Speed of Recreational Cyclists on Down-grade of Trafalgar Bike Path in London, Ontario

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The speed of recreational cyclists on down-grades of roadways and paths is largely unknown and misunderstood. Gorski Consulting has been conducting testing and observations at several locations in London, Ontario, Canada to provide some base data on this important issue.

In an article posted to the Gorski Consulting website in October, 2018, testing was reported at several sites with down-grades in the City of London. The present article focuses on the results of additional testing performed at one of those sites, the multi-use path south of Trafalgar Road in London.

Figure 1 below shows a general view of the Trafalgar bike path from the new bridge over the Canadian National Railway (CNR) line through to the underpass at Trafalgar Road. The total distance between these references is approximately 350 metres.

Figure 1: Overall view of the City of London multi-sue path south of Trafalgar Road.

Figure 2 below shows the southern portion of the trail from the CNR bridge to a point approximately 150 metres to the north. In August of 2018 testing was performed over this segment of the path and the results were reported in an article posted to the Gorski Consulting website.

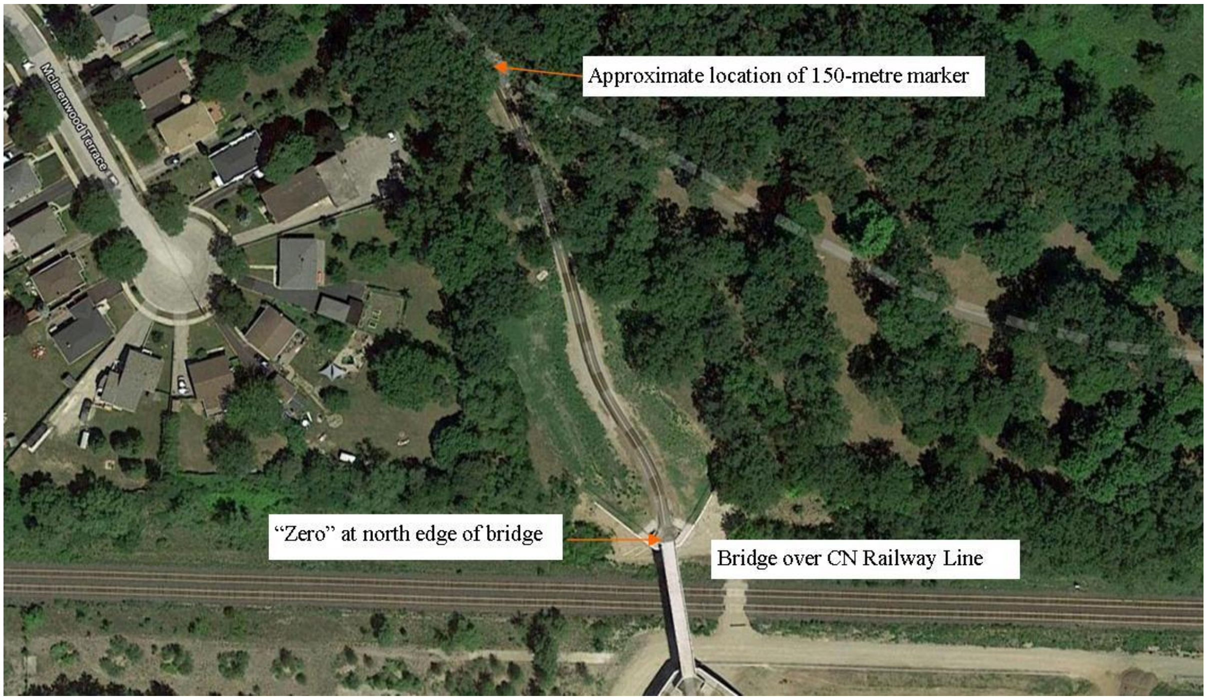


Figure 2: View of Trafalgar bike path near the CNR bridge.

Figure 3 below shows the northern portion of the trail from the 150-metre marker through to the underpass of Trafalgar Road at the 345-metre marker. This is the portion of the trail where additional testing was performed on June 2, 2020 and the results of that testing will be reported in the present article.

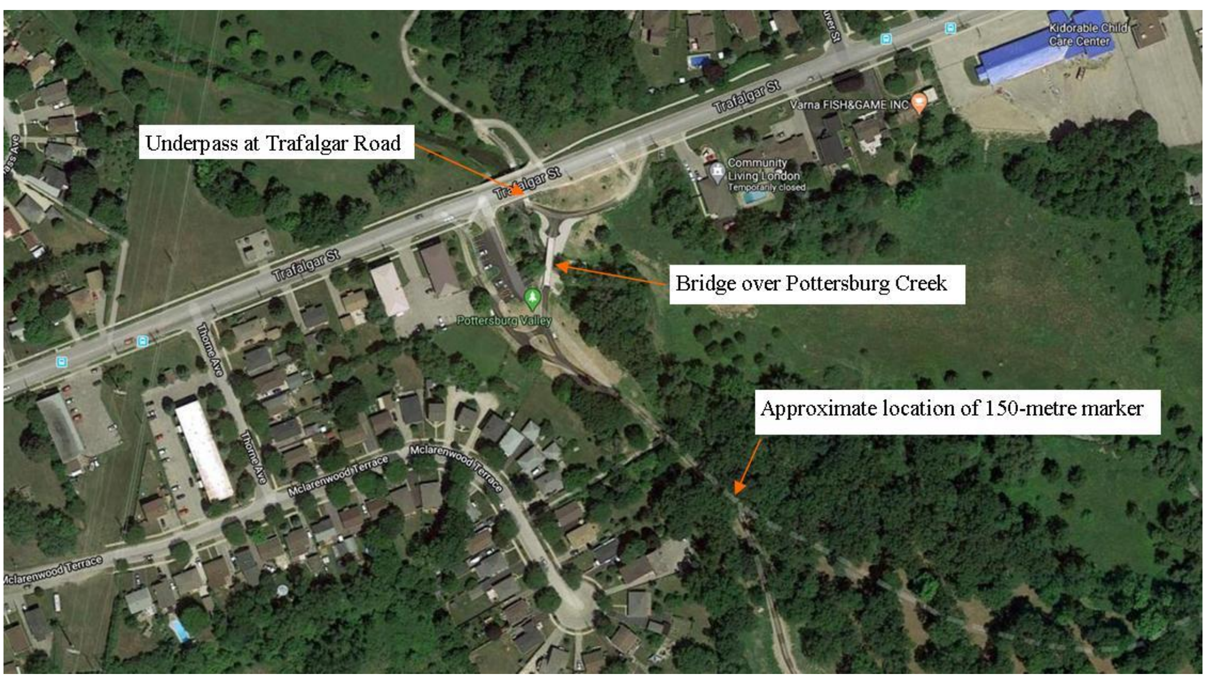


Figure 3: View of Trafalgar Road path approaching the Trafalgar Road underpass.

Figure 4 below shows a closer view of the trail on the approach to the Trafalgar Road underpass. It can be seen that, once cyclists cross the bridge over the Pottersburg Creek, they must make a sharp left turn and then an immediate right turn, while also travelling down a down-slope in order to enter the underpass.

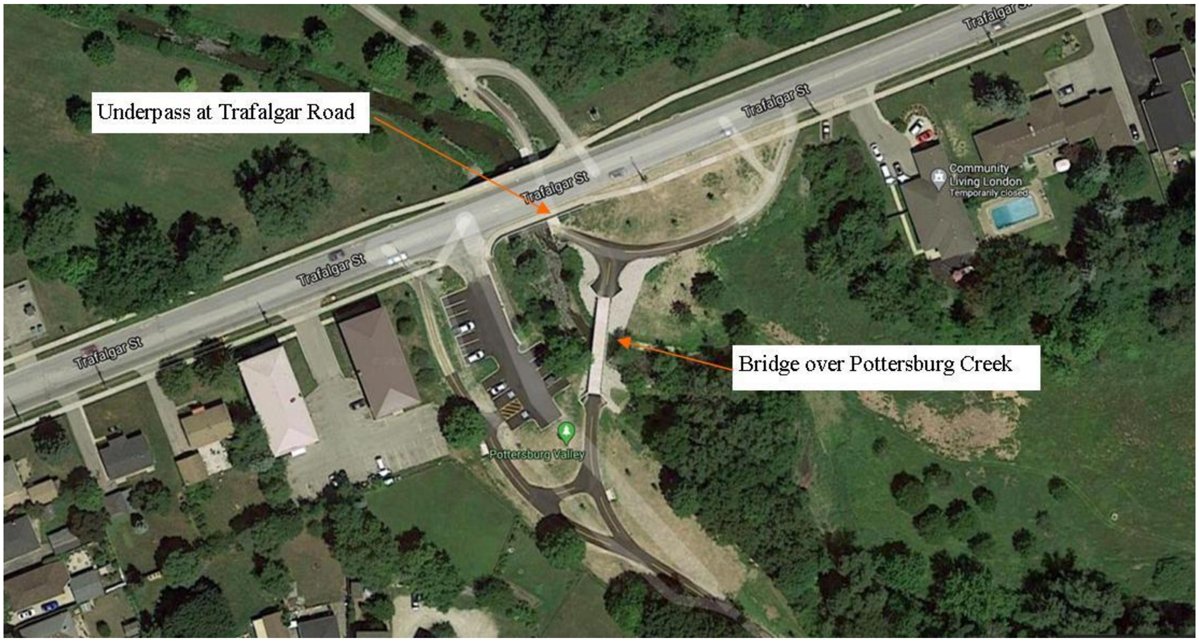


Figure 4: Closer view of bridge over Pottersburg Creek and the Trafalgar Road underpass.

Figure 5 below provides a close-up view of the changes in direction of the path at the Trafalgar Road underpass.

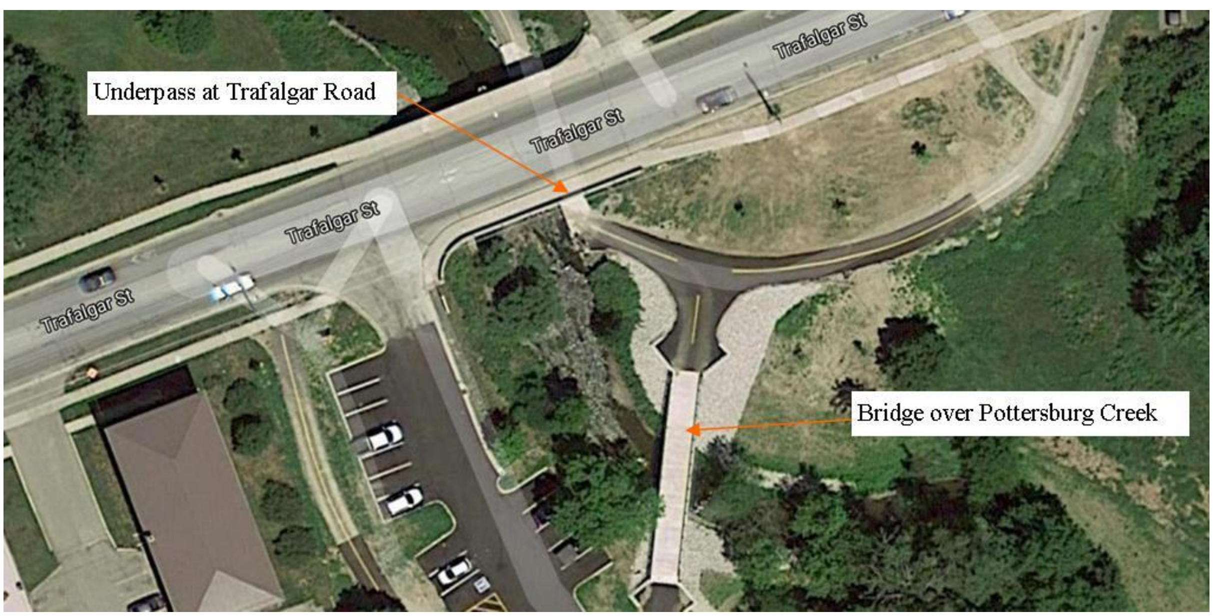


Figure 5: Close-up view of the Pottersburg Creek bridge and the Trafalgar Road underpass.

Further guidance about the features of the path can be obtained from the following photos taken in August, 2018, which show the path from the CNR bridge up to the underpass at Trafalgar Road.

Figure 6 below shows a view looking north from about 10 metres north of the CNR bridge and this shows the characteristics of the Trafalgar path in the zone where the observations were performed in August of 2018.

Figure 6: View looking north from approximately 10 metres north of the CNR bridge.

Figure 7 shows a view looking north from about 75 metres north of the CNR bridge. There is a steep down-slope in this portion of the path.

Figure 7: View looking north from approximately 75 metres north of the CNR bridge.

Figure 8 shows a view looking north from about 150 metres north of the CNR bridge. This is near the bottom of the down-slope where cyclists reach their highest speeds.

Figure 8: View looking north from approximately 150 metres north fo the CNR bridge.

Figure 9 shows a view looking north at about 225 metres north of the CNR bridge. Here the path levels out until it curves to the right upon approach to the bridge at Pottersburg Creek.

Figure 9: View looking north from approximately 225 metres north of the CNR bridge.

Figure 10 shows a view looking north from 275 metres north of the CNR bridge and we see how the path curves to the right to approach the bridge at Pottersburg Creek.

Figure 10: View looking north from approximately 275 metres north of the CNR bridge.

Figure 11 is a view looking north as one begins to cross the Potterburg Creek. Immediately after crossing the creek cyclists must make a sharp left turn followed by a right turn in order to enter the underpass of Trafalgar Road.

Figure 11: View looking north upon crossing the Pottersburg Creek bridge.

Figure 12 shows a view looking north at approximately 325 metres north of the CNR bridge. This is the view just as cyclists are making a sharp left turn and are preparing to counter-steer to the right in order to enter the underpass.

Figure 12: View looking north upon approach to the Trafalgar Road underpass.

The multi-use path south of Trafalgar Road was completed in the summer of 2018. As the project was nearing completion the design became of concern for several reasons and thus this precipitated the testing in 2018. The design involved the construction of an overpass above the Canadian National Railway (CNR) tracks. This overpass was tall which posed the potential problem that cyclists would increase their speed as they travelled down the substantial down-slope. The additional concern is that the overpass was located about 350 metres south of an underpass beneath Trafalgar Road at the precise location where the path contained a bridge crossing Pottersburg Creek. Designers developed a plan where the new path crossed the creek but also connected with the older underpass that was already existing at the Trafalgar Road bridge crossing that creek.

In August of 2018 coasting tests were conducted at the Trafalgar site with a Trek Hybrid bicycle to demonstrate the acceleration and maximum speed of the bike. The tests were commenced from a stopped position at the top of the down-slope at the CNR bridge The cycle was allowed to coast along a set of painted markers that were used to keep track of the cycle's speed. Video cameras were mounted on the cycle as well as along the route through the site.

Following the coasting tests video cameras were set up and the motions of independent cyclists were documented.

The results from the testing and observations in 2018 are noted in several tables below.

Results From Testing on the Trafalgar Bike Path Site In 2018

The following table shows the measurements of the slope of the Trafalgar Bike Path site.

Aug 23-18 - Bike Path S of Trafalgar - Slope Measurements North From CN Bridge

Location (metres)	Downslope (%)
N Edge CN Bridge (Zero)	0.7
10	5.9
25	9.5
50	8.7
75	6.0
100	7.5
125	3.4
150	2.3
175	0.9
200	0.5
225	0.5
250	-0.9
275	4.0
300	5.8
Average Total Length =	**3.9**

Figure 13: Measured slope of Trafalgar site.

The following two tables show the speeds (in km/h) of a Trek cycle coasting northward along the Trafalgar bike path from testing on August 24 and 25, 2018.

Aug 24-18 - NB Coasting on Trafalgar Bike Trail With Trek Hybrid Bike

Speed of Trek Bike in Km/h

Location	Speed in km/h
At Bridge (Zero)	0.0
10m	5.6
25m	14.6
50m	24.7
75m	30.5
100m	34.8
125m	37.8
150m	39.1
175m	37.9
200m	35.7
225m	33.1
250m	30.7
275m	29.1
295m	30.3

Figure 14: Speed of coasting Trek cycle from tests on Trafalgar site on August 24, 2018.

Aug 25-18 - NB Coasting on Trafalgar Bike Trail With Trek Hybrid Bike

Speed of Trek Bike in Km/h

Location	Speed in km/h
At Bridge (Zero)	0.0
10m	6.1
25m	15.1
50m	24.2
75m	30.5
100m	34.5
125m	37.6
150m	38.9
175m	37.6
200m	35.7
225m	32.2
250m	29.7
275m	28.5
295m	29.8

Figure 15: Speed of coasting Trek cycle from tests on Trafalgar site on August 25, 2018.

The table below shows the average speed of independent cyclists that were observed riding northbound on the down slope of the Trafalgar site in the 150 metres north of the CNR bridge. The table also shows data for cyclists travelling up the slope.

Aug 28-18 - Observed Speed of Cyclists

	Northbound (Downgrade)	Southbound (Upgrade)
Bridge to 10m	10.99	9.16
10m to 25m	16.77	9.32
25m to 50m	23.81	9.62
50m to 75m	29.28	11.34
75m to 100m	34.17	11.52
100m to 125m	35.24	15.39
125m to 150m	35.00	17.67
150m to 175m	32.00	17.60

Figure 16: Speed of Observed northbound cyclists from August 28, 2018.

Additional Testing on June 2, 2020

The testing in 2018 demonstrated that cyclists travelling north down the down-slope from the CNR bridge reached a substantial speed in the vicinity of the 150-metre marker. It was believed that this speed would continue to be high once cyclists reached the bridge crossing Pottersburg Creek and approached the underpass at Trafalgar Road.

This belief was evaluated in testing conducted on June 2, 2020. Average speeds of cyclists were calculated at approximately 25-metre segments from the 150-metre marker to the underpass near the 345-metre marker.

The table below (Figure 17) shows the results from the documentation of northbound cyclists, roller-bladers and skateboarders for about 85 minutes. The observations of roller-bladers and skate-boarders were included because they too could cause problems if there speeds are too high.

Observations 2, 3, 4 and 5 appeared to be a young family. The wife and 2 children were riding bicycles while the father was on roller blades. Near the 150 metre marker the father was trailing the others but he was picking up speed such that he was travelling almost 35 km/h as he reached the observation zone. This demonstrates that even persons on roller blades can travel quite quickly along down-slopes.

The fastest speed of a cyclist was achieved by a male rider who was travelling at over 46 km/h at the beginning of the observation zone (between the 150 and 175-metre markers). As he travelled toward the underpass he reduced his speed to about 27 km/h yet, in our view, this was well above a safe speed given the limited line of sight within the underpass. Yet this was not the fastest approach speed at the underpass.

The fastest approach speed at the underpass was that of Observation 20, another young male whose speed was 41.5 km/h as he entered the observation zone and 33.8 km/h as he approached the underpass.

This may demonstrate that the fastest riders may not necessarily be the greatest safety risk. Some riders who are experienced and know the capabilities of their bike (and themselves) may also have an appreciation where safety problems exist or might already have pre-thought plans of how to avoid them or lessen their consequences. In the two examples above, the fastest rider slowed from 46 to 27 km/h because he might have appreciated the level of danger at the underpass. Yet the second rider who was travelling slower, 41.5 km/h, only reduced his speed to 33.8 km/h at the underpass and likely did not appreciate the level of danger in his actions.

A number of cyclists did not follow the path toward the underpass and so their speeds in the table are incomplete.

Some of the riders actually stopped along the path and so their average speeds were very low at certain segments of the documentation and this also reduced the overall average speed of all the observations. This was the case with the family of 4 mentioned earlier (Observations 2, 3, 4 and 5). The mother stopped her bicycle at the south end of the Potterburg Creek bridge to wait for her children and then the father stopped at the north end of the bridge until his family passed through the underpass.

Jun 2-20 - NB Cyclists on Trafalgar Bike Path

Obs #	Rider & Cycle Type	150 t0 175	175 to 200	200 to 225	225 to 275	275 to 295	295 to 325	325 to 345
1	Young female on hybrid bike	35.57	32.14	27.27	26.20	28.02	28.20	23.23
2	Female White top Black pants	19.57	20.13	19.57	16.82	3.76	13.06	7.01
3	Young cyclist Red & White Top	23.26	22.11	20.32	7.54	10.33	13.12	6.21
4	Male Roller Blader	34.62	31.80	28.75	23.29	21.62	15.28	1.56
5	Young cyclist Black Top White pants	21.95	20.79	18.48	14.67	15.75	11.74	4.02
6	Male Skateboarder white top black pants	24.79	24.13	22.67	20.93	20.57	10.56	Walking
7	Male cyclist with Yellow shirt	46.63	45.00	43.48	40.27	39.34	34.84	26.97
8	Male Riding a skateboard	37.97	35.57	32.14	Off Path	Off Path	20.38	Off Path
9	Cyclist Pink Top black shorts	37.04	35.57	32.49	29.36	28.80	26.80	19.62
10	Cyclist Blue Top Black shorts	29.32	28.39	29.03	25.60	24.57	21.47	13.66
11	Female Cyclist Pink Top white shorts	36.00	34.62	29.32	23.68	24.57	23.33	Turned Right
12	Male Cyclist Black Top	27.03	37.04	34.22	30.35	29.63	32.43	Turned Right
13	Male Cyclist in Black & White	41.47	40.36	37.97	33.77	31.72	28.42	23.23
14	Male Cyclist in Red & White	42.86	42.25	41.47	33.96	32.29	27.91	24.83
15	Male cyclist Grey top	41.47	33.71	29.32	23.68	20.00	29.19	16.86
16	Female Cyclist White Clothing & Red Mask	39.65	38.63	36.00	Off Path	Off Path	22.04	15.22
17	Female Cyclist Black Clothing	37.50	36.44	35.02	Off Path	Off Path	22.18	20.57
18	Male Cyclist Black Clothing	34.62	33.71	32.14	Off Path	Off Path	18.72	16.00
19	Male Cyclist Dark Clothing	39.13	37.04	36.44	30.51	30.00	27.00	25.71
20	Male Cyclist Orange Shirt	41.47	38.63	38.63	30.66	22.71	25.29	33.80
21	Male Cyclist Black Top	15.33	14.68	14.29	13.50	20.75	13.55	12.86
22	Male Cyclist Black Clothing	33.33	30.72	28.75	25.46	24.24	20.89	14.69
23	Male Cyclist white hat	35.02	27.86	16.89	18.42	22.71	25.71	Turned Right
24	Male Cyclist Grey top white shorts	24.52	22.11	21.79	20.22	20.57	20.89	13.09
25	Male Cyclist Light Grey Top Black Shorts	33.71	30.30	26.47	23.47	22.02	24.55	22.50
26	Cyclist Black Top	39.13	33.71	27.03	22.70	22.50	21.05	20.40
27	Male Cyclist white top red shoes	41.47	38.63	37.97	33.77	31.72	30.00	25.71
28	Female Cyclist White Helmet Dark clothing	36.44	34.62	32.49	24.00	15.00	19.39	13.77
29	Male Cyclist dark clothing	36.44	33.71	32.14	25.82	24.57	26.15	20.57
30	Male Cyclist Black Top	End of Rec	End of Rec	End of Rec	31.75	28.80	32.43	28.46
31	Male Cyclist Red & White Top	End of Rec	End of Rec	End of Rec	End of Rec	End of Rec	31.49	22.29
32	Male Cyclist Black & White Top	End of Rec	End of Rec	End of Rec	End of Rec	End of Rec	29.43	21.18
					-			
	Average =	**34.05**	**32.22**	**29.74**	**25.02**	**23.71**	**23.36**	**18.30**

Figure 17: Observations of Cyclists, Roller-bladers and Skate-Boarders from June 2, 2020.

In the next table we selected only those northbound cyclists who were travelling above 35 km/h as they entered the observation zone.

June 2, 2020 - Northbound Cyclists on Trafalgar Bike Path

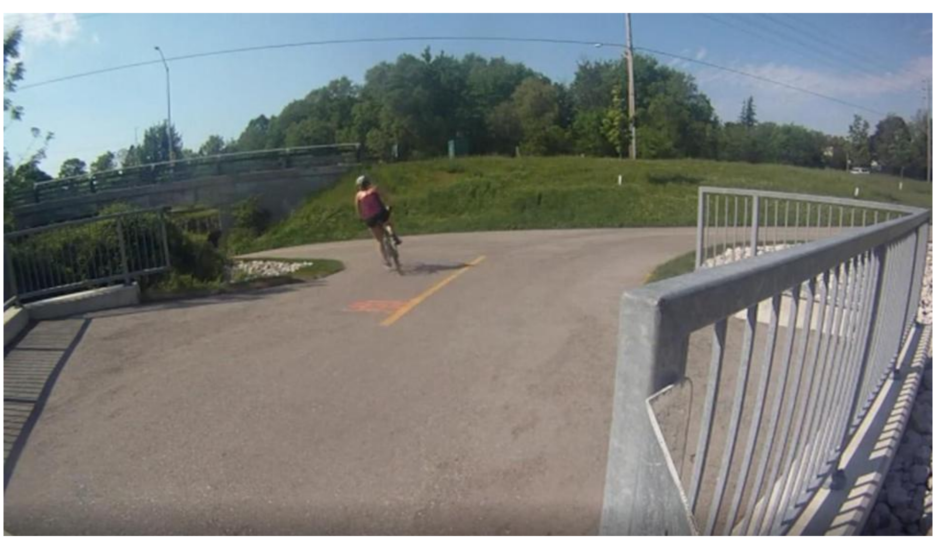
Obs #	Rider & Cycle Type	150 t0 175	175 to 200	200 to 225	225 to 275	275 to 295	295 to 325	325 to 345
1	Young female on hybrid bike	35.57	32.14	27.27	26.20	28.02	28.20	23.23
7	Male cyclist with Yellow shirt	46.63	45.00	43.48	40.27	39.34	34.84	26.97
9	Cyclist Pink Top black shorts	37.04	35.57	32.49	29.36	28.80	26.80	19.62
13	Male Cyclist in Black & White	41.47	40.36	37.97	33.77	31.72	28.42	23.23
14	Male Cyclist in Red & White	42.86	42.25	41.47	33.96	32.29	27.91	24.83
15	Male cyclist Grey top	41.47	33.71	29.32	23.68	20.00	29.19	16.86
19	Male Cyclist Dark Clothing	39.13	37.04	36.44	30.51	30.00	27.00	25.71
20	Male Cyclist Orange Shirt	41.47	38.63	38.63	30.66	22.71	25.29	33.80
26	Cyclist Black Top	39.13	33.71	27.03	22.70	22.50	21.05	20.40
27	Male Cyclist white top red shoes	41.47	38.63	37.97	33.77	31.72	30.00	25.71
28	Female Cyclist White Helmet Dark clothing	36.44	34.62	32.49	24.00	15.00	19.39	13.77
29	Male Cyclist dark clothing	36.44	33.71	32.14	25.82	24.57	26.15	20.57
					-			
	Average =	**39.93**	**37.11**	**34.73**	**29.56**	**27.22**	**27.02**	**22.89**

Figure 18: Selection of Northbound Cyclists Travelling at Over 35 km/h.

Some of the observations were affected by the presence of pedestrians. For example at Observation 28 the young female rider was partially obstructed by two pedestrians, one on each side of the path, near the 295-metre marker who were carrying on a conversation. As seen in the above table she reduced her speed to just 15 km/h as she approached the 295-metre marker. And as the female rider was approaching the underpass a male and female were walking their dog northbound and she had to slow down to about 13.8 km/h.

Further details of the motions of the northbound cyclists as they approach the underpass are demonstrated in the figures below. These figures are frames taken from the video cameras. These frames show how, in the very large majority of speeding cycles, they travel over the painted, yellow, centre-line of the path as they make their left turn. Thus they are on the wrong side of the path at a point when they approach the limited line of sight caused by the bridge wall.

Observation #1: Young Female on Hybrid Bike

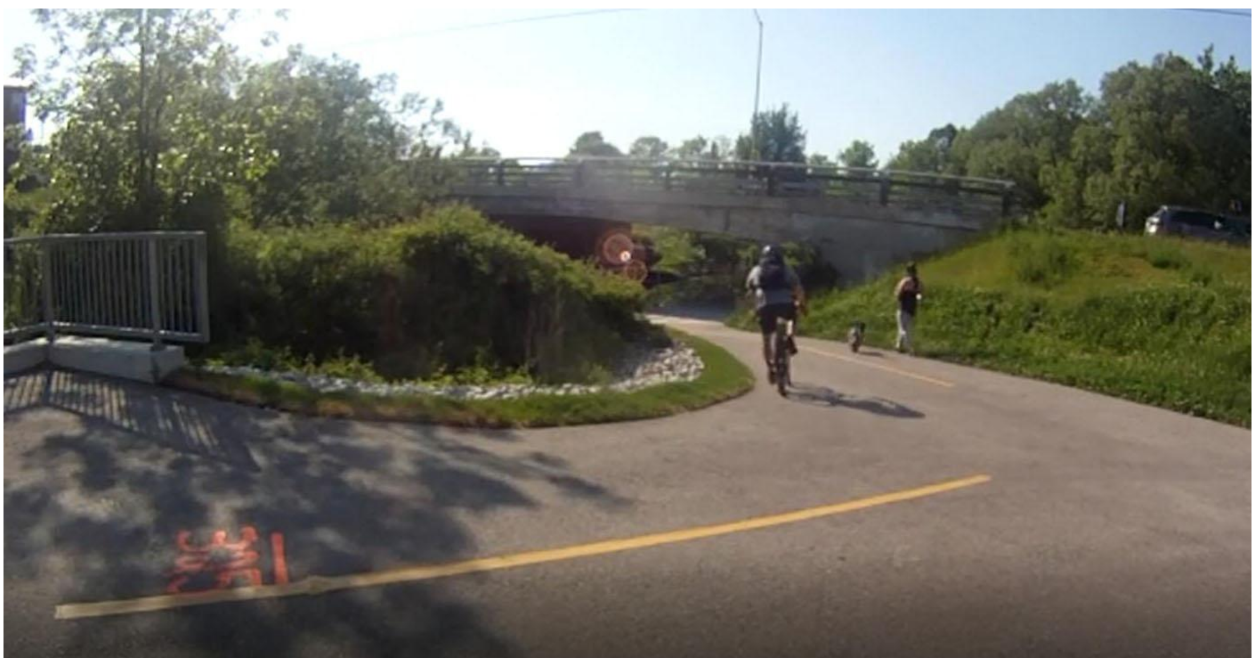


Observation #7: Male Cyclist With Yellow Shirt

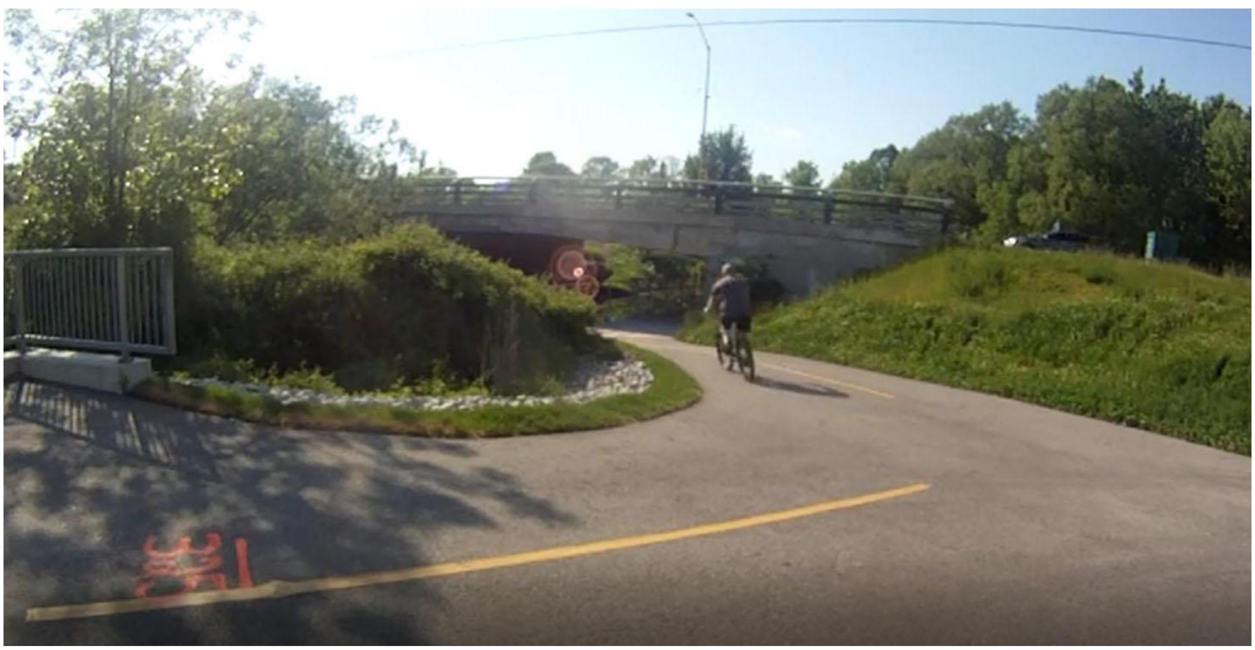
Observation #9: Cyclist in Pink Top With Black Shorts

Observation #13: Male Cyclist in Black and White Clothing and Observation #14: Male Cyclist in Red and White Clothing

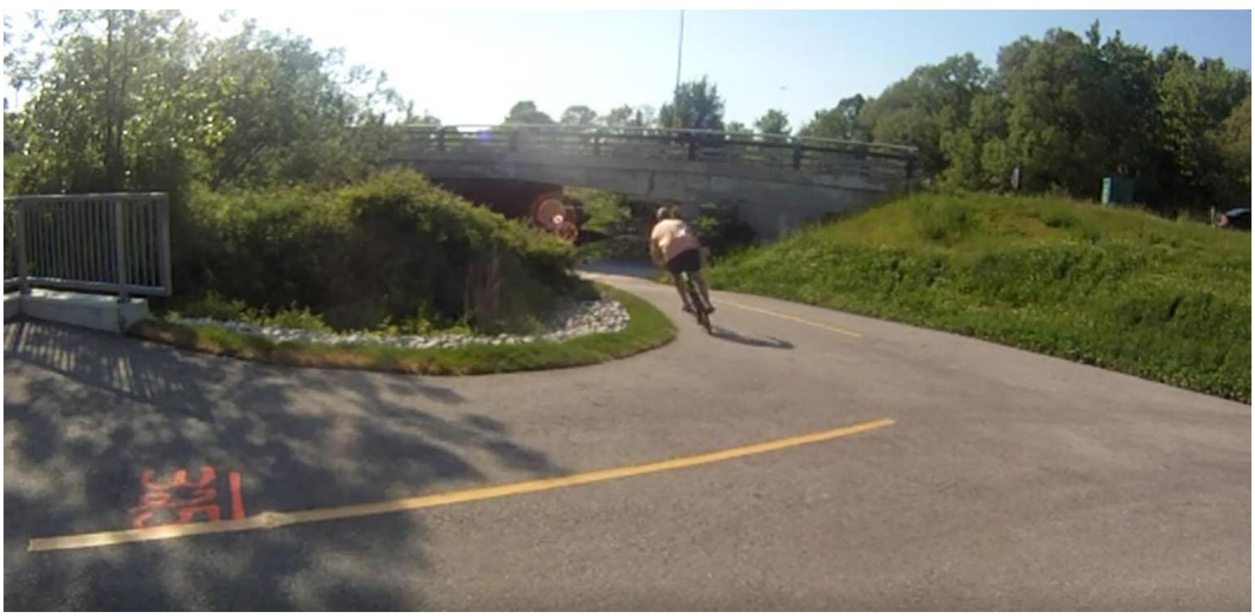
Observation #15: Male Cyclist With Grey Top



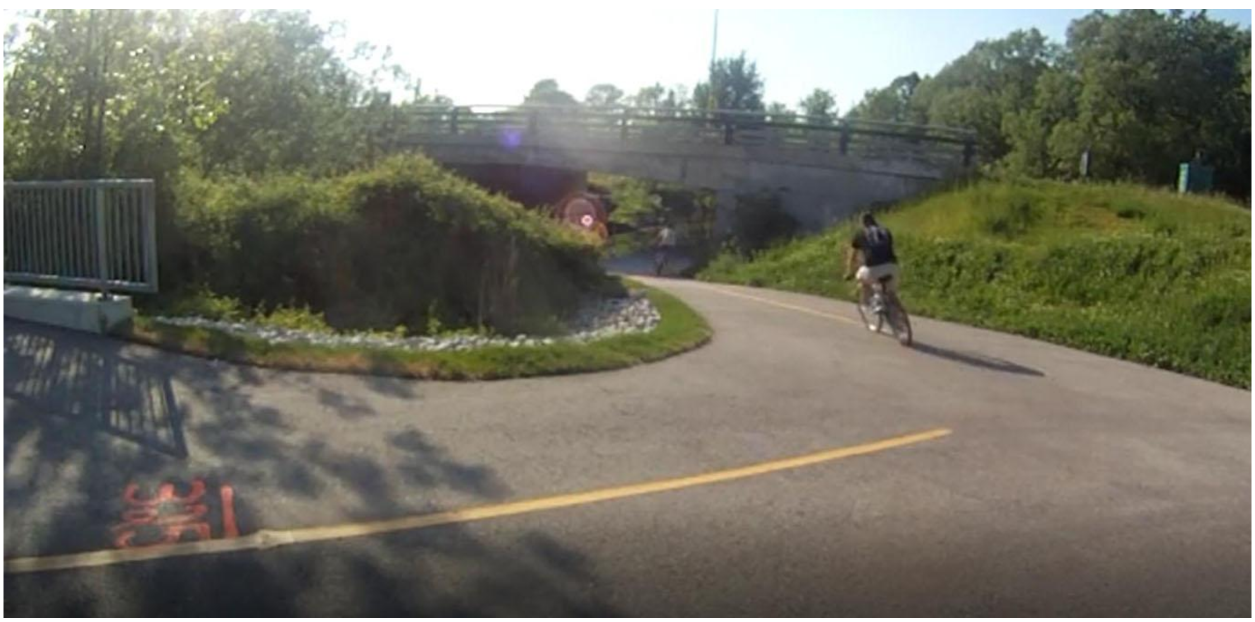
Observation #19: Male Cyclist in Dark Clothing



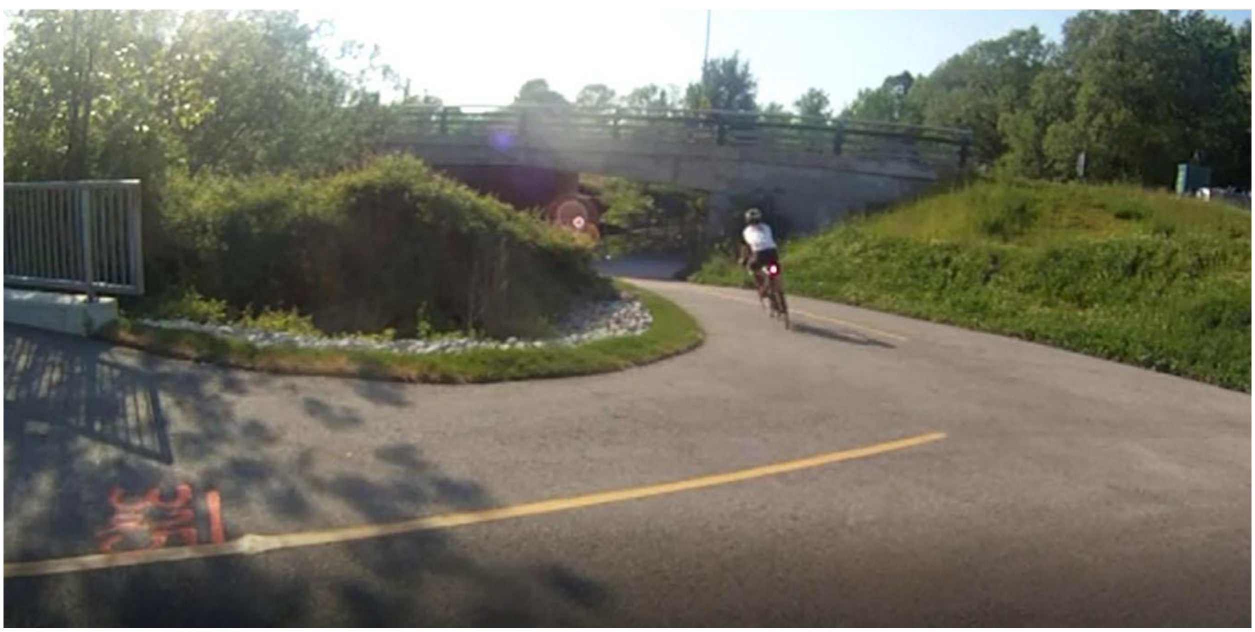
Observation #20: Male Cyclist in Orange Shirt



Observation #26: Male Cyclist in Black Top



Observation #27: Male Cyclist in White Top and Red Shoes



Observation #28: Female Cyclist With White Helmet and Dark Clothing

Observation #29: Male Cyclist in Dark Clothing

The findings from the above photos indicate that cyclists do not follow painted lines of pathways simply because that is the way designers would wish them to travel. They travel along directions that are most suitable to their passage through a site. Thus the “T” intersection on the approach to the underpass was only partially effective in slowing the cyclists.

Speed Results From Bicycling on a Path With a Level Surface

For those readers who are unfamiliar with speeds of recreational bicyclists travelling on a level surface, some data will be presented here that is typical of such speeds.

On May 8, 10 and 14, 2007 Gorski Consulting conducted observations of cyclists riding on a level portion of path on Adelaide Street near Kipps Lane in London, Ontario. Those observations demonstrated that cyclists rode at average speeds between 15.9 and 19.3 km/h.

In comparison, that table in Figure 18 shows that 10 of the 12 observed riders were travelling above 19.5 km/h as they approached the underpass at Trafalgar Road. This occurred even though the underpass contained a restricted line of sight and sharp changes in the path's direction of travel along with a substantial down-slope and some of the riders encountered pedestrian traffic.

Discussion

Historically North American transportation has been dominated by the automobile resulting in a roadway infrastructure designed narrowly toward that mode of travel. In recent years there has been an emphasis on active transportation via walking and bicycling resulting in a need for major changes to North American transportation systems.

In London, Ontario, like many other Canadian cities, the transition to active transportation has not been easy. A multi-use path system has been slowly developing, primarily following along the banks of the Thames River. Early developments of this system pose many safety challenges. Newer construction has involved better understanding that the safety systems needed for motor vehicle travel are also needed for pedestrian and bicyclist travel, although with adjustments due to the lower speeds. Standards for roadway geometry, signage, visibility and maintenance that apply to motorized vehicle travel must also apply to those designs where pedestrians and bicycles are the primary or exclusive modes of travel.

In many instances the current scenario is not much different from the early introduction of mechanized production whereby machine operators were viewed as totally at fault when their hands, legs or clothing became caught in a machine. Many operators lost limbs or their lives in various cutting and crushing machinery. It took considerable time before the design of such machines was changed to lessen the chance of such accidents. Various guards were installed to prevent the operator's hands and legs from coming too close to moving parts that could ensnarl them. In the same way, many pedestrian and bicycling paths in North America suffer from these archaic designs that "ensnarl" users into dangerous conflicts. The existence of dramatic downgrades may be acceptable in mountainous terrains where they are common and easily anticipated by most users. But in the relatively flat topography that exists in most of southern Ontario, such steep down-slopes are not common, are often not anticipated, and many recreational riders are simply unfamiliar with the techniques of handling a bicycle on substantial down-slopes.

Added to this are children who are learning to ride and whose bicycles do not fully match their physique. Children who receive their first bicycle are often too small for their bicycle because parents anticipate that they will grow into them. Pedals may be barely reachable. Children's strength in slowing a bicycle on a steep down-grade may be limited.

In other instances multi-use pathways are populated by vast differences in pedestrian characteristics. Some may be frail and elderly. Others may be family groups that contain small children and pets and can take up most or all of the width of path. In some instances a child may be walking safely on the correct side of a path and might suddenly dart out into the path of a cyclist before the parents or cyclist has an opportunity to intervene.

Figure 19 below shows an example of a cyclist travelling along the down-grade of the Trafalgar path with the CNR bridge in the background. It demonstrates the problem when pedestrians are approached from behind by a cyclist that is travelling at high speed.

Figure 19: In this typical view a cyclist is northbound on the down-slope of the Trafalgar bike path and approaches a family that is taking up most of the path width.

In another instance, Figure 20 below shows a view looking north toward the underpass. It is difficult to detect that there is a pedestrian lying on the pavement in the shadow of the underpass.

Figure 20: View of young female lying across the underpass within its dark shadow.

Figure 21 below shows a closer view of the young female who became interested in the fish that were passing through Pottersburg Creek. This interest made her fail to appreciate that her body was blocking the bike path at a location where she would not be seen. The high speed of northbound bicyclists and the lack of visibility formed by the curves of the path made it highly possible that a serious collision might have taken place.

Figure 21: Close-up view of young female lying across the underpass and distracted by the fish in the water of Pottersburg Creek.

While the solid railing shown at the edge of the creek may be of minimal concern when struck by motor vehicles, a cyclist who strikes such a railing will come to a sudden stop, while impact forces could be applied narrowly to vulnerable portions of the rider's body.

It needs to be questioned how the design was developed that connected the new section of the Trafalgar path to the underpass at Trafalgar Road. As cyclists travel northbound they approach a "T" intersection at Trafalgar Road which requires riders to either turn right or left. If they turn left then they are directed into the underpass. A possible reason for the "T" intersection is that the designers may have felt that this would cause cyclists to slow down before executing the left turn. Thus the slower speed may have been considered as a desirable outcome. Yet, by creating the "T" intersection they also created a situation where cyclists would have to make a sharp left turn and then an immediate, sharp, right turn to enter the underpass. These turns occur as there is a substantial down-slope and there is also very limited visibility caused by the south edge of the wall of the underpass.

The alternative could have involved construction of a longer bridge over Pottersburg Creek such that the bridge lined up more closely with the angle of the underpass and therefore the visibility obstruction of the bridge wall would be eliminated. While this alteration may result in higher cyclist speed it would also improve the visibility and allow cyclists an opportunity to slow down if they detect a problem ahead. This alternative may not have been economically feasible or the engineering may have been difficult. But whatever the reasons the status of the present design makes for an unsafe condition.