EFFICIENT URBAN FREIGHT

POLICY WORKBOOK

Smart City
MISSION TRANSFORM-NATION

सत्यमेव जयते

Ministry of Housing and Urban Affairs
Government of India

ROCKY MOUNTAIN INSTITUTE

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ABOUT MINISTRY OF HOUSING AND URBAN AFFAIRS (MoHUA)

The Ministry of Housing and Urban Affairs is the apex authority of Government of India to formulate policies, coordinate the activities of various central ministries, state governments and other nodal authorities and monitor programs related to issues of housing and urban affairs in the country. The Smart Cities Mission was launched by the Ministry in 2015 to promote sustainable and inclusive cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.

ABOUT ROCKY MOUNTAIN INSTITUTE (RMI)

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing. RMI has been supporting India's mobility and energy transformation since 2016.

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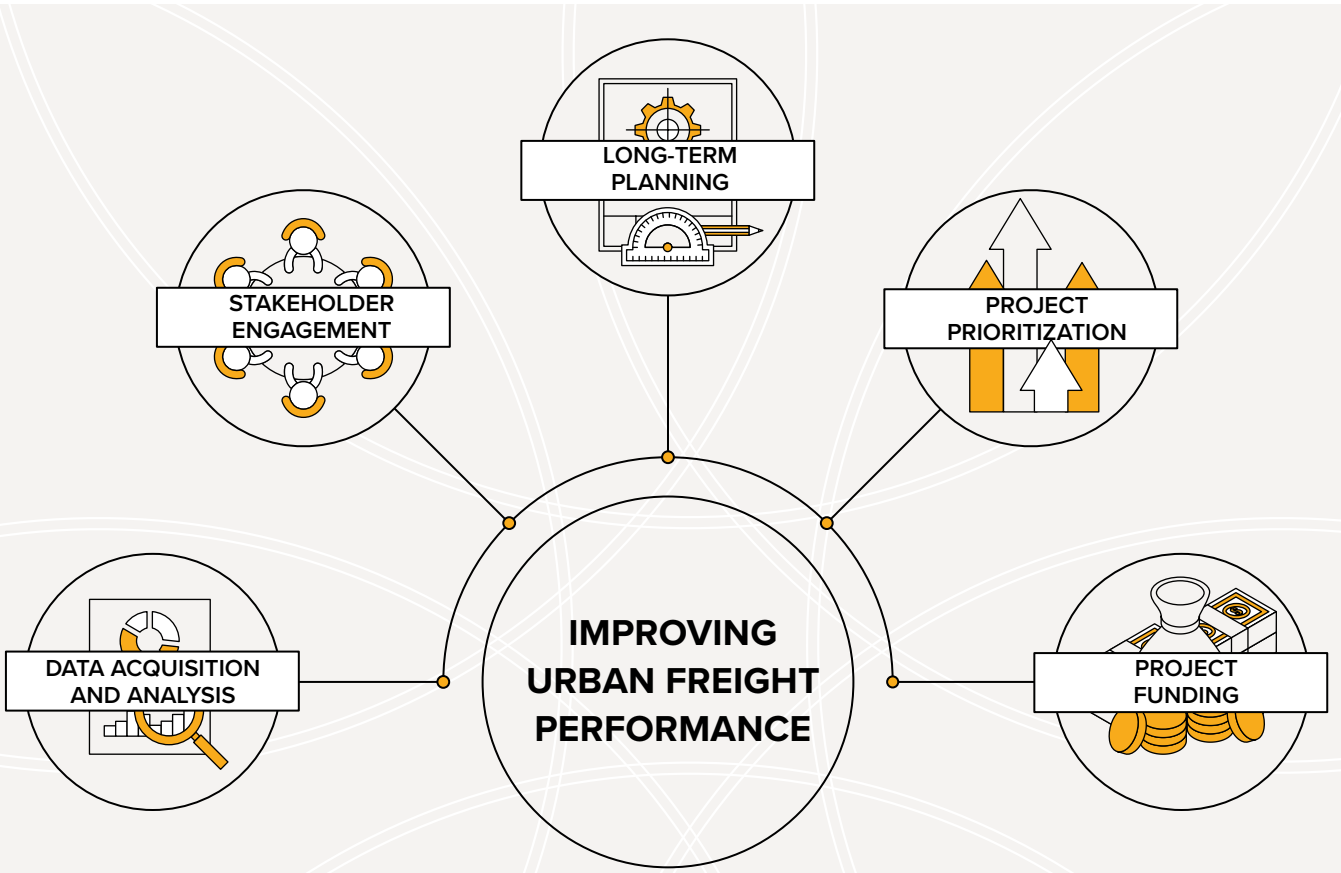
Document outline

This section is intended to give municipal transport policymakers high-level guidance on how to improve the efficiency of urban freight. It follows a checklist approach that builds on the logic and methodology explained in the urban freight Policy Framework Document. Municipal policymakers can evaluate where they stand in the process of building an effective urban freight system, what actions they can take to improve urban freight efficiency and how to best prioritize those actions.

In order to improve urban freight performance in both short and long terms, policymakers must be able to not only identify and resolve problems that currently exist but also understand the development trajectory of their city and its associated future logistics needs. To do so, five categories of activities are needed:

1. Data acquisition to identify problems and quantify their severity
2. Stakeholder engagement to understand the needs of logistics system users and create public-private partnerships to enhance system performance
3. Long-term planning to set a guiding vision for industrial and logistics development in medium and long terms
4. Framework to prioritize solutions to ensure a maximum value from system investments
5. Capital to enable project implementation



Action plan for improving urban freight performance

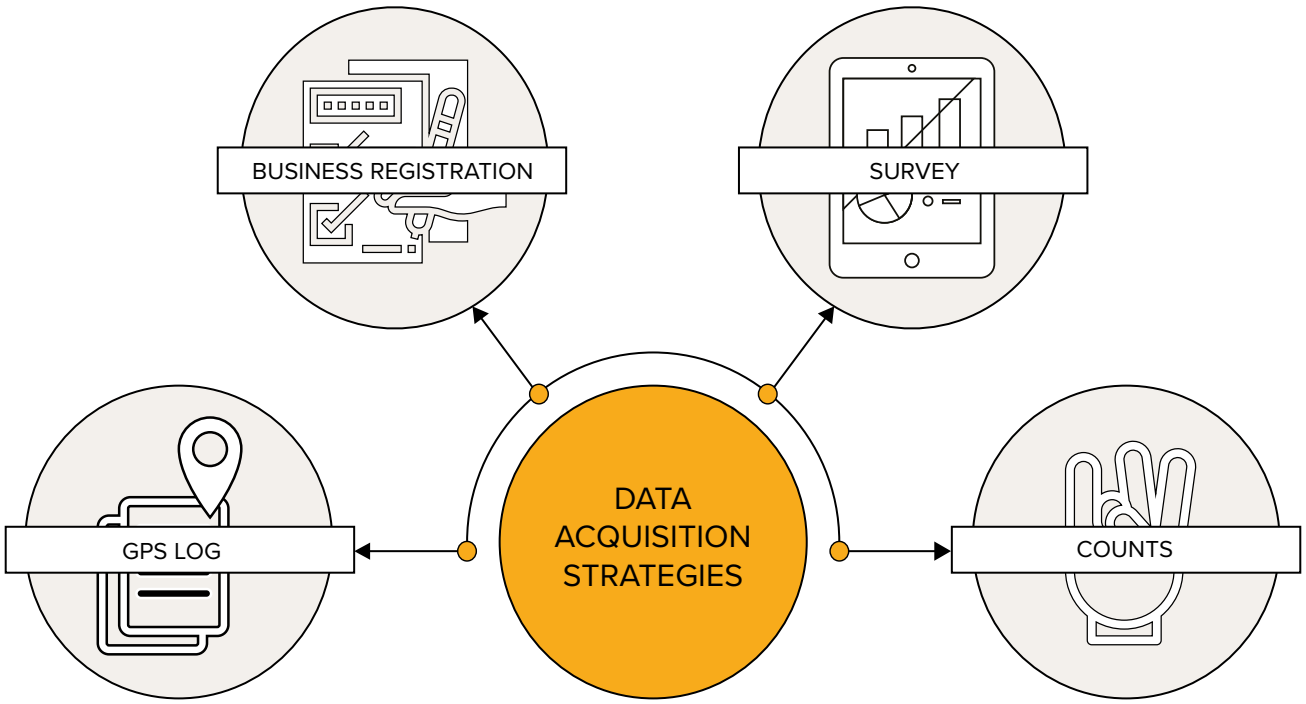
1.0 Data acquisition

The first step in resolving inefficiencies in urban logistics is understanding how freight is moving within a city. To understand freight movement, policymakers must have a data collection strategy. They should understand what problems they are attempting to resolve and deploy appropriate data collection tools to understand the problem dynamics and effectively address them. Several types of data are particularly important for evaluation of urban logistics efficiency: GPS logs, delivery vehicle logs, business registrations, surveys and manual counts.

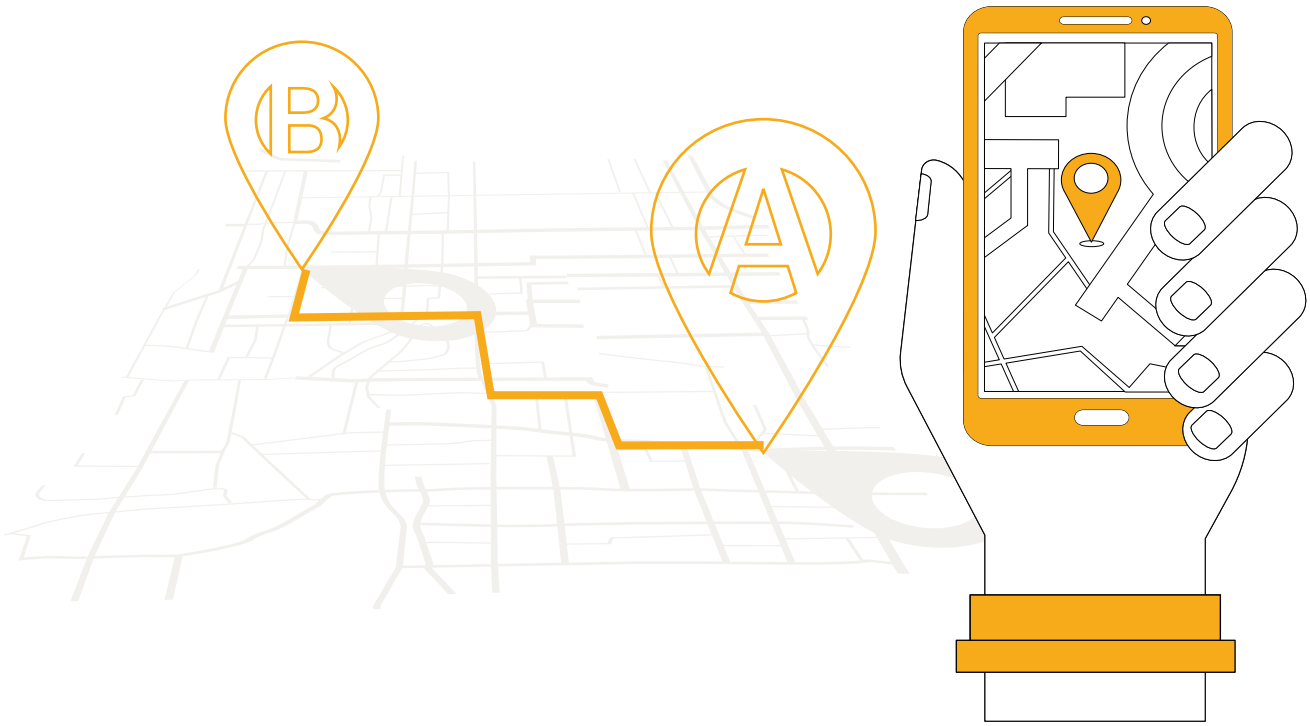
However, no single type of data can deliver a full understanding of how an urban logistics system is functioning. Various data types must be collected, analyzed and interpreted together in order to gain a clear picture. Table 1 shows different types of data that can be collected on urban logistics and their relative strengths and weaknesses.

	Driver survey	Vehicle diary	Establish-ment survey	Delivery space observation	GPS survey
Length of route	+	++			+++
Duration of route	+	++			+++
Number of stops	++	+++			++
Location of stops	++	+++			++
Type of operation	++	+	+	+++	+
Nature of the freight	+	+	+++	+	
Type of package	++	+	+++	+++	
Type of carrying tools	+++	+	+++	+++	
Usage of truck equipment	+++	+++	++	+++	
Nuisance to the environment		+			+++
Parking infractions	+	+		+++	
Stopping maneuvers	+			++	
Data collection costs	+++	+	+++	+++	++
Data processing costs	++	+++	++	++	+
Non-response rates	++	+++	++	++	+
Privacy issues	++	++	++		+++

Table 1: Urban logistics data types and uses[1] | Source: Pluvinet, Pascal, et al. "GPS Data Analysis for Understanding Urban Goods Movement," 2012 | Note: Table displays suitability of different data collection approaches for different applications (+++ most suitable; –least suitable)



1.1 GPS logs



» Description:	GPS can provide a picture of logistics vehicle locations at highly granular time intervals. For example, GPS data can show where delivery vehicles drive, stop, spend the night and charge (for electric vehicles).
» Uses:	GPS data is among the most powerful types of data to analyze the patterns of vehicle movement, including routing patterns, the effects of congestion on freight deliveries, parking patterns, etc. However, GPS is limited in its ability to describe other aspects of logistics vehicle behavior such as what type of freight the vehicle is carrying, the size of a load, etc.
» Barriers:	There are two main barriers to the collection of GPS data. The first is technical—delivery vehicles (or drivers) must be equipped with GPS-enabled devices, typically either on the driver's phone or the telematics device in the vehicle

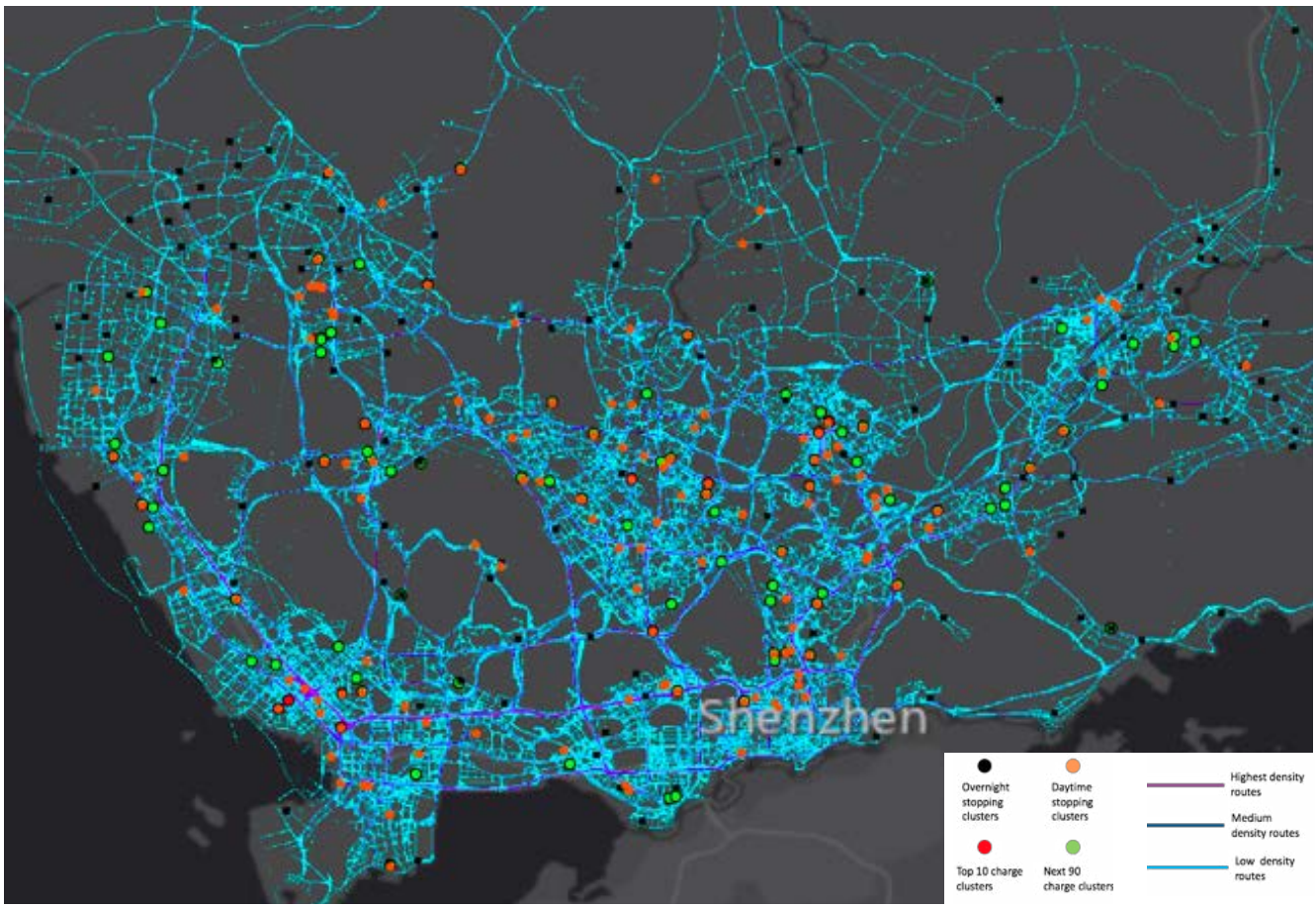


Figure 1: e-truck GPS data for Shenzhen, China | **Source:** Rocky Mountain Institute Analysis

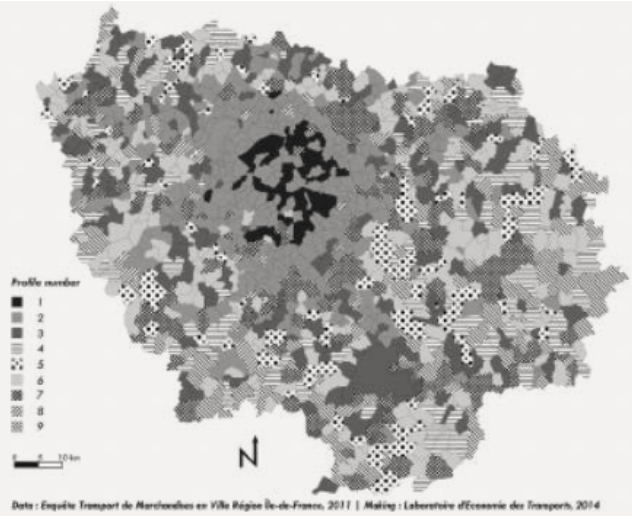
itself and that data must be transmitted to a database where it can be combined with data from other vehicles, analysis. The second barrier is privacy. GPS logs can provide a detailed look at driving and delivery patterns. In order to acquire and use GPS logs, it is critical to agree with private sector data owners on procedures to protect, anonymize and aggregate data in such a way that firms do not lose competitive advantage from sharing the data.

» Case Study

Aggregated and anonymized GPS data for electric delivery vehicles in Shenzhen, China is displayed in Figure 1. In this example, data are collected in a central data clearing house.[2] All e-trucks in the city are required to be equipped with telematics boxes that transmit GPS data through cellular networks to the data clearing house. The ability of governments to gather such data varies across countries, regions and cities.

1.2 Business registrations

» Description:	When businesses open, they typically register with municipal and/or tax authorities. Included in that registration is information such as business type, address, number of employees, etc.
» Uses:	Understanding the types of businesses operating in different areas of the city can help policymakers understand how freight flows within a city and plan infrastructure and land-use to support those flows. Business registration data must be combined with other data sources that describe an establishment's propensity to generate goods movement as well as how vehicles link various establishments.
» Barriers:	Typically, information about business registrations is collected by governments for tax and other regulatory purposes. So barriers to obtain that data are typically low.



Type	Name	Characteristics	No of municipalities	Surface area (km²)
1	High density	Dense, shops	75	341
2	Commuter belt	Non differentiated fabric	315	2,500
3	Commercial towns	Small retail	191	1,899
4	Industrial municipalities	Industry	93	976
5	Peripheral towns craft	Rural, craft	127	1,288
6	Predominance of wholesaling on outskirts	Wholesaling, industry	210	2,045
7	Predominance of large warehouses	Logistics activities	141	1,560
8	Green desert	Agriculture	122	1,221
9	Presence of hypermarkets	Hypermarkets	26	237

Figure 2: Logistics typologies of different districts in the metro Paris region | **Source:** Toilier, Florence, et al. "How Can Urban Goods Movements Be Surveyed in a Megacity? The Case of the Paris Region," 2016.

However, if those data are not collected from business establishments or if the government agencies, who collect the data are unable or unwilling to share them, transportation authorities are unlikely to be able to generate those data sets independently.

» Case Study

As part of a broad urban goods movement survey in the Paris Metropolitan region, researchers analyzed business registrations and classified them according to various typologies, which described the composition of businesses within specific districts of the area (Figure 2). This data, when combined with a set of surveys described in the following section, allowed researchers to gain an understanding of metropolitan freight flows and make projections related to logistics vehicle trip generation, vehicle use and delivery patterns within the metro region.

1.3 Surveys

» Description:	Surveys are questionnaires to gather data from logistics system players such as shippers, receivers, haulage companies and truck drivers. This allows for detailed knowledge of how goods move within the city, including details such as truck size, number of deliveries per tour, load size, route, how the delivery truck spends its time, etc.
» Uses:	When combined with establishment data, goods movement surveys allow for a granular understanding of urban goods movement patterns. This understanding can be used to project trip generation, parking requirements, congestion, emissions, etc.
» Barriers:	The first barrier is expense. The second is properly designing and executing the survey. Because all surveys involve sampling, the results are only robust to the extent that they are representative of the sampled population.

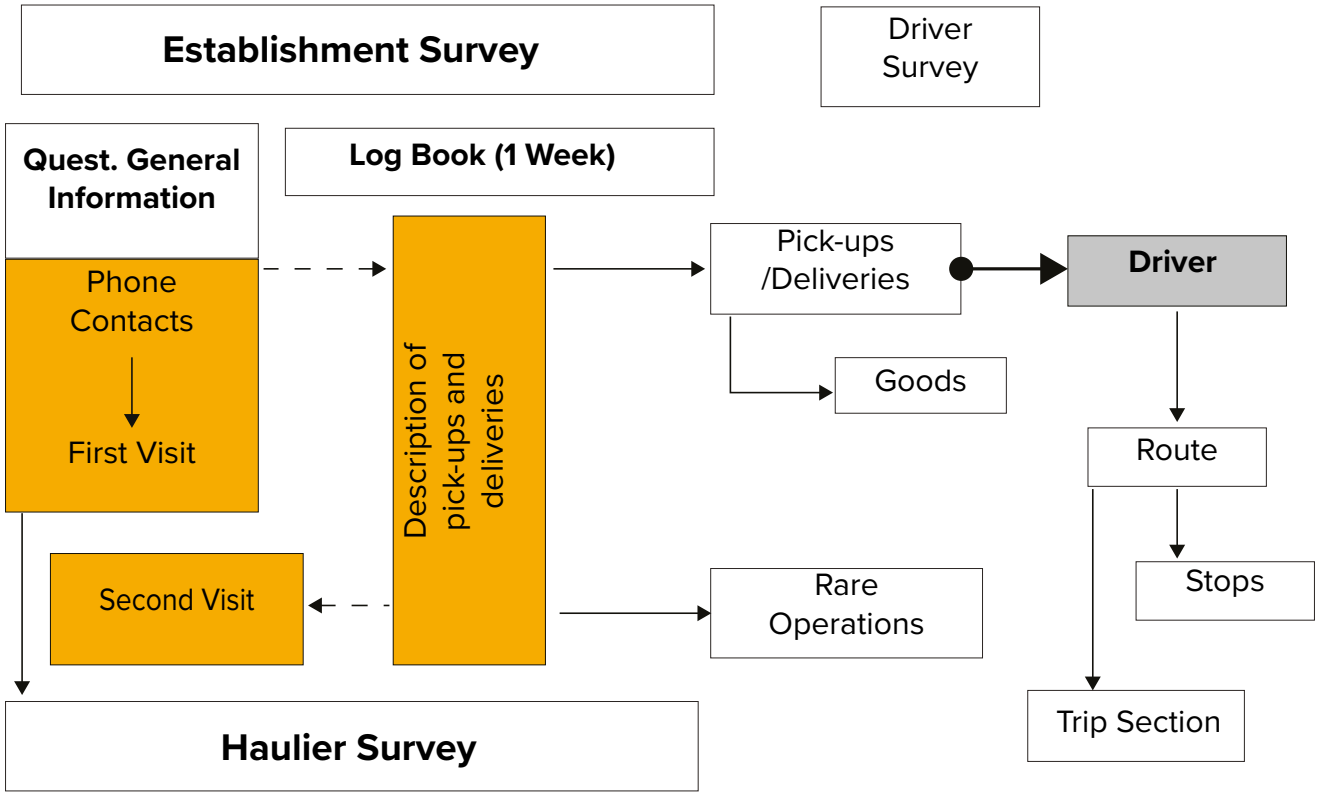


Figure 3: Survey methodology for French Urban Goods Movements surveys | Source: Toilier, Florence, et al. "How Can Urban Goods Movements Be Surveyed in a Megacity? The Case of the Paris Region," 2016.

» Case Study

Figure 3 describes the survey methodology for French Urban Goods Movements surveys, which is considered the gold standard of urban freight data collection. Surveys were carried out for establishments, both shippers and receivers, truck drivers and haulage companies to gather data about every stage of the delivery process. This allowed researchers to identify how different types of goods moved between different businesses in a detailed manner.

Results from French Urban Goods Movement surveys were used to create and calibrate a freight traffic simulation tool, FRETURB. FRETURB has been used in European cities beyond France to simulate logistics travel and guide policy and infrastructure planning.[3]

1.4 Counts

Figure 4a: Estimated delivery activity in central Santiago, Chile. **Source:** Winkenbach & Merchan. "Developing Sustainable Urban Freight Infrastructure." MIT Megacity Urban Logistics Lab. 2015.

» Description:	Counts involve collecting data about the vehicle travel and behavior at a specific place. They can be carried out manually, by having an observer physically count vehicles or by devices such as scales on a road or by analysis of video collected by traffic cameras. Two main types of counts are used to collect urban logistics data—(i) vehicle counts on roads as they move (ii) parking counts, which focus on how vehicles park.
» Uses:	Counts are typically used to monitor performance and demand at critical spots in an urban logistics network. Two common uses of count data are for parking and delivery patterns in dense areas in the urban core or vehicle travel patterns at key entry points into the city and along key logistics corridors.

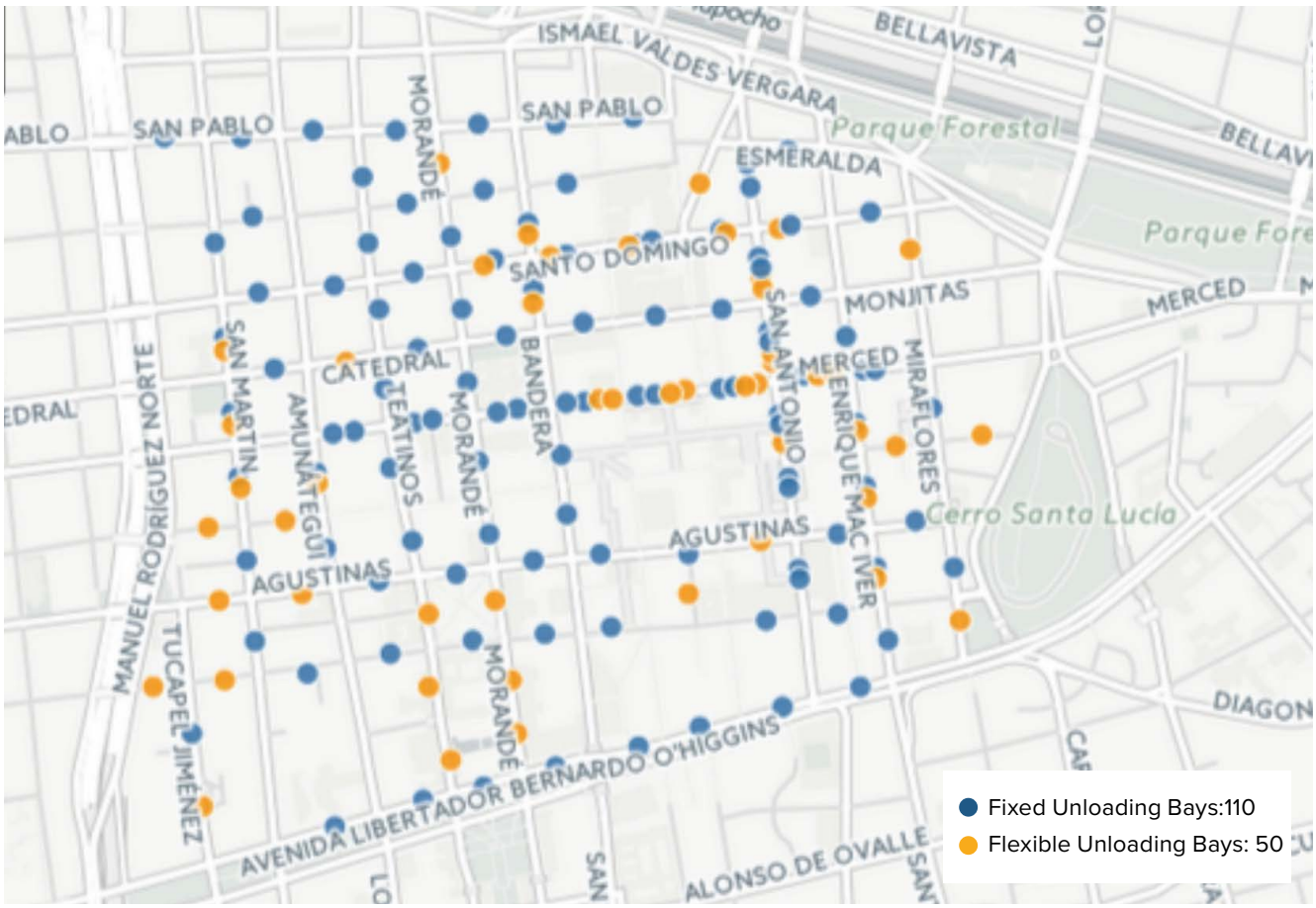


Figure 4b: Proposed parking infrastructure in central Santiago, Chile. **Source:** Winkenbach & Merchan. "Developing Sustainable Urban Freight Infrastructure." MIT Megacity Urban Logistics Lab. 2015.

» Barriers:	Counts are typically a relatively easy way to gather data. Since they describe use at a single point in the network, the counts cannot describe the entire logistics system. Instead, they describe use at a single point in the network.
» Case Study	In Santiago, Chile, delivery vehicle parking was disrupting traffic flows and deteriorating air quality in the commercial district at the city center. Increased logistics parking infrastructure was needed to accommodate deliveries but it was not clear how much was needed or where it should be placed. To resolve those issues, authorities studied how vehicles parked and simulated network performance, including traffic flow deterioration due to illegal delivery truck parking under different parking configurations (Figure 4). An optimal solution of permanent logistics parking and variable, mixed-use parking was identified based on those counts and the simulations that were used to calibrate.

1.5 Data and performance measurement

KEY PERFORMANCE INDEX (KPI)	CALCULATION METRIC	TYPE OF DATA REQUIRED TO MONITOR KPI
Freight Intensity of GDP	Ton/$GDP	Truck counts, carrier surveys
Through freight share of total freight	Tons through freight/total tons	Truck counts, carrier surveys
Truck loading capacity	Tons	Truck counts, carrier surveys and vehicle logs
Net load factor	Ton-km/km	Carrier surveys and vehicle logs
Delivery productivity	Deliveries/hour	Carrier surveys and vehicle logs, GPS
Logistics sprawl	KM to barycenter	Zoning maps by establishment code, GPS
Routing efficiency	Deliveries/km driven	GPS, Carrier surveys & vehicle logs
Travel time index on truck lanes	Time during peak congestion/free flow	GPS, police and traffic data
Truck-related casualties	Injuries and fatalities/KM driven	Police department data
Truck emissions	Gm/km (CO_2, SO_x, NO_x, PM, VOC, 0_3, etc.)	Truck counts, registration data, Carrier surveys, pollution studies
Unit costs	$/km	Carrier surveys

Table 2: Type of Data required to monitor KPIs for assessing urban freight performance

No single data type is fully capable of describing urban logistics efficiency. As a result, a key element in evaluating overall urban logistics performance is assembling and effectively deploying a multitude of data collection methodologies. In the accompanying performance measurement document, a set of KPIs is introduced that describe key sources of inefficiency in urban logistics. However, to effectively deploy that KPI system, policymakers also must collect data to quantify performance on each metric. Table 2 suggests data collection approaches and data types, which can be used to assign values to those KPIs.

2.0 Stakeholder engagement

Data collection is only the first step in diagnosing problems in urban logistics. Robust engagement, both with industry players and with other government stakeholders, is critical to understand how the logistic system is performing, and more crucially, what steps may be taken to improve overall performance.

Because urban logistics systems involve a multitude of players, both public and private and because they are physically linked to larger national transport networks, multiple types of stakeholder engagement at multiple geographic levels are required.

2.1 Freight quality partnerships

Figure 5: Cities with freight quality partnerships | **Source:** Brown and Lindholm. Freight Quality Partnerships: An international Study. 2014

» Description:

Freight quality partnerships are a forum for logistics players to interface with municipal policymakers on issues that affect logistics efficiency in the urban core. Freight quality partnerships are typically composed of commercial players, who are heavily affected by final mile inefficiency.

This type of public sector engagement with industry can assist policymakers in minimizing costs while protecting the public from externalities associated with urban delivery. These types of bodies are becoming common globally in major cities, especially in Europe, (Figure 5) and have been a useful tool for public-private partnership to enhance the efficiency of urban logistics.

» Focus areas:

Freight quality partnerships typically focus on the needs of commercial players who operate in the urban core. As such they focus on infrastructural topics such as parking availability, access policies such as entry restrictions, congestion pricing or low emissions zones and other policy areas that influence operational efficiency of the final-mile delivery.

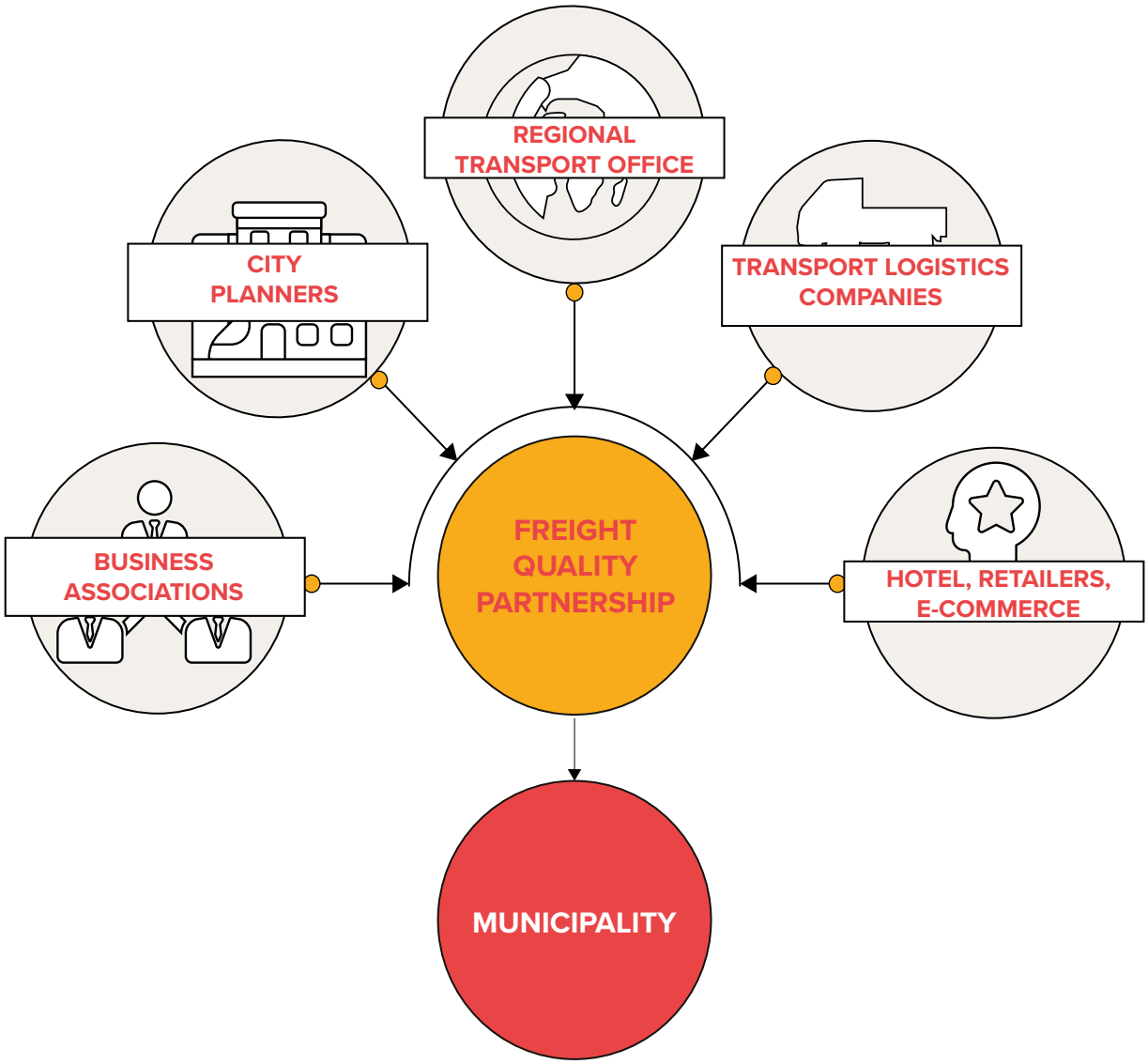


Figure 6: Freight quality partnerships.

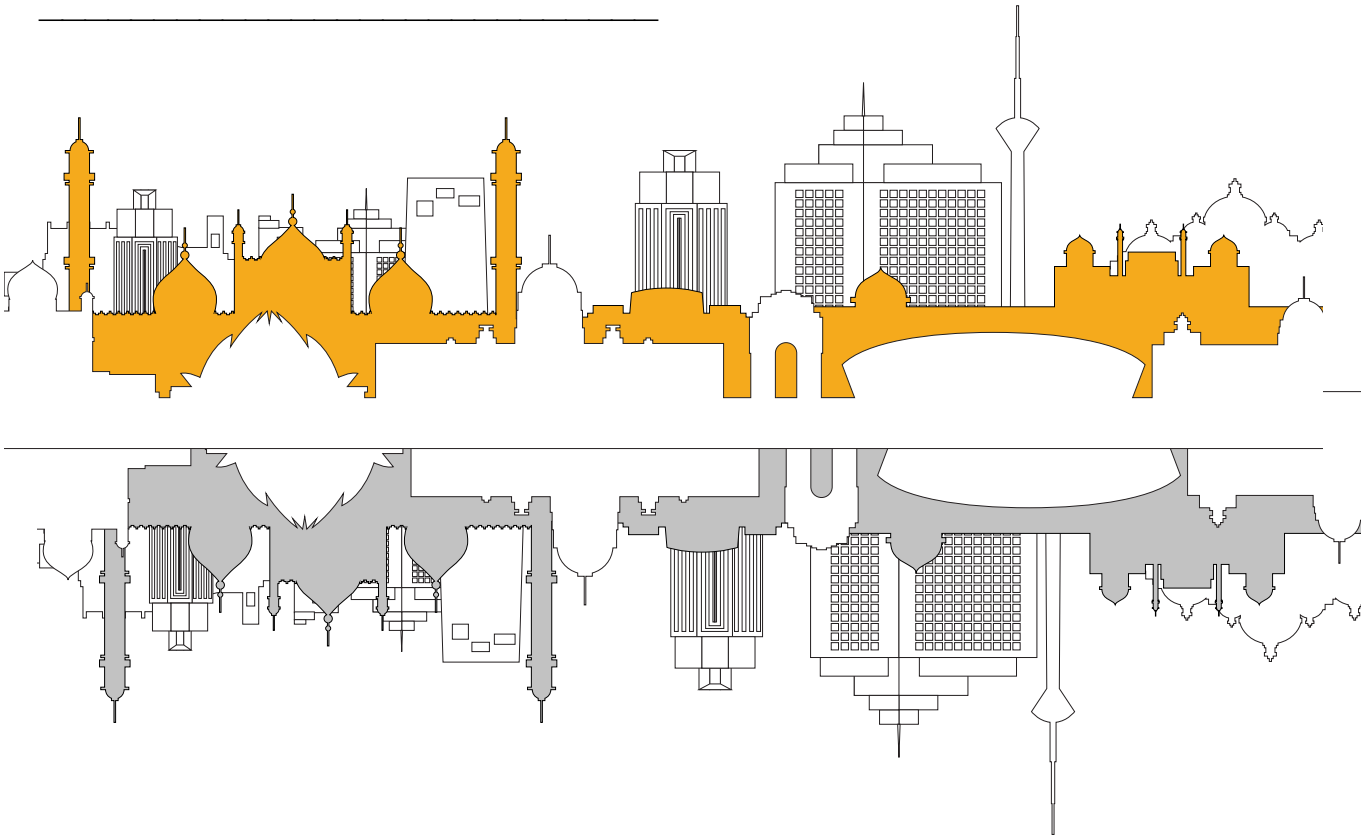
» Case Study

An example of robust freight quality partnership is the Central London Freight Quality Partnership. It consists of policymakers, logistics companies, industry associations for various types of retailers, university departments specializing in urban transport and more. This partnership has offered industry feedback to policies such as congestion charges, low-emissions zones, changes to traffic management policies, time restrictions on logistics activities such as loading and unloading, as well as other policy moves relevant to logistics performance.[4]

TOPIC	NO. OF FQPs MENTIONING THIS
Lorry routing	22
Overnight parking	20
Signing	19
Loading and unloading provisions	19
Good practice in freight operations	16
Out of hours deliveries	16
Urban consolidation centers	15
Vehicle access (times or weights/sizes)	14
Rail freight work	14
Reducing the number and impacts of deliveries	14
Loading and unloading restrictions and fines	13
Traffic information	13
Strategic planning	12
Low-emissions zones/emissions regulations	11
Environment-friendly vehicles	11
Conflicts between goods vehicles and other road users	10
Enforcement issues	10
Congestions	9
Water freight issues	8
Lorry lanes	7
Vehicle utilization	6
Driver training	5
Home deliveries	5
Bicycle delivery	5
Telematics	4
Road pricing	1

Table 3 : Topics addressed by FQPs in the UK. | **Source:** June & Allen, J & Browne, M & Piotrowska, Marzena & Woodburn, Allan. (2010). Freight Quality Partnerships in the UK–an analysis of their work and achievements.

2.2 Metropolitan planning organizations



» Description:	Because urban freight systems are integrated into national transport networks, a coordinated policy response by multiple levels of the government to urban and metropolitan freight issues is a critical element of efficient logistics. For this, intergovernmental coordination is also a critical element of urban logistics policy formulation. In the US, Metropolitan Planning Organizations (MPOs) exist to coordinate transport policymaking issues, including freight on a metropolitan level. They typically include elected representatives or political appointees such as leaders or municipal transportation departments, city employees such as traffic engineers and permanent MPO staff to handle admin and other functions.
» Focus areas:	MPOs serve as the forum to create a fair and transparent transportation development plan for an urban area. They would typically work towards two main outputs: a long-term transportation plan, with a 20 to 30-year time horizon,

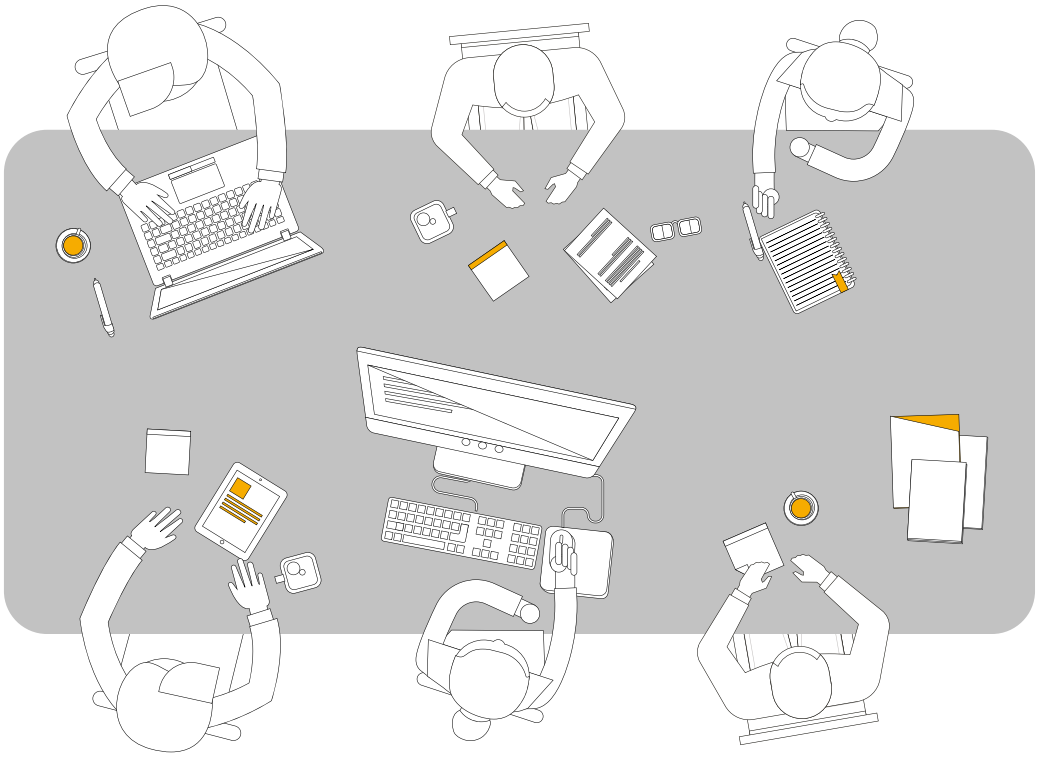
Figure 7: Hoboken city redesign | **Source:** New York Metropolitan Transportation Council

for people and goods that prioritize system performance and quality of life, as well as a shorter term plan, which looks to meet the most immediate needs.

» Case Study

The New York Metropolitan Transportation Council (NYMTC) is the MPO for the New York Metropolitan area. Investment in freight specific infrastructure is a key focus area for the NYMTC. Freight projects pursued by the NYMTC include feasibility studies of regional intermodal logistics parks/freight villages, analysis of the sufficiency and performance of truck rest stops and service areas, feasibility studies on the use of ferries and roll-on roll-off (RoRo) trucking and reducing congestion on chokepoints such as bridges and tunnels as well as numerous surveys and studies to analyze demand for and performance of freight services in the greater New York area.

2.3 Freight advisory committees



» Description:	Because urban freight flows typically originate outside of the urban core, often in other jurisdictions from the city itself, coordinating urban logistics development with broader networks is also a critical factor in the overall urban freight efficiency. To achieve it public-private-partnerships with regional, state and national stakeholders must also be created. Freight Advisory Committees (FACs) need to provide multi-stakeholder input in policy and infrastructure planning. Engagement with these types of bodies allow municipal policymakers to participate in the decision-making process for policies and infrastructure over which they do not have direct control but which influence logistics efficiency within their cities.
» Focus areas:	Topics that FACs commonly advise on and that are relevant to municipal authorities may include corridor improvement, multimodal integration or regional transportation and land-use master planning.

Figure 8: NYMTC Freight Transportation Working Group meeting | **Source:** New York Metropolitan Transportation Council

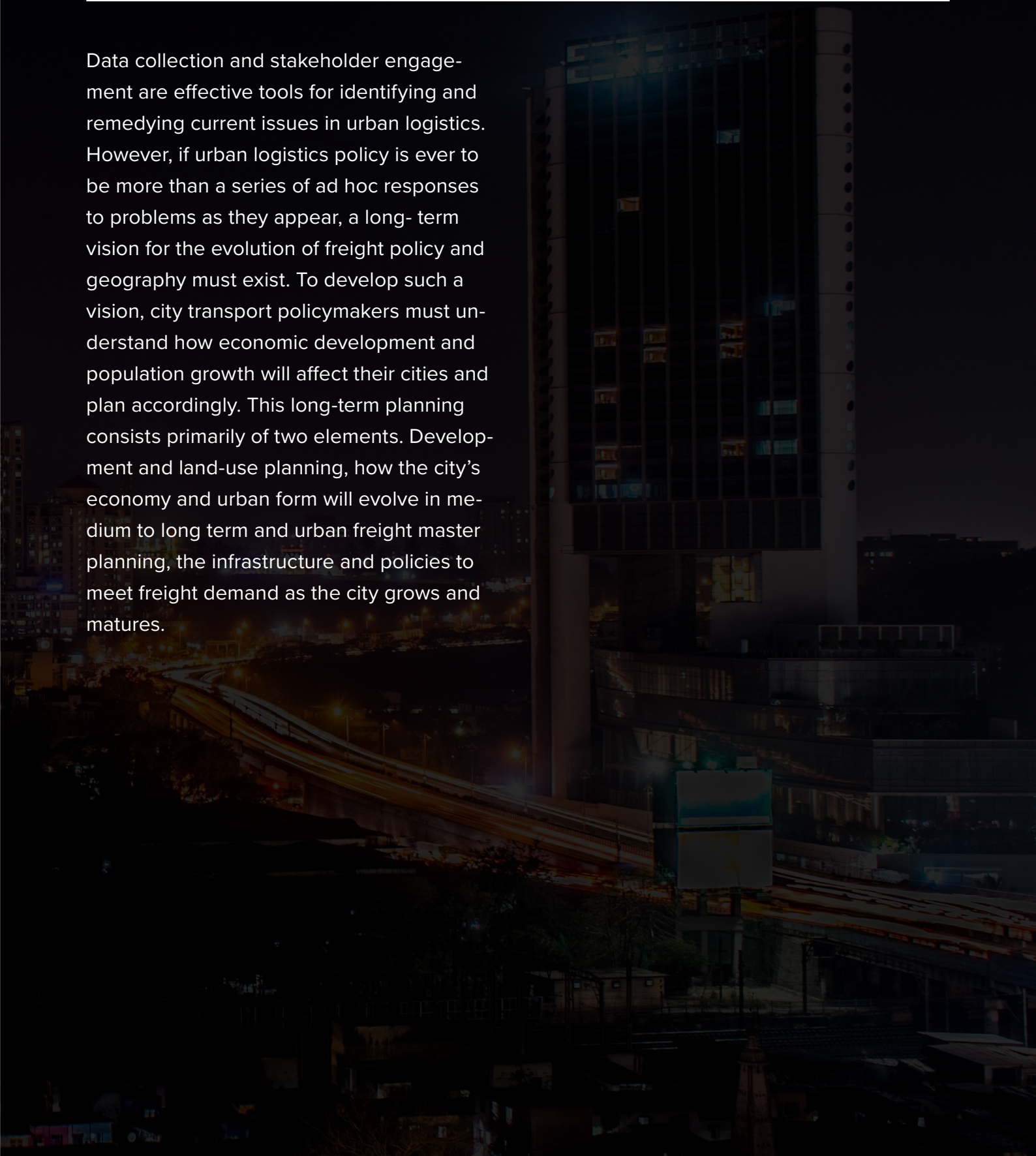
» Case Study

The Freight Transport Working Group (FTWG) is the FAC associated with NYMTC, discussed above in the MPO section. It is composed of regional logistics stakeholders such as shippers, receivers and carriers, MPOs in neighboring cities, elected officials and civil society groups.

This group collaborates with NYMTC to develop its regional freight plan, raise the profile of freight development in the policymaking process and provide the MPO with data and insight to effectively manage and improve the network.[6]

3.0 Long-term planning

Data collection and stakeholder engagement are effective tools for identifying and remedying current issues in urban logistics. However, if urban logistics policy is ever to be more than a series of ad hoc responses to problems as they appear, a long- term vision for the evolution of freight policy and geography must exist. To develop such a vision, city transport policymakers must understand how economic development and population growth will affect their cities and plan accordingly. This long-term planning consists primarily of two elements. Development and land-use planning, how the city's economy and urban form will evolve in medium to long term and urban freight master planning, the infrastructure and policies to meet freight demand as the city grows and matures.



3.1 Development and land-use

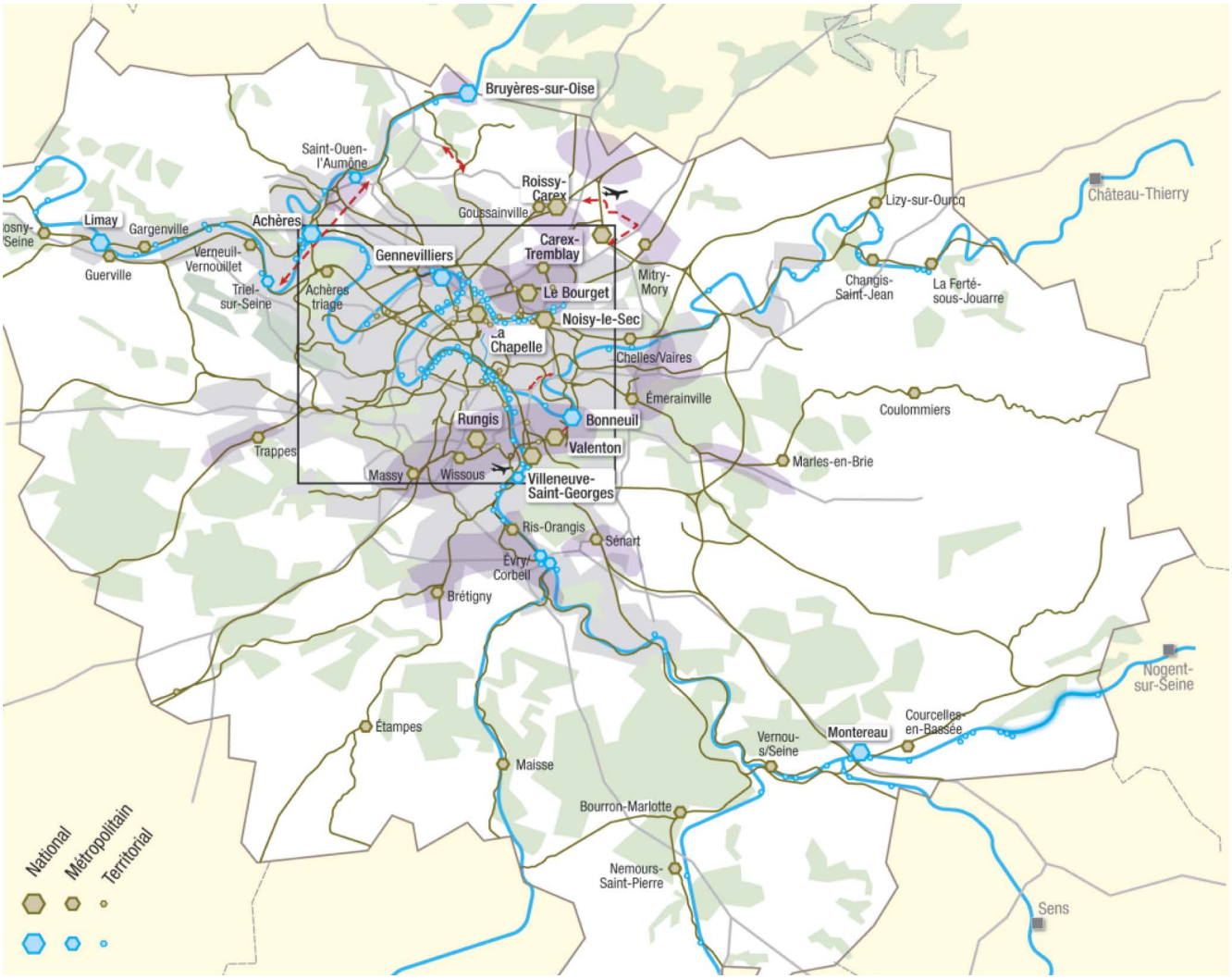


Figure 9: Paris industrial master plan
Source: Conseil régional d'Île-de-France. Île-de-France 2030 Defis, Projet Spatial Regional et Objectifs. 2013.

» Description:

In many cases, land-use planning does not take into account the logistics needs of a city or metropolitan area as the city develops. If allowed to proceed in a disorganized manner, this process of evolution and change can result in a city being locked into an irrational urban form and underperforming infrastructure, which do not meet the needs of logistics players. For this reason, it is important to identify land in the metropolitan area that is suitable for freight generating establishments such as distribution centers or industrial facilities and ensure that development progresses in coordination with planned infrastructure investments.

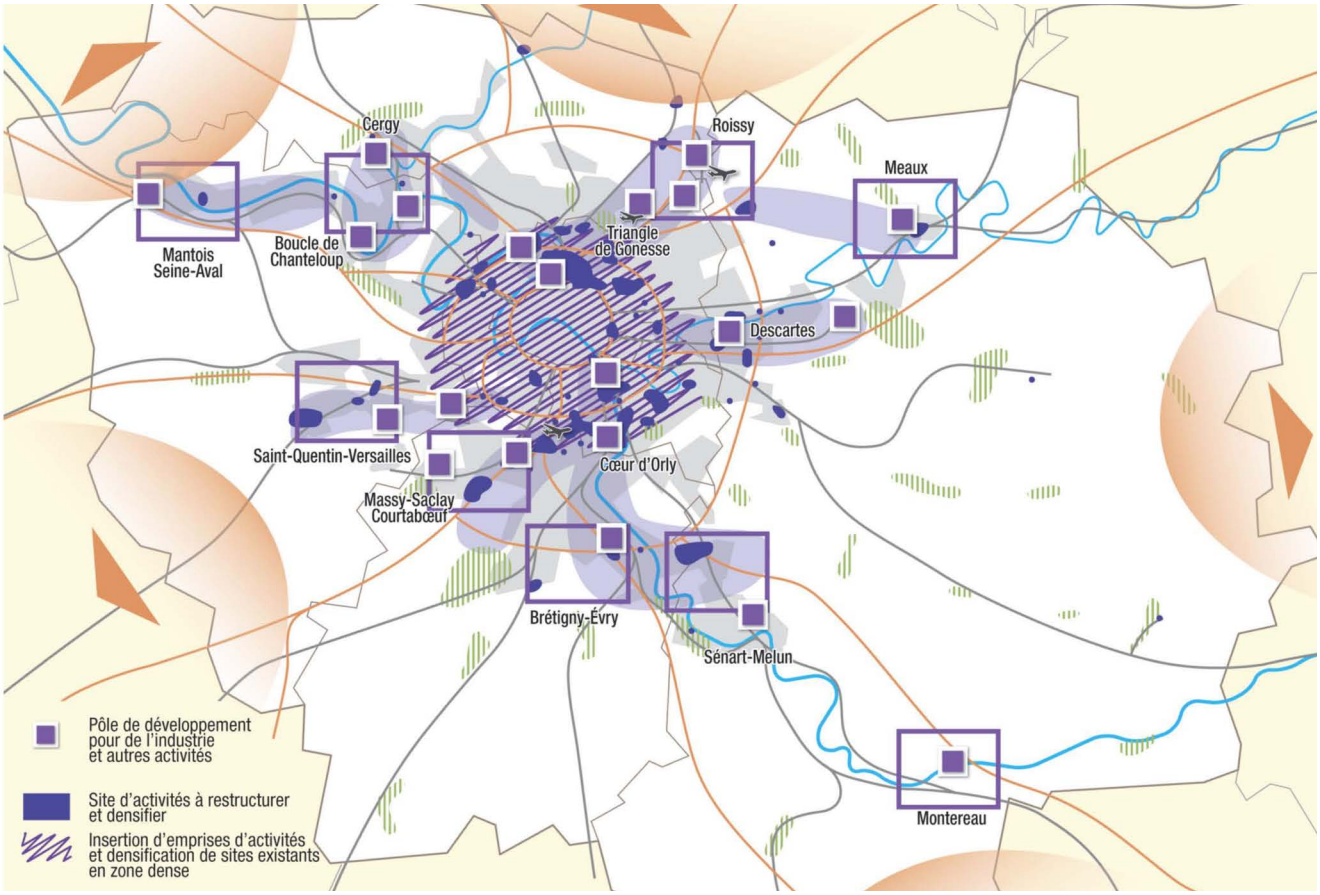


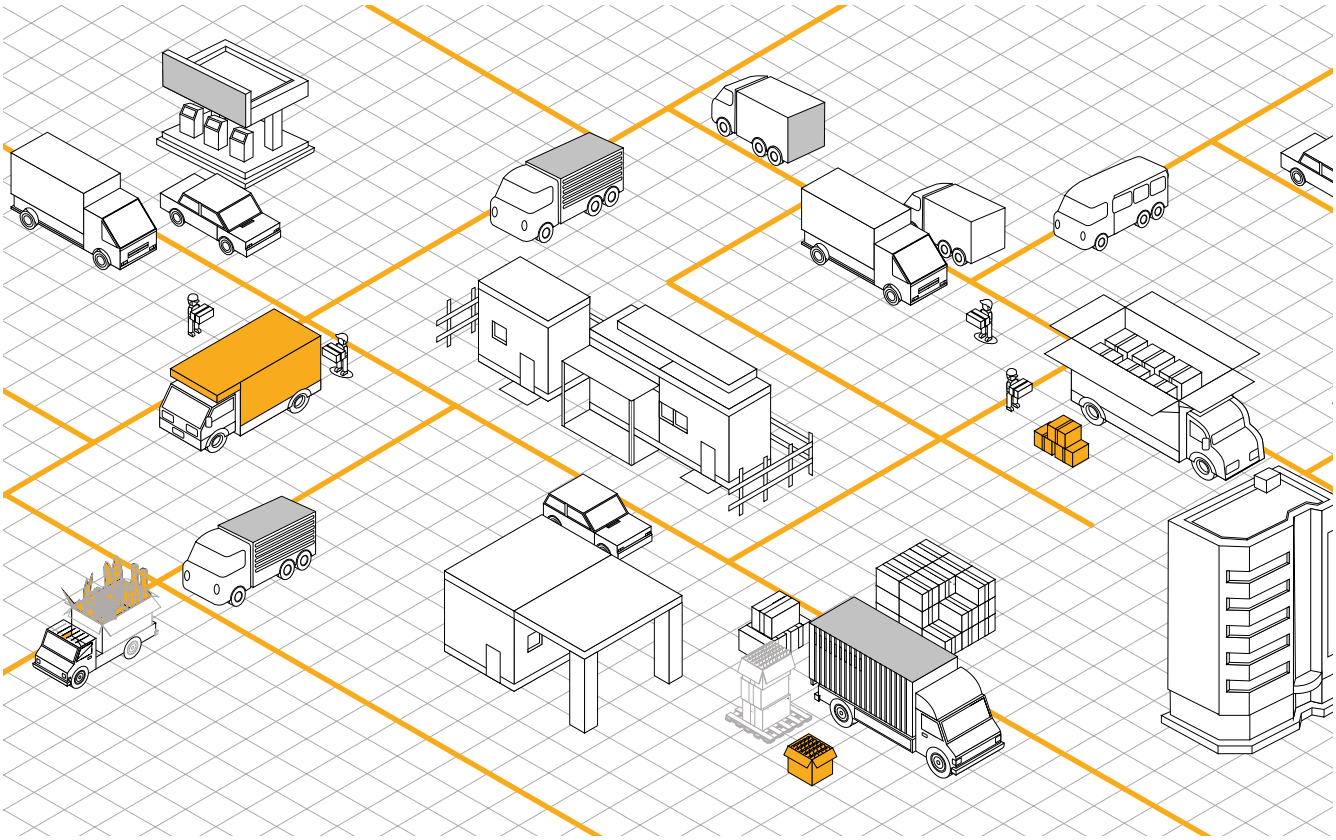
Figure 10: Multimodal development zones coordinated with industrial clusters
Source: Conseil régional d'Île-de-France. Île-de-France 2030 Defis, Projet Spatial Regional et Objectifs.2013.et Objectifs. 2013.

» Case Study

In parallel with planned industrial development, infrastructure was planned to meet the freight demand those industrial zones were projected to create. Specifically, industrial clusters (solid purple squares in Figure 9) were located in zones targeted for intermodal development (rectangles outlined in purple).

In the Paris Metro region, known as Ile De France, a long-term industrial development planning was carried out to support projected economic growth in the region for the next several decades. Identified land for industrial use (purple shading in Figure 8) was well outside the urban core and well-served by water transport infrastructure (blue lines and circles) and rail transport infrastructure (brown lines and circles) as well as road networks (grey lines).

3.2 Freight master planning



» Description:

As land-use, urban form and economic output into the future become clear, it becomes possible to project what freight volumes will be moving through a city and what infrastructure they will require. Projecting future freight volumes and land-use changes allow policymakers to assess what stresses the system will experience and plan how to mitigate them —before they start to cause problems. Master planning freight infrastructure for future development can ensure economic vitality and high urban quality of life for residents well into the future.

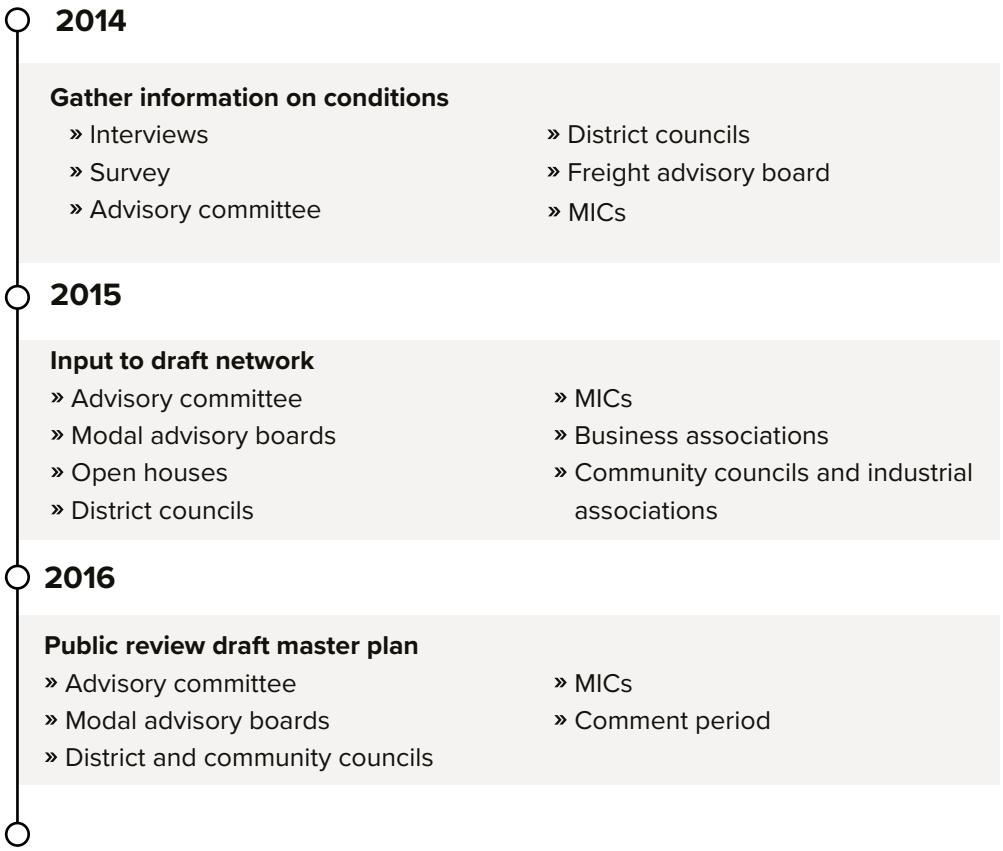


Figure 11: Public engagement process for Seattle's Freight Master Plan
Source: Seattle Department of Transportation City of Seattle Freight Master Plan. 2016.

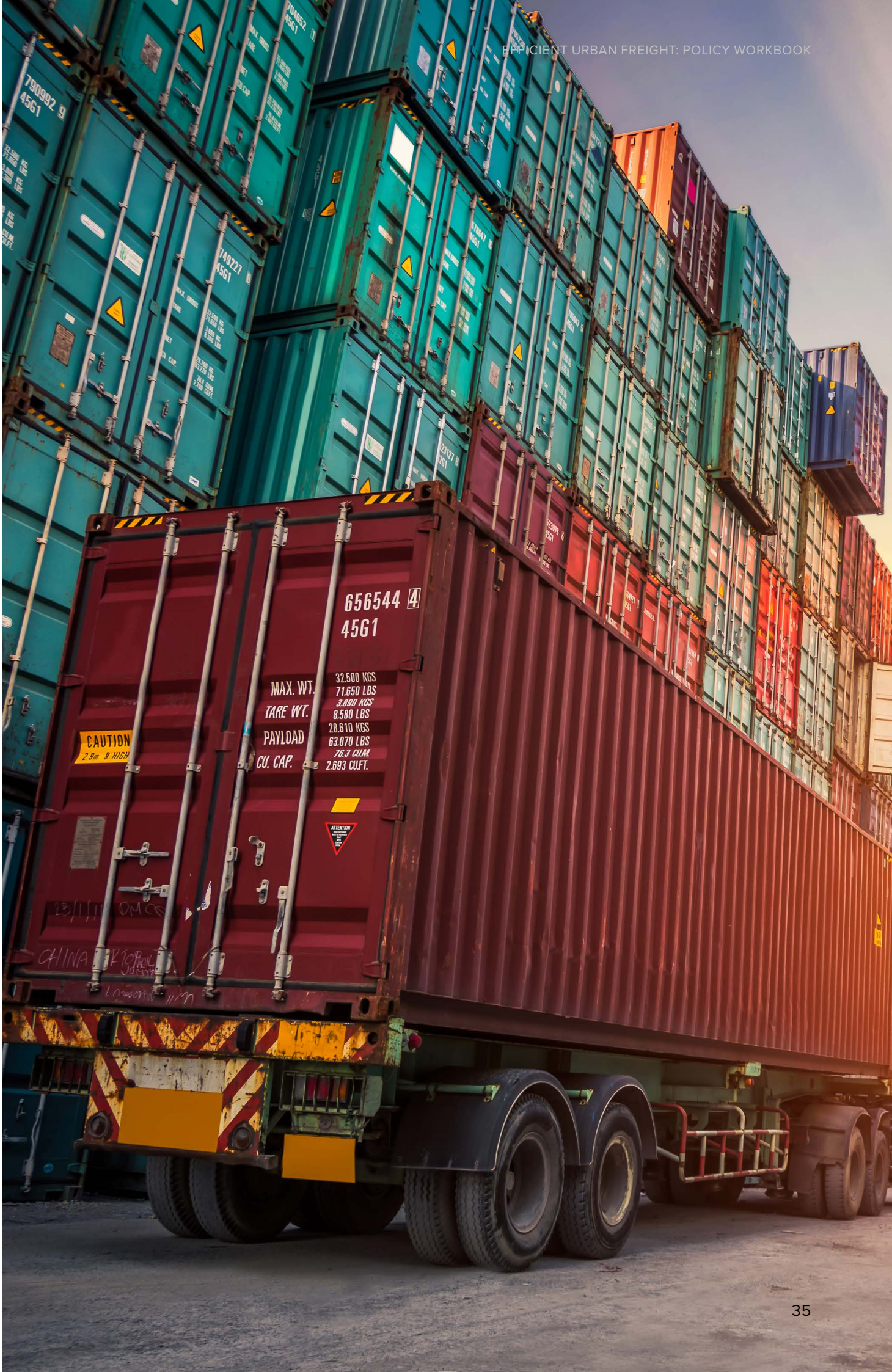
» Case Study

The city of Seattle undertook a long-term freight planning initiative to ensure that it would be able to meet the freight demands of the next generation of industrial and commercial enterprises in the city. There were two major phases of planning, the first was stakeholder engagement and consultation; the second was the creation of specific strategies and action items to address needs identified through the consultation process.

After consultation, the final result was a plan that included over 90 actions that could improve the performance of its urban freight system. The table on the next page shows specific actions for urban delivery, a subsection of strategies to promote economic vitality in the city.

STRATEGIES	ACTIONS
Develop an urban goods delivery strategy	» Establish a minimum distance for loading opportunities from any business address, either in on-street, alley or off-street locations; maintain or reassign loading development projects
	» When alleys are vacated, identify and address loading and circulation impacts to adjacent and nearby properties
	» Improve enforcement of commercial vehicle load zones
	» Expand commercial vehicle load zone hours to 24 hours a day, 7 days in a week in selected locations
	» Review the commercial vehicle load zone permit process to consider more effective use of price to manage demand, access and types of user
	» Consider potential expansion of the Downtown Traffic Control Zone in a manner that improves daytime street network reliability but still provides sufficient urban goods delivery access
	» Evaluate and recommend on- and off-street tactics to enable bicycle, non-truck and small truck deliveries in dense areas
	» Evaluate new curb designs to increase flexibility and opportunities to share space
	» Develop a pilot program for off-hours delivery in areas with a mix of residential and commercial land-use to facilitate truck movement
	» Explore freight demand management strategies to consolidate freight delivery trips and ensure vehicles are right-sized for an urban environment
	» Identify and employ innovative uses of technology to guide urban goods deliveries to destinations and manage access to loading locations
	» Develop a data collection plan and seek funding to regularly monitor on and off-street commercial loading locations and gather user input
	» Explore best off-street loading practices, including loading dock development and use standards
	» Work with other city departments to re-evaluate and update design requirements in new developments to accommodate increased online delivery package storage

Table 4: Actions to support efficient urban delivery identified in Seattle's Freight Master Plan. | **Source:** Seattle Department of Transportation. City of Seattle Freight Master Plan. 2016.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MAX. WT. 32.500 KGS 71.650 LBS
TARE WT. 3.890 KGS 8.580 LBS
PAYLOAD 28.610 KGS 63.070 LBS
CU. CAP. 76.3 CU.M. 2.693 CU.FT.
CAUTION
ATTENTION
CHINA

4.0 Project prioritization

Prioritizing projects requires a methodology to evaluate difficult trade-offs between competing goals such as safety, employment, quality of life, cost, etc. in consultation with urban stakeholder groups. To do so, policymakers can identify goals that they believe urban freight system should be achieving in their city and the relative importance of each goal.

Based on that they can create categories with an associated score. Each project can be scored on each goal and the overall project score would be the sum of the scores for each category. In the below example, the city of Seattle identified five goals for the urban logistics system (safety, mobility, economy, state of good repair, and equity and environment) which were all deemed to be of equal importance. Projects can receive a maximum of 20 points for each category for a total score of up to 100 points. The total point value for each project is an important factor in determining its priority relative to other projects competing for resources.

As the city evolves, the goals, relative scores and project slate may change. For that reason, policy-makers should continuously evaluate the slate of projects under consideration as well as the goals and relative weight of each goal to ensure that investment into the urban logistics system is maximizing benefit to the city's residents and its economy.

» Data collection, private sector engagement and long-term planning, all can help cities understand which projects are needed to enhance urban logistics efficiency. «

PRIORITIZATION PROCESS—QUANTITATIVE		
GOAL	**MEASURE**	**SCORE**
Safety	» Location has high number of collisions » Location has high potential for bicycle and/or pedestrian interaction with freight	**20**
Mobility	» Connects manufacturing and industrial centers and business districts with regional freight network » Promotes efficient truck movement in areas with high truck volumes	**20**
Economy	» Improves freight movement by addressing bottlenecks in the system » Improves connection to dense commercial land use	**20**
State of good repair	» Pavement condition (pavement coefficient index) » Heavy haul network, over-legal network	**20**
Equity and environment	» Areas with high number of jobs linked to freight » Investment would mitigate impacts to adjoining area and is in the area with minority and low-income populations	**20**

Table 5 | Prioritization process—quantitative **Source:** Seattle Department of Transportation. City of Seattle Freight Master Plan. 2016.

5.0 Project funding

5.1 Public-private partnership

» Description:	Urban logistics projects, as with many infrastructure projects, should be paid for by users in proportion to the benefit derived from them. Because the benefits of such projects typically accrue to both private operators, through greater operational efficiency and lower cost, as well as to the public, through congestion reductions, reduced use-conflicts, increased employment and economic growth, public-private partnerships (PPP) are typically an effective way of financing urban logistics projects. Under PPP arrangements, both government and industry would contribute capital to the execution of a project in proportion to the benefit derived.

CREATE PROGRAM BENEFIT TYPE			
GOAL	**MEASURE**	**YEARLY AVG.**	**30-YR TOTAL**
Increased rail system capacity/ avoided truck traffic	Travel-time savings	$1032 M	$13939 M
	Safety benefits	$141 M	$1908 M
	Sustainability	$18 M	$232 M
	Logistics cost savings	$668 M	$9016 M
	Avoided pavement damage	$392 M	$5297 M
	Passenger train delay savings	$17 M	$254 M
	Freight train delay savings	$30 M	$525 M
Grade Separation	Travel-time savings	$15 M	$237 M
	Safety benefits	$7 M	$115 M
	Sustainability	$1 M	$20 M
Total		**$2.3 B**	**$31.5 B**

Table 6: CREATE Program. | **Source:** 70 Projects to CREATE Chicago's Transportation Future.

» Case Study

CREATE is a set of 70 freight rail projects in the Chicago metropolitan area, which are designed to increase capacity on rail lines at a critical choke point in the national rail network and decrease conflicts with road users.
The projected benefits over 30 years from those projects are over $31.5 billion at an upfront cost of $4.4 billion. That upfront capital was contributed via a PPP composed of all parties who derived benefit from the projects, including US Dept. of Transport, the State of Illinois, Cook County, the City of Chicago as well as passenger, freight and commuter rail companies.

Figure 12: The Heartland Corridor | **Source:** Norfolk Southern

» Case Study

A robust effort to fairly attribute value and cost to parties of a PPP is often critical to its success. For example, the Heartland Corridor is a railline connecting ocean ports in Virginia with Chicago and Columbus, Ohio. By elevating clearances on 29 tunnels, double stack rail intermodal service between those ports and Chicago could be undertaken, reducing route distance by over 200 miles and travel time by over 24 hours versus the best existing options, reducing cost by $450-$600 per container.[7]

While that clearly reduced rail-road costs, it also improved the competitiveness of Virginia ports, increasing their revenues, generating employment at logistics parks built along the route and lowering costs for shippers. Due the multiple sources of value creation and uncertainties around the cost, an independent study team was formed to investigate those issues. That study team found that primary beneficiaries of the project would be the railroads and shippers, with the ports of Virginia capturing a smaller share of the value.

INVESTMENT IN ROAD SECTOR

	TENTH PLAN (2002–07)			ELEVENTH PLAN (2007–12)		
	IN RS.* (CR)	IN USD* (MN)	% SHARE	IN RS.* (CR)	IN USD* (MN)	% SHARE
Centre	71,536	17,884	46.87%	155,367	38,842	42.94%
State	68,143	17,036	44.65%	134,246	33,561	37.10%
Private	12,937	3,234	8.48%	72,209	18,052	19.96%
Total	**152,616**	**38,154**	**100%**	**361,822**	**90,456**	**100%**

Table 7: Investment in road sector (10th and 11th plan) | **Source:** Gajendra Haldia. Public private Partnership in National Highways: Indian Perspective. International Transport Forum. April 2013. https://www.itf-oecd.org/sites/default/files/docs/dp201311.pdf

» Case Study

Since shippers were not party to the PPP, the US federal government contributed that portion of the cost under the assumption that the extra value created would be eventually recaptured through increased income taxes.[8] As a result, the nearly $200-million rail upgrade was financed with 43% of the capital coming from the federal government, 52% from Norfolk Southern Railways and the remaining 5% coming primarily from the State of Virginia.[9]

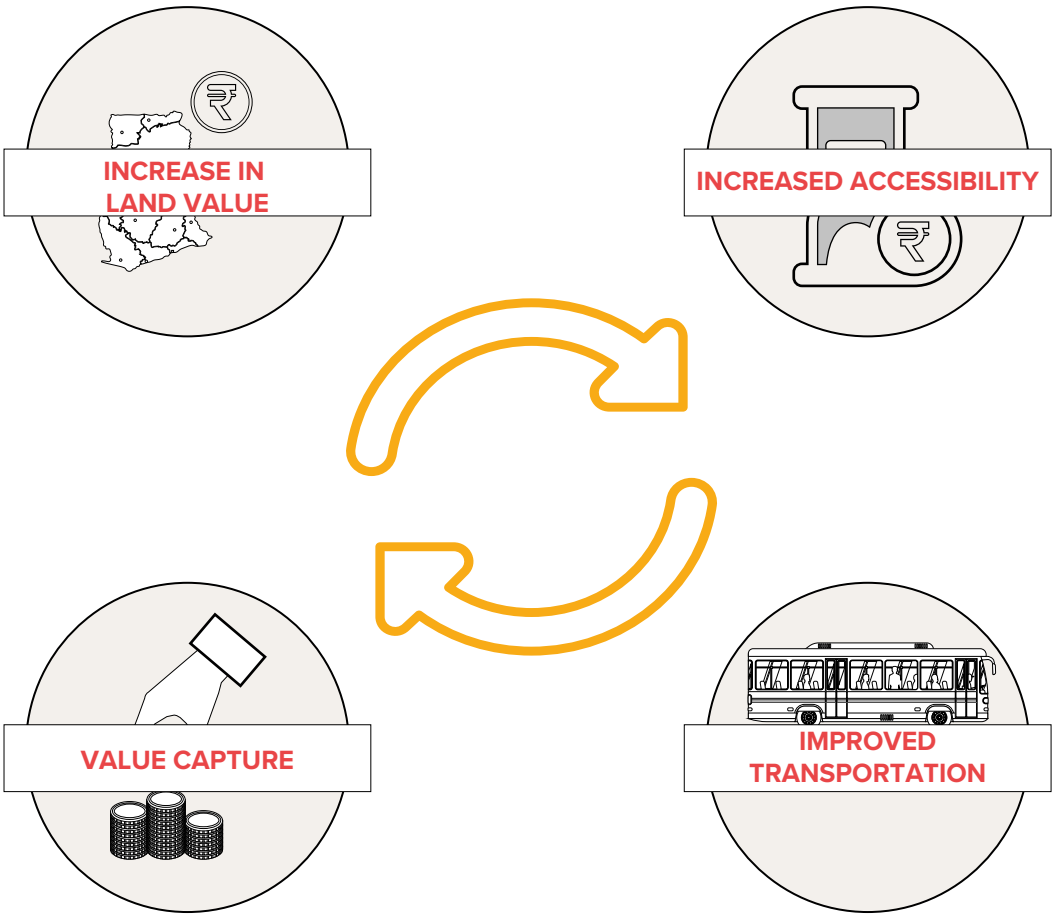
PPP models exist in India as well. National Highways in India are funded by public private partnership (PPP) with the cost recovery coming in two forms: toll and annuity models.[10] In the toll model, a concessionaire builds the infrastructure and recovers his investment by charging tolls from highway users. In the annuity model, the concessionaire gets returns on his investment in the form of annuity payments from the government. PPP Investment into Indian National Highways during 10th and 11th plan between 2002 and 2012 is as in Table 7.

5.2 User fees and project finance

Figure 13: Alameda Corridor

» Description:	Project finance uses revenues created by the use of a piece of infrastructure over the course of its lifetime to pay back a loan for its upfront cost. Project finance or related securitization approaches can be used for projects with very high upfront costs where the groups deriving the benefit are not in a position to provide such a large amount of capital at once. Project finance can be used in conjunction with PPPs.
» Case Study	The Alameda corridor is a high-capacity, below-grade, container rail line connecting the Port of LA and Long Beach with the United States' class 1 freight rail networks. It was built because the existing rail system was both short of capacity, which created substantial urban truck traffic and also had many level crossings, which interfered with urban traffic fluidity. The project is a PPP with the state of California contributing capital as well as the ports that the railway served. The largest share of capital, however, is from the bonds guaranteed by use revenue. Each container passing along the corridor is subject to a $48 fee, which creates a revenue stream to service the debt used to finance the project.

5.3 Value capture



» Description:

Transportation projects often enhance the value of real estate in their vicinity. Capturing some of that value appreciation, typically through property taxes or fees charged to developers, can be used to fund the transportation project, which provided that appreciation. The majority of examples of value capture financing come from passenger transport investments. However, the same principle could be applied to the value of commercial and industrial land that is more efficiently connected to logistics networks or to real estate that sees its value rise due to the resolution of use conflicts created by logistics activity.

Figure 14: Denver Union Station. | **Source:** City of Denver

» Case Study

Denver Union Station is a multimodal hub for public transportation with access to bus, light rail and commuter rail. It is surrounded by mixed-use, transit-oriented development, including commercial and residential areas. The redevelopment of Denver Union station was partly funded by loans from Railroad Rehabilitation & Improvement Financing (RRIF) and Transportation Infrastructure Finance and Innovation Act (TIFIA). For repayment of the loans, the city council created a Tax Increment Financing (TIF) district on the properties that benefited from the project around the station and in the surrounding 20 acres. The revenue collected from the TIF was used towards loan repayment.

Similarly, Bangalore is also using a value capture mechanism to finance its city metro project.[11] Construction of metro line increases the value of the surrounding land. A portion of that value will be captured as an additional land tax to fund the construction of metro stations.

6.0 References

1. Table displays suitability of different data collection approaches for different applications (+++ most suitable; - least suitable)

2. The municipal government of Shenzhen offers a subsidy to e-trucks used within the city. In order to be eligible for the subsidy, operators must provide the government with GPS data showing that their electric truck was actually used in the city and meet a minimum requirement of 30,000 km driven in the city. That GPS data is stored in a central database and is also used to analyze logistics system efficiency and infrastructure needs.

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