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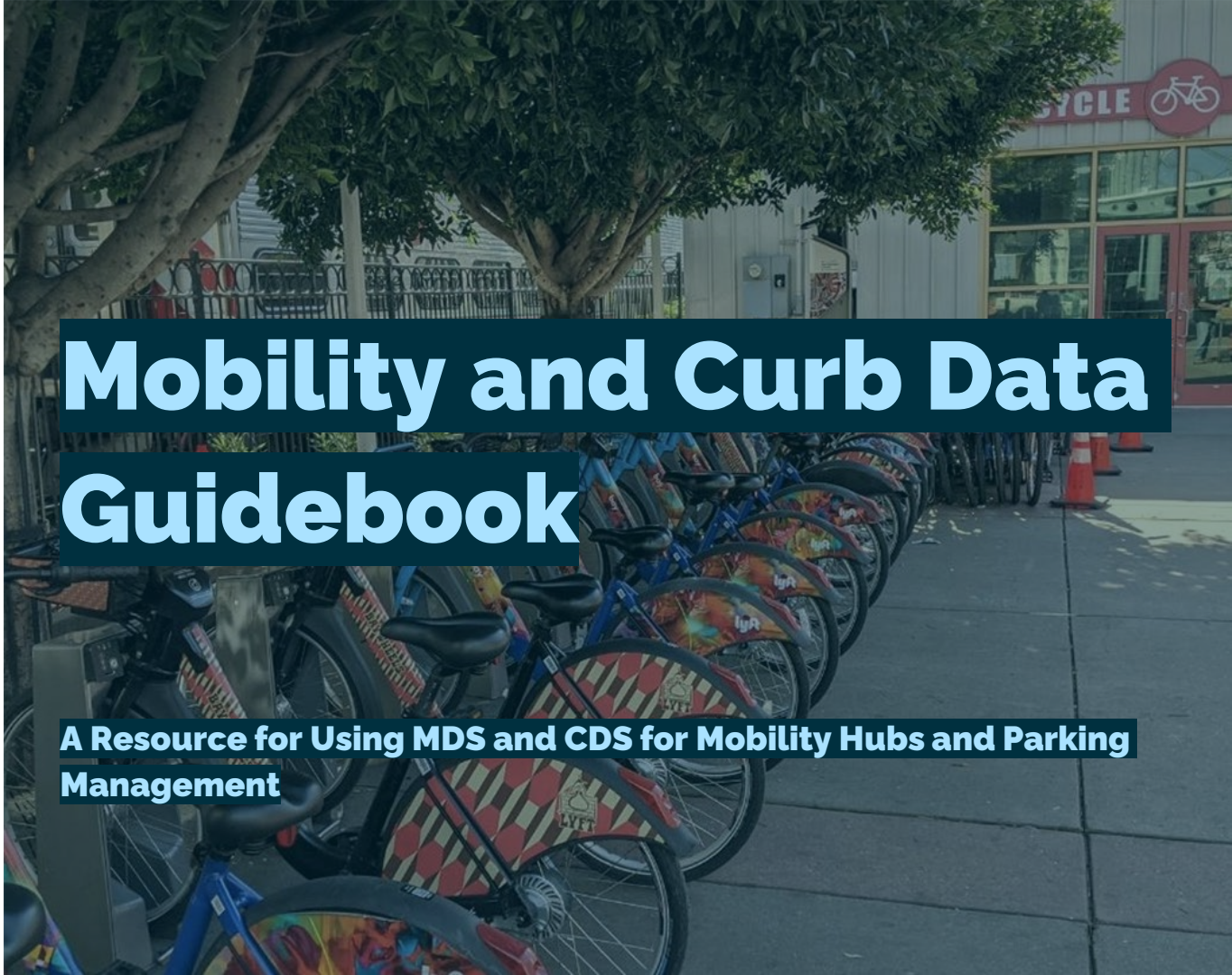

Mobility and Curb Data Guidebook

A Resource for Using MDS and CDS for Mobility Hubs and Parking Management

METROPOLITAN TRANSPORTATION COMMISSION

Cityfi

NELSON NYGAARD

OMF OPEN MOBILITY FOUNDATION

FINAL VERSION - REV 1.0, MAY 2026

Turning Data into Action: Managing Hubs and Streets with Open Standards

Across the Bay Area, cities and transit agencies are advancing ambitious goals to reduce congestion, meet climate targets, and manage the public right-of-way more proactively. Achieving these outcomes requires better tools and shared approaches for understanding how streets, curbs, and mobility services are used.

High-quality, interoperable data is a critical foundation for informed decision-making and effective transportation management.

Led by the Metropolitan Transportation Commission (MTC) and authored by Cityfi, this Mobility and Curb Data Guidebook provides practical guidance to help implement open mobility data standards in transportation programs and policies.

The Open Mobility Foundation (OMF) stewards the open standards underpinning this work, including the Mobility Data Specification (MDS) and Curb Data Specification (CDS). These standards support proactive, data-informed management of mobility services and public space.

METROPOLITAN TRANSPORTATION COMMISSION

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Executive Summary

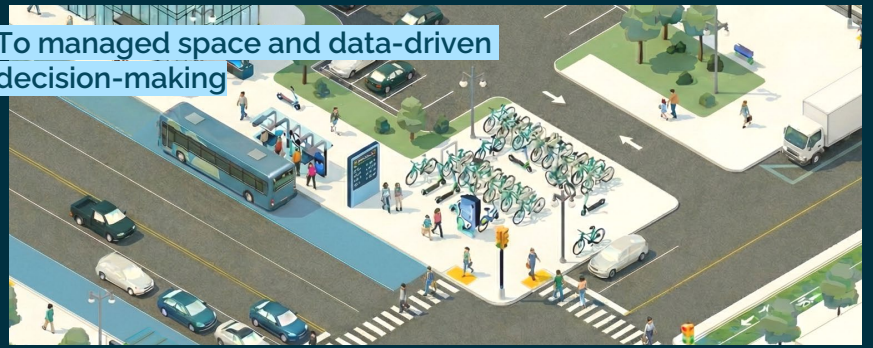
Key Guidebook Elements

What is the Mobility & Curb Data Guidebook?

The Mobility and Curb Data Guidebook is **a practical guide for policymakers, planners, and curb program managers to manage the public right-of-way (ROW)** in today's rapidly evolving urban environment.

The Guidebook is a step-by-step resource for using the Mobility Data Specification (MDS) and Curb Data Specification (CDS) to manage street and curb assets. MDS focuses on mobility services —like shared bikes, scooters, transit, and rideshare—while CDS focuses on the physical management of curb space and parking.

MDS and CDS are open source digital tools for organizing and sharing shared mobility and curb-related information consistently and effectively. This guide provides understanding on both separately and how together they can help to coordinate mobility operations and curb policies.



What problems does the Guidebook solve?

The public right-of-way faces mounting pressure as cities struggle to balance freight, ride-hailing, and transit within limited space. Adopting data standards like MDS and CDS enables resource-constrained jurisdictions to solve systemic challenges, such as reducing congestion by eliminating delivery double-parking or managing parking spillover in transit-oriented areas with parking maximums. By moving beyond manual processes, cities can use these digital tools to address both real-time operational needs and broader regional policy goals simultaneously.

Too little money, few staff limiting oversight. Limited budgets and staffing make it difficult to monitor and manage the public right-of-way and shared mobility services effectively.

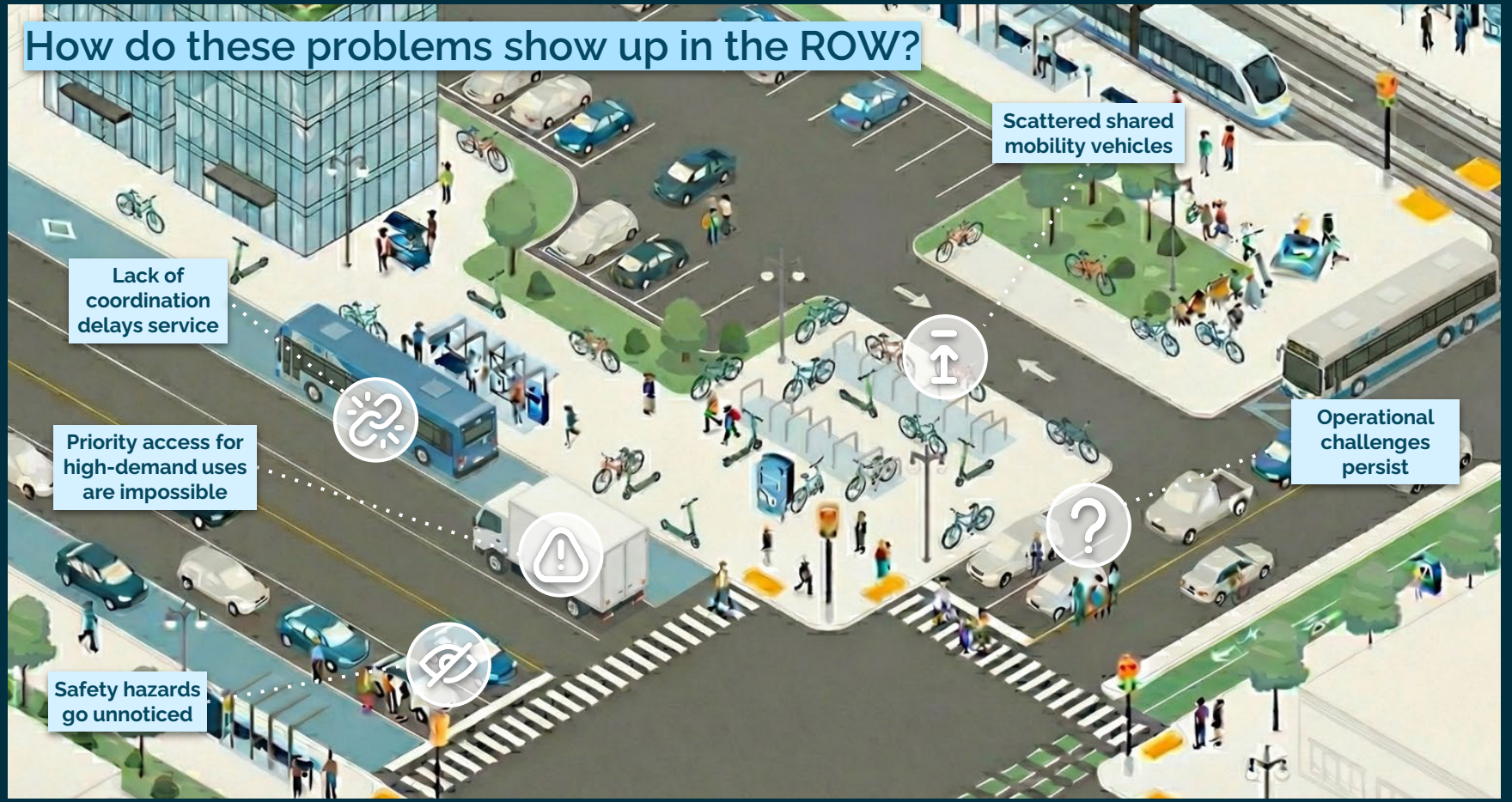
Hidden inefficiencies and risks. Inefficiencies, safety risks, and unmet demand can go unnoticed, affecting city operations and residents' quality of life.

Data gaps hindering decision-making. Without standardized and structured data, agencies struggle to prioritize resources, evaluate policies, and make evidence-based decisions.

Coordination challenges. Fragmented systems and inconsistent information block coordination across departments and external partners, increasing the time and effort spent reconciling datasets.

Limits on advanced strategies. The lack of organized data prevents dynamic management, ROW allocation, and pricing of curb assets, keeping operations reactive, labor-intensive and stretched beyond capacity.

How do these problems show up in the ROW?



Source: AI-generated image of the digital infrastructure layers. Gemini, Google, 2025.

How can MDS and CDS address these problems?

Data specifications like MDS and CDS standardize street, curb, and mobility asset information, allowing cities to monitor usage and performance, spot emerging issues, and digitize regulations.

As mobility options continue to evolve and real-time data becomes more commonplace, standardized information enables planners and policymakers to implement future-proof strategies.

Better oversight. Standardized data helps cities effectively manage streets and curbs without proportionally increasing resources.

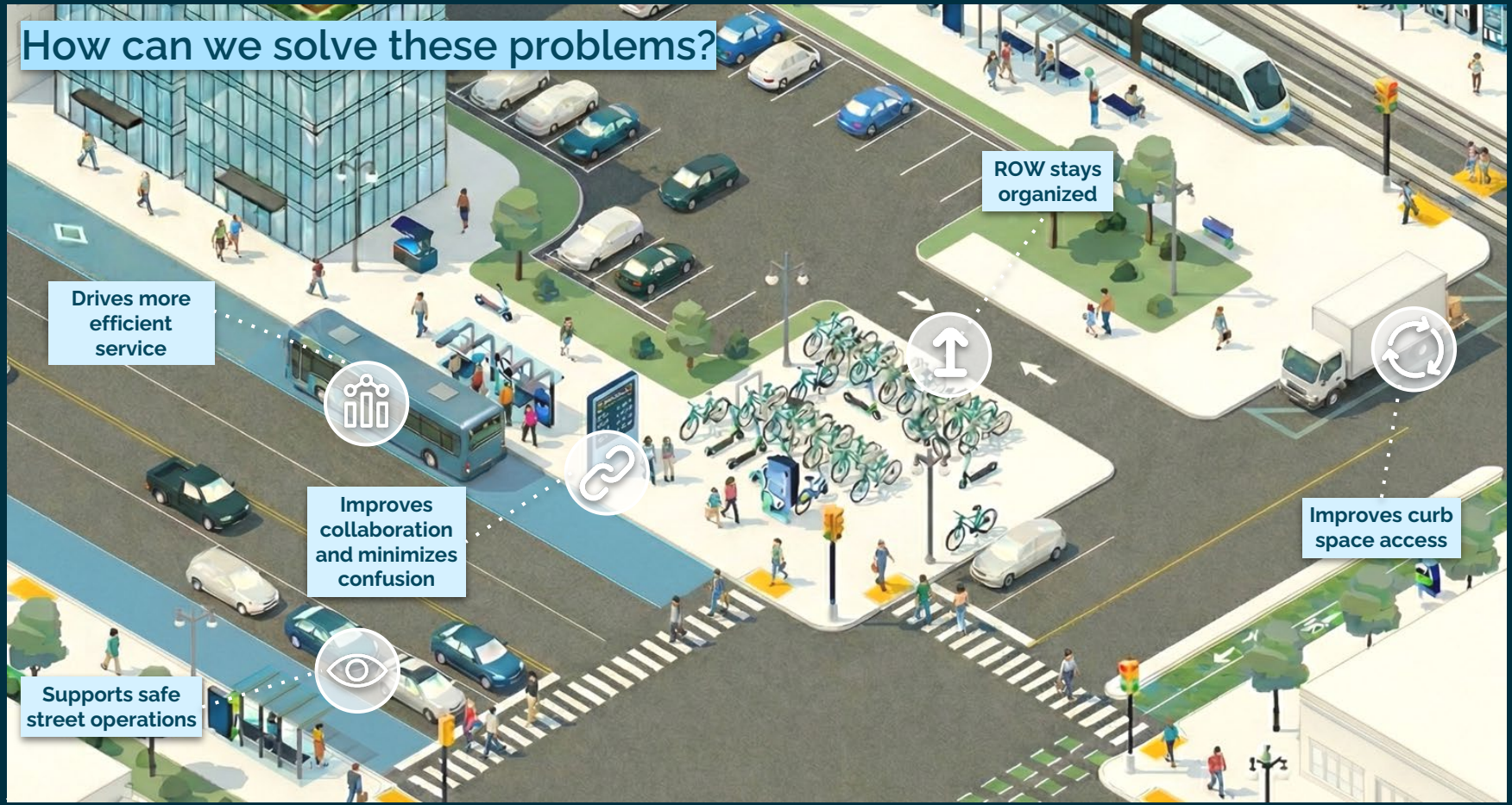
Spotting problems early. Standardized data highlights inefficiencies, safety risks, or unmet needs so issues can be tackled before they escalate.

Evidence-based decisions and storytelling. Standardized data informs resource prioritization, evidence-based policies, and compelling, data-driven storytelling.

Working together more easily. Sharing data in a structured way across teams and partners streamlines collaboration.

Managing streets dynamically. Standardized data unlocks digital policies and regulations, enabling cities to adjust street use, curb access, and pricing in real time.

How can we solve these problems?



Source: AI-generated image of the digital infrastructure layers. Gemini, Google, 2025.

What are MDS and CDS?

While there are many data specifications, this Guidebook focuses on two: Mobility Data Specification (MDS) and Curb Data Specification (CDS).

MDS provides real-time information from permitted mobility providers for shared scooters and bikes, taxis, shared cars, on-demand transit, autonomous vehicles (AVs), and sidewalk delivery robots

CDS tracks curb use for parking, loading, electric vehicle (EV) charging, deliveries, and ride-hail or bus pickups to optimize curb management.

Cities can use MDS and CDS to support ROW management from mobility hubs and parking to broader decisions about curb use, street operations, and overall ROW coordination.

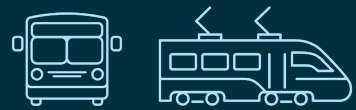
MDS CDS

MDS: Shared scooters, bikes, taxis, robotaxis, car share, ride-hail, AVs, and other permitted/licensed vehicles

CDS: Curb assets (e.g., parking, loading zones, shared scooter and bike parking, bus shelters, charging stations) and activities

GBFS: Shared bikes, scooters*

GTFS: Transit*



*For consumers/riders seeking to understand shared vehicle availability only (not for city use)

Who is the OMF?

The Open Mobility Foundation (OMF) is a global nonprofit organization that brings together cities, mobility companies and tech providers to create open-source tools and data standards that support safe, sustainable and equitable transportation. Known for stewarding the Mobility Data Specification (MDS) and Curb Data Specification (CDS), the OMF helps cities use digital infrastructure to manage mobility services like e-scooters, e-bikes, taxis, car share, ride-hail, autonomous vehicles (AVs), and on-demand transit services, and a wide range of curb activities.

The Guidebook emphasizes OMF's standards because they are widely used tools for organizing and sharing mobility and curb data. While standards like GBFS and GTFS show where shared vehicles are available, MDS and CDS give cities tools and information to *actively manage* new mobility services, *coordinate* how curb space is used, and *connect* data across different systems while still keeping public oversight of streets and public spaces. Through collaborative governance, the OMF helps ensure public agencies have a voice in how technology shapes the ROW.

Source: Open Mobility Foundation

What do you need to get started?

This Guidebook focuses on MDS and CDS because mobility and curb data form the foundation for managing the ROW, covering shared mobility, parking, and curb management.

Getting started with MDS and CDS doesn't require technical expertise. It begins by understanding the purpose and function of data specifications, then focusing on setting clear goals, building the right partnerships, and using data to power smarter, more coordinated ROW management.

Here's where to start

Step 1: Define Goals & Outcomes

Step 2: Assess Staff Capacity & Technical Fit

Step 3: Identify Data Needs & Relevant Specifications

Step 4: Secure Funding & Resources

Step 5: Develop Policies & Data Requirements

Step 6: Build or Procure the Technical Setup

Step 7: Test the System Before Launch

Step 8: Train Staff & Stakeholders

Step 9: Launch & Monitor

Step 10: Evaluate & Adjust

How to use this guidebook

Chapter Summary Pages

Each chapter begins with a summary page that provides a quick overview of the content covered.

On the right-hand side of the page, you'll find a section titled **"This chapter is most helpful for…".**

Full-color icon: This chapter contains key content for this audience.

Outlined icon with dotted contour: This chapter is less relevant for this audience.

The same three icons representing these audiences appear throughout the guidebook as visual cues to help you quickly identify the sections and tools most useful for your role.

Policymakers, Planners, and Program Managers

Technical/IT Staff

Private Mobility Providers

Navigation

Deeper-dive pages on key topics

Clicking this icon will take you to the Table of Contents

Glossary of Key Terms

Application Programming Interface (API): A way for different software programs to talk to each other and share data or services.

Curb Data Specifications (CDS): A mechanism for expressing static and dynamic curb regulations, measuring curb activity, and developing curb-related policies.

Data specifications: A set of rules that explains how data should be organized, shared, and understood.

Data sensitivity: Information that requires strict protection from unauthorized access, disclosure, or misuse because if compromised, it could lead to privacy violations or harm to individuals or organizations.

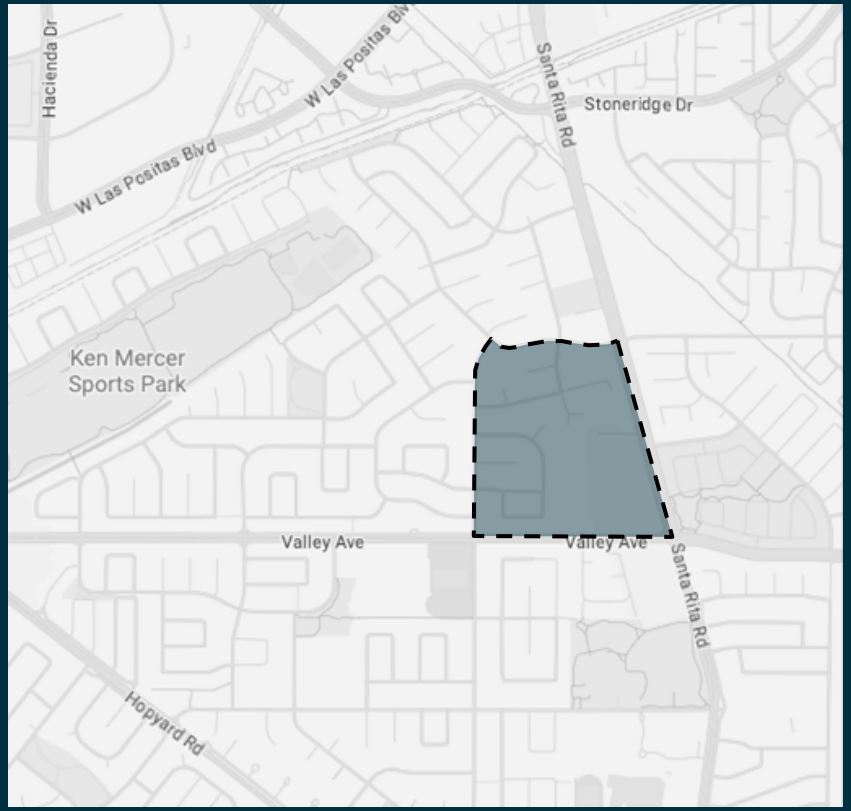
Digital policy: The digital representation of rules and regulations, such as speed limits and geofenced areas.

Endpoints: Specific web addresses (URLs) where apps or programs can ask for or send data using an API.

General Bikeshare Feed Specification (GBFS): A standard format used by micromobility service providers to present service information to riders (i.e., number of available bikes and docking stations).

General Transit Feed Specification (GTFS): A standard format used by public transit agencies to share static data for fixed-route service (i.e., schedules, stops, routes, and fares) so that rider-facing apps can show transit info.

General Transit Feed Specification (GTFS-Flex): An add-on to GTFS that lets transit agencies share information about flexible, on-demand transit services.



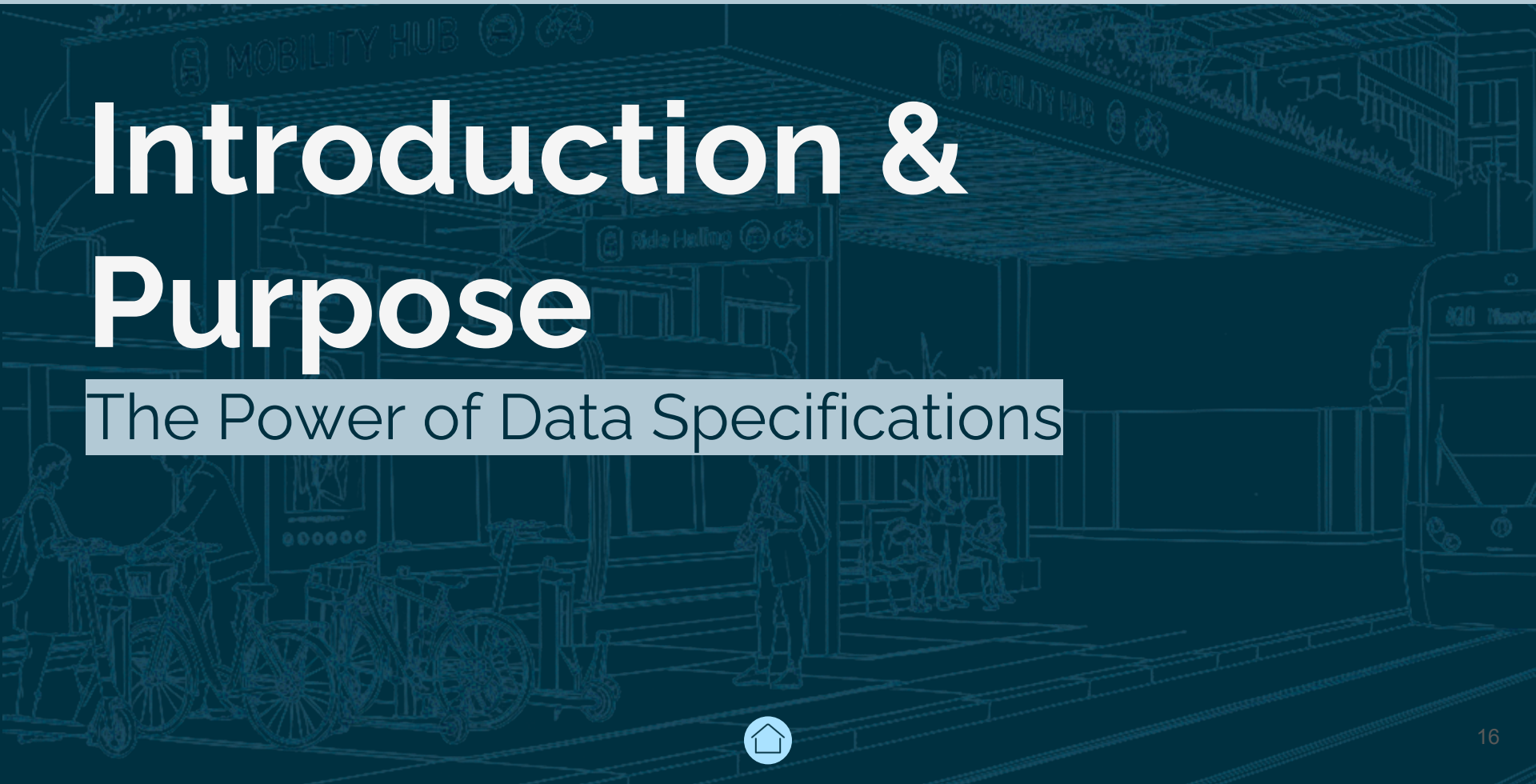
Example of a geofence, shown as a boundary on Google Maps
Source: Screenshot from Google Maps, Google, 2025.

Glossary of Key Terms

Geofence: A virtual boundary around a real-world geographic area. When a device enters or exits the boundary, it can trigger an action (i.e., sending a notification, locking or unlocking a device).

Mobility Data Specifications (MDS): A standardized format for cities and operators of scooter share, bike share, ridehail, on-demand transit, taxis, car share, and autonomous vehicle to organize and communicate to each other trip, vehicle, service, and regulatory information.

Open standards: A format that enables the consistent communication of information between devices and is openly available without cost or restrictions, publicly documented, maintained by an independent organization whose businesses are not impacted by standard's contents, contains structured versions, and has a community of contributors and transparent and inclusive governance.



Introduction & Purpose

The Power of Data Specifications

What is the purpose of this Guidebook?

This Guidebook, developed by the Metropolitan Transportation Commission (MTC), is a practical guide to bring order and equity to rapidly evolving urban mobility landscapes. Grounded in the Mobility Data Specification (MDS) and Curb Data Specification (CDS) stewarded by the Open Mobility Foundation (OMF), it shows how standardized data can be used to manage, evaluate, and improve complex mobility ecosystems. These standards create a common framework so multiple operators, agencies, and vendors can work together seamlessly to lower emissions and support congestion reduction strategies.

The Guidebook offers clear direction on implementing these specifications to advance any number of local and regional goals: from allocating curb space for shared bikes, scooters and electric vehicle charging, to managing growing delivery demands and tracking equity targets.

Most importantly, the guide's intent is to promote mobility data as a powerful tool for supporting proactive policies that reduce congestion, advance climate goals, and optimize the public right-of-way for safe, efficient, and equitable mobility.

Who is this Guidebook for?

This Guidebook is useful for anyone managing or shaping the public right of way: policymakers, parking and curb managers, parking enforcement staff, IT staff, and private mobility providers. Whether it's deploying new mobility services, setting and enforcing curb regulations, designing physical infrastructure, or ensuring rules are followed on the ground, this Guidebook explains how data specifications, and specifically MDS and CDS, can be used to plan, evaluate, and inform future investments in the public ROW.

Everyone in this ecosystem has a role to play. Public agencies are not just regulators. They are storytellers and stewards of both physical and digital infrastructure. By adopting specifications like MDS and CDS, public agencies and private providers can move from siloed decision-making to integrated management that reflects how people move through and use public space.

Policymakers, Planners, and Program Managers
I plan, evaluate, and manage mobility hubs and parking projects to meet community needs, inform decision-makers, and guide smart investments. I work with data but am new to data specifications.

Technical/IT Staff
I may or may not be new to data specifications, but I handle the technical heavy lifting, from designing, building, maintaining, and securing the digital systems that manage mobility data for public agencies.

Private Mobility Providers
I manage a fleet of shared vehicles, such as bikes or scooters, and partner with cities and transit agencies to integrate mobility services into mobility hubs and other infrastructure projects.

What is a data specification?

A **data specification** is an agreed-upon set of rules that defines how data is formatted, shared and understood between systems and organizations.

Data specifications provide a shared digital language that helps mobility and curb managers – including cities, county transportation agencies, transit agencies and private mobility providers – exchange information in a consistent way.

Think of Data Specifications as Mail

A data specification is like the standard format for sending a letter or package. Just as everyone puts the sender's name and address in the top left, the recipient's information in the center, and postage in the top right, a data specification defines exactly how data should be structured and shared.

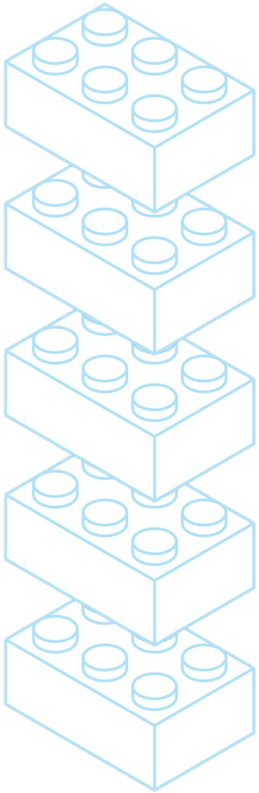
Because all organizations (USPS, UPS, FedEx, etc.) and systems (like automatic parcel scanners) follow the same rules, information can be shared accurately across different systems, ensuring the entire delivery process works smoothly.

Source: Open Mobility Foundation

What are the benefits of data specifications?

By providing a standardized framework, data specifications make it easier to share data accurately, improve operational efficiency, and ensure consistent accountability across all stakeholders.

Clear specifications are instrumental tools for cities, regions, public transit agencies, and private mobility providers to meet their shared responsibility of managing public space, customer information, mobility operations, performance measurement and data privacy.



What are the benefits of data specifications?

- Ensure scalability and interoperability across technology systems
- Enable data-informed management of the right of way (ROW)
- Facilitate adoption of new technologies
- Promote cross-sectoral trust and collaboration
- Create robust community of users and vendors

How do data specifications help mobility and curb managers?

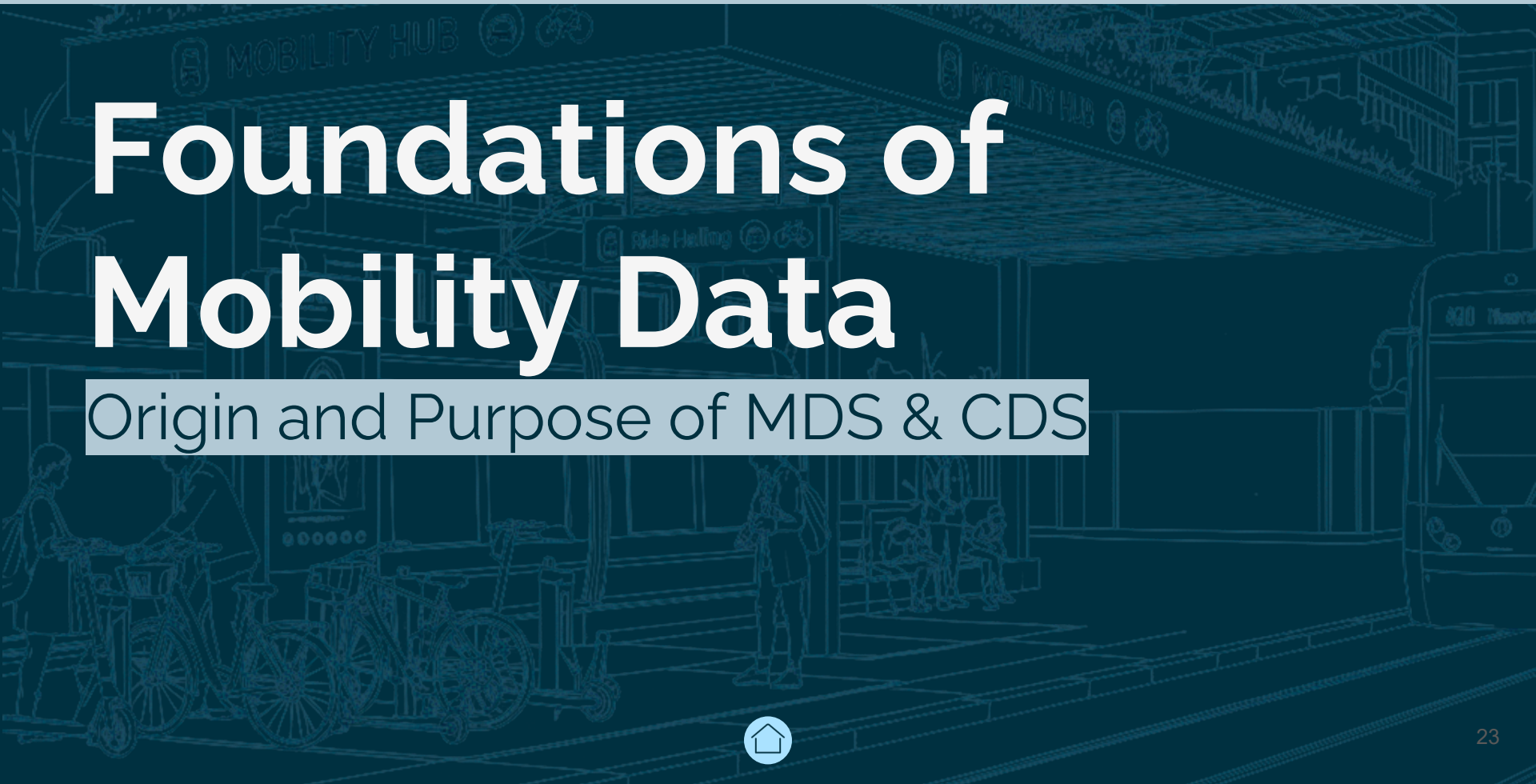
CHALLENGE / NEED	OPPORTUNITY
Different mobility operators and services collect data in different ways.	Consistency Across Sources Specifications make sure information is clear, consistent, and easy to compare.
Curb spaces change constantly with arrivals, departures and deliveries.	Real-time Management Standardized data can help Mobility and Curb Managers keep track and respond quickly.
Cities must make informed decisions, but data are often fragmented and hard to access.	Support Analytics and Decision-making Structured, standardized data makes it easier to see patterns, measure performance and plan improvements.
Mobility and parking projects should work with transit apps, payment systems and enforcement tools	Facilitate Integration with Other Systems Standardized data allows these systems to work together smoothly.
Cities often require reporting for equity, congestion or environmental goals.	Ensure Compliance and Transparency Clear standards make reporting accurate and trustworthy.

What are Mobility Data Specifications (MDS) and Curb Data Specifications (CDS)?

Mobility Data Specifications and Curb Data Specifications are examples of data specifications.

MDS provides a clear structure for how information about transportation, such as buses, bikes, e-scooters, taxis, autonomous vehicles (AVs), Transportation Network Companies (TNCs) like Uber and Lyft, or shared cars, is collected and shared. This structured approach ensures data remains consistent, easy to understand, and useful for planning, managing and improving transportation services.

CDS provides a structured way to track how city streets and curb spaces are used, including on- and off-street parking, loading zones, ride-hail pickups and deliveries, and curbside electric vehicle or bikeshare charging. It also supports building inventories of curb assets, such as commercial loading zones and signage, helping cities understand what exists where. CDS ensures data is standardized, accurate and helpful for efficiently managing curbsides and parking.



Foundations of Mobility Data

Origin and Purpose of MDS & CDS

This chapter is about:

What is MDS and CDS?

A foundational overview of MDS and CDS, including their history and purpose.

What are the key elements of MDS and CDS?

Explains the components that make up MDS and CDS and introduces APIs and endpoints through illustrative analogies and use cases.

Why do MDS and CDS matter for mobility hubs and parking management projects?

Describes how MDS and CDS are essential for effective management and planning of mobility hubs, parking, and curbspace.

This chapter is most helpful for:

Policymakers, Planners, and Program Managers

Technical/IT Staff

Private Mobility Providers

What are the key elements of MDS and CDS?

Application Programming Interfaces (**APIs**) are a set of instructions that helps different software systems talk and share information with each other. **Endpoints** are specific spots in the API where data is sent or received.

MDS and CDS use several APIs and endpoints that enable public agencies to exchange information with private mobility providers, commercial delivery companies, and other curb users, such as the general public.

Source: Open Mobility Foundation

Think of APIs Like a Waiter

An API is like a restaurant waiter connecting you (software application) to the kitchen (back-end system).

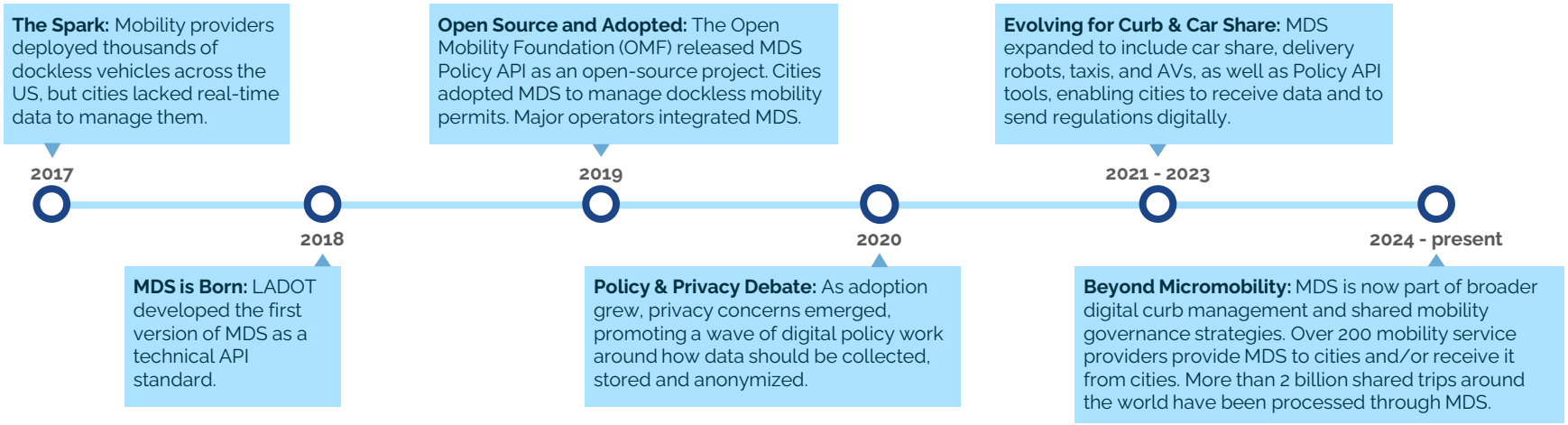
You request specific items from the menu (endpoints), and the waiter (API) delivers them. Using a shared language (data specifications) ensures your order with the waiter is understood and fulfilled correctly. Just as the waiter gets your dish without you entering the kitchen, an API allows an application to safely and reliably access another system and receive the exact data or service it needs.

What is the Mobility Data Specification (MDS)?

MDS is a digital tool that helps mobility and curb managers better manage shared mobility services like scooters, bikes, taxis, and car share.

MDS provides a standardized framework for public agencies and private mobility providers to share mobility information. Examples of mobility data that can be shared using MDS include real-time and historical information about where vehicles are, how they are being used, how they move through space, and whether they comply with local rules. MDS has helped public agencies move from static, ad-hoc operator reports to consistently formatted data that informs program operations and long-term planning.

History of MDS



Which MDS APIs and endpoints support ROW and mobility hubs management?

In version 2.0, MDS is a data specification used through a set of APIs that support mobility hub, curb, parking, and other ROW management applications. The most essential MDS APIs include:

Provider & Agency APIs

Give public agencies access to real-time and historical mobility data from mobility providers. Both APIs are intended for internal agency use, however, Agency APIs push data to the agencies and Provider APIs pull data from providers. Under MDS 2.0, both APIs have the same structure. Common endpoints include:

- /vehicles current location and status and properties of each vehicle[1] (e.g., available, reserved, unavailable)
- /trips: trip-level data, including start/end locations, timestamps, duration, distance, and additional contextual events like user complaints or maintenance
- /events: log of vehicle status changes (e.g., deployed, picked up, rebalanced) and additional contextual events

Policy API

Allows public agencies to define and widely communicate digital rules of the road for mobility operators (e.g., speed limits, parking restrictions, fleet caps, incentives). Common endpoints include:

- /policies: geofenced or zone-specific rules (e.g., no-ride/slow zones, parking rules, vehicle/deployment caps)

Geography API

Shapes or areas (in GeoJSON format) used to define zones in policies.

[1] *A "vehicle" represents any permitted mobility unit operated by a provider, such as a shared scooter, e-bike, car, taxi, or on-demand transit vehicle. The term does not imply a traditional automobile. It is used to consistently track trips, availability, and operations across providers.*

Why does MDS matter for public ROW management?

Mobility and curb managers can use MDS to monitor, manage and optimize shared mobility services, permitted delivery services and curb space in real time. It provides clear visibility into how mobility devices and public right-of-way assets are being used and supports dynamic policy enforcement. As new mobility modes emerge, the flexible framework of MDS adapts without losing focus on these core objectives. It turns mobility hub and parking management from guesswork into measurable, manageable operations.

As parking facilities increasingly are considered for conversion into mobility hubs, MDS becomes a critical tool for planners, program managers, and cities to make informed decisions about space allocation, prioritizing mobility functions and optimizing operations. It also helps private parking owners and operators assess opportunities to repurpose facilities for shared and personal mobility, ensuring that transitions are effective and impactful.

- **Visibility into Usage:** MDS provides real-time insight into vehicle locations, trips, availability and status.
- **Active Space Management:** Agencies can set geofenced rules and adjust curb and parking use dynamically across deliveries, shared mobility and private vehicles.
- **Performance Monitoring:** MDS enables tracking of equity goals, service reach and compliance with local policies.
- **Integration across modes:** A common data layer lets agencies manage bikes, scooters, car share and other services in relation to each other.
- **Scalability:** Standards extend easily to new services that may emerge at hubs, including drone deliveries, flying taxis, cargo bikes and delivery robots.

What is the Curb Data Specification (CDS)?

CDS is a digital tool that helps public agencies and companies pilot and scale dynamic curb zones.

Before CDS, curb rules existed only as posted signs, which worked for analog users like drivers reading parking signs, but were difficult to update, share or enforce in real time. CDS lets public agencies express both static and dynamic regulations, enabling digital systems like smart parking meters, bike share systems and e-scooters to follow and respond in real time. It also provides real-time curb activity insights, supporting more responsive policies that make curbs accessible, efficient and useful. CDS is to curbs what MDS is to shared mobility fleets.

History of CDS

Pre-2010

Curbs as Static Space: Curbs were managed solely through static regulations (signs and painted curbs) with data stored in spreadsheets, PDFs or paper records.

2010 - 2016

Rise of New Mobility & Curb Pressure: Explosion of services like TNCs, e-commerce, and food delivery created unprecedented curb activity. City agencies struggled to enforce regulations or adapt curbs to reflect real-time needs.

2017 - 2018

Beginning of Standardized Efforts: SharedStreets launched in 2018 as an open-source platform of standardized street and curb data. The Open Mobility Foundation (OMF) formed in 2019, connecting to SharedStreets' data spec efforts.

2019 - 2020

Formalizing CDS: SharedStreets and NACTO developed CurbLR as a lightweight, open curb regulation data format. OMF then launched a curb working group to understand city-specific needs for a curb data standard in 2020.

2021 - 2022

Adoption of CDS: Cities like Los Angeles, San Francisco and Miami began using CDS for curb management pilots involving commercial deliveries and TNC pick-up/drop-off zones. CDS officially launches in 2022.

2021 - present

Evolving Ecosystem & Applications: Cities piloting dynamic curb pricing, digital permits and real-time curb monitoring adopt CDS v1.0. CDS also is integrated with MDS and GTFS-Flex to support multimodal curb use.

Which CDS APIs and endpoints support public ROW and mobility hubs management?

In version 1.0, CDS is a data specification used through a set of APIs that support mobility hub, curb, parking and other ROW management use cases. The most essential CDS APIs include:

Curbs API

Lets cities define uses at the curb and manage static regulations by location and time, supporting other APIs like Events and Metrics.

- Curb Zone: a specific, contiguous curb segment on one block face, whose regulations are determined through planning and policy decisions, and has defined access policies and rules
- Curb Space: an individual parking spot along the curb for use by one vehicle at a time
- Curb Area: broader area, like a neighborhood or corridor, used to show proximity, approaches, conflicts, circling or other activities
- Curb Policy: rules that permit/restrict certain users from using specific curb spaces during set times

Events API

Enables Mobility and Curb Managers to receive real-time and historic curb activity data from sources like company feeds, sensors, payments and company feeds.

- Curb Event: any activity that occurs near, at or within a defined curb area
- Status: current status of a curb monitoring source (i.e., sensors)

Metrics API

Tracks curb usage details and standardizes calculations to measure historic dwell time, occupancy, usage and other aggregated statistics.

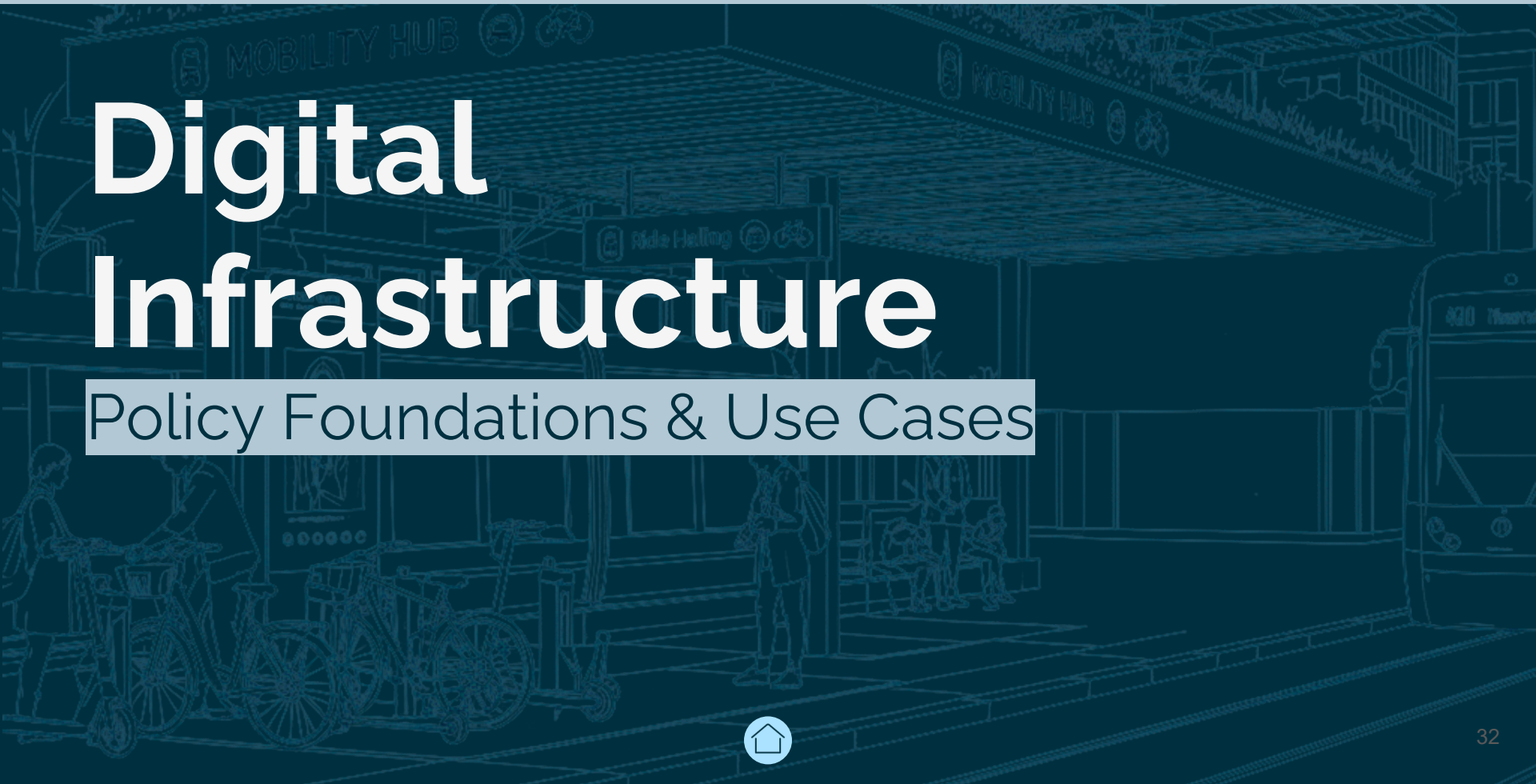
- Session: details of an activity that occurs near, at or within a defined curb area
- Aggregate: summarized counts for curb events

Why does CDS matter for mobility hub, curb and parking management projects?

CDS enables public agencies to define and communicate curb rules in a standardized digital format in real time. For example, with mobility hubs, CDS ensures designated pick-up and drop-off zones for ride-hail or bus loading are accurately mapped and enforced, making it easier to ensure these modes can access curb space.

In the case of parking management, CDS can optimize how curb space is used by reflecting current, static regulations and temporary changes, sharing data with delivery operators for coordinated scheduling, tracking compliance with no-parking zones, and optimizing turnover.

- **Curb Allocation & Occupancy:** Curbs API provides data on curb segment rules, including which uses (e.g., parking, loading, micromobility corrals) are occupied and by which vehicle types.
- **Dynamic Curb Management:** Cities can monitor active curb policies and real-time occupancy to dynamically adjust curb allocations (e.g., converting parking spots into ride-hail zones during peak hours).
- **Event & Enforcement Alerts:** Real-time occupancy and violation data help enforcement personnel respond to curb misuse or overstays.
- **Integration Across Modes:** CDS makes it easier to integrate parking and curb data with real-time trip planners, allowing mobility hub users to discover and access all services.



Digital Infrastructure

Policy Foundations & Use Cases

This chapter is about:

What is digital infrastructure?

Describes what digital infrastructure is and makes the case for why public agencies should treat it as a public good.

What is digital policy?

Defines digital policy.

What are common MDS and CDS use cases?

Introduces mobility hubs, parking, and curbside management-specific use cases for MDS and CDS.

This chapter is most helpful for:

Policymakers, Planners, and Program Managers

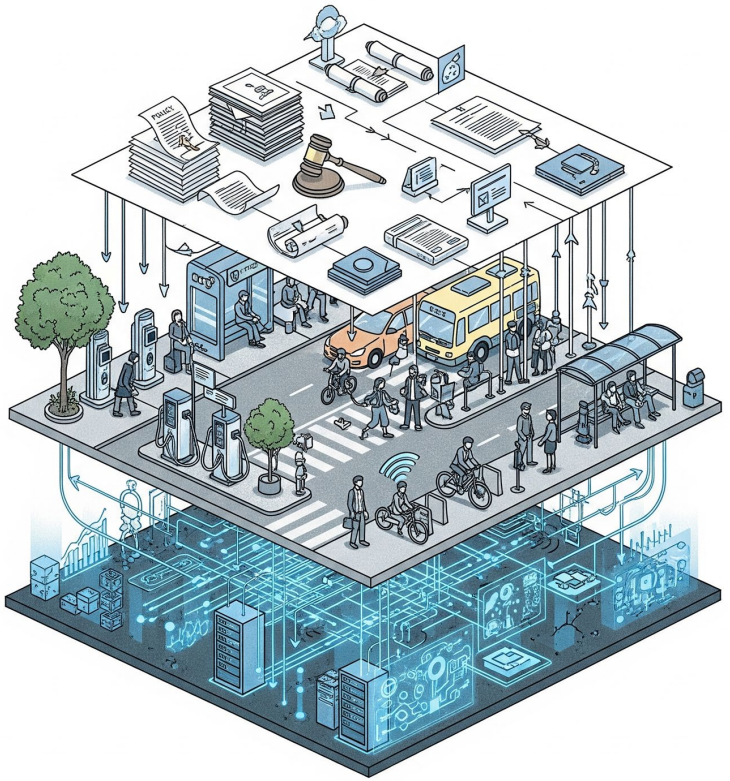
Technical/IT Staff

Private Mobility Providers

What is digital infrastructure?

Digital infrastructure is the invisible network that keeps mobility information flowing between government, transportation system operators, and the people who use streets. It's the software, data systems and shared formats that enable agencies, operators and community members to exchange and understand data. Just as roads carry physical traffic, digital infrastructure carries information traffic about vehicles, trips, curb rules and system performance. Digital policies guide system behavior behind the scenes, but they must align with the physical environment (e.g., signage and road markings) to make rules encoded in the system clear and actionable for users.

When digital infrastructure is treated as a public good, similar to how we treat our roads, mobility data becomes a shared resource that generates public benefit instead of being locked inside private systems. Public stewardship of digital infrastructure promotes equity, accessibility, transparency and accountability, and improves operational efficiency. This is especially important for ROW management, where coordinated oversight is needed to balance competing demands on limited public space.



Source: AI-generated image of the digital infrastructure layers. Gemini, Google, 2025.

What is digital policy?

Digital infrastructure provides the foundation for collecting, sharing and analyzing mobility data, while **digital policy** is the digital representation of rules, standards and regulations like speed limits, geofenced areas, and curb rules.

Digital policies enable public agencies to:

- Set clear rules for vehicle access, parking and street use
- Set speed limits or fleet size caps
- Enforce geographic-based and time-based restrictions (e.g., no parking during rush hour)
- Adjust pricing or fees dynamically
- Manage access for different vehicle types or operators


```
"name": "Improper Riding - Speed Limit | 7 Speed limits",
"policy_id": "a7cda310-e146-452f-9657-8fdb3f7b2a5d",
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 }
```
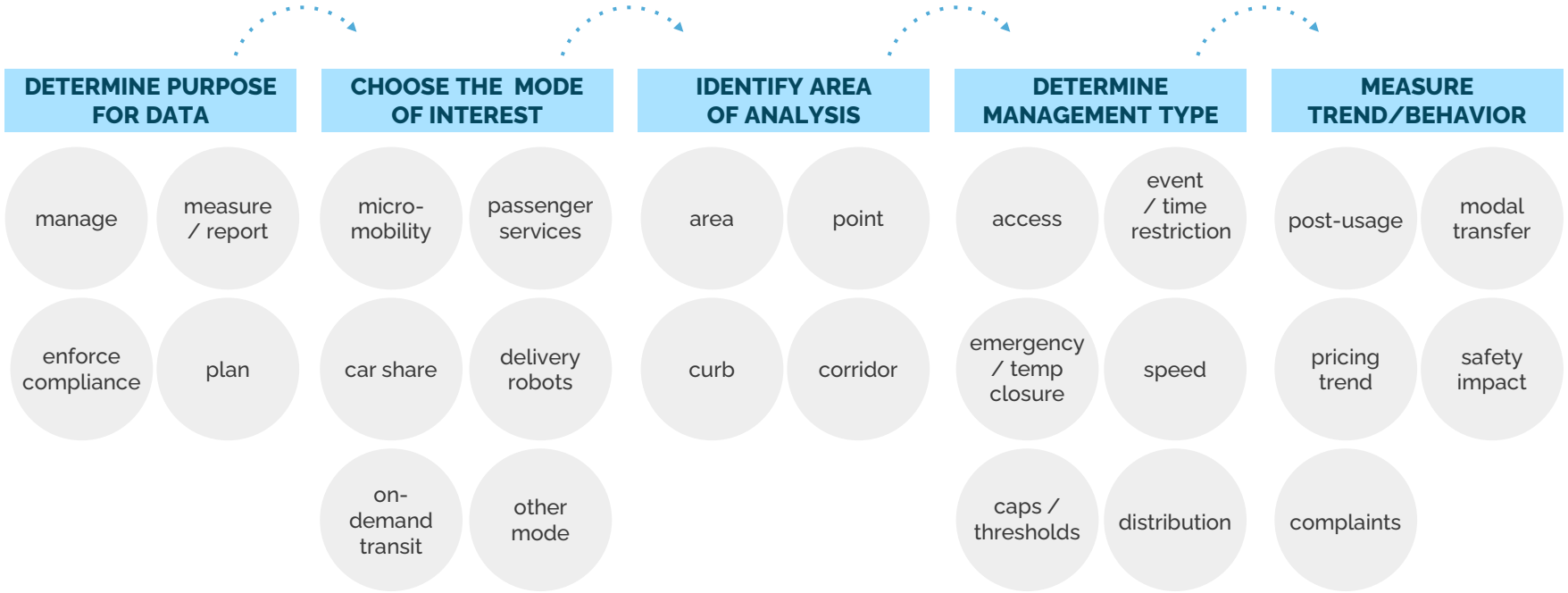


An example of digital MDS Policy that caps e-scooter speed limits to 12 mph in defined areas.

Countless use cases for MDS and CDS.

Cities and public agencies can create digital policies by expressing their adopted rules and regulations in machine-readable formats that software can interpret. Both MDS and CDS provide standardized vocabularies that support cities in defining and managing these digital policies. Use cases, such as geofencing no-parking zones or managing curb access, are made possible by translating policy into these standardized formats. The following diagram illustrates the inputs used to create use cases for MDS and CDS, with the next two pages providing guidance on which standard to use depending on the specific purpose.



Data specifications operationalize digital policies for real-world applications.

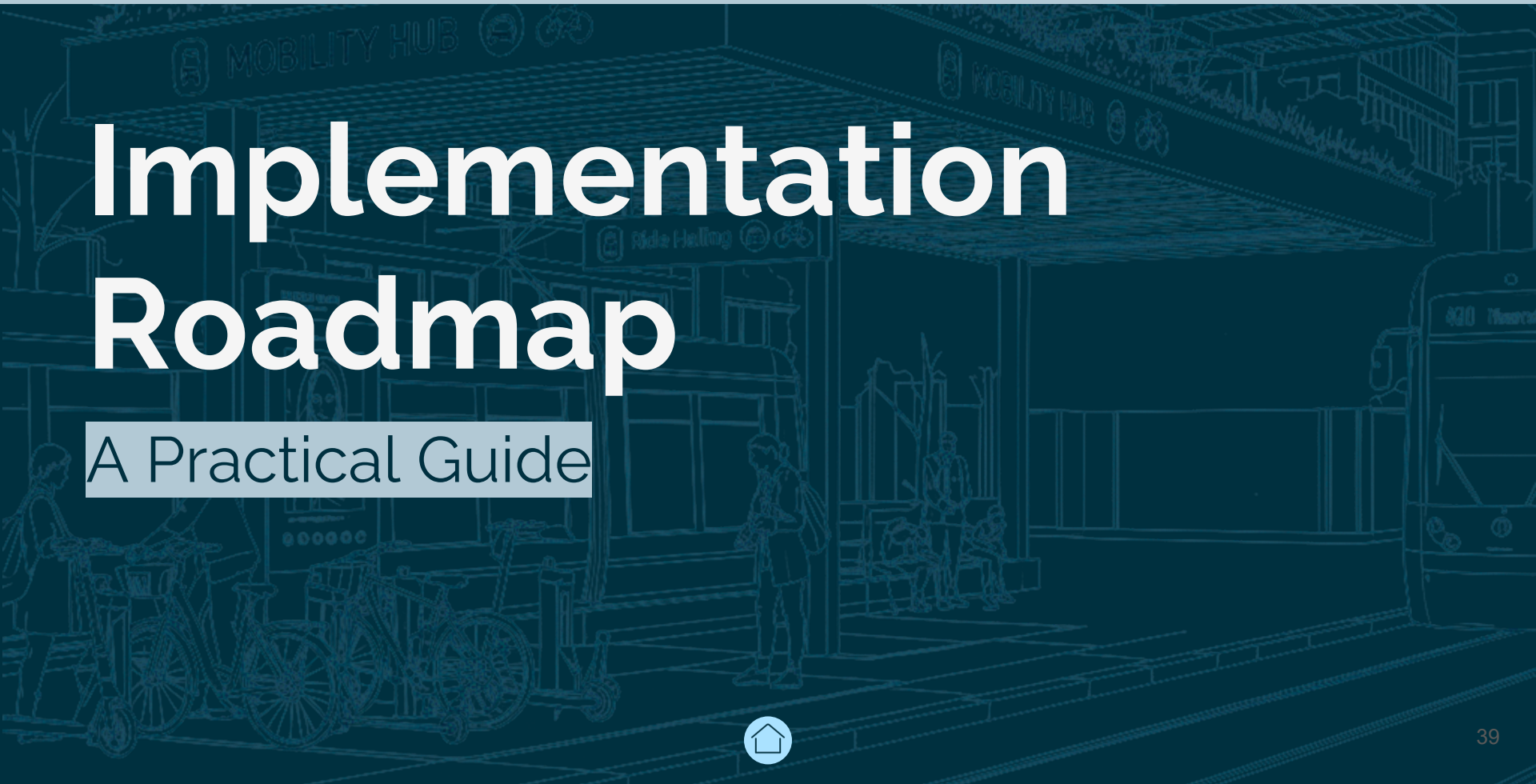
The tables below organize digital policies by type, provide examples of digital rules, connect rules to real-world use cases relevant to mobility hubs and parking management, and identify whether MDS Policy API, the CDS Curbs API policy endpoint, or both are best suited for implementation.

DIGITAL POLICY CATEGORY	DESCRIPTION	DIGITAL RULE EXAMPLES	EXAMPLE USE CASE	BEST FIT SPECIFICATION / API
ACCESS CONTROL	Defines who can use a space or operate in an area	• Vehicle type = scooter/bike/car share only • Permit required = yes/no • User group = delivery, passenger, EV car share fleet	• Restrict hub parking to shared fleets only • Reserve curb space for permitted delivery vans • Ensure only accessible vehicles serve paratransit pick-up and drop-off zones	CDS Policy endpoint MDS Policy API (fleet restrictions)
GEOGRAPHIC OR GEOFENCING	Defines where certain rules apply	• Zone = no-ride/no-parking • Allowed vehicle types by zone • Dynamic boundaries based on temporary or special event needs	• Keep scooters out of pedestrian plazas • Define shared mobility corrals at transit stations • Add temporary event curb zones for shuttles and deliveries	MDS Policy API (service area geofencing) CDS Curbs API
TIME-BASED	Controls when specific rules apply	• Start_time/end_time rules • Day_of_week restrictions	• Loading zones active 6-10 a.m., then general parking • Weekend-only pick-up areas at entertainment districts	Both CDS for curb operations and MDS for vehicle operating hours

DIGITAL POLICY CATEGORY	DESCRIPTION	DIGITAL RULE EXAMPLES	EXAMPLE USE CASE	BEST FIT SPECIFICATION / API
PRICING AND INCENTIVES	Influence behavior using dynamic pricing, fees or rewards	• Base rate per minute or hour • Surge or peak pricing triggers • Discount = EV or low-emission vehicles	• Charge higher curb fees for peak-hour delivery • Offer reduced hub parking fees for electric car share • Incentivize rebalancing, or repositioning vehicles within a service area, to underserved hubs	CDS Policy endpoint (curb fees, access pricing) MDS Policy API (operator compliance and incentives)
VOLUME OR CAPACITY	Limits the number of vehicles or amount of space used	• Max fleet size per operator • Max dwell time per vehicle • Max occupancy threshold for a zone	• Cap scooter fleets at 100 per hub • Enforce 15-min limit at loading zones • Trigger alerts if curb occupancy nears limit (i.e., > 85%)	MDS Policy API (fleet caps) CDS Policy endpoint (curbside space allocation, dwell time limits)
PRIORITY OR EQUITY	Ensure priority access for specific groups or vehicles	• Vehicle priority tag (e.g., wheelchair accessible) • Zone priority for specific users • Mandatory service coverage areas	• Reserve mobility hub charging spots for shared EV fleets • Guaranteed curb space for paratransit pick-up/drop-off • Require operators to serve equity-priority neighborhoods	CDS Policy endpoint (curbside priority) MDS Policy API (equity requirements for operators)

Implementation Roadmap

A Practical Guide



This chapter is about:

How can public agencies get started with MDS and CDS?

Differentiates roles and responsibilities for policymakers, planners, and program managers and technical/IT Staff, and provides a high-level overview of key implementation steps.

What makes MDS and CDS data sensitive?

Learn how to manage MDS/CDS output to balance privacy with policy and operational insights.

What might a Data Integration Framework look like for common mobility?

Guidance for Technical/IT Staff to inform system buildout planning, design, and implementation.

How is MDS and CDS raw data transformed into actionable insights?

Guidance for technical/IT Staff on how to transform raw MDS and CDS data into aggregated values for analysis and interpretation.

This chapter is most helpful for:

Policymakers, Planners, and Program Managers

Technical/IT Staff

Private Mobility Providers

IMPLEMENTATION GUIDE

How can public agencies get started with MDS and CDS?

While data specifications may initially feel daunting to planners, policy wonks and program managers, the ideas behind them aren't new. Foundational formats like the General Transit Feed Specification (GTFS, 2006) and the General Bikeshare Feed Specification (GBFS, 2016) have been helping mobility and curb managers organize and share transit and bike share data with consumers for years. Newer formats like MDS and CDS expand to include other forms of shared mobility and curb activity.

Implementing MDS or CDS doesn't require planners, engineers or policymakers to be coding experts. The key is setting clear goals, working with the right technical partners, and aligning data needs with mobility, parking and curb management objectives. Often, someone in the agency already has experience with specifications, or working knowledge, and can guide the process with help from an existing ecosystem of vendors.

In practice, planners, engineers, and policymakers define the "what" and "why," while vendors or IT teams manage the technical "how."

MDS: Shared scooters, bikes, taxis, robotaxis, car share, ridehail, AVs and other permitted/licensed vehicles

CDS: Curb assets (e.g., parking, loading zones, micromobility parking, bus shelters, charging stations) and activities

GBFS: Shared bikes, scooters*

GTFS: Transit*

*For consumers/riders only, not for city use.

1. Define Goals & Outcomes

Clearly articulate what MDS or CDS implementation aims to accomplish, such as improving curb space turnover, optimizing mobility hub operations, or tracking shared mobility availability. Depending on your goals, it may make sense to start with either MDS or CDS. These goals should be specific and align with broader mobility plans to ensure data directly supports planning and operations decisions.

2. Assess Staff Capacity and Technical Fit

Assess existing internal resources, including IT infrastructure, data tools and staff expertise to determine in-house capabilities, training needs, and areas requiring vendor support. While cities theoretically could handle some of the more technical tasks internally, doing so generally is less cost-effective and less efficient than leveraging vendors, particularly when considering ongoing maintenance and system updates.

(*Step 2 Continued*) In most cases, cities implementing MDS/CDS engage vendors experienced in MDS/CDS integration to setup APIs and dashboards so internal staff can focus on policy development, planning analysis, vendor oversight, and interdepartmental coordination.

Note that cities implementing MDS or CDS may involve partnering with the city's shared mobility program manager, or equivalent staff, who is responsible for the broader network. In larger cities, this is typically a distinct role, whereas in smaller cities, this role may overlap with other responsibilities that could impact capacity.

3. Identify Data Needs & Relevant Specifications

Determine what information is needed to meet the defined goals and whether MDS, CDS or data from charging infrastructure provides the necessary information. Then, determine the data type (e.g., real-time data for operations and enforcement or historical data for planning and evaluation), the relevant APIs and endpoints, and how often the data will be collected.

4. Secure Funding & Resources

Establish a budget for technical infrastructure builds and upgrades, vendor support, staff training and ongoing operations. Funding can come from transportation grants (e.g., FTA, FHWA, local innovation funds), mobility permit fees from shared mobility operators for MDS, and curb use fees or parking revenues for CDS. Specific examples of funding sources include:

- Annual shared mobility operator permit fee
- Micromobility per-trip and usage-based fees
- Introducing commercial loading zone fees
- Repurposing parking fees

5. Develop Policies & Data Requirements

Work with city legal staff to confirm authority to collect and use operator data, then set clear rules for sharing in the chosen specification format, covering reporting frequency, privacy, security and required fields. While MDS and CDS are GDPR-compliant and support tracking real-time vehicle status for compliance purposes, agencies should consider partnering with an analytics platform to manage and analyze all complex analyses, including aggregation, metric performance and routing features, among others.

For MDS, integrate requirements into permits, contracts or RFPs, such as specifying data delivery (e.g., real-time or daily) and key fields like trip starts/ends or parking compliance of shared mobility vehicles. Use compliance as a condition for permit renewals or fleet cap expansion.

For CDS, require parking, enforcement or curb technology vendors to support CDS Policy and Metrics API to ensure seamless policy integration and usage tracking.

*See the **Appendix** for Sample Policy Language that can be tailored to different procurement pathways.*

What makes MDS & CDS data sensitive?

MDS data comes from vehicles, not riders. It tracks things like location, availability and trip activity from the vehicle to the operator and then to the city.

CDS works similarly for the curb. It standardizes data on pick-up, drop-offs, deliveries and other curb interactions.

While neither contains direct information about who is using a vehicle or accessing the curb, movement data over time potentially could be combined with other datasets to identify individuals. Because of these privacy risks, **cities should treat MDS and CDS data it receives as sensitive.**

This means carefully managing how mobility data is collected, used, stored, discarded and shared, and applying strong practices like limiting collection to only what's needed, limiting retention, encrypting data and controlling access, similar to how cities manage other sensitive data.

Key measures to ensure MDS/CDS data collection and usage comply with relevant privacy and security regulations include:

- **Establish clear data governance policies** on how data is used, who can access it, and retention periods.
- **Implement data minimization principles** and collect only what's needed.
- **Anonymize and aggregate data** to protect identities.
- **Secure data transmission and storage** with encryption and access controls.
- **Ensure vendor and partner compliance** through contracts and audits.
- **Conduct Privacy Impact Assessments (PIAs)** to mitigate risks.
- **Maintain transparency and communication** with the public about data use.
- **Comply with applicable laws and standards.**
- **Train staff and partners** on privacy best practices.
- **Process data correctly** and anonymize when publishing to your open data website.
- **Classify data** based on its sensitivity, criticality and regulatory requirements.

6. Build or Procure the Technical Setup

Collaborate with an internal IT team or a technical vendor to set up the technical infrastructure, which may involve establishing data pipelines (pathways that take data from one system to another), APIs, storage systems (where data is kept and organized for later use) and visualization tools (ways to see and understand data through charts, maps or graphs).

For MDS, this involves connecting to mobility operator APIs and testing data feeds for accuracy. For CDS, it includes creating digital representations of all curb zones, including their location, type and regulations, and publishing digital Curb policies, tracking Events, and generating Metrics.

A clear, structured Data Integration Framework (*see next page)* is a crucial part of this setup. It guides how raw MDS and CDS data are converted into actionable insights. Defining the Framework upfront ensures that data collection aligns with goals; raw data is processed consistently into standardized metrics; and insights are actionable.

7. Test the System Before Launch

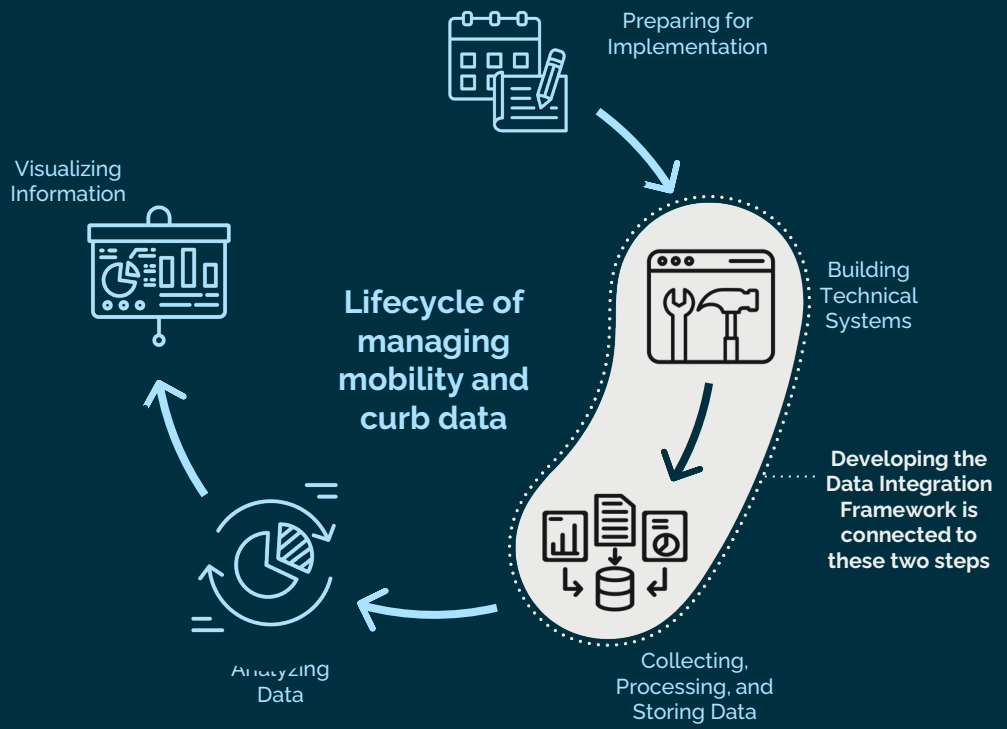
Conduct a limited-scale pilot, such as monitoring one mobility hub or a single curb zone, to confirm that the data flows correctly, meets accuracy thresholds, and supports the intended use cases. Piloting can be difficult when managing a broader shared mobility system or program, but feasible when managing discrete public spaces. Also check internal operations dashboards for usability. For data coming directly from operators, it is acceptable to audit data feeds by taking real world trips and comparing your data to theirs.

Once the new specifications are live and data is flowing, cities and agencies can access and analyze the results. At this point, relevant MDS and CDS APIs can be used to query aggregated statistics like historical dwell time, occupancy, ridership and usage. **See the Metrics Workflow in the Appendix** for common MDS and CDS metrics applicable to mobility hubs and curb/parking management projects.

Developing a Data Integration Framework is a critical step when designing the technical systems to support mobility data.

A Data Integration Framework is a structured process for combining mobility and curb activity data from various sources (e.g., MDS, CDS) into a single, unified view. It ensures that information is captured in a standardized way. This allows public agencies to generate actionable insights, evaluate mobility hub and curb performance, identify trends in demand and infrastructure use, and make informed decisions to improve operations, compliance and infrastructure.

Most importantly, it allows public agencies to **develop a complete and comprehensive picture of mobility and curb activity.**



Data Integration Framework

The proposed Data Integration Framework illustrates a high-level process that IT staff and technical vendors can use to unify data from shared vehicles, curbs and other sources via data specifications to ensure information is collected, ingested, transformed, stored and automated in a consistent way across all sources. Before starting this process, check with agency IT staff on whether a Data Integration Framework or similar guides already exists.

01 Data Sources

First, identify the metrics and their sources. For example, if the desire is to understand general availability and activity levels of all services at a mobility hub during peak commute times, the sources and metrics needed might include:

- MDS: Vehicle telemetry (location, battery status), trip data from operators, real-time transit availability, bike share fleet status
- CDS: Curb zone rules, events
- Other sources: Parking data

02 Data Ingestion

For the same scenario, request (pull) raw data from relevant APIs and endpoints, which might include:

- MDS: trip_start, trip_end
- CDS: curb_inventory, curb_occupancy, curb_events
- Vehicle availability, arrivals and departure data from non-standardized third-party vendor APIs or data exports

03 Data Transformation

Once the data is pulled, transform the raw mobility and curb activity information to ensure accuracy and consistency across sources. This step typically involves:

- Addressing missing values
- Removing duplicate records
- Normalizing information like timestamps into a consistent format
- Enriching data by linking trips to curb zones or mobility hub areas

04 Loading & Storage

Once the data is transformed, load the data into a dedicated system where it can be stored, easily accessed and analyzed. Depending on how the data is structured, how it will be used, and when it will be needed, various dedicated storage systems can be used:

- Data warehouses: Structured storage for analytics and reporting
- Data lakes: Raw or unstructured data storage for flexible analysis
- Other databases

05 Automation

Finally, define the workflows and schedules that dictate how data automatically moves through the system. This may look like:

- Scheduled API requests to mobility providers' MDS
- Load raw data returned by mobility providers into the designated storage system
- Deploy automated scripts to periodically check for updates to static information for CDS (curb rules)

8. Train Staff & Stakeholders

Provide targeted training so planners, enforcement officers and operations staff can interpret and act on the collected data. This may involve training staff on how to read dashboards, interpret metrics, and respond to non-compliance (for MDS) or policy conflicts (for CDS). Also make time to educate external stakeholders, such as mobility providers, on compliance expectations.

9. Launch & Monitor

Deploy the system at the intended scale and establish processes for ongoing monitoring. This may include automated alerts for rule violations, regular usage reports, and monitoring operational performance metrics.

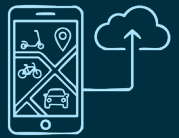
10. Evaluate & Adjust

Use evaluation results to refine policies, technical systems, and infrastructure improvements (e.g., add racks, widen sidewalks) and to ideate new and/or emerging use cases. Feedback loops should capture input from staff, mobility providers, and the public to ensure the system remains responsive to evolving transportation needs.

RECOMMENDATIONS TO CITY & AGENCY PARTNERS

Technology Tools Behind MDS & CDS

Cities rely on a variety of technology tools to collect the data that powers MDS and CDS. These tools capture information on shared mobility, curb use, parking and street activity, and are then fed into MDS and CDS to help make data-driven decisions.

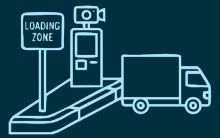


Shared Mobility Platforms

Apps and systems for scooters, bikes and car share vehicles that track vehicle location, availability and trip data (e.g., operator reporting dashboards, fleet management platforms)

Parking Sensors and Smart Meters

Devices embedded in parking spaces, or meters/sensors/devices that detect occupancy, usage duration, and payment status (e.g., embedded ground sensors, RFID readers, smart payment readers).



Curb Management and Access Control Systems

Tools that monitor and Regulate curb space for loading zones, ride-hailing, and delivery access (e.g., computer-vision cameras, digital kiosks, sensors).

Automated Vehicle Location (AVL) and GPS Tracking Devices

Systems that capture real-time vehicle location, speed and route information (e.g., vehicle-mounted trackers, GPS units, telematics devices).

Traffic and Pedestrian Counters

Sensors and cameras that record vehicle, bike and foot traffic volumes (e.g., cameras, infrared or radar counters, inductive loop sensors).

Information Access

User Journeys

This chapter is about:

How do different MDS and CDS users access and interact with their data?

Illustrates user journeys for people who are likely to interact with MDS and CDS in different capacities. These include end-users, enforcement personnel, planners and policymakers.

This chapter is most helpful for:

Policymakers, Planners, and Program Managers

Technical/IT Staff

Private Mobility Providers

How do different users access and make decisions using MDS/CDS data?

People interact with MDS and CDS data on a regular basis, though in different ways. It can be to gather information, visualize a system, or to make informed decisions.

Customers using e-scooters, e-bikes, or EV car share rely on General Bikeshare Feed Specification (GBFS)-powered apps to check availability, location, pricing and battery levels, allowing them to choose the most convenient, cost-effective option for their trip. Parking enforcement officers use enforcement apps or dashboards that may incorporate CDS-formatted data to support citation issuance and provide real-time information to parking management teams.

Transportation planners analyze aggregated MDS and CDS datasets to identify travel patterns, gaps in micromobility coverage, and opportunities for infrastructure improvements. Meanwhile, policymakers use these insights to evaluate program performance, set equitable pricing strategies, and shape long-term mobility and curb management policies.

Together, these different users demonstrate how data is accessed and how MDS and CDS underpin everyday decision-making across the mobility ecosystem.

Commuter

A morning commuter is riding Caltrain into the 4th and King Street Station in San Francisco and needs to quickly identify available mobility options (e.g., e-scooters, shared bikes, car share) to connect from the station to their office.

MDS Application

	ACCESS	FIND	EXPLORE	DECIDE	ACT	END
User Experience	Opens mobility app or city portal using their smartphone	Searches for the location of the train station	Sees a map displaying the mobility options and vehicles available at the train station	Selects an e-bike closest to the train station entrance	Gets off the train, walks to the e-bike, and starts their trip	Completes their trip and receives summary information about the route and payment
Back-end	Mobility app queries GBFS/MDS endpoints for mobility hub data	System requests vehicle locations, availability, type and battery status	System displays mobility options and vehicles at the train station in map view	System shows detailed info, including estimated walk time to the vehicle, pricing, and reservation or unlock option	App communicates with the mobility provider; back-end logs the trip and vehicle status unavailable to other users	System updates the MDS datasets in real- time; vehicle becomes available again

Enforcement Staff

Enforcement officer needs to quickly verify parking status, enforce time limits, and report violations in downtown along a busy commercial corridor.

CDS Application

	ACCESS	FIND	EXPLORE	DECIDE	ACT	END
User Experience	Officer opens their mobile enforcement device/ tablet with a dedicated mobility management app	Navigates the interactive map interface or list view	Selects a specific curb and checks parked vehicles for violations	Determines enforcement action (e.g., ticket, tow, verbal warning)	Issues a notice of violation or citation	At the end of their shift, the officer runs a daily report
Back-end	System requests real-time CDS feeds from the city's curb data platform or backend API (reservation status/time limits)	System displays curb types[1], enforcement rules, active reservations or blocked curb zones, and current occupancy	System highlights violations (e.g., expired dwell time, unauthorized vehicle type)	System auto-fills form with vehicle ID, location and timestamp from MDS/CDS feeds	Enforcement action is sent back to the city/agency data portal for storage and analytics	System generates a report identifying high-violation areas

[1] E.g., loading, pick-up/drop-off, shared micromobility parking

Planner

MDS & CDS Application

Planner is tasked with evaluating downtown mobility hubs to ensure dedicated parking for EV car share is sufficient, accessible and efficiently used. Rather than collect data in the field, the planner uses a platform (either custom-built or off-the-shelf) that taps into real-time MDS- and CDS-formatted data feeds.

	ACCESS	FIND	EXPLORE	DECIDE	ACT	END
User Experience	Opens a desktop GIS dashboard, planning portal, or analytics platform connected to MDS/CDS feeds	Navigates a city map or list of hubs	Selects a specific zone dedicated to EV car share for detailed view.	Sees EV car share spaces are underutilized	Defines interventions (e.g., reallocating EV car share spaces for general parking, incentivizing use for ride-hail)	Generates reports showing EV car share parking and occupancy trends, and recommendations for space reallocation
Back-end	System requests real-time information from CDS feeds	System displays map view of parking zones by type[2] and current occupancy, space, availability and reservation status	System generates summaries of time-of-day usage trends, average dwell time, and number of reservations	System provides simulation tools to model impact of hypothetical scenarios	System generates different scenarios for review based on defined interventions	System generates a report

[2] EV car share, ride-hail, EV charging, general parking

Policymaker

MDS & CDS Application

Policymaker responsible for citywide mobility planning, hub performance evaluation, and policy updates must assess mobility hub performance to inform city council decision on future hub investments.

	ACCESS	FIND	EXPLORE	DECIDE	ACT	END
User Experience	Accesses city data portal and navigates to mobility hubs dashboards or requests CSV exports	Filters by hub, time window, and/or mobility provider	Reviews trends (e.g., demand vs. capacity, turnover, general ridership of services) and cross references with equity and land use data	Confers with planners, mobility providers, and community groups to further contextualize trends and ROI	Recommends expansion, redesign, or decommissioning of mobility hub(s)	Drafts presentation and memo for city council using generated reports
Back-end	System checks user's permissions and pulls the latest pre-calculated numbers from a secure database	Prebuilt scripts compute trips by hub, time window, and/or mobility provider; links trip ends to hub boundaries on a map; calculates KPIs	Generates output of graphs, charts, and maps of trends	N/A	N/A	Data export applies privacy filters, packages the data, and generates CSV or PDF snapshots

Scalability & Evolution

Future Expansion of MDS & CDS

This chapter is about:

What role(s) can city and agency partners play in the future expansion of MDS and CDS?

Provides recommendations to cities and transit agencies for scaling and evolving MDS and CDS beyond individual mobility hubs and parking projects

This chapter is most helpful for:

Policymakers, Planners, and Program Managers

Technical/IT Staff

Private Mobility Providers

RECOMMENDATIONS TO CITY & AGENCY PARTNERS

Flexible Data Infrastructure

As cities begin generating curb and mobility data, a phased approach is recommended to prioritize regional compatibility over independent systems. Since the vendor market for MDS and CDS is not yet supported by a vetted regional bench, cities should first align with MTC's Regional Mapping and Wayfinding program. Utilizing established GTFS and GBFS standards ensures transit and micromobility data is consistent across the nine-county area, reducing technical burdens and ensuring "region-ready" data from the outset. Eventually, connecting to an MTC-hosted environment will facilitate regional trend analysis and standardized reporting. For cities operating independent systems, ongoing engagement with MTC and regional peers is essential to maintain alignment with data standards and facilitate future scaling.

Phased Expansion

Cities should start with strategic hub or curb segments to test integration, data collection, and reporting, and to track KPIs that are of interest to MTC (e.g., utilization, parking compliance). This allows MTC to analyze regional trends, while cities evaluate local impacts before expansion.

Capacity Building

Cities and transit agencies should dedicate staff time for training to support independent, data-driven decision-making. As programs expand, cities and transit agencies should participate in regional working groups, which can be convened by MTC, to share lessons on mobility hubs and curb management. Additionally, engaging with the Open Mobility Foundation (OMF) will help cities stay aligned with evolving standards, ensuring local efforts support consistent regional scaling.

Performance & Adjustment Protocols

Cities and transit agencies should track KPIs identified by MTC (e.g., hub utilization, availability, parking compliance) while adding metrics that reflect unique local goals. In coordination with MTC, cities and transit agencies should define data thresholds (e.g., 80% occupancy during peak hours for three months) that prompt operational adjustments such as, adjusted pricing and expanded enforcement, or adding more hubs. To ensure alignment, cities and transit agencies should commit to an annual joint review with MTC to refine performance targets and policy tools.

RECOMMENDATIONS TO PUBLIC AGENCIES

How to Work with Vendors

To effectively work with technology and platform vendors to start using MDS and CDS, public agencies should adopt a collaborative and well-defined approach that establishes clear data governance frameworks, sets mutually agreed-upon performance metrics, ensures transparency around data privacy and security, and incorporates iterative testing to adapt to evolving mobility needs and technological standards.

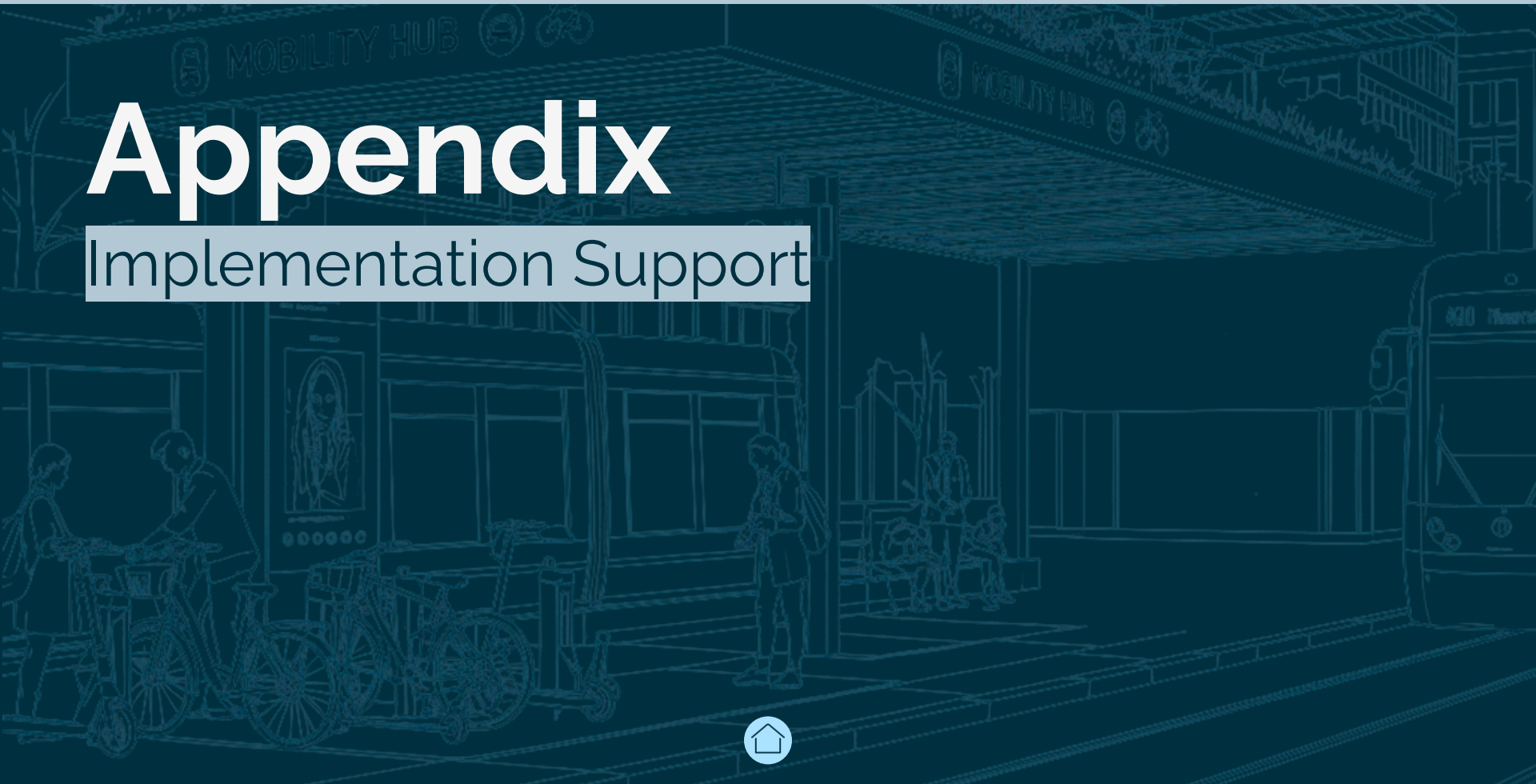
Agencies can start by:

- Articulating policy goals and technical requirements in procurement processes
- Establishing shared understanding of scope, timeline and data governance policies from the outset
- Designating key points of contact on both the agency and vendor sides for coordination
- Requiring vendors to document their processes, provide training for internal staff, and build a system that can be managed and maintained by the agency over time

Source: Unsplash, Theo Lonic

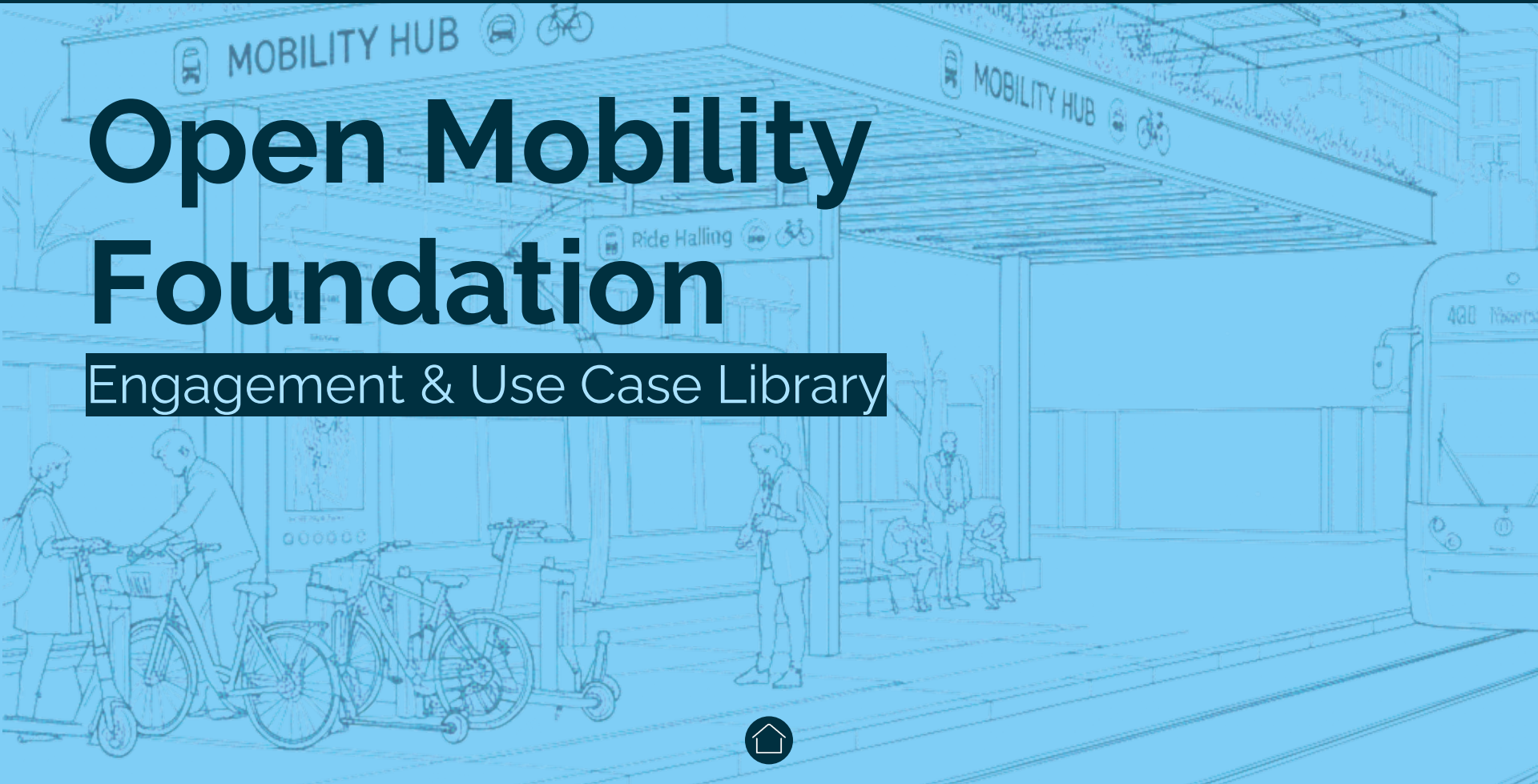
Appendix

Implementation Support



Open Mobility Foundation

Engagement & Use Case Library



Background on the Open Mobility Foundation

The Open Mobility Foundation (OMF) is a global nonprofit organization that brings together cities, mobility companies and tech providers to create open-source tools and data standards that support safe, sustainable and equitable transportation. Known for stewarding the Mobility Data Specification (MDS) and Curb Data Specification (CDS), the OMF helps cities use digital infrastructure to manage mobility services like e-scooters, e-bikes, taxis, car share, ride-hail, autonomous vehicles (AVs), and on-demand transit services, and a wide range of curb activities.

The Guidebook emphasizes OMF's standards because they are widely used tools for organizing and sharing mobility and curb data. While standards like GBFS and GTFS show where shared vehicles are available, MDS and CDS give cities tools and information to *actively manage* new mobility services, *coordinate* how curb space is used, and *connect* data across different systems while still keeping public oversight of streets and public spaces. Through collaborative governance, the OMF helps ensure public agencies have a voice in how technology shapes the ROW.

Source: Open Mobility Foundation

ENGAGEMENT WITH THE OPEN MOBILITY FOUNDATION

As the trusted source for guidance, resources and collaboration on MDS and CDS, the OMF provides tools, knowledge and community support to help cities and partners integrate and learn more about and leverage mobility data.

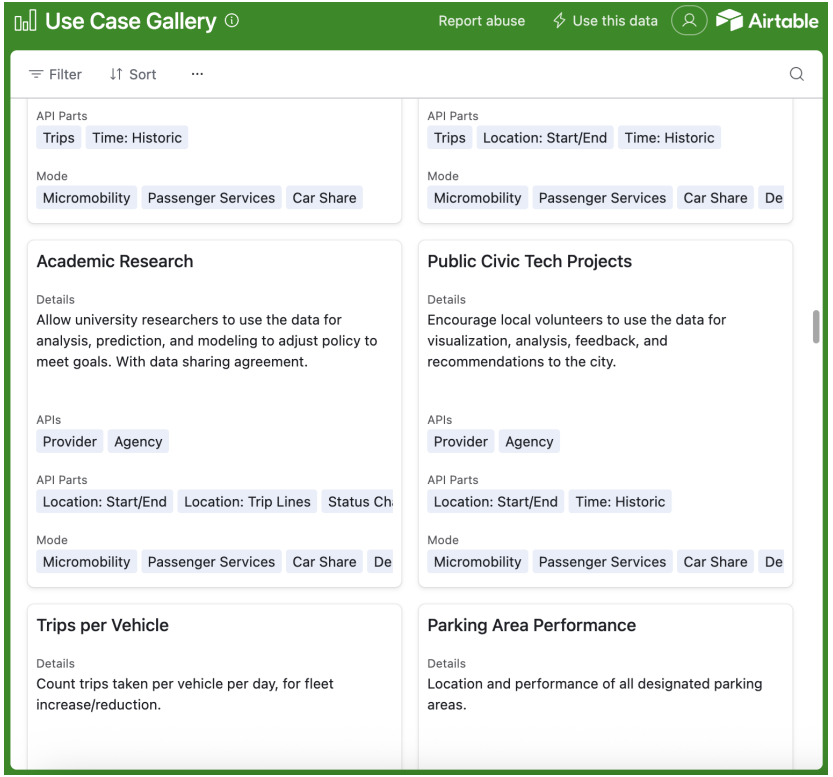
Individuals and organizations can engage with the OMF at different levels:

1. **Follow Along** - Stay informed by following OMF on Linkedin and subscribing to its newsletter for updates, resources, and event announcements. Ideal for newcomers or those seeking to stay current. Follow progress and chime in on the MDS repository and CDS repository.
2. **Join a Working Group** - Contribute directly to mobility innovations:
    a. **MDS Working Group**: Shapes the MDS to help cities manage shared transportation such as e-scooters and delivery robots.
    b. **Curb Working Group**: Advances the CDS for smarter curb management. Participation involves reviewing Wikis, joining mailing lists, attending monthly meetings, and engaging on repositories.
3. **Connect & Learn** - Attend OMF webinars, workshops and the annual OMF summit to gain knowledge, network with peers and explore future mobility tools.
4. **Become a Member** - Play an active role in OMF governance and tool development. Members join steering committees, councils, and project groups to shape initiatives and drive decision-making alongside municipal and private-sector partners.

OMF USE CASE LIBRARY

The Open Mobility Foundation maintains a dynamic database of MDS use cases using Airtable (database management platform) to illustrate the specific ways in which cities are using MDS to create policy, enforce rules, manage shared mobility devices and ensure the safe operation of vehicles in the public right-of-way. The use cases are compiled from years of developing MDS in partnership with member cities and individual contributors. Each use case is tagged with the MDS API associated with it, plus any cities that are actively using or working to implement MDS for this purpose. The MDS use case database can be found here.

The Open Mobility Foundation also has begun to collect real-world use cases for CDS, and how to use the CDS APIs and endpoints. Use cases continue to be developed and shared with cities via the CDS Working Group Steering Committee. Common use cases for CDS can be found here.



Sample Contract Language

Request for Proposal (RFP), Policy and Service Level Agreements Guidance

MDS SAMPLE CONTRACT LANGUAGE

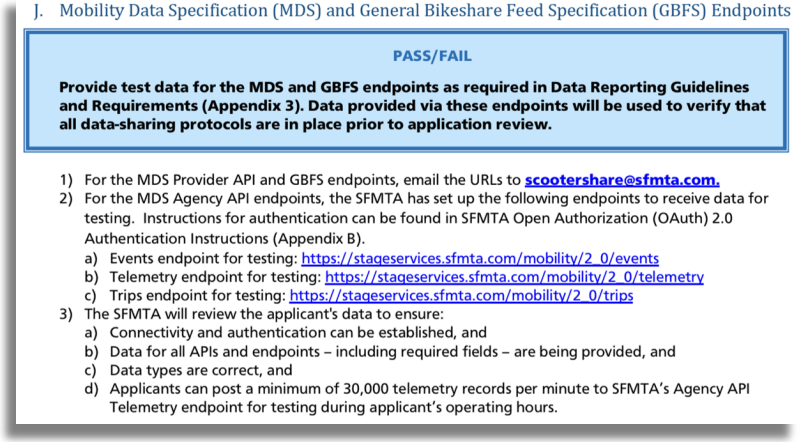
This provides resources that guide cities in writing MDS into their operating policy, permits, tenders or RFPs. The Open Mobility Foundation created sample language for cities to use based on existing policy documents and feedback from its members. The sample language offers a starting point while creating flexibility for cities to customize the language based on their local requirements.

RFP Guidance
For public agencies using an RFP, RFI, RFQ, tender, etc., to procure vendors for a project, consider integrating MDS as part of the evaluation process.

Policy Guidance
Cities can ask mobility providers to stay up to date with the latest MDS releases by incorporating language into the city's operating, policy, tender or RFP.

Contract Renewal
For public agencies preparing for an upcoming annual contract renewal, specify MDS as part of a requirement for renewal.

Service Level Agreement Guidance
Cities should specify a Service Level Agreement (SLA) to establish technical performance expectations. This should include, at a minimum, data availability and response time (e.g., how long it takes the API to return data).



J. Mobility Data Specification (MDS) and General Bikeshare Feed Specification (GBFS) Endpoints

PASS/FAIL

Provide test data for the MDS and GBFS endpoints as required in Data Reporting Guidelines and Requirements (Appendix 3). Data provided via these endpoints will be used to verify that all data-sharing protocols are in place prior to application review.

1) For the MDS Provider API and GBFS endpoints, email the URLs to **scootershare@sfmta.com.**
2) For the MDS Agency API endpoints, the SFMTA has set up the following endpoints to receive data for testing. Instructions for authentication can be found in SFMTA Open Authorization (OAuth) 2.0 Authentication Instructions (Appendix B).
   a) Events endpoint for testing: https://stageservices.sfmta.com/mobility/2_0/events
   b) Telemetry endpoint for testing: https://stageservices.sfmta.com/mobility/2_0/telemetry
   c) Trips endpoint for testing: https://stageservices.sfmta.com/mobility/2_0/trips
3) The SFMTA will review the applicant's data to ensure:
   a) Connectivity and authentication can be established, and
   b) Data for all APIs and endpoints – including required fields – are being provided, and
   c) Data types are correct, and
   d) Applicants can post a minimum of 30,000 telemetry records per minute to SFMTA's Agency API Telemetry endpoint for testing during applicant's operating hours.

Source: San Francisco Municipal Transportation Agency, 2024

CDS SAMPLE CONTRACT LANGUAGE

This provides resources that guide cities in writing CDS into their operating policy, permits, tenders or RFPs. The Open Mobility Foundation created sample language for cities to use based on existing policy documents and feedback from its members. The sample language offers a starting point while creating flexibility for cities to customize the language based on their local requirements.

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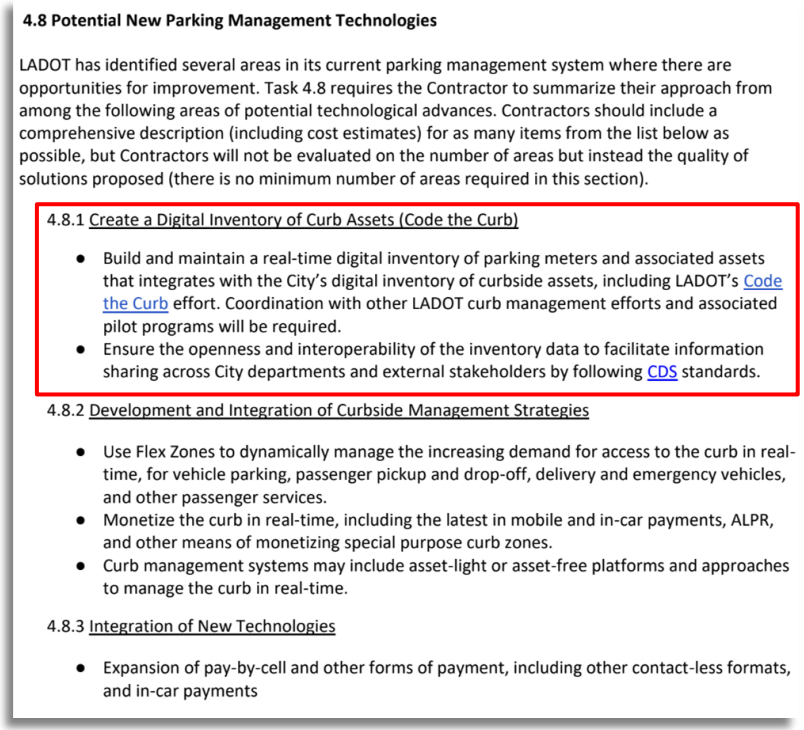


4.8 Potential New Parking Management Technologies

LADOT has identified several areas in its current parking management system where there are opportunities for improvement. Task 4.8 requires the Contractor to summarize their approach from among the following areas of potential technological advances. Contractors should include a comprehensive description (including cost estimates) for as many items from the list below as possible, but Contractors will not be evaluated on the number of areas but instead the quality of solutions proposed (there is no minimum number of areas required in this section).

4.8.1 Create a Digital Inventory of Curb Assets (Code the Curb)

- Build and maintain a real-time digital inventory of parking meters and associated assets that integrates with the City's digital inventory of curbside assets, including LADOT's Code the Curb effort. Coordination with other LADOT curb management efforts and associated pilot programs will be required.
- Ensure the openness and interoperability of the inventory data to facilitate information sharing across City departments and external stakeholders by following CDS standards.

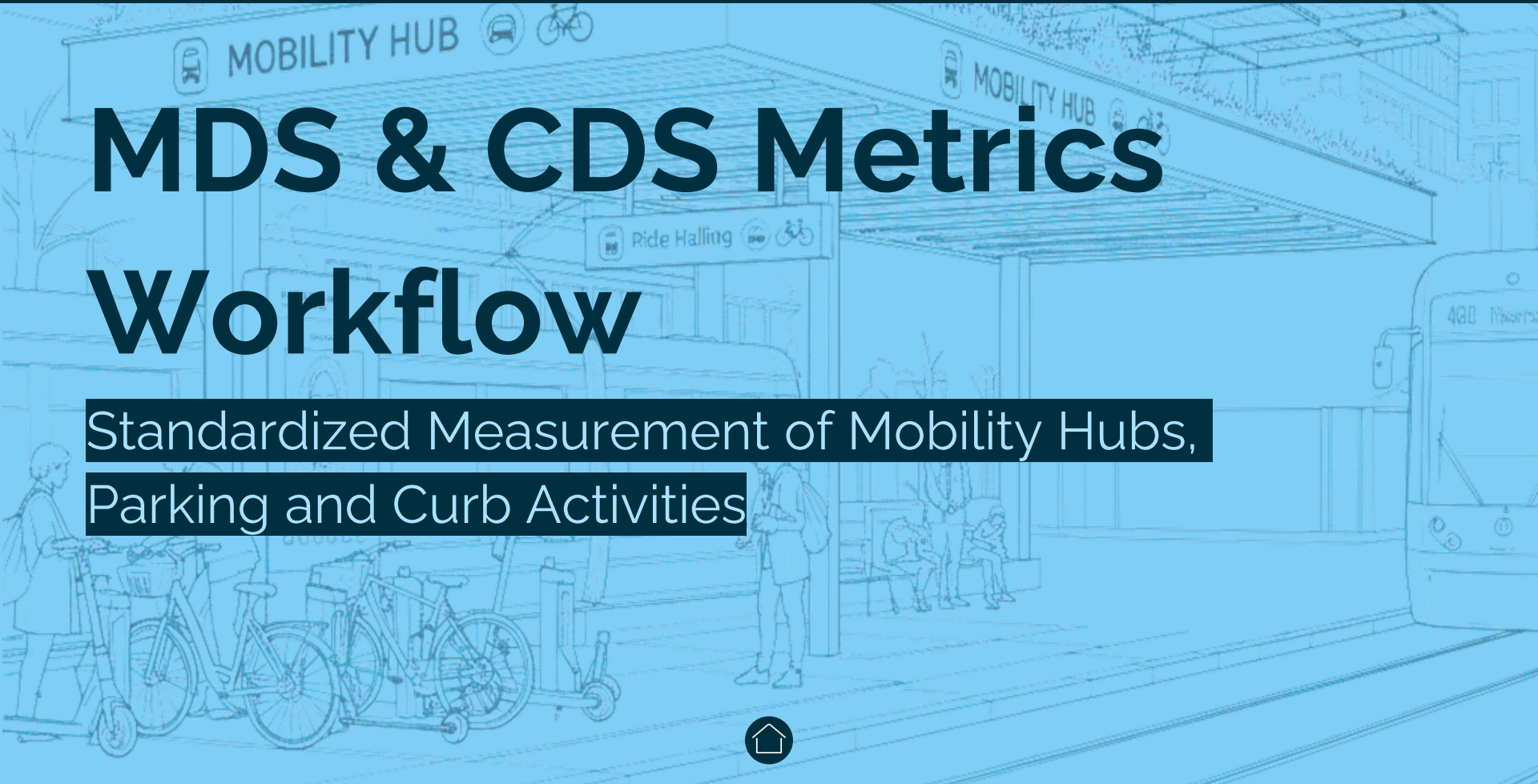
4.8.2 Development and Integration of Curbside Management Strategies

- Use Flex Zones to dynamically manage the increasing demand for access to the curb in real-time, for vehicle parking, passenger pickup and drop-off, delivery and emergency vehicles, and other passenger services.
- Monetize the curb in real-time, including the latest in mobile and in-car payments, ALPR, and other means of monetizing special purpose curb zones.
- Curb management systems may include asset-light or asset-free platforms and approaches to manage the curb in real-time.

4.8.3 Integration of New Technologies

- Expansion of pay-by-cell and other forms of payment, including other contact-less formats, and in-car payments

Source: Los Angeles Department of Transportation, 2024



MDS & CDS Metrics Workflow

Standardized Measurement of Mobility Hubs, Parking and Curb Activities

MDS METRICS WORKFLOW & DATA ANALYSIS

The tables outline common mobility hub and parking activities, corresponding metrics from MDS data, relevant endpoints from the Agency API, and how these outputs support informed decision-making and project evaluation.

Parking Activities	Common Mobility & Curb Metrics	MDS 2.0 Endpoints	Ways to Aggregate & Calculate Metrics	Key Insights Enabled
Occupancy and Availability Monitoring	Parking Occupancy: % of parking spots or curb space occupied over time by vehicle	/trips /events	Infer parked vehicle by identifying status changes to "reserved" or "stopped" within designated parking zones, aggregated over time	Identifies utilization trends, optimizes parking allocation for car share and ride-hail, and informs demand-responsive policies
Turnover and Duration Analysis	Turnover Rate and Average Dwell Time: frequency and length of parking events	/trips /events	Track unique vehicle visits per parking space and calculate average duration of "stopped" or "reserved" status	Measures space utilization efficiency, guiding dynamic parking and curb management and time limit adjustments
Violation and Misuse Tracking	Violation Rate: count and type of parking infractions (overstay, no-park zones)	/trips /events /policies	Detect vehicles remaining beyond allowed time or in restricted zones, aggregated by violation type	Supports enforcement actions and evaluates the effectiveness of parking policies
Curb Space Allocation Compliance	Compliance Rate: adherence to assigned parking zones and permit uses	/trips /events /policies	Compare vehicle parking locations against defined curb zones and permitted vehicle uses	Ensures authorized use of curb spaces, reducing conflicts and improving multimodal parking management

Mobility Hub Activities	Common Mobility & Curb Metrics	MDS 2.0 Endpoints	Ways to Aggregate & Calculate Metrics	Key Insights Enabled
Vehicle Availability and Deployment	Fleet Availability: active/deployable vehicles by type and location	/vehicles	Count vehicles with "available" or "reserved" status within defined geographies and time windows	Tracks fleet distribution to identify oversaturation or gaps, enabling optimized rebalancing and policy adjustments
Trip Start and End Events	Trip Volume and Patterns: trip counts, patterns (start/end locations), and peak times	/trips /status_changes	Aggregate records from the /trips endpoint over a defined time period (hourly, daily) and geography	Reveals demand hotspots and peak periods, helping allocate resources and adjust mobility hub layouts
Vehicle Usage During Trips	Utilization Rates: ratio of vehicles in use vs. total fleet	/vehicles /trips	Calculate % of fleet engaged in trips by dividing active trips by total deployable vehicles, excluding those that are "removed" and "inactive"	Measures operational efficiency, informing decisions on fleet size and mobility provider caps at mobility hubs
Trip Details (i.e. Duration and Distance)	Average Trip Duration and Distance	/trips	Calculate the average trip time and distance from trip start/end timestamps and location data	Provides user behavior insights, assisting in planning service areas, and infrastructure needs
Battery and Charging Status Monitoring	Battery and Charging Status: % of vehicles with low battery or charging	/vehicles	Identify vehicles with battery levels below thresholds or charging flags, expressed as % of fleet	Supports maintenance planning and fleet health management to ensure vehicle availability and reduce downtime
Geofence & Violation Monitoring	Geofence Compliance: frequency of unauthorized entries or exits	/trips /geographies /rules	Count geofence violation events by vehicle and geography over time	Enables enforcement of curb and hub access rules, maintaining safety in the public right-of-way

CDS METRICS WORKFLOW & DATA ANALYSIS

The tables below outline common mobility hub and parking activities, corresponding metrics from CDS data, relevant APIs and endpoints, and how these outputs inform better curb management and project evaluation.

Parking Activities	Common Mobility & Curb Metrics	CDS APIs & Endpoints*	Ways to Aggregate & Calculate Metrics	Key Insights Enabled
Parking Space Allocation	Parking Occupancy: % of parking spots occupied by authorized vehicles	/curb (Curbs)	Count parked vehicles within designated parking zones, compared to total available spots	Informs close to real-time parking management and helps balance curb space between uses
Temporary Restrictions and Updates	Compliance with Temporary Rules: adherence to time-limited or event-based restrictions	/curb (Curbs) /events (Events)	Track vehicle behavior against temporary curb restrictions, flagged via policy updates or events	Supports event management and temporary policy enforcement for special circumstances
Violation and Misuse Tracking	Violation Rate: count and type of curb and parking infractions	/events (Events)	Aggregate and analyze enforcement event data tied to violations like overstays and no-parking zones	Enables targeted enforcement and continuous improvement of curb management policies
Turnover and Dwell Time Monitoring	Turnover Rate and Average Dwell Time: frequency and length of parking/stop events	/curb (Metrics)	Calculate the number of unique vehicles per spot over time and average duration of stops/parking	Measures space utilization efficiency, guiding adjustments to time limits and curb use policies

*Some activities require using multiple CDS APIs and endpoints. The APIs are noted in parentheses.

Mobility Hub Activities	Common Mobility & Curb Metrics	CDS APIs & Endpoints*	Ways to Aggregate & Calculate Metrics	Key Insights Enabled
Designated Zone Enforcement	Zone Compliance Rate: % of vehicles following designated pick-up/drop-off and staging rules	/curb (Curbs)	Compare observed vehicle stops and dwell times against zone definitions and allowed use types	Ensures proper use of designated zones, reducing conflicts and improving multimodal access
Dynamic Curb Allocation	Space Utilization: % of curb space actively used by authorized vehicles vs. available	/curb (Curbs)	Measure occupancy and duration of use within dynamically assigned curb zones	Optimizes curb space allocation in real time, supports demand-responsive management
Policy Enforcement	Enforcement Event Rate: count of violations and compliance actions	/events (Events)	Aggregate reported enforcement actions like citations or warnings in response to policy violations	Tracks effectiveness of curb policies and helps refine enforcement strategies
Mode-specific Curb Usage	Mode Usage Distribution: share of curb space used by different vehicle types	/curb (Curbs)	Categorize curb usage data by mode (e.g., micromobility, taxis, delivery vehicles)	Supports multimodal integration and curb prioritization

*Some activities require using multiple CDS APIs and endpoints. The APIs are noted in parentheses.

Case Studies

Real-world Applications for Mobility Hubs and Parking Management

MDS CASE STUDY - ENFORCING PARKING RULES

LADOT Dockless Vehicle Pilot Program

After complaints about clutter and safety along the Venice Boardwalk, the Los Angeles Department of Transportation responded by creating geofences (virtual boundaries around the area) with digital policies that restricted where scooters and bikes could be used or parked. Using MDS data reporting, LADOT monitored compliance in real time and enforced the rules, limiting scooter and bike parking to designated areas and restricting riding in crowded pedestrian areas. By verifying compliance and penalizing non-compliant mobility providers, the city reduced scooter and bike deployments from 270 to 15 vehicles per day and cut MyLA311 service requests by nearly 30%, all while ridership increased.

Combining geofencing with MDS data enables precise management of shared mobility vehicles within specific zones. For mobility hubs, where multiple modes converge and space is limited, such tools help ensure vehicles are properly operated and parked, reducing clutter and safety risks while maintaining convenient access.

MDS CASE STUDY - INFRASTRUCTURE PLANNING

Baltimore Covington Street Installation

Understanding how new infrastructure influences rider behavior and route choices can be difficult without precise, real-time data. The City of Baltimore needed a reliable way to evaluate whether newly installed bicycle facilities were actually shifting ridership patterns and encouraging safer route usage. By using MDS data, Baltimore was able to easily analyze micromobility trip routes along key corridors before and after the installation of the new bicycle facility on Covington Street. The city found travel on Covington Street increased after the installation, while parallel streets saw no similar change, showing that riders were willing to adjust their routes for safer, more comfortable infrastructure.

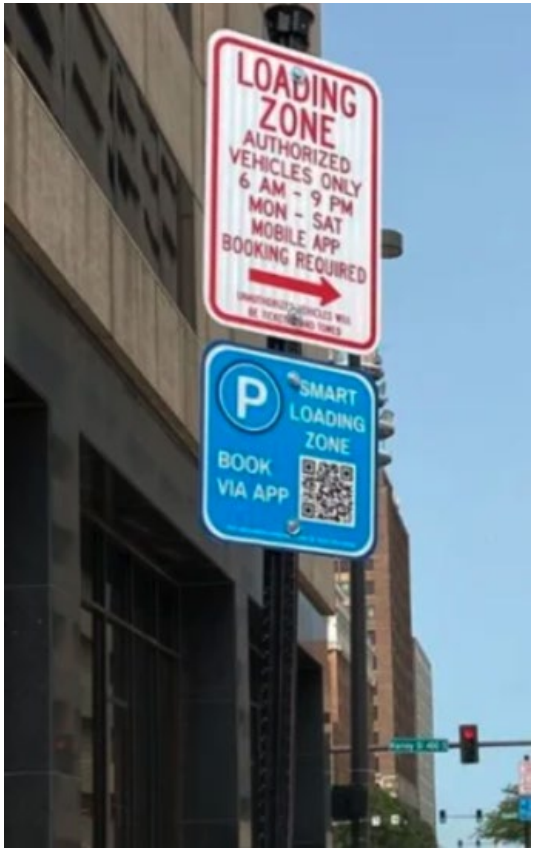
MDS can reveal how patrons of mobility hubs respond to infrastructure changes, enabling planners and engineers to design facilities that better meet rider preferences. Unlike pre- and post-surveys, which rely on self-reported behavior and limited samples, MDS taps into continuous, real-world data that captures actual travel patterns across all users, reducing bias and improving reliability.

CDS CASE STUDY - ANALYZE CURB USAGE PATTERNS

Omaha Downtown Congestion Management

As with many cities, Omaha, Neb., faced limited curb space serving multiple uses in downtown, including commercial deliveries, ride-hail pick-ups and drop-offs, transit stops and parking. Omaha needed a dynamic system to track curb usage and enforce policies that balance these competing demands. Omaha implemented CDS APIs and used computer-vision cameras to track real-time curb activities, including vehicle arrivals, dwell times and occupancy across designated downtown curb zones. By analyzing this data, the city identified peak congestion times and locations, adjusted curb policies to prioritize users needing curb access, and actively monitored compliance with loading and parking rules. Using CDS data, Omaha was able to optimize curb allocations to reduce double parking and improve turnover in loading zones.

CDS enables practitioners to monitor curb activity in real time, adjust policies to balance competing uses and target enforcement strategically, resulting in safer, more user-friendly parking environments.



CDS CASE STUDY - DYNAMIC CURB SPACE MANAGEMENT

Edmonton Real-Time Parking Maps

The Canadian city of Edmonton, Alberta, faced challenges in managing downtown parking efficiently. Traditional static parking maps were insufficient and failed to reflect real-time availability. In partnership with HotSpot, CurbIQ deployed a real-time parking map for the city, monitoring nearly 4,000 parking spaces. By leveraging HotSpot's parking payment service, CurbIQ developed real-time maps to demonstrate the value of a digital-first approach to parking operations. The system pulls live transaction data, which represents parking sessions paid for through the HotSpot app, through API feeds to determine when and where users are paying for parking, allowing for accurate estimation of on-street and off-street parking occupancy across the city.

Integrating real-time curb and parking data improves operational efficiency. It enables dynamic reallocation of curb and parking spaces, enhances the user experience by reducing the time spent searching for parking, and provides actionable insights for data-driven planning and policy decisions.

METROPOLITAN TRANSPORTATION COMMISSION

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OMF OPEN MOBILITY FOUNDATION