DATA-DRIVEN TRANSPORTATION SYSTEMS

POLICY WORKBOOK

Smart City
MISSION TRANSFORM-NATION

Ministry of Housing and Urban Affairs
Government of India

ROCKY MOUNTAIN INSTITUTE

Ministry of Housing and Urban Affairs
Government of India

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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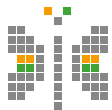
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Document outline

This document builds on the Policy Framework to guide city managers in understanding various ways in which data can be used in the passenger transportation sector and what steps to take towards implementing and supporting these use cases.

Instituting the framework outlined in the Data Smart Cities strategy and appointing a Transport Data Champion are key first steps in developing a data-driven transportation system. After understanding what use cases for data in the transportation sector are possible, a Transport Data Champion could consider three primary steps:

Prioritizing transport data use cases by identifying challenges and goals to address

Establishing a baseline for the city by understanding the current status of the city in terms of data collection and availability as well as related policy and stakeholder landscape.

Acquire the necessary data and/or develop a repeatable process for acquiring the necessary data to support the selected use cases. This document aims at supporting this process.

Appoint a Transport Data Champion
Allocate appropriate resources (e.g., staff) for the Champion to develop initiatives

Responsibilities of the Transport Data Champion include:
» Prioritizing transport data use cases and initiating the design of initiatives and policies accordingly (steps 2–4)

» Communicating with and convening key stakeholders

» Working closely with the City Data Officer and Mission Data Hub to develop and maintain a data-sharing platform for the city and and ensure appropriate safeguards for privacy and security
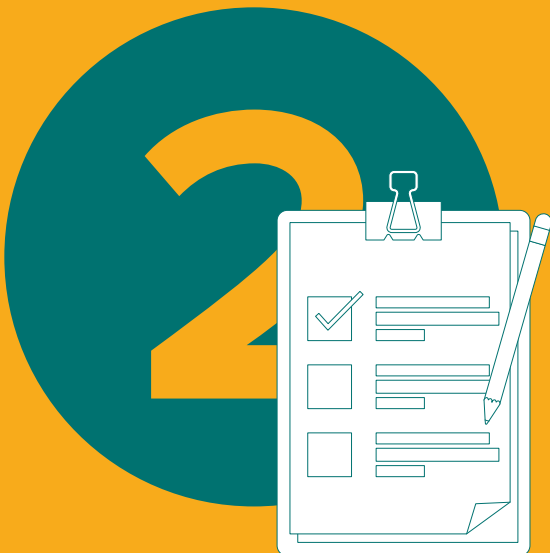
Prioritize transport data use cases based on the city's goals and challenges

Consider:
» What are the most pressing challenges to be addressed within the transportation sector?

» What transportation goals does the city have?

» Does the city have funds to invest in the initiatives and infrastructure?

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Establish a baseline for the city's current data collection, availability, policy, and stakeholder landscape as a starting point for each selected use case

Evaluate:

» Stakeholder ecosystem and current relationships

» Data collection, availability, and quality

» Policy and government landscape

» Current initiatives

4

Acquire the necessary data
Develop a repeatable process/means for acquiring it to support the selected use cases

To acquire data for specific use cases:
» Identify the necessary data

» Determine what data is available and what gaps remain

» Obtain remaining data, either by acquiring from other data owners (if the dataset already exsists) or primary data collection

1.0 Identifying uses of data in the transport-ation sector

This section describes potential use cases for mobility data for passenger transport.[1] These use cases are organized by the three primary categories of beneficiaries outlined in the Policy Framework document: cities and governments, travelers, and researchers. While a city may primarily focus on the use cases for cities and governments, it may also play a role in supporting and enabling the traveler and researcher use cases.
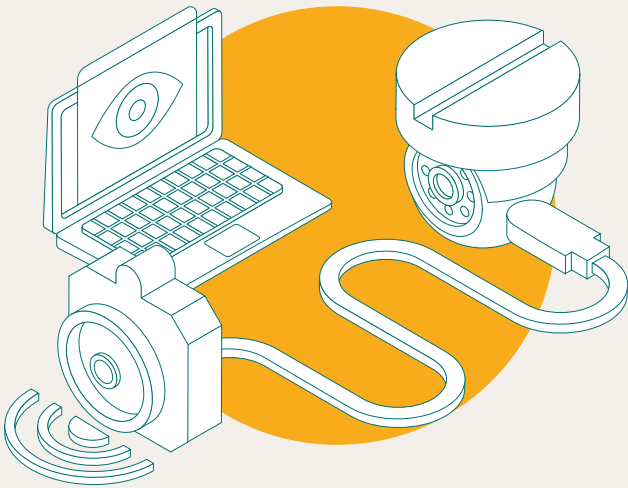
Cities and governments

» Safety and security

» Transportation, route & infrastructure planning

» Road and infrastructure maintenance

» Real-time system and maintenance

» Enforcement and regulation

Travelers

Mobility as a service:

» Multimodal trip planning

» Seamless payment

» Real-time mode connectivity and optimization

Ancillary trip information
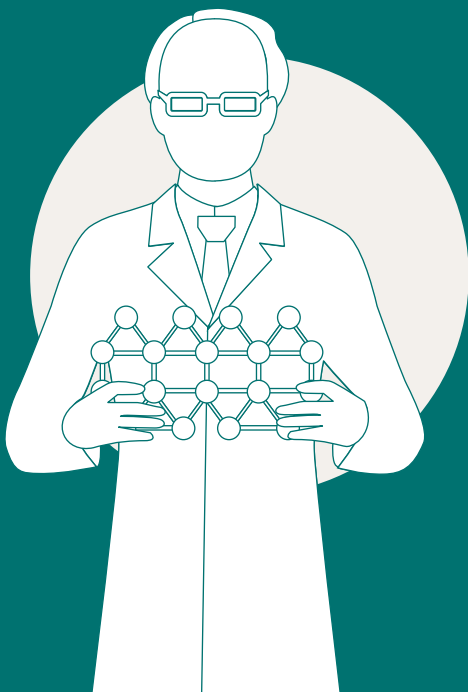
Researchers

Mobility research and analysis

Figure 02: Summary of the primary mobility data use cases

1.1 City and government use cases

Cities and governments around the world are realizing the value of using mobility data to improve system safety and optimize transit planning and city design around the efficient movement of people and goods. Some of these use cases are discussed below.

» Analyzing traffic and commute patterns allows planners to understand where to build infrastructure and add transit routes to ease stress in highly-trafficked areas. «

**» Safety and security:** Data can enable improved safety and security within the transportation system in a number of ways. For example, increased access to data allows cities to see where accident hotspots are, thus enabling them to respond more quickly and also understand the issues in those areas. With increased understanding of when and how accidents occur, cities can ensure a greater level of safety for their citizens by responding faster when incidents occur and developing solutions to systemic concerns. One particular area of concern in India is women's safety in the transportation sector. Many women feel unsafe traveling alone and frequently avoid using public transport.[2] Improved tracking of vehicles and verification of drivers and vehicles that are deemed safe are some examples of how data may allow women to feel safer using transportation.

» Transportation, route and infrastructure planning: Transportation planners can leverage data analytics to better design and maintain routes, public transit and mobility infrastructure. For example, analyzing traffic and commute patterns allows planners to understand where to build infrastructure (including non-motorized transport infrastructure) and add transit routes to ease stress in the most highly-trafficked areas. Data analytics can aid planners in minimizing congestion in cities by identifying the primary cause (like poorly-timed signals, insufficient parking, etc.).

» Road and infrastructure maintenance: Access to data can allow cities to see when, where and what maintenance is required for roads and various infrastructure. Doing so can allow cities to prioritize maintenance, in order to manage resources more effectively and know when to act to prevent excess damage, which may lead to greater costs than addressing weak points early on.
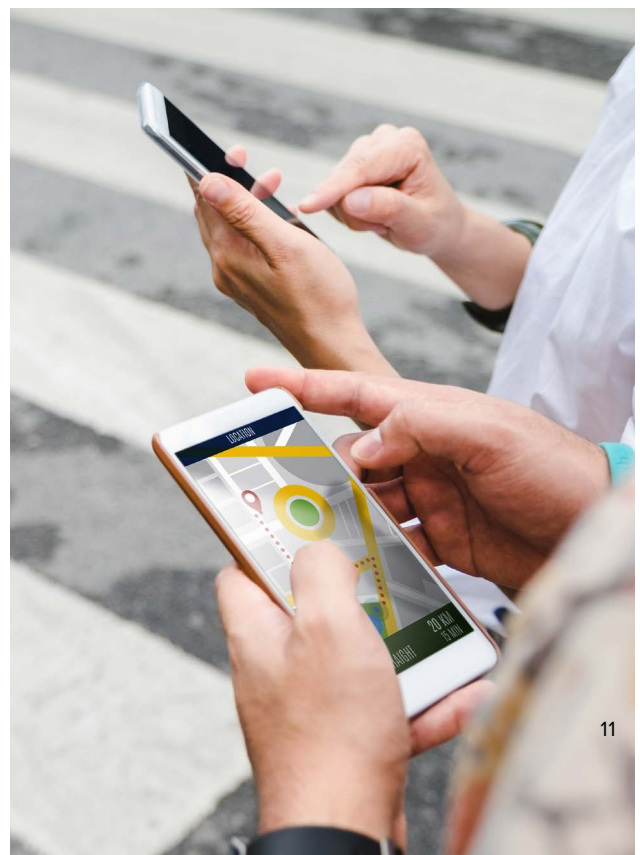
» Mobility data—as well as organizations' willingness to share data—is the key to unlocking MaaS. «

ity into the transportation system, allowing them to improve the enforcement of regulations and develop new or modify existing regulations to ensure a smooth system.

» Real-time system management: Data can aid in the real-time functioning of the mobility system. Operators can remotely monitor the transportation system and manage system operations. Increased access to data will give operators more real-time information that will help them ensure the smooth functioning of the transportation system.

» Enforcement and regulation: Increased access to data gives regulators better visibil-

1.2 Traveler use cases

There are many potential use cases that apply to improving transportation efficiency for individual travelers. Many of these can be grouped under the general category of "mobility as a service".

» Mobility as a service: Mobility as a service, or MaaS, refers to the technology-enabled, on-demand availablity of multi-modal trip options, including multimodal trip planning and seamless payment.[4]

Mobility data—as well as organizations' willingness to share data—is the key to unlocking MaaS. There are several data-supported elements that go into MaaS, many of which are described in more detail below.

Multimodal trip planning: A primary element of MaaS is the ability to see all available modes of transport and choose the mode that is most optimal for the situation and be able to easily link various modes of transport to get to the destination. For example, a traveler could go onto a single platform and enter her destination and be shown the best option for getting there, which may include a portion of the trip using one mode and another portion using a different one.

Seamless payment: Enabling travelers to seamlessly pay various transportation providers

through a single portal could increase the accessibility of transport options and promote multimodal trips. Implementing seamless payment requires collection and integration of transit data and also relies on transit companies' willingness to share data.

Real-time mode connectivity and optimization: Mobility data can enable the real-time optimization of travel plans around changing factors such as weather and traffic as well as travelers' preferences (e.g. least expensive, shortest time, etc.).[7]

1.3 Researcher use case
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The researcher use case includes organizations, groups and individuals conducting mobility-related research, such as academic institutions and think tanks. Increased access to data gives these groups and individuals a greater ability to conduct in-depth analysis on the passenger transportation system, in order to draw conclusions and make recommendations for the mobility system.

Which use cases a city decides to prioritize depends on its starting point, priorities and goals. The next section outlines how a Transport Data Champion can evaluate the city's starting point and begin to prioritize data use cases.

» Ancillary trip information: In addition to MaaS, there are a number of other services that access to data can provide to increase the efficiency and ease of a traveler. This could include accessing data on real-time conditions (i.e. traffic, weather, accidents, etc.), information about interesting landmarks along the route or any other sort of ancillary information to enhance a trip.

2.0 Prioritizing data use cases and evaluating city baseline

To implement the use cases outlined above and benefit substantially from the use of data in the passenger mobility sector, it is critical for a city to consider its goals and challenges and use this framework to prioritize a few use cases on which to focus. A city should consider following three primary steps towards implementing data use cases. This section outlines the first two steps in this process.

Prioritizing transport data use cases by identifying challenges and goals to address

Establishing a baseline for the city by understanding the current status of the city in terms of data collection and availability as well as related policy and stakeholder landscape.
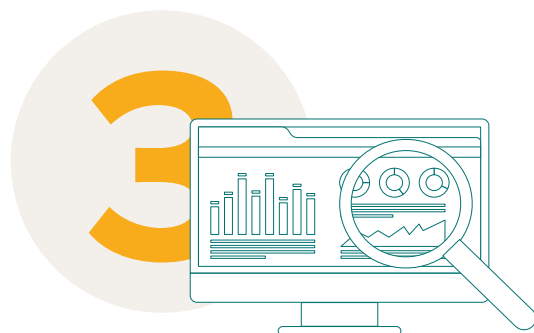
Acquire the necessary data and/or develop a repeatable process for acquiring the necessary data to support the selected use cases. This document aims at supporting this process.

2.1 Prioritizing transport data use cases
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The use cases for mobility data can support larger goals for the transportation sector while addressing pressing challenges. In order to prioritize mobility data initiative and policy developments, a city should consider its goals and challenges before deciding where to put its efforts.

In order to identify the transportation goals and challenges that the city wants its data efforts to serve, a city manager could consider the following questions.
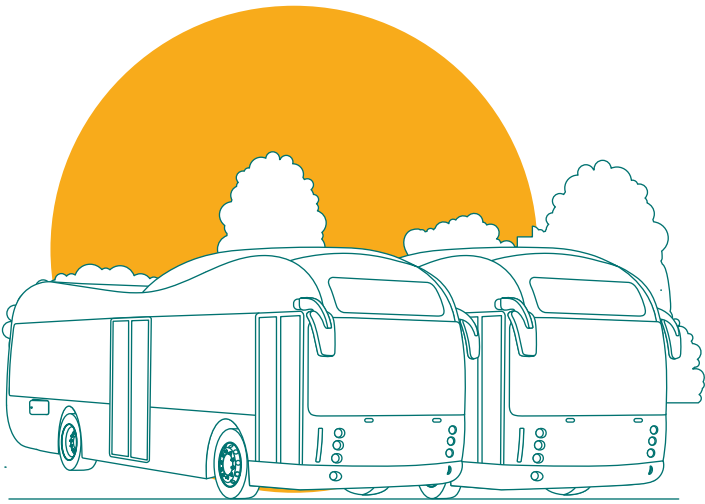
What transportation goals does the city have? What are the citizens' transportation priorities?

For example, if a city has a high demand for affordable public transit and/or the city has set a goal of increasing public transit ridership by X% by 2030, they could prioritize analyzing data to plan transit routes and improving GPS tracking of buses so that riders could better plan around and reply on the bus system.

Does the city have funds to invest in initiatives and infrastructure? To what extent?

To determine whether the city should prioritize initiatives that may require government investment (e.g., installment of additional monitoring infrastructure) or those that require less or could be funded using innovative business models.

What are the most pressing challenges to be addressed within the transportation sector?

For example, if a city struggles with a high rate of road accidents, they could prioritize road safety as the transportation goal/challenge on which to focus its data efforts. There could be one or more challenges on which the city could decide to focus.
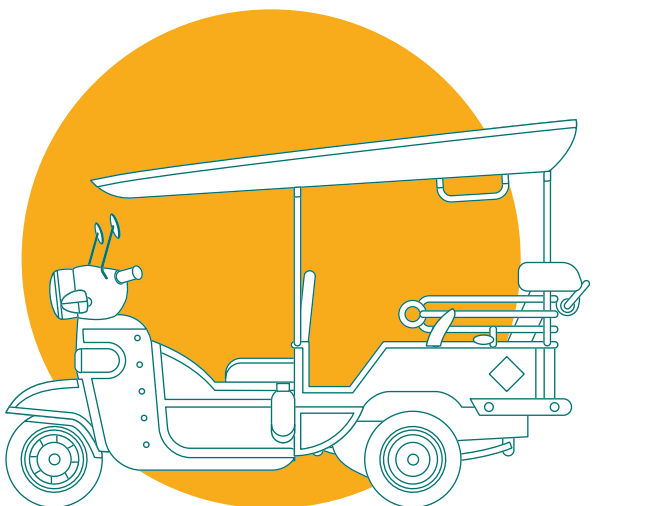
2.2 Evaluating the city's starting point

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After selecting the use cases on which to focus, the Transport Data Champion should establish a baseline for the city's current status and landscape with respect to data as a starting point for understanding what actions will need to be taken to implement the selected use cases. To do this, the city manager should explore questions across four primary areas:

» Stakeholder ecosystem and current relationships: To understand the players involved and how to engage them

» Data collection, availability and quality: To identify what sort of data are already being collected, who it is available to and what quality it is (e.g. frequency, accuracy, etc.)

» Policy and government landscape: To identify what additional policies and guidelines may exist at the city and state levels and which government entities should be involved in develo-ping mobility data initiatives

» Current initiatives: To understand how the city is currently using data and what relevant plans might already exist

Below is a sampling of questions across each of these categories to understand the baseline situation. The Transport Data Champion may use these as a starting point and dig deeper with follow-up questions as they arise to ensure as complete an understanding as possible. The questions should be asked with the prioritized use cases in mind.

Who are the data owners and beneficiaries relevant to the use case? (e.g., public transit agency, traffic police, etc.)

Do any data-sharing partnerships currently exist? Are there any relevant partnerships that could be expanded to include data-sharing? (e.g., if the city is working with a private transportation company in another capacity, could this relationship be leveraged to promote data sharing)

How does the Municipal Corporation or Smart City SPV currently work with the public transit agency/agencies and private transit companies? Are data and information shared between these groups?

STAKEHOLDER ECOSYSTEM & CURRENT RELATIONSHIPS

Has the city developed a City Data Alliance, as per the DataSmart Cities strategy?

Do any of the transit operators (public or private) in the city currently share their data? If there is a transit operator present who also operates in other cities, does he/she have a history of being willing to share data with other organizations?

GTFS—General Transit Feed Specification—defines a common format for public transportation schedules and associated geographic information; it is a strandardize format widely used around the world.[8]

Do transit operators in the city (public or private) collect data in GTFS format? Do they publish their GTFS feeds to make their APIs available?

An API—application program interface—is a set of programming standards and instructions for accessing a web-based software application[9]; making an API available allows software developers outside the oranization to design products that incorporate that API's data and functionality.
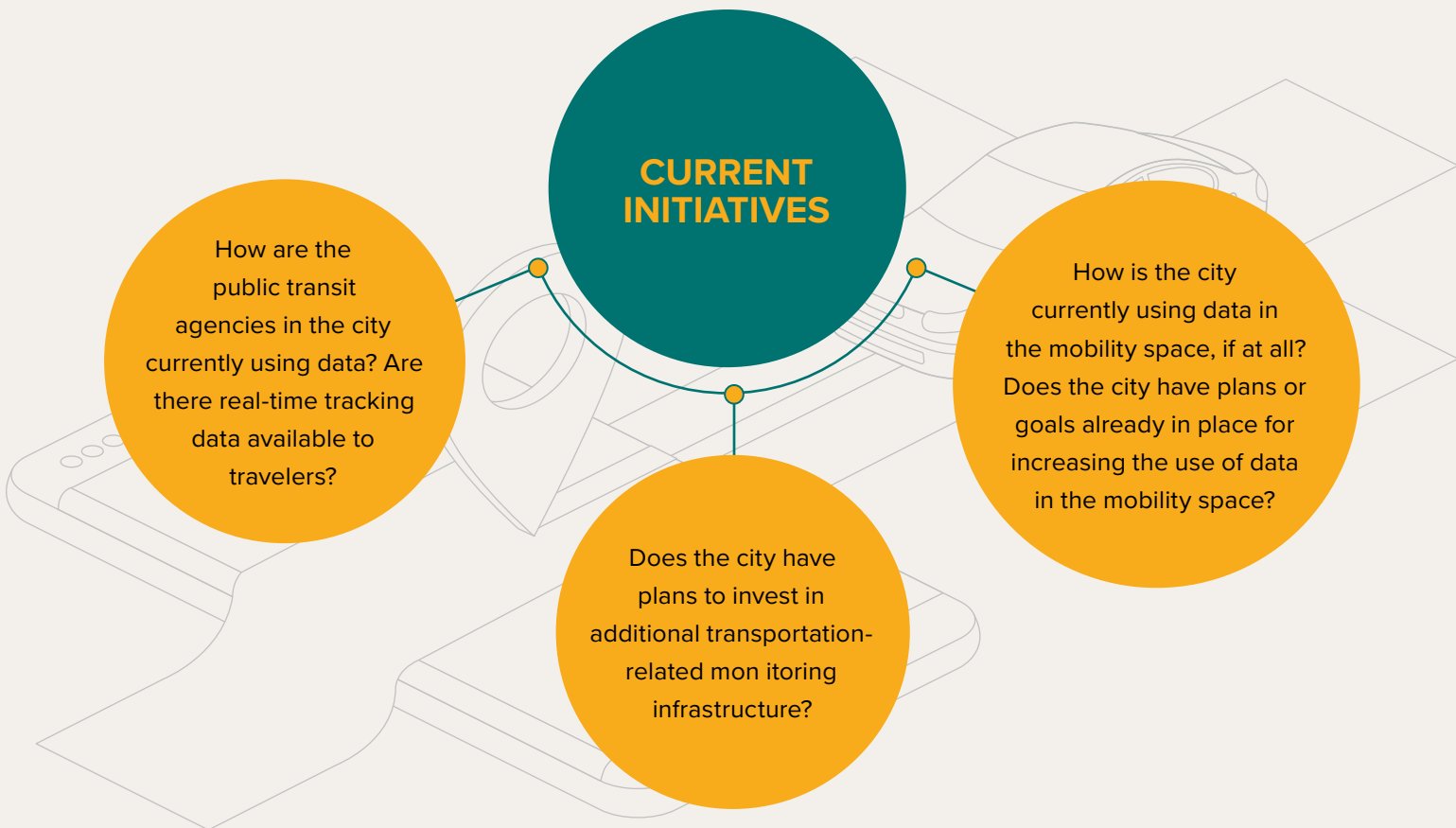
What are the primary modes of transit in the city? (Depending on the use case, this question may be important to understand which providers are most critical to get information from first.)

What sort of data collection and monitoring infrastructure does the city currently have, relevant to the use cases? Is it functioning and accurate?

DATA COLLECTION, AVAILABILITY & QUALITY

What type of data is being collected and what is the frequency with which it is collected and published? Are these data being shared with other public agencies/corporations? Are these data made available publicly?

What relevant departments and public entities need to be involved to ensure success of this use case?

Does the city or state currently have policies or guidelines related to data or personal information, such as Open Data Policy?

Has the city taken steps to implement the National Data Sharing and Accessibility Policy (NDSAP), e.g. by appointing a Chief Data Officer or setting up an NDSAP Cell?

Has the city taken steps to implement the DataSmart Cities strategy?

POLICY & GOVERNMENT LANDSCAPE

CURRENT INITIATIVES

How are the public transit agencies in the city currently using data? Are there real-time tracking data available to travelers?

How is the city currently using data in the mobility space, if at all? Does the city have plans or goals already in place for increasing the use of data in the mobility space?

Does the city have plans to invest in additional transportation-related mon itoring infrastructure?

Some of these questions may be easily answerable while others will require greater time and effort to answer fully. One potential approach to thoroughly answering these questions could involve two parts:

1. Stakeholder interviews: Reach out to all stakeholders involved in the ecosystem (including various government departments, public transit agencies and private transit companies) to understand how they are collecting data and what they are willing to share.

2. Literature and policy review: Review all available policies and recent reports related to this topic.

3.0 Process of data acquisition for specific use cases

Once use cases have been prioritized, there are three primary steps for acquiring the necessary data for each: identifying the sources for the required data; surveying what data are available and identifying what gaps remain; collecting additional data or acquiring data from other data owners to fill those gaps.[10]
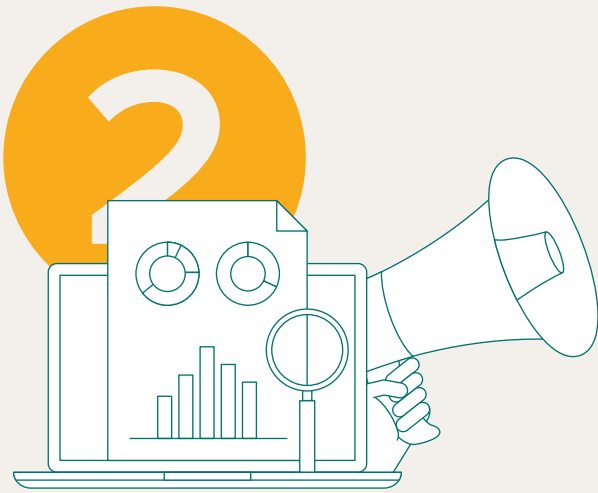
Identifying necessary data

The first step is to identify what sort of data are needed to fit the desired use case. This is an essential step—thoroughly analyzing what types of data sets are needed and conversely, what are not needed, will allow the city to efficiently collect or obtain the needed data. Doing so will also allow the city to make more effective and specific requests for data if a data owner already has some of the necessary data.

» Example: route planning
After evaluating the city's goals and challenges, a Transportation Data Champion decides to use data to inform public transit route planning. To do this, he/she works with a team of transportation planners and together they determine that they want historic data on commute patterns in order to identify the most highly-trafficked routes to determine where new mass transit routes can be developed to meet the needs of commuters and ease congestion. They recognize that they do not need real-time data or ancillary data such as weather information, trip fare, etc.

Determining what data are available and what gaps remain

Once the necessary datasets have been identified, the organization can survey which data are already available to them, either through data that they already own or have access to or through publicly available data. There are already many sources of open data. Surveying all the data that are already available will prevent an organization from collecting redundant data or making unnecessary data requests. Once the organization has determined which of the datasets are already available to them, they can identify where gaps still exist and what sort of data coule be acquired to fill these gaps.

» Example: route planning

The team notes that they have open access to historic data on the ridership of current public transit options from the public transit agency. They also have data on traffic patterns from the several traffic sensors that have been installed throughout the city. Then they determine that their existing traffic pattern data do not have as much detail as they would like and leave off a few key areas of the city. They decide to acquire additional data for commute and traffic patterns in the city.
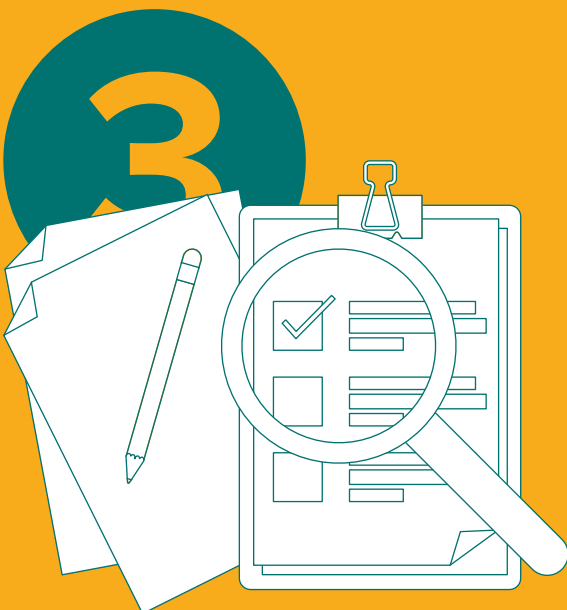
Collecting remaining data

To fill in the gaps identified, an organization or individual has two options:

1. Acquire the data from another data owner: One option is to acquire the needed data from someone who already owns it.

2. Collect the data: If no one owns the needed data, or if the data owner is unwilling to share it, the organization must devise a way to collect it themselves.

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» Example: route planning

The team evaluates the options of installing more traffic sensors to collect their own data on commute and traffic patterns or approach other data owners to acquire data that already exist. They decide to take a combined approach of installing additional sensors as well as working with shared mobility providers to acquire existing data-sets.

4.0 Common challenges in collecting and sharing data

Despite the numerous benefits that come from collecting and sharing mobility data, there are many challenges to it. Acquiring data can prove difficult; even once this is accomplished, often the data are incomplete, of poor quality and lack standardization. Some of the biggest challenges and barriers are outlined below; recommendations on how to minimize these challenges are addressed in the guidelines in the following section. Some challenges and barriers include:

» Acquiring data from private data owners: Private data owners are often concerned with jeopardizing competitive advantage by sharing data and are wary of blanket requests for their data without a clear outline of how it will be used or a value proposition to the data owner for sharing it. This can be addressed by cities making very clear and specific requests for data as well as being transparent about how the data will be used. See recommendation 2 in the following section.

» Poor quality and incomplete data: Existing data are often of poor quality or incomplete— for example, inaccurate, published infrequently or missing for certain days or services.

Setting best practices for data collection and hosting capacity-building opportunities for transit organizations can help address this barrier.

» Lack of data standardization: Commonly used standards for many modes of transport don't exist while for other modes the standards are incomplete. The lack of data standardization makes it challenging to aggregate data from different sources and use them in an efficient manner. Creating and publicizing data standards or best practices can help address this challenge.

» Privacy/cyber security: Data must be reliably scrubbed of personal identifiers so that an individual's privacy is not compromised. Both individuals and companies are often concerned that sharing data openly might be a breach of their privacy. This challenge can be addressed by creating policies to ensure appropriate safeguards for data privacy and security.

» The lack of data standardization makes it challenging to aggregate data from different sources and use it efficiently. «
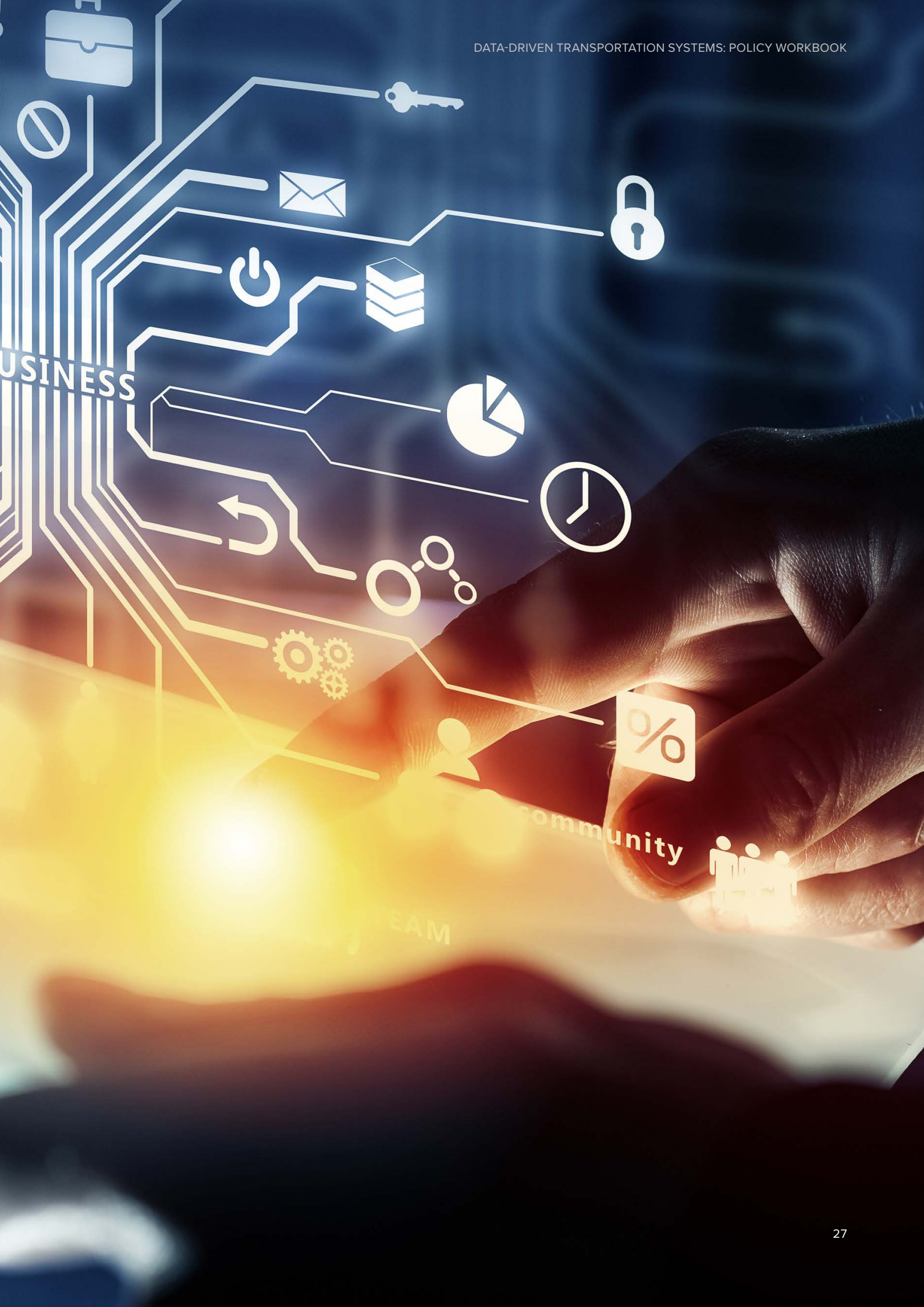
5.0 Recommend-ations for supporting data-driven transport-ation systems

This section outlines six key actions that a city can take to develop and strengthen the data collection and sharing ecosystem to enable the use cases described above.

These actions correspond to benchmarks outlined in the Evaluation Metrics document and overlap with and build on the ground-work laid by the DataSmart Cities strategy:

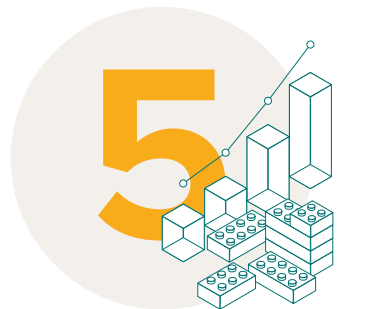**Implement DataSmart Cities framework and form-ulate a City Data Policy**

Appoint a Transport Data Champion

Clarify and communicate the purpose and value of data collection & sharing

Ensure appropriate safeguards for data privacy and security

Build a participatory framework for transport data stakeholders

Develop and maintain a city-level data-sharing platform

Implement DataSmart Cities framework and formulate a City Data Policy

Before taking steps to promote transport-specific data use cases, a city should develop or begin to develop the foundational framework for supporting data-related initiatives. The DataSmart Cities strategy outlines the framework that every Smart City must put in place to support the development of a culture of data-driven governance.

Appointing a City Data Officer to be responsible for the implementation of the Smart Cities data strategy.

Appointing Data Champions and Data Coordinators within each relevant department or agency to champion and coordinate the implementation of the City Data Policy in their respective organization, such as identifying and publishing datasets from their organization.

Developing a City Data Policy, which would include proposed smart solutions/projects, an assessment of current IT systems, a list of datasets of interest and a road map with milestones for publishing datasets.

Developing a City Data Alliance, which would be a network of government departments, agencies, private sector companies, community organizations, city policy-makers, domain and legal experts, researchers, academic institutions, incubators, entrepreneurs, etc., within the city who come together to advise on the development of the City Data Policy, identify data use cases to address key challenges in the city and promote education and awareness about data in the community.

Appoint a Transport Data Champion

The Transport Data Champion will lead all transport data efforts—evaluating the current city status, choosing use cases on which to focus and supporting the development of data initiatives for selected use cases. Depending on the size of the city, the capacity of the city government and the complexity of the transport system, the City Data Officer (per Data-Smart Cities strategy) or Chief Data Officer (per the NDSAP implementation guidelines) could also play the role of the Transport Data Champion.

The Transport Data Champion should be given the mandate and authority to work with the City Data Officer to launch initiatives and draft policy to support the development of an effective data collection and sharing ecosystem in the city. The Transport Data Champion should be allotted the necessary resources (e.g., staff, funding as available) to achieve the goals decided upon by the city. The size of the team required to support the Transport Data Champion will vary depending on the city's size, avail-

ability of resources and complexity of its transport system.

With many stakeholders involved in the mobility data landscape—public transit agencies, private service providers, travelers, etc.—municipal corporations and Smart City SPVs can play a key role as conveners to get the relevant parties on board with standardizing and sharing data.

Responsibilities of the Transport Data Champion may include:

» Identifying priorities for data use for the passenger mobility sector and initiating the design of initiatives and policies accordingly

» Ensuring the City Data Plan supports the needs of transport data goals

» Working closely with the City Data Officer and Mission Data Hub to develop and maintain a city-specific data-sharing platform and ensure appropriate safeguards for privacy and security

» Managing relationships with other entities, including private data owners

» Convening stakeholders in the system to address common challenges and opportunities when appropriate

» Tracking the city's progress in developing and strengthening transport data initiatives

» Communicating with Transport Data Champions of other cities to learn from their progress and challenges, as well as coordinate initiatives as transportation crosses city boundaries

Clarify and communicate the purpose and value of data collection and sharing

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An important step is for the city to understand the purpose and value of data collection and sharing and align its priorities with respect to data collection and use cases. Doing so will also allow the city to focus its efforts, using resources efficiently to successfully implement the selected use cases, as well as to communicate more effectively with data owners.

Though this may seem like an obvious point, a common downfall for cities is to try to do too much without a sense of prioritization around which data are going to unlock the most value. This lack of focus also prevents cities from being able to clarify the data's use to those from whom they are requesting it. Clarifying the city's overarching goals and using that as a framework to understand the purpose in collecting and using data will help a city avoid this common challenge.

Being able to clearly articulate the purpose and value of data collection and use will allow the city to:

» Align internally with the many government agencies and departments to support a common goal

» Communicate more effectively with the private sector, resulting in greater participation in data-sharing initiatives

» Promote a data-sharing platform and other data initiatives more effectively

» **Communicating effectively with data owners:** To develop a successful practice of sharing open mobility data, the private and public sectors must collaborate effectively. As described in the challenges section, bringing private companies onboard sharing data can prove challenging to building a robust data-sharing ecosystem. Many companies are concerned that sharing proprietary information may jeopardize their competitive advantage. One pitfall of cities is to make a request for all data from private companies— this approach tends to be ineffective as many organizations are wary of these blanket requests for their proprietary information without sufficient justification. This can be avoided by city governments by being specific and judicious with the types of data they are requesting and making clear exactly why they need it and how they plan to use it.

While promoting open data sharing has many benefits, not all data need to be made open to support a certain use case. There may be

instances where a city government could form a partnership with an organization to acquire data for a specific use, without that data being made publicly available. Involving private data owners through a participatory framework—such as the City Data Alliance outlined in the DataSmart Cities strategy—will help build relationships and convince participants of the value of sharing data. In addition, there may be a need to engage data owners individually and make specific requests for data. In these cases, how the data owner is approached and the nature of the request can greatly impact a data owner's willingness to share his/her data.

When making a data-sharing request to a data owner:

» First understand the use case and determine what kind of data are needed for it

» Request only the data that are needed to support the use case, rather than making a blanket request for all available data

» Be clear and transparent with exactly how the data will be used

» Make a value proposition to the data owner of how they will benefit from sharing the data and/or offer to trade data (if the city has access to information that could benefit the private data owner)

The example of Waze's Connected Citizens Program—detailed in the Best Practices document—demonstrates a private company being willing to share data when the use case is very clear and the use is transparent. In this case, the value proposition to Waze for sharing its data was clear, as the private company benefits from receiving information from the city in return for the data it provides.

Ensure appropriate safeguards for data privacy and security

To ensure that the privacy and security of citizens and organizations are not compromised through data sharing, appropriate safeguards must be in place. As outlined in the Policy Framework, there are several draft policies at the national level, which provide guidelines for processing personal data and outline requirements for data privacy. Additionally, several states and cities may already have privacy policies in place.

The city should make sure there are adequate protections in place to protect citizens' privacy and security and supplement with additional policy and guidelines if necessary. These privacy and security policies/guidelines should be embedded in the City Data Policy and developed in consultation with the Mission Data Officer, as outlined in the DataSmart Cities strategy.

The proposed Personal Data Protection Act of 2018, prohibits the processing of sensitive personal data without explicit consent. It means that any organization that has access to mobility data for specific individuals must do one (or both) or two things:

» Remove any PII from the data before allowing it to be used publicly. In this case, personal identifiers must be reliably removed from the data so that an individual's privacy is not compromised

» If data are to be transferred, ensure that those containing PII (or ideally, all data) are sent through secure channels so that PII remains only in the possession of the parties that have been authorized to own or access it

Data shared on the city-wide data-sharing platform or other public forums must be adequately processed to ensure that the privacy of an individual is maintained and the security of the city, state or country is not compromised.

Build a participatory framework for transport data stakeholders

A participatory framework for transport data stakeholders should be developed, through which stakeholders can surface shared challenges and help develop solutions as well as provide input on the development of policies and initiatives.

This transport stakeholder network may be developed as a subgroup of the City Data Alliance (as per the DataSmart Cities strategy) focused specifically on transport data or as a separate entity. This framework could take many forms, ranging from less involved—for example, an online forum—to more involved, such as an organized consortium that meets regularly. The format may depend on the city's capacity as well as the level of interest of its stakeholders.

The key actors involved should include both public transit agencies and private transit companies and any other relevant stakeholders.

The Transport Data Champion may be responsible for developing the framework and convening/soliciting input from stakeholders and the resulting feedback and ideas generated should be used to inform the design of initiatives and policies. Where appropriate, the stakeholder group should be in contact with similar organizations in other cities to maximize knowledge-sharing.

The participatory framework should aim at harnessing the collective expertise of the many stakeholders involved to support the development of effective policy and best practices that are in line with industry consensus and technology trends. If the city has a strong existing City Data Alliance, it would be a logical platform on which to develop a transport-specific convening framework.

The functions of the stakeholder engagement platform may include:

» Internally aligning the value of data-sharing and promoting this beyond the participants of the framework

» Identifying critical stakeholders in the transit data and shared mobility ecosystems and creating a framework for sharing data among different players

» Co-developing best practices and recommendations for collecting and sharing transport data

» Providing input and feedback on the development of policies and initiatives

» Periodically reviewing policy and recommending updates as the new mobility ecosystem evolves

» Identifying incentives and producing road maps for transit agencies and other mobility service providers to provide higher-quality mobility data

» Assisting public agencies to build capacity (e.g., through skills training)

» Creating action plans for piloting various projects to test critical elements of the shared mobility system

Develop and maintain a city-level data-sharing platform
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A city-level data-sharing platform will support the development of transport data use cases, as well as innovations beyond the selected use cases. This platform should endeavor to support the transparent sharing of open data as well as the transfer of private data between certain parties.

The DataSmart Cities strategy outlines a plan for implementing a three-part platform for data sharing: an Open Data Platform, for providing free and open data sets in consumable and machine-readable format; a Data Exchange Platform to allow stakeholders to publish and consume free and open data via a secure platform and act as a Data Broker to create partnerships between data producers and consumers and a data marketplace, to allow for the sale and purchase of data between two parties via a secure platform. This platform would be created at the central level. The City Data Officer for each Smart

City would create and steward a unique page for his or her city on the platform.

The city should ensure its participation in the central-level portal or otherwise develop its own data-sharing mechanisms. If a city already has an Open Data Portal or is looking to develop one, it should be updated to reflect the data standards and guidelines decided upon through the City Data Policy and include guidelines for publishing data on the portal. NDSAP provides some guidelines on developing effective open data portals. Additional cities around the world may provide examples to use as a model (for example, the US cities of Austin and Chicago) for well-organized and easy-to-use platforms hosting a wide range of data.

Once the Open Data Portal has been successfully implemented and updated, the city could consider adding another layer to facilitate the transfer of private data between certain parties (as opposed to making it open on the site).

Currently, if a city wants to acquire data from private owners, it must approach each owner and build a separate agreement/relationship with him/her. There may be value in standardizing and streamlining this process and this could be supported by an added layer on the base functionality of a data-sharing portal. This may include a set of transactional tools that allow for more efficient but individual agreements between the producers and consumers of data, such as a template for a data-sharing agreement. This would allow the portal to become a marketplace to facilitate

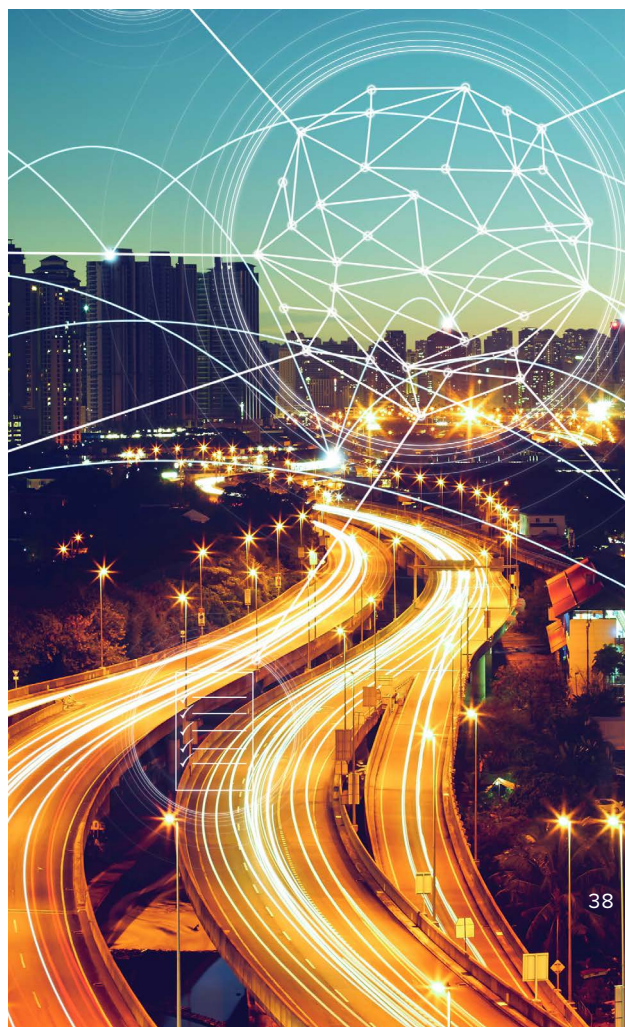transactions of private data, in addition to hosting open datasets.

Whether the city develops its own data portal or uses the central government's platform, the portal should be updated frequently and monitored to maintain the quality of datasets. The city government should ensure that government entities contribute to the portal and encourage other organizations and companies to contribute as well. The portal needs to be promoted appropriately, so that it may be used to spark innovation and support data-driven developments in the transportation sector, developing the portal alone will not incentivize people to add data to it or utilize it as a resource. The Transport Data Champion should be responsible for promoting the participation of key transport stakeholders in the portal.

6.0 References

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