Use of signalised pedestrian crossings

Assignment 2: Quantitative Analysis

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Executive Summary

The purpose of this study is to investigate the use of signalized pedestrian crossings and present adequate information as precise as possible regarding manual, and digital analysis of the case as an aspect of traffic management.

The report aims to assist the city council by having a simple overall objective view regarding queue times and other recorded values as part of the whole system. And to provide the council with a summary of what the bigger picture looks like outside the cloud of data and information processing.

Data collection was done by hand. And timed using a stop-watch.

Data was screened and plugged into an Excel worksheet.

Finally, the data was analyzed using RStudio IDE.

Findings were recorded and showed patterns of behavior, as in whether the person actually waits for pedestrian traffic lights to become green in order to cross. It also showed how busy the crossing is at different times of the day.

This information aims to help Auckland City Council in developing and implementing new policies and methods for better pedestrian traffic flow.

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1. Introduction

Auckland City Council contacted my company regarding traffic management issues. Auckland City is known for its overwhelming growth rate for its base structure and this scales into problems with traffic management, as demands for restructuring of traffic management sometimes become a necessity to adapt.

In this report, we will see detailed figures and data collected to answer a few basic constraint questions.

- At what rate does a traffic signal stop the traffic and show the “green-man” at a signalized pedestrian crossing?
- How many pedestrians cross each time the signal shows the “green-man”?
- There is also the case of jaywalkers.

18% of fatal and serious injuries from 2005 to 2009 were pedestrian crashes. The problem is mostly due poor observation and failure to give right of way to vehicles approaching from their right. This scaled into a total of 1640 injuries in that given time period.

2. Methods

2.1 Data Collection

The data used in this analysis was collected manually, through observation of pedestrian traffic flow and using a stop watch on a personal mobile phone to record “lap times”.

2.2 Screening

Because the data was collected manually, it was also necessary to screen it as human errors are an often occurrence. There were some assumptions and hence were analyzed and calculation measures were taken as to how they reflected into the readings.

Reliance on visual awareness, audio signals (of people clicking the button)

Due to how busy the pedestrian crossing on Shortland/Queen Street was, 3 sets of readings were taken at 3 different times, at 13:50, 16:30 and 19:00 respectively, and for each, data was recorded of 30 lap intervals.

Lap intervals and Timelines were the cornerstone of the data collection. The interval number symbolizes implies which reading this was, in order from the initial reading. It is simply a numbering mechanism.

Lap timeline however involved a process of turning on the timer as the pedestrian light turned green (by waiting carefully for the audio signal). And pressing the “lap” button the moment another person has clicked the button.
And through reliance of visual awareness, the pedestrians were counted one by one.

But for this method to work seamlessly, a few steps had to be taken first.

The first one was the calculation of the duration that the green light stays on at any point. And this revealed that it remains green for exactly 30 seconds.
The second one was find a reconciliation time of both the red light being on, and having no light on at all. (I.e. The button has not been pressed yet). And this showed that this process is a 40

second process at any moment in time, as it is prioritized through vehicle traffic instead of pedestrian traffic.

And this opened up the idea that those 40 seconds can be disregarded and should not be accounted for as part of the analysis.

2.3 Analysis

The data was analyzed through visual scanning first to check for anomalies and other misread or incorrect information.

Then it was analyzed through Rstudio IDE.

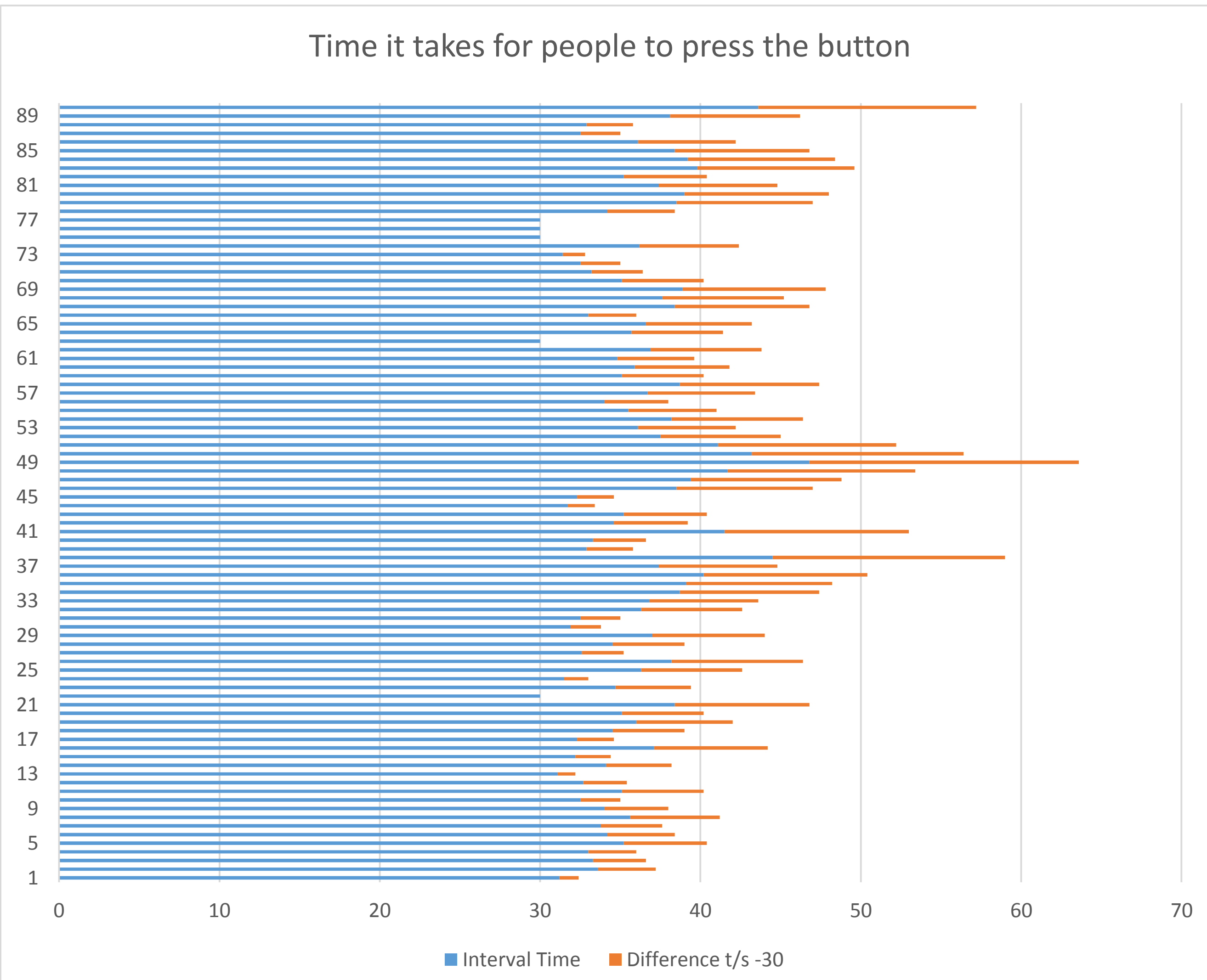
3. Findings

3.1 Summary of the Data

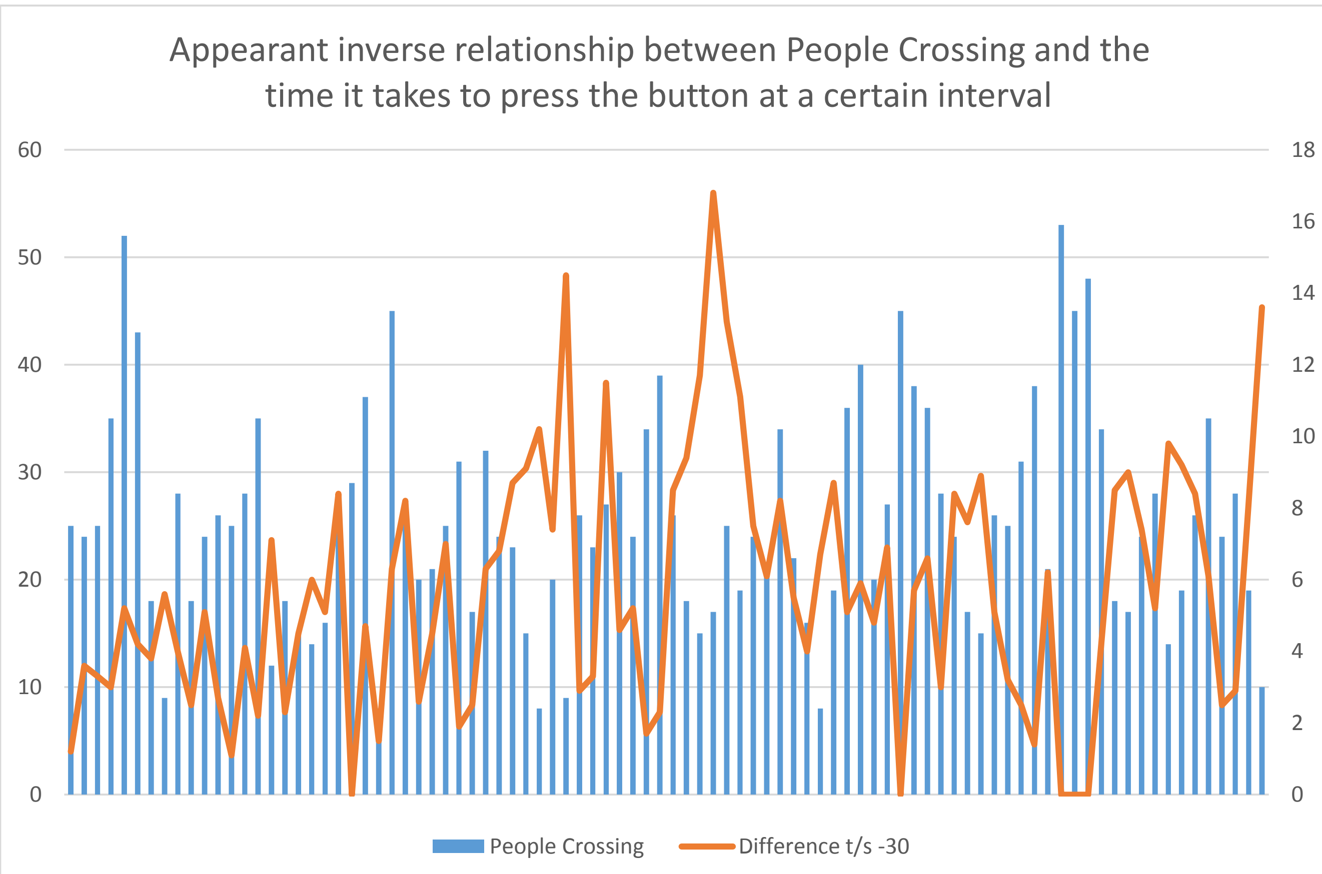
Using the lap method of calculating the interval through which the green light is open until another person presses the button after it turns off is a very accurate method.

Basically the lap time is recorded, then subtracted from the previous one to give us the interval time.

30 seconds are then subtracted from the interval time to lead to the realization of the time from the moment the pedestrian light is off, until a person clicks the button.



The graph shown next has one very interesting visual feature. There are many instances when the blue bar is taller, the orange line graph presents a lower value and vice versa. Showing an inverse relationship where as the number of pedestrians crossing the street rises, there is a larger chance that the button gets pressed faster. The trend does not necessarily manifest at every interval, but as an overall pattern, it is indeed established.

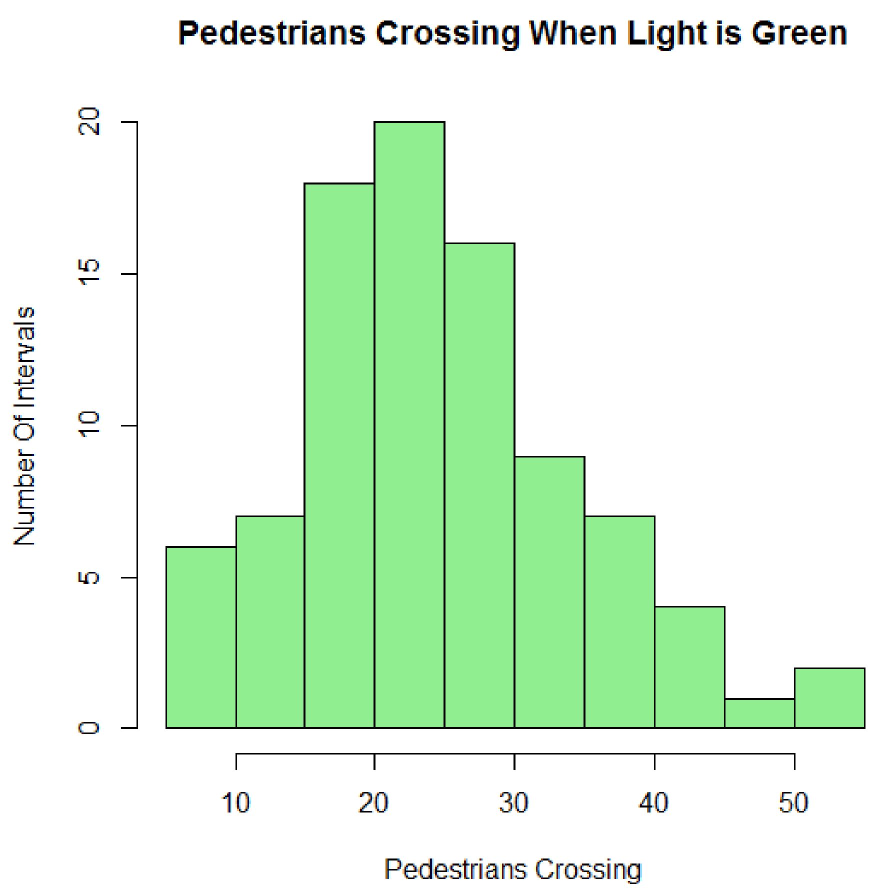


3.1.1 Rate of pedestrians crossing when light is “Green”

Analysis through RStudio IDE gave a total mean value of people crossing when the traffic light is “Green” of 25.3777. This value compared to each subset of 30 intervals, where intervals 1:30 yielded a mean of 25.333, intervals 31:60 yielded a mean of 23.0333, and finally intervals 61:90 yielded a mean of 27.7666.

This shows how the number of people crossing the street changed from time to time.

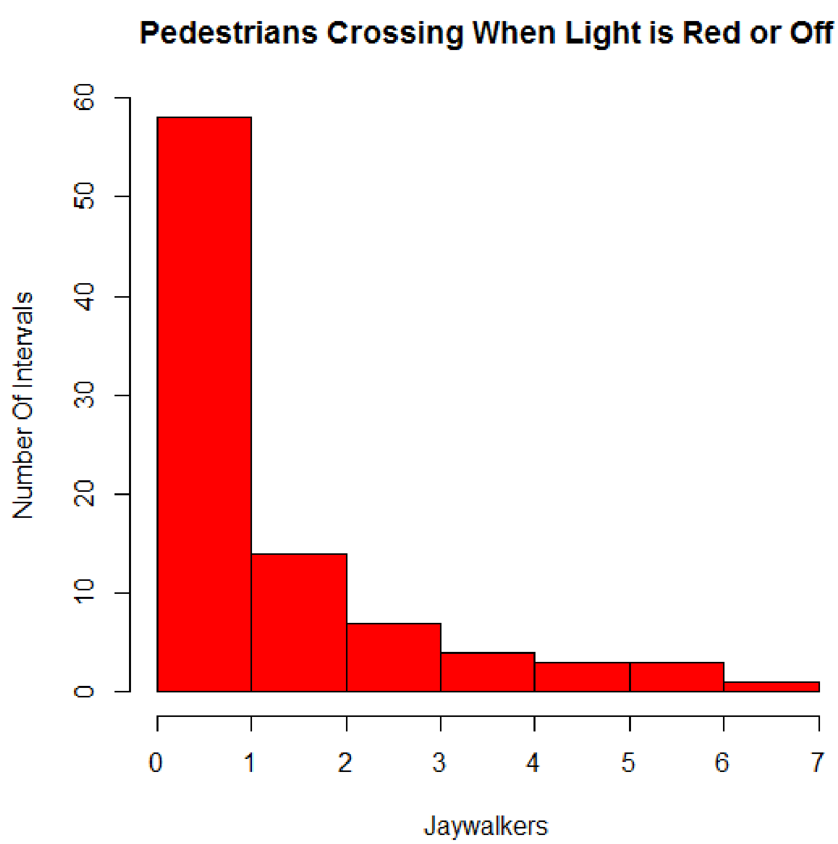
At any one time, there was at least 8 people crossing the traffic light, suggesting an usually busy crossing with a maximum of 53 people as peak pedestrian traffic flow.



3.1.2 Rate of pedestrians crossing when light is "Red or Off"

Commonly referred to as Jaywalkers. There are those who will cross the traffic light in spite of it being Red or even Off. The data is reflected in the following histogram.

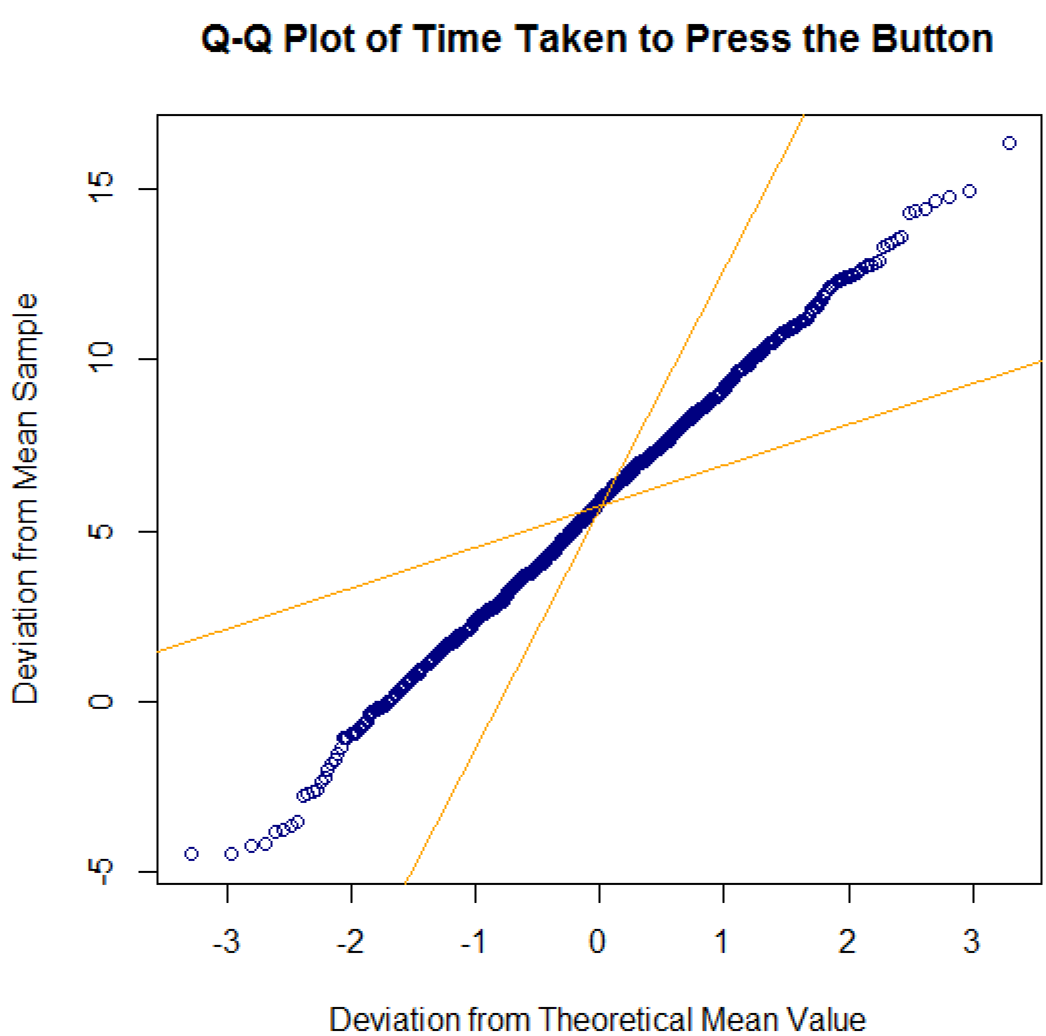
There were many instances where there were no jaywalkers, however analysis showed that a maximum event where 7 pedestrians have crossed the same traffic light as it was Red, or Off.



3.2 Reconciliation of Theoretical Mean Value & Sample Mean

Here is where it gets interesting. Now we have shown how we calculate the time it takes from the moment the light turns off until the next person clicks the button again.
Here we have a Q-Q Plot of the Time Taken to Press the Button.

This is a complex plot of the Difference T/Sec column shown in the appendix. That has gone through normalization process as well as projected with two diagonal lines intersecting the Theoretical Mean Value.



Now the actual mean of Difference T/Sec of all the intervals 1:90, as analyzed through RStudio IDE, showed that it equaled a value of = 5.69222sec

Notice in the graph how the intersection point of the two diagonals lines can be visually estimated as [0, 5.7].

Now this shows a few things.

First of all, most readings were around 5.7 as the mean determined, however one can visually determine through the graph how it nearly scatters equally as it deviated from the mean.

Here's where the Mean Sample and Theoretical Mean Value come in.
The Mean Sample is the actual mean, without normalization, a simple numbered axis.

However the Theoretical Mean Value normalizes at the actual mean value, hence a mean value of 5.69222 is set to 0, and anything deviating from this number either in the positive or negative will have a 0 starting point for this deviation. And this makes it a very powerful graph to determine the density of the time it takes to press the button.

This cancels out any significant error that readings equal to 0 may have caused, i.e. a person pressing the button immediately as the light turns off, or if a person on a perpendicular pedestrian crossing to the one we are investigating has pressed it. It minimizes the effect it has on the mean values through setting the actual mean value as the origin.

4. Conclusions

To conclude this report, I would say the data collected was sufficient to determine certain patterns through real-time observation as well as data analysis using RStudio IDE.

There is a great deal of variable to be taken if this report is to be improved or taken into a larger scale. Many of which will demand time and further calculation.

In the end, trusting intuitive reading may make you right once, twice and even a lot of times, but laying a graph on every time you were right or wrong will probably yield a much clearer picture.

One example is the inverse relationship between pedestrians crossing at any point and the time it takes for someone to press the button again. It is a pattern, but it is not the entire picture.

Details and presentation of details, especially visual representation is very important, as it shows the power of calculation.

Pedestrians will cross red lights, or run when the light is off. But it is not always the case. Most people do in fact wait.

Changing the minds of the people is not an option, that why pedestrian traffic flow management is the target.

5. References

https://at.govt.nz/cycling-walking/pedestrian-safety/

6. Appendix

Interval Set 1:30, starting time 13:50

Interval	People Crossing	Jaywalkers	Lap Timeline t/sec	Interval Time	Difference t/s -30
1	25	0	31.2	31.2	1.2
2	24	0	64.8	33.6	3.6
3	25	2	98.1	33.3	3.3
4	35	3	131.1	33	3
5	52	3	166.3	35.2	5.2
6	43	2	200.5	34.2	4.2
7	18	0	234.3	33.8	3.8
8	9	0	269.9	35.6	5.6
9	28	0	303.9	34	4
10	18	1	336.4	32.5	2.5
11	24	2	371.5	35.1	5.1
12	26	1	404.2	32.7	2.7
13	25	0	435.3	31.1	1.1
14	28	0	469.4	34.1	4.1
15	35	5	501.6	32.2	2.2
16	12	1	538.7	37.1	7.1
17	18	1	571	32.3	2.3
18	15	2	605.5	34.5	4.5
19	14	2	641.5	36	6
20	16	0	676.6	35.1	5.1
21	28	0	715	38.4	8.4
22	29	0	745	30	0
23	37	3	779.7	34.7	4.7
24	8	0	811.2	31.5	1.5
25	45	6	847.5	36.3	6.3
26	26	4	885.7	38.2	8.2
27	20	1	918.3	32.6	2.6
28	21	0	952.8	34.5	4.5
29	25	0	989.8	37	7
30	31	2	1021.7	31.9	1.9

Interval Set 31:60, starting time 16:30

Interval	People Crossing	Jaywalkers	Lap Timeline t/sec	Interval Time	Difference t/s -30
31	17	3	1054.2	32.5	2.5
32	32	1	1090.5	36.3	6.3
33	24	2	1127.3	36.8	6.8
34	23	4	1166	38.7	8.7
35	15	0	1205.1	39.1	9.1
36	8	0	1245.3	40.2	10.2
37	20	0	1282.7	37.4	7.4
38	9	0	1327.2	44.5	14.5
39	26	6	1360.1	32.9	2.9
40	23	0	1393.4	33.3	3.3
41	27	0	1434.9	41.5	11.5
42	30	0	1469.5	34.6	4.6
43	24	4	1504.7	35.2	5.2
44	34	3	1536.4	31.7	1.7
45	39	2	1568.7	32.3	2.3
46	26	2	1607.2	38.5	8.5
47	18	2	1646.6	39.4	9.4
48	15	1	1688.3	41.7	11.7
49	17	0	1735.1	46.8	16.8
50	25	1	1778.3	43.2	13.2
51	19	1	1819.4	41.1	11.1
52	24	0	1856.9	37.5	7.5
53	21	0	1893	36.1	6.1
54	34	0	1931.2	38.2	8.2
55	22	0	1966.7	35.5	5.5
56	16	0	2000.7	34	4
57	8	2	2037.4	36.7	6.7
58	19	1	2076.1	38.7	8.7
59	36	5	2111.2	35.1	5.1
60	40	4	2147.1	35.9	5.9

Interval Set 61:90, starting time 19:00

Interval	People Crossing	Jaywalkers	Lap Timeline t/sec	Interval Time	Difference t/s -30
61	20	1	2181.9	34.8	4.8
62	27	0	2218.8	36.9	6.9
63	45	7	2248.8	30	0
64	38	1	2284.5	35.7	5.7
65	36	1	2321.1	36.6	6.6
66	28	1	2354.1	33	3
67	24	1	2392.5	38.4	8.4
68	17	0	2430.1	37.6	7.6
69	15	0	2469	38.9	8.9
70	26	0	2504.1	35.1	5.1
71	25	6	2537.3	33.2	3.2
72	31	5	2569.8	32.5	2.5
73	38	2	2601.2	31.4	1.4
74	21	0	2637.4	36.2	6.2
75	53	1	2667.4	30	0
76	45	3	2697.4	30	0
77	48	1	2727.4	30	0
78	34	0	2761.6	34.2	4.2
79	18	0	2800.1	38.5	8.5
80	17	0	2839.1	39	9
81	24	0	2876.5	37.4	7.4
82	28	0	2911.7	35.2	5.2
83	14	0	2951.5	39.8	9.8
84	19	0	2990.7	39.2	9.2
85	26	2	3029.1	38.4	8.4
86	35	3	3065.2	36.1	6.1
87	24	2	3097.7	32.5	2.5
88	28	1	3130.6	32.9	2.9
89	19	1	3168.7	38.1	8.1
90	10	1	3212.3	43.6	13.6