Locating Charging Stations

Identifying zones for early deployment in the GTHA using real-world truck data

July 2025

Chandan Bhardwaj

PEMBINA Institute

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The Pembina Institute
#802, 322 – 11 Avenue SW
Calgary, AB T2R 0C5
403-269-3344

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These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

Contents

Figures

Tables

Executive summary

Having adequate charging infrastructure is critical to shifting medium- and heavy-duty vehicles (MHDVs) from fossil fuels to electricity. However, the deployment of public electric vehicle (EV) charging stations accessible to MHDVs in Canada has been slow.

Jurisdictions across the country need a long-term strategy to develop such stations. A phased approach — starting with initial establishment at high-traffic sites, followed by a broader rollout across the country — can help streamline the process. Early identification of candidate locations for initial charging station deployment is, therefore, a critical first step.

This analysis presents a data-driven approach to identify candidate locations or zones for early EV charging station deployment. Using telematics data on the daily movement patterns of Class 3 to 8 trucks and vans, we assessed traffic volume, stop duration and the frequency of daytime stops. To account for seasonal variation in vehicle behaviour, we analyzed data from both winter and summer months. Our analysis focused on the five most populated municipalities in the Greater Toronto and Hamilton Area, though the framework can be extended to other jurisdictions.

We observed significant variation in traffic volume across municipalities, with significant clustering within them. In fact, just 10% of forward sortation areas (geographic areas based on the first three characters of a postal code) account for 50% of total vehicle activity — suggesting that strategically located charging stations could serve a vast majority of the truck population.

Average daytime stop durations were approximately 30 minutes or more across municipalities and MHDV classes. This indicates that, using existing charging technology, most vehicles could fully (or almost fully) charge during a typical stop if needed. Though consistent with existing literature, we assume that truck operators will use daytime stops primarily for opportunity charging, relying on overnight charging to satisfy the bulk of their daily energy needs.

By combining insights on traffic volume, stop duration and stop frequency, we identified high-potential forward sortation areas for early deployment of charging stations available to MHDVs:

- five in Toronto: M9W, M9V, M9L, M3J, M4M
- three in Brampton: L6S, L6T, L6W
- four in Hamilton: L0R, L8H, N0B, L8E
- three in Mississauga: L4T, L5W, L4W
- two in Markham: L3T, L6G

These findings have important policy implications. Municipalities can use this analysis to identify "priority zones" for early public charging station deployment and to streamline regulatory approvals. Utilities can leverage localized traffic and vehicular behaviour data to prioritize grid upgrades in areas with the greatest potential for electric MHDV adoption.

1. Introduction

Electric medium- and heavy-duty vehicles (MHDVs) offer a promising pathway for decarbonizing Canada's busy freight sector. These vehicles reduce local diesel-related air pollution since they produce zero tailpipe emissions. They are also more energy efficient, saving operators thousands of dollars in fuel and maintenance costs. Beyond environmental and operational benefits, in Ontario electrification presents an opportunity to revitalize its stagnating automobile manufacturing sector by shifting production toward electric vans and trucks. Between 2014 and 2024, total vehicle production in Canada (majority of which happens in Ontario), which has largely focused on producing vehicles powered by diesel and gasoline, has declined by more than 50%.[1] In contrast, global demand for electric vehicles is rising rapidly, with electric truck sales growing by nearly 80% in 2024.[2] To align with this global shift, Ontario could accelerate its transitions toward electric vehicle manufacturing and adoption, attracting new investment and creating thousands of local jobs.

Having adequate charging infrastructure is critical for enabling this transition. While some MHDV drivers, owners and operators may rely primarily on private depot charging, many will need access to publicly available or shared access EV charging stations.[3] In a 2023 survey by National Resources Canada, 79% of MHDV operators identified lack of charging infrastructure as a key barrier to adoption.[4] Public EV charging stations are particularly important for small fleet operators, who often lack the space or funds to install private charging stations.

The rollout of public EV charging stations suitable for MHDVs in Canada, however, remains slow.[5] For example, Ontario currently has fewer than 20 public charging stations that can accommodate medium-duty vehicles (Classes 3 to 6) and three charging stations that can

[1] International Organization of Motor Vehicle Manufacturers, "Production Statistics", https://www.oica.net/category/production-statistics/2024-statistics/

[2] International Energy Agency, "Global EV Outlook 2025", March 2025. https://www.iea.org/reports/global-ev-outlook-2025/trends-in-heavy-duty-electric-vehicles

[3] Our definition of "public charging" encompasses any charging that is off-site or not owned by the fleet. This includes the option for dedicated or shared charging which may not be publicly accessible to anyone/everyone. Though we do not delve into the details of the distinction between pure public charging and shared charging in this study.

[4] Abacus Data, *Medium and Heavy-Duty Vehicles (MHDV) Fleet Awareness, Knowledge and Attitudes Related to Zero-Emission Vehicles (ZEVs) Survey*, prepared for Natural Resources Canada (2023). https://publications.gc.ca/collections/collection_2023/rncan-nrcan/M4-234-2023-eng.pdf

[5] Office of the Auditor General of Canada, *Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: The Zero Emission Vehicle Infrastructure Program—Natural Resources Canada* (2023), 10. https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202311_08_e.pdf

accommodate heavy-duty vehicles (Classes 7 and 8).[6] Of these, only five stations include fast chargers; the rest are equipped with slower chargers.[7] Further, in the Greater Toronto and Hamilton Area (GTHA), there are just four public fast charging stations for medium-duty vehicles and one for heavy-duty vehicles (Figure 1). For context, a 2024 Natural Resources Canada study estimated that Ontario would need 1,555 public MHDV fast chargers by 2025.[8] Assuming an average of four chargers per station,[9] this implies a need for about 400 fast public EV charging stations — compared to just 20 available today.

Figure 1. Public fast charging stations accessible to medium-duty vehicles (green dots) and heavy-duty vehicles (red dot) in and around the GTHA as of June 12, 2025.

Data source: Government of Canada

The slow deployment of public charging infrastructure is often due to lengthy regulatory approvals and extended timelines for connecting stations to the electricity grid.[10] Accelerated

[6] Government of Canada, "Zero-emission vehicle charging stations." https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/zero-emission-vehicle-charging-stations#/analyze?country=CA&region=CA-ON&tab=station&fuel=ELEC&maximum_vehicle_class=MD

[7] Due to their larger battery size, electric MHDVs need chargers with higher power output Public charging stations with lower power output chargers (<50 kW), which are suitable for light-duty vehicles and are more common, are not suitable for MHDVs. Each public charging station can have multiple chargers (or charging ports). Typically, one electric MHDV connects to one charger during the charging process.

[8] Dunsky Energy + Climate, "Electric vehicle charging infrastructure for Canada," prepared for Natural Resources Canada, February 2024, Table 44. https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/resource-library/electric-vehicle-charging-infrastructure-canada#a35

[9] "Electric vehicle charging infrastructure for Canada," section 3.4.2.

[10] Chandan Bhardwaj, *Helping Fleets Charge: Barriers and solutions to charging electric medium- and heavy-duty vehicles in Ontario* (Pembina Institute, 2024). https://www.pembina.org/pub/helping-fleets-charge

deployment will require advance planning by policy-makers and municipalities,[11] streamlined connection protocols from energy regulators, proactive investment from utilities, and early site development applications by station and network operators.

A phased approach — starting with early deployment of charging infrastructure at high traffic zones followed by a broader rollout — can help boost the adoption of electric MHDVs by:

- supporting faster permitting
- improving charging station utilization rates
- helping utilities plan and prepare for grid impacts

Some jurisdictions in Canada and elsewhere have already adopted phased approaches for charging infrastructure deployment. For example, through its Go Electric Public Charging and Hydrogen Fuelling Infrastructure Program, the Government of British Columbia has outlined a core network of fast charging stations for geographic connectivity.[12] BC Hydro, the province's electric utility, has also published a map of planned public EV charging station locations.[13] In the U.S., several government agencies have jointly developed the National Zero-Emission Freight Corridor Strategy.[14] This strategy sets out a phased approach to deploying charging stations. The first phase (2024–2027) involves identifying key high freight traffic sites that are best suited for early deployment of EV charging stations for fleets. Similarly, the European Union has adopted a phased approach of deploying fast public EV charging stations along key corridors and highways across European cities. In October 2022, the European Parliament passed the Alternative Fuels Infrastructure Regulation, which mandates infrastructure deployment for both battery-electric and fuel cell–electric heavy-duty vehicles along the Trans-European Network (a network of key highways connecting major European cities).[15]

In this report, we present a framework — grounded in real-world truck travel data — to identify priority zones for early deployment of public charging stations for MHDVs. We focus on the five

[11] Chandan Bhardwaj, "Charging solutions for electric fleets: Experts offer key insights on navigating the roadblocks to infrastructure," *Pembina Institute*, July 2024. https://www.pembina.org/blog/charging-solutions-electric-fleets

[12] Government of British Columbia, "Go Electric Public Charging and Hydrogen Fuelling Infrastructure." https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/clean-transportation-policies-programs/clean-energy-vehicle-program/dcfc-program

[13] BC Hydro, "Map of current and upcoming EV fast charging stations." https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/electric-vehicles/ev-current-upcoming-stations-map.pdf

[14] Kang-Ching Chu et al., *National Zero-Emission Freight Corridor Strategy* (U.S. Joint Office of Energy and Transportation, 2024). https://driveelectric.gov/files/zef-corridor-strategy.pdf

[15] European Commission, "European Green Deal: ambitious new law agreed to deploy sufficient alternative fuels infrastructure," March 28, 2023. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1867

most populated municipalities in the GTHA. Our framework can be applied in other regions across Canada to develop a phased approach to electric MHDV charging infrastructure.

2. Methodology and data

2.1 Previous research

Various approaches for selecting public charging sites are discussed in the academic literature.[16] Common approaches include computer simulations of traffic flows and travel surveys. However, both have known limitations related to scalability, accuracy and costs.[17] In contrast, an activity-based approach, which uses real-world vehicle movement data, is considered more comprehensive. This approach better represents drivers' charging needs and can capture the variability in true truck-driving behaviour within a region, which simulations or traffic surveys cannot. An activity-based approach also covers the full scope of a vehicle's activity during the study period, including origin, destination, distance travelled, routes taken and dwell times. This allows for identifying optimal charging locations based on actual usage patterns.[18]

In one notable example of an activity-based approach, a large-scale dataset covering 11,880 taxis in Beijing over one month was examined to study how travel patterns affected charging infrastructure needs.[19] The site selection criteria for public charging stations included total number of parking events within one mile of the site, average vehicle-hours per day at the site, and average vehicle-hours per vehicle at the site. Other studies adopting data-driven, activity-based approaches have used similar criteria for charging station site selection. Choosing

[16] Marc-Olivier Metais et al. "Too much or not enough? Planning electric vehicle charging infrastructure: A review of modeling options," *Renewable and Sustainable Energy Reviews* 153 (2022), 111719. https://www.sciencedirect.com/science/article/pii/S136403212100993X#b94

Fang He, Di Wu, Yafeng Yin, and Yongpei Guan, "Optimal deployment of public charging stations for plug-in hybrid electric vehicles," *Transportation Research Part B: Methodological* 47 (2013), 87–101. https://www.sciencedirect.com/science/article/pii/S0191261512001336#b0060

T. Donna Chen, Kara M. Kockelman, and Moby Khan. "The electric vehicle charging station location problem: A parking-based assignment method for Seattle," in *Proceedings of the 92nd Annual Meeting of the Transportation Research Board,* Washington, D.C., January 2013. https://www.researchgate.net/profile/T-Donna-Chen/publication/269854065_Locating_Electric_Vehicle_Charging_Stations/links/55dcc0de08aeb41644aeca94/Locating-Electric-Vehicle-Charging-Stations.pdf

[17] Mohammad M. Vazifeh, Hongmou Zhang, Paolo Santi, and Carlo Ratti. "Optimizing the deployment of electric vehicle charging stations using pervasive mobility data." *Transportation Research Part A: Policy and Practice 121* (2019), 75–91. https://www.sciencedirect.com/science/article/pii/S0965856417300010

[18] Marc-Olivier Metais et al. "Too much or not enough? Planning electric vehicle charging infrastructure: A review of modeling options," *Renewable and Sustainable Energy Reviews* 153 (2022), 111719. https://www.sciencedirect.com/science/article/pii/S136403212100993X

[19] Hua Cai et al. "Siting public electric vehicle charging stations in Beijing using big-data informed travel patterns of the taxi fleet," *Transportation Research Part D: Transport and Environment* 33 (2014), 39–46. https://www.sciencedirect.com/science/article/abs/pii/S1361920914001291

appropriate criteria can help in selecting sites that will minimize stress on the power grid,[20] improve charger utilization,[21] and not create traffic or parking issues. Building on the Beijing study, we developed our own set of criteria for identifying suitable zones for deploying public charging stations for MHDVs.

2.2 Criteria used for zone selection

Several factors influence whether a location is suitable for installing a public charging station. We used the following three criteria in our selection process:

1. Traffic volume

This can be measured by the total number of stopping events at the site per day (or per hour), and by the number of vehicles stopping at the site per day (or per hour).[22] We used a threshold of 50 vehicles per hour. Only zones where the number of unique vehicles stopping exceeded this were considered for selection.

2. Daytime stop duration

To ensure that fleet operators can charge their vehicles without significantly altering their operations, we only considered stops already occurring along existing routes. Sites had to have an average stop duration of 30 minutes or more during the daytime (8:00 a.m. to 5:00 p.m.). According to a 2024 study by Natural Resources Canada, the average MHDV battery size is 179 kWh.[23] With fast chargers offering 350 kW output (or higher), a 30-minute stop allows for substantial charging, supporting vehicle electrification without major changes to fleet behaviour. We acknowledge that operational constraints (e.g., engagement in other activities such as loading and unloading) may limit the vehicles' ability to charge during a typical stop. While this is beyond the scope of the current work, future analyses will examine how the operational characteristics of different vehicle use cases affect charging behaviour.

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[20] Dale Hall and Nic Lutsey, *Emerging best practices for electric vehicle charging infrastructure* (International Council on Clean Transportation, 2017), 31. https://theicct.org/wp-content/uploads/2021/06/EV-charging-best-practices_ICCT-white-paper_04102017_vF.pdf

[21] "Siting public electric vehicle charging stations in Beijing using big-data informed travel patterns of the taxi fleet."

Dario Pevec et al. "A data-driven statistical approach for extending electric vehicle charging infrastructure," International Journal of Energy Research 42, no. 9 (2018), 3102–3120. https://onlinelibrary.wiley.com/doi/abs/10.1002/er.3978

[22] A vehicle may have multiple stop events at a site. The number of stopping events captures the aggregate of all stop events by all vehicles, while the number of vehicles stopping captures the number of unique vehicles stopping at the site.

[23] Government of Canada, "Electric vehicle charging infrastructure for Canada," February 2024. https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/resource-library/electric-vehicle-charging-infrastructure-canada

3. Distribution of stop events

A 2023 study by the U.S. National Renewable Energy Laboratory found that public charging station usage typically follows an inverse U-shaped curve, with peak utilization during midday and lower usage in the early morning and evening.[24] The Ontario Energy Board used similar assumptions in a 2025 analysis on electricity pricing.[25] Following this pattern, we prioritized zones where stop events follow this distribution, peaking around noon and tapering off outside standard daytime hours, as these sites align with typical public charging demand.

Zones that met all three criteria were considered good candidates for public fast charging stations. Among these, a short list of top-performing zones within each municipality was created for early implementation.

2.3 Data

Our analysis drew on anonymized telematics data that captures detailed truck travel behaviour. Approximately 50% of trucks in Canada are equipped with telematics devices that collect real-time data on vehicle location, speed and internal systems such as engine performance and fuel use. We partnered with Altitude by Geotab, which manages roughly 250,000 telematics units in light-, medium- and heavy-duty vehicles across Canada. Our dataset covered two one-month periods, January 2023 and July 2023, to reflect potential seasonal variations in travel patterns.

To capture the variation in driving behaviour across different vehicle types, we analyzed data for MHDVs in Classes 3 to 8 across various industry sectors. Geographically, we focused on the five most populous municipalities in the GTHA: the city of Brampton, city of Mississauga, city of Toronto, town of Markham and city of Hamilton.

To capture local variation, we did our analysis at the forward sortation area (FSA) level.[26] Canada has about 1,600 FSAs,[27] with roughly 500 in Ontario and 95 in Toronto alone. FSAs vary in size, though typically range between 10 km^2 to 36 km$^{2.}$ Data extraction and analysis were performed using Altitude by Geotab's analytics platform.

[24] Referred to as an n-shaped curve in: Ewan Pritchard, Brennan Borlaug, Fan Yang, and Jeff Gonder, "Evaluating electric vehicle public charging utilization in the United States using the EV watts dataset," preprint, presented at the *36th Electric Vehicle Symposium and Exposition, Sacramento, California, June 11–14, 2023* (National Renewable Energy Laboratory). https://www.nrel.gov/docs/fy24osti/85902.pdf

[25] Ontario Energy Board, "Additional Consultant Analysis." https://engagewithus.oeb.ca/ev-integration

[26] An FSA is a geographical area based on the first three characters of a postal code.

[27] Statistics Canada, "Forward Sortation Area Boundary File, Reference Guide, Census year 2016," September 13, 2017. https://www150.statcan.gc.ca/n1/pub/92-179-g/92-179-g2016001-eng.htm

2.4 Limitations

- This analysis is based on telematics data from January 2023 and July 2023, and represents a subset of the total vehicle population. As a result, it may not fully capture all behavioural patterns in truck travel.
- The criteria used for zone selection only covered vehicle travel behaviour. Future analyses may consider additional criteria, such as real estate or other financial costs, environmental concerns, and connectivity to existing grid infrastructure.

3. Results

3.1.1 Traffic volume

Table 1 depicts the number of stopping events during a typical day for different MHDV types across the five municipalities. The results show significant regional variation, with Toronto experiencing ten times more stopping events than Markham. This disparity is largely uniform across vehicle classes.

Table 1. Average number of vehicle stopping events per day, by MHDV class and GTHA municipality

Class	Toronto	Brampton	Mississauga	Hamilton	Markham
3	9,901	1,352	2,888	5,610	1,296
4	3,078	685	1,505	1,115	172
5	8,270	974	2,877	2,759	590
6	3,546	853	1,966	1,446	411
7	4,846	1,005	2,910	1,732	337
8	22,451	9,118	14,214	8,604	2,673

Table 2 depicts the number of unique vehicles stopping per day in each municipality. The trend in vehicle counts closely mirrors the trend in Table 1. Denser areas such as Toronto and Hamilton have significantly more stopping vehicles compared to less dense regions like Markham. Again, this variation is generally consistent across the different MHDV classes.

Table 2. Average number of vehicles stopping daily, by MHDV class and GTHA municipality

Class	Toronto	Brampton	Mississauga	Hamilton	Markham
3	760	167	358	527	126
4	185	39	86	56	23
5	820	156	403	410	134
6	448	170	352	288	98
7	752	256	563	373	122
8	3,081	1,830	2,519	1,325	567

The regional disparity in truck travel activity becomes even more pronounced at the FSA level, with the number of vehicles stopping concentrated in a few FSAs within each municipality. This is discussed in section 3.1.4.

3.1.2 Daytime stop duration

Table 3 depicts average stop durations for each stop event across the five municipalities, broken down by MHDV class. On average, MHDVs remain at each stop location for 30 to 60 minutes. Overall, stop durations are consistent across the five municipalities and vehicle classes.

Some regional disparities, however, are apparent at the more granular FSA level. The average stop duration exceeds 30 minutes in 60% of FSAs in Toronto, 65% in Brampton, 70% in Mississauga, 65% in Hamilton and 75% in Markham. Despite these disparities, what the findings reveal is that in more than 60% of FSAs in the GTHA, average daytime stop durations are long enough to fully (or nearly fully) charge the average electric MHDV with a 350 kW fast charger.

Table 3. Average daily daytime vehicle stop duration (in minutes), by MHDV class and GTHA municipality

Class	Toronto	Brampton	Mississauga	Hamilton	Markham
3	40	39	32	28	30
4	42	25	33	25	32
5	37	60	47	34	40
6	45	60	33	44	36
7	40	44	52	52	41
8	50	35	47	38	44

3.1.3 Distribution of stop events

As discussed in the methodology section, actual data from charging stations shows that electric MHDV charging typically follows an inverse U-shaped distribution. Thus, public charging stations are likely to see higher utilization rates at locations where stop events are shorter, more frequent and concentrated during the middle of the day.

Figures 2 to 6 illustrate the distribution of stop events for each of the five selected GTHA municipalities. Stop frequency is low before 8:00 a.m., increases throughout the day, peaks around noon and then declines significantly after 5:00 p.m. This pattern is consistent across the municipalities, vehicle classes and, with minor variations, within most FSAs in each municipality. This suggests that the distribution of stop events is not a limiting factor for site selection as most locations show the same inverse U-shaped distributions. As such, regions with the highest daytime stop frequency can be prioritized for early deployment of public charging stations.

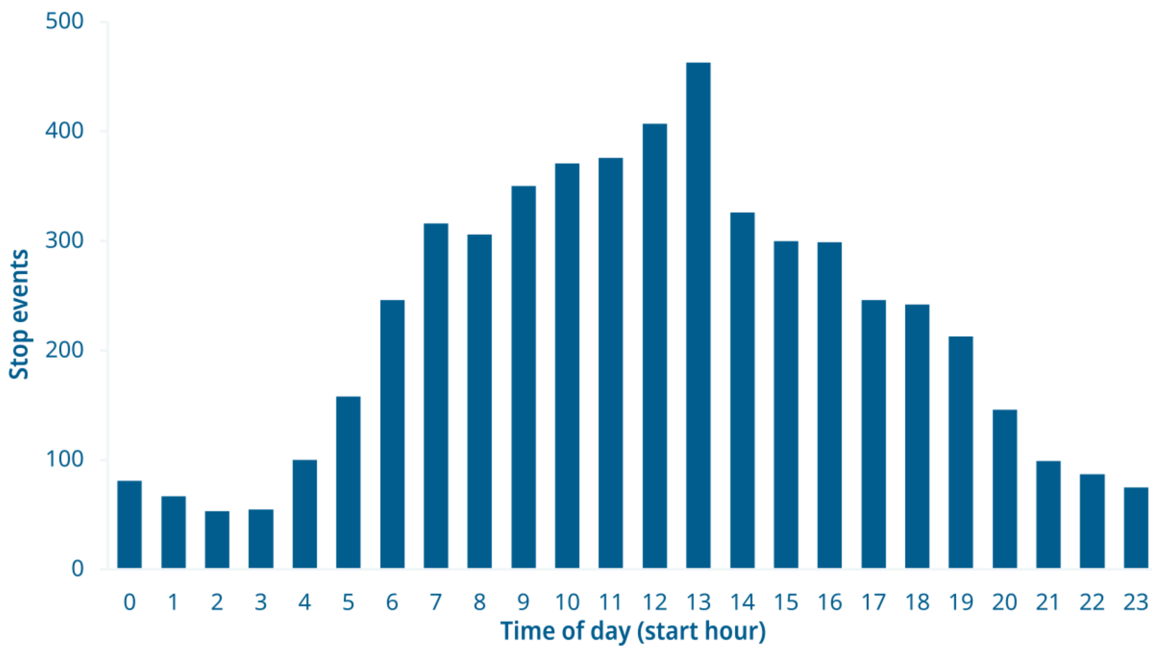

Figure 2. Distribution of daily stop events in Toronto

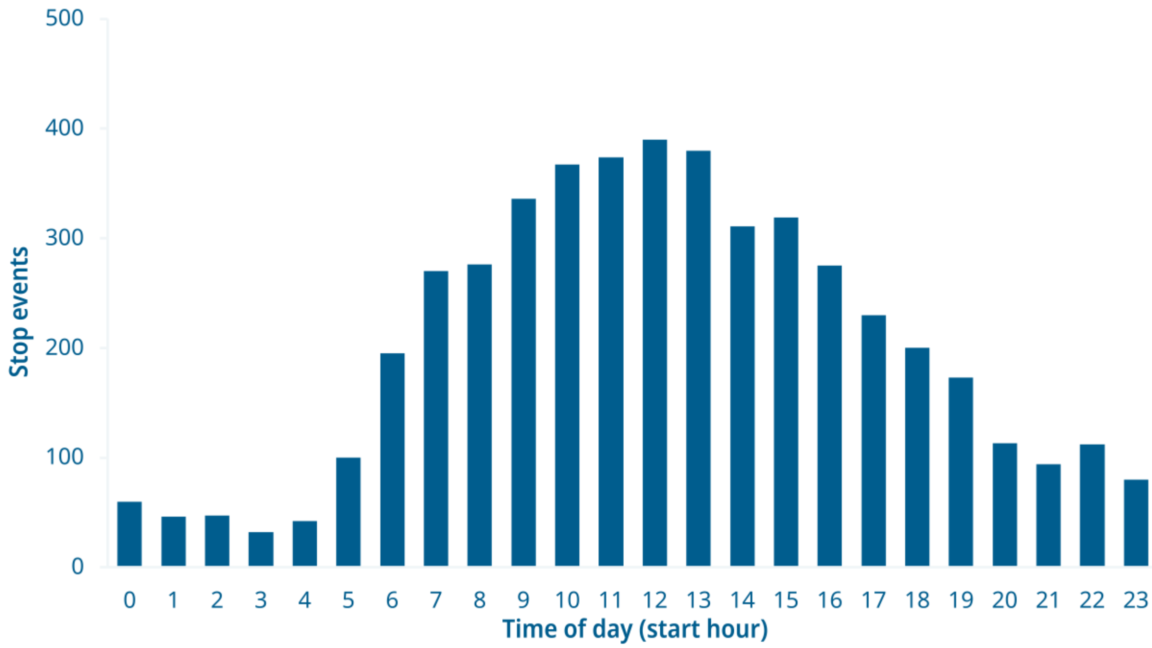

Figure 3. Distribution of daily stop events in Brampton

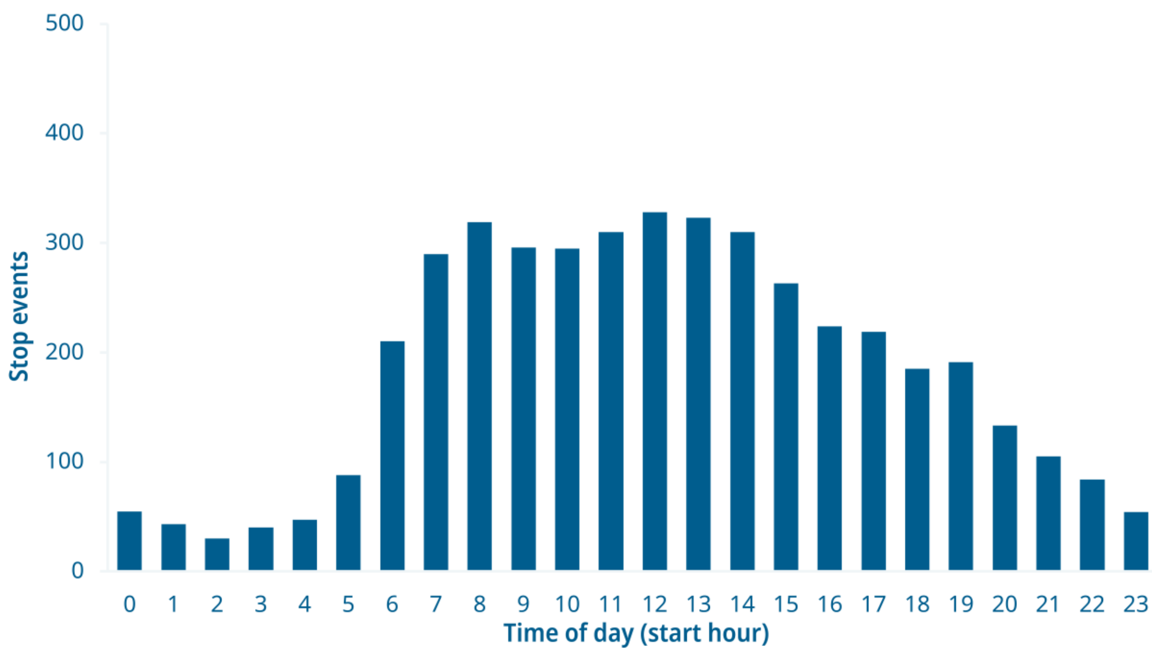

Figure 4. Distribution of daily stop events in Mississauga

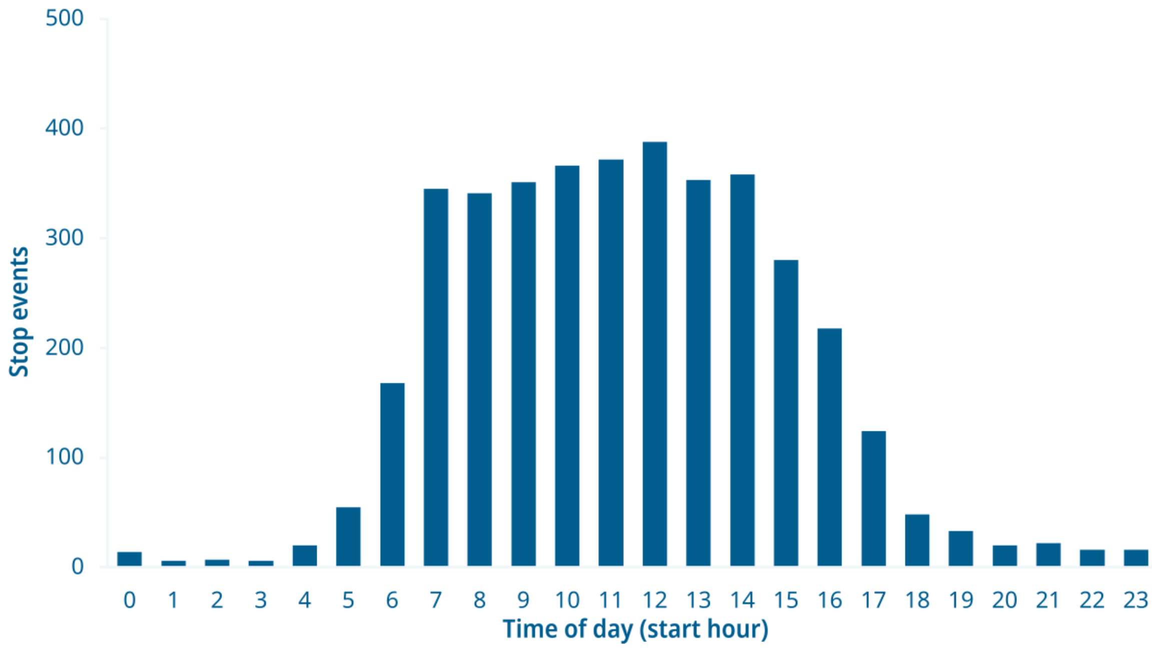

Figure 5. Distribution of daily stop events in Hamilton

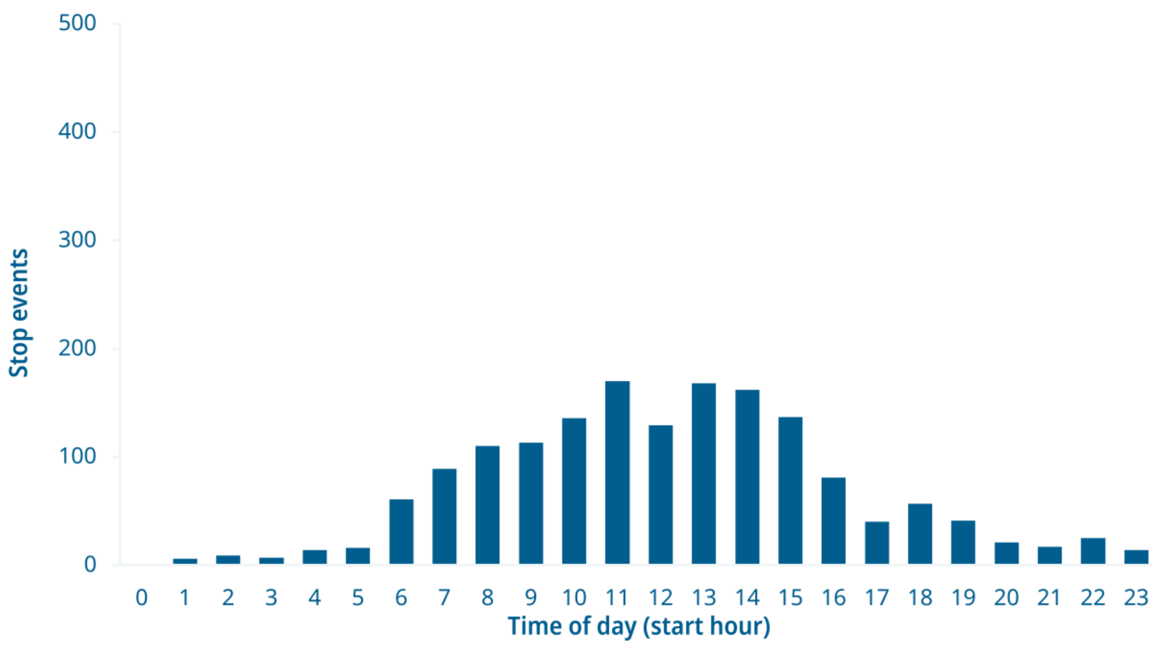

Figure 6. Distribution of daily stop events in Markham

3.1.4 Priority zones

We identified FSAs that satisfied the following three criteria for early deployment of public charging stations:

- More than 50 vehicles stop per hour between 8 a.m. and 5 p.m.

- The average daytime stop duration is 30 minutes or longer.
- The distribution of stop events follows an inverse U-shaped curve.

A small subset of FSAs in each municipality satisfied all three criteria, ranging from 20% of FSAs in Toronto to 35% in Markham. Within this subset, vehicle activity was more concentrated in a few FSAs. Less than a handful of FSAs accounted for around 50% of daily vehicle stops in their respective municipalities, making them strong candidates for early investment in charging infrastructure. For example, in Toronto, five FSAs accounted for about half of all vehicle stops across the 95 FSAs in the city, and in Brampton, 63% of all vehicle stops on a typical day occurred in just three FSAs.

This regional disparity suggests that strategically placing fast public charging stations at select sites could effectively serve a significant portion of the vehicle population, without requiring that charging stations be uniformly distributed across the province. In Canada, fast public EV charging stations have low utilization rates of just 5–6.5%.[28] Installing public charging stations in these high traffic zones would increase the likelihood of high utilization rates.

Table 4 sets out priority FSAs for deploying public charging stations.

Table 4. List of FSAs identified for early deployment of public charging stations, by GTHA municipality

Toronto	Brampton	Mississauga	Hamilton	Markham
M9W	L6S	L4T	L0R	L3T
M9V	L6T	L5W	L8H	L6G
M9L	L6W	L4W	N0B	
M3J			L8E	
M4M				

[28] Power Advisory, *Electric Delivery Rates for Electric Vehicle Charging*, prepared for the Ontario Energy Board (2023), 6. https://engagewithus.oeb.ca/ev-integration/news_feed/delivery-costs-report

Government of Canada, "Electric vehicle charging infrastructure for Canada," Table 31. https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/resource-library/electric-vehicle-charging-infrastructure-canada#bb

Chandan Bhardwaj, *Helping Fleets Charge* (Pembina Institute, 2024). https://www.pembina.org/pub/helping-fleets-charge

Figures 7 to 11 show maps of each municipality, with shaded hexagons indicating priority zones for public charging stations.[29] These zones meet all three selection criteria of traffic volume, stop duration and frequency of stops.

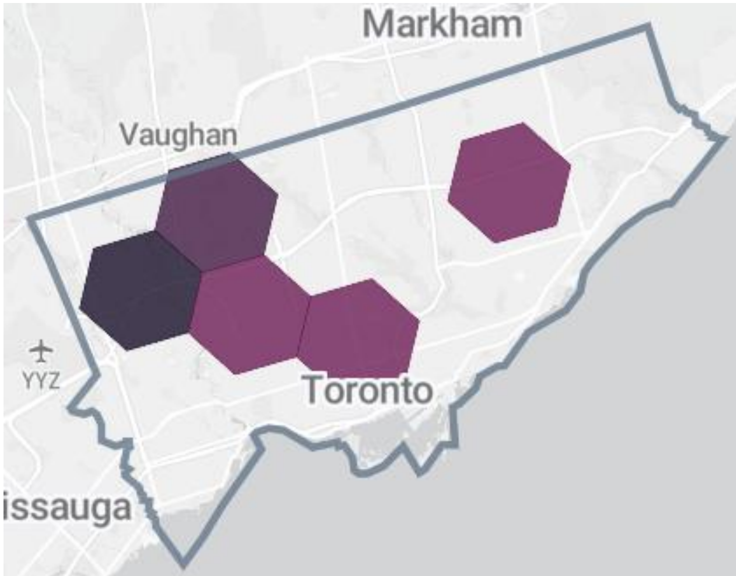

Figure 7. Priority zones (hexagons) for early deployment of public EV charging stations in Toronto

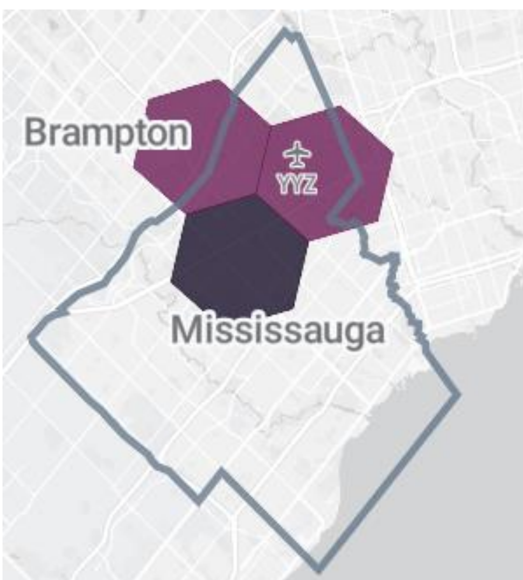

Figure 8. Priority zones (hexagons) for early deployment of public EV charging stations in Mississauga

[29] The area of each selected zone (hexagon) in Figures 7 to 11 is about 36 km². Future analyses with more granular data can allow us to zoom in to locate / identify zones less than 1 km². The figures were generated using Altitude by Geotab.

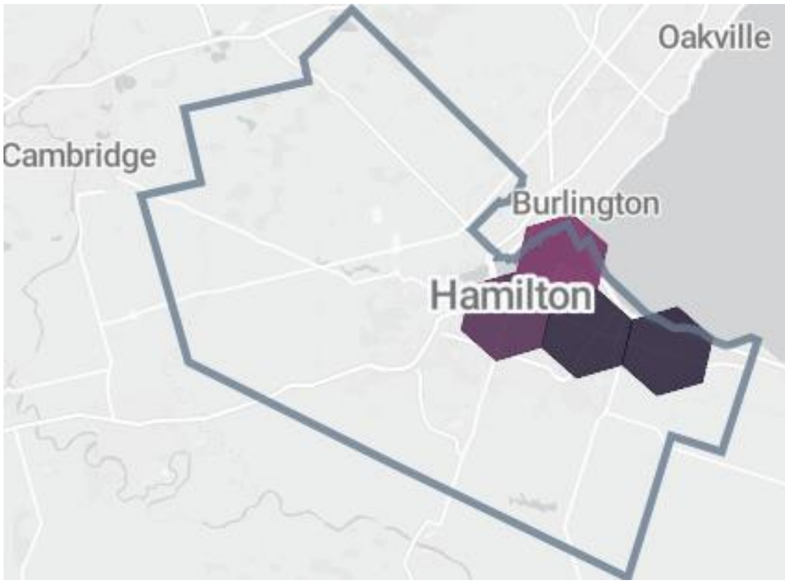

Figure 9. Priority zones (hexagons) for early deployment of public EV charging stations in Hamilton

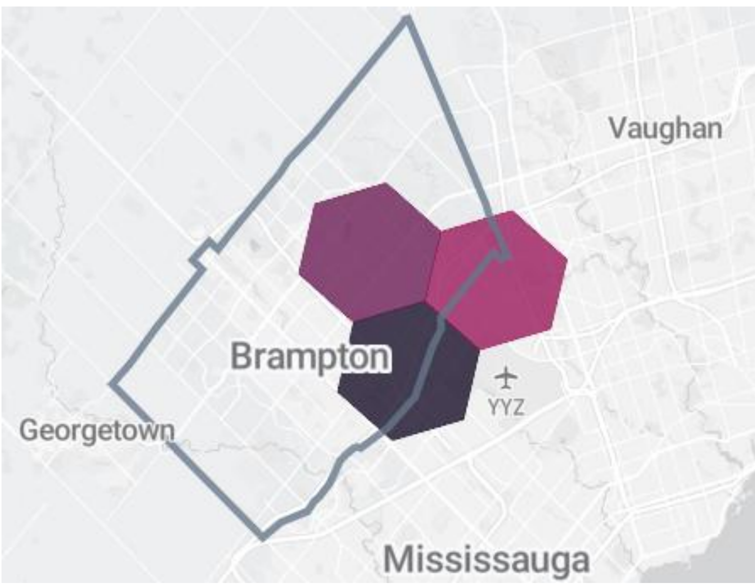

Figure 10. Priority zones (hexagons) for early deployment of public EV charging stations in Brampton

Figure 11. Priority zones (hexagons) for early deployment of public EV charging stations in Markham

3.1.5 Discussion/Policy implications

Our findings can help municipalities, utilities and regulators accelerate public charging station deployment.

Municipalities – Municipal governments play a primary role in granting approvals and permits for charging station installations. As we noted in a previous report, permitting delays are a significant barrier to timely deployment.[30] Municipalities can follow the approach we set out above to identify "priority zones." They could then streamline the permitting process for charging stations in those areas.

Utilities – Electrical upgrades such as installing new transformers, feeder circuits or distribution lines can be time intensive and costly. Our analysis identifies regions with high vehicle stop frequency, and in turn zones that are candidates for early deployment of public charging stations. With greater insight into where charging stations will likely be concentrated, utilities can prioritize investments in grid infrastructure in those areas. Our current analysis can support utilities within the GTHA in deciding on where to make near-term upgrades and determining where more localized assessments of future charging demand might be warranted.

[30] *Helping Fleets Charge*.

Energy regulators – Energy regulators set electricity prices for different consumer segments, including operators of public charging stations. As an example, the Ontario Energy Board recently initiated a consultation process to design electricity rates for public charging stations in Ontario. A study commissioned by the Ontario Energy Board to inform electricity price design shows that electricity pricing impacts monthly expenditures for public charging station owners differently, depending on charger utilization and location.[31] The study finds that public EV charging stations with high utilization are less affected by rate fluctuations, while those in rural areas are generally more sensitive to electricity prices than those in urban centres. Our analysis shows how traffic volume and, in turn, charger utilization could vary by region. Energy regulators could use a similar approach to select regions of high (or low) utilization rates, which in turn could be used to design customized electricity delivery rates for public charging stations in different regions (e.g. rural versus urban).

[31] *Electric Delivery Rates for Electric Vehicle Charging*, 7.

4. Conclusion

In Canada, as in Ontario, deployment of public charging stations suitable for MHDVs remains low. A targeted/phased deployment strategy — focusing on a few high-potential locations — can help improve utilization rates and streamline the process of deploying charging stations. This approach is preferable to deploying fast public charging stations uniformly across the region, which can lead to underused stations and slow infrastructure build-out, especially in the early stages.

In our study, we undertook a data-driven approach to identifying locations suitable for early deployment of public charging stations in the five most populated municipalities in the GTHA. We found the following:

- Traffic volume varies significantly across municipalities and within individual FSAs. For example, the number of daily stops in Toronto is about ten times higher than in Markham. Moreover, traffic volume is concentrated in a few key areas — just 10% of FSAs account for 50% of vehicular movement, indicating that establishing public charging stations in high-potential zones can serve a vast majority of the truck population.
- Average daytime stop durations are 30 minutes or longer across municipalities and vehicle classes. This suggests that most vehicles can fully (or almost fully) charge during typical stops using current fast charging technology.
- Vehicle stop events are more frequent during daytime hours in many FSAs, making these areas well-suited for public charging stations.

Applying the criteria of high traffic volumes, average stop durations compatible with fast charging technology, and frequent daytime stop events, we identified the following zones for early deployment of public charging stations:

  - Toronto: M9W, M9V, M9L, M3J, M4M
  - Brampton: L6S, L6T, L6W
  - Hamilton: L0R, L8H, N0B, L8E
  - Mississauga: L4T, L5W, L4W
  - Markham L3T, L6G

4.1 Next steps

We focused our work at the municipal and FSA level, with zones around 36 km^2 in size. With access to more granular data, we could delineate zones less than 1 km^2 for more precise siting of charging stations. Figure 12 provides examples of these smaller deployment zones within one of Toronto's busiest FSAs. Higher-resolution data can improve the accuracy and specificity of siting recommendations, enabling a more strategic and efficient rollout of public charging stations. Our future work will involve expanding our approach to other jurisdictions in Canada and using more detailed data to provide siting recommendations at a sub-FSA level.

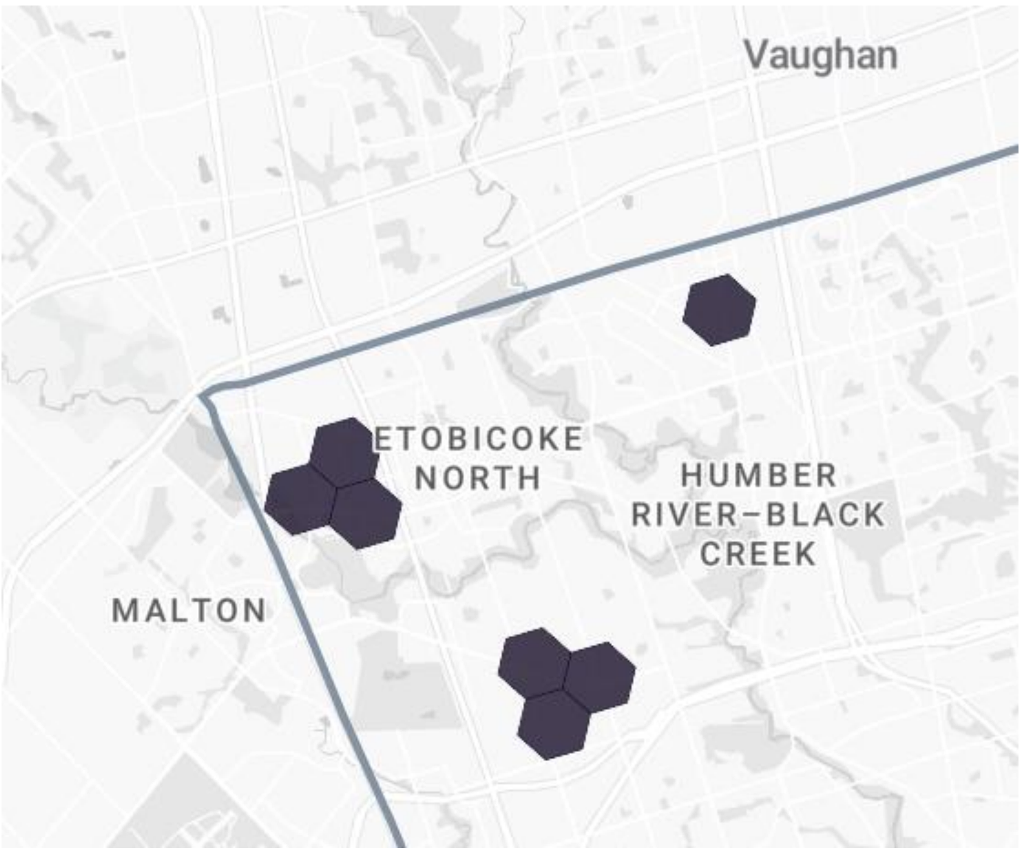

Figure 12. Illustrative example showing priority zones (hexagons) for early deployment of public charging stations within one of Toronto's busiest FSAs.

Photo: iStock.com/hstiver

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