Transportation equity and sustainable mobility from mixed-use development

Full methodology and findings

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Summary of Transportation Methodology

This section outlines the analytical framework used to evaluate the transportation equity and trip generation impacts of mixed-use developments. It describes two core components: (1) the application of Foster–Greer–Thorbecke indices to assess transportation poverty and employment access for low-income households under various growth scenarios, and (2) the use of the District-level MXD Travel Model to estimate trip generation and mode share changes based on population, employment, land use, and accessibility variables. The methodology emphasizes open-source tools, reproducibility, and scenario-based analysis to understand how development patterns influence sustainable transportation outcomes.

Transportation Equity Implications of Development

To evaluate how mixed-use developments might affect transportation poverty, we applied the Foster-Greer-Thorbecke (FGT) indices, an established method for measuring poverty and adapted for use in transport poverty research.[1] In this context, our focus was on understanding how people living in poverty, as defined by Statistics Canada's Low Income Cut-Off (LICO) threshold, could access employment opportunities under different development scenarios. FGT indices are calculated at different alpha levels. We focus on the alpha=0 (FGT-0) and alpha=1 (FGT-1), which represent the headcount ratio and the income-gap measure, respectively. The headcount ratio is the "extent" of poverty, measured as the proportion of low-income families below the poverty line. The income-gap measure represents the "severity" of poverty, and is calculated as the average percent distance between the poverty line and the accessibility of the low-income households who are below it. This can be thought of as for those below the poverty thresholds, how far below it are they on average.

Results were calculated under four scenarios: existing conditions, general growth, and each of the two scenarios developed by the project team, here referred to as current

[1] Karner, Alex, Rafael H. M. Pereira, and Steven Farber. "Advances and Pitfalls in Measuring Transportation Equity." *Transportation*, ahead of print, January 12, 2024. https://doi.org/10.1007/s11116-023-10460-7.

trajectory – for the scenario that follows existing growth patterns – and optimized – for the scenario that uses more optimal land use changes.

We began by assessing current conditions using census data to identify populations living below the LICO threshold and business register data to measure job accessibility at the dissemination area (DA) level. These baseline scores were then updated to reflect the three future development scenarios. This involved spatially linking proposed parcel data to the DA boundaries and adjusting population and employment figures accordingly. In the general growth scenario, we distributed projected increases in population and employment, originally derived from Scenario 1, across all dissemination areas in proportion to their existing values. Additionally, newly proposed affordable housing units were assumed to be occupied by individuals living in poverty, ensuring that the analysis remained focused on equity outcomes for vulnerable populations. For the two project scenarios, we increased population and unit counts based on the locations of the proposed new buildings in each of those scenarios.

Mixed-Use District Trip Generation

Residential and commercial developments inevitably generate trips, making trip generation and mode-share analyses critical components of planning. The industry standard for this analysis is the Institute of Transportation Engineering's (ITE) Trip Generation Handbook. However, ITE's estimates are largely drawn from US suburban contexts with minimal pedestrian or transit infrastructure,[2] making them less suitable for mixed-use and transit-oriented developments. TODs, by design, incorporate robust transit infrastructure and enable shorter trips, often replacing vehicle trips with walking, cycling, or transit.[3]

To address these limitations ,we implemented the District-level MXD Travel Model, an open-source trip generation tool from Envision Tomorrow. The tool builds on research specific to mixed-use environments. It adjusts ITE methods using multiple inputs related to site characteristics and surrounding land-use patterns, accounting for internal trip capture and mode share shifts driven by density and land use diversity.[4] While it covers various transportation outcomes, we focused on the trip generation report, implementing only the necessary information for analyzing trip generation and mode shares. The table below

[2] Institute of Transportation Engineers (ITE). *Trip Generation , 8th Edition*. ITE, Washington, D.C., 2008.
[3] Ewing, Reid, Michael Greenwald, Ming Zhang, et al. "Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures." *Journal of Urban Planning and Development* 137, no. 3 (2011): 248–61. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000068.
[4] Gulden, Jeff, JP Goates, and Reid Ewing. *Mixed-Use Development Trip Generation Model*. University of Utah, 2013.

summarizes the variables used, their data sources, and the methodology for calculating them.

Category	Sub-Category	Abbreviated Methodology	Data Source
Population	Region	Sum of DA populations in the CMA.	Statistics Canada 2021 Census – Population
	Station Area	Sum of DA populations with population-weighted centroids in the station area.	
Employment	Region	Sum of DA employment counts (bin average) in the CMA.	Statistics Canada Business Register
	Station Area	Sum of DA employment counts (bin average) with population-weighted centroids in the station area.	
Land Use	Residential, Commercial, Industrial, and Public	Spatial overlay of study area and land-cover dataset.	DMTI Land Cover 2023
Residential Unit Mix	Single Family, Townhomes, Multifamily, and Manufactured Housing	Data extracted for the station area.	Environics Analytics – DemoStats
Intersections	Station Area Intersections	Buffered intersections joined to road data. Intersections defined as junctions between two roads (excluding curves), with 4-way intersections having four segments. Results aggregated to station areas.	DMTI Road Junctions and Lines 2023
	Station Area 4-Way Intersections		
	Buffered 4-Way Intersections		

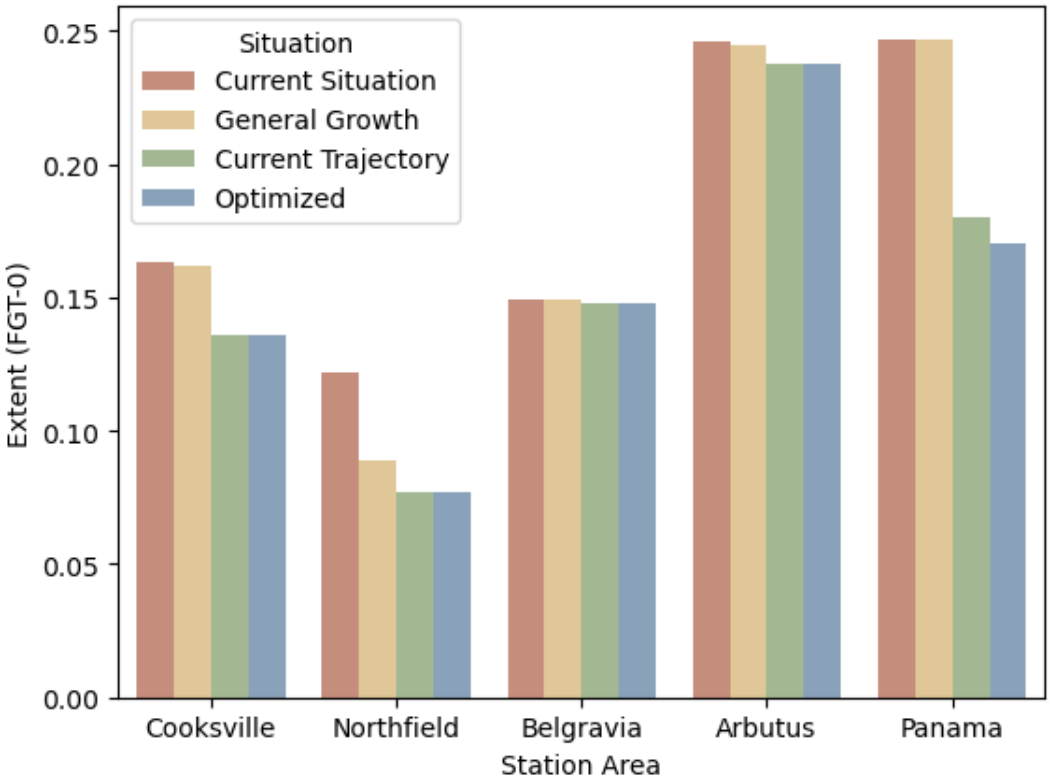
Household Characteristics	Size	Values were pulled directly for all households, single-family households, and other households at the DA level. DAs with their population weighted centroid within the station area were retained.	Statistics Canada 2021 Census – Household Characteristics
	Income		
Local and Regional Access	Transit Stops	Transit stops were pulled from the CPTND Summary Geopackage. Spatial overlay of station area with a) the stop points and b) a 0.25 mile (~400 m) buffer around the stop points.	Canadian Public Transit Network Database
	Employment Access	Travel times from each DA in the station area to all DAs in the CMA were calculated using r5py with OSM and CPTND GTFS data. Employment counts from the Business Register were summed within 20- and 30-minute automobile and 30-minute transit travel times.	Canadian Public Transit Network Database, Statistics Canada Business Register, and OpenStreetMap Street Networks

Because the future scenarios emphasize infill development and the consolidation of smaller parcels, we updated only the variables directly affected by these changes, namely, population, employment, land use, and residential dwelling mix. Each parcel was geocoded and spatially linked to its corresponding dissemination area. Variable values were then adjusted to reflect proposed changes, such as reductions in units or area due to building removal, and increases based on new or intensified land uses.

Overall Findings

Across all development scenarios, the increases in units lead to a decrease in the extent (and the severity) of transport disadvantage for low-income households. In most cases, the optimized scenarios had the largest impact, with additional improvements over the current trajectory growth scenarios and major improvements over existing conditions and the generalized growth. The depth of the impact is closely tied to the number of affordable units included in the development, with McKernan-Belgravia having the least proportion of affordable units and, consequently, the lowest change in FGT score. Although a greater proportion of affordable units would result in additional FGT improvements, a high proportion of affordable units is not necessary for meaningful effects. The optimized development in Panama, which has 15% affordable units, is projected to decrease FGT

scores by 7%, benefitting nearly 1,000 low-income households. Moreover, the optimal development in Cooksville, which has 10% affordable units, while decreasing FGT by only 3% still benefits 2,600 families due to the site's size and location. Including affordable housing units in MXD projects amplifies equity benefits by reducing transport disadvantage.



Furthermore, new development in mixed-use districts is consistently projected to reduce vehicle trips while increasing transit and walking trips, both within the development area and in surrounding neighbourhoods. However, the degree of mode-share shift varies across case studies, depending on the unique characteristics of each site.

A key factor influencing these outcomes is the land-use mix, which is central to the concept of mixed-use development. Drawing on Ewing et al. (2011)—the foundational research behind the MXD Trip Generation Tool—three variables stand out as primary drivers of vehicle trip reduction in these contexts:

1. **Total population and employment** within the development site;
2. **Employment within walking distance** (1600 meters) of the site;
3. **Employment** reachable within a 30-minute transit ride.

To evaluate the impact of these developments on sustainable transportation, we focus on two outcome metrics:

- **Sustainable Mode Share**: the percentage of total trips made by transit or walking.
- **Sustainable Mode Shift**: the increase in sustainable mode share from the baseline to the future scenario (e.g., a 10% rise in transit and walking trips).

By plotting each of the three key variables against these two outcome metrics, we can observe how they influence transportation behaviour and identify policy strategies tailored to different types of mixed-use developments.

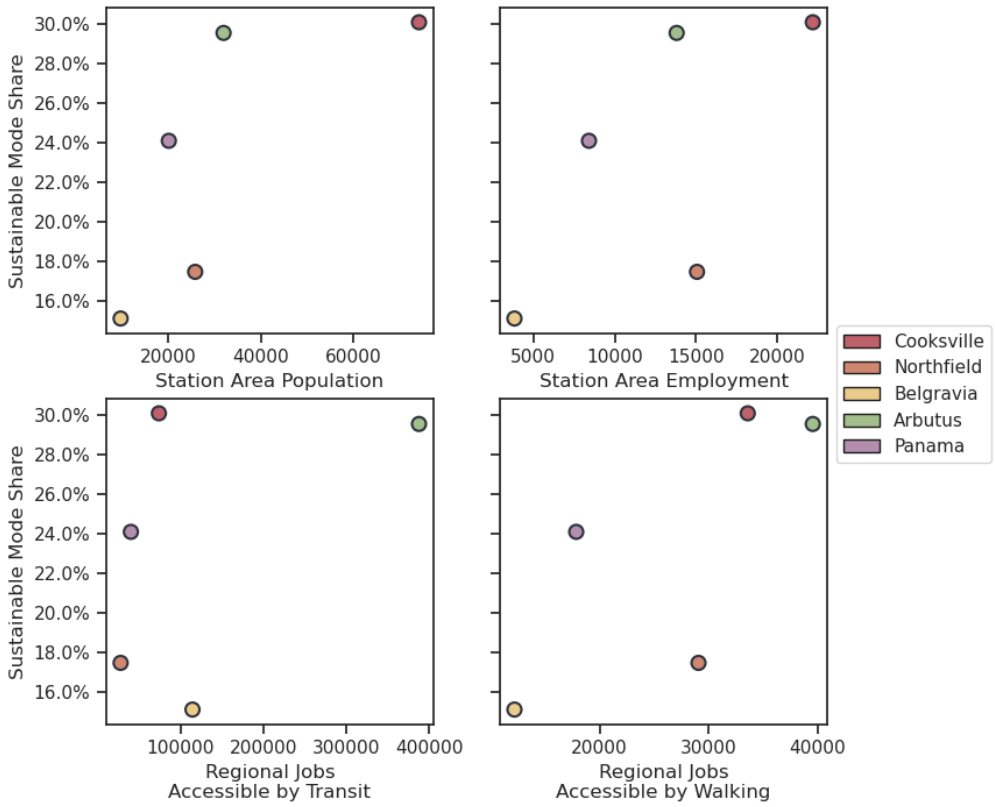


Figure 2: Total Sustainable Mode Share by Station Area Population, Employment, and Job Accessibility by Transit and Walking

As illustrated in Figure 2, site population, employment, and the number of jobs accessible by transit and walking are all associated with total sustainable mode share. This reflects a broader urban trend: larger, denser cities tend to support higher shares of transit and walking trips. These variables are therefore considered “high-impact” levers, but they also require substantial investment and structural change to influence meaningfully.

Population and employment naturally rise with new development in station areas, which can lead to modest increases in sustainable mode share. However, the scale of change needed to produce significant shifts is often beyond what a single mixed-use district can achieve. For example, Arbutus Station, despite having the highest population and employment among the case studies, shows only a modest increase in sustainable mode share, as shown in Figure 3. Furthermore, for less developed station areas, the population and employment growth that would be required to cause significant mode share increases would likely require citywide demographic and urban form changes unattainable by a single development district.

Access to jobs by transit and walking are closely related to both the total regional jobs (as it is a raw accessibility rather than relative to the region jobs) and the extensiveness of the transit system. These are also harder targets for smaller communities as they draw heavily from employment size and larger transit infrastructure, however, might be good targets for larger communities. Among the two larger station areas, Cooksville Station stands out for its high population and employment counts, but it lacks the transit accessibility found at Arbutus Station. This gap marks a strategic opportunity for transit investments, particularly the planned Hurontario LRT, which could significantly improve access to jobs and increase sustainable mode share in the area. More broadly, areas like Cooksville that already have strong population and employment bases, but limited transit connectivity should be prioritized for infrastructure upgrades that leverage existing networks to expand employment accessibility via transit.

Transit investments in smaller communities play an important role in expanding access and strengthening regional transit networks. However, their impact on overall mode share may be limited due to lower regional employment densities. In these contexts, focusing on **sustainable mode shift**, rather than total **sustainable mode share**, provides more meaningful insight for policy development.

One key factor in this shift is **land use entropy**, which measures the diversity of land uses within an area. A value of 1 indicates a highly mixed-use environment, while a value of 0 reflects minimal land use diversity. Higher entropy is associated with greater potential for internal trip capture and increased sustainable mode shift, making it a valuable planning metric for smaller, less developed station areas.

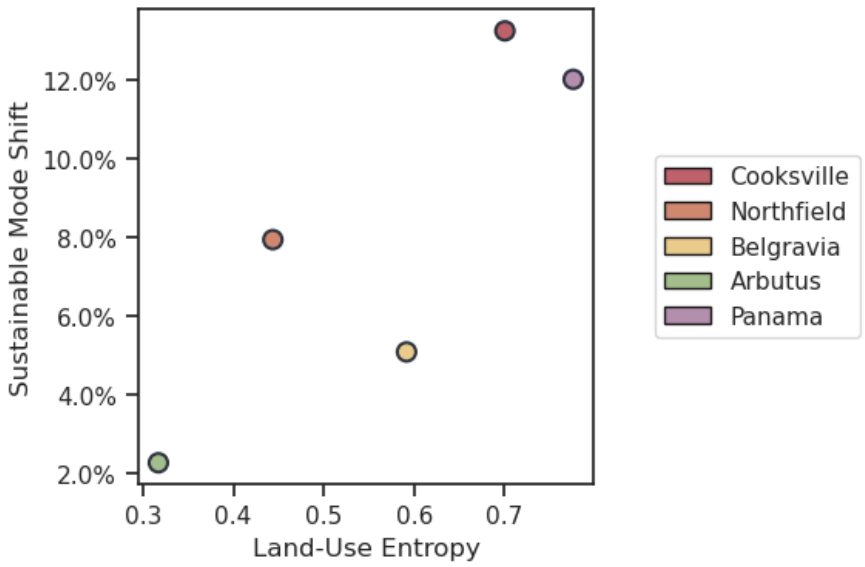


Figure 3: Station Area Mode Shift after TOD Implementation by Land-Use Mix (Entropy)

As shown in Figure 3, land-use entropy in the optimized scenario is strongly correlated with shifts in sustainable mode share. Higher levels of land-use mixing are associated with greater increases in transit and walking trips. This relationship is especially important for smaller station areas, which may have lower overall mode shares due to limited population and employment, but still demonstrate significant potential for mode shift when compared to existing conditions, a critical first step toward long-term sustainability. This is particularly relevant in areas with underutilized or vacant land, where infill development can introduce a diverse mix of uses. Such diversity encourages internal trip capture and supports a transition toward more sustainable travel behaviour.

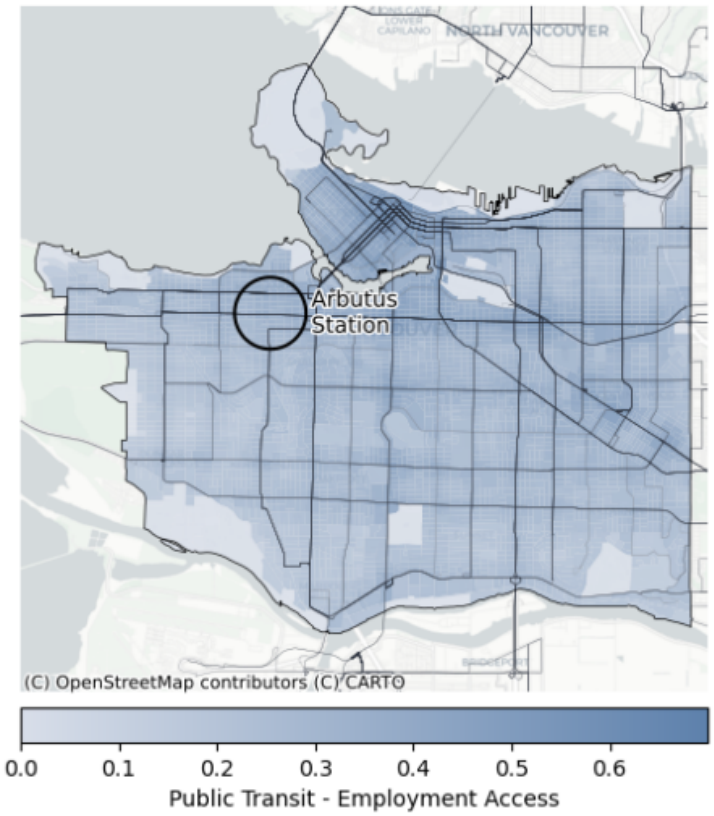
Key Takeaways

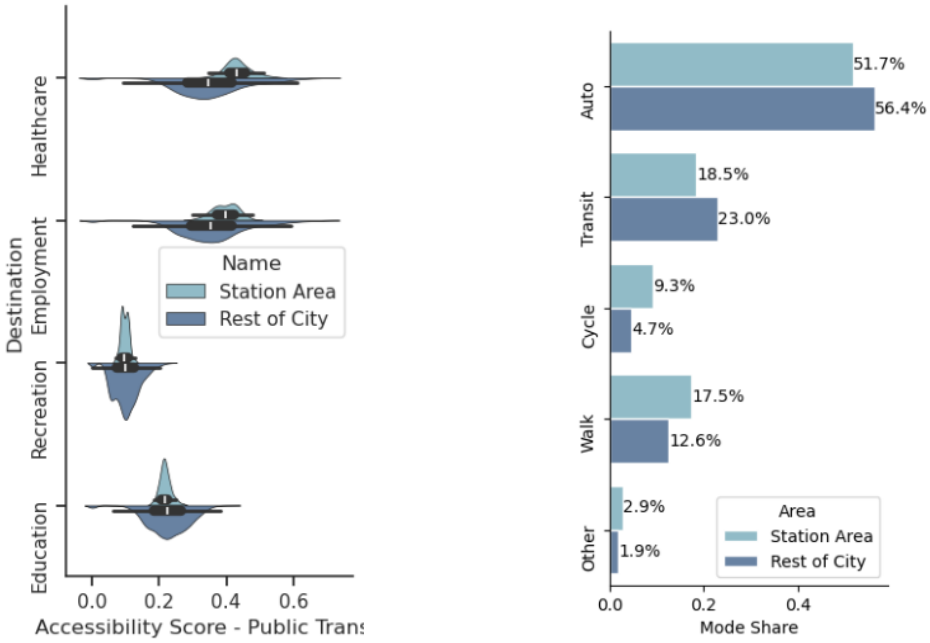
1. Including **affordable housing** units in MXD projects **amplifies equity benefits** by reducing transport disadvantage.
2. **Population and employment growth** resulting from mixed-use development tends to shift travel behaviour toward more sustainable modes, such as transit and walking.
3. **Larger sites** with high concentrations of population and employment should be paired with **strategic transportation investments**—especially those that improve access to regional employment via transit—to maximize gains in total sustainable mode share.
4. **Smaller sites** may not achieve high total mode share due to limited scale, but can still realize **significant mode shifts** by promoting diverse land uses. This increases internal trip capture and supports sustainable travel behaviour.

Detailed Findings: Arbutus Station (Vancouver, BC)

Existing Transportation Landscape

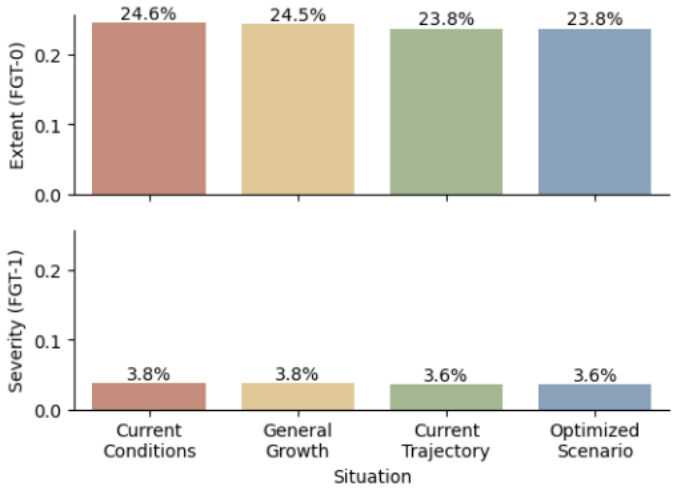
Arbutus Station, currently under development on Vancouver's Millennium Line, will be located southwest of downtown. The area already offers above-average transit accessibility, for employment and healthcare, with just below-average access to education and recreational activities. Vancouver as a whole has a low automotive mode share of approximately 56% of the population, with a station area that is even lower at 50%. This is primarily due to increased walking and cycling rates, which are each about 5% higher than the rest of the city average. The station area exhibits lower transit rates than the city average, despite having higher transit access than the city average. This is likely due to the station's current incomplete status and the high walkability of the area. It is still high compared to other places.





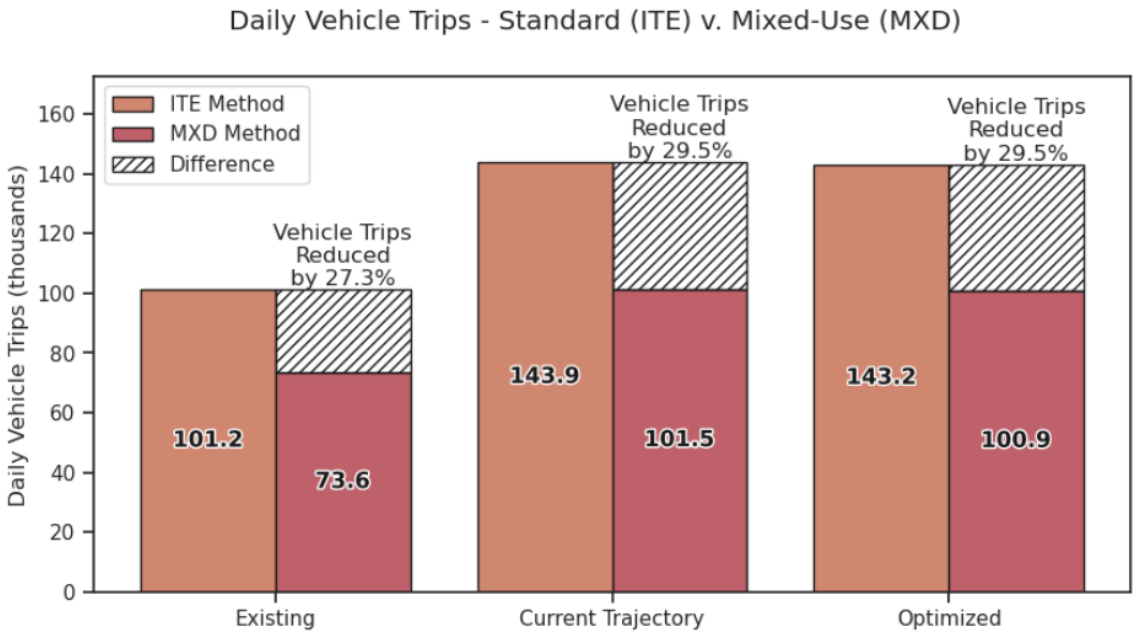
Transportation Equity Implications of Development

Both TOD scenarios are projected to reduce the share of low-income households experiencing transportation disadvantage at the 25th percentile by about 1%, compared to only 0.2% under the general growth scenario. While this change may seem modest, it represents roughly 1,500 households gaining access to better-served areas with affordable housing, an outcome that can significantly improve equity.

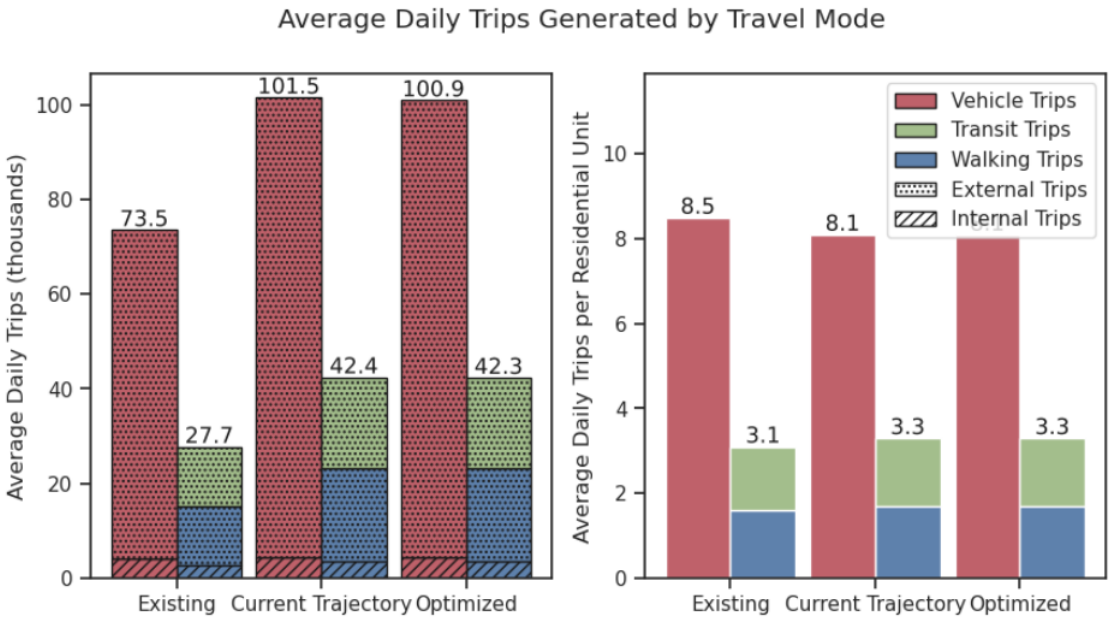


Mixed-Use Development Trip Generation

Detailed methodology for applying this tool is provided in the Transportation Methodology section. By combining ITE and MXD approaches, we can estimate how mixed-use, transit-oriented development reduces vehicle trips compared to a more typical suburban development.



The station area is already mixed-use, which likely results in fewer vehicle trips than predicted by the ITE method. However, the most significant benefits of mixed-use development emerge under future scenarios that promote infill and expand mixed-use commercial spaces rather than purely residential growth. These changes could reduce daily vehicle trips by 40,000 compared to a typical suburban development. The optimized scenario, prioritizing infill on vacant and underutilized lots and incorporating more “missing middle” housing, achieves a slightly greater reduction, eliminating about 500 additional vehicle trips beyond the current trajectory scenario. While this incremental decrease may seem small, its cumulative effect over time is substantial.

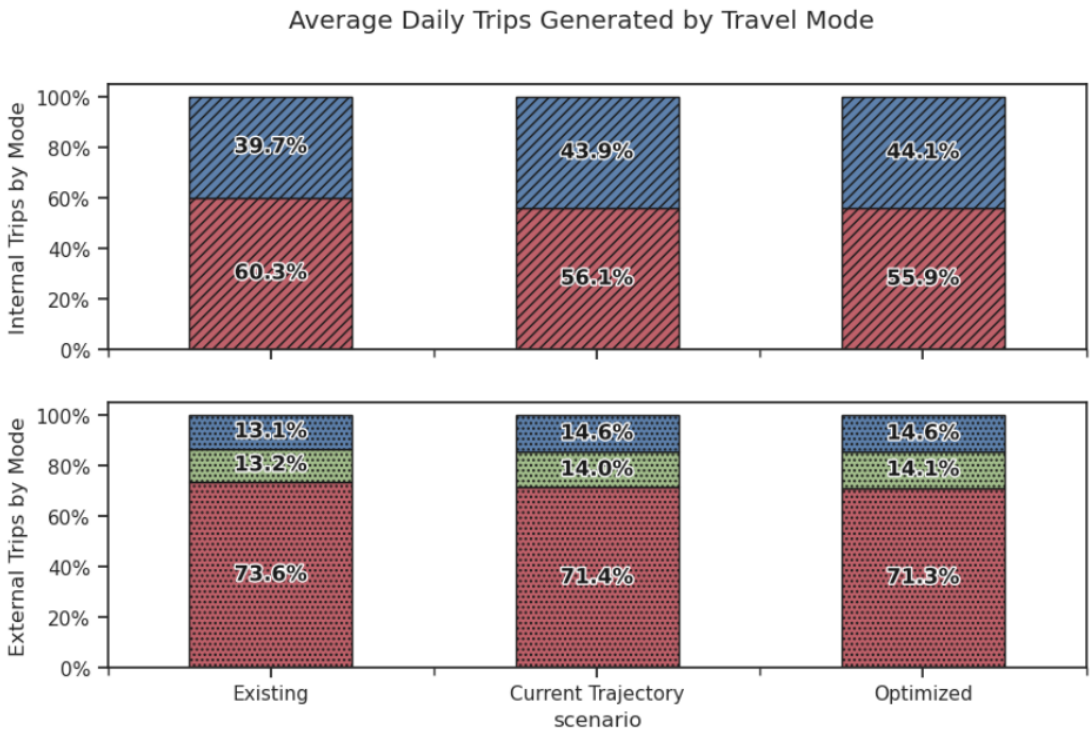


Where do these vehicle trips go? Some disappear entirely, but most shift to walking or transit trips. Of the 40,000 vehicle trips avoided, roughly 8,000 convert to walking and 6,500 to transit.

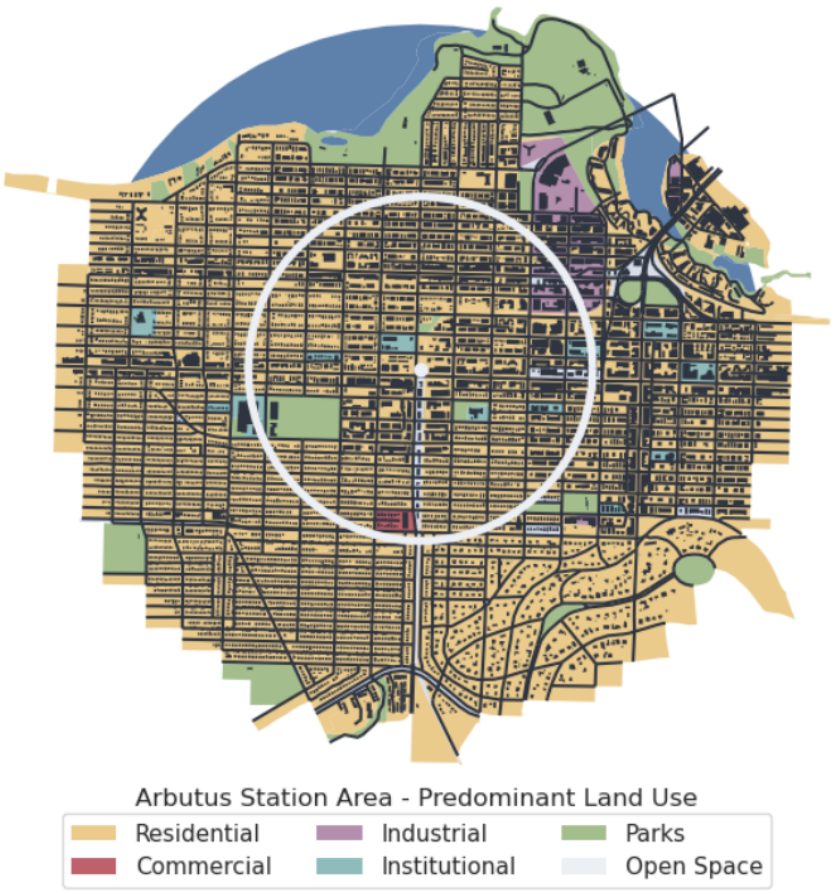
These trips fall into two main classifications:

Internal Trips: Trips that begin and end within the station area, such as a resident shopping at a local grocery store. These represent “internal capture”, where mixed-use development both generates and satisfies travel demand locally.

External Trips: Trips that either originate in the station area and leave, or start outside the station area and end inside. For example, a local resident visiting a doctor outside the station area or a non-resident commuter travelling into the station area for work.



Currently, the station area has a high walking rate for internal trips due to the existing mixture of uses. However, intensifying density and adding more commercial and mixed-use buildings in both scenarios further increases the walk share by about 5%. Internal capture improves as residential growth boosts trip generation and commercial uses enable those trips to be completed locally. Visitors arriving by car or transit can also walk between locations within the station area. Critically, MXDs don't exist in isolation, their benefits extend regionally through transit connections, enabling easy access from adjacent neighbourhoods and other transit-served areas.



External trips, which comprise the larger share of overall trips, also shift toward walking and transit as vehicle share declines. By concentrating activities and diversifying land-uses, nearby residents are enabled to walk to the district, while those living near other transit stations can easily reach the district by train. Moreover, people living at transit hubs gain access to other transit-served MXDs, enabling transit for external trips that would otherwise require driving.

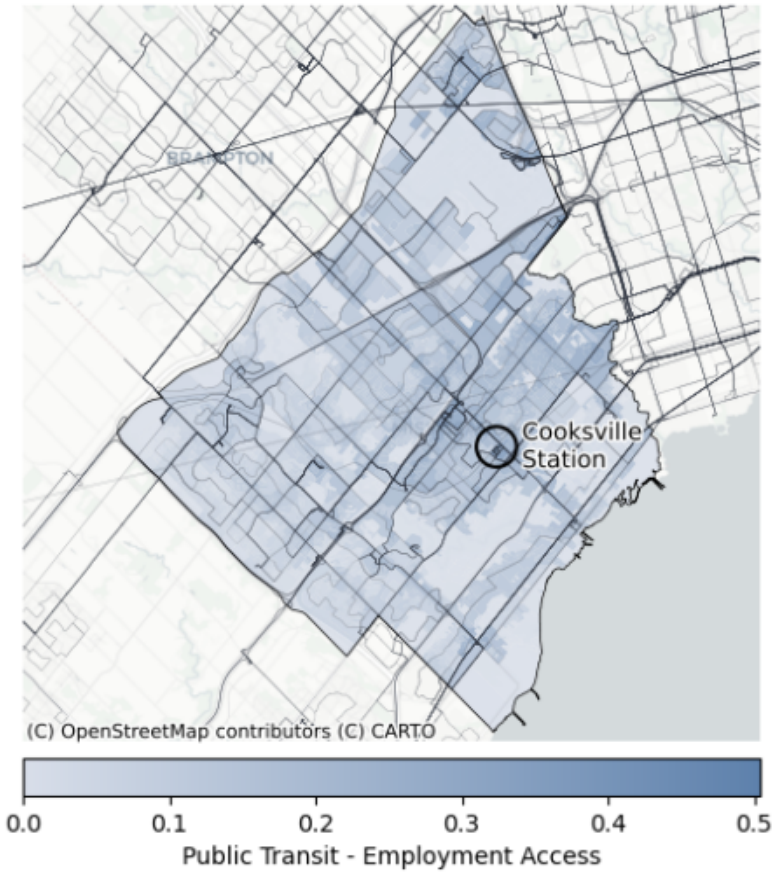
Key Takeaways

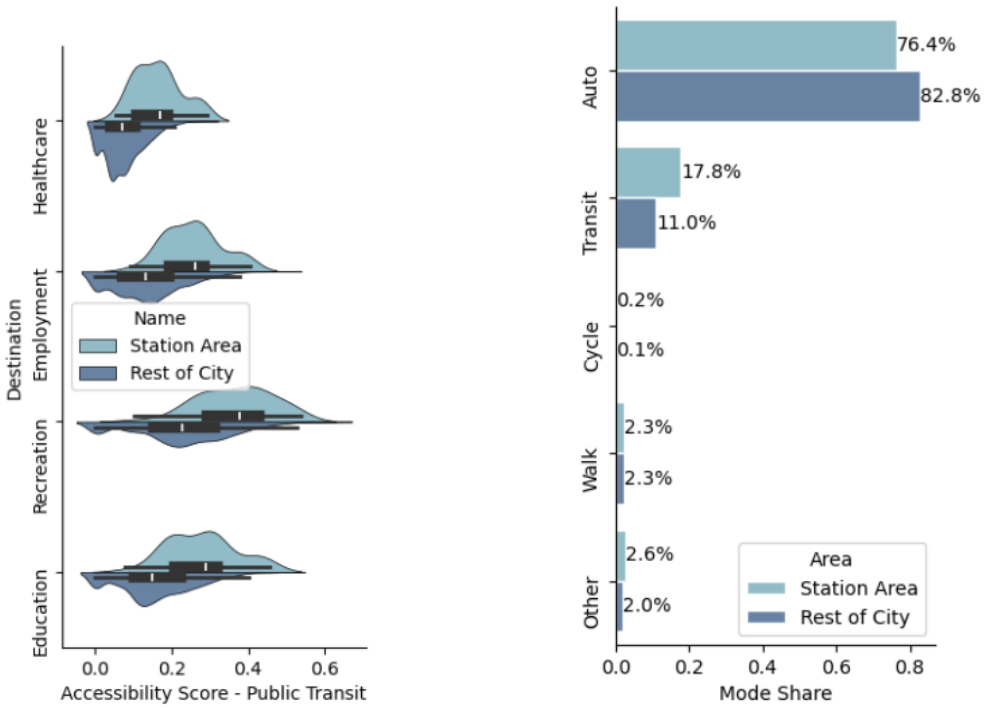
1. Mixed-use development significantly reduces vehicle trips compared to suburban developments.
2. Mixed-use developments influence mode share for both residents and surrounding area, incentivizing regional transit use.
3. Including affordable housing units in MXD projects amplifies equity benefits by reducing transport disadvantage.

Detailed Findings: Cooksville Station (Mississauga, ON)

Existing Transportation Landscape

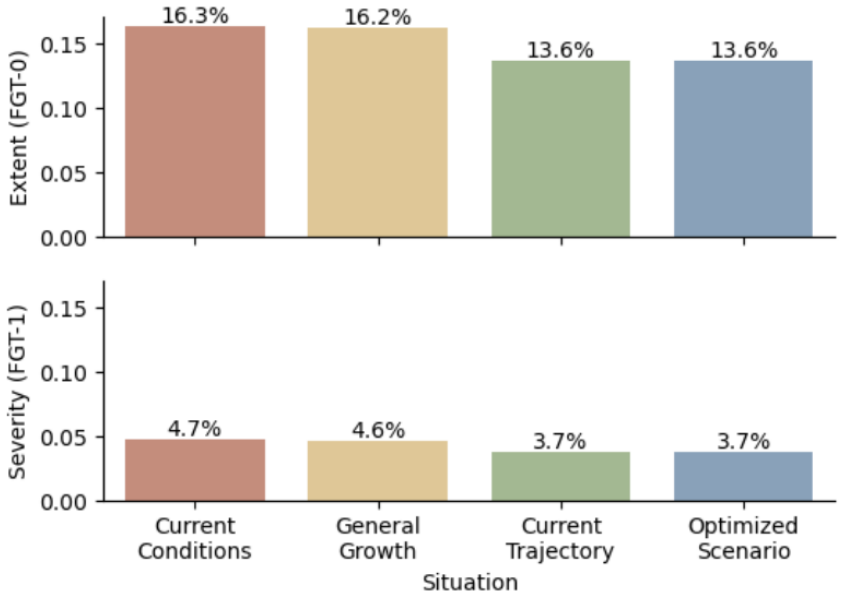
Cooksville GO Station, located on the Milton GO line, is set to become an important transit hub with the addition of the future Hurontario LRT. Its central location provides significantly greater transit accessibility to most destinations compared to the rest of Mississauga. Consequently, the area already exhibits a higher transit mode share, though automobile use remains substantial. Cycling and walking account for only a small share of trips, reflecting the auto-orientated design of the area.





Transportation Equity Implications of Development

While Mississauga already has a relatively low FGT-0 score compared to other case studies, implementing the TOD project under either scenario is projected to decrease this score by an additional 3%, benefitting nearly 2,600 low-income households.



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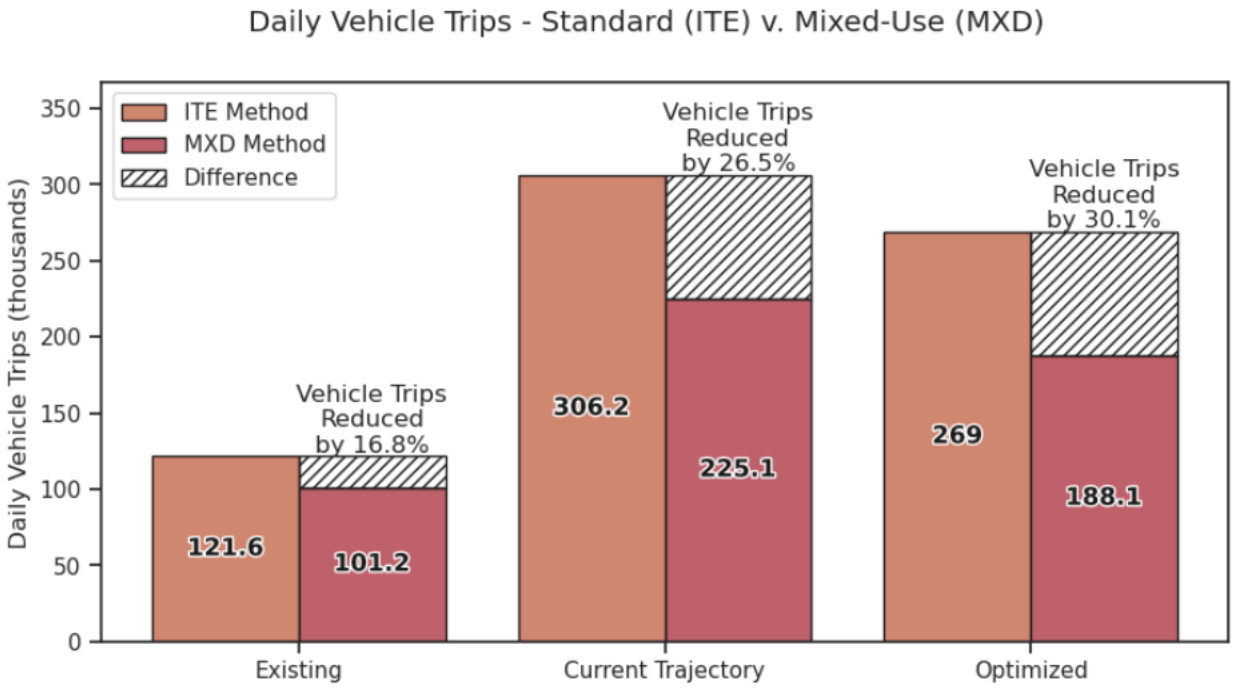
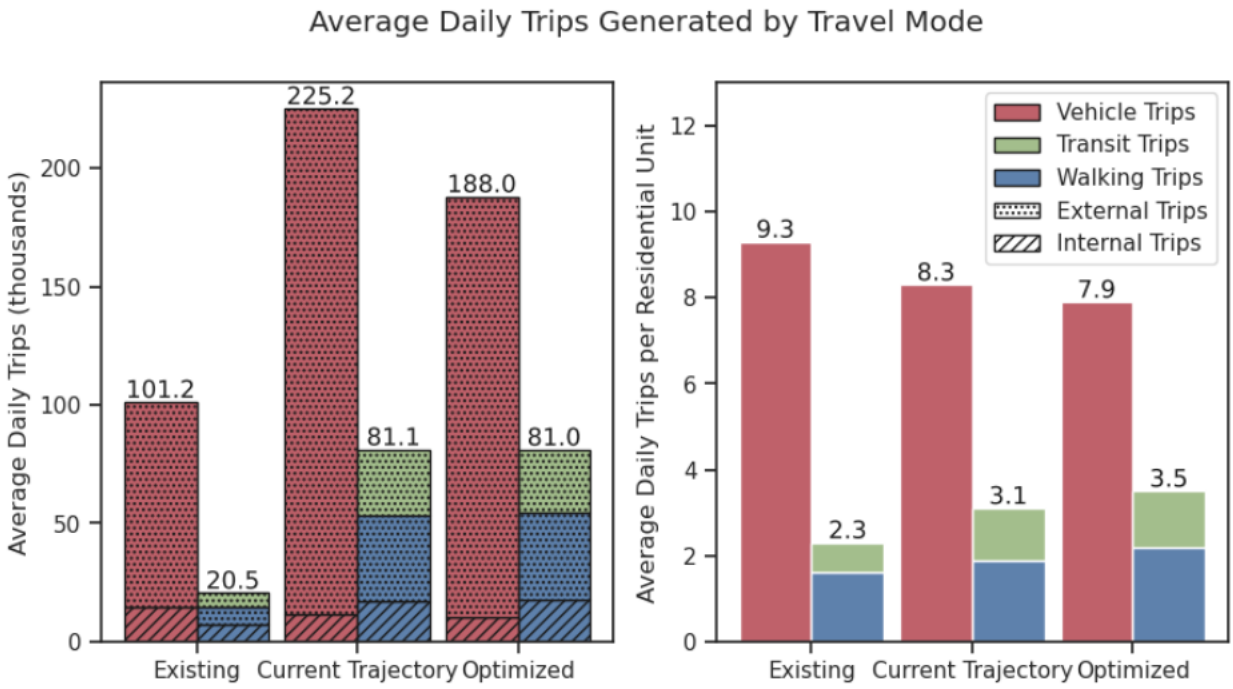


The station area already exhibits some transit orientation, which likely results in fewer vehicle trips than predicted by the ITE method, as reflected in its higher transit mode share. However, it remains predominantly auto-oriented. The proposed mixed-use developments demonstrate the benefits of increased density and infill, with projected reductions in auto trips of 26% and 30% compared to similar suburban developments in Mississauga. While vehicle trip generation at this site remains significant, the optimized scenario can limit auto trip generation to less than double the current level while delivering nearly three times more housing units and six times more jobs.

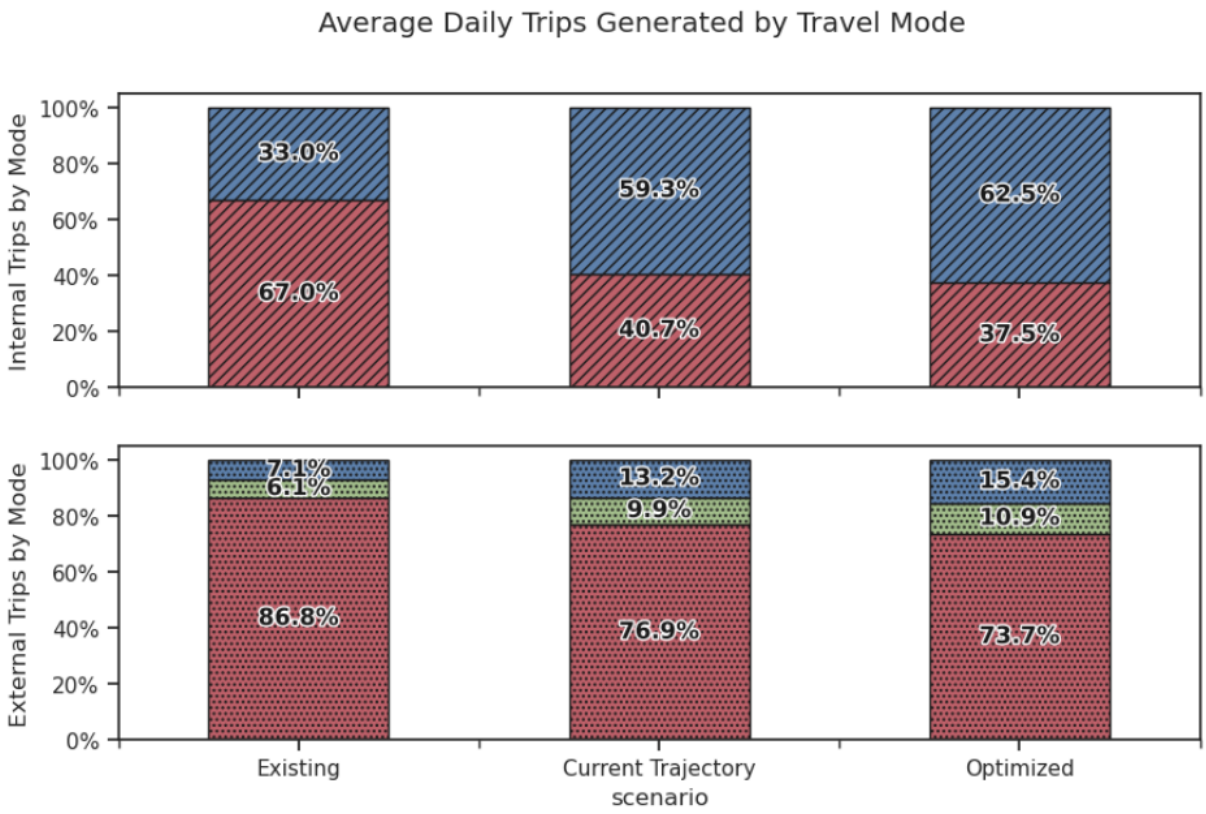


Where do these vehicle trips go? Some disappear entirely, but most shift to walking or transit trips. Of the approximately 80,000 fewer vehicle trips, about 70,000 are replaced by walking and transit trips, primarily through internal and external walking trips. This represents an increase of roughly four times compared to existing conditions.

These trips fall into two main classifications:

Internal Trips: Trips that begin and end within the station area, such as a resident shopping at a local grocery store. These represent “internal capture”, where mixed-use development both generates and satisfies travel demand locally.

External Trips: Trips that either originate in the station area and leave, or start outside the station area and end inside. For example, a local resident visiting a doctor outside the station area or a non-resident commuter travelling into the station area for work.



The scale of the proposed district enables substantial internal trip capture and a near reversal of mode share between walking and vehicle trips. Internal capture improves as residential growth boosts trip generation and commercial uses enable those trips to be completed locally. Visitors arriving by car or transit can also walk between locations within the station area. Critically, MXDs don't exist in isolation, their benefits extend regionally through transit connections, enabling easy access from adjacent neighbourhoods and other transit-served areas.

External trips, which comprise the larger share of overall trips, also shift toward walking and transit as vehicle share declines. By concentrating activities and diversifying land-uses, nearby residents are enabled to walk to the district, while those living near other transit stations can easily reach the district by train. Moreover, people living at transit hubs gain access to other transit-served MXDs, enabling transit for external trips that would otherwise require driving. The scale of this proposed district is expected to spur substantial increases in external trips across all modes, requiring adjustments to the transportation network. Significant transit investments like the Hurontario LRT will be critical to further reducing external vehicle trips and accommodating higher walking and transit demand, provided the system is adapted to handle the added load from a development of this magnitude.

Key Takeaways

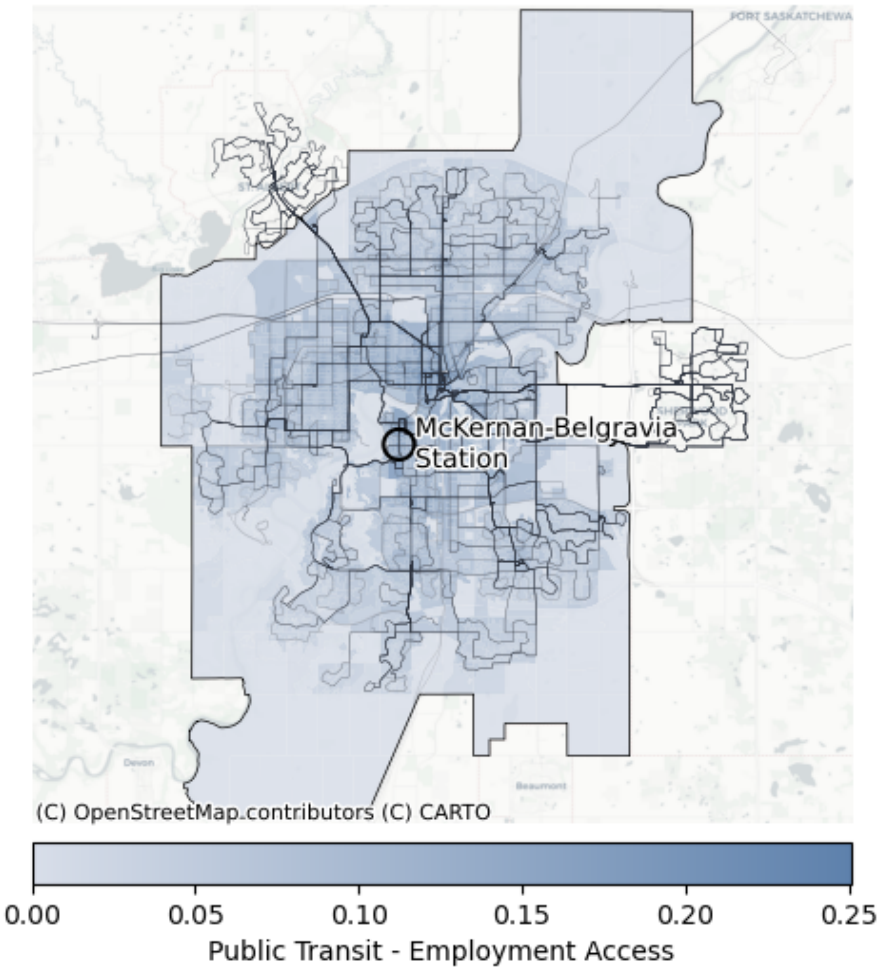
1. Mixed-use development significantly reduces vehicle trips compared to suburban developments. Adding transit service to this area (such as the Hurontario LRT) has high potential to convert further external vehicle trips into transit trips.
2. A development of this size has the potential for significant reductions in vehicle trips, however, trips across all modes will increase by a large proportion and the transportation system will need to be adjusted to account for them.

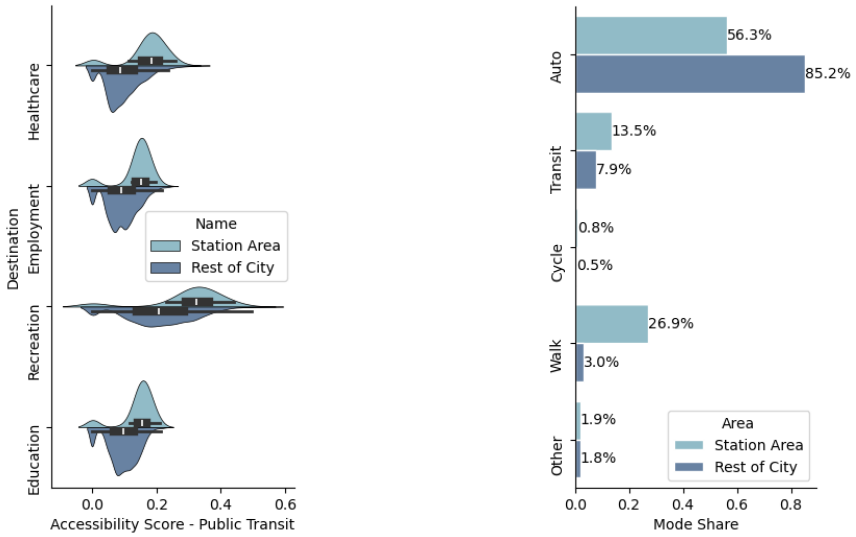
3. Including affordable housing units in MXD projects amplifies equity benefits by reducing transport disadvantage.

Detailed Findings: McKernan-Belgravia Station (Edmonton, AB)

Existing Transportation Landscape

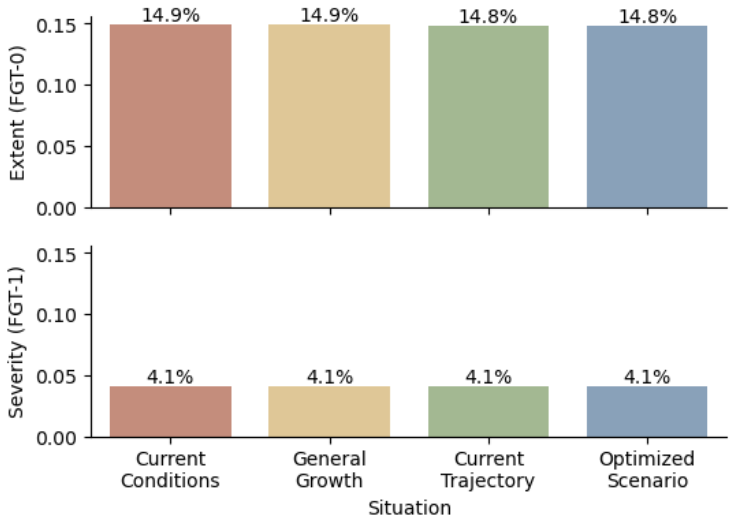
McKernan-Belgravia Station, located on Edmonton's LRT Capitol Line, sits between two sections of the University of Alberta campus, offering excellent connectivity. The area boasts higher transit accessibility than most of the city and a notably lower reliance on automobiles. While increased transit use contributes to this trend, the primary factor is a strong walking mode share of 27%, likely driven by the station's close proximity to the university.





Transportation Equity Implications of Development

The McKernan-Belgravia TOD projects have only a modest effect on FGT scores, reducing them by approximately 0.1%, equivalent to about 60 families. This limited impact is primarily due to the relatively small number of affordable units included in the TOD scenarios, despite the area's strong job accessibility compared to the rest of the city. While citywide FGT scores are already low at the 25th percentile, achieving a more substantial improvement will likely require a stronger emphasis on housing affordability within future development plans.



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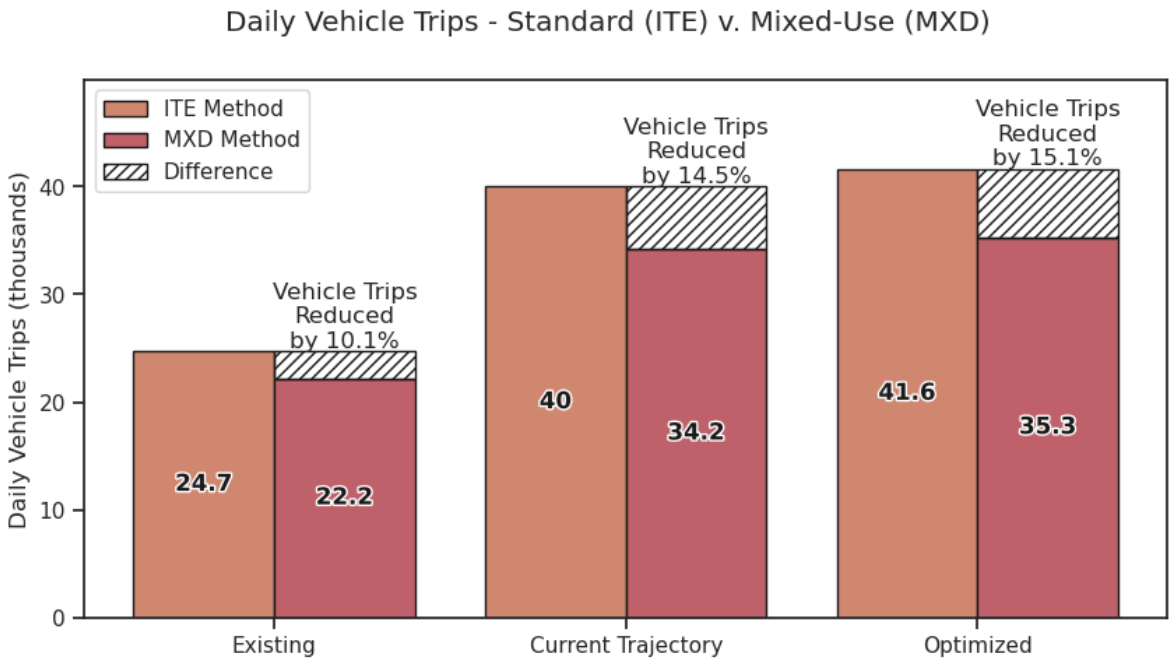
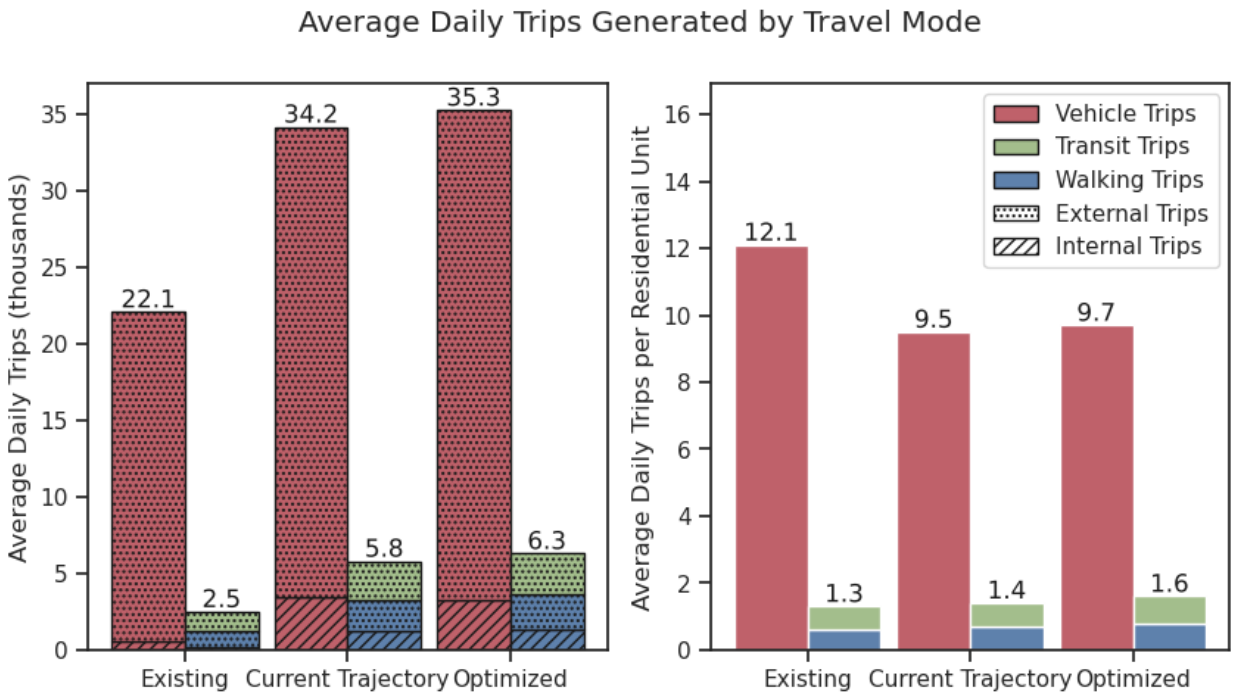


The existing station area does have good access to transit, which lowers the expected auto trips compared to a more suburban development. However, the real benefit of mixed-use development can be seen with both future scenarios that promote infill and add more mixed-use commercial areas rather than purely residential. This results in a potential reduction in 6,000 daily vehicle trips compared to what a suburban development might look like.

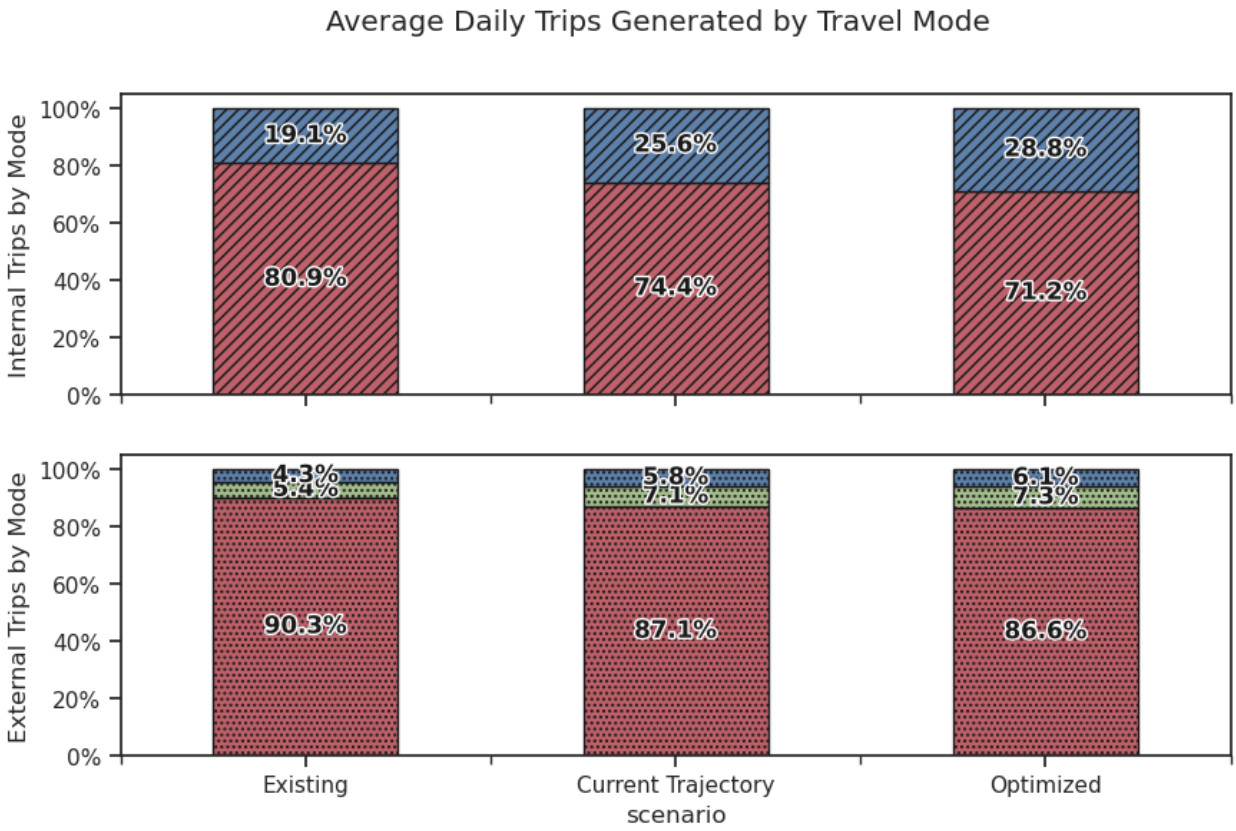


Where do these vehicle trips go? Most of the impact on daily trips per residential unit comes from *reducing* the need for automotive trips overall, with comparatively smaller increases in transit and walking trips. Whereas for total trips, most shift to walking or transit trips. In the optimized scenario, the reduction of roughly 6,000 vehicle trips is accompanied by an increase of about 4,000 walking and transit trips—more than doubling both modes compared to existing conditions.

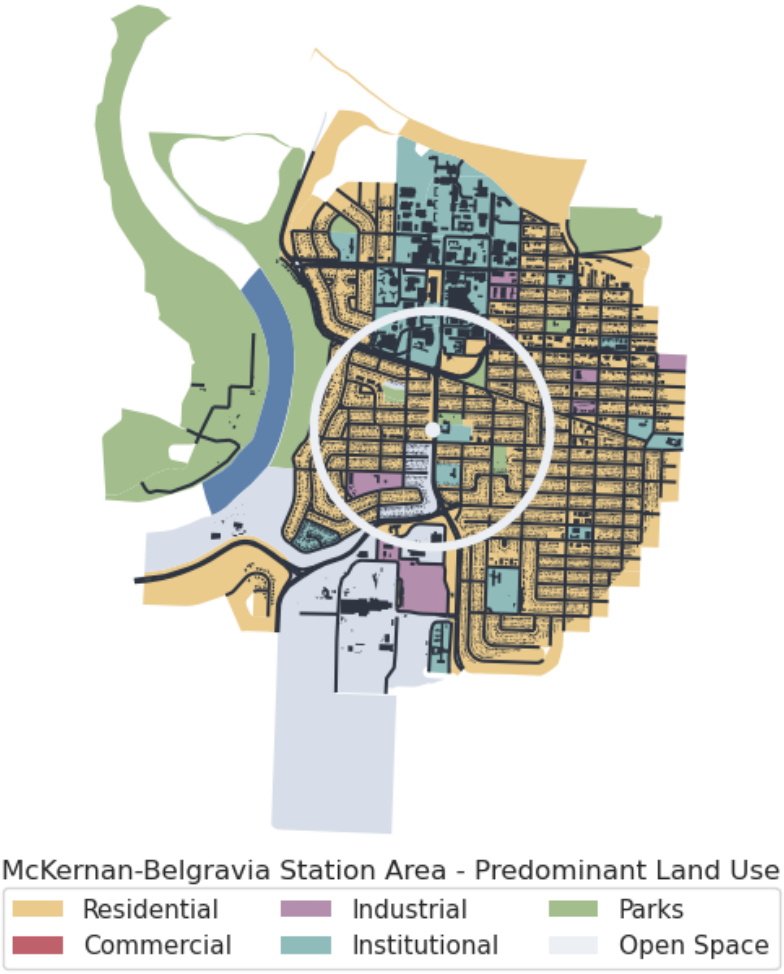
These trips fall into two main classifications:

Internal Trips: Trips that begin and end within the station area, such as a resident shopping at a local grocery store. These represent “internal capture”, where mixed-use development both generates and satisfies travel demand locally.

External Trips: Trips that either originate in the station area and leave, or start outside the station area and end inside. For example, a local resident visiting a doctor outside the station area or a non-resident commuter travelling into the station area for work.



McKernan-Belgravia is the smallest case study in terms of population and employment, and its current land-use pattern lacks significant commercial uses. While the proposed scenarios introduce substantial commercial space, trip generation remains largely auto-focused, with greater reductions in vehicle travel for internal trips. Internal capture is largely due to adding more residential units and this addition of commercial area. Residences increase internal residential trip generation and the commercial uses enable them to complete those trips within the station area, allowing for both more internal trips and a higher share of walking among those trips. Internal capture improves primarily through added residential units and new commercial uses, enabling more trips to be completed within the station area and increasing the share of walking. While vehicle trips still dominate, they are shorter than before, as many no longer require leaving the district. Further intensifying density and expanding commercial uses would likely enhance mode share, while also encouraging more residents in the surrounding area to shift to transit for accessing new local amenities.



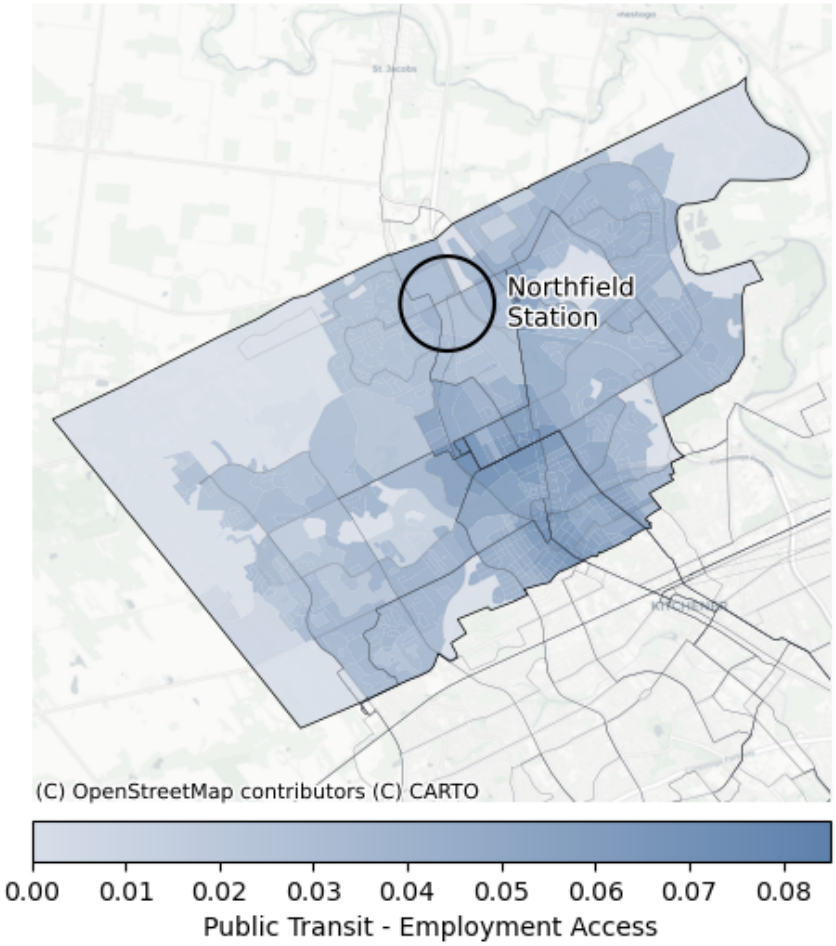
Key Takeaways

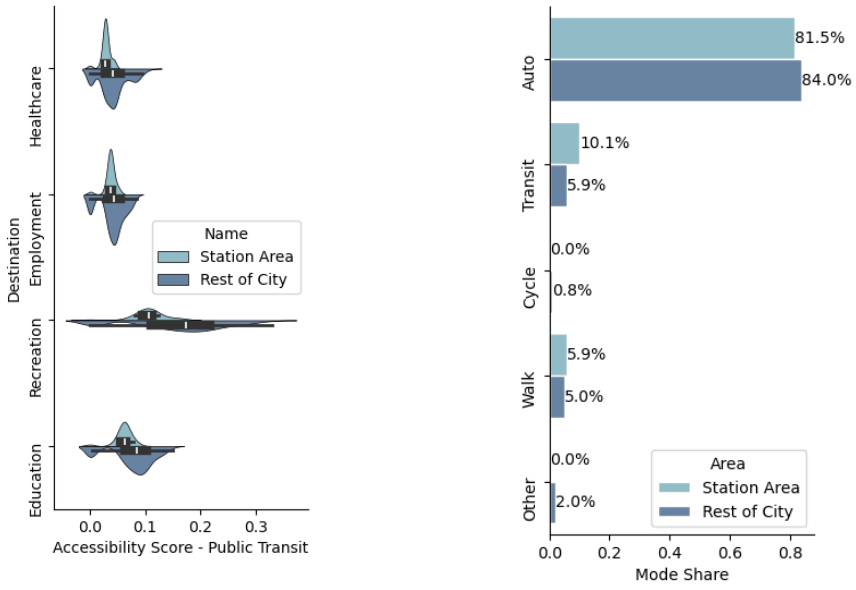
1. Despite continued reliance on vehicles, internal trips increase substantially, enabling more walking trips and shortening vehicle trips since many can now be completed within the station area.
2. Mixed-use development influences travel behaviour beyond its boundaries, improving mode share of residents and encouraging regional transit use.
3. The current proposal has a limited effect on transport disadvantage, but a stronger emphasis on affordable housing could deliver greater equity benefits given the area's high accessibility.

Detailed Findings: Northfield Station (Waterloo, ON)

Existing Transportation Landscape

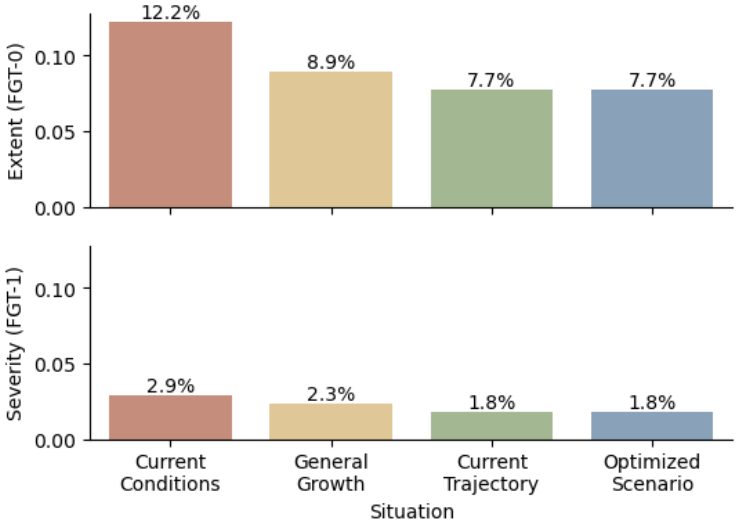
Northfield Station is an existing station on the Waterloo Region ION rapid transit system. Located to the north of downtown, it generally has lower access to most destinations by public transit, likely due to its peripheral location. Despite this, the station area exhibits higher than average transit use and decreased automobile use, although automobiles remain the largest share by a wide margin.





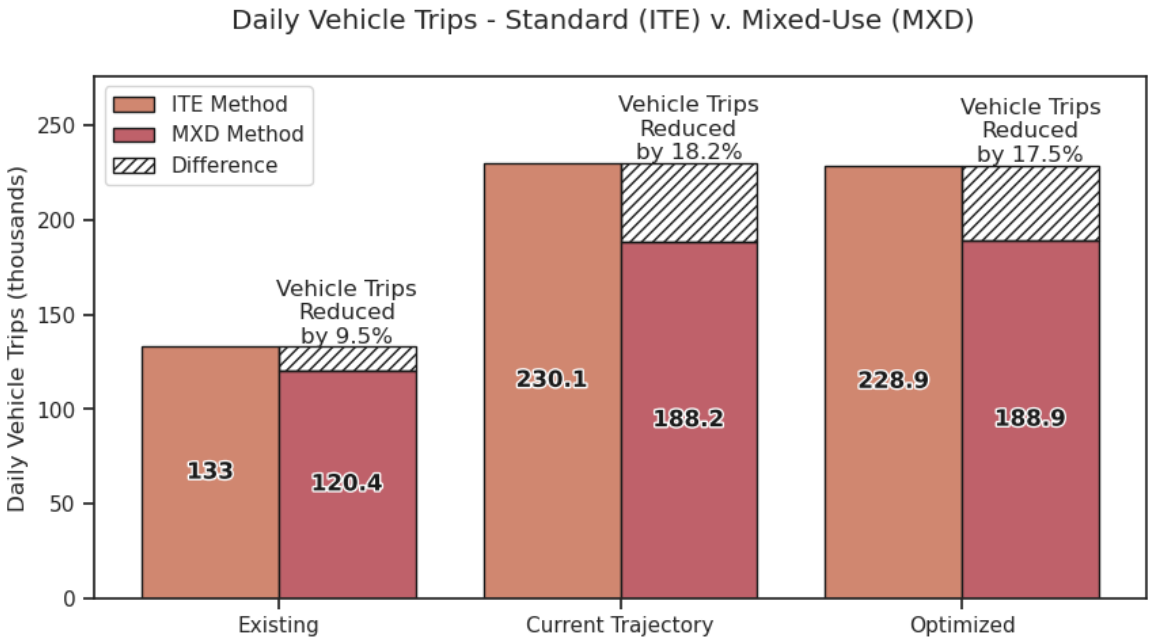
Transportation Equity Implications of Development

Northfield is unique among the case studies because the general growth scenario also reduces transport disadvantage at the 25th percentile, though the TOD scenarios lower it further by an additional 1%. However, these findings should be interpreted cautiously. The city as a whole has relatively low transit accessibility (see access scores in the Northfield map compared to the other case studies), which means the 25th percentile threshold is already quite low. As a result, the observed differences may not represent the same level of improvement in access as in other regions.

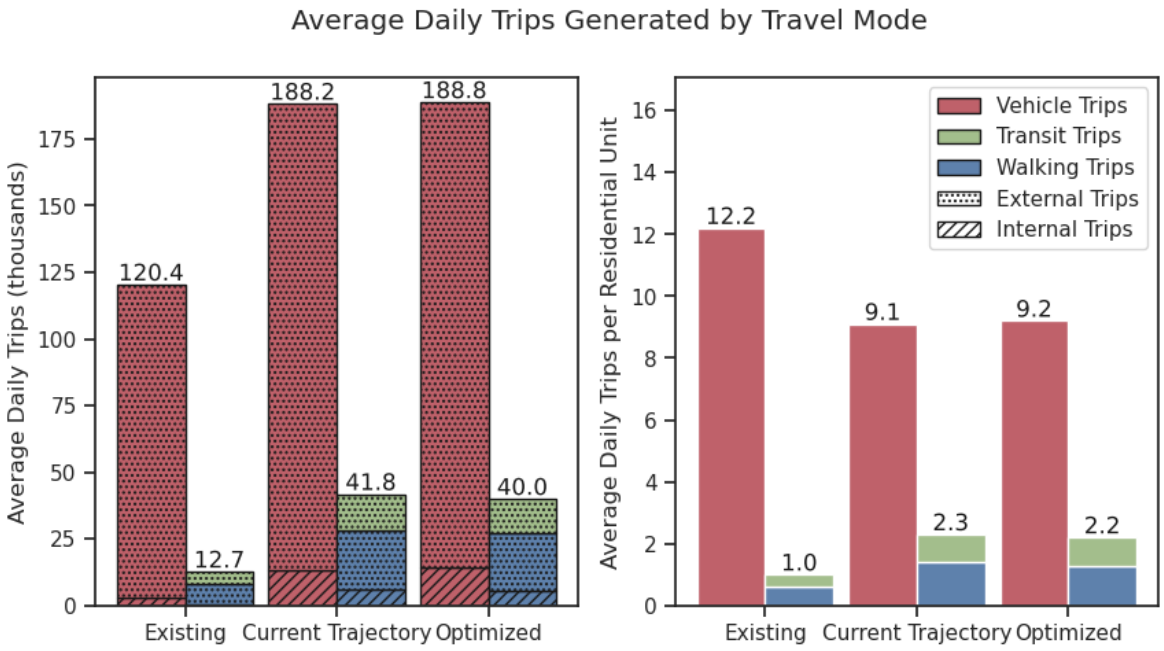


Mixed-Use Development Trip Generation

Detailed methodology for applying this tool is provided in the Transportation Methodology section. By combining ITE and MXD approaches, we can estimate how mixed-use, transit-oriented development reduces vehicle trips compared to a more typical suburban development.



While there is some decrease in automotive trips due to the proximity to the transit station, the most significant advantage of mixed-use development emerges in scenarios that encourage infill and incorporate diverse commercial uses rather than exclusively residential growth. These strategies could lead to a reduction of approximately 40,000 daily vehicle trips compared to a suburban development alternative. While the optimized scenario achieves a slightly smaller reduction in trips, it still delivers substantial benefits by prioritizing gentle density and integrating more transitional and public use areas.

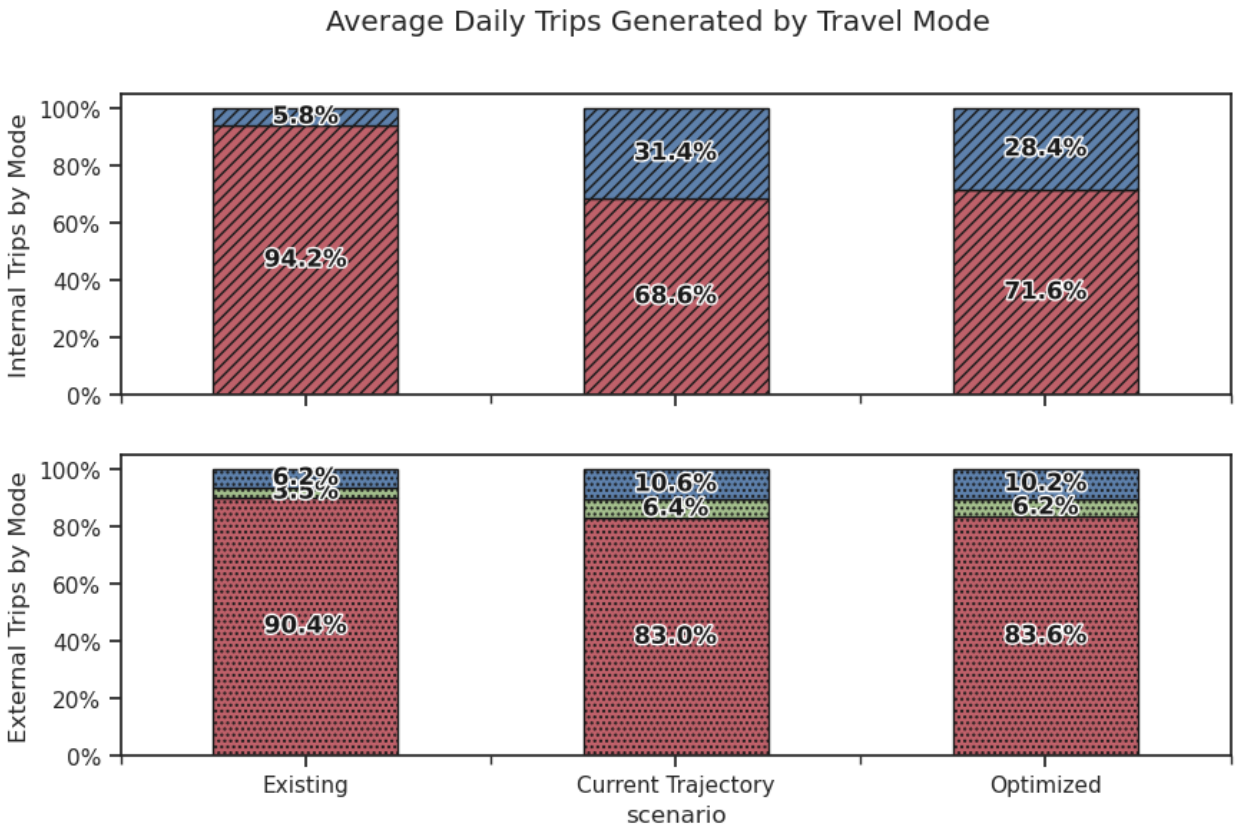


Where do these vehicle trips go? Some disappear entirely, but most shift to walking or transit trips. Of the approximately 40,000 fewer vehicle trips, there is a corresponding increase of about 30,000 thousand walking and transit trips, almost quadrupling the number of sustainable trips. A large portion of these additional trips are walking, which would likely generate significant foot traffic for new commercial uses in the district.

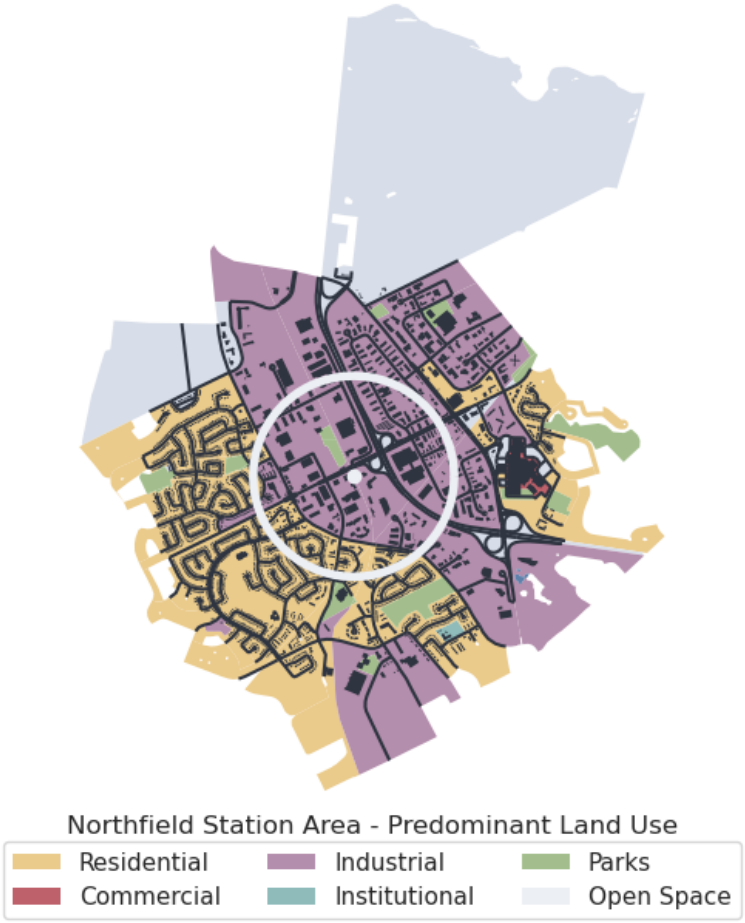
These trips fall into two main classifications:

Internal Trips: Trips that begin and end within the station area, such as a resident shopping at a local grocery store. These represent “internal capture”, where mixed-use development both generates and satisfies travel demand locally.

External Trips: Trips that either originate in the station area and leave, or start outside the station area and end inside. For example, a local resident visiting a doctor outside the station area or a non-resident commuter travelling into the station area for work.



The existing land-use pattern at Northfield Station lacks significant commercial uses, which is reflected in the limited number of internal trips and predominance of auto travel. While the proposed scenarios introduce substantial commercial space, trip generation remains largely auto-focused, with greater reductions in vehicle travel for internal trips. Internal capture is largely due to adding more residential units and this addition of commercial area. Residences increase internal residential trip generation and the commercial uses enable them to complete those trips within the station area, allowing for both more internal trips and a higher share of walking among those trips. Internal capture improves primarily through added residential units and new commercial uses, enabling more trips to be completed within the station area and increasing the share of walking. While vehicle trips still dominate, they are shorter than before, as many no longer require leaving the district. Further intensifying density and expanding commercial uses would likely enhance mode share, while also encouraging more residents in the surrounding area to shift to transit for accessing new local amenities.



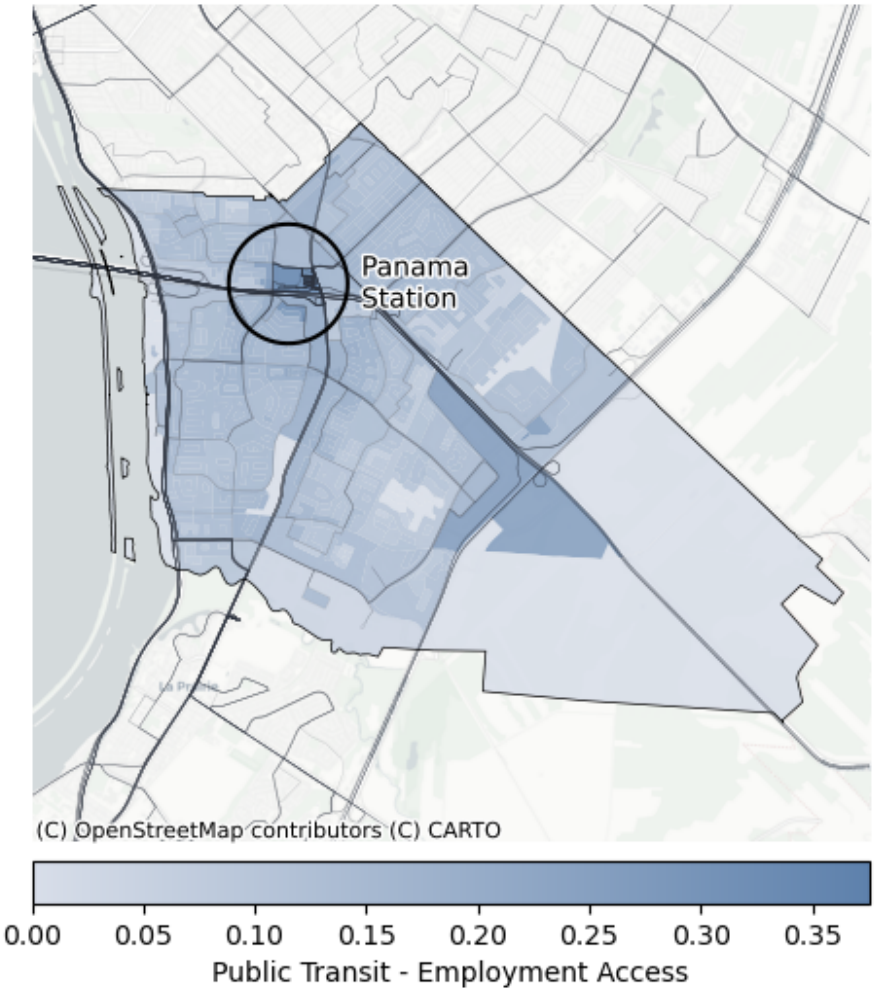
Key Takeaways

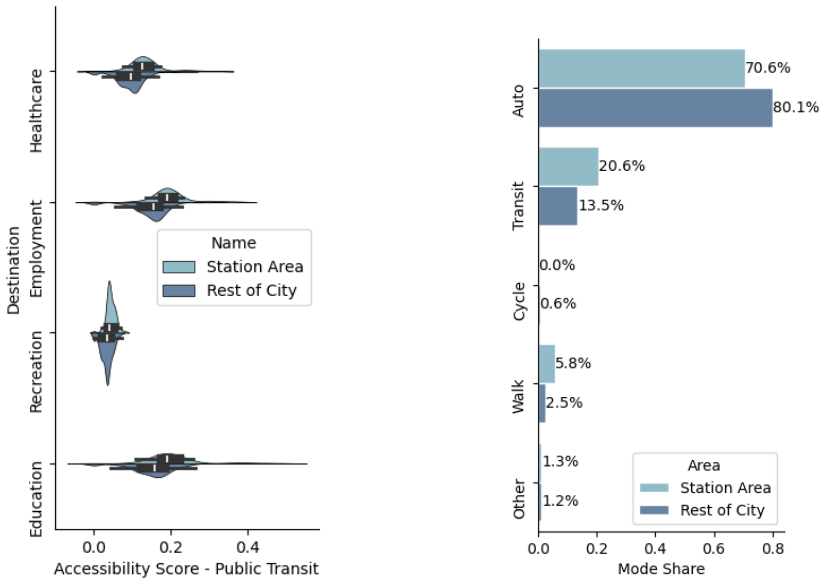
1. Despite continued reliance on vehicles, internal trips increase substantially, enabling more walking trips and shortening vehicle trips since many can now be completed within the station area.
2. Mixed-use development influences travel behaviour beyond its boundaries, improving mode share of residents and encouraging regional transit use.
3. Including a mix of affordable units in mixed-use can enhance transportation access for disadvantaged populations. However, this benefit must be evaluated within the broader context of the city's overall transit accessibility level, which remains relatively low.

Detailed Findings: Panama Station (Brossard, QC)

Existing Transportation Landscape

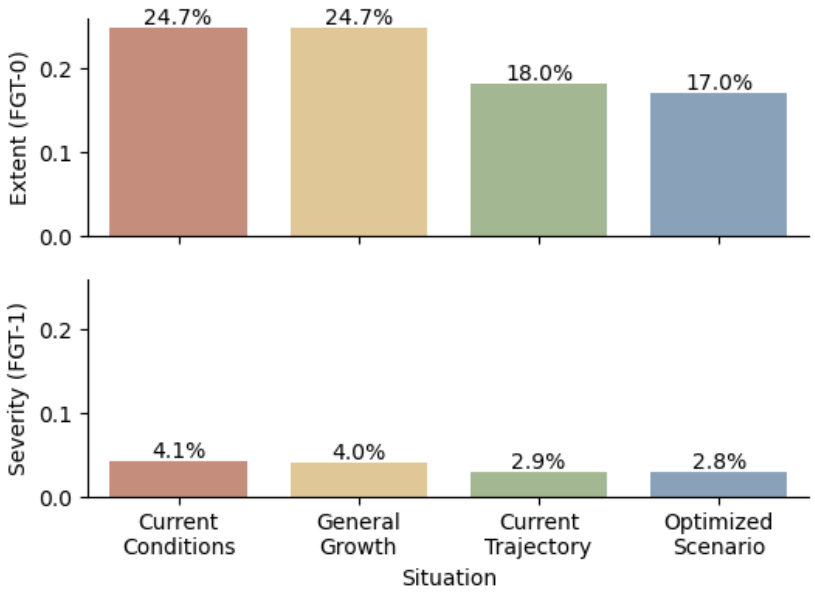
Panama Station is an existing station on the South Shore branch of the REM. The area already offers above-average transit accessibility across all destinations. The station area has a 10% lower automotive share compared to the rest of Brossard. This is largely due to an increased transit share of about 7% as well as increased walking rates.





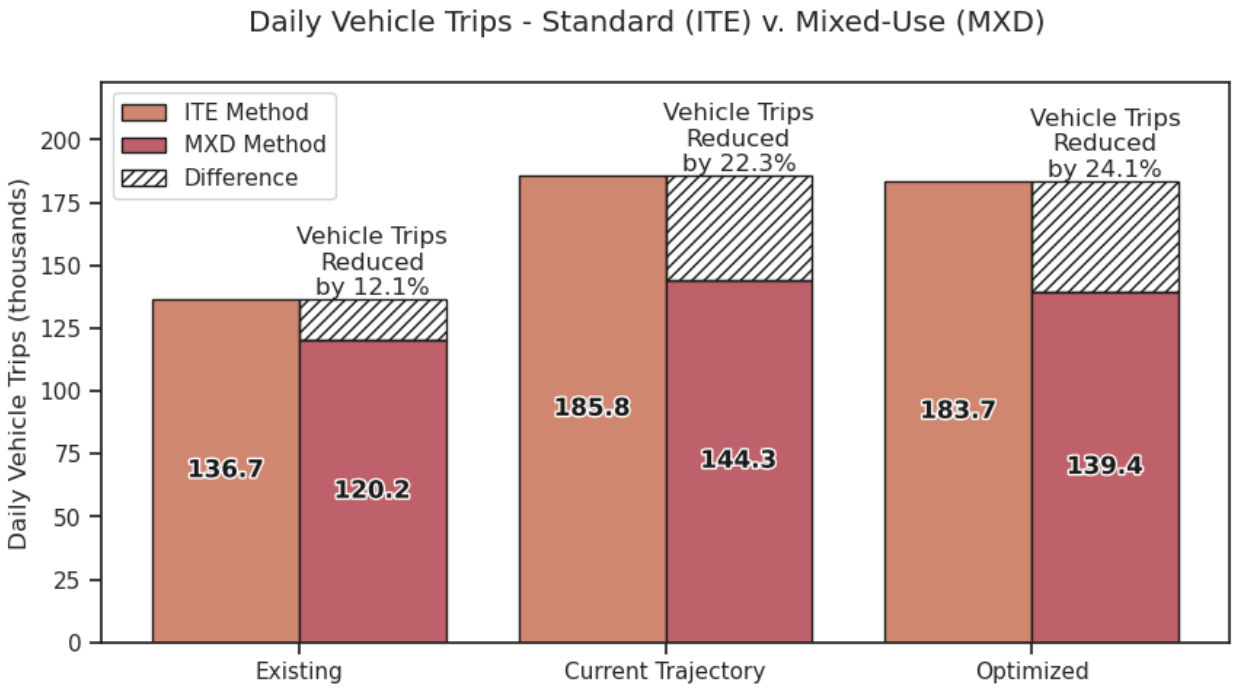
Transportation Equity Implications of Development

The Panama TOD scenarios have a sizeable impact on transport disadvantage at the 25th percentile, with around a 7% decrease in the number of households below the threshold, accounting for over 1,000 families. This is particularly stark in comparison with the general growth scenario which has no impact on transport disadvantage, showing the benefits of coordinating residential development with transit infrastructure.

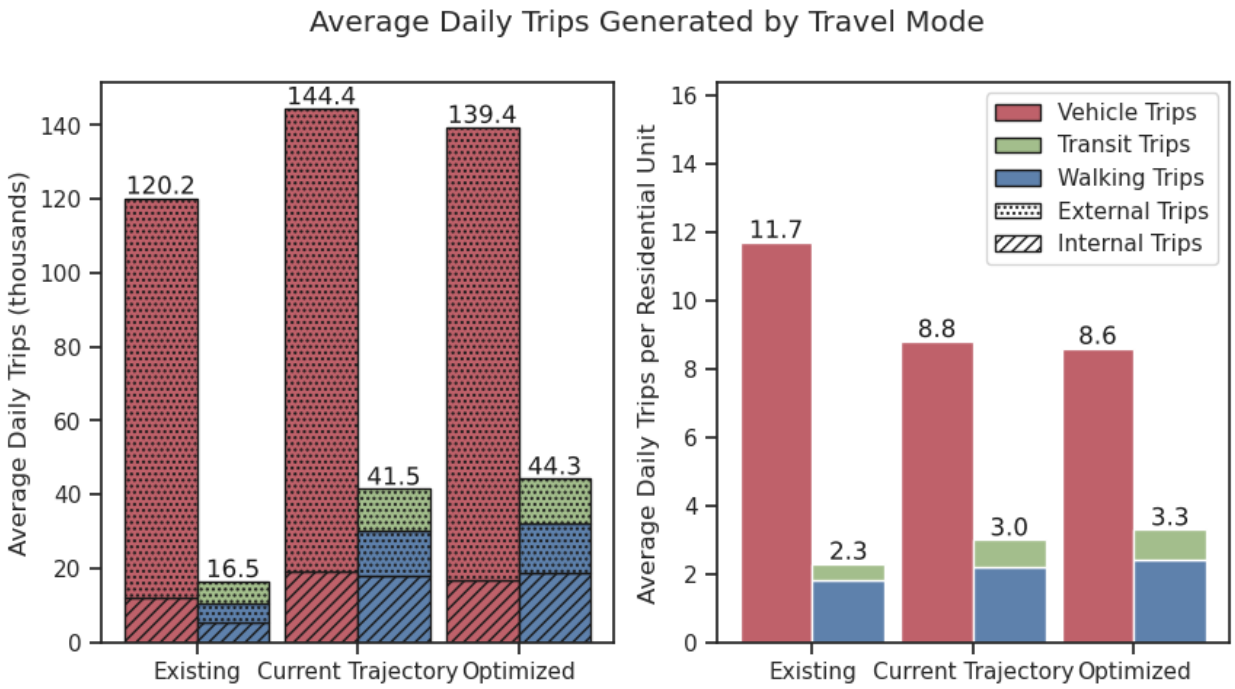


Mixed-Use Development Trip Generation

Detailed methodology for applying this tool is provided in the Transportation Methodology section. By combining ITE and MXD approaches, we can estimate how mixed-use, transit-oriented development reduces vehicle trips compared to a more typical suburban development.



The station area is already mixed-use, which likely results in fewer vehicle trips than would be predicted by the ITE method. The true advantage of mixed-use development emerges in future scenarios that promote infill and add commercial areas alongside residential uses. These changes could reduce daily vehicle trips by 40,000 compared to a typical suburban development. The optimized scenario, which prioritizes mid-rise density without tall towers, achieves an additional reduction of 5,000 trips.

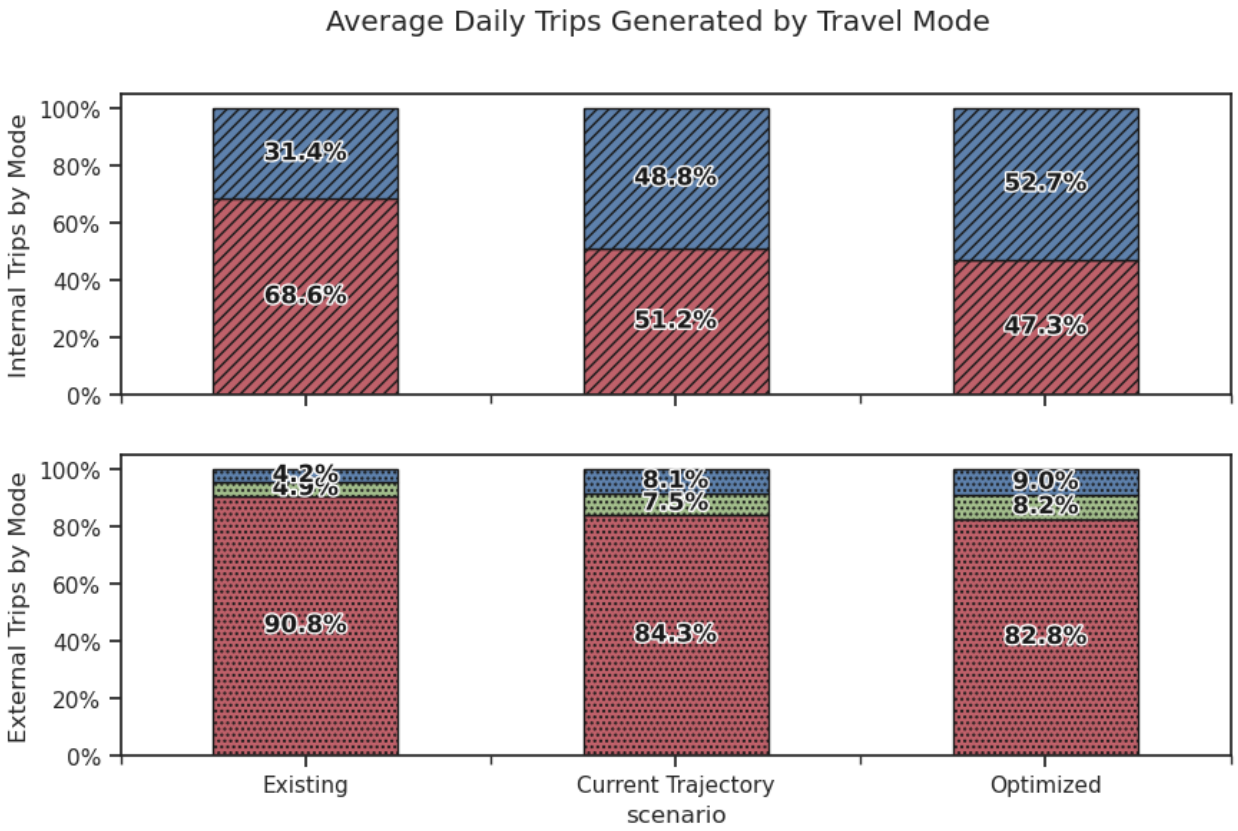


Where do these vehicle trips go? Some disappear entirely, but most shift to walking or transit trips. Of the 40,000 avoided vehicle trips, about 25,000 convert to walking and transit, nearly tripling sustainable trips compared to existing conditions. Brossard station also shows a significantly smaller increase in vehicle trips compared to other stations, with most of the trip increases from both scenarios coming from transit and walking.

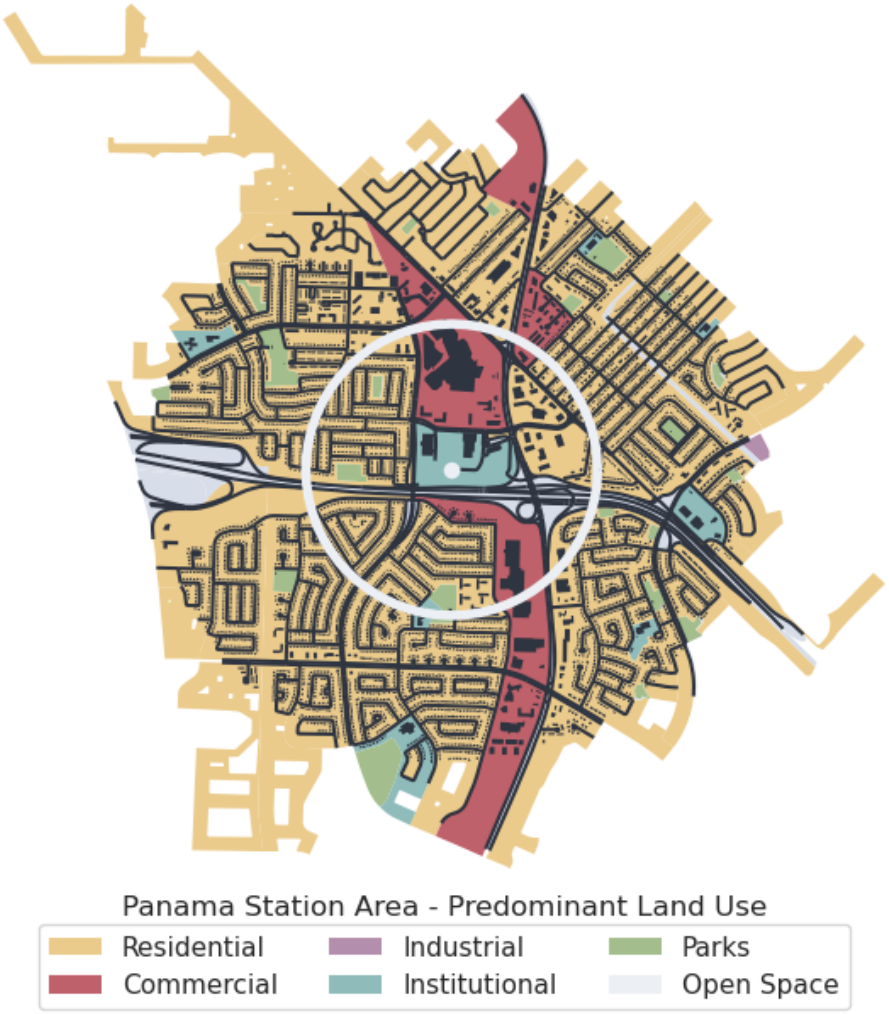
These trips fall into two main classifications:

Internal Trips: Trips that begin and end within the station area, such as a resident shopping at a local grocery store. These represent “internal capture”, where mixed-use development both generates and satisfies travel demand locally.

External Trips: Trips that either originate in the station area and leave, or start outside the station area and end inside. For example, a local resident visiting a doctor outside the station area or a non-resident commuter travelling into the station area for work.



The station area already exhibits a high walking rate for internal trips due to its existing mix of uses. Further intensifying the density and adding more commercial and mixed-use buildings in both scenarios is projected to boost the walk share by about 15% and 20% respectively between the two scenarios. Internal capture improves as residential growth boosts trip generation and commercial uses enable those trips to be completed locally. Visitors arriving by car or transit can also walk between locations within the station area. Critically, MXDs don't exist in isolation, their benefits extend regionally through transit connections, enabling easy access from adjacent neighbourhoods and other transit-served areas.



Key Takeaways

1. Mixed-use development significantly reduces vehicle trips compared to typical suburban developments.
2. Mixed-use developments influence travel behaviour beyond their boundaries, shifting mode share for nearby residents and encouraging regional transit use.
3. Incorporating affordable housing within mixed-use developments can greatly enhance accessibility for disadvantaged residents.