GOODS MOVEMENT IN OTTAWA: TRANSITIONING TO A SUSTAINABLE FUTURE

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ABSTRACT

Most Canadian urban areas promote a more sustainable future in their long-range transportation master plans (TMPs). This applies to all urban travel, but most TMPs consider goods movement at a high level, if at all.

To address this gap, the City of Ottawa commissioned a study of goods movement. The study will inform Ottawa's upcoming transportation policies and plans.

Other urban areas have developed stand-alone goods movement strategies. These strategies typically look at current and long-term issues, and recommend packages of operational, regulatory, technological, planning and policy solutions that can be implemented over time. Many of the packages consider sustainability but, again, at a high level.

Ottawa's goods movement study looks at a range of opportunities, but it differs from other Canadian goods movement studies in that it focuses on sustainability and ways to transition to a sustainable transportation future. The Ottawa study does not recommend solutions but instead presents opportunities that the City can consider in its policies and plans. It should be noted that the study looked at goods movement within, to and from Ottawa, although it did not look at interregional goods movement through the city.

The Ottawa study looks at how sustainability can be incorporated through short-term operational and traffic management improvements and through long-term policies and land use planning. It looks at how goods movement is incorporated in today's sustainability initiatives, such as Complete Streets rehabilitations of urban streets and intersections, along with some of the current challenges faced by couriers and truckers and how these might be resolved. The study considers the potential role of emerging goods movement technologies, such as connected and autonomous vehicles, in promoting sustainable urban goods movement in the future, while accounting for the inherent uncertainties associated with industry uptake of new technologies and trends such as e-commerce and the growing role of independents in urban deliveries. Finally, the study looks at how these actions can be integrated to transition to a more sustainable future over time, while recognizing market realities, the need to maintain economic sustainability and the uncertainties associated with emerging technologies.

The paper speaks to all these aspects by providing an overview of the Ottawa study's goals, how its focus on sustainability differs from other Canadian urban goods movement studies, how economic/business and other realities must be considered, and how current opportunities and emerging technologies can set the stage for long-term sustainability initiatives.

INTRODUCTION AND APPROACH

This paper describes the outcomes of recent research on opportunities for a potential long-term transition to sustainable urban goods movement in a large Canadian city. The City of Ottawa commissioned the research to inform upcoming policy and planning work.

The research began by identifying issues of importance to goods movement stakeholders in Ottawa. The stakeholders comprised City of Ottawa staff, representatives of other governments that have jurisdiction in and around the city, a range of private sector stakeholders from across the economic spectrum (truckers, couriers, retailers, construction, food services, business improvement areas and so on) and industry association representatives. This consultation allowed the research to focus on specific local needs and conditions while also ensuring that

multiple perspectives were heard. Potential opportunities for addressing these issues were then derived. The potential opportunities were then detailed and exemplified through a review of good and best practices in Ottawa, other Canadian cities, the United States, Europe and elsewhere. Although the research focused on large cities, the literature revealed applications in cities of varying sizes - hence the findings are also applicable to medium and small Canadian cities.

The outcome of the research is a report that explains the issues, describes the opportunities and discusses how they could be implemented.

It must be emphasized that the research is strictly intended to inform future policies and plans. By design, the research does **not** imply or require any commitments or endorsements on the part of the City or of any stakeholders. This 'backgrounder' approach has the advantage of educating the City and stakeholders on various aspects of a relatively unfamiliar topic - not least how urban goods movement actually functions and how goods movement is incorporated into plans and policies. It also establishes a basis for further discussion and for potential future collaborations to implement these opportunities if and as the City and its partners desire.

As a result, the research did not identify a specific vision of what a sustainable future for goods movement should look like in Ottawa. This is left for future deliberation by the City and its potential partners, informed by the research. This also recognizes that the literature has varying definitions of sustainability in urban goods movement and what it is meant to achieve. Although much of the literature on sustainable urban goods movement (sometimes referred to as sustainable urban freight or low-carbon goods movement) focuses on reducing fuel consumption and greenhouse gas (GHG) emissions, it also can incorporate reducing air pollutants, noise and vibrations, improving traffic safety and managing last kilometre (final leg) parking and delivery requirements.[1] A broader perspective defines a sustainable urban freight system as fulfilling all the following objectives:

- "To ensure the accessibility offered by the transport system to all categories of freight transport.
- To reduce air pollution, green house gas emissions, waste and noise to levels without negative impacts on the health of the citizens or nature.
- To improve the resource- and energy-efficiency and cost-effectiveness of the transportation of goods, taking into account the external costs.
- To contribute to the enhancement of the attractiveness and quality of the urban environment, by avoiding accidents, minimising the use of land and without compromising the mobility of citizens."[2]

Other Canadian urban areas and provinces have conducted goods movement strategies in recent years. These generally consider sustainability at varying degrees of detail and emphases but almost always within a broader treatment of goods movement. For example:

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1 "Making urban freight logistics more sustainable, CIVITAS Policy Note." October 2015. Eltis urban mobility observatory, European Commission.

2 Behrends, S., Lindholm M. and Woxenius, J. 2008. "The Impact of Urban Freight Transport: A Definition of Sustainability from an Actor's Perspective." *Transportation Planning and Technology*. 31 (6): 693-713.

- Goods movement as part of a broader transportation master plan (TMP). Many TMPs recognize the importance of goods movement, but generally as a complement to their focus on passenger movement. Some offer more detail: for example, the City of Hamilton's 2018 *TMP Update* examined goods movement as one component of its Complete-Livable-Better streets and Vision Zero safety initiatives. Other examples include Metrolinx's 2018 *Regional Transportation Strategy* and recent TMPs in York Region and Durham Region in Ontario.

- Goods movement strategies. These are stand-alone strategies for goods movement, which may or may not be linked to broader TMP policies. For example, TransLink's 2017 *Regional Goods Movement Strategy* considered ways to support quieter, cleaner and lower-carbon goods movement and to balance local good movement demands with community liveability, all within a broader context of improving the efficiency of goods movement and maintaining and expanding the multi-modal transportation network to accommodate goods and other demands. Peel Region, Ontario's *Goods Movement Strategic Plan (2017-2021)* and the 2018 *Calgary Goods Movement Strategy* are other examples of multi-faceted goods movement strategies in which sustainability is but one component.

- Goods movement as part of climate change plans. Several Canadian municipalities have developed climate change action plans or have declared climate emergencies. For example, The City of Calgary's 2018 *Climate Resilience Strategy and Action Plan* included a white paper on alternative fuel technologies, vehicle equipment retrofits and logistics operations that could be implemented by the trucking community to reduce GHG emissions. Goods movement is also a component of the City of Vancouver's 2019 *Climate Emergency Response*, which sets a city-wide target of being carbon neutral before 2050.

The Ottawa work differs from TMPs and goods movement strategies in that it looks a broad range of goods movement issues from the sustainability perspective (i.e., it inverts the context). The Ottawa work differs from climate change plans in that it focuses on the long term transition to a sustainable future for goods movement.

PAPER ORGANIZATION

The rest of the paper is organized in several sections: A profile of goods movement in Ottawa is followed by an overview of local, national and global trends that impact goods movement. The next sections summarize the identified issues and a list of the opportunities identified for potential application in Ottawa.

In itself, the list of opportunities serves as a menu for further consideration. It is a compilation of what others have done or have proposed to promote sustainability and improve the efficiency of goods movement. What this paper hopes to contribute to Canadian planning practice for sustainable goods movement is the ensuing discussion of selected opportunities from the perspective of sustainability, responding to specific questions that were posed as part of the research. The paper closes with a synopsis of takeaways that could be considered in other sustainable goods movement studies.

GOODS MOVEMENT PROFILE

This section presents key characteristics of goods movement in Ottawa and of the underlying determinants. In some ways, Ottawa is unique among Canadian cities: for example, the importance of public administration in the city's economic composition and the relatively small role of air and rail in transporting cargo to and from the city. On the other hand, the dominance of trucking in urban and external goods movement, the high value of goods that are generated by or attracted to the city and the importance of goods-generating industries to Ottawa's economy are features that are common to other Canadian cities. These common factors also underline the importance of accounting for goods movement in land use, transportation, environmental and economic plans and strategies for cities of all sizes and composition.

- Demand for goods movement will continue to grow as the city grows. Households, population and jobs are important indicators of the demand for goods movement. Ottawa's 2016 population was 934,243, representing 373,756 households.[3] Households are expected to increase faster than the population over the next few years at 1.17% versus 1.13% per year through 2031, after which both will grow slightly more slowly. Jobs (employment) will grow slightly more slowly over the next few years, at 0.91% through 2031, with growth tapering off after that. Ottawa had 566,000 jobs in 2011.[4]

- Almost all goods in Ottawa are moved by truck. To support this activity, City has well-defined bylaws that govern truck circulation and parking, establish heavy truck prohibitions, designate a truck route network for heavy trucks and regulate the use of over-dimensional vehicles. The City also regulates the use of long combination vehicles (LCVs) on City roads, under the guidance of Provincial policy.

- Truck volumes in central locations are stable or have dropped slightly. Data on urban goods patterns do not exist. However, the City conducts traffic counts at several locations around Ottawa. A review of the counts in and around the downtown and the older inner core (Central and Inner Areas, respectively) found that light and heavy truck volumes have been stable or have decreased slightly in the eight-year period between 2007 and 2015. Light truck volumes generally were greater than heavy truck volumes at these locations. Light and heavy truck volumes generally were greater in the AM commuter peak period than in the PM peak period at most locations. The higher AM volumes may be consistent with greater activity at the start of the business day, suggesting that truck drivers are not advancing or delaying trips due to the morning commuter traffic peak as much as they might be in the afternoon peak.

- Goods-generating industries are an important part of Ottawa's economy. All industries generate the movement of goods, some more than others. In Ottawa, public administration has comprised almost one-quarter of all jobs for several years (24.4% in 2012). However, the key goods-generating industrial sectors of wholesale and retail trade, construction, accommodation and food service, manufacturing and transportation and warehousing combine to represent almost another one-third of the city's jobs (30.6% in 2012). In other words, even though Ottawa does not have the large-scale intermodal terminals, manufacturers or numbers of distribution centres that are found in other major

[3] *2016 Census of Population*, Statistics Canada.
[4] *Ottawa Employment Survey 2012, Results of the 2012 Employment Survey*, City of Ottawa, September 2013.

Canadian cities, the city's goods-generating industries are nonetheless an important part of the local economy.[5]

Notwithstanding the dominance of the public sector in Ottawa's economy, some of the goods-generating proportions are comparable to those of other cities: For example, in Calgary (a similarly-sized urban region) wholesale and retail trade represented 15% of jobs in 2015 (11.8% in Ottawa in 2012) and manufacturing represented 5% (4.5% in Ottawa). On the other hand, Ottawa's 3.7% proportion of jobs in transportation and warehousing is only two-thirds of Calgary's 6%: the difference likely reflects the latter's emergence as a key western Canadian logistics hub.[6]

- Truck trips to and from Ottawa represent a high economic value. Every 5-6 years, the Ontario Ministry of Transportation surveys truck drivers throughout the Provincial highway network. Several observations can be made from the most recent survey (2011-2012):[7]

    - Every day, more than $59 million in goods is delivered to destinations in Ottawa, and another $51 million is shipped from locations in Ottawa. These figures represent $22 billion and $19 billion in goods moved annually to and from locations in Ottawa, respectively. These values demonstrate the economic importance of goods movement to Ottawa's residents and businesses; and the values are clearly understated because they cannot capture a large portion of urban goods movement activity, for which data do not exist, as noted.

    - A wide variety of goods is moved to and from Ottawa. Minerals represent the largest single category by weight, at one-third of origins (35%) and destinations (34%). However, machinery and electrical goods represent one-third of all origins by value (34%) while manufactured products represent one-fifth (20%) of destinations by value.

- Ottawa is served by air and rail. However, compared with truck these modes carry relatively small shares. The Ottawa International Airport provides airfreight and air express service to domestic, transborder and international destinations. Loaded and unloaded cargo tonnage has dropped since its 2012 peak, although the volumes are starting to grow again and reached 11,700 tonnes in 2017. These volumes are well below those handled at airports in comparably sized cities such as Hamilton (97,950 tonnes), Winnipeg (61,550 tonnes), Calgary (85,907 tonnes) and Edmonton (27,113 tonnes).[8] The airport's 2018 master plan indicates that air cargo is of minor importance relative to anticipated passenger demand. Air cargo demand is expected to grow mainly

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5 City of Ottawa. *Ottawa Employment Survey 2012, Results of the 2012 Employment Survey*. September 2013. Results of the 2016 Employment Survey are not yet public. However, the proportions cited above are virtually identical to 2017 figures for the Ottawa-Gatineau Census Metropolitan Area (CMA) hence they can be considered current.

6 The City of Calgary. *The City of Calgary Goods Movement Strategy, Stage 1 Report: State of goods movement in Calgary*, 24 January 2018. Figures are for the Calgary CMA.

7 Consultant's tabulation of the Ontario Ministry of Transportation's 2011-2012 *Commercial Vehicle Survey* (CVS) data. A new CVS is now underway across the Province.

8 Statistics Canada, *2017 total cargo loaded and unloaded, Air cargo traffic at Canadian airports, annual*, Table 23-10-0254-01.

as passenger aircraft sizes increase (i.e., air cargo demand is a function of the available belly capacity of passenger aircraft).[9]

Walkley Yard is Ottawa's only rail yard. It is served by Canadian National Railways. Unlike the aforementioned comparator cities, Ottawa does not have an intermodal terminal – meaning that containerized goods must be trucked in from other cities.

GOODS MOVEMENT TRENDS

Several related trends impact goods movement in Ottawa. Many of these are local manifestations of national and global trends. Many of these trends are pervasive among Canada's cities and around the world – notably, the rapid growth of e-commerce and the ensuing demands on deliveries. Others are specific to Ottawa, especially the fact that some of Ottawa's retail, grocery and food service sector is served directly by distribution centres located outside the city. These trends are described below in four categories:

- Last kilometre delivery (final step of the delivery of goods to customers), comprising such trends as:
    - The growth in omni-channel retailing, which allows purchasers (households and businesses alike) to purchase items online without stepping foot into a store.
    - The associated demand for express delivery to the purchaser's doorstep or some other location beyond the traditional 9-5 work hours into evenings and weekends ('I want it at a specified location at a specified time').
    - Disruptive technologies such as Uber-like crowdshipping apps that allow individuals to informally move small parcels on demand at competitive costs to established couriers - hence anyone can be a courier using their own vehicle.
- The emergence of new technologies such as connected and autonomous vehicles, electronic logging of driver hours-of-service (which impacts the demand for truck parking), delivery lockers, drones, higher-capacity trucks, low- and zero-emission vehicles), cargo bicycles and emissions-reduction technologies.

  Costs are a principal factor in effecting these changes. In order to offset rising labour costs, manufacturing and distribution processes are increasingly being automated - for example, Sobeys is introducing an automated grocery distribution centre in the Toronto area.[10] One result is that these processes can operate 24/7. On the other hand, the uptake of new technologies is dependent on several factors: although they are open to new technologies, recent consultations with individual trucking executives in studies elsewhere in Canada indicate that the uptake will depend especially on cost (payback period) and the reliability and durability of the technology. Liability, insurance, regulatory and public acceptability parameters – factors beyond the control of individual trucking firms – also have yet to be sorted out.

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[9] Ottawa International Airport Authority, *YOW 2038 Master Plan Executive Summary*, Ottawa International Airport Authority, April 2018.

[10] *Sobeys to expand online grocery business by tying up with Britain's ecommerce giant Ocado*, Financial Post, 22 January 2018.

There are also concerns that the current low-cost – i.e., free – delivery is not sustainable. One result is that couriers and retailers have begun to experiment with lower-cost delivery alternatives, such as delivery lockers and self pick-up. Other delivery solutions include a shift to smaller vehicles for the final portion of the trip between the distribution centre and the destination (the last kilometre).

Some retailers are experimenting with drones for deliveries, while others are considering the use of driverless vehicles to deliver fast food.[11] However, there remain significant barriers to the broader use of these technologies: for example, with current technology, many drones can carry only a single parcel and then must be re-charged before they can make another delivery.[12]

Note that the demand for more traditional types of goods movement continues to grow, even as technological innovations are deployed. This is exemplified by growth in the demands for the delivery of large consumer products to stores, the scheduled daily restocking of neighbourhood supermarkets and the delivery of aggregates to construction sites – all of which are commonly made by heavy trucks. Some carriers are also using longer single-trailer vehicles, which improve cost-efficiency, to make traditional deliveries of the types noted above.

- Sustainable road design and the competition for road space, through the introduction of Complete Streets designs. These initiatives have achieved many successes in providing a safe and attractive environment for all corridor users, especially for vulnerable road users (cyclists and pedestrians) and those using other sustainable transportation modes.

  Many Complete Street guidelines accept that trucks and other vehicular traffic will have priority over other corridor users in industrial areas but the situation may be reversed elsewhere – evidenced, for example, by Ottawa's varying level of service (LOS) targets for different modes in different contexts. However, it is important to recognize that high truck volumes can be found anywhere in the urban environment. Accommodating large trucks in all areas is not appropriate although goods, particularly those delivered by couriers, still need to reach all areas of the city.

  As a result, the implementation of Complete Streets, if not well planned, can lead to conflicts such as lane widths being too narrow for trucks and truck turning radii sometimes coming in conflict with pedestrian curb extensions and traffic calming treatments. Encroachments onto pedestrian paths and bicycle lanes also occur nonetheless. As well, because the introduction of bicycle lanes can reduce the supply of on-street loading spaces, competition for these spaces can result in illegal parking, increased congestion as drivers wait for an open space (see or increased fuel use, emissions and delays as drivers circulate to find an available space.

- Distribution centres (DCs), whose use is growing with e-commerce but is also changing rapidly as retailers seek to expand their market reach while reducing costs. Urban distribution centres have also been tested in other cities as strategically located points

[11] For example, tests are now evaluating the use of driverless cars to deliver pizza, by Ford and Domino's Pizza and by Toyota and Pizza Hut. See http://www.cbc.ca/news/technology/dominos-pizza-ford-self-driving-car-1.4266349 and http://www.businessinsider.com/toyota-pizza-hut-team-up-for-self-driving-pizza-delivery-2018-1.

[12] Howard, C. "The new bazaar, Special Report on e-commerce." *The Economist*. 28 October 2017.

that allow loads to be consolidated prior to their final delivery in the urban core. These are discussed further below.

Retailers have long deployed DCs as depots that receive and sort products from various sources before they are transmitted onwards to stock individual stores. Today, with the growth in business-to-consumer (B2C) and business-to-business (B2B) transactions via e-commerce and other retail channels, final deliveries are made directly to customers directly from the DC.

The nature of DCs is evolving, driven by ongoing changes in retailing, costs, technology, land availability and market reach. The current construction of Amazon's new fulfillment centre in rural Ottawa reflects the growing need to meet local B2C and B2B demands. It is expected that this DC will also serve the neighbouring communities while being supplied through Montréal, about a two-hour drive away.

Nonetheless, an important trend that is particular to Ottawa is that major Ottawa retailers are often served by DCs located outside the city, notably in the Toronto and Montréal areas but also closer to the city:

- Some Ottawa retailers are served by DCs in Eastern Ontario. Shoppers Drug Mart's DC in Cornwall, Ontario is a notable example, within an hour's drive of Ottawa. Cornwall's attraction derives from its proximity to Ottawa, Montréal and the US border, as well as to land availability, availability of labour at relatively low costs and a critical mass of other DCs (notably, Walmart) and complementary businesses.

- Some Ottawa-based retailers have relocated their local DCs to sites along Highway 401 (the Montréal – Toronto – Windsor corridor). For example, Giant Tiger's DC is now located near the Highway 401 interchange with the Highway 416 expressway link to Ottawa.[13] This new location provides the retailer improved connections to a broader market and supply area, while still remaining within an hour's drive of Ottawa. Note that this new DC is largely automated, largely using robots to unpack and pack shipments.

- Expansion plans and industry consolidation can also impact the location of DCs. Ottawa-based grocer Farm Boy, whose DC is in Ottawa, is expanding its presence in south-central Ontario and has plans to expand elsewhere in Canada.[14] Empire Company Ltd., the parent company of Sobeys, recently announced its purchase of Farm Boy, with a view to "accelerating" the latter's growth.[15] The implications on Farm Boy's local DC are as yet unknown.

These Ottawa-specific trends are consistent with the emergence across North America of mega distribution centres that, due to their size, are located in suburban and even rural areas. These mega distribution centres cover a large geography, within which they

[13] *Giant Tiger officially opens high-tech distribution centre to fuel growth*, Giant Tiger Stores news release, 27 September 2018.

[14] *Farm Boy Grocery Chain Launches Ambitious Expansion*, Retail Insider, https://www.retail-insider.com/retail-insider/2018/3/farm-boy, 12 March 2018.

[15] *Empire Company reaches agreement to acquire Farm Boy – Ontario's fastest growing food retailer*, Empire Company Limited news release, 24 September 2018.

> can serve smaller DCs that are located closer to the inner urban cores. Last kilometre delivery is made from these local DCs via established modes. Given their dependence on global supply chains, some of these mega distribution centres now seek to co-locate near ports and other international gateways; in any event, they also depend on easy access to major highways in order to serve the local DCs. The mega DCs and their network of small, local DCs are set up to provide quick service to consumers (and businesses) who increasingly make purchases online and expect a fast delivery to their doorstep. Autonomous vehicles would contribute to the development of this system because they can be loaded 24/7 and operated continuously, which in turn allows a single mega distribution centre to reach a more broadly distributed network of local DCs within a shorter time.[16]
>
> Retailers' ability to provide quick delivery service across an increasingly larger catchment area also is seen as contributing to another retail trend: namely, e-commerce allows manufacturers to bypass retail stores and deliver purchases directly to customers, both individuals and businesses. One outcome is that some retail chains are closing brick-and-mortar stores, and shopping centres are adding entertainment and dining venues in order to retain their attractiveness. There would also be an impact on parking requirements for both passenger and goods vehicles. Another potential outcome is that local DCs could conceivably replace some smaller local shopping centres.[17]

Overall, these trends reflect those that impact the manufacturing and distribution of goods globally and locally, as well as actions taken by local authorities to promote a sustainable urban form and sustainable transportation. They describe both opportunities and challenges. They describe industry-wide realities that the City can manage but cannot fundamentally change (e.g., growth in e-commerce), and other trends over which the City has greater influence (e.g., the location of distribution centres).

ISSUES AND KEY MESSAGES

Private and public sector stakeholders discussed a wide range of issues and trends that concerned them. These covered the economic realities of goods movement, growth in courier / express deliveries, distribution of goods within Ottawa, deliveries to construction sites, parking for long-distance trucks, policies to accommodate future goods movement demands, Complete Streets and the shared use of road space, site design and loading constraints, industry innovations and new technologies, and road network connectivity especially near the airport.

The stakeholder discussion can be summarized in four key messages:

1. There is a need to enhance **efficiency** in goods movement, commensurate with private sector needs.

2. There is a need to promote **sustainability** in goods movement, commensurate with City policies and aspirations.

3. The greatest challenges arise with **last kilometre deliveries**.

[16] Carlson, G. (Spring 2017). "Warehousing." *Urbanism Next,* University of Oregon, Portland.
[17] Clark, B.Y., Larco, N. and Mann, R.F. (August 2017) "The Impacts of Autonomous Vehicles and E-Commerce on Local Government Budgeting and Finance." *Urbanism Next*, University of Oregon, Portland.

4. **Flexibility** in plans is needed to adapt to a changing future, especially as new technologies emerge and consumer demands evolve.

A LIST OF POTENTIAL OPPORTUNITIES

Table 1 lists the eleven categories of potential opportunities that were explored as responses to the identified issues and messages.

It can be seen that the list covers a range of operational, technological, planning, design and communications initiatives. Many of the opportunities are related to each other – for example, several opportunities have a safety aspect.

Figure 1 shows how the eleven potential opportunities respond to the four key messages expressed by stakeholders. As shown by the grey boxes with the solid blue dot (●), it can be seen that:

- Several opportunities respond to each message, meaning that they serve multiple purposes.
- There is 'something for everyone' which helps gain broad buy-in across the stakeholder spectrum.
- The figure reaffirms the experiences of other cities, which is that goods movement needs are met most effectively through a package of opportunities, rather than piecemeal with selected individual opportunities.
- The goods movement council (the eleventh opportunity) is important to responding to all four messages.

Message \ Opportunity	1. Management of off-street loading and deliveries	2. Management of on-street loading and deliveries	3. Complete Streets	4. Road design guidelines	5. Vehicles, technologies and logistics practices	6. Urban distribution centres	7. Accommodating emerging technologies	8. Safety	9. Long-distance trucking and designation of employment lands	10. Network connectivity (strategic goods movement networks)	11. Goods movement council
1: Efficiency	●	●			●		●	●	●	●	●
2: Sustainability	●	●	●	●	●	●	●			●	●
3: Last kilometre deliveries	●	●			●			●	●		●
4: Flexibility							●		●	●	●

Figure 1. How the potential opportunities address the four stakeholder messages

Table 1. Goods movement opportunities

1.	**Management of off-street loading and deliveries**
	1.1. Enhanced building design requirements
	1.2. Alternatives to doorstep delivery (e.g., delivery lockers or pick-up points)
	1.3. Management of construction site deliveries
2.	**Management of on-street loading and deliveries**
	2.1. On-line parking reservation systems and real-time parking availability apps to reduce circulation
	2.2. On-line wayfinders to reduce circulation and promote adherence to designated truck routes
	2.3. Management of public space (e.g., designated sidewalk space for couriers at certain times of day)
	2.4. Vehicle reception points (time sharing of street space – e.g., trucks-only access at certain times of day)
	2.5. Off-hours delivery (shift demand to less-busy hours, thereby reducing congestion and improving efficiency)
3.	**Complete Streets**
	3.1. Managing the interaction between on-street loading and bicycle lanes through design
	3.2. Managing the movement of goods across bicycle lanes trucks
	3.3. Loading in pedestrianized areas (manage loading to promote pedestrian / cyclist safety)
	3.4. Designation of truck level of service targets (allow for small and medium-sized trucks)
4.	**Road design guidelines**
	4.1. Road design guidelines (especially to accommodate vulnerable road users at intersections)
	4.2. Special needs of roads in residential areas (use of design/control vehicles to manage goods movement)
	4.3. Special needs of roads in industrial areas (accommodate goods vehicles in goods-generating areas)
5.	**Vehicles, technologies and logistics practices**
	5.1. Low-/zero-emission vehicles: alternative propulsion / engine technologies
	5.2. Low-/zero-emission vehicles: cargo bicycles
	5.3. Low-/zero-emission vehicles: other small vehicles (e.g., small electric delivery trucks)
	5.4. Load utilization (e.g.,crowdshipping of deliveries)
	5.5. Load efficiency / load management (e.g., optimizing available trailer space)
	5.6. Local delivery plans (e.g., to share deliveries among neighbouring businesses thereby reducing truck trips)
6.	**Urban distribution centres** (load consolidation in urban cores)
7.	**Accommodating emerging technologies** (e.g., accounting for autonomous trucks in future plans)
8.	**Safety**
	8.1. Road engineering and vehicle technology initiatives (e.g., bicycle storage lanes at intersections, signs, etc.)
	8.2. Industry-led initiatives (e.g., vehicle retrofits to improve visibility, driver training)
9.	**Long-distance trucking and the designation of employment lands**
	9.1. Truck parking (accommodating growing demand to provide safe parking for long-distance trucks)
	9.2. Long-combination vehicles (planning appropriately located/designated lands and accesses for LCVs)
	9.3. Designation of future employment lands
10.	**Network connectivity** (strategic goods movement network, to maintain consistent LOS and mobility for trucks across the city while ensuring that goods-generating activity centres and terminals are connected)
11.	**Goods movement council** (keeping the dialogue going)

DISCUSSION – SUSTAINABILITY OPPORTUNITIES

The sustainability aspects of various opportunities merit further discussion, which is presented below. The discussion is phrased in terms of six questions that stakeholders posed over the course of the research:

1. Some of the opportunities address short term operational, traffic management and safety needs. This is important, but how do they fit a long term transition to a more sustainable future? In addition to meeting the definition of sustainable urban freight described above, the short term opportunities set the stage for achieving long term sustainability initiatives in several ways: improving the management of goods movement and last kilometre deliveries, which in itself may be conducive to switching to, for example, smaller vehicles; increasing awareness and education among all participants (e.g., working with drivers and businesses to better manage the times and frequencies of deliveries); minimizing long term demands (e.g., incorporating self-serve delivery lockers in public and retail spaces so as to reduce design requirements for off-street loading spaces); and informing the planning and definition of long term initiatives (e.g., refining the design of Complete Streets schemes so as to better meet on-street loading requirements as the demand for express delivery grows).

2. What are the goods movement challenges associated with Complete Streets schemes? Many Canadian cities have successfully implemented Complete Streets schemes that provide a safe and attractive environment for all corridor travellers, protecting vulnerable road users while promoting the use of transit and other alternatives to driving. However, although these users clearly have a critical need, in practice many Complete Streets schemes have given less attention to accommodating trucks and delivery vehicles than they have to other modes.[18] Four common considerations are relevant. To some degree, these considerations overlap:

    - Managing the interaction between on-street loading and bicycles through design. Many Complete Streets schemes place a bicycle lane next to the curb, which must be crossed by drivers making deliveries from their vehicles, even if they are parked in designated loading areas. Truck – bicycle conflicts also arise from truck intrusions in the bicycle lane, by parking in the lane or crossing the lane to park. The conflicts are either direct or, as a result of bicycles moving to get around the trucks, indirect. Other conflicts arise from the proximity of parked trucks to the bicycle lane, around which bicycles had moved or had been 'doored.'[19]

      A review of US and Canadian cities (Vancouver) found two common approaches to reducing truck-bicycle conflicts. First, research has found that clearly marked, bicycle-specific facilities are safer for cyclists, compared with on-road cycling with traffic or off-road cycling with pedestrians and other users. (Ottawa's downtown cycling lanes are physically delineated from the adjacent road lanes.)

      The second approach worked with the local cycling and goods movement "communities" to develop potential solutions, such as physical separation, alternate routes, better signalization at dangerous intersections and road modifications to improve flow. The

[18] Green, J. 21 January 2015. "Complete Streets vs. Trucks." The Dirt, online newsletter of the American "Society of Landscape Architects.

[19] Gelino, K., Krass C., Olds, J. and Sandercock, M. December 2012. "Why Can't We Be Friends? Reducing Conflicts Between Bicycles and Trucks." University of Washington, Seattle.

implementation of a given solution(s) is based on location-specific factors, such as lane width, vehicle speed, availability of alternate routes, proximity to destinations and the importance of the route to each user group.[20]

The Ontario Ministry of Transportation's 2016 *Freight Supportive Guidelines* provide guidance on the accommodation of truck and cyclist "interactions." These include planning for appropriate truck and bicycle networks, avoiding or limiting the number of roads that are designated for both trucks and cyclists to reduce conflicts, providing separate bicycle paths, ensuring adequate widths of on-street bicycle lanes, providing appropriate lane/pavement markets and signage to alert both cyclists and truck drivers.[21]

- Managing the movement of goods across bicycle lanes. Whereas the preceding point speaks to design and layout, there is also a need to consider actual delivery operations – in particular, how individual addresses can be accessed for deliveries and pick-ups; how cargos can be moved across bicycle lanes, which are typically at the curbside; and where on-street loading zones should be located so as not to intrude on the bicycle lanes.

  One approach is offered by a demonstration project in Brooklyn, New York, which examined ways to accommodate bicycle lanes and on-street loading. The project converted a two-way street with bicycle lanes on each side of the street (which experienced intrusions of trucks for unloading), to a one-way street, with the bicycle lanes paired on one side of the street, and the other side converted to a curbside loading lane. Another treatment moved the loading lane beside the curbside bicycle lanes, meaning that trucks could park adjacent to, but not block, the bicycle lanes. At night, curbside delivery is permitted on the bicycle lane to a 24-hour pharmacy. Evaluations of the initiatives, including interviews with truck drivers, were conducted, although the findings have not been disclosed.[22] As well, although cyclist activity may be low at night, it is under these conditions that cyclists are most vulnerable: there are fewer cyclists so drivers are not expecting them and they are difficult to see, especially once they are diverted from the bicycle lane.

- Loading in pedestrianized areas. Many cities have introduced no-car streets, especially in commercial, entertainment, restaurant and tourist areas. These treatments have the benefit of increasing the attractiveness of the area hence increased foot traffic, patronage and revenues for the adjoining businesses.

  However, deliveries still must be made to these varied venues. Many cities have implemented specific delivery windows, in which trucks are allowed to access the pedestrianized streets to make deliveries directly to individual venues – e.g., in the early morning before businesses open or late at night after they are closed. Some observers note that these initiatives also force deliverers to use smaller vehicles, in order to safely manoeuvre the pedestrianized areas. Other treatments include urban consolidation centres, which are discussed below.

[20] Gelino et al., "Why Can't We Be Friends? Reducing Conflicts Between Bicycles and Trucks."
[21] "Freight-Supportive Guidelines." 2015. Ontario Ministry of Transportation, Toronto.
[22] Conway, A., Faivre, G. and Conway, M. October 2013. "Accommodating Freight on Mixed-Use Urban Streets", presentation to the METRANS International Urban Freight Conference, Long Beach, California.

- Accommodating varying levels of truck traffic. Many Complete Street guidelines accept that, in industrial areas, trucks and other vehicular traffic will have priority over other corridor users. For example, the City of Ottawa's *Multi-Modal Level of Service Guidelines* establish truck LOS targets as "high" on truck routes but "low" in the Central Area (downtown) and in mixed-use centres and generally "low" or "medium" on all other roads.

  This differentiation does not preclude trucks from using these roads. However, it is important to recognize that high truck volumes can be found anywhere in the urban environment. Clearly, accommodating large trucks in all areas is not appropriate although goods, especially those delivered by couriers, still need to reach all areas in the city.

  The implementation of Complete Streets, if not well planned, can lead to conflicts such as lane widths being too narrow for trucks and truck turning radii sometimes coming in conflict with pedestrian curb extensions and traffic calming treatments. Although many guidelines provide general indications of ways to serve all corridor users, from the perspective of goods movement, the key difficulty is "considering site-specific requirements and treating every block and intersection for its specific needs."[23] To harmonize goods movement needs and the implementation of Complete Streets schemes on individual corridors, one observer proposes three steps:

  - Plan to support – not eliminate – goods movement from the corridor.
  - Ask goods movement operators what they need and what could work for them.
  - Think beyond corridor design alone – for example, by making capacity and signal timing modifications at upstream intersections that are better suited to handle truck traffic in order to divert that traffic before it reaches the shared corridor.[24]

  The City of Seattle has developed a framework to address these conflict points. In Seattle's Complete Streets policy context, mobility is noted as the policy's second priority, after safety. Consistent with these two priorities, on streets that have been designated as "Major Truck Streets," the policy requires that design and operational improvements "support" all modes and "are consistent with freight mobility."[25]

  A Major Truck Street is "… an arterial street that accommodates significant freight movement through the city, and to and from major freight traffic generators. The street is typically a designated principal arterial . . . Major Truck Streets generally carry heavier loads and higher truck volumes than other streets in the City…"[26]

  A Major Truck Street does not have to be within an industrial area; instead, it can include arterials anywhere in the city that are "significant" to freight activity. On a Major Truck

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[23] Bassok, A. et al., 2013. "Smart Growth and Urban Goods Movement." NCFRP Report 24, National Cooperative Freight Research Program, Transportation Research Board, Washington, DC.

[24] Plumeau, P. 21 May 2014. "Complete Streets and Goods Movement, Options and Considerations." Talking Freight.

[25] "Complete Streets in Seattle." City of Seattle. https://www.seattle.gov/transportation/projects-and-programs/programs/urban-design-program/complete-streets-in-seattle. Accessed March 2019.

[26] "Truck Classification Legend Definitions." City of Seattle. http://www.seattle.gov/transportation/streetclassmaps/trucklegend.pdf. Accessed March 2019.

Street, "because freight is important to the basic economy of the City and has unique right-of-way needs to support that role, freight will be the major priority on streets classified as Major Truck Streets. Complete Street improvements that are consistent with freight mobility but also support other modes may be considered on these streets."

In 2016, Seattle updated its freight network. In doing so, it grouped the city's roads and highways into four categories, which connect 'urban centres,' 'urban villages,' commercial districts and other non-industrial generators, in addition to manufacturing and industrial centres and intermodal terminals. The document also points out that "designating a street as part of the freight network will not necessarily change its overall function, design or character. Rather, the designation underscores the importance of ensuring that goods movement can be accommodated on that street in a safe manner."[27]

It must be emphasized that the objective of this discussion is not to give priority to trucks on Complete Streets but rather to ensure that goods can still be moved and unloaded in Complete Streets schemes. Accommodating goods movement does not necessarily mean designing infrastructure to primarily benefit trucks. For example, strategies such as relocating stop bars to enable truck-turning movements while minimizing the distances pedestrians must cross the street can be considered. Other concepts include moving deliveries to the back of the building and strategically placed on-street loading zones with time restrictions.[28] Going forward, Complete Streets schemes can take into account opportunities to switch to small, zero-/low-emission vehicles and other potential initiatives for managing goods movement.

3. How can urban distribution centres (UDCs) work? UDCs, also known as urban consolidation centres, are "intended to optimize the delivery of goods in cities, on the functional and environmental levels, by setting up break-in-bulk points." UDCs bundle or consolidate goods at strategically located points for onward delivery, so as to consolidate less than full loads, reduce congestion and promote the use of smaller and low-/zero-emission vehicles to cover now-shorter distances in dense urban cores. UDCs can be dedicated to specific economic sectors, such as supplying downtown construction sites, better managing deliveries to a major retailer from multiple sources, or to serving multiple retailers at a specific location.

   UDCs have been deployed in Europe, the United Kingdom and Asia. They are typically adapted to areas for which delivering products is difficult, most commonly in city centres. They are not normally intended to handle large quantities of goods to the same destination or bulk shipments, and they have proven more difficult to be used for perishable products or luxury goods. UDCs must be situated close to the city centre in accessible places and must offer low rental costs.

   However, the success rates have been mixed. Many UDCs have failed. The most common factor is the additional time and costs that are imposed by moving goods through this facility - i.e., an extra stop and modal transfer are now imposed. There can also be difficulties in securing private sector funding: successful UDCs often depend on government capital and operational support to be financially viable, especially in smaller cities. Other challenges include the requirement for available land close to the city centre and the need for several competing retailers and transporters to cooperate with each other. Absent regulatory

[27] "City of Seattle Freight Master Plan." 2016. City of Seattle.
[28] "Complete Streets Fact Sheet." 2011. New York State Association of MPOs (Metropolitan Planning Organizations).

imperatives, benefits must be of a scale that demonstrably offset any increases in costs and must be apparent to all participants, especially shippers, receivers and transporters.

Offsetting these challenges are governmental subsidies that reduce tenancy and operational costs. Some cities also make available municipally owned lands as a means to lower costs and increase the financial attractiveness to private sector investors. A UDC in central Lyon, France, shares a site with a car-sharing mobility hub. The City of Lyon added charging stations for electric vehicles, thereby facilitating the use of electric delivery vehicles.[29]

Other factors for success focus on improving the cost-effectiveness of UDCs and strengthen the business case through increased government support, pricing mechanisms (e.g., road tolls) and the provision of additional services at these centres. ITS offers the potential to implement virtual consolidation centres, through improved communications among and between carriers and retailers. Access restrictions to large vehicles in core areas that are heavily pedestrianized and which have narrow streets (as in some parts of Paris, France), or which have strong security needs (as for retailers at Heathrow Airport in London), have resulted in viable distribution centres – although it is unclear whether or not this would be the case in the absence of restrictions.[30]

Finally, the concept of microhubs can be noted. These are UDCs that have a small footprint and, in some cases, are mobile. They provide an opportunity for delivers to bring parcels and small packages to a central location in or near the core, from which they are delivered to their final destination by bicycle or by another small vehicle.[31] At least one courier in Ottawa has adopted this model, using bicycles to deliver envelopes and small packages to downtown destination from a microhub that is located at the edge of the core. The avoidance of the need to search for a downtown parking space and the ability to navigate narrow streets makes the bicycle time-competitive with deliveries by motorized vehicle. DHL, a global courier company, uses microhubs in several compact city centres in Europe with vans operating as mobile microhubs from which cargo bicycles make the final deliveries. In 2015, DHL introduced the Cubicycle, an electric four-wheel cargo bicycle with a container that can carry loads of up to 125 kg in weight and 1 cubic metre in volume. The containers are standardized to match the dimensions of a standard shipping pallet, which allows easer and faster transfer between modes.[32]

4. How can we account for emerging technologies? Many technologies are emerging that can be expected to impact all aspects of goods movement – for example, the introduction of autonomous vehicles, platooning (connected vehicles) and drones. However, many uncertainties are inherent in the planning for emerging technologies. These include the timing, phasing, uptake and pervasiveness, about all of which the literature is replete with widely divergent views. Two potential approaches for accommodating emerging technologies are discussed below:

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[29] Patier, D. and Toilier, F. 2018. "Urban Logistics Spaces: What Models, What Uses and What Role for Public Authorities?" In *City Logistics 2: Modeling and Planning Initiatives*, Taniguchi, E. and Thompson, R.G. (Eds.), Wiley, Hoboken, New Jersey.

[30] van Duin, R. and Muñuzi, J. 2015. "Urban Distribution Centers." In *City Logistics: Mapping the Future*, Taniguchi, E. and Thompson, R.G. (Eds.), CRC Press, Boca Raton, Florida.

[31] Kim, C. and Bhatt, N., 2019. "Modernizing urban freight deliveries with microhubs," Pembina Institute, Toronto, January 2019.

[32] van Amstel, W.P., *DHL expands green urban delivery with City Hub for cargo bicycles*, www.citylogistics.info, posted 3 March 2017.

- Promoting the incorporation of flexibility in long-range transportation planning. In this way, the plans can be made flexible in order to accommodate large scale technological changes as they arise while in the meantime continuing to plan for already identified demands for goods movement.

  To do this, several municipalities have explored the topics in order to gain a more informed understanding of the potential implications of new technologies. For example, the City of Calgary's *The Future of Transportation in Calgary* reviews potential new technologies that affect the mobility of Calgarians and the transportation sector in general.[33] A 2018 report distinguishes between current and emerging technologies and "future topics with high uncertainty" in an attempt to more reliably assess their potential impacts.[34] The City of Seattle has developed the *New Mobility Playbook*, a protocol for evaluating innovative passenger and goods transportation solutions. The protocol recognizes that the benefits and disbenefits could vary significantly. It develops several principles and "plays" that can react and shape the implementation of new technologies in order to maximize the benefits and minimize the disbenefits. In this way, Seattle hopes to shape the implementation of new technologies, rather than merely responding to them.[35]

- Municipalities can also be proactive where the understanding of new technological needs is firmer – e.g., regarding the implementation of vehicle-infrastructure communications. As the potential grows for autonomous vehicles, dynamic traffic signal timings and similar technological innovations, many local agencies recognize that there is a need to ensure that the necessary supporting vehicle-infrastructure communications capabilities are in place. For example, as roads are reconstructed in Chicago, local authorities are trying to ensure that the upgrade includes information technology and other infrastructure, such as fibre and the flexibility to enable vehicle-to-infrastructure communication. Although the timing of a widespread implementation of vehicle-to-infrastructure (and other vehicle and infrastructure) communications is uncertain, authorities are at least taking advantage of reconstruction opportunities to prepare for future deployment of the technologies on a broad scale.

5. How can we move forward on defining the opportunities? Several urban agencies have developed strategic goods movement networks (SGMNs). Peel, York and Durham Regions and Metrolinx in Ontario and Phoenix, Arizona are noteworthy recent examples. A SGMN is a strategic, connected and continuous network of road and rail corridors that facilitates the movement of freight. It is used to better integrate goods movement into municipal planning, prioritization and capital and operating budgeting processes. It promotes reliability through redundancy – that is, the need for alternative routes is taken into account – and it ensures that alternative routes can be designated to avoid key transit infrastructure and sensitive areas. It connects all intermodal terminals (rail and the airport) and major goods-generating activity centres with each other and with the major road and highway network.

   A SGMN is intended to serve as a road map for identifying upgrades and improvements that will benefit the movement of goods and people – for example, upgrading load capacities of structures and pavements. It informs planning, right-of-way protection and priorities, as well

[33] City of Calgary, *The Future of Transportation in Calgary*, 2017.
[34] Shaheen, S., Totte, H. and Stocker, A. January 2018. "Future of Mobility White Paper," University of California Berkeley.
[35] "New Mobility Playbook", Version 1.0. September 2017. Seattle Department of Transportation, Seattle.

as zoning and land use planning decisions and the designation of future employment and industrial lands. Peel Region used its SGMN to identify priorities for its multi-point goods movement action plan. The SGMN also enhances the integration of goods movement with Complete Streets schemes and other corridor improvements.

A SGMN is related to but differs from a preferred set of truck routes and truck restrictions on other routes. Truck routes and restrictions identify where trucks can and cannot go. They can have specific conditions concerning the time-of-day, temporary seasonal weight restrictions (noting that there are exceptions for some types of commodities), permanent restrictions on dimensions and weights, over-size / over-weight loads, which may require special permits, and the transportation of dangerous goods. Their definition can be permissive (where a truck can go) or restrictive (where it cannot go). However, truck routes do not identify any needs for preferential treatment for truck traffic within the designated routes and restrictions. Finally, truck route designations and restrictions can be changed at any time (the City of Ottawa updates its routes annually), whereas the SGMN is meant to be a planning and investment tool. Nonetheless, the SGMN is always intended to respect the existing truck routes and restrictions on intersecting and feeder roads. In this way, the SGMN sits at the top of a hierarchy of a definition of truck corridors.

The SGMN can also be tailored to address the appropriateness of different sized trucks to different roads. The Metrolinx SGMN explicitly recognizes that in some parts of the Greater Toronto and Hamilton Area, especially in the denser urban cores such as downtown Toronto, small- and medium-sized truck movement exceed heavy truck activity. However, the design and planning needs associated with small and medium-sized trucks, while important, tend to be more localized, focusing on smaller geographies and on individual roads and streets. A hierarchy of SGMN designations could be used to account for these varying conditions, integrated with the City's Complete Streets process and multi-modal LOS target definitions while ensuring that corridors still support goods movement and deliveries.[36]

6. How do we get there from here? The research identified a number of means and measures that can be deployed to implement the opportunities. These mainly comprise policies, programs and databases that are common to municipal governments across the country, although some may also involve partnerships with the private sector, academia and others. The means and measures include guidelines for site planning / road and intersection design; zoning, parking and loading bylaws and restrictions; on-road access / staging area permits; on-line / truck route mapping; review and monitoring programs; education and awareness programs and protocols; plan evaluation protocols; Official Community Plan / employment land designation; pilot tests / demonstrations; strategic goods movement network; goods movement council; data; and forums to facilitate collaboration. The point is that many of the implementation means and measures already exist.

   Finally, the importance of continued dialogue with stakeholders cannot be understated. The research brought together a wide variety of perspectives across the goods movement spectrum. Although most opportunities would be led by the municipality, their implementation necessarily requires collaboration with other governments and the private sector. Before investing time or resources into the opportunities, the latter will seek to understand the potential benefits to their operations in terms of reliability, durability, payback period (i.e., the business case), consistency and regulations. A goods movement council

[36] "GTHA Strategic Goods Movement Network, Final Report." March 2018. Metrolinx, Toronto.

would facilitate the necessary collaborations, while also serving to inform, set priorities, exchange ideas and identify upcoming challenges. Several other Canadian urban authorities have recently established councils for these purposes, including Peel Region, Metrolinx, Calgary and TransLink.

CLOSING TAKEAWAYS

The preceding discussions considered specific topics on ways to transition to a sustainable future for urban goods movement. To close the paper, several takeaways can now be derived in order to inform future sustainable urban goods movement plans while at the same time engaging stakeholders and addressing other needs. These include:

- A sustainable goods movement plan must have a coordinated and effective package of opportunities that crosses all the major themes. Cherry-picking ideas will not make progress.

- That said, short-term actions that address operational traffic and safety concerns can also serve as the first steps in a comprehensive, ongoing move towards sustainability.

- Complete Streets and safe and efficient goods movement are not rivals competing for curbside space. Both can occur at the same time, and can be coordinated and managed through planning, design, operations and education.

- Vehicle types and levels-of-service should be appropriate for the delivery type, the street type, the destination context and the other users and uses of the street.

- Urban distribution centres can be viable models for a community or provider. However, the larger regional goods movement context must be understood, and the concept can need some form of public support to work.

- A flexible framework is key to accommodating emerging technologies. Focusing on principles, performance measures and protocols rather than technology will help set the stage for future resiliency.

- A strategic goods movement network is more that just a map of priority corridors. It is a comprehensive framework that plans for physical actions to improve goods movement in the overall context of the city.

- Dialogue is critical. Little will be accomplished unless the diverse industry stakeholders come together, with public sector partners to participate in all stages, from the beginning vision to the detailed actions.

- TMPs should include enabling language that speaks specifically to a sustainable future for goods movement and what policies and actions are required to achieve this. Details can follow in a separate analysis.

- Efficiency in goods movement is tied closely to economic development. Therefore, aspirations for achieving a sustainable future for goods movement must be linked to economic development as well as to land use, transportation and climate change.

- A sustainable goods movement plan must recognize the realities of how goods movement operates today. It must understand the underlying economics and business decisions that influence these operations. It is important to understand especially the factors that influence the uptake of new technologies and other initiatives, such as cost, payback period and reliability. The plan must be realistic and practical – for example, it cannot be assumed that truck-borne cargos can simply be transferred to rail.

- Complementary initiatives may be needed. For example, driver shortages coupled with the increasingly sophisticated skill sets required to meet today's logistics needs may compel the need for additional local training programs: these programs could incorporate new sustainability initiatives, such as optimal vehicle loading practices that reduce unused space. Changes to hours-of-work regulations and noise bylaws might be needed to support, for example, off-hours deliveries.

- Experience suggests that larger fleets and retailers generally support sustainability aspirations. Many already have implemented in-house sustainability programs across a large part of their operations. However, independent truckers and couriers and small businesses may require special consideration in sustainability plans, especially given that their resources are often quite limited for handling changing practices, new technologies, equipment retrofits and so on.

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