Driving Down VKT Transit Accessibility's Influence on Auto Mode Choice and Distance Across Trip Purposes

ABSTRACT

- O Curtailing driving is a key component to reducing transport-related pollution, including greenhouse gas emissions.
- O This study uses Montreal's 2013 Origin-Destination survey to explore how various city-controlled factors and regional and local accessibility, influence driving mode choice and distance across a range of trip purposes.
- O Both local and regional accessibility possess statistically significant and negative impacts on driving mode choice and vehicle distance driven by Montreal drivers.

 \rightarrow Regional accessibility exerts a greater impact on the initial decision to drive but the relative impact of both types of accessibility on total driving distance varies.

- For work and school driving, regional accessibility is correlated with the greatest declines in distance driven.
- For healthcare and discretionary travel, local accessibility is correlated with a larger decline in total driving distance.
- O The findings highlight the impact of other explanatory factors, particularly car ownership, pointing the way to additional potential policies to reduce unnecessary driving.

DATA

2013 Montreal Origin-Destination Survey

- O Mode and travel distance data were obtained from the 2013 edition of Montreal's origin-destination survey, the most recent publicly available version.
- Conducted every five years since 1970, this survey collects information from a random sample from mor than 70,000 Montreal-area households regarding travel habits over the preceding 24-hour weekday period.
- The O-D survey covers 5% of the Montreal metropolitan region population.
- Our analysis draws on a subset of this data representing people who made trips fully within the regional public transit-service areas.
- O Focused exclusively on those people who could be reasonably classified as "potential drivers." For purposes of this analysis, a potential driver means a licensed driver from a household with at least one car.

METHODOLOGY

- Two-step "hurdle process" (Ewing et al. 2015).
 - (1) Multi-level logistic regression to explain the binary choice to drive or not.
 - (2) Multi-level linear regression model to explain driving distance among respondents who drove.
- O Two measures of accessibility, reflecting different geographic scales and types of destinations.
- -->Local accessibility: Walk Score (2010), a third-party gravity-based assessment of amenities within 1 mile of locations.
- \rightarrow Regional accessibility: Cumulative transit-based jobs accessibility (45-minute threshold) calculated using R and ArcGIS.

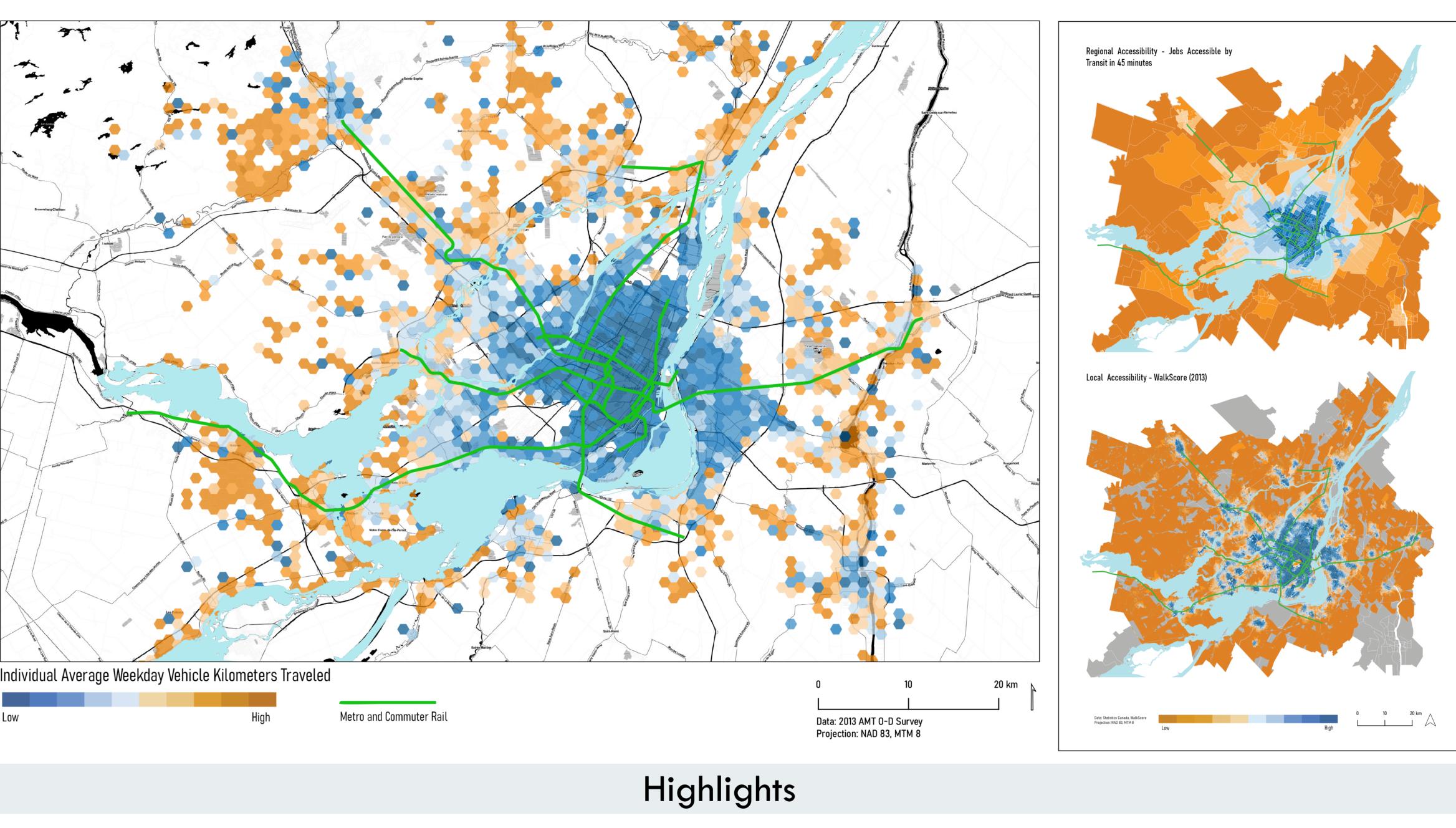
MODELS

| | Positive VKT | Positive Work VKT | Positive School VKT | Positive Healthcare VKT | Positive Discretionary VK |
|--|--------------|----------------------|------------------------|----------------------------|------------------------------|
| Predictors | Odds Ratios | Odds Ratios | Odds Ratios | Odds Ratios | Odds Ratios |
| Age (years) | 1.0625 *** | 1.039 | 1.262 | 1.0431 ** | 1.0333 *** |
| Age (sq.) | 0.9995 *** | 1 | 0.998 | 0.9996 ** | 0.9998 *** |
| Female (y) | 0.5572 *** | 0.623 | 0.795 | 0.6345 *** | 0.6753 *** |
| Part-time worker (vs. full-time employed) | 0.3052 *** | 0.391 | 1.176 | 0.677 | 0.4744 *** |
| Unemployed or homemaker (vs. full-time employed) | 0.87 | 1.28 | 3.066 | 1.09 | 3.3160 *** |
| Additional cars in household | 2.5771 *** | 3.3330 ** | 2.7792 *** | 1.3810 *** | 1.3298 *** |
| Adults in household | 0.6132 *** | 0.574 | 0.649 | 0.7236 *** | 0.7731 *** |
| Preschoolers in the household | 1.2960 *** | 1.112 | 1.157 | 1.071 | 1.2974 *** |
| School-age children in the household | 1.071 | 1.033 | 0.792 | 1.071 | 1.2123 *** |
| Lower-income household (<60K CAD/yr) | 1.3760 ** | 1.771 | 1.634 | 1.2783 * | 1.1038 *** |
| Medium-income household (60K CAD to 120 CAD/yr) | 1.064 | 1.155 | 1.136 | 1.075 | 0.994 |
| Transit-accessible jobs w/i 45 minutes (10,000s) (z-score) | 0.7594 *** | 0.721 | 0.7 | 0.7726 *** | 0.8323 *** |
| Home neighborhood Walk Score (z-score) | 0.8739 ** | 0.844 | 0.809 | 0.8843 * | 0.9693 ** |
| Positive Work VKT | | | 5.1819 * | 0.3037 *** | 0.1767 *** |
| Positive School VKT | | 4.778 | | 1.252 | 0.4959 *** |
| Positive Healthcare VKT | | 1.91 | 7.769 | | 0.2049 *** |
| Positive Discretionary /KT | | 1.029 | 1.369 | 5.2825 *** | |
| Intercept) | 0.558 | 0.536 | 0.0029 ** | 0.939 | 0.3358 *** |
| Observations | 63538 | 37104 | 4999 | 2750 | 63149 |

| | log(total vkt) | log(work vkt) | log(school) | log(health vkt) | log(discretionary vkt) |
|--|------------------------|------------------------|-----------------------|-----------------------|---------------------------|
| dictors | Estimates | Estimates | Estimates | Estimates | Estimates |
| e (years) | 0.0170 *** | 0.0294 *** | 0.0361 *** | 0.0077 | 0.0157 *** |
| e (sq.) | -0.0002 *** | -0.0003 *** | -0.0005 *** | -0.0001 | -0.0002 *** |
| nale (y) | -0.1628 *** | -0.1967 *** | 0.0580 * | -0.0368 | -0.0969 *** |
| rt-time worker (vs. -time employed) employed or | -0.0362 | -0.4222 *** | 0.1502 ** | -0.2724 | 0.0615 |
| nemaker (vs. full-time ployed) | -0.4472 *** | -0.1117 ** | -0.0553 | -0.0244 | 0.0116 |
| ditional cars in usehold | 0.0472 *** | 0.0131 * | 0.0475 ** | -0.0359 | 0.0418 *** |
| ults in household | -0.0545 *** | -0.0442 *** | -0.0019 | -0.0075 | -0.0472 *** |
| schoolers in the sehold | -0.0251 *** | 0.0405 *** | -0.0674 | 0.0048 | -0.0734 *** |
| ool-age children in household | -0.0123 ** | -0.0058 | -0.0417 ** | -0.0556 * | -0.0432 *** |
| ver-income household 0K CAD/yr) | -0.1777 *** | -0.1990 *** | -0.0726 | -0.0983 | -0.1482 *** |
| dium-income sehold (60K CAD to) CAD/yr) | -0.0449 *** | -0.0634 *** | -0.0593 | 0.0047 | -0.0428 ** |
| nsit-accessible jobs nin 45 minutes ,000s) (z-score) | -0.0913 *** | -0.1198 *** | -0.2264 *** | -0.1418 *** | -0.0173 |
| ne neighborhood alk Score (z-score) | -0.1020 *** | -0.0749 *** | -0.0560 ** | -0.1659 *** | -0.1432 *** |
| itive Work VKT | | | 0.0114 *** | -0.0058 ** | -0.0128 *** |
| itive School VKT | | 0.0110 *** | | -0.0013 | -0.0121 *** |
| itive Healthcare VKT | | 0.0003 | -0.0147 * | | -0.0085 *** |
| itive Discretionary | | -0.0093 *** | -0.0100 *** | -0.0065 *** | |
| ercept) | 2.8929 *** | 2.7078 *** | 2.2681 *** | 2.8187 *** | 2.3708 *** |
| ndom Effects | | | | | |
| | 0.76 | 0.54 | 0.39 | 0.21 | 0.81 |
| | 0.06 house_id:ct | 0.06 house_id:ct | 0.06 house_id:ct | 0.66 house_id:ct | 0.12 house_id:ct |
| | 0.02 ct | 0.03 ct | 0.04 ct | 0.02 ct | 0.01 ct |
| | 0.09 | 0.15 | 0.22 | 0.76 | 0.14 |
| | 34128 house_id | 21523 house_id | 1795 house_id | 1749 house_id | 18955 house_id |
| | 805 ct | 732 ct | 413 ct | 466 ct | 722 ct |
| servations rginal R² / nditional R² | 48551 0.124 / 0.206 | 28298 0.083 / 0.221 | 1908 0.190 / 0.364 | 1808 0.084 / 0.785 | 21536 0.054 / 0.184 |

* p<0.1 ** p<0.05 *** p<0.01

DISCUSSION AND RESULTS



Local and Regional Accessibility

- O Driving Mode Choice
- on the decision to drive to work.

• Driving Distance

- associated with lower VKT.
- more reductions.
- influence than local accessibility.
- confidence level.
- accessibility has a statistically significant correlation.

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Spatial Distribution of Average VKT and Accessibility

Regional accessibility to jobs by public transport and local accessibility are associated with a lower likelihood of driving for all trip purposes combined and for discretionary travel. Neither shows an impact

 \rightarrow All Purposes: Both local and regional accessibility

with lower VKT but regional accessibility corresponds to

with lower VKT. Regional accessibility displays a stronger

 \rightarrow Healthcare: Both local and regional accessibility are significantly neggatively correlated with VKT at the 95%

 \rightarrow Discretionary: Only local, rather than regional,

Sociodemographic & Household Factors

O Driving Mode Choice

driving 2.58 times.

than men across all categories of trvel except work.

-->Income: Relative to people from high-income households, people from lower-income households are more likely to travel by car for all purposes combined and for discretionary travel. (Transit may currently be structured to provide access to job destinations that are more desirable or relevant to wealthier people than to people from lower-income households).

O Driving Distance

purposes.

Income: Being from lower-income household associated with 16% less VKT for all trip purposes combined.

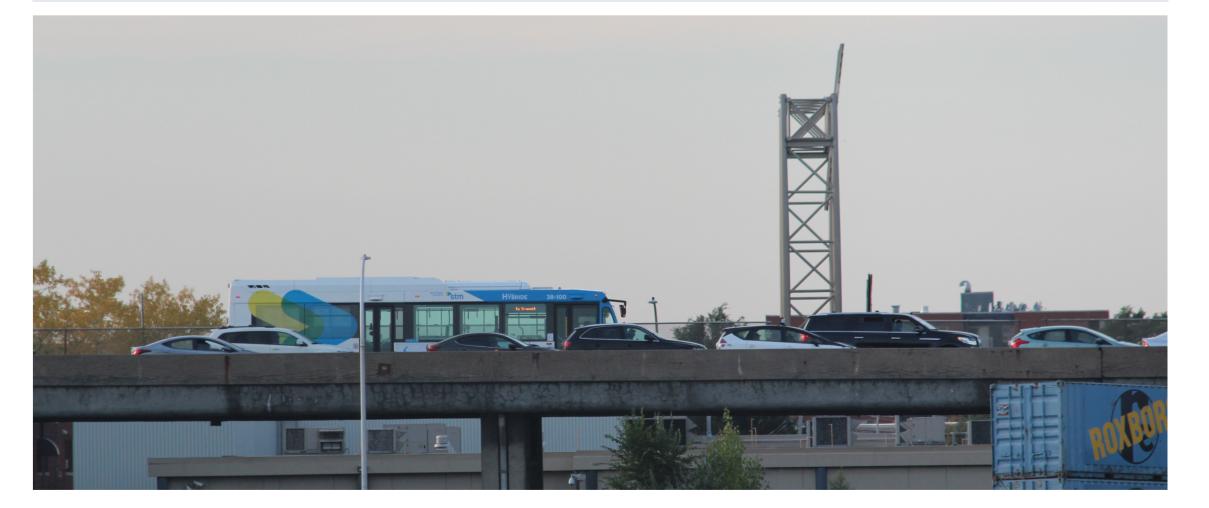
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CONCLUSION

- Local and regional accessibility show consistent 0 impacts on driving and driving distance across most travel purposes considered. Accessibility-focused planning efforts may directly and indirectly reduce VKT.
- Equity is a vital consideration. The data show that 0 people from lower-income households are far more likely to drive than people from wealthier households. But in many cases, these same people are likely to drive shorter total distances for both work and than people from discretionary purposes higher-income households, meaning existing transit may not provide access to the locations to which lower-income households must travel even if lower-income jobs may be more broadly dispersed.
- Trips for different purposes are subject to different 0 considerations. Policy responses must be conceived and targeted in different ways and not all these policies will relate directly to the built environment.
- Reducing car ownership must be a much greater portion of the policy puzzle when it comes to reducing transport-related VKT. Among all the variables studied, the presence of additional cars in the household represents the only consistently statistically significant relationship across all categories of travel for both the binary decision to drive and the distance driven once that decision is made.



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