Conflicts Between Cyclists and Motorists in Toronto, Canada

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This paper presents the findings of an analysis of 2572 police-reported collisions between bicyclists and motorists that occurred between January 1, 1997 and December 31, 1998 in the city of Toronto. The aim of the study was to identify the most significant kinds of car/bike collisions in the city, and to try to understand the factors involved. By "most significant" we mean those collisions which are most frequent, or which typically result in the most serious injuries. It was hoped that the results would suggest specific countermeasures that might be most effective in reducing the danger of cycling in the city's traffic. The study was successful in characterising the types of crashes that are most prevalent in Toronto. These primary results of the analysis will be discussed, but first, a brief description of Toronto's traffic environment will provide some context.

With a population of over 2.3 million (Greater Toronto Area: 5 million), Toronto is Canada's largest city. The central area is well served by an efficient public transit system based on a high-volume sub-way system, several tram lines, and a dense network of bus routes. Over half of central area households do not own a car,(1) and most of Toronto's utilitarian cycling occurs in the inner city.(2) Toronto experienced very rapid growth during the post-war "automobile era," and so the dense, older core is surrounded by vast, sprawling suburbs that are increasingly dependent on auto travel. There is a high concentration of employment in the central business district,(3) and a large number of workers travel by car from the surrounding suburbs. Hence there is a tremendous amount of traffic during the morning and afternoon peak periods.(4) These are the times when most collisions occur (fig. 1).

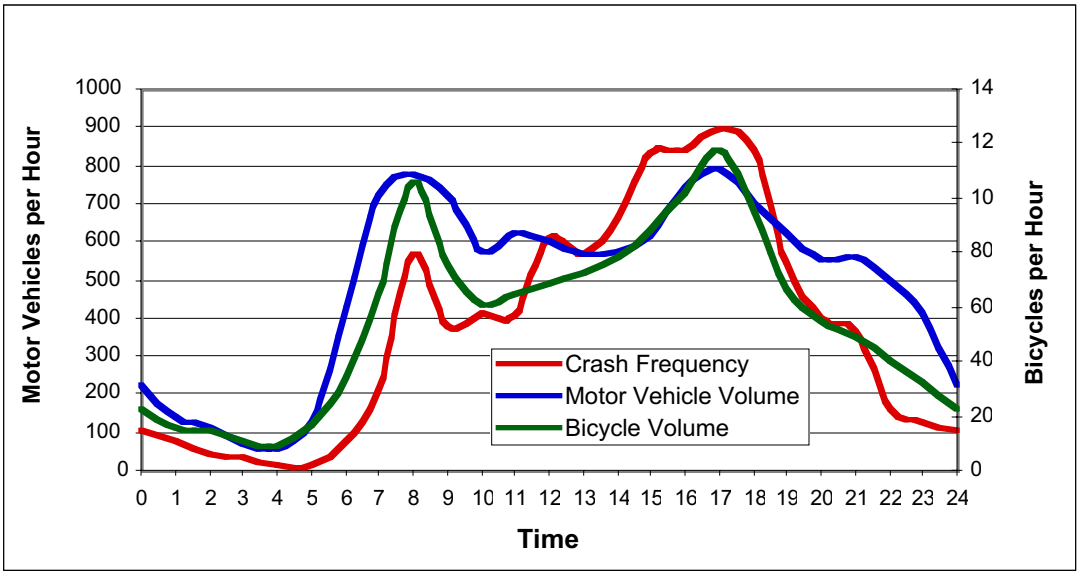

Fig. 1: Crash Fequency and Traffic Volumes

In addition to sheer volume, several other factors contribute to a somewhat chaotic road environment in the city centre. These include: curb-side parking and streetcar (tram) tracks on many main routes; large numbers of pedestrians, often crossing mid-block; and motorists making right turns at red lights, which is permitted at most intersections. The afternoon rush hour seems to be the most hectic time, perhaps because many automobile commuters face long journeys home, and are anxious to get onto the expressways. Many motorists seem to treat the brief all-red traffic signal as an extended amber signal. In fact, it is very common for motorists waiting to turn left to proceed after their signal has turned red, cutting across the path of vehicles proceeding on the green signal. Since cyclists usually filter through to the front of the stopped traffic queue, they are frequently in conflict with these drivers.

During the summer months, approximately six to ten car/bike crashes are reported each day in Toronto, the highest number being twenty-two.(5) On average, there are nearly twice as many collisions per day during the week as on weekends. Together with the hourly pattern mentioned

above, this seems to indicate that car/bike collisions are largely a commuter traffic problem, rather than a recreational cycling issue.(6)

Surveys show that males account for roughly half of all recreational cyclists and 60% of utilitarian cyclists in Toronto,(7) while 77% of the collision-involved cyclists are male. It is yet to be determined whether males make frequent or longer trips by bicycle. If not, this higher crash rate for males may reflect a greater tendency for males to take risks. Proportionally fewer males were found to be wearing a cycling helmet at the time of their crash, but no correlation was found between helmet use and injury severity.

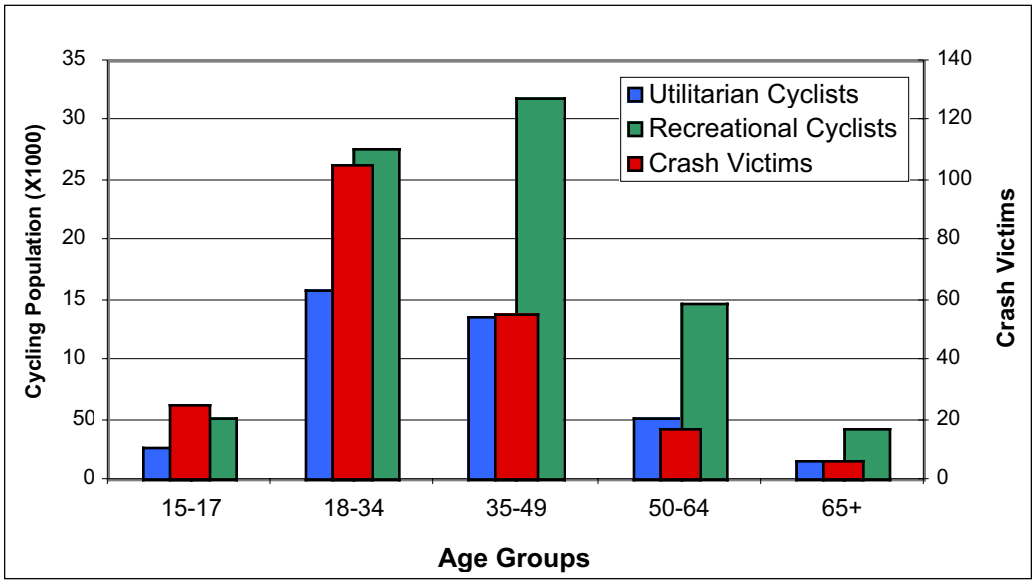

Fig. 2: Age of Cyclists: Crash-Involved Vs Cycling Polulation

When the age profile of the cyclists who were struck by motorists is compared with the age distribution of recreational and commuter cyclists in Toronto, it is apparent that younger cyclists are more likely to become involved in collisions than older ones (fig. 2). Of course, younger cyclists are typically less experienced, and may also be more willing to take risks, than older cyclists. As figure 2 shows, while there are fewer utilitarian cyclists than recreational cyclists in Toronto, they tend to be younger. They are also more likely to ride in traffic. However, while younger riders exhibit a higher crash risk, the vast majority of the cyclists involved in collisions with motor vehicles in this city are adults. (Average age 29.6 years.)

Each collision was categorised according to a new crash typology that is based on the one developed for the U.S. National Highway Traffic Safety Administration (NHTSA) by Cross and Fisher.(8) The NHTSA typology was modified to suit our local data, while maintaining the ability to compare results with other similar studies. The individual categories in these systems are based on the actions of the vehicle deemed primarily responsible for the crash. Since many collisions involve a certain degree of error on the part of both road users, secondary contributing factors were also recorded, in order to provide a more complete and impartial understanding of each type of incident.

The top ten crash types are tabulated in figure 3, in order of descending frequency. These account for nearly 80% of the collisions that could be categorised. The reports for 247 cases contained incomplete information, and those could not be “typed.”

The most frequent type of crash involved a motorist entering an intersection controlled by a stop sign (73%) or red light (17%), and either failing to stop properly, or proceeding before it was safe to do so. Injuries were less severe than average, perhaps thanks to low vehicle speeds. In just over half of these crashes, the cyclist was struck while crossing the intersection within the pedestrian crosswalk. Drivers in a hurry tend to approach intersections quickly, often without stopping until they have already entered the crosswalk area. Such behaviour might be addressed through targeted police enforcement.

Crash Type	Number of Cases	Relative Frequency
Drive Out At Controlled Intersection	284	12.20%
Motorist Overtaking	277	11.90%
Motorist Opens Door in front of Bicyclist	276	11.90%
Motorist Left Turn – Facing Bicyclist	248	10.70%
Motorist Right Turn – Other	224	9.60%
Motorist Right Turn at Red Light	179	7.70%
Drive Out From Lane or Driveway	179	7.70%
Ride Out At Controlled Intersection	73	3.10%
Wrong Way Bicyclist	59	2.50%
Ride Out At Mid-block	51	2.20%

Fig 3: Most Frequent Crash Types

Cyclists between the ages of 10 and 20 years of age were highly over-represented in this type of collision. Young cyclists are allowed to ride on sidewalks in Toronto, but they should be taught that walking across intersections increases their own safety, as well as the comfort of pedestrians. It is likely that this age group generally lacks the cycling experience that might help them anticipate motorist behaviour at intersections.

Another very frequent type of crash involved motorists overtaking. These involved more adult cyclists (age 23 to 37) than most other crash types. Injuries usually tended to be less severe than the average, but on the other hand, this type of collision also resulted in four of the ten cyclist deaths in this two-year period. It also involved six of the sixteen reported “vehicular assaults.” Darkness and poor weather, which can affect visibility, were not significant factors. It would appear that most of these cases were minor impacts that occurred when impatient motorists attempted to squeeze past a cyclist, with the occasional disastrous result.

The third most frequent type of collision involved a stopped motorist opening the vehicle door into the path of a passing cyclist. Unlike the first two categories, this crash type does not involve significantly different sub-types. Thus, “the Door Prize,” as it has become known, could actually be regarded as Toronto’s most common bicycle/motor-vehicle collision. The cyclists involved were typically adults between twenty and forty, and the injuries sustained were generally somewhat more severe than average. As was mentioned, many major routes in downtown Toronto have on-street parking, and cyclists tend to ride in the space next to parked cars, rather than in the adjacent traffic lane. We are not aware of any other jurisdiction with such a high incidence of this type of crash.

The rest of the significant crash types are not particularly unusual for a large urban area, except that jurisdictions which prohibit right-turns on red lights will see fewer collisions of that type. Analysis of the contributing factors involved is instructive, though. Overall, the most significant secondary factor was cycling on the footpath or crosswalk. This behaviour was most frequent in collisions where the motorist was turning right at a red light (86%) or emerging from a private drive (81%). Typically, the motorist in these situations was looking out for traffic approaching from the left, while the cyclist approached from the motorist’s right. In these situations it is clear that the cyclists would have been better off in the roadway.

These are just a few of the key findings, among the many detailed observations. The project also revealed much that was unexpected, sometimes through omissions in the study. We would suggest to anyone attempting a similar analysis that it is necessary to compromise between obtaining richly detailed data and a large, robust sample. Since each variable will be coded for hundreds or thousands of cases, adding one more can increase the time and work involved dramatically. On the other hand, when the data entry is complete, and analysis gets underway, it is inevitable that a missing bit of information will seem vital.

In hindsight, we probably could have sacrificed quantity for more detail. The large number of cases in our analysis has yielded firm statistics, but we regret not including certain information. For example, the type of motor vehicle involved was recorded only for the 1998 collisions. We are curious to see if any relationship emerges between vehicle type and crash rate or injury severity. A comparison between the numbers of traffic violations committed and charges laid by

police could refute or confirm allegations of police bias. Finally, any attempt to quantify such factors as driver and cyclist error, inattention, negligence, or culpability must be carefully thought through. Assessing these always involves many layers of subjective judgements, in the statements from the individuals, the evaluation of the investigating officer, and the eventual interpretation by the researcher.

The next step in this research project will be to map the collisions with a Geographic Information System (GIS). The data-base will continue to provide answers to questions that arise as Toronto enters an era of accelerated bicycle planning activity. A simplified crash typology will enable all future collisions to be easily coded, so that trends can be monitored as new programs are implemented. A Bicycling Master Plan is in the works, including a co-ordinated network of on-street bicycle lanes and several kilometres of new trails along disused rail lines and electric power lines. The city's bicycle parking program has also been greatly expanded. By the time of the next Velo Mondial conference, we hope to be able to present news of a significant increase in cycling in a safer cycling environment.

Notes:

1. Ministry of Transportation of Ontario.
2. Decima Survey.
3. Job density in central Toronto (1990) was 927 jobs per hectare, compared with Amsterdam (98), Copenhagen (270), London (423), New York (989), Hong Kong (1,713) (Newman & Kenworthy).
4. Within the "old city" of Toronto, approximately 108,000 residents travel by car between 6-9am, while 165,000 autos enter the area from outside during the same period (Ministry of Transportation of Ontario).
5. Stutts and Hunter quote several studies comparing police and hospital records, revealing that less than half of all such collisions are ever reported to the police. Thus it is possible that, on a typical summer weekday in Toronto, roughly ten to twenty cyclists will be struck by motorists.
6. Per Garder, in a similar study in the US state of Maine, finds similar weekly and seasonal patterns, but very few collisions during morning peak hours. He concludes that "…bicycling is primarily a recreational or leisure activity…"
7. Decima Survey.
8. U.S. D.O.T., Publication No. FHWA-RD-95-163.

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