Goods Movement White Paper

Ver02

Vaughan Transportation Plan

City of Vaughan, ON

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1 Introduction

The City of Vaughan is developing a new Vaughan Transportation Plan, which will update the City's Transportation Master Plan and develop a blueprint for moving people and goods sustainably for the next 20 years and beyond. This white paper contains a summary of a best practices and potential strategies to support the City of Vaughan's goods movement planning efforts.

2 Background

The City of Vaughan is an attractive location for freight and freight dependent companies. According to the City's Economic and Cultural Development department, Vaughan's freight dependent construction, manufacturing, transportation and warehousing and wholesale trade industry sectors have a location quotient above 1.2[1]. Location quotients compare the concentration of an industry within a specific area to the concentration of that industry nationwide. An industry with a location quotient above 1.2 is deemed to have a significant concentration.

Key attributes that attract freight related businesses to Vaughan include:

- Proximity to population and commerce centers
- Proximity to intermodal rail facilities
- Access to Pearson International Airport and international and domestic air cargo services
- Access to highway networks, including border crossings with the U.S.

A byproduct of a concentration of these industries, is a high volume of truck movement. As shown in **Figure 1** and **Figure 2**, truck activity is focused on key routes in the City, such as east-west roads Highway 7, Langstaff Road (RR 72), and Rutherford Road (RR 73), and north-south roads Keele Street (RR 6) and Highway 50 (RR 50). **Appendix A** illustrates the key freight related highway networks and their relationship with land uses in the City of Vaughan.

At the same time, the City of Vaughan is forecast to grow significantly over the next 30 years from well over 300,000 people and 200,000 jobs today to 560,000 people and 350,000 jobs by 2051 (York Region Draft Municipal Comprehensive Review). About 56% of this growth will occur in existing built-up areas where much of this growth will result in significant intensification and transit-oriented density. In many parts of the City, the prevailing automobile-oriented built-form which also facilitates goods movement is envisioned to change to support this growth by prioritizing pedestrians, cyclists, and transit.

[1] Vaughan Economic and Cultural Development

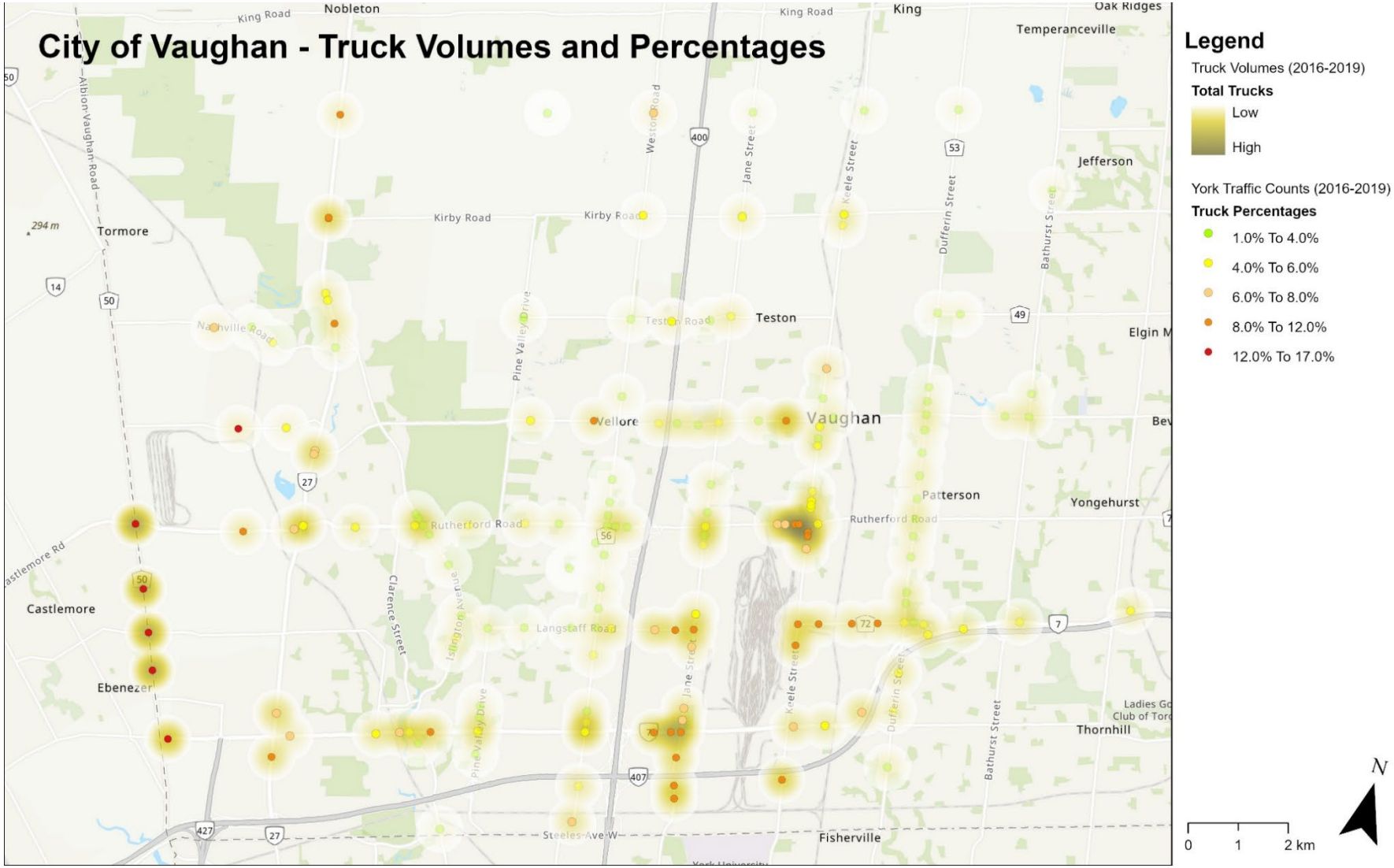


Figure 1. Truck Volumes

Figure 2. Truck Volumes on Regional Roads

3 Context of Public Sector Freight Initiatives

It is recognized that freight movement produces significant externalities, such as emissions, noise, comfort and safety concerns for vulnerable road users, congestion, collisions and accelerated wear on roads. While the majority of freight movement occurs in the private sector and is driven by the principles of service (meeting customer expectations) and cost and, often having to balance the two elements, the public sector seeks to minimize the externalities associated with freight activity by providing the highway and local road infrastructure upon which freight activity is reliant. This section of the white paper identifies a series of initiatives and case studies associated with best practices to help inform a comprehensive goods movement strategy for the City of Vaughan.

3.1 Urban and Metropolitan Freight Plans/Goods Movement Strategies

To better manage freight activity and reduce externalities associated with freight, some cities have developed their own freight plans. What sets these freight plans apart from more regional or strategic freight plans is their focus on developing solutions to actively address key issues such as safety, emissions and improving freight efficiency, and to consider behavioral change programs. The freight plans and strategies identified in this section illustrate different approaches and considerations to addressing freight in urban and metropolitan areas.

3.1.1 London Freight Plan

In 2005, Transport for London was tasked with developing a freight plan to support the Mayor of London's transport and environmental strategies, the London Plan and the Mayor's Climate Change Action Plan. A dedicated freight team was established to develop the plan which identified the following Vision Statement:

> *'…the safe, reliable and efficient movement of freight and servicing trips to, from, within and, where appropriate, through London to support London's economy, in balance with the needs of other transport users, the environment and Londoners' quality of life…'*

The plan also identified four key actions / projects:

1) **The Freight Operator Recognition Scheme** will employ a tiered set of membership levels to address fleet and freight vehicle operational efficiency, improving all areas of sustainable distribution to reduce CO2 emissions, congestion, collisions and operator costs. It will recognize legal compliance as the base 'bronze' level and promote the uptake of best practice covering fuel efficiency, alternative fuels and low carbon vehicles, management of road risk, legal record keeping and reducing penalty charge notices through the higher 'silver' and 'gold' levels. It will also recognize operator achievements with rewards that encourage operators to raise standards to reduce, in particular, CO2 emissions and collisions between heavy goods vehicles (HGVs) and cyclists.
2) **Delivery and Servicing Plans (DSPs)** will be used to increase building operational efficiency by reducing delivery and servicing impacts to premises, specifically CO2 emissions, congestion and collisions. Contractual relationships between building operators and their supply chain will be used to specify companies committed to sustainable freight distribution, such as Freight Operator Recognition Scheme members, and ensure that they use legal loading locations. DSPs aim to reduce delivery trips (particularly during peak periods) and increase availability and use of safe and legal loading facilities, using a range of approaches including consolidation and out-of-hours deliveries.

3) **Construction Logistics Plans (CLPs)** have similar objectives to DSPs, but will be applied to the design and construction phases of premises, specifically to improve construction freight efficiency by reducing CO2 emissions, congestion and collisions. Ultimately, they will be integrated into the travel plan process and each traffic authority's response to the Network Management Duty to increase road network efficiency by minimizing congestion and therefore emissions caused.
4) **Freight Information Portal**. This will offer London, for the first time, a single interface for information on freight between London's public authorities and freight operators. It will enable the integration of systems and act as a single point of registration for deliveries in London, directly and indirectly by construction-related trips

Three workstreams were also identified:

1. **Partnership development.** This will assist the Plan's delivery by building partnerships at pan-London and sub-regional levels to help coordination between TfL [2], businesses, operators and boroughs. This is in line with the Mayor's Transport Strategy, as it includes London's sub-regional Freight Quality Partnerships
2. **Major freight projects**. Projects focused on promoting modal change from road to more sustainable alternatives (such as rail and water), and on reducing CO2 emissions, will be developed as they arise and as funding is secured.
3. **Freight data, modelling and best practice**. This work will identify case studies of innovations to reduce CO2 emissions and collisions involving freight vehicles, with the aim of improving operational efficiency, driver behaviour, and the use of alternative fuels and low-carbon vehicles.

3.1.2 New York

Delivering New York: A Smart Truck Management Plan for New York City was published in 2021 and is the City's strategic freight management plan. This plan provides a comprehensive policy framework for a safe, sustainable, equitable, and efficient last-mile freight delivery system. The plan emphasizes the importance of transforming the "last mile" – the final stage of delivery. This plan introduces new and creative approaches to:

- Accommodate growth in truck traffic
- Expand intermodal delivery methods including programs to reduce freight travel demand, such as off-hour deliveries
- Provide better access to the curb
- Test innovative delivery methods
- Improve truck routing
- Streamline regulations for smarter, data-driven governance

Goals of *Delivering New York* include:

- Safety: Improve the safety of truck travel through and within the city
- Efficiency: Improve the efficiency of freight movement to, from, and within the city
- Sustainability: Foster the sustainable and responsible movement of goods
- Partnerships and Knowledge: Expand partnerships within the public and private sectors to increase awareness and understanding of freight activity

[2] Transport for London, a local government body responsible for most of the transportation network in London

The Plan identifies 32 strategies, programs and policies to transform the City's last mile delivery system. Examples include:

- Increase the number of loading zones citywide to reduce conflicts between vulnerable road users and double-parked trucks and pursue placard reform in commercial and truck loading spaces.
- Pilot green loading zones in several neighborhoods by end of 2021
- Identify appropriate changes to the Truck Route Network in the city to better serve critical freight hubs. DOT will continue to update the City's Truck Route Network every two years to reflect current land use and truck access needs and evaluate select qualified access routes for select combination vehicles operations servicing freight hubs.
- Increase commercial vehicle access to the curb in commercial areas, while balancing curbside needs through street design changes, and exploration of treatments for various levels of commercial vehicle type and activity.
- Advocate for legislation that would phase in the requirement for trucks involved with city contracts to be fueled by low or zero emission fuels (where this is operationally feasible).

A further aspect of freight planning has also been to increase public awareness of freight activity and seek to better engage the public in freight related discussions and policy development. The NYC plan included an overview of some supply chains (**Figure 3**) to highlight the importance of freight activity and its role in supplying the goods and services New Yorkers require.

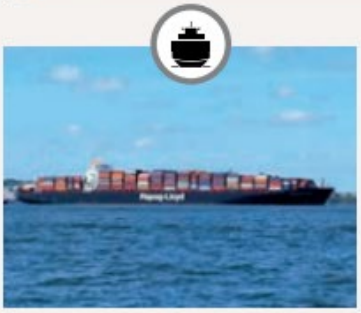
How do New Yorkers get their stuff?

Following the supply chain for three common products to a home in Brooklyn

The Role of Trucks in Today's Complex Supply Chains

The city receives goods and shipments from all over the world via a complex international supply chain. Trucks play a critical role in this delivery. Even goods that arrive in the city by ship, rail, or planes rely on trucks for the final miles of delivery.

The map below shows the route three different products take as they arrive into the city and are delivered to a consumer, in this case a home in Brooklyn. Despite coming from multiple places and arriving by different modes, each product still relies on trucks to complete the journey.



Cargo Ship

Cargo Plane

Truck

Source: NYC

3.1.3 Calgary Goods Movement

The Calgary Goods Movement Strategy was developed in 2018. Its objectives are to:

- Identify and prioritize short-, medium-, and long-term actions, policies and investments in transportation infrastructure to enhance goods movement in Calgary.
- Support the Municipal Development Plan (MDP)'s urban growth policies and the Calgary Transportation Plan (CTP)'s sustainable transportation initiatives, as well as identifying proposed changes to the CTP's Primary Goods Movement Network.
- Compliment city and regional economic development initiatives by articulating the strong linkage between efficient goods movement and the economy.
- Review and where appropriate consolidate the City's by laws related to goods movement.

The strategy has two sets of outcomes:

1. **Policies** specific to goods movement that can be incorporated into future CTP, MDP and other City plans. The consolidated truck read bylaws also inform City policies.
2. **Actions and investments**. The strategy identifies potential investment areas in infrastructure and operations that warrant further investigation for facilities that are under the jurisdiction of the City and other levels of government. The strategy also identifies actions and investments in technology operations and practices based on best practise in Calgary and elsewhere that could be led by the city in conjunction with other private and public sector stakeholders.

Figure 4 identifies measures associated with the vision of the Calgary Goods Movement Strategy.

Safe	Economical	Reliable	Efficient	Environmentally sustainable
Reduce the number of fatal and serious injury crashes involving trucks.	Reduce the costs of implementing improvements.	Reduce travel times/speeds by time of day.	Increase the percentage of trucks that use desirable routes, such as the Primary Goods Movement Network, and reduce the percentage using other routes, such as local roads.	Increase percentage of urban goods movement trips made in alternative fuel vehicles or by active transportation.
Reduce bicycle-truck collisions.	Reduce the costs of maintaining infrastructure.	Improve reliability of truck travel times.	Increase the percentage of trip distances made via Primary Goods Movement Network.	Increase average vehicle fullness and reduce empty vehicle kilometers travelled.
Reduce the number of accidents involving dangerous goods spills.	Reduce the average truck operating cost.	Improve the percentage of on-time deliveries.	Increase percentage of deliveries made with vehicles parked close to destination.	Reduce number and severity of dangerous goods spills involving trucks.

Source: City of Calgary

3.1.4 Port of Oakland Truck Management Plan

The truck management plan is an action-based plan designed to reduce the effects of transport trucks on local streets in West Oakland. The plan's goals are:

- Reduce disruptions from truck circulation and truck parking on residents and businesses in West Oakland.
- Increase safety near designated truck routes.
- Have truck drivers know preferred routes to reach their destinations and know the City's parking restrictions

The plan identified 10 strategies:

- Improve Safety at Street Intersections Near the Port
- Improve Truck Routing
- Update the Network of Truck Routes and Truck Prohibited Streets
- Improve Truck Route Signage
- Conduct Traffic Enforcement Spot-Checks
- Use Urban Design to Promote Use of Truck Routes
- Improve Training for Issuing Parking Tickets
- Change Parking Regulations
- Consider Increasing Truck Parking Fines
- Conduct Targeted Parking Enforcement

3.1.5 Relevance

Freight plans, goods movement plans and truck management plans can help direct resources and attention to specific, local freight issues and can be used to inform public engagement. They can also better integrate freight movement within different facets of agency and municipality planning and decision making and provide consensus as to what freight related activities, actions and projects are prioritized. However, each plan must be sensitive to the local context and in particular the remit, desire, ability and resources of the plan promoter. The London Freight Plan had a supporting budget and dedicated staff to develop and deploy the initiatives such as the Freight Operator Recognition Scheme. What works in one city or region may not be applicable to another city or region. Furthermore, the freight dynamics can vary between localities. The type of freight trips, land uses and competing needs or plans will also determine the context of a local freight plan or goods movement strategy. These types of high-level, city-wide strategies are appropriate at the city-wide planning level to inform infrastructure planning for all modes in multimodal transportation master plan studies such as the VTP.

3.2 Truck Route and Restriction Strategies

Truck routes in metropolitan and urban areas can be designated a variety of reasons. However the two main reasons are to restrict trucks to certain parts of the network, or identify routes for strategic planning purposes. Many municipalities seek to restrict where and sometimes when, trucks can travel. The objective is to ensure trucks are not using inappropriate routes and to minimize potential conflicts with other road users and sensitive land uses, such as residential areas and community facilities including schools. Truck route networks typically designate routes trucks must use, but also make allowances for trucks that must travel off the route network to make deliveries. Truck route networks may also be based on the following characteristics:

- Truck weight including axle loadings
- Truck dimensions such as length, or number of axles. Longer combination vehicles may be restricted to certain defined routes
- Journey purpose - a through truck, or a truck making a delivery in the locality
- Type of commodities carried e.g., exclusion of trucks carrying dangerous goods from certain areas or specifying dangerous goods routes to avoid environmentally sensitive areas such as water courses
- Applicable at certain times of the day e.g., trucks banned at night due to resident concerns

Other considerations in establishing a truck route network include:

1. How is the truck network and its restrictions communicated to users?

2. How is the truck route enforced?
3. Ensuring major freight generators are connected to the network
4. Aligning the truck network with other transportation networks such as transit and cycling
5. Redundancy of routes
6. Evolving the network as land uses change over time
7. Connectivity and alignment with neighboring municipalities and any truck routes they may have.

3.2.1 City of Vaughan

City of Vaughan already restricts heavy trucks on specific roads based on by-law 284-94 Schedule C and D and amendment 169-2019. Schedule C states Heavy Traffic Restrictions, which restrict the operation of heavy trucks, unless a local delivery is being made. A heavy truck is defined as a commercial motor vehicle having a weight when unloaded, of three tonnes or more, or when loaded, of five tonnes or more, but does not include a passenger vehicle, an ambulance or any vehicle of a police or fire department. Axle Load Weight Restrictions prevent vehicles with more than two axles, with a weight in excess of 5 tonnes each, from accessing certain roads. This restriction applies to all roads with some exceptions. Further to these local by-laws, some weight restrictions also apply on Regional Roads year-round. These are applicable to commercial vehicles that weigh over five tonnes per axle. A map of the current restrictions in the City is provided in **Figure 5**.

3.2.2 City of Brampton

The neighboring City of Brampton also has restricted trucks on its highways. Its definition of a heavy truck is any commercial motor vehicle having an unloaded vehicle weight in excess of four thousand five hundred (4,500) kilograms (9,925 lbs.), but does not include ambulances, buses, fire apparatus, vehicles owned by or operated for the City of Brampton, Regional Municipality of Peel, the Ministry of Transportation (Ontario) or any utility. However, for the purposes of deliveries, trucks can navigate the restricted highways if there is no other alternative highway to use. **Figure 6** illustrates the restrictions within the City of Brampton. It is worth noting that the City of Brampton heavy truck classification differs slightly from the Region of Peel and the City of Vaughan.

3.2.3 Region of Peel

The Region of Peel restricts heavy trucks on several its highways, as shown in **Figure 7**. The Region defines a heavy truck as a commercial motor vehicle with a weight unloaded, of three tonnes or more, or when loaded, of five tonnes or more, but does not include a passenger vehicle, an ambulance or any vehicle of a police or fire department.

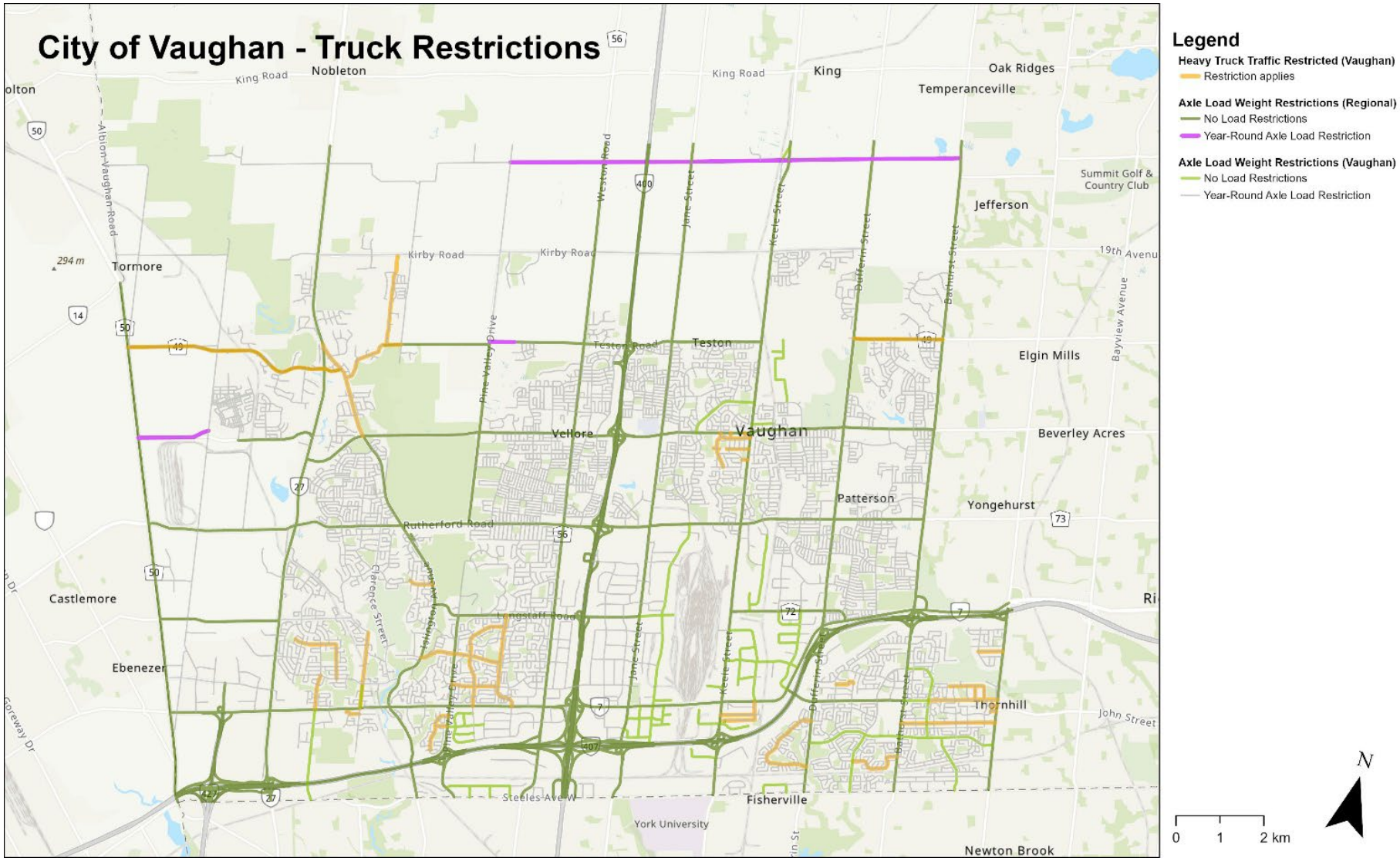
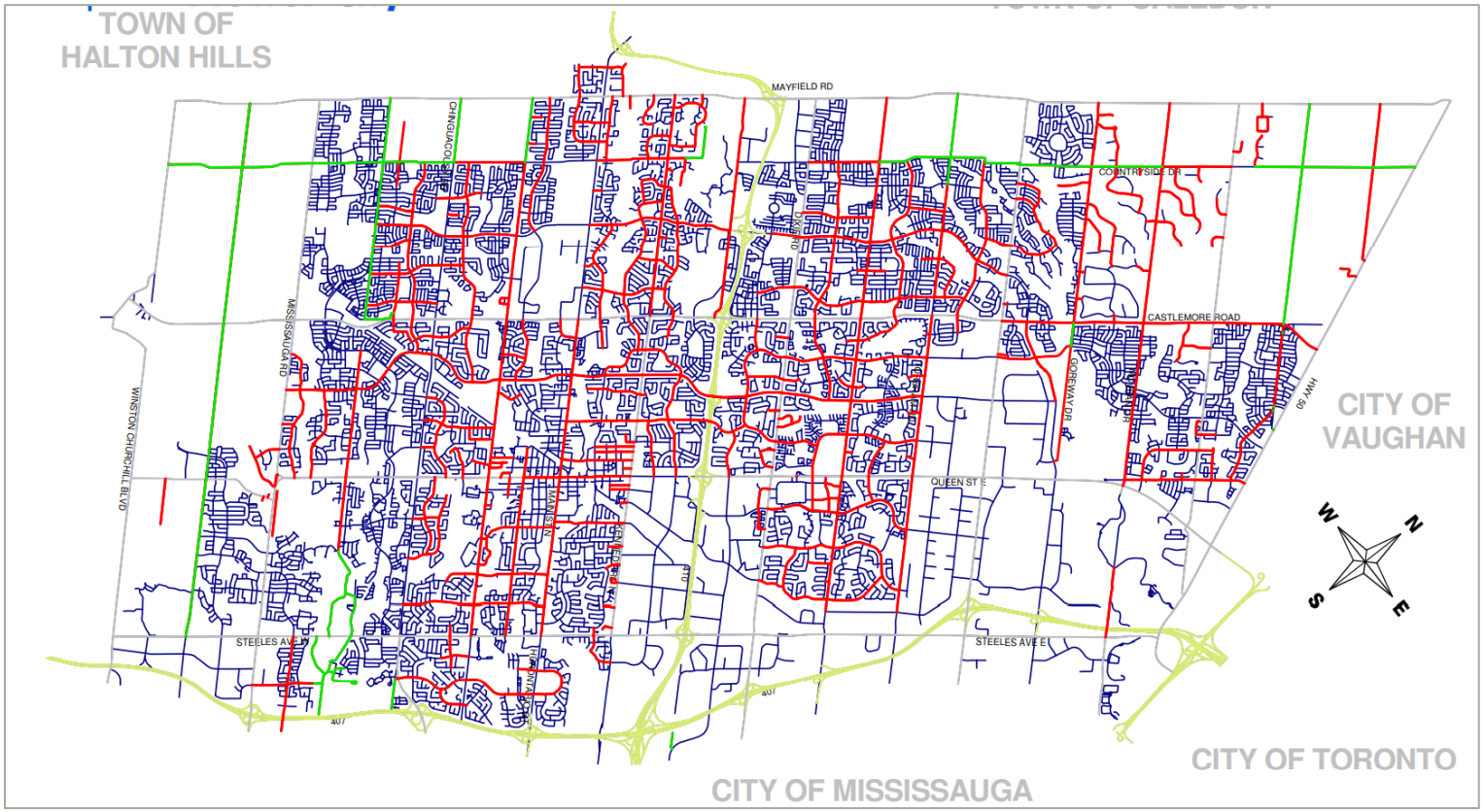


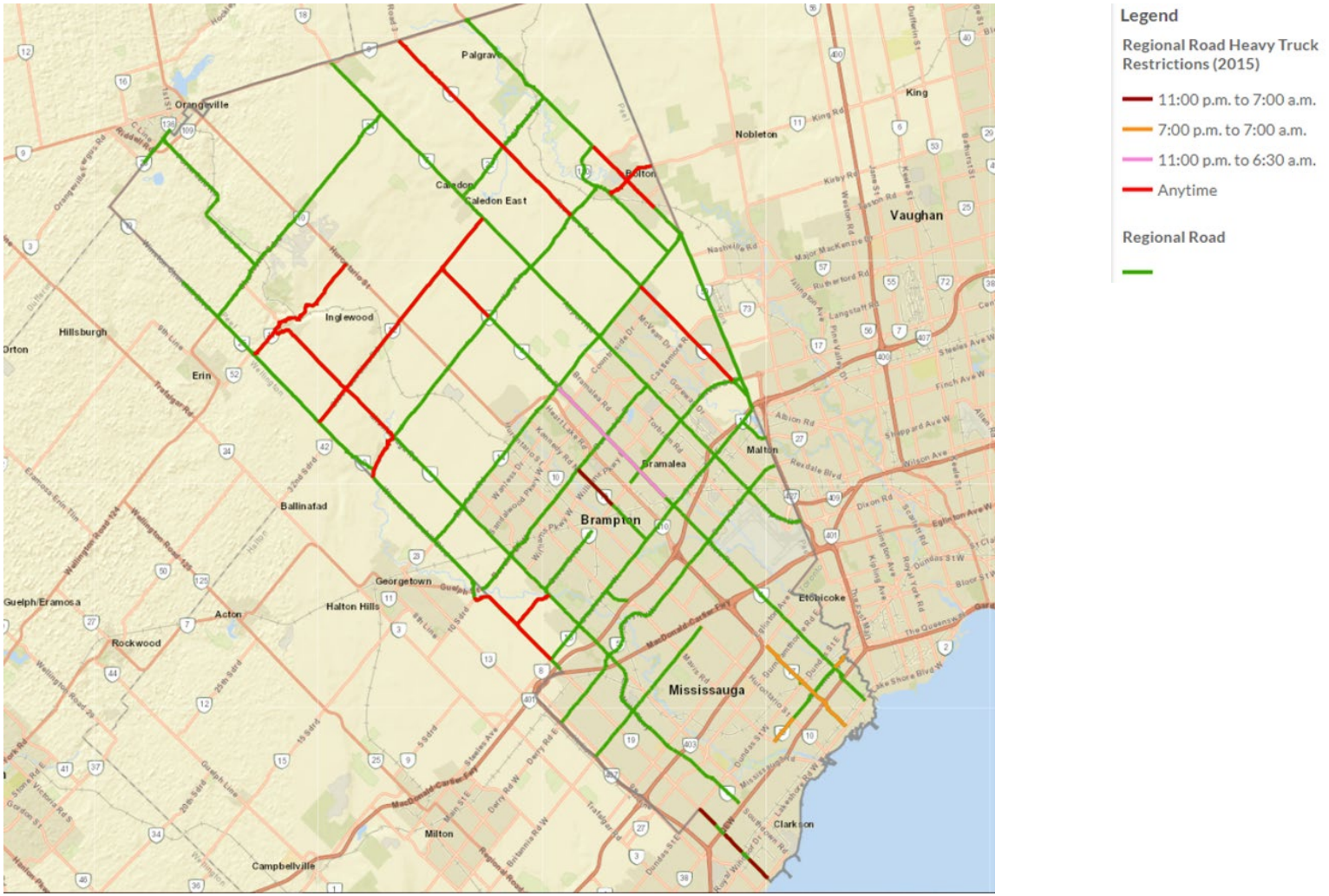
Figure 5: Truck Restriction Map for the City of Vaughan



Legend

- No Heavy Vehicles Anytime
- Reduced Vehicle Load - 5 Tonnes Per Axle
- Time Restricted
- BRAMPTON
- PEEL
- MTO

Source: City of Brampton

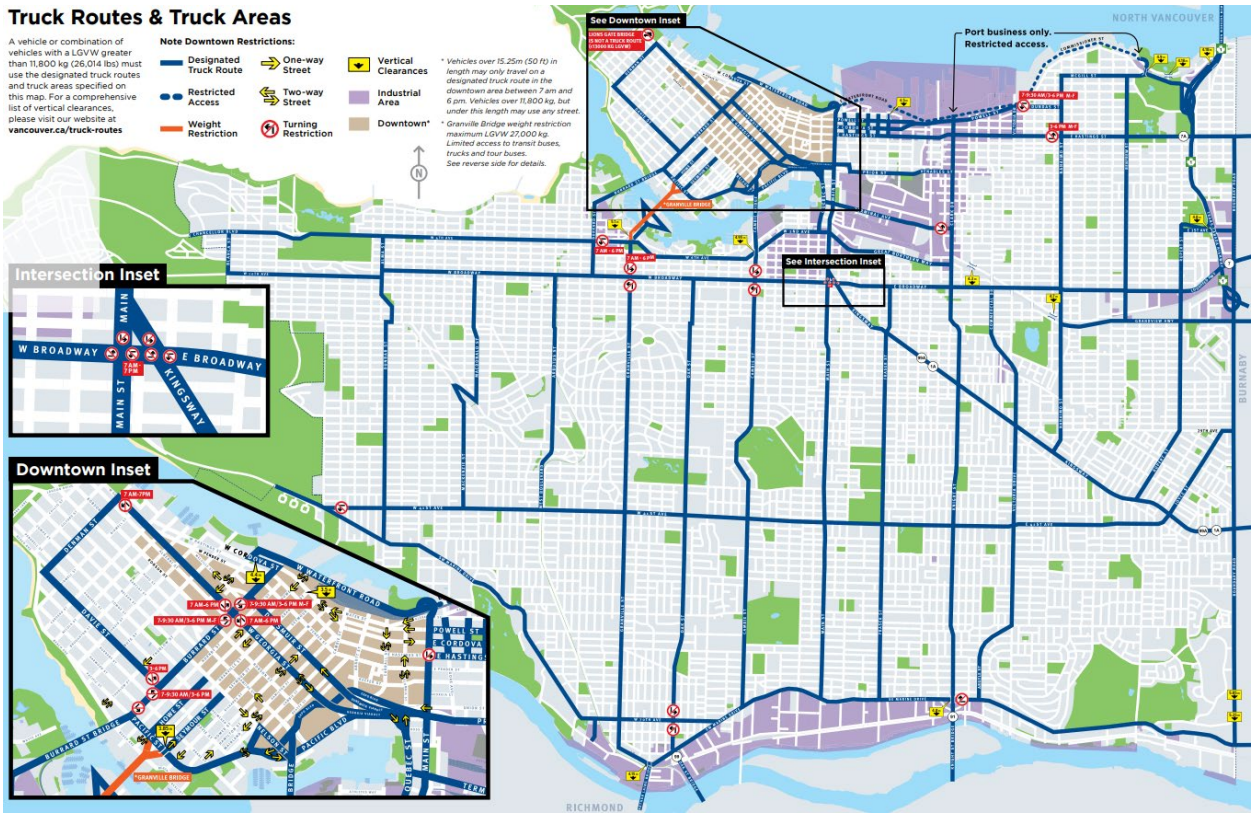


Source: Region of Peel

Figure 7: Region of Peel Truck Restriction

3.2.4 City of Vancouver

Vancouver, B.C. has a truck route network that restricts a vehicle or combination of vehicles with a gross vehicle weight greater than 11,800 kg (26,014 lbs) to use designated truck routes. Truck routes link the downtown area, industrial locations, other truck route networks in neighboring cities as shown in **Figure 8.** The City provides a printable map and also directs any residents reporting concerns associated with off route trucks, to report using a non-emergency police number.



Source: City of Vancouver
Figure 8. Vancouver BC Truck Route Network Map

3.2.5 City of Calgary

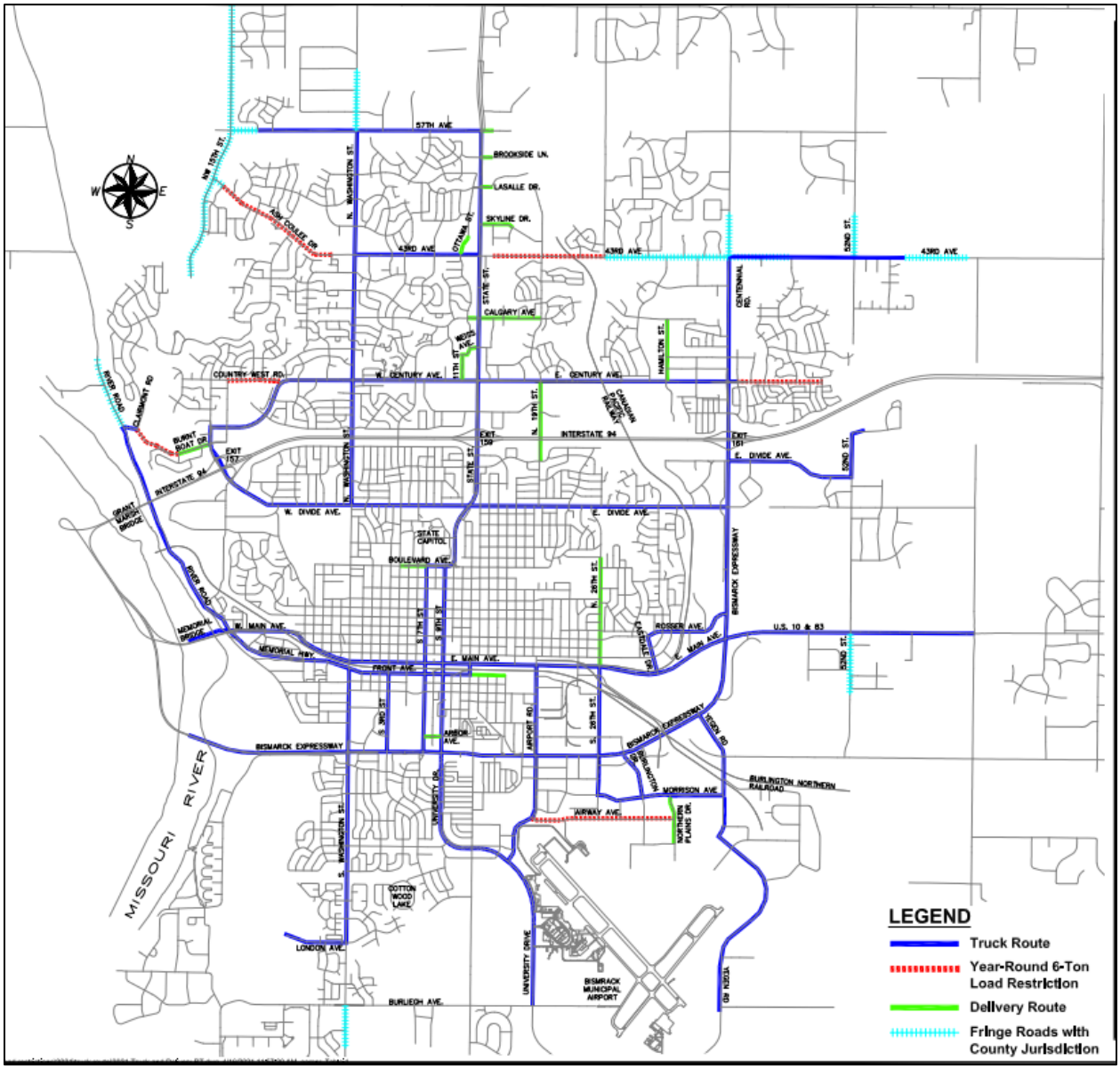
The City of Calgary designates certain roads or areas for use by trucks and restricts certain truck routes by time of day or by number of axles. Trucks are prohibited from all other roads except where necessary to make deliveries, supply a service, or obtain fuel, repairs, food or accommodation.

3.2.6 City of Bismarck, North Dakota

Trucks with an actual or gross vehicle weight of 10,000 lbs (4,535 kgs) or more must use designated truck or delivery routes as provided in the city ordinance with some exceptions:

Local deliver and pick up. Trucks used for home delivery and pick up must use truck routes except when actually making deliveries or pickups.

Designated delivery routes are shown in **Figure 9**.



Source: City of Bismarck
Figure 9. City of Bismarck Truck Route Network

3.2.7 New York City Truck Route

The New York City Truck Route Network is a set of roads that commercial vehicles must use in New York City. This network is comprised of two distinct classes of roadways, Local Truck Routes and Through Truck Routes.

The Local Truck Route Network is designated for trucks with an origin and destination within a borough. This includes trucks that are traveling to make a delivery, or for loading or servicing. Trucks should only use non-designated routes for the purpose at the beginning or end of a trip, when traveling between their origin/destination and a truck route.

The Through Truck Route Network is primarily composed of major urban arterials and highways and must be used by trucks that have neither an origin or destination within the borough. **Figure 10** illustrates the network of local and through routes in the New York City boroughs of Manhattan and Queens.

Source: New York City Department of Transportation
Figure 10. New York City Truck Route Network

3.2.8 Long Combination Vehicle Route Networks

A Long Combination Vehicle is truck that has more than one semi-trailers. In Ontario an LCV can pull two full-length semi-trailers and can be up to 40 meters in length. In Ontario, the LCV program currently allows 3 types of LCV configurations; an A-train comprised of two 12.2 - 16.2 meter long trailers, a B-train

comprised of a single 11.5 - 14.65 meter lead trailer and a single 11.5 - 16.2 meter second trailer and a Twin Stinger-Steer Auto Carrier comprised of two trailers up to 14.65 meters. The advantage of using these types of vehicles is reduced fuel consumption, lower emissions and reduced transportation costs.

An example of an LCV is shown in **Figure 11**.

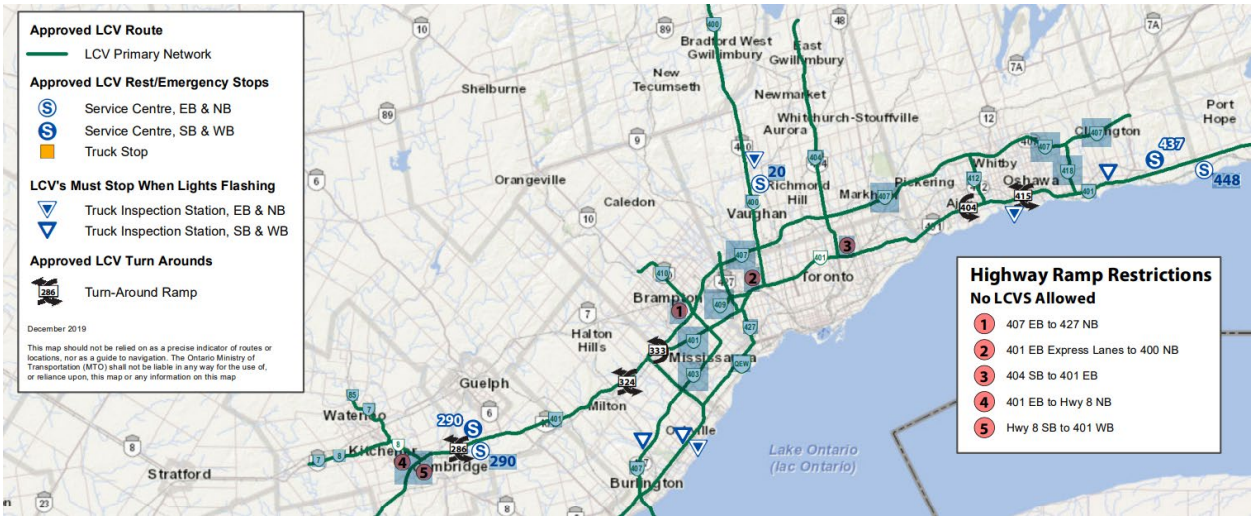
Figure 11. A Long Combination Vehicle

Because the vehicles are much longer, they have several additional rules associated with their operation. In Ontario these include:

- Can only operate on designated divided highways (primarily 400-series highways).
- Can only access destination terminals within two kilometres of highway interchanges, and only if routes have been carefully assessed and approved.
- Must have special safety equipment, including enhanced braking requirements and an electronic stability control system.

- May not carry more weight than existing multi-axle tractor-trailers.
- May not operate at the start and end of long weekends.
- May not carry dangerous goods that would require a warning on the vehicle's exterior.
- May not carry livestock.
- Must avoid driving in bad weather or slippery conditions.
- May not exceed 90km/hr

The Ontario LCV Primary Route network is shown in **Figure 12**.



Source: Ontario Ministry of Transportation
Figure 12. The Ontario LCV Primary Route Network

The Primary network is also complemented by a secondary highway network that allows origins and destinations to be served by LCVs that are located off the Primary network. If the recently opened 427 highway is designated as part of the LCV Primary Network, it is possible that LCV users may request LCV access to industrial and logistical facilities adjacent to Route 72 and Route 73.

3.2.9 Communicating Truck Routes to Users

A key challenge is promoting truck routes to the intended audience, namely truck drivers, their supervisors and management and those that schedule deliveries. Producing and distributing paper-based maps and directing users to their online equivalents are tried and tested mechanisms. NYCDOT has also provided truck route GIS data to truck based sat-nav system providers. However, a common issue is that not all truckers use truck based sat nav systems. Some truckers use phone based or other sat nav systems that are not tailored for truck drivers and these do not have highway truck restrictions, such as low bridges, truck routes or weight restrictions contained in the maps.

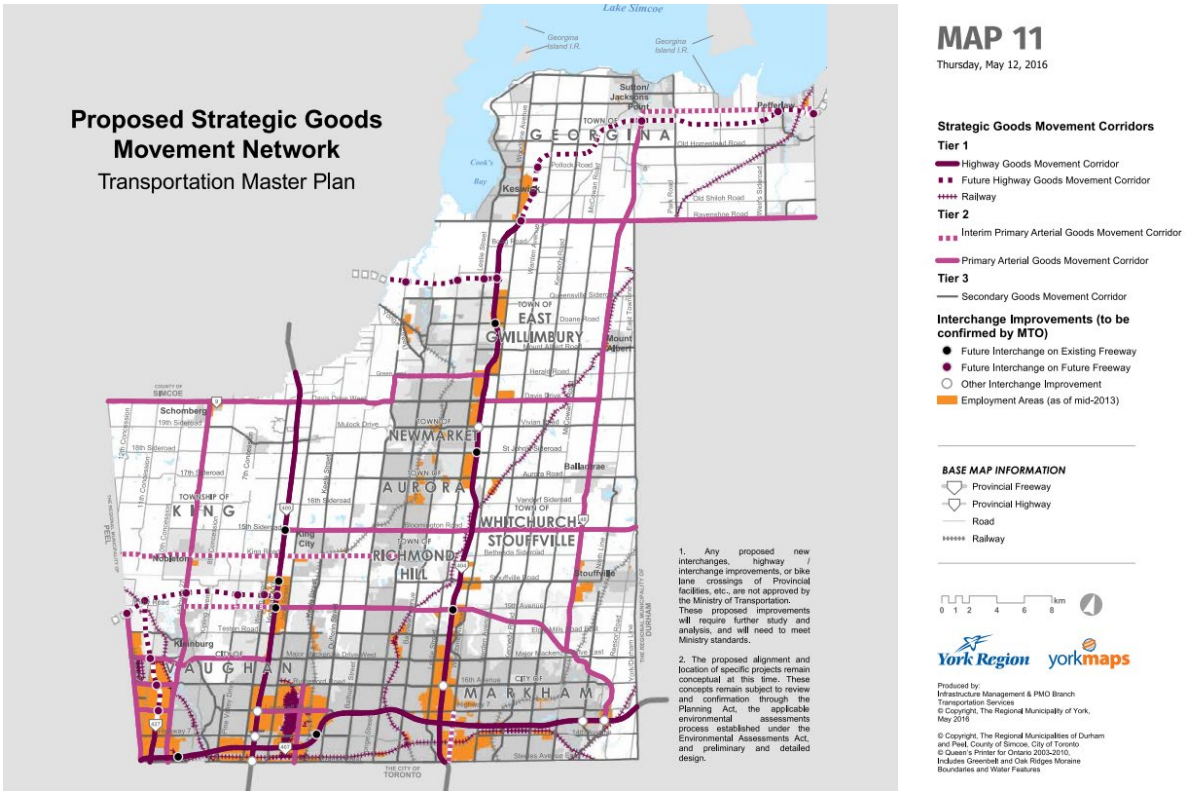
Regions and cities in proximity Vaughan have developed or are developing their own freight plans or strategies and defining highway networks related to goods movement. These include:

- York Region
- Peel Region
- City of Toronto

Appendix A illustrates the strategic goods movement network and their relationship with the City of Vaughan. Key takeaways from these plans that are relevant to the City of Vaughan are detailed below.

York Region 2016 Transportation Master Plan

The 2016 TMP identified a proposed Strategic Goods Movement Network that includes highways within the City of Vaughan as illustrated in **Figure 13**. This consists of three tiers of highways and rail with the highways categorized as detailed in the **Table 1**.



Source: York Region

Figure 13. York Region Proposed Strategic Goods Movement Network

Table 1. Strategic Goods Movement Network in 2016 York Region TMP

Source: York Region

Classification and Description	Typical Volumes	Accommodation of trucks
Highway goods movement corridors **(400 series freeways and secondary highways)**	Greater than 3,000 trucks per day More than 5% medium and heavy trucks	Mixed traffic May have HOV lanes or shoulder transit lanes
Primary arterial goods movement corridors **(Urban arterials serving employment and industrial lands)**	More than 2,500 trucks per 8-hour period More than 10% medium and heavy trucks	Mixed traffic Generally future six-lane corridors Minimal overlap with rapid transit corridors Consider truck-only design elements in special cases
Secondary arterial goods movement corridors **(All other regional arterial roads)**	Fewer than 2,500 trucks per 8 hour period Fewer than 10% medium and heavy trucks	Mixed traffic

Source: Region of Peel

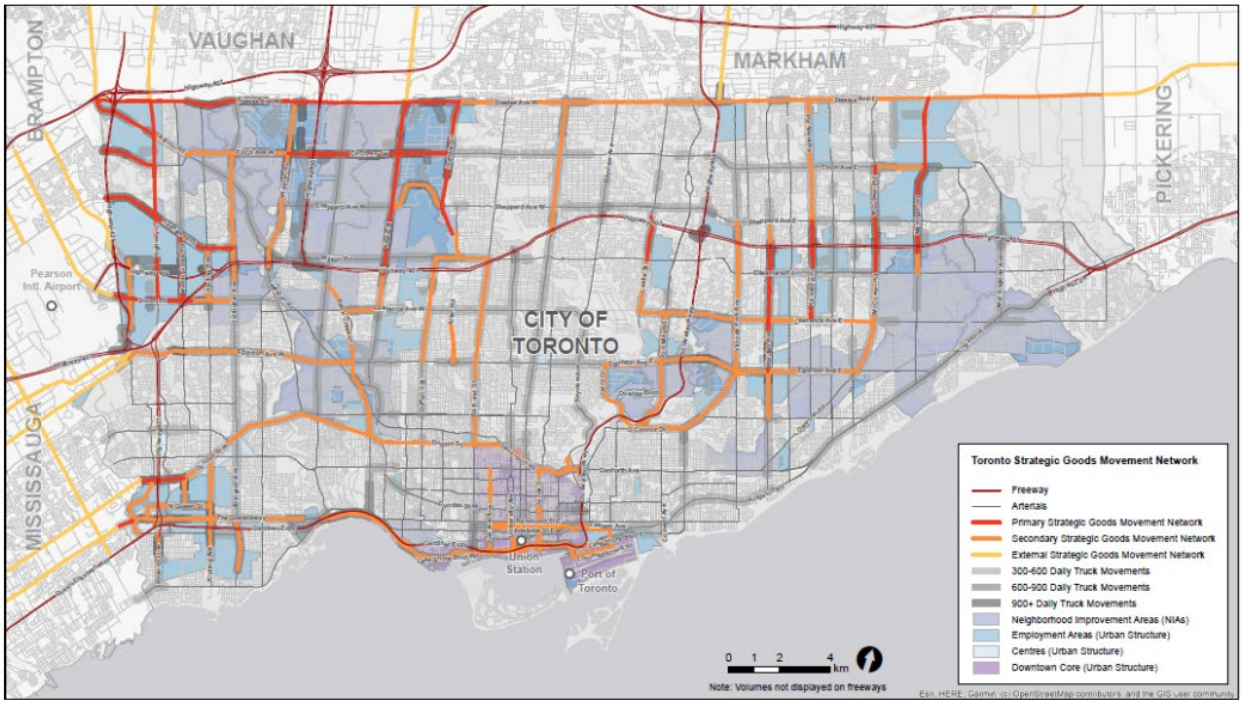
Figure 14. Region of Peel Strategic Goods Movement Network

Peel Region Goods Movement Strategic Plan 2017

The Peel Region Goods Movement Strategic Plan also identifies a Strategic Goods Movement Network. This network (**Figure 14**) identifies the primary and connector truck routes for safe and effective routing through the Region.

City of Toronto

City of Toronto adopted the Freight and Goods Movement Strategy Framework in October 2017. The framework proposed a Strategic Goods Movement Network, as shown in **Figure 15**, and 24 strategies for implementation, such as developing additional truck street design guidelines and a city-wide public education program with private sector partners to enhance safety.



Source: City of Toronto
Figure 15. City of Toronto Strategic Goods Movement Network

3.2.11 Relevance

While the Peel and York regions identified truck routes for strategic planning purposes and in Toronto's case to identify corridors and alternative routes that are priorities for the implementation of freight and goods movement supportive infrastructure improvement, they did not identify truck route networks that excluded trucks. Truck route networks in metropolitan areas is an established and proven methodology to limit truck activities to certain routes and preclude trucks from other routes, as examples shown in City of Vancouver, Calgary, Bismarck, and New York. Even though some highways in the City of Vaughan exclude trucks, there is a not a defined truck route network. This network could for example, restrict through trucks to certain highways and provide a better mechanism to inform truck drivers on route restrictions, rather than solely relying on signage. Other opportunities to promote truck route networks to the trucking industry include the provision of paper maps, hosting maps online, information points at truck stops and providing open source data so truck specific journey planners and routing systems can include network information in their respective systems. Clear identification of truck restrictions or designation of

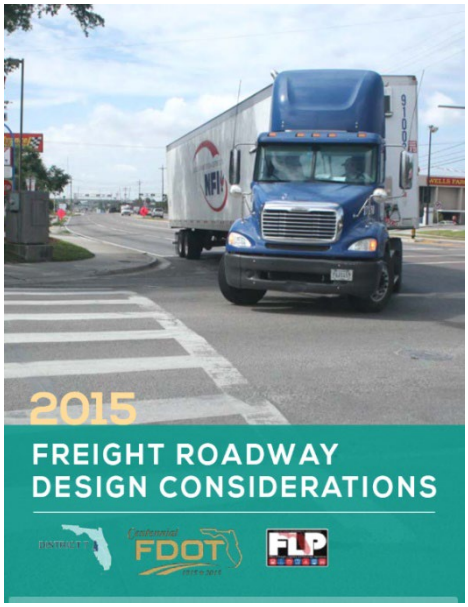
truck routes is an important component of higher-level city-wide freight and goods movement strategies. Success relies upon truck drivers having access to network information and an appropriate enforcement mechanism that can police compliance.

4 Planning for Freight and Infrastructure

Freight activity is not usually well understood by various public practitioners such as highway designers and planners. However, several initiatives have been developed to educate, inform, and assist practitioners with identifying better freight related solutions and address issues on a highway network.

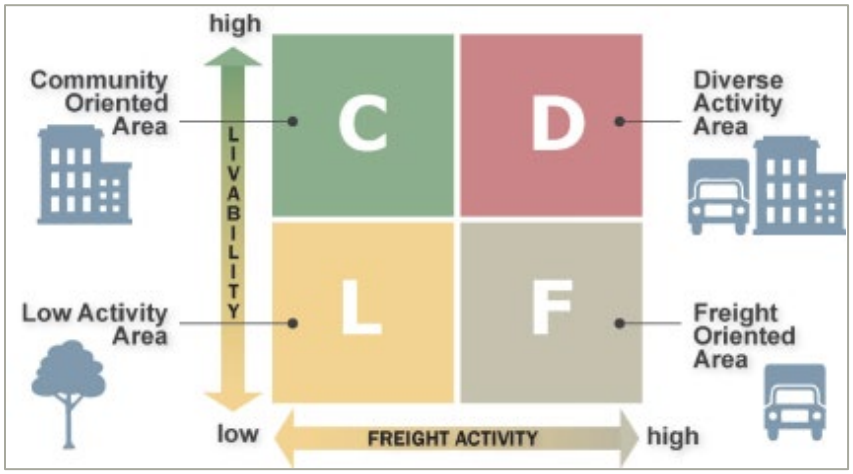
4.1 Reference and Guidelines Documents

4.1.1 Florida DOT - Tampa Bay Regional Strategic Freight Plan – Freight Roadway Design Considerations



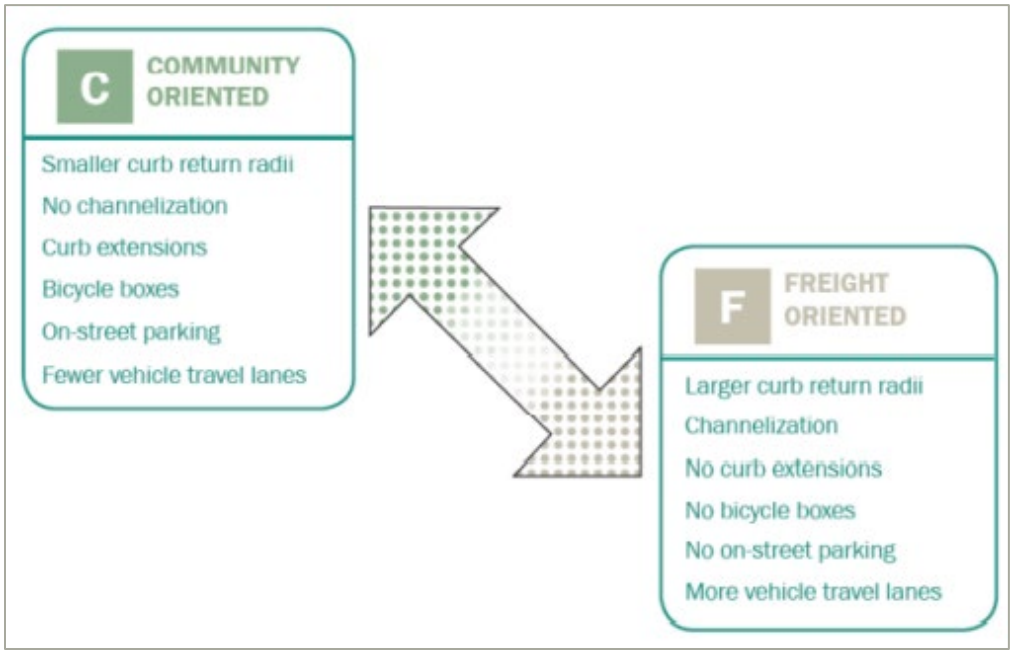
This document provides ideas and suggestions to help roadway designers and transportation planners select designs that balance goods movement and livability, within the parameters established by Florida DOT manuals and policies. The document identifies considerations for selecting appropriate design strategies relative to the function, multimodal characteristics, and land use context of roadway corridors. The considerations documented in this document:

- Identify principles and strategies for the thoughtful integration of freight mobility needs into the roadway planning and design process.
- Facilitate the incorporation and documentation of goods movement considerations into each step of the roadway implementation process.
- Include a matrix to help planners identify project context (**Figure 16**).
- Help select appropriate strategies and design elements (**Figure 17**).



Source: Florida DOT

Figure 16. Matrix to assist with identifying freight context



Source: Florida DOT
Figure 17. Highway strategies and design elements

4.1.2 City of Portland - Designing for Truck Movements and Other Large Vehicles in Portland

This design guide includes a discussion of design considerations, an explanation of truck operating requirements, and a tool kit of potential design solutions. The purpose of these guidelines is to continue to improve the safety and accessibility of City streets for all users. This document provides specific guidelines and appropriate geometric design information for maintaining truck access and mobility in the design of intersections and roadways in freight districts, Centers and Main Street environments, and residential areas. This document purposely does not reference nor proposes any design "standards." Rather, it provides design "guidelines" and/or design "guidance" for consideration by roadway engineers who work to accommodate all users of Portland streets–trucks, autos, pedestrians, bicyclists, and transit riders. While these guidelines incorporate all of the safety, mobility, and access requirements found in nationally recognized engineering standards, they also incorporate the numerous needs by adjacent land uses for roadway use.

The document identifies how different streets could be categorized for freight, as shown in **Figure 18** .

Classification*	Function	Application	Design Objectives**
Regional Truckway	Routes for interregional and interstate movement of freight. Provide for safe and efficient continuous-flow operation for trucks.	Applied to roadways with inter-state or inter-regional truck movement: I-5, I-84, I-205, I-405, US 26, and US 30, 99E.	Design Regional Truckways to be limited access facilities and to standards that facilitate the movement of all types of trucks.
Priority Truck Street	Serve as primary routes for access and circulation in Freight Districts, and between Freight Districts and Regional Truckways. Accommodate high truck volumes and provide high-quality mobility and access.	Applied to major city traffic streets in industrial districts and that connect industrial districts to the regional system: N. Marine Dr., NE Columbia Blvd., NW St. Helens Rd.	Priority Truck Streets should be designed to facilitate the movement of all truck classes and over-dimensional loads, as practicable.
Major Truck Street	Serve as principal routes for trucks in a Transportation District. Provide truck mobility and access to commercial and employment uses along the corridor.	Applied to commercial areas of major city traffic streets, arterial connections to central city, regional, and town centers: NE MLK Blvd., NE Sandy Blvd., SE Powell Blvd.	Major Truck Streets should accommodate all truck types, as practicable.
Freight District Street	Freight Districts are determined by presence of industrial sanctuary zoning (IG1, IG2 & IH). Freight District Streets are intended to provide safe and convenient truck mobility and access in industrial and employment areas serving high levels of truck traffic and to accommodate the needs of intermodal freight movement.	Applied to all streets in freight districts, unless classified with a higher designation.	Freight District streets should be designed to facilitate the movement of all truck types and over-dimensional loads, as practicable.
Truck Access Street	Serve as access and circulation routes for delivery of goods and services to neighborhood-serving commercial and employment uses. Provide access and circulation to land uses within a Transportation District. Non-local truck trips are discouraged from using Truck Access Streets	Applied to commercial corridors along collector streets that serve neighborhoods: NE Fremont St., NE. Halsey St., SE Division St., SE Woodstock Blvd.	Design Truck Access Streets to accommodate truck needs in balance with other modal needs of the street.
Local Truck Street	Provides local truck access and circulation for goods and service delivery to individual locations in neighborhoods.	Applied to local streets outside freight districts to provide access/circulation for goods and service delivery.	Should give preference to accessing individual properties and the specific needs of property owners and residents along the street. Use of restrictive signage and operational accommodations are appropriate.

Source: City of Portland
Figure 18. City of Portland Street Categorization

4.1.3 Ministry of Transportation Ontario – Freight Supportive Guidelines[3]

The purpose of the Guidelines is to help municipalities, planners, engineers, developers, and other practitioners create safe, and efficient freight-supportive communities. It includes measures to assist:

- Land use and transportation planning
- Site design
- Road design and operations

[3] Ontario Ministry of Transportation (2016). Freight – Supportive Guidelines. [Online]. Available: http://www.mto.gov.on.ca/english/publications/pdfs/freight-supportive-guidelines-english.pdf

- Implementation strategies

4.1.4 Transport Association of Canada – Understanding Goods Movement in Canada: Trends and Best Practice[4]

This document is a presentation of trends and best practices for goods movement in Canada. The objectives of the document are to develop tools for goods movement planning, develop tools for interacting with goods movement stakeholders, and provide knowledge of goods movement planning best practices. Module 2 of the document identifies a range of considerations associated with planning projects and incorporating freight requirements and needs into these projects. Considerations identified in the document include:

- Project Planning
- Data Collection and Management
- Stakeholder Consultation
- Analysis of Current and Future Needs
- Developing Strategies
- Evaluation Tools
- Integration with Other Disciplines
- Road Design
- Site Design
- Demand Modelling

Of particular relevance are freight related guidelines for adequately designing freight activities into various types of locations such as offices, residential and commercial locations. These guidelines are particularly relevant in new developments.

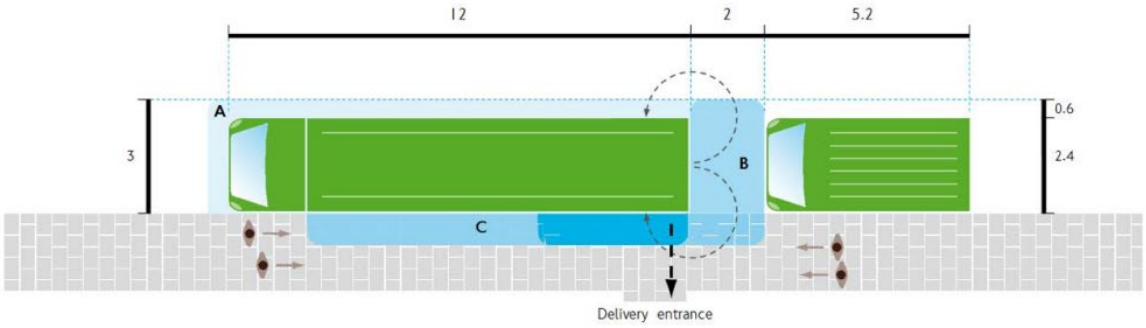
4.2 Loading and Curb Space Management

A number of organizations have compiled guidance documents to assist planners in better identifying solution for managing truck activity at the curb and including loading and unloading functions into street design.

4.2.1 Kerbside Loading Guidance

Transport for London (London, UK transport authority) produced its second version of Kerbside Loading Guidance in 2017. This guide aims to ensure appropriate kerbside loading facilities are included on London's highways and in street design schemes and facilitate loading at the right place and time. The document identifies key planning attributes associated with loading, such as the typical space requirements around a vehicle loading. **Figure 19** demonstrates the space requirements around a loading vehicle in a loading facility outlined in the document.

[4] Transportation Association of Canada (2021) Understanding Goods Movement in Canada: Trends and Best Practices. [Online]. Available: https://www.tac-atc.ca/sites/default/files/site/doc/publications/2021/ptm-goodsmvmt-e.pdf



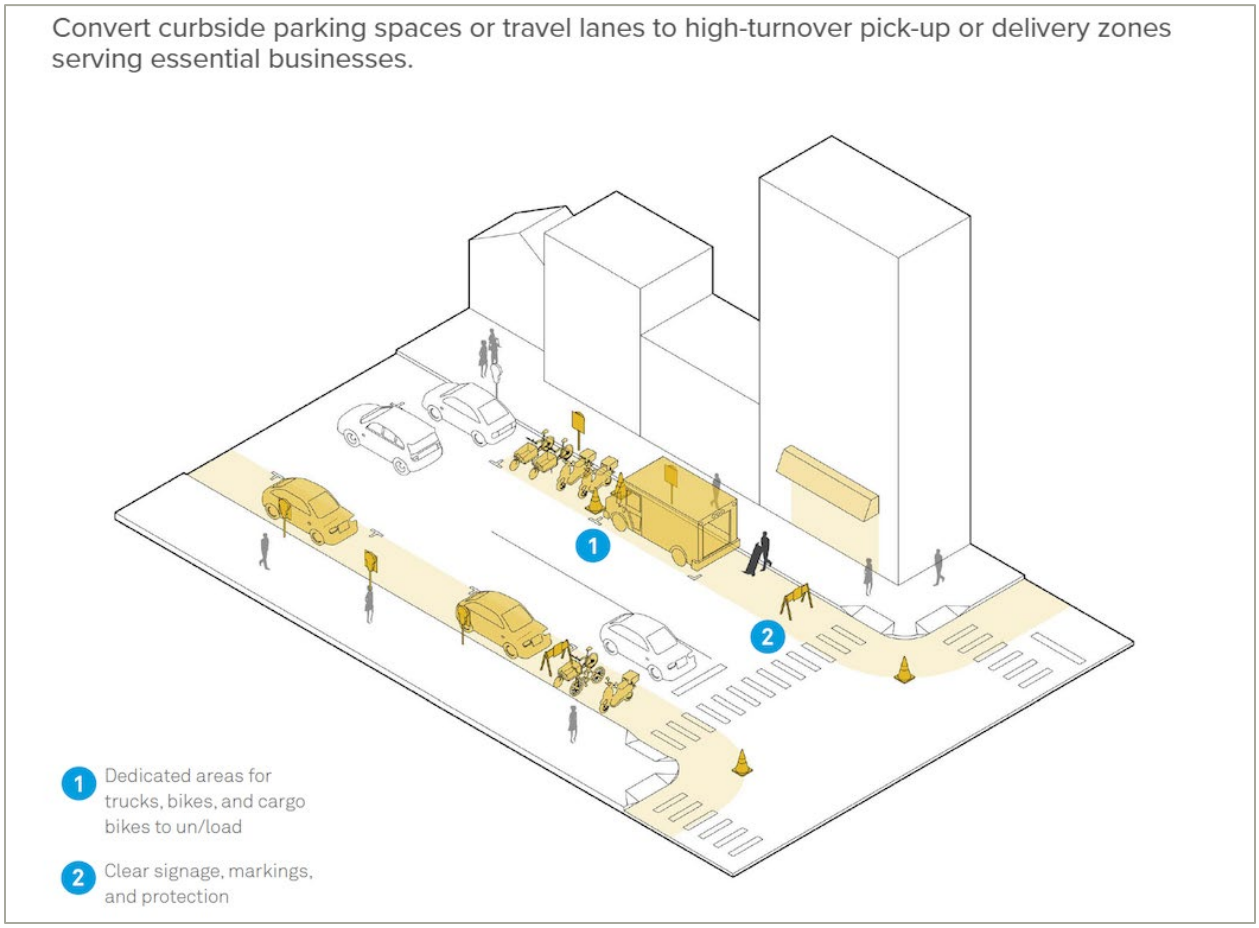
Key
A: Area where driver walks to alight vehicle
B: Area of rear loading activity
C: Area of side loading activity
All measurements are in metres

Source: Transport for London
Figure 19. Kerbside Loading Design Considerations [5]

4.2.2 NACTO

National Association of City Transportation Officials produces a series of documents associated with street design including the Urban Street Design Guide. Other documents include the Streets for Pandemic Response and Recovery which includes a section on pick up or delivery zones that is shown in **Figure 20.**

[5] Transport for London (2017). Kerbside Loading Guidance, Second Edition. [Online]. Available: http://content.tfl.gov.uk/kerbside-loading-guidance.pdf



Source: NACTO
Figure 20. NACTO Streets for Pandemic Response and Recovery Guide

4.3 Complete Streets

4.3.1 Trucks, Safety and Planning

The concept of Complete Streets encompasses many approaches to planning, designing, and operating roadways and rights of way with all users in mind to make the transportation network safer and more efficient. As the demand for street space intensifies in urban areas, freight activities, both in terms of freight movement and stopping for loading/unloading purposes need to be considered within the overall street design to ensure optimal performance of the overall street and satisfies the needs and demands of various users. Some organizations such as NACTO have sought to incorporate elements of freight activity within design documents as described previously. Despite this, there is more that can be done to proactively accommodate freight activity into a streetscape. It is recognized that if loading spaces are not adequately designed for the size of vehicles being used, and are available at an appropriate time of day, then trucks may park in unsafe locations and use infrastructure designed for other uses, such as the example in **Figure 21**. Parking tickets or citations tend not to change behavior as their cost is often absorbed into the cost of doing business by delivery companies.

Source: HDR
Figure 21. Truck astride a bicycle lane and parking zone

A truck loading study delivered by HDR for the City of Cambridge, MA identified a number of loading improvements to better cater for truck loading while reducing the risk associated with trucks encroaching into bicycle lanes. The example in **Figure 22** illustrates a rerouted bicycle lane around a loading zone designed to accommodate a tractor trailer for urban deliveries. This design removes the conflict of a truck having to cross the bicycle lane when it emerges back into traffic, largely due to the blind spots associated with a truck and the visibility of bicyclists travelling alongside the truck.

Source: HDR
Figure 22. Loading zone and bicycle lane

4.4 Relevance

There are key truck routes in the City of Vaughan that pass through different land uses. Different sections of these routes also have various competing road user needs and a document such as the ones illustrated here can help planning for existing and future freight activity and ensure planners and designers integrate freight into the different types of highway infrastructure and maximize benefits and improve safety and efficiency for all road users. These guidelines are also relevant and should be considered as part of the street classification task for VTP, as well as the City's on-going Complete Streets study and inclusion within new developments.

5 Future Considerations and Trends

5.1 Automated Trucks

In March 2021, Canadian Tire, startup NuPort Robotics Inc, and the government of Ontario announced an investment to test automated heavy duty truck autonomy by retrofitting two trucks with high-tech sensors and controls, a touchscreen navigation system, and other advanced features such as obstacle and collision avoidance. These trucks, operated with a driver, will shuttle containers between rail intermodal yards and Canadian Tire warehouses in Ontario. In 2020, Gatik, another technology startup partnered with retailer Loblaw Companies, to deploy five autonomous box trucks in the Toronto region.

Volvo Trucks and DFDS, a European logistics operator, are trialing a vehicle called "Vera" in Gothernburg, Sweden (**Figure 23**). This is a fully autonomous (it does not have a driver cab) electric vehicle. It operates between a port and a DFDS logistics centre shuttling containers. The port terminal is being equipped with automatic gates to allow Vera to enter and exit the terminal without stopping.

Source: Volvo Truck
Figure 23. Volvo Autonomous Vehicle

The operations described above are focused on the so called "middle mile" which applies to the movements of goods between intermodal facilities, suppliers, warehouses, and distribution centres, rather than the "last mile". The middle mile appears to be an "easier", less complex environment in which to deploy autonomous trucks for a variety of reasons such as pre-determined, repetitive, and regular routes,

access to and from industrial areas and using predominately multi lane primary routes. Large scale uptake for last mile deliveries using fully autonomous trucks to locations such as retail outlets, business locations or retail locations appear to be some way off, though pilots or trials may be ongoing.

An example of autonomous middle mile routings connecting the Vaughan Intermodal Terminal with warehouses nearby is shown in **Figure 24**.

Figure 24. Conceptual Autonomous Delivery Route

Given the concentration of warehousing in the region and two intermodal rail yards, it is certainly probable, that as technology continues to evolve, there will be an increasing number of autonomous trucks on the region's roads. How the City prepares for this and works with key decision makers including MTO, could be a workstream within any future Goods Movement Strategy.

5.2 Alternative Vehicles

5.2.1 Cargo Bikes

Cargo bikes are increasingly being seen as a viable vehicle to deliver packages and groceries in urban areas as an alternative to traditional delivery vans. A key requirement associated with cargo bike operations is electrical assistance. The weight of the payload carried distance to be travelled and terrain means that the cargo bike operator needs to be assisted. While this may not be true for all cargo bikes, it will be necessary for the cargo bikes carrying heavier payloads such as the type shown in **Figure 25**.

Source: Gnewt Cargo
Figure 25. Cargo Bike

London, New York, and Toronto have all had to amend legislation to allow electrically assisted cargo bikes to operate on their respective streets.

Given the limited range and payload, cargo bikes may need to be operated from micro distribution facilities. London, Paris and New York have cargo bike operations using car park facilities that have been repurposed to facilitate transloading of packages from larger vehicles to a fleet of cargo bikes. Other solutions have involved a mobile depot, such as the TNT parcel delivery company trial in Belgium, that had cargo bikes operating from a tractor trailer (**Figure 26**).

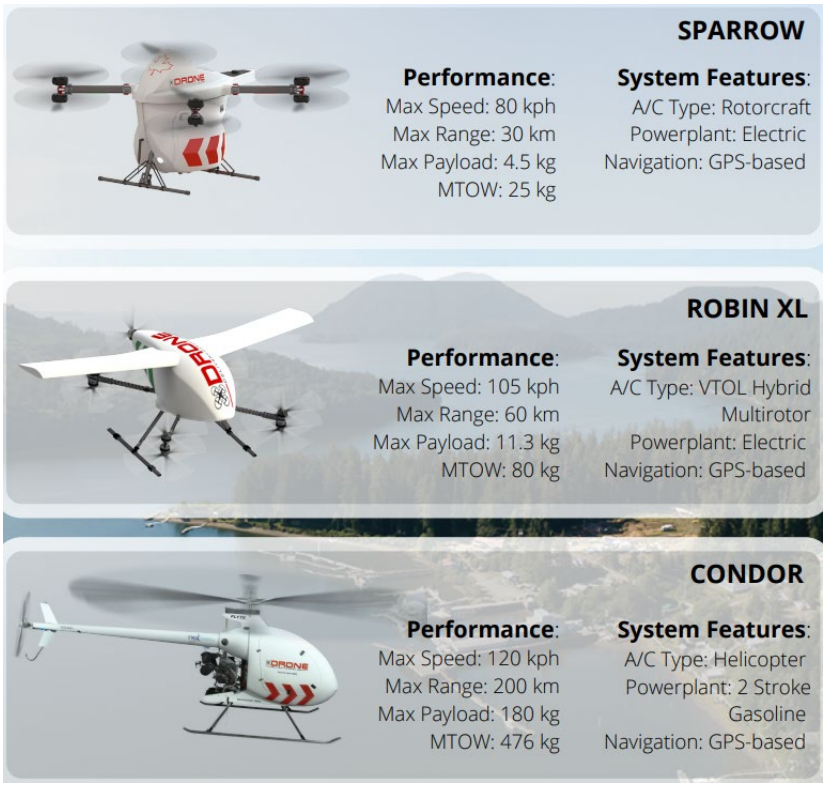
Source: TNT
Figure 26. TNT Mobile Depot

Cargo bikes could be applicable to within the City of Vaughan's intensification areas where there is likely to be sufficient delivery density, and distances between delivery locations will be relatively short. However, some form of micro distribution facilities would need to be incorporated into these areas or very close by to support the transloading of products from trucks to a fleet of cargo bikes and also be used to store these bikes when not in use.

5.2.2 Drones

In recent years, delivery drones have captured headlines as various companies have sought to develop drone technology for the delivery of packages and supplies. While use of drones as a delivery vehicle is still in its relative infancy, there are niche operations currently underway, predominately focused on lightweight, urgent, high value items such as blood and medical samples. The ultimate aim of most drone operators is for drones to be operated autonomously. Eliminating the human operator removes cost, but to do so requires the drones to be capable of safely flying delivery routes. By using humans to remotely pilot drones and capture data allows the drone system to learn. Some drone operations flying take away coffees and light snacks are using this as an opportunity to learn, especially at the drop off/delivery interface. For example, what does the drone do when making a drop off in someone's back garden/yard and it senses a pet dog in the garden?

Other considerations include payload weight. Drone Delivery Canada has developed a series of drones that can carry payloads from 4.kgs up to 180 kgs with a range of 200kms. **Figure 27** shows a number of available drone models from Drone Delivery Canada.



Source: Drone Delivery Canada
Figure 27. Drone Delivery Canada Product Models

Weather may also influence drone use and some drone operations have experienced conflicts with wildlife. A significant challenge to more widespread drone use in urban areas is delivery density and cost

competition with other forms of delivery transport. While niche markets, focused on lightweight, urgent, high value items would appear to be suitable for drone operations, the more run of the mill, day to day deliveries may prove harder for drone operations to capture, due to high delivery density in urban and metropolitan areas, where more traditional van and multi drop operations are very cost effective. However, it is very much a matter of watch this space and seeing how drone technology, learning, the overall economics of drone operations and regulations continues to evolve and develop in delivery operations.

5.2.3 Street Robots

Small autonomous vehicles are also being used in final mile deliveries. Starship has developed autonomous street robots that can deliver goods within a 6-kilometer radius. The majority of its operations are within College campuses, but in the UK pilots have been undertaken in town center environments as shown in **Figure 28**.

Source: Starship
Figure 28. A Street Robot

Pennsylvania state law now allows delivery drones to operate on city streets and also classifies them as pedestrians. This law identifies legal limits for autonomous delivery robots such as a maximum top speed of 12 mph in a pedestrian area, 25 mph on a roadway, and a load limit of 250kgs.

The robot illustrated in **Figure 29** is a robot employed in a pilot scheme in Singapore that can carry 20kgs of groceries.

Source: OTSAW
Figure 29. A Grocery Robot in Singapore

Some companies are also deploying larger street robots. Smaller robots have been designed to operate on sidewalks, but larger robots, due to their size are operated on highways as shown in **Figure 30**.

Source: Nuro
Figure 30. A Sidewalk Robot

5.3 Alternative Fuels

According to the Pembina Institute, 10.5% of Canada's greenhouse gas emissions come from freight transportation and a majority of these come from diesel trucks. Diesel powered trucks also produce air pollutants, but newer trucks with emission control equipment, such as particulate filters, have reduced this over time. Despite this, there is an increasing desire to further reduce emissions. Electric heavy duty trucks are proven technology and would be able to replace conventional fueled trucks on some duty cycles that take place within the City, namely regional and delivery trips of less than 240 kilometers and return to base at the end of trip to recharge. Longer distance, over the road trucking where vehicles do not return to the same location, such as a depot at the end of the day, are a more challenging operational

environment for battery electric trucks, due to availability and location of charging stations, charging time etc. An increasing number of global and domestic truck manufacturers are now producing electric versions, including Lion, a manufacturer based in Quebec. However, a key issue with electric trucks is that the capital cost is significantly more (potentially double the cost of a new traditional fueled truck) than a traditional fueled vehicle, but overall operating costs are much lower, for example maintenance costs are reduced by 60%.

Renewable diesel (RD) is also gaining traction in fueling trucks. RD is a broad term essentially referring to any diesel fuel that is produced from a renewable feedstock such as vegetable oils or animal fats and is chemically identical to conventional (fossil) diesel fuel, but contains no fossil carbon. This makes RD a "drop in" replacement for ultra-low sulphur diesel (ULSD). RD's primary environmental benefit is that it provides a compelling greenhouse gas (GHG) reduction (predominately CO2) strategy for diesel engines. The net result is that, depending on the specific feedstock and pathway, RD can provide GHG reductions ranging from about 35 to 80 percent when used as a substitute for ULSD to power heavy-duty vehicles and equipment. Animal tallow, which is currently the most prevalent feedstock used to make RD consumed in North America, provides GHG reductions of about 65 percent compared to ULSD. While most of the focus for RD is on the U.S. west coast states, largely driven by California's Low Carbon Fuel Standard and Oregon and Washington are considering a similar scheme, Canada is expected to launch its own Clean Fuel Standard in 2022. Investments in canola processing plants in Saskatchewan to supply feedstock to RD plants have recently been announced.

Hydrogen is another alternative truck fuel that can be used to cut carbon emissions. When hydrogen burns it produces water and no carbon dioxide. In heavy trucking, it would be used to operate fuel cells that generate electricity. The Alberta Zero-Emissions Truck Electrification Collaboration project is developing two heavy-duty, 64-tonne hybrid trucks with hydrogen fuel cells that will haul freight between Calgary and Edmonton.

There is significant potential for trucks based within the City of Vaughan to be fueled by cleaner, alternative means. For some alternative fuels, infrastructure such as electric charging facilities will be necessary. This could have implications on local and power networks, which may need to be upgraded to accommodate any significant increase in power consumption. RD on the other hand could be sold and distributed through existing outlets, while hydrogen requires a dedicated infrastructure of pipelines and dispensing stations.

Fleets will gradually transition to cleaner fuels, though the speed of uptake will be driven by economics (capital and operational cost comparison with traditional fueled trucks), national and provincial legislation, company's green commitments, and incentivization. Incentives are offered in both BC and Quebec – for up to $100,000 in B.C. for medium- and heavy-duty trucks, and $175,000 per vehicle in Quebec for heavy-duty trucks. New York City also has a rebate incentive funding program to reduce diesel exhaust emissions by replacing older, heavy polluting diesel trucks with new battery electric, or EPA emission compliant alternative fuel (compressed natural gas, diesel-electric hybrid, and plug-in hybrid electric) and diesel trucks. The scheme also places restrictions on applicants to ensure the City and adjacent region receives the benefits of cleaner trucks. These include requirements that the vehicle is registered in the region, operates for 70% of time within NYC's neighboring three states and is also operated within the city's industrial zones at least twice per week.

The City of Vaughan and its residents will undoubtedly benefit from increasing the number of cleaner trucks operating in the City limits, but the City will require partnerships with York Region and the Province of Ontario to develop incentives or programs to speed up the uptake which may include schemes such as rebate programs or other forms of local tax related incentivization.

Currently, there are numerous priorities under development at the Ministry of Transportation Ontario (MTO) from the Greater Golden Horseshoe (GGH) Transportation Plan, which emphasizes sustainability, including reduction of the environmental impact of transportation. Some of these initiatives will include developing a strategy for low and zero-carbon charging or fueling stations, alongside the adoption of low and zero-carbon truck options. These may be electric or hydrogen-powered.

Another "tool" to lever good practice is to recognize companies and organizations that are doing the right thing and leading the implementation of cleaner fleets. In Dallas, TX, the Dallas-Fort Worth Clean Cities (DFWCC) coalition has instigated a fleet recognition award program to recognize fleets that are making extra efforts to efforts to reduce petroleum use and improve air quality in North Texas. This is based on an annual survey and criteria shown in **Table 2**.

Table 2. DFWCC Fleet Recognition Award Program

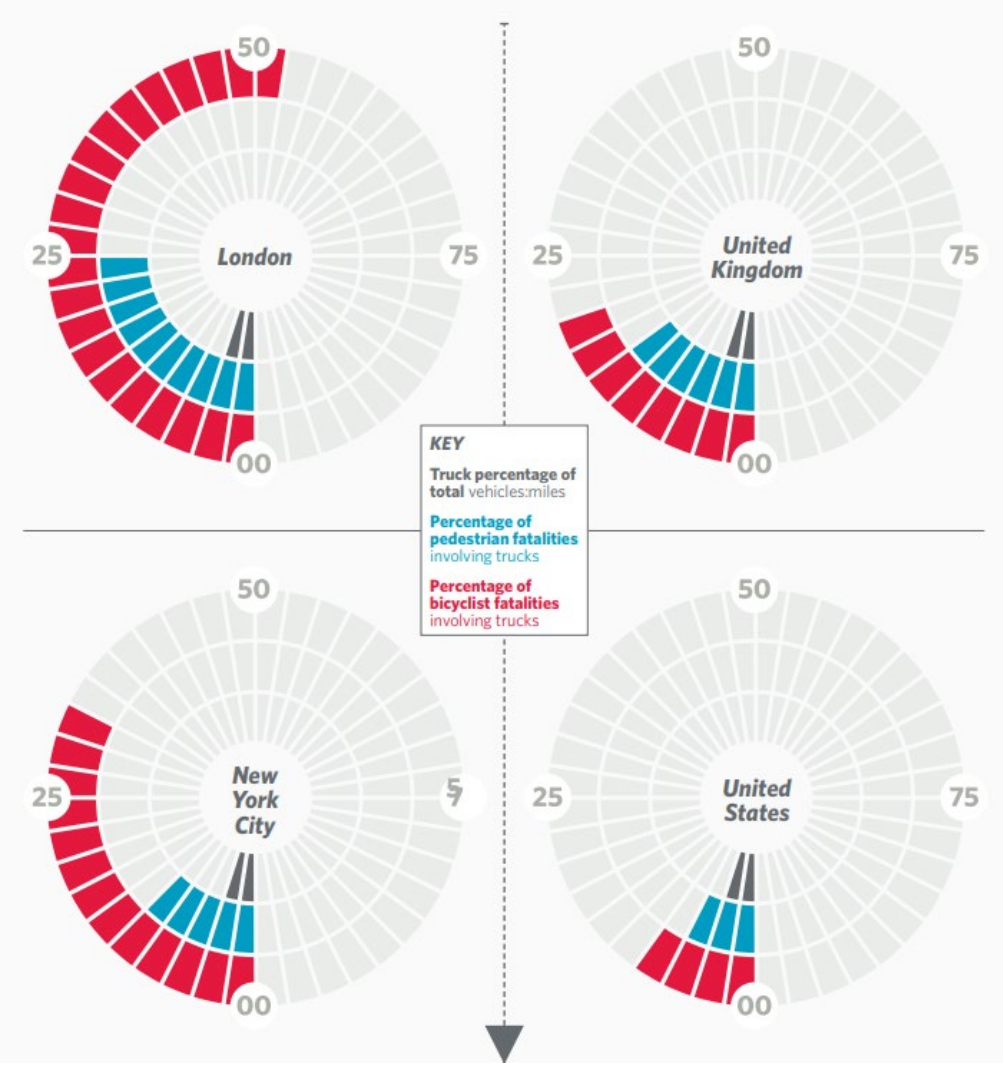
Partnership with DFWCC	Emissions Reduction	Fuel Consumption Reduction
20 Points Maximum	55 Points Maximum	25 Points Maximum
• Attendance and Presentation or Speaking at any DFWCC Sponsored Event/Webinar • General Involvement with DFWCC	• Amount and Composition of On-Road and Non-Road Alternative Fuel Vehicles • Implementation and Enforcement of Idle Reduction Policy • Time Idling Reduced	• Overall Fleet Efficiency Improvements • Smaller Vehicles, Lightweight Materials, etc. • Practices to Reduce Vehicle Miles Traveled

Source: DFWCC

While the DFWCC scheme is focused on public fleets, such a scheme has potential to be developed on a regional or City of Vaughan basis. It is a relatively low-cost scheme.

5.4 Improving Urban Truck Safety

Large truck design presents inherent challenges for pedestrian and bicyclist safety, especially in urban areas. A previous HDR analysis of truck involved crashes in New York City and London, UK highlighted the disproportionate impact of pedestrian and bicyclist fatalities involving trucks (**Figure 31**). As cities look to increase the number of people walking and cycling, there is increased exposure to truck involved crashes, which tend to have more fatal outcomes.



Source: HDR

Figure 31. Comparison of Truck Involved Bicyclist and Pedestrian fatalities in NYC and London

Many cities are now taking active steps to reduce and eliminate truck involved fatalities. Some of these solutions and activities are described in the following sections.

5.4.1 Safer Truck Design

Sideguards

Sideguards are standard equipment in the European Union, UK, Japan and Brazil where they are mandated by legislation. UK studies show side-guards are an effective countermeasure to reduce the number of vulnerable road user fatalities and severity of injuries. Fatality rates for bicyclists and pedestrians colliding with a side of a truck decreased by 61% and 20% respectively after side-guards were required in 1986. **Figure 32** demonstrates the sideguards installed on trucks.

Source: NYC
Figure 32. Examples of Sideguards

In 2010, the National Research Council Canada produced a report on truck side guards. The study points out that the height, strength, and location of side guards affect their effectiveness in minimizing incident severity[6].

Improving Driver Vision

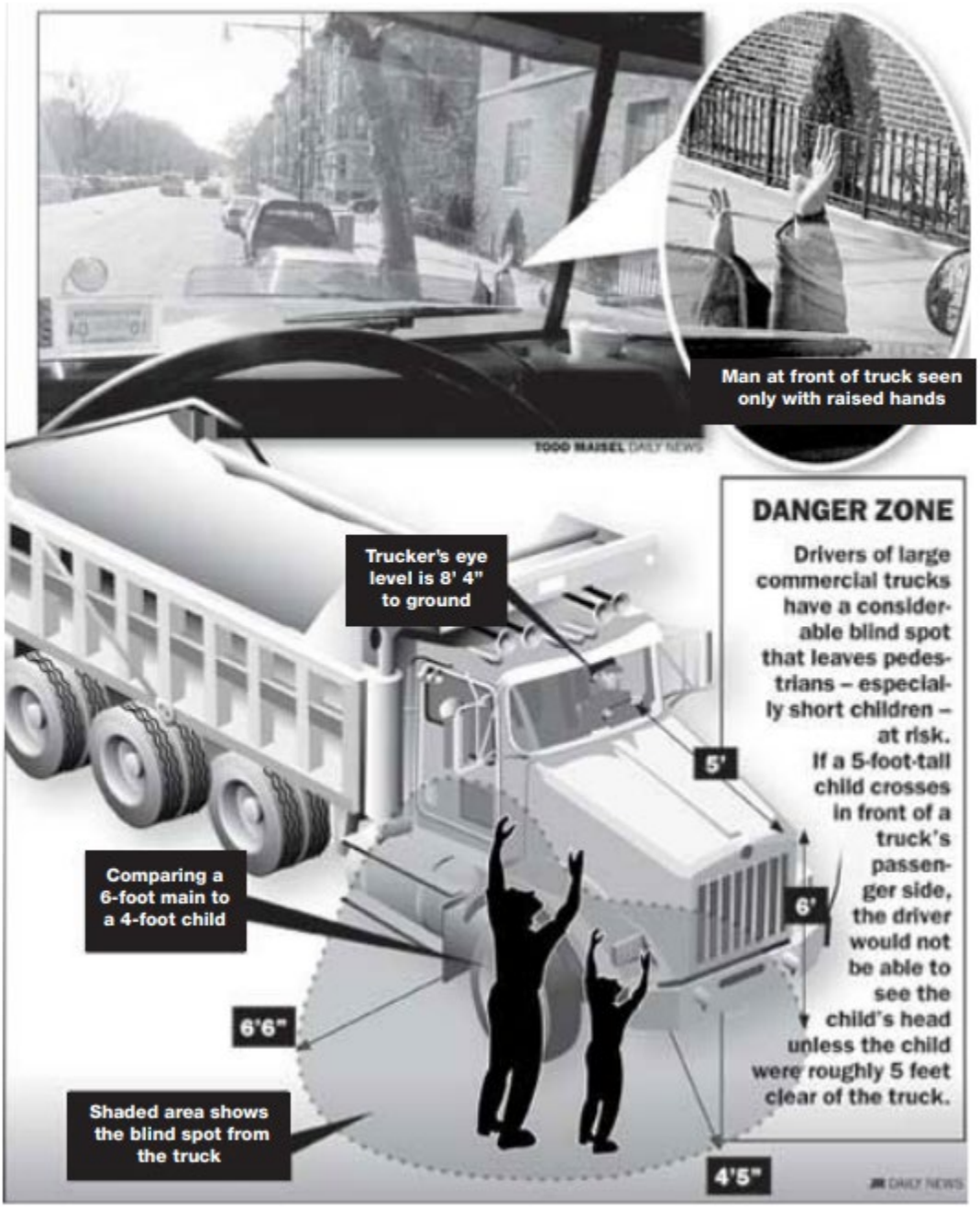
Truck drivers often must rely on multiple mirrors to observe what is happening around their vehicle, but despite this there are often blind spots as shown in **Figure 33**.

Source: Transport for London
Figure 33. European Type Truck Driver Vision

While this is a typical European type truck, a North American style truck also a significant blind spot to the front as shown in **Source:** NYC

[6] J. D. Patten, C. V. Tabra (2010). Side Guards for Trucks and Trailers Phase 1: Background Investigation. *Centre for Surface Transportation Technology*. Available: https://www.volpe.dot.gov/sites/volpe.dot.gov/files/docs/side-guards-for-trucks-and-trailers-phase-1-background-investigation-jd-patten-canada.pdf

Figure 34. New York City enacted a requirement for cross over mirrors to be installed on trucks operating in the City.



Source: NYC

Figure 34. Blind Spot of a North American Type Truck

Some truck manufactures are now building truck cabs with improved driver vision and specifically targeted for urban operations. The example shown in **Figure 35**, is now available in North America and **Figure 36** demonstrates the drivers' direct vision.

Source: Dennis
Figure 35. Hi-vision truck cab

Source: Transport for London
Figure 36. Direct Vision.

Other solutions to improving driver vision and awareness include:

- Blind Spot mirrors e.g., the Crossover mirror used in NYC
- Blind spot cameras
- Fresnel lenses
- Turn alarms including visual and audible methods
- External sensors such as ultrasonic and radar.

5.4.2 City Leadership

Many cities will operate their own fleets or contract in trucks for a variety of services they supply to their residents. This includes waste collections, highway maintenance etc. Some cities have led by example and sought to better integrate safer trucks into their contracted and own fleet operations.

In 2012, the City of Boston engaged Volpe to volunteer as a test bed city, initiating the truck side-guard technology demonstration and evaluation process in the U.S. Volpe and Boston launched a side-guard pilot of 19 city owned trucks in May 2013 and collaborated in 2014 to develop the nation's first side-guard ordinance requiring the adoption of this safety technology on private truck fleets; the "Ordinance requiring city vendors to safeguard unprotected road users" was enacted in October 2014 took effect in May 2015, and will impact up to 230 trucks.

The City of Cambridge, MA, also engaged Volpe in 2014 to retrofit its city-owned truck fleet, while the University of Washington held a sideguard press event in Seattle for its fleet of 31 retrofitted trucks. Additional side-guard adoption is underway in Portland, OR, Washington, D.C., San Francisco, and Somerville and Newton, MA.

New York City operates over 30,000 owned and leased vehicles, the largest municipal fleet in the United States. The City's fleet operator, the Department of Citywide Administrative Services (DCAS) has installed over 60,000 safety systems on city vehicles including the largest truck sideguard program in North America and one of the largest singular telematics programs. It has also started to introduce hi-vision trucks into its fleet.

5.4.3 Education

Truck Drivers

New York City operates over 30,000 owned and leased vehicles, the largest municipal fleet in the United States. TfL's Safe Urban Driving module is a one-day course designed for both truck and bus drivers. Aspects of the course include hazard recognition, defensive driving techniques, driver attitude and what to do in the event of an incident. It combines a half day classroom exercise with a half day on the road practical cycling module. This gives truck drivers firsthand experience of the issues faced by vulnerable road users and has proved transformative in truck and bus driver behavior. Truck driving simulators have also been used to train drivers to operate trucks on different types of roads (urban, rural, motorways), traffic conditions and weather conditions.

Exchanging Places

Both cities have a program that gives cyclists the opportunity to sit in a truck and share the perspective as to what a truck driver can see and more importantly what they cannot see. Authorities utilize good relations with the local trucking industry to provide a truck, so that cyclists and pedestrians can be invited to sit in a truck and see the road from the perspective of a truck driver. **Figure 37** shows the Exchange Places event happened in New York City

Source: NYC
Figure 37. Exchanging Places event in New York City

5.5 Managing Demand

5.5.1 Out of Hour/Off peak Deliveries

One solution that has been trialed by several municipalities and authorities is actively promoting the retiming of deliveries to quieter periods of the day and reducing congestion. This includes early morning, typically prior to vehicle peak travel times, during the night or late evenings. London developed a retiming program for the London 2012 Olympics and Toronto did something similar for the 2015 Pan-Am games. New York City has also introduced an off-hours program and seeks participants for their program. It has developed online materials to help inform communities and operators of the program - ohdnyc.com and includes toolkits associated with How to Guides and Noise Management.

Noise and disturbance to residents is often cited as an issue and barrier to off peak deliveries. In 1998, the Dutch government established standards for noise emissions during night time loading/unloading operations for the retail industry. This resulted in a project called PIEK and in 2004 the PIEK certification scheme for vehicles and equipment operating under 60dB(A) was launched. Electric trucks and electric reefer units used for cold chain food deliveries are quieter than their diesel counterparts and will no doubt form part of the toolkit for noise mitigation measures in the future.

HDR's experience with off hour programs and its staff's work in NYC and London is that retiming is a significant challenge. Not all delivery activity can be retimed – package deliveries are good examples, while deliveries into commercial establishments such as offices are timed when staff are there. Retail establishments, particularly those associated with vertically integrated and consolidated distribution operations present more opportunities, as there is often a benefit in getting product into store early and placed on the shelves, when customers are not in the store. Some companies also employ unattended delivery solutions, where the driver can access the store, leave the product when no staff are present. Getting companies to think about retiming and what the benefit is for them is critical.

5.5.2 Urban Consolidation Centres

Urban freight consolidation centers (UCC) are warehouse facilities located near a city center, town or other service area, which collect large truckloads of freight. Goods are then distributed according to the most efficient route on smaller vehicles. UCCs also facilitate the usage of alternative vehicles, whether electric or human powered and their role in cargo bike operations was discussed in an earlier section. UCCs have been implemented in various capacities over the last few decades, mostly as publicly run endeavors in Europe. A mini boom of consolidation center planning occurred in the 1990s, but many that were planned were never implemented, and those that were implemented did not last long due to financial issues when public subsidies were stopped. Identifying a sustainable business case is one of the critical challenges associated with the wider deployment of shared user, UCCs.

5.6 E-Commerce and Deliveries

In 2020, Canada had the second highest growth of e-commerce in the world at 75%. The pandemic was a major influence, but expectations are that e-commerce will still have robust growth in the short term. The implications, from a transport perspective include:

- More trucks and vans delivering in residential, but also commercial areas.
- Larger delivery vehicles in residential areas.
- Growth in trucks and vans on highway networks as interregional and last mile delivery trips increase.

5.6.1 Residential Deliveries

In addition to package deliveries, there is also expected to be substantial growth in grocery home delivery services. In 2020, Ocado opened its first automated warehouse in North America in the City of Vaughan fulfilling orders for Sobeys. Loblaw and Walmart are other providers.

In the City of Vaughan's low rise, relatively spacious residential neighbourhoods, parking for delivery trucks and vans whilst unloading can occur with relative ease. The roads are wide enough to allow traffic to maneuver round a parked van or truck, traffic volumes are relatively low etc. However, as some residential areas may intensify and there is greater densification of population, such as the increased development of townhouses or apartment buildings, then some interventions may be needed to reduce demand for deliveries or better incorporate the activity in the design of the streetscape.

5.6.2 Neighbourhood Loading Zones

NYC DOT's Neighborhood Loading Zone (NLZ) program aims to reduce double parking on narrow residential streets by providing space at the curb for activities such as:

- Package deliveries by commercial vehicles
- Taxi and car service pick-up and drop-off
- Active loading and unloading of personal vehicles

While most loading zones are typically focussed in commercial and business districts, the increase in package deliveries to residential areas, has seen a demand for curbside access by delivery vehicles on residential streets, including during evening hours.

5.6.3 Parcel Delivery Lockers

A common issue with e-commerce deliveries is the impact of failed deliveries. In the US, 8% of first-time deliveries fail, at an average cost of $17.20. In Germany, 7% of deliveries go wrong in the first instance, costing on average €14.69 apiece. In the UK, it's a 6% failure rate at an average cost of £11.60 each.[7] Not only does this increase cost, but also adds vehicle miles and emissions.

There are several reasons for failed delivery, but more common issues include:

- Parcel recipient is not in to receive delivery
- No suitable location to leave delivery item
- Item cannot fit into post box

One solution that has been adopted by Amazon is the use of parcel lockers. Rather than direct a package to a home or business address, the recipient identifies a convenient locker location, where the parcel is delivered to. Recipients then collect the package from the locker using a barcode and unique number to access the item. Lockers have been installed in shops, office lobbies and some residential locations.

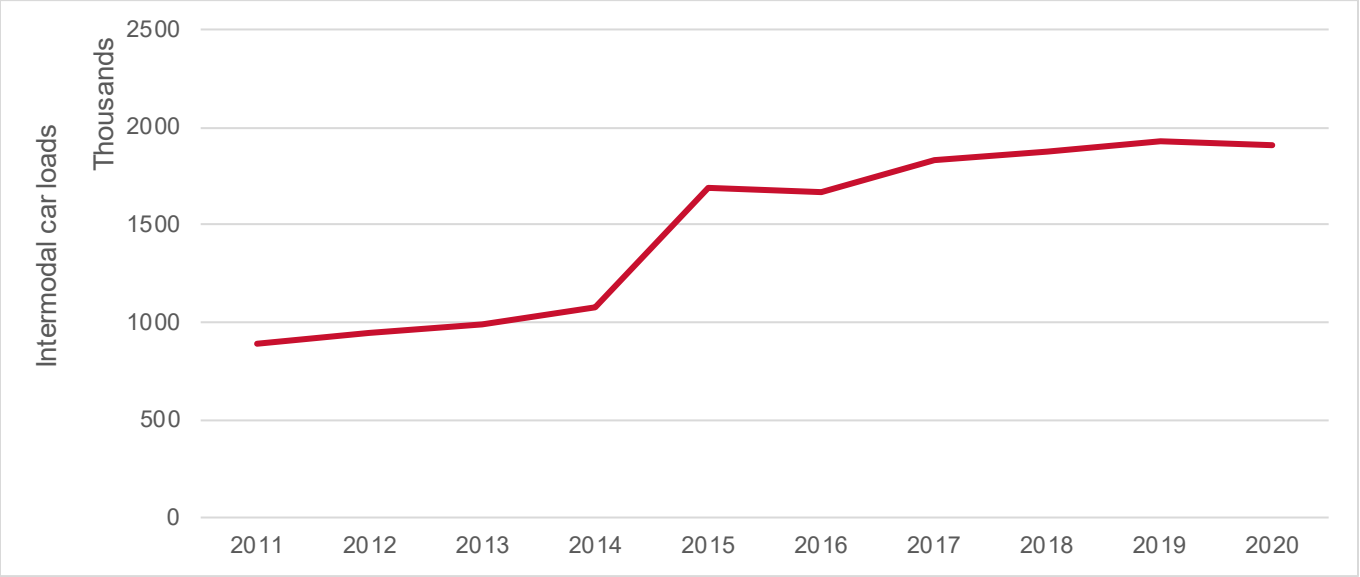
In the UK, lockers have also been installed in transit hubs and train stations (**Figure 38**). This allows passengers to pick up their items as part of their journey. UPS has also developed UPS Access Point™ and UPS Access Point™ Lockers. These locations are typically comprised of neighborhood retail locations such as independently owned and operated stores. They benefit the retailer by driving footfall to their location. In Vaughan, such lockers have potential to be installed at transit hubs, in intensification zones and potentially in other public or community facilities such as libraries.

Source: Govia Thameslink
Figure 38. Amazon Locker

5.6.4 Growth in Rail Intermodal Traffic

As shippers and logistics companies seek to respond to changing supply chain dynamics associated with e-commerce, reduce cost, improve their environmental credentials, and respond to truck driver shortages in the long-haul trucking market, it is expected that intermodal growth will continue to rise for both domestic and export/import journeys. As shown in **Figure 39**, the number of intermodal railcars moved on Canadian railways has significantly increased from 2011.

[7] Loqate.com



Source: Railway Association of Canada
Figure 39. Intermodal rail cars moved by railways in Canada – 2011 to 2020.

This growth is expected to generate more truck trips at the intermodal yards in Brampton and Vaughan. Autonomous and electric trucks will assist in mitigating some impacts, but other improvements may have to be made to local infrastructure. For example, the main access routes to the CP intermodal yard are not controlled and trucks have to wait for gaps in traffic. As truck volumes entering and exiting these yards increase, there is likely to be a need to manage traffic to address safety and efficiency concerns and so interventions such as traffic signals or truck enabled roundabouts could be considered at these locations.

Growth in intermodal is also likely to increase the number and length of trains accessing these yards. This could also have implications on highway network efficiency at grade rail crossings, on rail roads that serve these intermodal facilities, such as the one on Rutherford Road.

5.7 Partnerships, Public and Industry Engagement and Education

Public and industry education and engagement can be a critical component for successful freight projects, initiatives, and strategies. Many freight projects and plans across North America include public engagement as a distinct workstream to solicit input and create awareness from key users and the wider public. Methods of engagement include surveys and questionnaires, online and in person meetings and videos. Some departments of transportation in North America establish Freight Advisory Committees (FAC) to assist in the development of statewide freight plans. Establishing a FAC is recommended in federal regulations. Freight quality partnerships (FQP) have been established in some parts of the UK to provide a forum for the freight industry to engage with local authorities providing a method for two way information exchange on particular issues and seeking solutions to complex situations. Examples of freight forums in Canada include:

- The GTHA Urban Freight Forum that was established for the development of the Urban Freight Action Plan.
- In April 2009, Peel Regional Council directed that a Peel Goods Movement Task Force be created to promote and advocate for efficient goods movement in the Region.

A 2014 international study by the Volvo Research and Education Forum and Gothenburg Urban Freight Platform identified the following benefits and strengths of these freight related partnerships:

- Input to policy development
- Network of professionals on freight
- Networking
- Industry insight
- Knowledge exchange about freight between different organisations
- Focus on pragmatic solutions to real freight issues
- Cooperation
- Dialogue
- Technical studies
- Contact with policy-makers and planners
- Three levels of government are present – municipal, provincial and federal
- Well-rounded mix of groups representing public agencies, community groups and the business community.
    - Better understanding of policy complications for private sector
    - Public sector is better informed about the new practices, organisations, aims, constraints of the private operators

Issues and weaknesses included:

- Cannot reach agreement
- Slow implementation of initiatives
- Lack of technical knowledge
- Lack of understanding of urban freight issues (which is improving)
- Many people come to meetings but do not really take part in the discussions, they only come to collect information
- Lack of participation from some industry sectors
- Lack of resources to dedicate more time to the FQP

Some public engagement initiatives can be focused on promoting the importance and recognition of freight and logistics to a community. This may include identifying the number of jobs supported by the freight industry, taxes generated and access to products and services.

It is expected that industry and public engagement will be an integral part of future planning and strategy efforts within the City of Vaughan and consideration could be given to establishing formal freight forums, such as the examples identified above, to inform and provide better freight related planning and project outcomes. An engagement framework could also consider partnerships with other entities including the Smart Freight Centre, who may have ready access to relevant data and knowledge. Their independence can also be a benefit and assist with outreach and dealing with commercially or operationally sensitive data from industry, that private companies would not necessarily want shown to a wider audience. Another advantage is that an entity such as the Smart Freight Centre, could facilitate the hosting and organising entity for a formal freight forum, assuming sufficient resources are available. The Central London FQP in London, UK was initially assisted by the University of Westminster.

6 Summary and Key Opportunities

This white paper has highlighted several freight related practices and activities from across North America and Europe that seek to better manage and improve freight movement and reduce freight impact on communities and neighbourhoods. It is not meant to be an exhaustive list, but rather provides a flavour as to what sort of activities might be applicable to the City of Vaughan. A stakeholder engagement meeting was held in September 2021 with the Ministry of Transportation Ontario, York Region, and neighbouring, and municipalities. Meeting minutes can be found in **Appendix B: Goods Movement White Paper Stakeholder Engagement**.

Based on both the review and inputs from stakeholders, recommendations for further consideration include:

1. There are clear benefits in articulating a goods movement strategy for the City of Vaughan, that seeks to balance the needs of the City's residents and freight dependent businesses, address key focus areas and establish vision, goals and objectives that are relevant and important to the City and within remit and capability of the City to deliver.

2. Define a truck route network for the City that builds upon the City's existing bylaw; reflects the City's existing and planned land uses; supports the needs of the City's businesses; and integrates with other Provincial, Regional, and neighboring jurisdictions. Development of the recommended truck route could consider a similar matrix to that identified in the Tampa Bay case study, including key considerations in the design and implementation of freight related highway infrastructure.

3. Designing for cargo bike operations in intensification and transit-oriented development areas. A key factor will be allocating space for a facility that can accommodate a truck, stage cargo bikes and facilitate the transfer and sortation of packages between the truck and the cargo bikes. This could be potentially incorporated into commercial or public off street parking facilities, or under utilized public facilities to support a trial or pilots. .

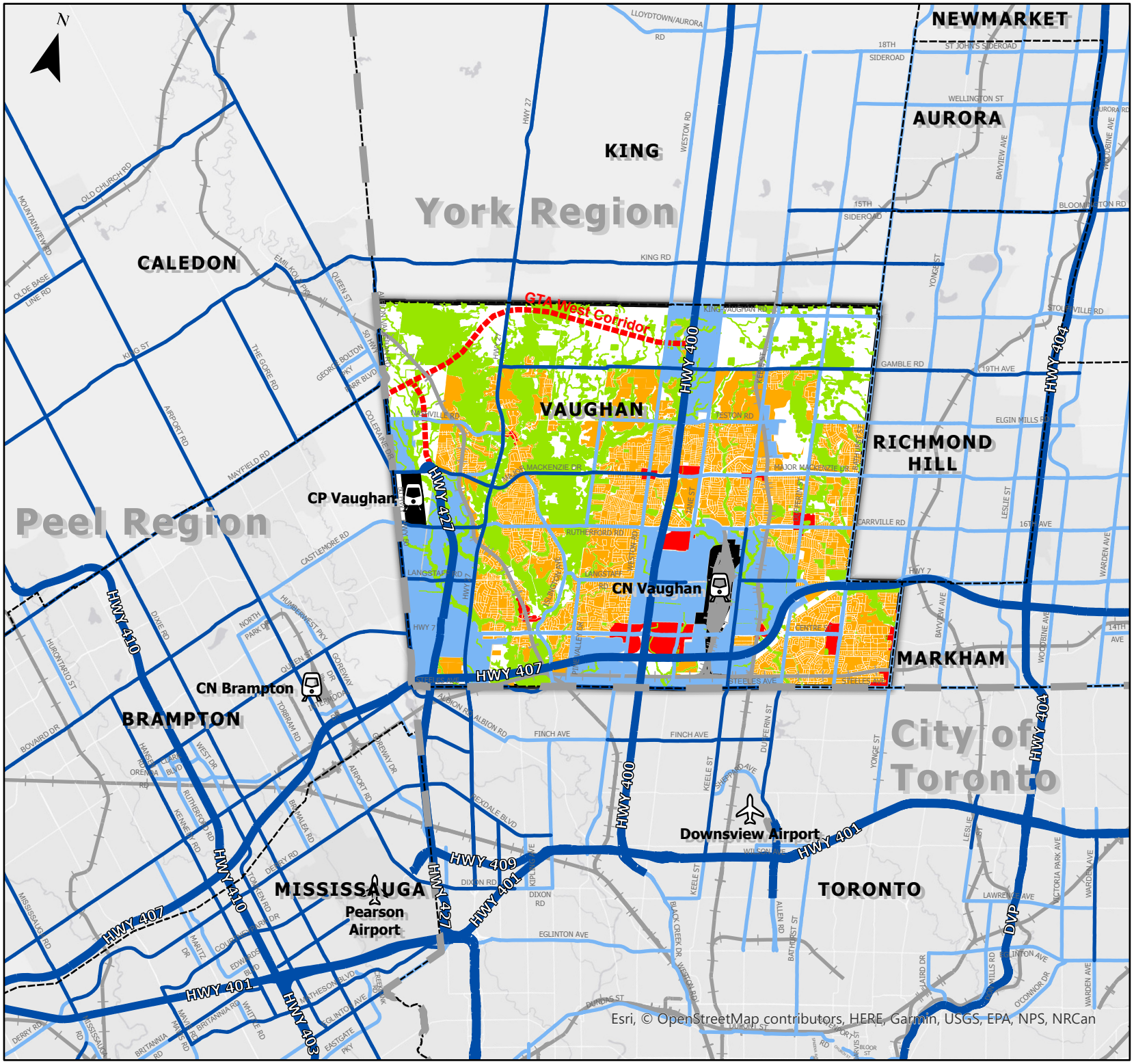
4. Considering safer fleet practices within the City of Vaughan's fleet operations, including vehicles designed to mitigate risks and impacts to vulnerable roadway users.

5. Formally incorporating freight activities within Complete Street strategies.

6. Develop a formal freight forum to assist with future freight strategies and other plans and developments within the City of Vaughan. This is particularly noteworthy given the future demand and increase for siting freight related developments within the City's boundaries, the growth in e-commerce and the ongoing development of autonomous vehicles.

Appendix A: Strategic Goods Movement Network Overview

Appendix B: Goods Movement White Paper Stakeholder Engagement



Legend

Freight Movement Routes

- Freeways
- Primary Routes
- Secondary Routes
- Rail Lines

Boundaries

- Regional Boundaries
- Municipality Boundaries

Land Use

- Rail Facilities
- Natural Areas
- Employment Areas
- Community Area
- Intensification Areas

Intermodal Facilities

- Airports
- Rail Yards

Kilometers
0 1 2 4

Sources:
1. Regional Municipality of Peel (2017). Peel Region Goods Movement Strategic Plan 2017.
2. Regional Municipality of York (2016). York Region 2016 Transportation Master Plan
3. City of Toronto (2017). Toronto Strategic Goods Movement Network.
4. City of Vaughan (2017). City of Vaughan Official Plan.
5. Ontario Ministry of Natural Resources and Forestry (2019). Ontario Railway Network.

Meeting Minutes

Project:	Vaughan Transportation Plan
Subject:	Goods Movement White Paper Stakeholder Engagement (Draft)
Date:	Tuesday, September 21, 2021
Location:	Teams Meeting

Attendees:		
	Andrew Tam, MTO	Christopher Tam, City of Vaughan
	Arash Olia, Town of Caledon	Selma Hubjer, City of Vaughan
	Jillian Britto, Town of Caledon	Winnie Lai, City of Vaughan
	Brian Lakeman, City of Brampton	
	Henrik Zbogar, City of Brampton	Jonathan Chai, HDR
	Ahmad Subhani, York Region	Yunfei Zhang, HDR
	Lauren Crawford, York Region	Joseph Dack, HDR
	Arthur Lo, City of Toronto	Gurbani Paintal, HDR

	Topic	*Action Item*
1	*VTP introduction – blueprint, engagement, future actions*	
2	*GM Characteristics in Vaughan* • Note: MTO data doesn't cover enough about CN and CP intermodal yards since the companies have not given permission. There is a gap in the data.	**HDR** to note gap in the data source
3	*Key Themes*	

3.1A	Public Sector Freight initiatives
	Truck Parking
	• Brampton – Truck parking for when trucks are not in use (short and long term) are important to consider for freight-dependent industry areas.
	  ○ HDR – Time of day considerations and overflow parking onto residential streets has also been seen in other areas. Adequate parking measures are needed.
	
	Staff Parking and Mode of Transportation to Work
	• Brampton – Small firms typically struggle with parking facilities for staff
	  ○ HDR – Similarly, Amazon warehouses also need large parking for staff. Car parks are expensive and take up land. Transit can play an important role here. This can be further explored.
	
	Alternative Fuels
	• MTO – Municipal vehicles can be the first to push for alternative fuels to reduce environmental impact. Cities want to encourage goods movement and not add restrictions there just yet.
	• MTO – Tools for advancing behavioural change may not be effective in municipalities here due to low profit margins, especially in smaller companies. Some of these initiatives are there in the	

	corporate goals, however. We could try to run surveys to get an idea of what will be accepted.	

3.1B	Truck Restrictions
	• Brampton – Peel identified Goods Movement streets that explicitly permit trucks, and Brampton has a bylaw that bans trucks from most city roads.
	  ○ HDR – How are these enforced? E.g., NYPD enforces truck restrictions. There's an education program with police staff and NYC DOT to train police on the rules
	  ○ Brampton – The City by-laws are enforced by Peel Police as they are considered moving violations
	• Brampton – Link to Brampton's truck restriction map, Link to Brampton's traffic by-laws
	• Caledon – Link to Peel's truck restriction map
		HDR to review goods movement restrictions in Brampton and Peel

3.2	Planning for Freight & Infrastructure Design • MTO – There are ongoing efforts on this topic and an updated document by MTO called Freight Supportive Guidelines addresses this. • MTO – An online course for this is available, and topics including engineering street design, disruptive technology, and alternative fuels are covered.	**HDR** to review relevant documents

3.3	Future Considerations and Trends
	Automated Trucks – middle mile, repetitive journeys
	Alternative Delivery Vehicles – Drone Delivery
	Alternative Delivery Vehicles – Cargo Bikes
	• Brampton – What is the viability of these bikes in a suburban context?
	  ○ HDR – It comes down to delivery density and start location for the cargo bike's journey. It needs to be economically viable.
	  ○ This can be applicable in the City's intensification areas, Major Transit Station Areas (MTSAs), or transit-oriented development (TOD) areas. Identifying appropriate truck delivery access streets and centralized loading areas at a Secondary Plan level could be adopted.
	Alternative Fuels – carbon reduction and air quality
	• HDR – Low carbon recognition programs are a low-cost way to get public recognition of these companies, to showcase behaviour change for the greater good.
		HDR to add cargo bikes and implementation considerations into white paper

3.4	Key Opportunities • Goods Movement Strategy • Truck Route Network	
4	*Discussion*	
4.1	**Truck Routes Integration with Neighbouring Municipalities** • Brampton – can see the benefit of an integrated Truck Route Network with Peel and Brampton. For example, Highway 50 is shared between Brampton and Vaughan. There's an opportunity to consolidate and come up with a consistent overlapping truck route system.	**HDR** to identify this in the white paper, potentially develop an opportunities map that overlays Region's SGMN with land use in

	○ HDR – It comes down to compliance and being easy to understand as it was designed. ○ Gaps in the network or where the different networks don't complement each other make them difficult to use.	Vaughan, external plans from Peel, Brampton, and Toronto
4.2	**Enforcement and Industry Engagement** • Brampton – Peel region staff talked about developing a paper-based map that could be distributed to trucking firms. ○ HDR – Work with NYC has shown that paper-based maps are great for local users, however infrequent drivers (once in a year or six months), would be harder to educate about the truck route network with this method. How do they access it? Especially with a car GPS or mobile phone, the route choice is not designed for trucks ○ Brampton – It would ideally be in the mapping platform people are using. • Brampton – Vaughan might want to dive into formalization of communications with private sector. In Peel they do that through the Peel GM Task Force. It may be of benefit in Vaughan. It allows the private sector to have concerns heard. It is hard to follow through, but it needs to be actionable to get continued engagement. A larger GTA task force is also a good idea but harder to implement. ○ Toronto - Toronto Freight and Goods movement strategy adopted by council last year. It identifies municipal and other stakeholders as part of each of these strategies. Link to document. ○ York Region – No task force conversations yet. We are exploring through the current review and update to the TMP. It would be a sound idea to set something up for broader GTA taskforce.	**HDR** to discuss these considerations in the white paper, specifically on identifying the opportunity to establish a Task Force with the industry
4.3	**Public Education on Goods Movement** • Brampton - Other public opposition is of note. People do not like being stuck behind trucks. We need to educate the public about how trucks can benefit the economy. We need to try and bring residents on board. ○ HDR – How do we engage and seek consensus from the public? They are voters. It is critical to ensure they're a part of the discussion.	**HDR** to discuss these considerations in the white paper
4.4	**Complete Streets and Goods Movement** • Brampton – As we plan for higher order transit, they tend to fall on the same arterials used for goods movement. How to accommodate both, and allow them to function as planned? ○ HDR – There are good examples in London – a priority bus route was impacted in central London by increased journey times due to trucks. The transport authority had to carefully plan for delivery activity and ensure both can happen. ○ Certain measures are not useful to control the system; parking tickets don't deter companies anymore. ○ A conscious effort needs to be made for the overall success and performance of the transportation system, including accounting for freight activity and design.	**HDR** to discuss these considerations in the white paper

- Also, roads with lower volume bus routes also allowed trucks to share the road in London. We must account for different needs.

- Toronto - Safety is of public concern especially in municipalities with complete streets. Vulnerable users are at the top of the list. Safety or design inventions that can be incorporated into truck routes should be considered, especially intersections where there is a higher potential for conflict.
  - HDR – Trucks and cyclists don't mix well. Cities can promote safer trucks on city fleets, and have those with side guards installed. Better vision can be created for truck drivers by using specific cabs/trucks. Stickers creating awareness of truck blind spots is another cost-effective safety measure.
  - MTO – Truck bike conflicts are rare in suburban areas. It is mainly an issue in Toronto.
    HDR – Could be a future conflict
    MTO – These cities have flexibility and room to plan it out.

4.5 **Off-Peak Deliveries**

- MTO – Toronto has limited road real estate. For example, at Yonge and Lawrence a 53-footer exiting a terminal can take 25 minutes. Cyclists try to get by on narrow city roads and they are sharing the road space to capacity. Night deliveries must account for banned streets, so there is a balance to be had.
  - HDR – Operators often consider delivery at night.
    Noise is also a big issue in urban areas. There can be a scheme related to a certain noise level. Trucks must make their delivery under a certain level in Europe. NYC DOT trialed European equipment with noise monitoring. It's important to get operators to thinking about this. Night deliveries are more fuel efficient, and they can double-trip the truck as well. There are economic advantages.
  - MTO – It doesn't really work for all industries. Uptake was slow when this was offered here.
  - There was a noise specialist for the recent night-delivery pilot. They went around with the noise detection device. No specific issues.
  - MTO - Peel Region Task Force and U of T jointly did a pilot– Off peak delivery pilot study report (2020). The GGH plan also encourages them to adopt these alternatives. It is important to contextualize it. Each municipality is different.
  - HDR – Different groups will play different roles. Some strategies may be federal, others at different levels of government.

HDR to discuss these considerations in the white paper

4.6 **Automated Trucks**

- Vaughan – We could encourage testing of automated trucks on specific routes suitable to automated trucks. We could also collect data for future planning. Truck network could include classification of Automated Truck routes.
  - MTO – Automated trucks are piloted on restricted corridors, so it requires approval since it is a provincial undertaking

HDR to identify this opportunity in the white paper