COMMUTING IN MONTREAL
Estimating VMT and GHG Reductions of Shifting Driving Commutes to Cycling

Promoting cycling as an alternative to driving is increasingly recognized as an important way to reduce vehicle miles traveled (VMT) and thereby reduce greenhouse gas (GHG) emissions. The City of Montreal has committed to reducing its citywide GHG emissions from the transport sector. Based on commuting data for the Island of Montreal, this study provides spatial insights into people’s commuting patterns and investigates the potential for reducing VMT and GHG emissions by shifting short car trips to cycling.

TRANSPORTATION GHG EMISSIONS
Transportation is one of the fastest growing sources of GHG emissions. In 2015, transport accounted for 24% of global GHG emissions, with the vast majority of these emissions generated by the road transport sector. In Canada, transport accounted for 24% of GHG emissions in 2017, whereas passenger vehicles were the largest transport contributor, accounting for 49% of the total emissions from the transport sector.

ENERGY IMPLICATIONS OF MODAL SHIFT
Promoting cycling is increasingly recognized as a key element of low carbon strategies. Lifecycle emissions from cycling can be ten times lower per kilometer than those stemming from individual motorized transport. Woodcock et al. (2007) projected that significant reductions in GHG emissions would result from a shift to non-motorized transport forms.

POTENTIAL FOR CYCLING
Share of Car Trips by Origin

Car Trips under 5 km

Montreal’s urban areas (i.e., downtown and surrounding census tracts) have systematic concentrations of relatively low driving rates. In other parts of the Island of Montreal, driving rates are relatively higher. However, we find that almost a third (28.6%, N=96000) of the car trips were shorter than 5 kilometers, suggesting a strong potential for mitigating car dependency and reduce VMT and GHG emissions.

We aimed to identify car trips that could be reasonably cycled by commuters. We estimated cycling potential based on three features of currently commuting trips made by bicycle: trip distance, the ratio of the cycling time over driving time, and elevation gain. We find that half of cycling trips are less than 4.6 kilometers. This distance is used in this study as the “reasonable” cycling distance, which can be reasonable cycled within 20 minutes. The elevation gain indicates how hilly the cycling routes are likely to be.

We created citywide street networks with elevation data and calculated elevation gain as the sum of all the gains in elevation along the cycling route. In order to determine the threshold for transferability, we measured the distributions of time ratios, elevation gain, and trip distances of bicycle trips and used mean values as thresholds.

VMT AND GHG EMISSIONS SAVINGS
We devised two alternative scenarios, that each describes how a modal shift from car to cycling might reduce carbon footprint through reducing VMT, according to various criteria based on characteristics of current bicycle trips.

Scenario 1 considers reasonable distance and assumes that commuters would substitute cycling for car trips if the trip distance is reasonable for riding. Overall, 60,460 current car trips would be potentially cycled. This scenario would reduce vehicle travel by approximately 102,862 miles and reduce 31,453 kg GHG emissions per day.

Scenario 2 estimates the potential of VMT and emissions savings if all car trips with comfortable trip distance, cyclable trip time, and relatively flat terrain are replaced by cycling, over one in ten (12 percent) car trips would be replaced by cycling, and such a move would shift 72,992 VMT in short car trips to cycling and thereby reduce 22,320 kg GHG emissions.

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