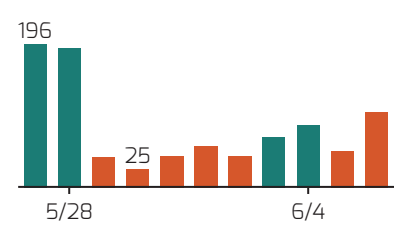
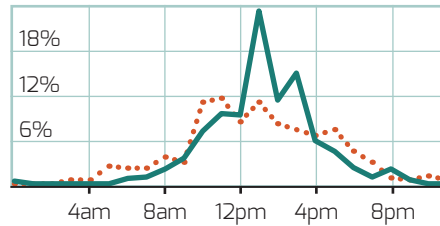
Segment: Rushford to Mile 33
Segment length: 3.2 miles
Count Location: Mile Post 31

Sample dates: 6/8/17 - 6/14/17
Counting days: 7
Observed traffic: 544
Correlation with Reference Site: 0.93 *



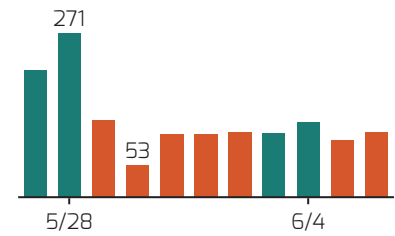
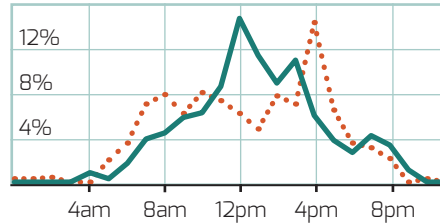
Segment: Mile 33 to Mile 39
Segment length: 5.5 miles
Count Location: Mile Post 35

Sample dates: 5/27/17 - 6/6/17
Counting days: 11
Observed traffic: 907
Correlation with Reference Site: 0.93 *



Segment: Mile 39 to Houston
Segment length: 3.9 miles
Count Location: Mile Post 41

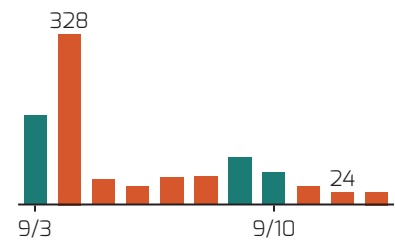
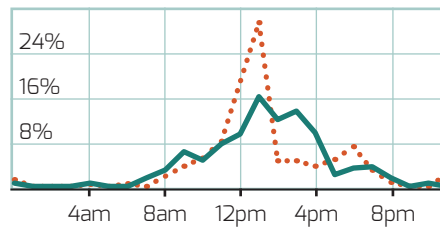
Sample dates: 5/27/17 - 6/6/17
Counting days: 11
Observed traffic: 1,411
Correlation with Reference Site: 0.96 *



PAUL BUNYAN STATE TRAIL

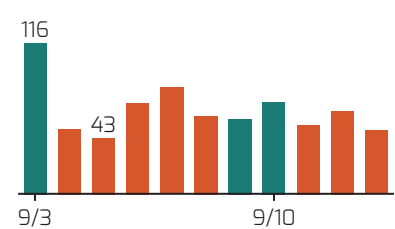
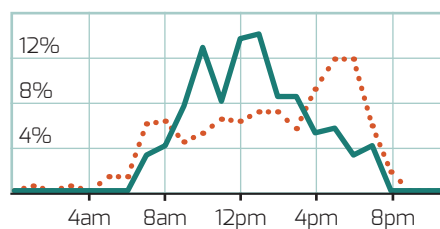
Segment: Crow Wing State Park to Baxter
Segment length: 5 miles
Count Location: Mile Post 1

Sample dates: 9/3/17 - 9/13/17
Counting days: 11
Observed traffic: 932
Correlation with Reference Site: 0.18



Segment: Baxter (Brandon Way to Isle Dr.)
Segment length: 4.3 miles
Count Location: Mapleton Road

Sample dates: 9/3/17 - 9/13/17
Counting days: 11
Observed traffic: 716
Correlation with Reference Site: 0.88 *



* $p < .05$

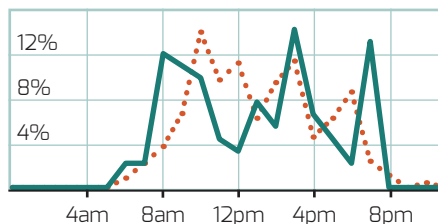
Appendix B: Sample Statistics, continued

Segment: Beaver Dam Rd. to Merrifield
Segment length: 6.6 miles
Count Location: Legionville Road

Sample dates: 8/26/17 - 9/1/17
Counting days: 7
Observed traffic: 548
Correlation with Reference Site: 0.88 *

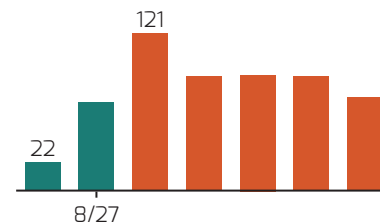
HOURLY TRAFFIC

● Weekday ■ Weekend
 (% of average daily traffic)



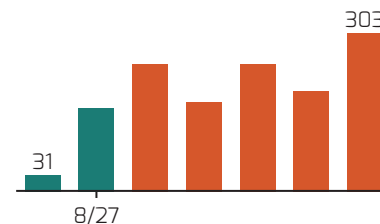
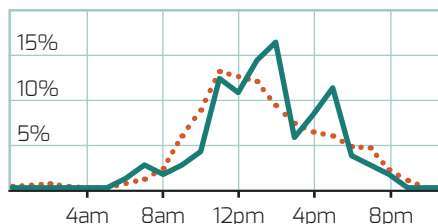
DAILY TRAFFIC

■ Weekday ■ Weekend



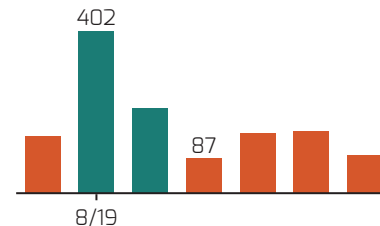
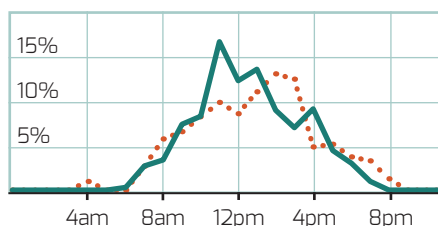
Segment: Merrifield to Nisswa
Segment length: 6.8 miles
Count Location: Lake Hubert

Sample dates: 8/26/17 - 9/1/17
Counting days: 7
Observed traffic: 1,346
Correlation with Reference Site: 0.46



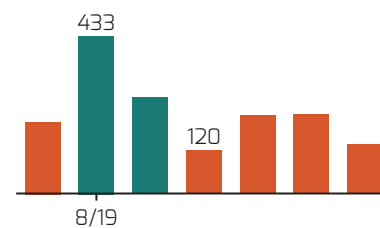
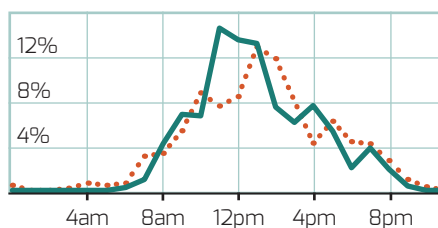
Segment: Nisswa to Pequot Lakes (Derkson Rd.)
Segment length: 5.2 miles
Count Location: Olson Road

Sample dates: 8/18/17 - 8/24/17
Counting days: 7
Observed traffic: 1,238
Correlation with Reference Site: 0.97 *



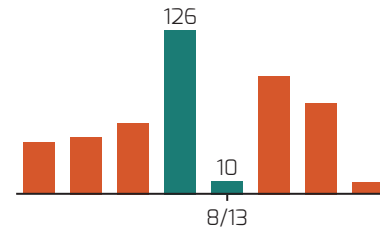
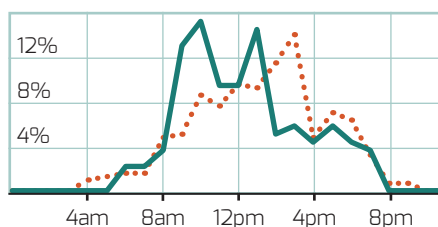
Segment: Pequot Lakes (Derkson Rd. to Patriot Ave.)
Segment length: 1.8 miles
Count Location: Woodman Street

Sample dates: 8/18/17 - 8/24/17
Counting days: 7
Observed traffic: 1,585
Correlation with Reference Site: 0.95 *



Segment: Pequot Lakes (Patriot Ave.) to Pine River
Segment length: 8.4 miles
Count Location: 12th Avenue SW

Sample dates: 8/9/17 - 8/16/17
Counting days: 8
Observed traffic: 445
Correlation with Reference Site: 0.93 *



* $p < .05$

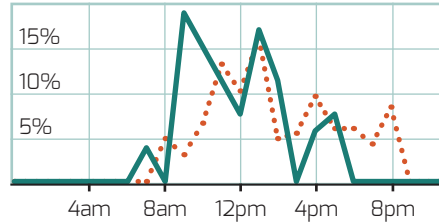
Appendix B: Sample Statistics, continued

Segment: Pine River to Backus
Segment length: 9.1 miles
Count Location: 16th Street SW

Sample dates: 8/9/17 - 8/16/17
Counting days: 8
Observed traffic: 216
Correlation with Reference Site: 0.92 *

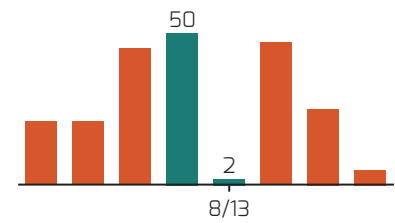
HOURLY TRAFFIC

● Weekday ■ Weekend
 (% of average daily traffic)



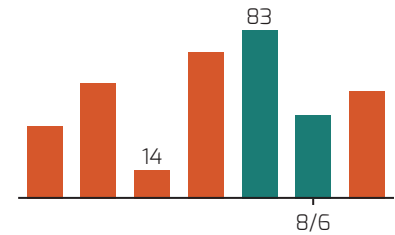
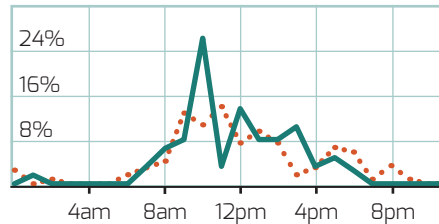
DAILY TRAFFIC

■ Weekday ■ Weekend



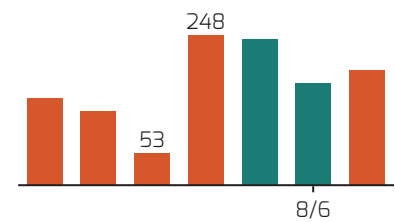
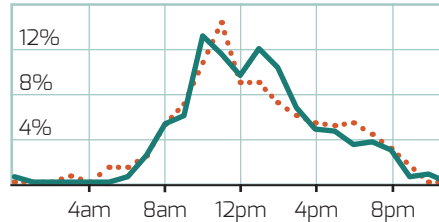
Segment: Backus to Hackensack
Segment length: 7.4 miles
Count Location: 16th Street NW

Sample dates: 8/1/17 - 8/7/17
Counting days: 7
Observed traffic: 356
Correlation with Reference Site: 0.89 *



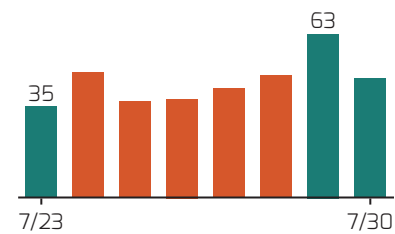
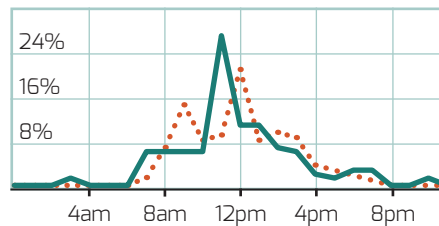
Segment: Hackensack to Shingobee Jct.
Segment length: 8.1 miles
Count Location: Birch Lake Road

Sample dates: 8/1/17 - 8/7/17
Counting days: 7
Observed traffic: 1,167
Correlation with Reference Site: 0.78 *



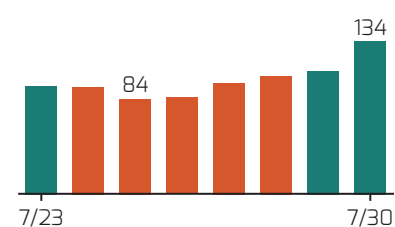
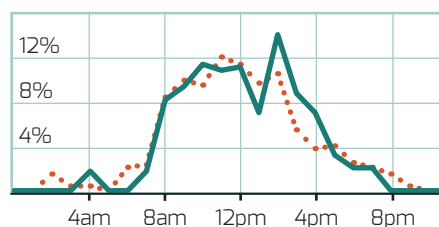
Segment: Shingobee Jct. to Heartland Trail Jct.
Segment length: 9 miles
Count Location: County Road 50 NW

Sample dates: 7/23/17 - 7/30/17
Counting days: 8
Observed traffic: 356
Correlation with Reference Site: 0.66



Segment: Heartland Trail Jct. to Fifth Lake
Segment length: 2.5 miles
Count Location: Lake Alice Road NW

Sample dates: 7/23/17 - 7/30/17
Counting days: 8
Observed traffic: 802
Correlation with Reference Site: 0.47



* $p < .05$

References

- 1 Minge, E., Falero, C., Lindsey, G., Petesch, M., and Vorvick, T. (2017). *Bicycle and Pedestrian Data Collection Manual*. MnDOT Report No. MN/RC 2017-03, Minnesota Department of Transportation, Office of Transit, Bicycle / Pedestrian Section, Minneapolis, MN.
- 2 Arrowhead Regional Development Commission. (2016). *Gitchi-Gami State Trail 2015-2016 Usage Study*. Duluth, MN.
- 3 Hankey, S., Lindsey, G., and Marshall, J.D. (2014). Day-of-Year Scaling Factors and Design Considerations for Non-motorized Traffic Monitoring Programs. *Transportation Research Board*. 2468: 64-73.
- 4 Gobster, P., Sachdeva, S., and Lindsey, G. (2017). Up on the 606: Understanding the Use of a New Elevated Pedestrian and Bicycle Trail in Chicago, Illinois. *Transportation Research Board*. 2644: 83-91.
- 5 Hankey, S., Lindsey, G., and Marshall, J.D. (2014). Day-of-Year Scaling Factors and Design Considerations for Non-motorized Traffic Monitoring Programs. *Transportation Research Board*. 2468: 64-73.
- 6 Holmes, T., Knight, J., Newman, D., and Wu, X. (2016). *Monitoring Use of Minnesota State Trails. Considerations and Recommendations for Implementation*. Prepared for Minnesota Department of Natural Resources. Humphrey School of Public Affairs, Univ. of Minnesota, Minneapolis, MN.



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