

**FINAL REPORT**

**2012**

**Chain of Lakes Trail Use  
Monitoring Study**



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Parks Canada

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## Section 1 – Preamble

In 2011, Parks Canada was approached by the Chain of Lakes Trail Association (COLTA) to determine the level of use of the newly built [Chain of Lakes Trail](#) (COLT), which starts on Joseph Howe Drive in Halifax, continues through Bayers Lake Business Park, and ends at the Lakeside Business Park where it connects to the Beechville Lakeside Timberlea Trail (see map below). Parks Canada agreed to do so and installed three [Trafx](#) automated counters at two locations at opposite ends of the trail (see locations below) to provide a general indication of the level of use of the trail at these locations.

### Lakeside Location:

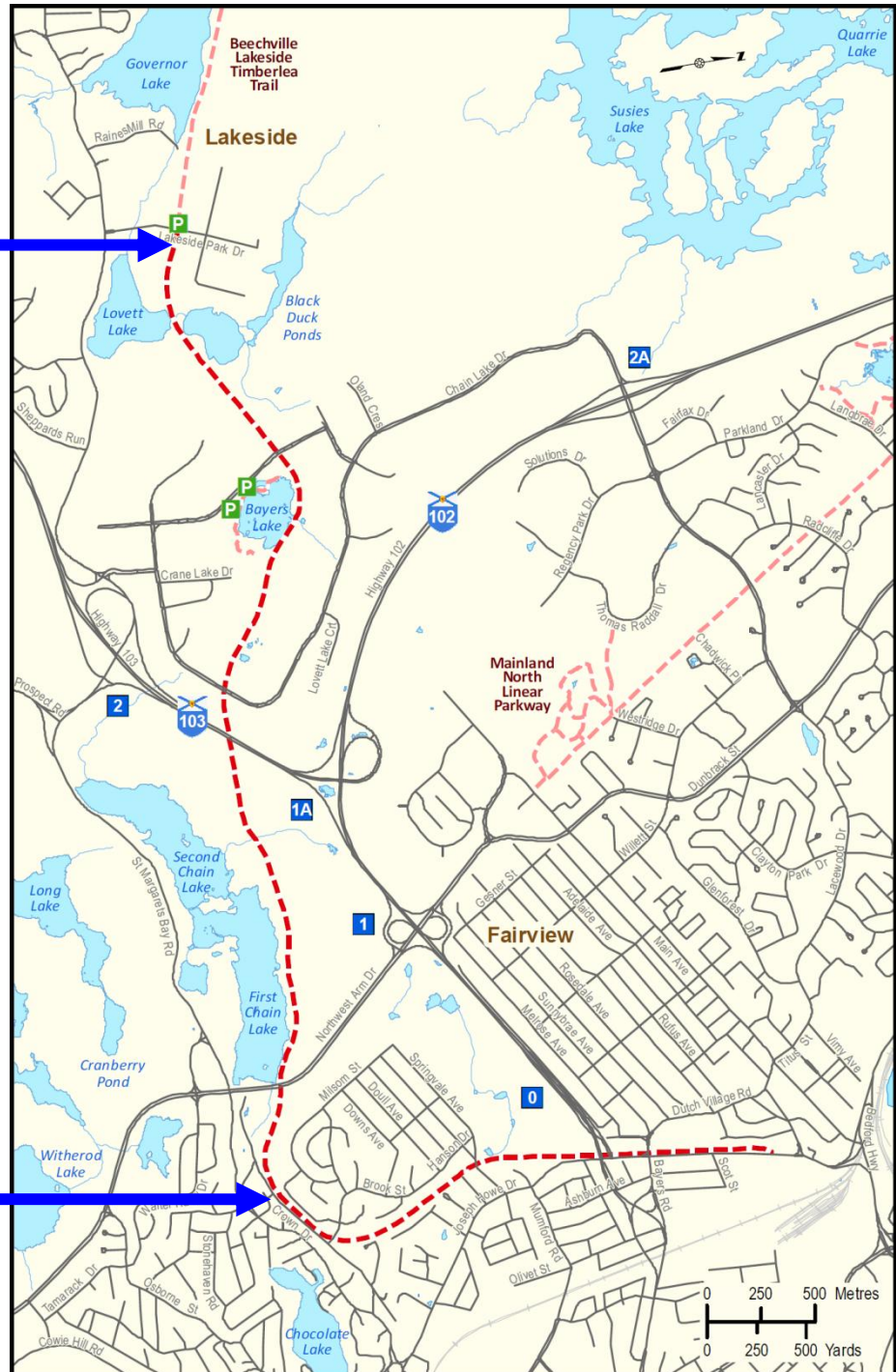
Two counters were installed here; one infrared counter and one bicycle counter.

The infrared counter records all trail users (walkers, runners, cyclists) while the bicycle counter uses a magnetic sensor to detect bicycles, and possibly the occasional baby stroller.

### Crown Drive Location:

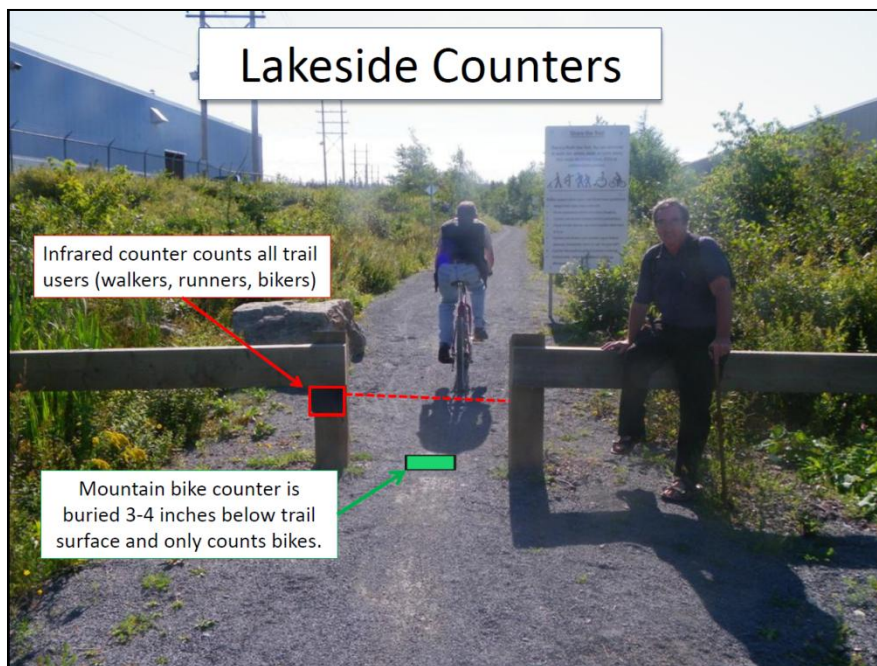
One infrared counter that records all trail users was installed at this location.

It was not possible to install a bicycle counter at this location because the trail surface is paved and this type of counter has to be buried under the trail surface.



## Section 2 – Methodology

The counters were installed at the end of the month of June 2011 and remained in place until December 2012 – a period of just over 17 months. The data was downloaded on a regular basis (every few months) by Alain Boudreau from Parks Canada and the counters' batteries were replaced two or three times a year. During each download, silica desiccants were also replaced which help absorb any moisture that accumulates within the cases that house and protect the counters. These cases were locked and firmly secured to a post or telephone pole to prevent theft or any tampering with the equipment. The pictures below show where the counters were installed.



## Section 3 – Data preparation

### 3.1 – Missing or erroneous data and imputation

1. During the first summer of operation, it was determined that there was a problem with the infrared counter at the Lakeside location (recording extremely high counts 24 hours per day) so that counter was replaced with a new one in October 2011.
2. The batteries died much sooner than expected on the bike counter installed at Lakeside and therefore no data was captured on cyclists from mid-October 2011 to the end of March 2012.
3. There was also a very short period in July 2012 when the Lakeside infrared counter recorded extremely high counts due to a weed that had grown directly in front of the counter’s infrared scope, which triggered false counts as it swayed back and forth in the wind.

The [imputation](#) of missing or erroneous data during the study period is detailed below.

Missing or erroneous data from the...	Time period	We replaced it by...	<u>R value</u> (higher, the better)
1. Lakeside infrared counter: problems with the original counter – high counts being recorded 24 hours/day	June 30 2011 to October 27 2011 (120 days)	Linear regression using Lakeside bike counter as the independent variable (up to October 16 2011)	.906
		Linear regression using Crown Dr. infrared counter as the independent variable (October 17-27 2011)	.507
2. Lakeside bicycle counter: batteries died	October 17 2011 to March 30 2012 (166 days)	Linear regression using Crown Dr. infrared counter as the independent variable (October 17-27 2011)	.555
		Linear regression using Lakeside infrared counter as the independent variable (October 28 2011 to March 30 2012)	.906
3. Lakeside infrared counter: spikes in data due to vegetation growing in front of counter	July 9 to July 12 2012 (4 days)	Linear regression using Lakeside bike counter as the independent variable	.906

### 3.2 – Data Calibration

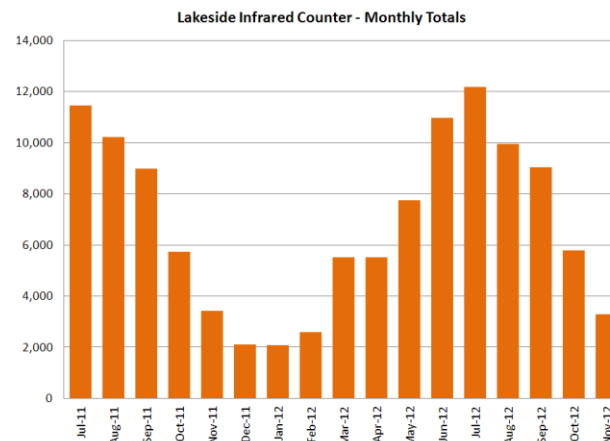
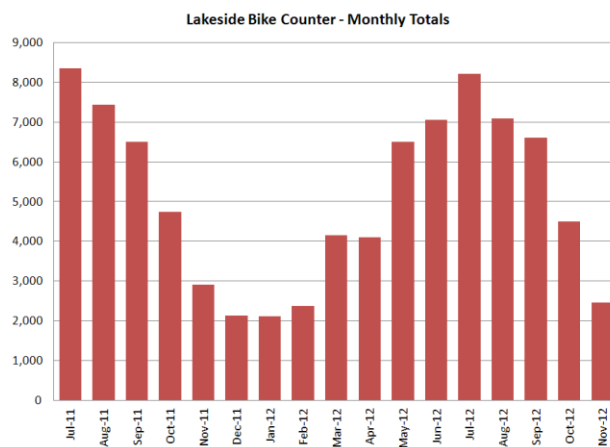
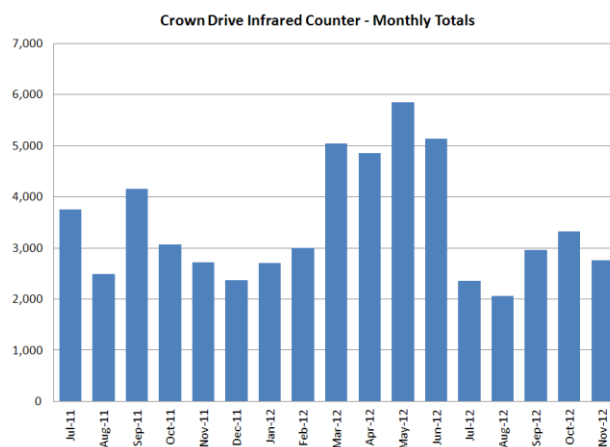
Whenever counters are used, it is prudent to conduct a few hours of calibration to ensure that the counter is accurately recording data. A few hours of calibration were conducted by COLTA volunteers, as well as by Parks Canada staff at the two locations in 2012. The findings are summarized below:

- **Lakeside location:** one hour of calibration was conducted at this location in July 2012. It revealed that the infrared counter was undercounting (especially cyclists, due to the low height of the counter) and a correction factor of 1.93 was established. Meanwhile, the bicycle counter was also undercounting and a correction factor of 1.39 was established (e.g. 100 electronic counts = 139 bicycle counts).
- **Crown Drive location:** 4 hours of calibration were done in July and August 2012. This revealed that the infrared counter was undercounting by a significant margin during this period, which led the author to further investigate the seasonal distribution of the data, as explained in the next section.

### 3.3 – Data Distribution

Now that there is a complete dataset to work with (i.e. the missing or erroneous data has been replaced by imputation), the next step in the process is to review the data to see if it is normally distributed. In the context of recreational trail use in the city of Halifax, one would expect that the data would follow a seasonal bell curve pattern with the peak of use occurring during the warm summer months followed by a steady decline in the fall and winter months, when the level of use of the trail would typically reach its lowest point during the year.

The three graphs below reveal that the counter installed at the Crown Drive location recorded an “abnormal” pattern of use compared to the two counters at the Lakeside location, which follow the expected pattern of use (peak in summer, trough in winter). This problem at Crown Drive was initially uncovered following a calibration exercise that revealed that the Crown Drive counter was undercounting by a significant margin (only counting 1 in 6 trail users in July & August) in the summer.



### 3.4 – Method used to correct data distribution

Based on the monthly totals that were recorded by the three counters and the percentage of the 17-month total that each month accounts for, it appears that the Crown Drive infrared counter was undercounting during the summer months of June, July, August and September. There are several possible explanations for this:

- Unlike the counters at Lakeside, which trail users had to walk/bike right next to (because of the barricade), the counter at Crown Drive (see picture on page 4) was installed a few meters away from the trail surface, which is also quite wide. The counter was at its maximum range from trail users on the far/right side of the trail, and during the summer it is more likely that some people would have been missed by the counter if they were walking on the far side of the trail to make room for those travelling in the opposite direction, or if they were walking side by side with others (counter cannot see past the person nearest to the counter).
- It is also possible that the infrared counter had difficulty “detecting” trail users on the far side of the trail during the warmest part of the year when the difference between a person’s body temperature and the ambient temperature is very small compared to the rest of the year. The infrared counter “detects and counts the infrared signature associated with warm, moving objects” and as a result, it functions better in cooler weather or shaded areas.

**Step 1:** To produce estimated monthly totals for the Crown Drive counter for the months of July, August and September 2011 as well as June through September 2012, we calculated the percentage of the 17-month total that each month accounted for, for the two counters installed at Lakeside.

Month	Lakeside Bike counter	% of total	Lakeside Infrared counter	% of total	Average for 2 Lakeside counters
Jul-11	8,349	9.6%	11,444	9.8%	9.70%
Aug-11	7,429	8.5%	10,212	8.8%	8.64%
Sep-11	6,510	7.5%	8,973	7.7%	7.58%
Oct-11	4,743	5.4%	5,738	4.9%	5.18%
Nov-11	2,905	3.3%	3,417	2.9%	3.13%
Dec-11	2,130	2.4%	2,108	1.8%	2.13%
Jan-12	2,111	2.4%	2,077	1.8%	2.10%
Feb-12	2,371	2.7%	2,590	2.2%	2.47%
Mar-12	4,157	4.8%	5,529	4.7%	4.76%
Apr-12	4,101	4.7%	5,517	4.7%	4.72%
May-12	6,501	7.5%	7,738	6.6%	7.05%
Jun-12	7,052	8.1%	10,960	9.4%	8.74%
Jul-12	8,210	9.4%	12,195	10.5%	9.94%
Aug-12	7,095	8.1%	9,964	8.5%	8.34%
Sep-12	6,604	7.6%	9,026	7.7%	7.66%
Oct-12	4,490	5.1%	5,779	5.0%	5.05%
Nov-12	2,462	2.8%	3,280	2.8%	2.82%
<b>Total trips</b>	<b>87,220</b>	<b>100.0%</b>	<b>116,547</b>	<b>100.0%</b>	<b>100.0%</b>

The average percentage for the two Lakeside counters will be used in the next step of the process.

**Step 2:** Next, we used the average monthly percentages at Lakeside to determine what percentage of the 17-month total our valid figures accounted for, which in this case was only 39.4%. Next, we divided the 10-month total by 0.394 to give us our estimated 17-month total ( $35,712 / 0.394 = 90,640$ ).

	<b>Crown Drive Infrared Counter</b>	<b>Average % of 17-month total for 2 Lakeside counters</b>
Jul-11		
Aug-11		
Sep-11		
Oct-11	3,075	5.18%
Nov-11	2,722	3.13%
Dec-11	2,375	2.13%
Jan-12	2,706	2.10%
Feb-12	3,005	2.47%
Mar-12	5,041	4.76%
Apr-12	4,857	4.72%
May-12	5,851	7.05%
Jun-12		
Jul-12		
Aug-12		
Sep-12		
Oct-12	3,326	5.05%
Nov-12	2,754	2.82%
<b>10-month total</b>	<b>35,712</b>	<b>39.4%</b>

**Step 3:** Lastly, we calculated the estimated monthly totals for the months of June through September by multiplying the average percentages from Lakeside by the 17-month total, as shown in the table below.

	<b>Crown Dr IR</b>	<b>Average % of 17-month total for 2 Lakeside counters</b>
Jul-11	8,788	9.70%
Aug-11	7,831	8.64%
Sep-11	6,872	7.58%
Oct-11	3,075	5.18%
Nov-11	2,722	3.13%
Dec-11	2,375	2.13%
Jan-12	2,706	2.10%
Feb-12	3,005	2.47%
Mar-12	5,041	4.76%
Apr-12	4,857	4.72%
May-12	5,851	7.05%
Jun-12	7,926	8.74%
Jul-12	9,008	9.94%
Aug-12	7,561	8.34%
Sep-12	6,941	7.66%
Oct-12	3,326	5.05%
Nov-12	2,754	2.82%
<b>17-month total</b>	<b>90,640</b>	<b>100.0%</b>

8.74% x 90,640  
= 7,926

## Section 4 – Data Analysis

At this point, we have a full, calibrated dataset (with the exception of Crown Drive, which is not calibrated due to problems with the distribution of the data) that we can analyze to provide a general indication of the level of use of the Chain of Lakes Trail at the two locations that were monitored. The table below presents the monthly total number of trips (not trail users) recorded at the 2 locations. Note that for the Lakeside location, the number of trips made by cyclists is also reported, which accounted for 75% of the trail use at this location.

Month/Year	Crown Drive Trips made by All Trail Users	Lakeside Trips made by All Trail Users	Lakeside Trips made by Cyclists
Jul-11	8,788	11,444	8,349
Aug-11	7,831	10,212	7,429
Sep-11	6,872	8,973	6,510
Oct-11	3,075	5,738	4,743
Nov-11	2,722	3,417	2,905
Dec-11	2,375	2,108	2,130
Jan-12	2,706	2,077	2,111
Feb-12	3,005	2,590	2,371
Mar-12	5,041	5,529	4,157
Apr-12	4,857	5,517	4,101
May-12	5,851	7,738	6,501
Jun-12	7,926	10,960	7,052
Jul-12	9,008	12,195	8,210
Aug-12	7,561	9,964	7,095
Sep-12	6,941	9,026	6,604
Oct-12	3,326	5,779	4,490
Nov-12	2,754	3,280	2,462
17-month total	<b>90,640*</b>	<b>116,547</b>	<b>87,220 (75% of total)</b>
12-month total (Dec 2011 to Nov 2012)	<b>61,352*</b>	<b>76,763</b>	<b>57,284</b>
<b>*This data has not been calibrated.</b>			

In the author’s opinion, **the figures from the two Lakeside counters are very accurate** (given the proximity of the counters to trail users) and the one-hour calibration session that was done during the summer of 2012 has allowed us to report calibrated counts, which are reflected in the table above.

However, the Crown Drive counter data is still not calibrated at this point, even though it has been corrected to reflect a normal distribution pattern over the year. Because of the width of the trail and the distance that the counter was installed from the trail, **the counts recorded at Crown Drive inevitably under-estimate the total use of the trail at this location** for a number of reasons:

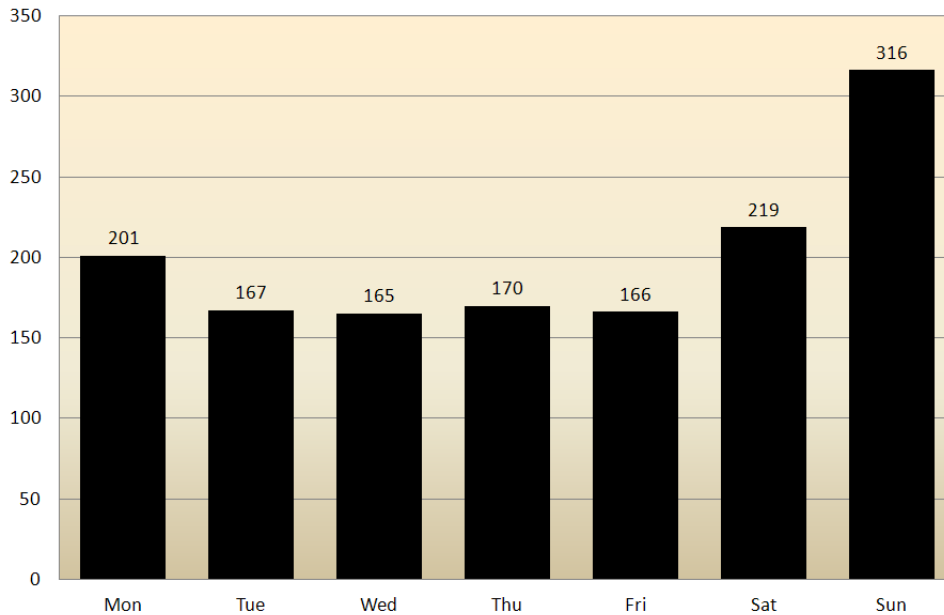
1. Because of the width of the trail, it is common for trail users (especially walkers) to walk side by side, which was frequently observed when the author was onsite to download the data. As a result, the counter is not able to “detect” all of the trail users; it only “sees” the person closest to the counter (e.g. three people walking side by side would likely only generate 1 count).
2. Likewise, if people were walking or biking in opposite directions directly in front of the counter, the counter would only detect the person nearest to the counter, which would also under-estimate the total amount of trail activity.
3. Since this is a paved trail, cyclists can travel along the trail at a fairly high speed. As a result, it is possible that the counter did not record all of the cyclists using the trail, which would also under-estimate the total number of trail users (person-trips) at this location.



### Use of COLT by Day of Week

As shown in the chart below, Sunday was the busiest day of the week on the COLT at the Lakeside location with nearly double the amount of trail use than on weekdays. Saturday was the second busiest day of the week. The day of week pattern is identical at the Crown Drive location.

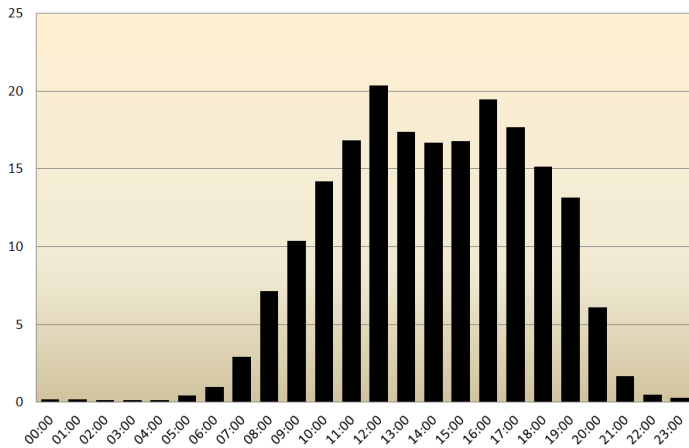
Average number of person-trips by day of week @ Lakeside  
(Nov 2011 to Nov 2012)



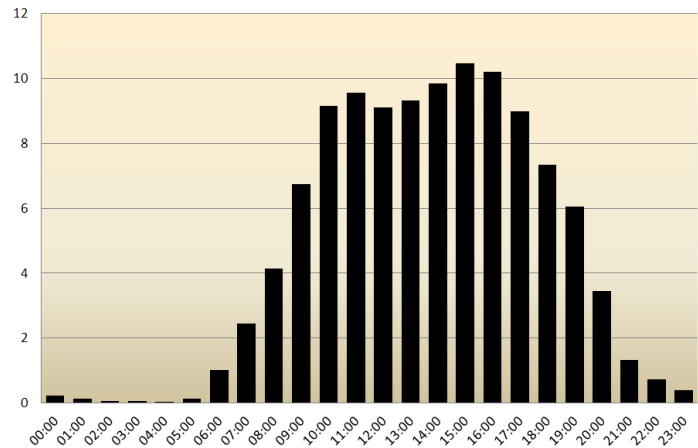
### Use of COLT by Hour of Day

As shown in the chart below, the noon hour and the late afternoon were the busiest periods of the day on the COLT at the Lakeside location. Meanwhile, trail use at the Crown Drive location peaks in the late afternoon (3 to 5pm). \*Please note that the averages for the Crown Drive location underestimate the actual level of trail use (due to factors discussed in this report), but the pattern of use over the course of the day would remain the same.

Average number of person-trips by hour of day @ Lakeside  
(Nov 2011 to Nov 2012)



Average number of person-trips by hour of day @ Crown Dr.  
(Nov 2011 to Nov 2012)



## Conclusion

In the professional opinion of the author, who has a lot of experience working with counters and conducting this type of statistical analysis, **the actual level of trail use at Crown Drive is likely two to three times what is reported in the table on page 8**, so possibly 120,000 to 180,000 person-trips per year.

Unlike the Lakeside location, the Crown Drive portion of the trail is right in the middle of a heavily populated residential area and a lot of local residents appeared to be using the COLT for their daily exercise (this is what was observed by the author during onsite visits). Therefore, it would be logical that the Crown Drive portion of the COLT would receive far more use than the section of the COLT in Lakeside, which sees approximately 75,000 person-trips per year, the majority of them by cyclists.

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