## Toronto's Vision Zero safety approach

Traffic collisions have been a longstanding challenge in Toronto. Between 2006 and 2019, over 6,100 people were killed or seriously injured[b] (KSI) in a traffic collision in the city. [4, 7] Pedestrians make up 45 per cent of KSI road users in Toronto – the largest share among all transportation modes – and a pedestrian is killed or seriously injured every three days on Toronto's streets.[8]

In response to rising rates of fatal collisions, the City of Toronto began developing its first road safety plan in 2015. [9] This plan was modeled after *Vision Zero*, an approach to road safety developed in Sweden that aims to eliminate traffic fatalities and injuries and promote safe, healthy, and equitable mobility. [10] This approach has been implemented in many cities across the globe and represents a movement toward injury prevention that is systems-focused, data-driven, and exclusively targets fatal and severe collisions (Figure 1).[9] *Vision Zero*'s key design principles target the separation of vulnerable road users (e.g., pedestrians, cyclists) and the reduction of speeds where separation is not possible. [11] This includes features like median barriers, speed humps, and pedestrian islands. Importantly, *Vision Zero* initiatives place the safe travel of people ahead of the efficient movement of vehicles. [12]

Figure 1. Vision Zero approach to road safety
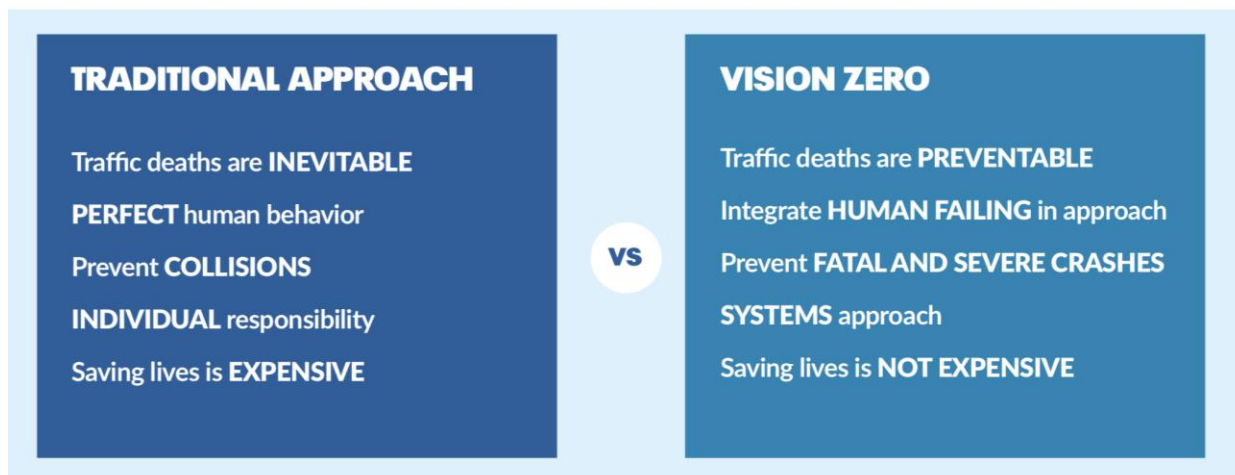
Source: Vision Zero Network (2018).

Vision Zero road safety plans are built around a few core elements. [12] They begin with a commitment from senior leaders across sectors (e.g., transportation, police, public health) to achieve zero traffic fatalities and severe injuries, along with meaningful community engagement to understand firsthand experiences with road safety. Plans are then developed collaboratively, comprised of measurable road safety strategies with clearly defined timelines, responsibilities, and funding sources. Interventions within the plan aim to reduce speeds, prioritize high-risk

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[b] KSI collisions are when a person has sustained a major or fatal injury. [74] Major injuries are those which require hospitalization, even if only for observation at the time of the collision. Fatal injuries are those in which death occurs in less than 366 days as a result of the collision and is unrelated to natural causes.

roadways, and establish a transportation network that connects all road users. Ongoing decision-making is based on routine data analysis that underscores transparency, proactive mitigation of risk, and equitable outcomes.

Toronto's Vision Zero Road Safety Plan was implemented in 2017 and focuses on six emphasis areas – pedestrians, school children, older adults, cyclists, motorcyclists, and aggressive driving and distraction. [8] The plan sets out targeted interventions for each of these areas, through engineering and street design, new technologies, education, and enforcement. In 2019, Toronto renewed its approach to road safety through adoption of *Vision Zero 2.0* (2020-2024), which extended and expanded initiatives under the same philosophy.[5]

Over the past four years, the City has implemented evidence-based actions to promote road safety through the *Vision Zero Plan*. [8] Speed limits have been reduced on 250 kilometers of streets, red light cameras have been installed at several intersections, and safety zones with measures like increased crossing times and enhanced pavement markings have been added in areas with high volumes of seniors and children. [4] Some interventions have been targeted directly at pedestrians, such as sidewalk repairs, priority traffic signals, and crosswalks between intersections. [4] There have also been *Vision Zero* initiatives to promote active and safe routes to school, daylight savings time awareness, and reflective gear for seniors. [4] The City's road safety efforts to date have been informed by traffic collision data and stakeholder consultation.[8]

Yet since the start of *Vision Zero*, more than 700 pedestrians have been killed or seriously injured on Toronto's streets. If there have been data-driven, city-wide improvements to road safety, why does Toronto continue to have so many pedestrian collisions? Understanding the connections between neighbourhood socio-demographics and collision risk can help to answer this question.

Neighbourhood socio-demographics and pedestrian collisions

Pedestrian collisions are driven by a mix of environmental, behavioural, and social risk factors.[13] A review of the international literature demonstrates a consistent relationship between pedestrian collisions and indicators of neighbourhood socioeconomic status. Studies from urban centres in Canada and comparable jurisdictions (Australia, United Kingdom, United States) published between January 2004 and July 2020 have identified neighbourhood characteristics associated with higher rates of pedestrian injury and fatality in an area (Table 1).

Table 1. Review of literature on neighbourhood socio-demographics and pedestrian collisions

Neighbourhood sociodemographic	Relationship with pedestrian collisions	Study setting (year)
Car ownership [14-18]	Higher rates of pedestrian collisions were associated with lower levels of car ownership.	Chicago (2010) Florida (2012, 2014, 2015, 2019)

Home values [19, 20]	Higher rates of pedestrian collisions were associated with lower home values.	Halifax (2015) Seattle (2015)
Household income [16, 17, 21-23]	Higher rates of pedestrian collisions were associated with lower household income.	Chicago (2011) Florida (2012, 2019) Montreal (2012) New Jersey (2013)
Population, residential, and employment density [15, 17, 18, 22, 24-29]	Higher rates of pedestrian collisions were associated with higher levels of all types of density.	Orange County (2010) Denver (2009) Florida (2012, 2014, 2015) Los Angeles (2007) Melbourne (2017) New Jersey (2013) Seattle (2011) Vancouver (2017)
Poverty [14, 16, 24, 25, 30-35]	Higher rates of pedestrian collisions were associated with higher levels of poverty.	California (2004) Chicago (2010) Devon County (2004) Florida (2015, 2019) Los Angeles (2007) Orange County (2010, 2012) San Francisco (2009) Toronto (2019)
Racial/ethnic minority concentration [14, 15, 20, 23, 25]	Higher rates of pedestrian collisions were associated with higher levels of racial or ethnic minorities.	Chicago (2010, 2011) Florida (2015) Los Angeles (2007) Seattle (2015)
Socioeconomic status [36-40]	Higher rates of pedestrian collisions were associated with lower socioeconomic status.	London (2010, 2016) New South Wales (2007) Ottawa (2010) Wisconsin (2019)

International studies have also considered associations between pedestrian collisions and area-level education, unemployment, and age distribution. [15, 16, 18, 19, 23, 24, 32, 34, 41, 42] However, relationships with these neighbourhood socio-demographics are less conclusive as there are fewer studies available and they do not show a consistent trend across papers.

Relationships can exist between neighbourhood factors to produce collision risk. For example, a Florida study investigating only collisions within low-income areas found that pedestrian collisions were still more frequent where there were larger populations, higher levels of visible minorities, and more zero-car ownership households. [16] In a London study, the relationship between area deprivation and child pedestrian injury rate varied by ethnic group. [39] Authors

found that for white and Asian pedestrians, the rate of injury and level of deprivation had a positive linear relationship, while Black pedestrians had a constant rate of injury across deprivation levels.

The literature in Toronto is more limited. In one study, higher residential instability and a higher concentration of recent immigrants and visible minorities were identified as significant independent predictors of pedestrian collisions. [43] However, measures of material deprivation and workforce participation were not significantly associated with pedestrian collisions. Another local study found that the rate of child pedestrian collisions was more than five times higher in low-income census tracts than high-income census tracts. [33]

Mechanism of action: Built environment inequities

Studies that have explored neighbourhood socio-demographics and pedestrian collisions have suggested processes that may be driving their relationship. One mechanism frequently reported in the literature is that neighbourhood socio-demographics influence the quality and safety of the built environment, which in turn influences the risk of pedestrian collisions. [21, 39, 43-46] In this pathway, marginalized neighbourhoods (e.g., those with significant low-income and/or racialized populations) end up with less supportive infrastructure, where community features like streets, housing, parks, or amenities are not designed in ways that promote pedestrian safety. [37, 44, 45, 47, 48] Built environment inequities are often due to historical patterns of disinvestment and systemic exclusion from urban planning processes. [37, 44, 45, 47] This mechanism is acknowledged in the *Vision Zero* philosophy and aligns with its systems approach to road safety. [12] Other drivers proposed in the literature mainly focus on differential road user behaviour, which is outside the scope of this paper.

The built environment pathway of disparities is supported by a body of literature – including from Toronto – that identifies marginalized areas as having poorer walkability, more high-volume and high-speed roadways, denser housing, and fewer traffic calming measures. [6, 19, 21, 33, 37, 39, 45, 47, 49-51] A study of pedestrian collisions in Montreal illustrates this pathway well. Researchers found that the significant negative relationship between pedestrian collisions and area-level income was largely mediated by roadway features like traffic volume, intersection geometry, and active transportation volumes. [21] Yet the built environment could not completely explain the original relationship; even when taking roadway features into account, it remained significant.

Built environment inequities can arise from municipal practices. A recent review of Canadian cities' pedestrian safety plans found that engagement strategies and policies targeting the needs of low-income and minority groups were largely absent. [52] For instance, Toronto and many other jurisdictions offer request-based processes to implement traffic calming measures (e.g., speed humps), which may favour the needs of higher-income residents who face fewer barriers to civic engagement. [33, 52] These inequities are also connected to issues of displacement. Neighbourhood infrastructure improvements may reduce the affordability of an

area and subsequently displace lower-income residents. [45, 51] This indicates that the pathway between neighbourhood marginalization and built environment safety is likely bidirectional.

These complex effects of neighbourhood socio-demographics suggest that Toronto's current road safety approach may not be reaching some of the root causes of pedestrian collision risk. Interventions that aim to change pedestrian behaviour or add modest safety features to the roadway may not be sufficient to address more systemic disparities in the built environment or ensure that improvements are incurred by marginalized populations.

Intervening on pedestrian safety inequities through Vision Zero

Since its creation, equity has been a central principle of *Vision Zero*. Within the approach, equity is described as inclusive and representative planning processes and equitable road safety outcomes for all road users in all areas of a city. *[10, 53]* A review of *Vision Zero* materials and its uptake in over 25 North American jurisdictions illustrates some of the ways that equity has been applied to road safety planning.[c]

Vision Zero positions safe mobility as a human right, part of the government's obligation to provide its people with life, liberty, and security. [54] It also calls for prioritization of roadway investments in areas with disproportionate traffic collisions, recognizing that equity in road safety is not about equally distributing resources, but rather about identifying and addressing areas with historically less infrastructure investments. [10, 55] Strategies to center equity within the approach include emphasizing policy and environmental changes over behavioural ones, engaging communities in the decision-making process, and collaborating with multiple stakeholders with diverse perspectives. [53]

Equity in *Vision Zero* is also addressed in the context of enforcement. [55] In many jurisdictions, traffic safety regulations involve police enforcement, which connect road safety approaches to issues of police violence and systemic racism. [56] *Vision Zero* has emphasized that its approach to road safety is one that aims to proactively improve the built environment, rather than rely on punitive enforcement practices. [56] It has also urged caution with data-driven decision-making, since this usually relies on police-collected crash information rather than meaningful community engagement. [56]

Several cities that have adopted a *Vision Zero* approach have incorporated equity into their road safety planning. For example, the opening statement of Portland's *Vision Zero Action Plan* explicitly states that road safety interventions will address inequities faced by marginalized communities in both traffic collisions and built environment features, and that the Plan must do so without resulting in racial profiling. [57] This vision is acted on through the Plan's commitment

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[c] The review of *Vision Zero* road safety strategies was conducted in September 2020 and included all 19 Canadian jurisdictions that use *Vision Zero* and seven American cities that were identified through search engine browsing for key terms.

to consider equity data in decision-making, prioritize projects for 'communities of concern' (e.g., racialized persons or low-income households), and limit enforcement measures. [57, 58]

San Francisco has also considered the role of data in equitable road safety planning. Their Department of Public Health found that collision reports from police, which informed *Vision Zero* decision-making, significantly under-reported pedestrian injuries, particularly for African Americans and males. [59] Based on this finding, they have now created a more comprehensive database for collision reporting that draws on several administrative data sources to better capture traffic collisions. [59] San Francisco has also targeted equity in enforcement by publicly reporting police traffic enforcement activities on a quarterly basis, with transparency on racial bias in traffic stops. [60]

Community engagement has been another area where cities have incorporated equity in *Vision Zero*. Washington DC has hosted events in public spaces, like transit stations, where residents could share their safety concerns and contribute to a crowd-sourced safety map that informed intervention planning. [61] Portland has shifted the location of its community consultations on road safety to local organizations rather than city-owned buildings and requires that law enforcement officials attend consultations in plain clothes rather than uniform. [61] San Francisco, Los Angeles, and Washington DC have all developed community grant programs that aim to remove financial barriers to consultation participation and build local capacity to design and implement community-led road safety measures. [61]

Canadian cities have also enacted promising practices for equity in *Vision Zero*. Edmonton, the first Canadian municipality to adopt *Vision Zero*, has been a leader in equity-oriented road safety with its upcoming Safe Mobility Strategy 2021-2025.[62] The City has started using Gender-Based Analysis Plus[d] across its decision-making processes, which prompted an equity analysis of traffic collision data.[63] As a result, Edmonton has developed criteria for road safety projects to prioritize those in equity-seeking neighbourhoods. [62] It is also moving to proactive safety reviews, where the City independently initiates safety evaluations in areas that are experiencing high collision rates, instead of relying on resident-initiated infrastructure improvement requests. [62]

Montreal's *Vision Zero Action Plan* notes that it must ensure social equity when addressing road safety, and that both planning process and evaluation indicators should capture disparities between different social groups and road users.[64] *Vision Zero* Surrey presents data on the higher burden of collision harms for Indigenous people and low-income communities and contains equity as a focus area with actions around targeted improvements for and partnerships with neighbourhoods and populations disproportionately affected by collisions.[65]

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[d] The Government of Canada defines Gender-Based Analysis Plus as: *an analytical process used to assess how diverse groups of women, men, and gender diverse people may experience policies, programs and initiatives*. The 'plus' refers to intersecting identity factors like race, ethnicity, religion, age, and mental or physical disability.

Other places in Canada, like Hamilton, Kingston, and Manitoba do include equity in their *Vision Zero* strategies, but with limited action beyond setting it as a guiding principle for the strategy itself and community engagement activities. [66-68] However, most of the 19 Canadian jurisdictions that use *Vision Zero* do not mention equity in their road safety plans. [69]

Toronto is ahead of many other cities with its recognition of collision disparities by area-level socio-demographics and the need for a social justice and equity lens in road safety planning. In early 2021, Toronto furthered its progress by defining a Transportation Equity Lens that considers seven equity categories (e.g., ability, gender, race) comprised of 17 equity-seeking groups (e.g., low-income groups, racialized groups).[6] This Lens will be used to generate baseline equity measures of transportation capital programs and ultimately guide capital funding decisions.

This step forward can be a catalyst for improved pedestrian safety across the city. As Toronto continues into the second phase of its road safety strategy, it has a timely opportunity to become a leader in equitable planning and create meaningful change in marginalized neighbourhoods.

Policy goals for Toronto's approach to road safety

As Toronto looks ahead its renewed road safety strategy and upcoming equity tools, there are key policy goals that the City can use to best implement equitable pedestrian safety planning, drawn from the literature and other jurisdictions. [6, 55, 61, 70-72]

1) Developing a definition of equity

To achieve equity in road safety in Toronto, it is first necessary to have a clear and explicit understanding of how equity will be operationalized and evaluated in practice. The City has started to meet this need through development of a Transportation Equity Lens, which follows the best practice of directly naming equity-seeking populations and communities. As this definition and its application are further established, it will remain important for the City to engage diverse stakeholders, acknowledge the systemic barriers that have produced inequity, and continue to draw connections between elements of the road safety strategy and their potential impacts on equity-seeking groups. A strong definition can also go a step further to link transportation equity to broader equity issues around housing, employment, and land use. The City has also begun to measure equity baselines for its transportation capital programs – adopting another best practice of complementing an equity definition with evaluation indicators to monitor and assess if equitable outcomes are being achieved. Since both the equity definition and evaluation metrics currently apply to only capital programs, future efforts can aim to translate these approaches to operating expenses.

2) Applying inclusive planning processes

Urban planning processes can often exclude marginalized groups and therefore not reflect the needs of diverse communities. Community engagement approaches that leverage Toronto's local champions and spaces, offer financial compensation, and build community capacity for built environment design can reduce some of the traditional barriers to participation. Engagement activities and materials should continue to be culturally and linguistically appropriate and develop long-term relationships with stakeholders. The City can employ innovative methods of community engagement like 'pop-up' feedback opportunities in public spaces and community-led street transformation projects. It can also continue to emphasize proactive quantitative and qualitative data-driven decision-making over request-based processes for road safety interventions.

3) Leveraging data for equity

Data on collision inequities can support action to eliminate them. *Toronto's Vision Zero Mapping Tool* and commitment to open data on collisions are great examples of making data accessible for equity analysis and evaluation. Toronto has also identified certain districts of the city that have more collisions and indicators of lower socioeconomic status. An important next step will be to analyze collision data at smaller geographies to determine sociodemographic predictors of pedestrian and other traffic collisions, and their connections to the built environment. Findings of this equity analysis can be used in the City's upcoming prioritization tool for transportation capital programs and be shared publicly to allow for data transparency. This will align with Toronto's ongoing shift from a focus on vulnerable road users to a focus on neighbourhoods requiring infrastructure improvements. This can be complemented with data analysis and evaluation beyond KSI collisions that capture the distribution and quality of built environment features, something the City has started to undertake in developing equity baseline measures for its capital programs. Additionally, potential limitations of police collision data can be mitigated by using multiple sources of data on collisions, such as administrative health data, which can advance understanding of health burden.

4) Ensuring equitable enforcement practices

Road safety regulations can be inequitably enforced due to systemic discrimination and racial profiling. Toronto has taken steps to address enforcement inequities through the use of automated enforcement technologies, however, these technologies need to be developed and placed in consultation with equity-seeking groups to mitigate bias and concerns with surveillance. Toronto's approach should ensure it does not promote increased penalties, fines, or police involvement, and engage with affected communities around the $2.5M in new funding for enhanced traffic enforcement teams through Toronto Police Services. Prioritizing a road safety approach that truly improves policies, processes, and design will hopefully limit the need for enforcement.

Conclusion

Pedestrian collisions remain a serious challenge on Toronto's streets. Even with several road safety interventions recently implemented across the city, pedestrian safety has not improved under the *Vision Zero* approach – and marginalized communities may be the most at risk for harm. A new framing of road safety that is guided by equity and considers neighbourhood socio-demographics offers the potential for safer streets. Recent progress in equitable transportation planning creates an opportunity to get there. To act on this, Toronto's Road Safety Plan can commit to further development and application of an equity definition and evaluation indicators, an inclusive and innovative community engagement process, an equity-focused data strategy, and addressing enforcement. These steps can shape a city with safe and equitable mobility for all its residents.

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