



**Gemeente
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CDS-M Blueprint

Framework for business to government data sharing within mobility

Foreword

Since the birth of the Internet in the mid 1990s, the transportation of data packets over connected nodes in a network has driven innovation in ways that were almost inconceivable at the time of its inception.

Over the last two decades the Internet has spawned new models of commercial, political, and social interaction. It has driven revolutions and birthed whole new currency markets. It has brought us closer together and pushed us apart. It has become the fabric of our world.

This technological revolution shows no sign of stopping on its meteoric rise; drawing more and more of the physical world into its digital domain as the fusion of new ideas and the emergence of technologies come together.

The vision of the future for cities is to leverage the opportunities that these technologies bring to provide better infrastructure, living conditions, transport services, and job opportunities to the people who live within its boundaries. This web of data allows us to gain deep insight and understanding of the physical world it helps model.

Understanding how the infrastructure of a city and its occupants interact, provides a wealth of positive benefits to the city and its citizens. However, we must remember that the source of this information is often a person at the beginning of this data chain.

As a city we have the purpose of delivering better outcomes for urban inhabitants through smart policies, smart governance, smart investment and smart technologies. We must therefore always look to give consideration to new technologies primarily from the perspective of a citizen; to what purpose does it serve the people we serve?

The generation of the City Data Standard for Mobility is to explore the needs of data exchange between business and government for the purpose of communication around transportation and its use by its citizens. We aim to look to gain the right insights through the relevant means for the desired objectives.

This blueprint serves as the beginning of a discussion document to bring together the various parties involved in the communication chain of data for transport. We look to engage businesses and governments alike to build a consensus around how we will share the data we have available.

As the cities and citizens of Europe, we together can build innovations for the connected Europe of tomorrow.

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1 Introduction

Through the continued growth of European cities, and the ongoing flood of transport providers within the micro mobility sector, the pressure on public amenities and infrastructure increases.

This increase often results in a less positive experience of both the city itself and the experience of the multi-modal transport services delivered, within it, by private parties.

It has long been a recognised need for city planners and transport operators (TOs) to find a common strategy to help in the management and delivery of these services within a city's boundaries.

To achieve such a strategy, a smart city solution is often presented. At the core of a smart city is the sharing of meaningful data between different parties to achieve common goals as part of the outcome. This enables both the public and private sectors to operate at a successful level through insight, awareness, and transparency, within their own domains. This type of exchange is often known as a Business to Government (B2G) collaboration.

Due to the highly sensitive nature of the data that is being shared by TOs and cities within the B2G collaboration, there must be a very clear definition on how data must be communicated (The Standard). There is also a very clear need on how the data must be collected, stored, shared, treated, and used (The Agreement).

As the City Data Standard for Mobility (CDS-M) we will look to facilitate the communication, development, and ratification of The Standard and The Agreement.

During our research into these areas, we have explored many different standards and agreements that are already present in the market. We have conducted interviews with various parties in the public and private sector, and analysed current offerings against the necessary backdrop of EU legislation to which we must adhere.

Based on this initial research we felt the need to investigate the development of our own data specification for the exchange between business and government around transport. However, with recent updates to existing standards in the market, we feel the necessary EU objectives for an aggregated set of data within a standard have begun to be realised.

For the purpose of The Standard, the CDS-M will explore using parts of the Open Mobility Foundation's (OMF) Mobility Data Specification (MDS)¹ as its core. While not all API definitions within MDS are EU compliant or necessary, it will be the role of the CDS-M to clearly define what APIs are necessary to achieve the smart city objectives we have within the EU. It will also be our role as a B2G collective to help define The Standard through a more EU aligned MDS against the considerations of current and future EU legislations, regulations, and standards.

¹ <https://github.com/openmobilityfoundation/mobility-data-specification>

We explore the relevant areas that the MDS now has to offer in [section 3.2](#).

The second role of the CDS-M is to facilitate the definition of The Agreement when using such a standard. It will be our role to communicate and innovate through an open and equal representation of all parties within the B2G collaboration. This will also be done in alignment with existing EU legislative requirements and laws to which we must look to uphold.

1.1 Background to the CDS-M

In 2017, 130 representatives of Dutch cities, companies, and scientists delivered the Smart Cities Strategy to parliament. The strategy detailed an approach to deal with the issues that arise from this increase of populations.

After its delivery, the five largest cities of the Netherlands (the G5) agreed to work together to achieve the ambitions laid out in the report. This effort was agreed in order to help the G5 and the 32 remaining cities of the Netherlands build the Smart Cities of the future within the Netherlands.

Within the report, smart mobility was highlighted as one of the five main considerations for an improved future within the urban landscape.

The report also contained five pillars, or pre-conditions, that the executive identified as being required in order to achieve success:

- 1 *Safe, standardised digital infrastructure*
- 2 *Public-private partnership with room to experiment*
- 3 *New models of governance, integral and in collaboration with citizens*
- 4 *Education and employability*
- 5 *Regional collaboration in which cities operate as a network*

We can easily adopt these pillars as being at the core of the efforts of the CDS-M. It is clear that the objectives that we choose to achieve in the definition of The Standard and The Agreement, fulfil each of these steps.

The idea of smart cities through the advancement of transportation models, and the data behind them, is also a key consideration within the European Union (EU). The European Commission (EC) have published many reports and directives within the EU in relation to the development of an Intelligent Transport Service (ITS).

An example of this desire by the EC is shown in directive 2017/1926 where it defines the provision of EU-wide multimodal travel information services.²

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%63A32017R1926>

These directives tend to focus more on The Agreement and the frameworks within B2G collaborations.

Additionally, the EC has also put many technical standards in to legislation for the purpose of ITS. Such an example is the NeTEx standard from CEN that is formally produced by Technical Committee 278, Work Group 3, Sub Group 9. The purpose of NeTEx is for the delivery of information relating to networks, fare, and timetables by a Public Transport Operator (PTO). This forms part of the Transmodel that is produced by CEN.³

This is important because, under European Directive 2010/40/EU (Priority Action A), by the year 2019, all EC member states must make their data available under Transmodel based standard formats such as NeTEx and SIRI.

This is again important to the CDS-M. Within our remit we must ensure that we provide guidance into, and the adoption of, standards that already make up legislation within the EU in relation to ITS and smart cities in relation to mobility. Without this we run the risk of creating more fragmentation in the market. This is at opposition to the core value of all these standards and legislations, convergence.

1.2 What is the CDS-M

The City Data Specification for Mobility (CDS-M) is a proposed body that is backed by and made up of representatives from both private market parties and government representatives.

The role of the CDS-M is to assist and develop the partnership between the private and public sector for the purpose of business to government (B2G) data sharing through open communications and collaboration.

This objective has additionally been clearly identified and explored by the European Commission in their recent publication exploring the role of data in this partnership.⁴

The aim of the CDS-M is to agree on The Standard that will be used for the communication, and The Agreement for the use of this data, as part of the B2G collaboration.

Within the B2G collaboration, TOs may be market parties offering traditional (e.g., trains, buses, taxis, etc.) and/or new modalities of transportation (e.g., shared bikes, shared cars, scooters, etc.). Government parties may also involve 3rd party data processors and/or collectors on their behalf to enable their objectives. They will also therefore need to be part of the CDS-M for the purpose of these definitions.

The three key areas that The Standard will need to address and provide service to are: Policy; Planning; Enforcement.

³ <http://www.Transmodel-cen.eu/overview/use-of-the-Transmodel/>

⁴ <https://ec.europa.eu/digital-single-market/en/news/meetings-expert-group-business-government-data-sharing>

The five key areas that The Agreement will need to cover are: Collection, Storage, Usage, Security, and Removal.

Within the exchange of B2G data we must also be sensitive to the main party involved in this exchange of data, that of the end user. This is particularly important within the European Union where regulations around the use of an individual's personal data is outlined within GDPR Law.⁵

More details about the scope of the CDS-M can be seen in 2.2 below.

1.3 Benefits of the CDS-M

The European Commission's report on B2G data sharing highlights the many benefits to be achieved through this public/private partnership. This is particularly the case in the delivery of public services as outlined below.

"Access to the right data can help us, for example, radically improve public transport, make cities greener and cleaner, tackle epidemics and develop better policies by making them more evidence-based. Indeed, business-to-government (B2G) data sharing for the public interest can be a game-changer for improving general welfare."⁶

Through the standardisation of B2G data exchange, there is also benefits for the parties directly involved.

One of the major benefits of having a common method of communication is the reduction in technical development and the management overhead of implementing a standard. This is in comparison to the effort that would be required by individual parties when dealing with a mixed matrix of different formats and data sets for each TO vs each city's data requirements on a per license basis. This is only amplified as we move across the multiple TOs and Cities within the European level.

This standardisation also opens a more direct access to both sides of the data exchange without an additional need for further boutique requirements. A city can therefore access and invite new modalities into its infrastructure using past data sets from other cities as reference. TOs can also enter new markets without the need for additional license requirements relating to data sharing in order to operate.

1.4 Why another body?

While there are already a series of initiatives and organisations openly developing standards and agreements relating to the provision of transportation services within cities, there are none yet that are focused on the data exchange within a B2G collaboration for the European market directly.

⁵ <https://gdpr.eu/>

⁶ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=64954 - page 3

While MDS provides most of what is required within The Standard it still has a series of drawbacks that need to be addressed. At present the standard focuses on micro-mobility. It is also still heavily US centric so does not always comply with, nor consider, existing EU standards. There is also little definition from a European perspective on how we should use such a standard in a way that is still considerate to all parties in the B2G collaboration. This consideration needs to be extended further in to what is legally possible in the use of such a standard against EU law.

Due to this need to adopt and work within existing EU, we must have the ability to operate in an inclusive and agile way to cover all the necessary requirements as member city of the EU.

The European Commission has also highlighted the need for creating such a standard in this way within their report on B2G data sharing:

*"In the absence of structures to support and oversee B2G data sharing, it remains a complex, time-consuming and overall uncertain process. Furthermore, several economic barriers, such as a lack of incentives to contribute to the public interest, high costs to enter into a B2G datasharing collaboration and, in certain cases, monopolistic data pricing, hinder the emergence of B2G data sharing. Moreover, access to private-sector data for public-interest purposes is currently governed by a combination of national laws, some EU sectoral legislation as well as contractual arrangements. As a result, there is an increasingly fragmented landscape between and within Member States, as well as between and within sectors. Given these circumstances, the EU is failing to reap the full potential of B2G data sharing."*⁷

Although MDS is increasingly becoming a standard often implemented by EU cities due to a current lack of an EU focused alternative, the cost for entry is extremely high for market parties.

This is one of the key considerations and issues identified by the European Commission in their report that identifies this type of practice as potentially monopolistic and a high-cost economic barrier to enter such a B2G contract. With the cost for entry to the OMF beginning at \$10,000 for a private party, there is a potential economic barrier that is often too high for new modality providers to consider in the initial phase of their start up.

We therefore see a very real need for the CDS-M to look to support the continued development of The Standard through MDS in partnership with the OMF to ensure:

- 1 Coverage of, and adherence to, standards relating to EU legislation and regulation
- 2 Multi-modal transport at all levels

The CDS-M does not plan to create a completely separate standard to MDS. Instead, CDS-M should aim to provide a forum for all its members to gain better representation and integration on the points above. This will also include suggested additions for data requirements that the CDS-M might identify from its own efforts.

The City Data Standard for Mobility (CDS-M) therefore sets out to follow the approach outlined in this introduction to become the European centric standard for the exchange of data between

⁷ https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=64954 - page 31

Cities and the Transport Operators to help build the Smart Cities of the future in an open-source collaboration by all relevant market parties.

We will look to follow the guiding principles below:

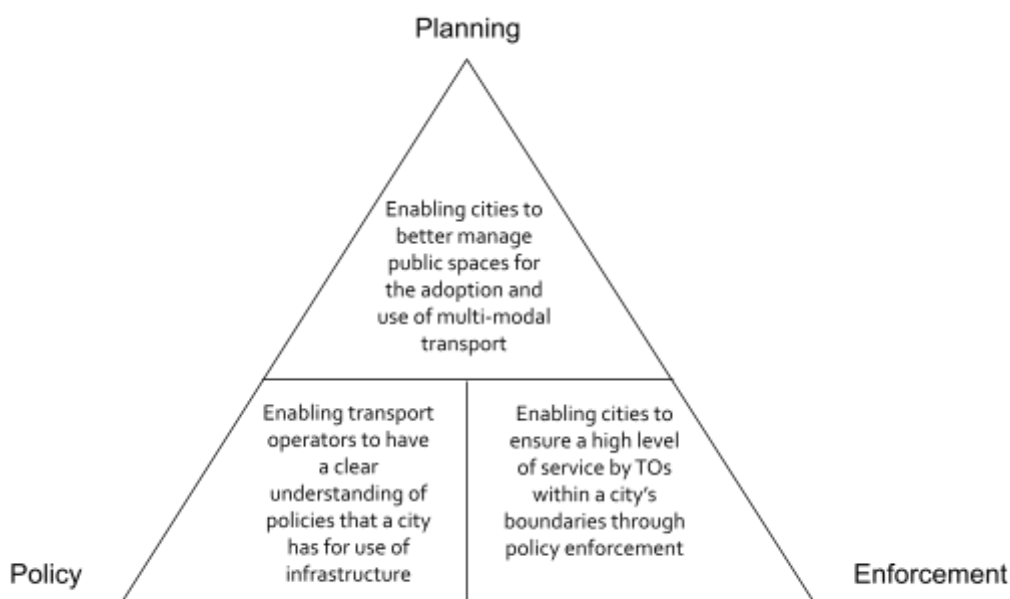
- 1 *Uphold a user's privacy at all times where possible in line with GDPR*
- 2 *Be considerate to the commercial sensitivity of the data provided by a TO*
- 3 *Deliver a standard that provides data sharing at a level that is shown to be both necessary and proportionate for the purpose of the data being shared*
- 4 *Don't reinvent standards where a relevant standard already exist for the purpose to which you are trying to define against*
- 5 *Allow the communication to be open and accessible between all market parties to create a truly B2G collaboration*

2 Goal of the Blueprint

The long-term goal of the blueprint is to put forward a standardised way to communicate, collect, and process data for the purpose of the data exchange between the Cities and the Transport Operators that provide services to their citizens. Its purpose is to drive discussion between all market parties involved in the exchange of this data in order to achieve a clear definition of The Standard and The Agreement.

The objective outcome of the CDS-M is to align definitions behind available parameters from existing standards and to introduce agreed new standard definitions and parameters where necessary for the European market.

Within the Blueprint we are focusing on three core areas of the exchange of data as shown in the figure below. These areas will be explored in more detail in a future version of the blueprint.



2.1 Who is involved?

This initial version of the document has been produced as a consolidation of various discussions between different parties from public, private, and ancillary parties involved in the sharing of data between TOs and Cities.

CDS-M Blueprint

The ongoing purpose of this document is to continue to present and consolidate the future work and deliverables of the CDS-M.

The CDS-M is an initiative that was started by representatives of the G5 and the TOMP-WG via the Interreg project for e-HUBS. The G5 are the five largest cities of The Netherlands. The TOMP-WG is an initiative started by the Ministry of Infrastructure and Water Management in The Netherlands in 2018.

A complete list of all collaborators, companies, and stakeholders involved in the design and the development of the CDS-M to date is provided below:

Gemeente Amsterdam	Ministry of Infrastructure and Waterways
Gemeente Utrecht	ICTU
Gemeente Rotterdam	Ralynx
Gemeente Eindhoven	Go Sharing
Gemeente Den Haag	Helsinki
SBB/MOVI+ (Project Arc Mobilité)	Polis
Dat.mobility	TOMP-WG

Table 1

2.2 What is in this version

The first implementations of the CDS-M took place towards the end of 2020.

The digital version of The Standard and The Agreement will be published via our GitHub page at <https://github.com/TOMP-WG/CDS-M>

2.3 Scope of the CDS-M

The CDS-M is defined as a standard for the delivery of data between transport operators and the cities that they operate within. Additional 3rd party data processor may be involved in the communication chain as a representative of one or more transport operators and/or one or more cities. The role of the 3rd data processors will also be defined within the CDS-M standard.

At its core the CDS-M must look to deliver the best solution as a standard for the purpose of data sharing between these different parties in line with existing EU legislations and regulations where relevant.

The use of The Standard should cover the three areas of communication between these parties to inform each side of necessary information relating to their role within the data chain. The three areas are:

- 1 *The distribution of policy information relating to the use of a cities infrastructure*

- 2 *The collection of aggregated data in a standardised format to enable efficient analysis of transport usage data within a city boundary*
- 3 *The enforcement of policy requirements from the city to the TO*

Item 3 is considered out of scope at this time due to the complex nature of GDPR law and the often-conflicting opinions of parties within B2G data sharing collaborations.

2.4 Versioning and releases

- How we plan to define the standard
- What the planned roadmap is for delivery

Changes in The Standard and The Agreement are inevitable since we are exploring a new field where knowledge and experience improve over time. These changes are controlled using milestones and semantic versioning.

First, the CDS-M defines functional milestones for the definition of The Standard and The Agreement. The milestones refer to new capabilities of the API at a point in time.

Semantic versioning means that by looking at our version number, you can quickly identify what has changed and how much work goes into changing your own implementation.

Table 1 below shows the different CDS-M versions and the major updates that can be found at <https://github.com/TOMP-WG/CDS-M>.

Version	Release Date	API Content	Agreement Content
CDS-M 0.0.1	February 2021	Adoption of MDS	tbc

Table 2

3 Existing Standards

3.1 Transport Operator MaaS Provider API (TOMP-API)

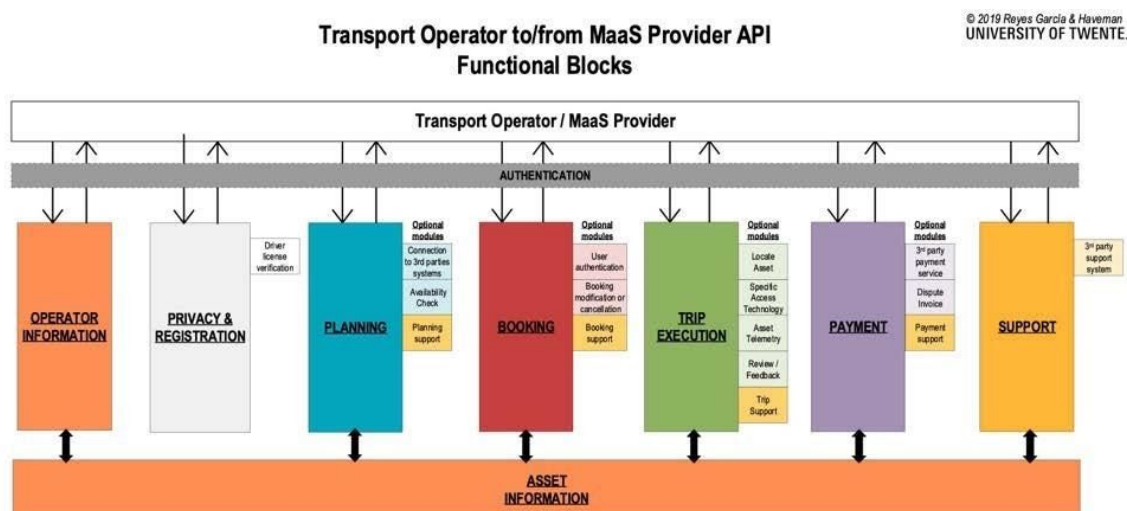
3.1.1 Background

The TOMP Working Group is an initiative started in the Netherlands by the Ministry of Infrastructure and Water Management in 2018. The goal of the group is to provide standardised APIs to facilitate the development of the MaaS ecosystem for data communications between TOs and MaaS Service Providers (MPs).

It allows all participating companies to communicate about planning, booking, execution, support, general information and payments of multimodal, end-user specific trips. Using the TOMP-API enhances the interoperability between parties in the MaaS ecosystem.

3.1.2 Design

The goal of the TOMP-API is to accommodate different business models and variations of transportation within these 8 functional flows. Asset information can be shared for both free-floating systems (bike sharing, car sharing, ride sharing, taxi) and (virtual)station- or fixed-route- based systems (public transport, (virtual)mobility hubs, or station-based transportation).



3.1.3 Opportunities

The TOMP-API provides several APIs that have already been designed towards the MaaS eco-system within the EU market.

Within this design there are two key blocks of functionality that can be adopted in to the CDS-M for the purpose of defining a TOs offering within a City. They are the Operator Information set of APIs and the Asset Information set of APIs.

- **Operator Information / General Information**

Gives static information on the operator according to the General Bikeshare Feed Specification+ (GBFS+) standard.

- **Asset Information**

Is defined as a separate module that can be used by other modules to supplement API calls with specific asset information where applicable. Assets can be vehicles or for example infrastructural assets.

By using these standards to provide information about a TOs service within a City we promote a smoother implementation path of CDS-M by companies that are already supplying data via the TOMP-API. This also means that cities can extend datasets provided by MPs with a cross relevance to a shared description of operator and assets.

As an EU developed standard, it already accommodates existing EU legislation and regulation where relevant.

The TOMP-WG is open source and accessible to all parties which gives an opportunity for all parties involved in the direction of the CDS-M to also be present in the TOMP-WG.

3.1.4 Issues

The TOMP-API is still in an early stage of implementation by market parties. This has the potential to cause changes in the API definitions that the CDS-M looks to adopt. Management of these changes would therefore need to be tracked and updated within the CDS-M in order to stay in parity.

This therefore creates the potential of a delta or dialect of the TOMP-API within the CDS-M.

3.1.5 Considerations

The TOMP-API does not cover the core areas required for a complete CDS-M standard.

3.2 Mobility Data Specification (MDS)

3.2.1 Background

MDS is the US based data standard provided by the Open Mobility Foundation (OMF)⁸. The standard was first introduced in the US by the Los Angeles Department of Transport (LADOT) in June 2018 for cities to manage private mobility providers and the public right-of-way.

Since its inception it has evolved to reach a 1.0.0 release in September 2020. This was achieved under the guidance of the US based Open Mobility Foundation who took over stewardship of MDS from LADOT in April 2019. The standard is still heavily led by US state governments although there is an opportunity for EU cities to also join for free.

3.2.2 Design

MDS has three core areas of APIs to deliver a common data standard of communication between cities and TOs.

■ Provider

Provider allows private mobility companies to report data to cities on the number, location, status, and ride history of devices in use.

■ Policy

Policy allows cities to set rules for how and where different vehicles can operate, how many can operate, and other high-level policy initiatives.

■ Agency

Agency allows real-time updates and collaboration between city officials and providers when complex city transportation problems demand dynamic solutions.

3.2.3 Opportunities

The CDS-M recognises the great work put forward by the OMF and the different contributors to MDS to date. The CDS-M will look to align with API design from MDS that reflect and serve the needs of a common data sharing standard against EU legislation and regulations.

At present we believe that the following APIs fit the purpose to which they are defined for use within CDS-M:

■ Policy⁹

The Policy API endpoints are intended to be implemented by regulatory agencies and consumed by mobility providers. Providers query the Policy API to get information about local rules that

⁸ <https://www.openmobilityfoundation.org/>

⁹ <https://github.com/openmobilityfoundation/mobility-data-specification/tree/main/policy>

may affect the operation of their mobility service or which may be used to determine compliance.

■ **Jurisdiction** ¹⁰

This specification details the purpose, use cases, and schema for Jurisdictions, a beta feature. Jurisdictions are an optional service that, if implemented, must be authenticated, and served by a coordinated group of agencies.

■ **Geography** ¹¹

This specification contains a collection of RESTful APIs used to read Geographies (descriptions of geographical information, e.g. multi-polygons, currently represented via GeoJSON).

Geographical data has many applications in the context of mobility, such as the description of municipal boundaries, locations for pick-up and drop-off zones, and areas of temporary closure for special events or emergencies. This API is intended to support a variety of other APIs, including the Policy API.

Geographical data will be stored as GeoJSON and read from either `geographies.json` or the `/geographies` endpoint, referenced by UUID. Geography data once published through this API shall be treated as immutable, to ensure that any rules or regulations referring to the boundaries cannot be retroactively changed. A Geography may be deprecated and replaced by an updated version with a new UUID.

■ **Metrics** ¹²

The Metrics API endpoints are intended to be implemented by regulatory agencies, their third party appointed representatives, or city designated partners for requesting historical calculated core metrics and aggregations of MDS data. The Metrics API allows viewing of aggregate report data derived from some MDS endpoints that may be used for use cases like compliance, program effectiveness, and alignment on counts. The metrics methodology definitions may be used by providers and third parties in their own calculations.

We feel that through cross-collaboration on the above APIs we can define changes where necessary to facilitate and incorporate EU level requirements into their design.

This would be handled by the CDS-M as a representation of our members.

3.2.4 Issues

The core issue with MDS is the lack of coverage for EU legislation and regulation. This is impacted further by the high economic barrier of entry to the OMF that would be required to amend the governance of the MDS standard by the private parties.

¹⁰ <https://github.com/openmobilityfoundation/mobility-data-specification/blob/dev/jurisdiction/README.md>

¹¹ <https://github.com/openmobilityfoundation/mobility-data-specification/blob/dev/geography/README.md>

¹² <https://github.com/openmobilityfoundation/mobility-data-specification/tree/dev/metrics>

We feel that the CDS-M can create a partnership that enables an agile development of the MDS standard that is EU enabled to provide continued contribution and learning from our members to help improve the MDS in the long term.

3.2.5 Considerations

While the standard is open source and allows external contributions to the open-source standard via its GitHub channel, the opportunity to be a member of the Open Mobility Foundation is reserved for free membership to municipalities or paid members from the private sector. The cost of membership begins at \$10,000. This can be seen by the list of members of the OMF presented on their website.¹³

The focus of MDS is the micro-mobility market of TOs rather than all transport modalities that may make up the multi-modal transport types of the Smart Cities initiative.

*"MDS helps cities interact with companies who operate dockless scooters, bicycles, mopeds and carshare in the public right-of-way. MDS is a key piece of digital infrastructure that supports the effective implementation of mobility policies in cities around the world."*¹⁴

While the MDS promotes privacy at its core it is considered to be a non-GDPR compliant standard due to the request for raw trip data that contains geolocations of booked assets during a trip. While there is a potential for a third party to anonymise this data before it is supplied to a city, it is not possible for a TO to anonymise data themselves. This means that the raw data is still collected by a third party before anonymisation with no guarantee that the raw data will be deleted.

This means that a single point of failure exists within the third party where a data leak could result in personal and commercially sensitive data being leaked.

This topic is covered in great detail by Bird & Bird in their "Memorandum on data sharing through MDS".¹⁵

3.3 NeTEx

Within transport there are already existing standards that need to be considered when looking to define new way of exchanging data. This is part of EU directives in relation to Intelligent Transport Systems (ITS) that form legislation.

At present CEN have defined a series of standards relating to the classification and exchange of data within transport. This is part of the Transmodel definition.

We want to closely align EU standards such as these for the purpose of compliance and to enable a wider pool of data sources to be used for statistical analysis in the long term.

¹³ <https://www.openmobilityfoundation.org/members>

¹⁴ <https://github.com/openmobilityfoundation/mobility-data-specification>

¹⁵ "Memorandum on data sharing through MDS" – Bird & Bird (April 2020)

The key standard from the Transmodel definition that CDS-M will look to align with is the NeTEx standard. This standard is widely used by Public Transport Operators (PTOs) across the EU and is an EU standard by law. It is also part of the TOMP-API. It is therefore to the benefit of the CDS-M to incorporate the principles of the standard as much as possible.

We also want to work closely with CEN to ensure that the development of CDS-M as a whole co-aligns with the Transmodel definitions.

More on this standard will be provided in future versions of this Blueprint.

3.4 Standard Interface for Realtime Information (SIRI)

SIRI is another standard produced by CEN as part of the Transmodel. The following description is taken from CEN's website for SIRI.¹⁶

"SIRI It is divided into five parts, each compliant with CEN Transmodel:

- *Part 1: Context and framework (CEN/TS 15531-1:2015);*
- *Part 2: Communications infrastructure (CEN/TS 15531-2:2015);*
- *Part 3: Functional service interfaces (CEN TS/15531-3:2015);*
- *Part 4: Functional service interfaces: Facility Monitoring (CEN/TS 15531-4:2011);*
- *Part 5: Functional service interfaces – Situation Exchange (CEN/TS 15531-05:2016)-*

As regards the SIRI-SX and SIRI-FM, these parts are of specific relevance for Transmodel (Part 4: Operations Monitoring and Control).

- *The SIRI Situation Exchange service (EN 15531-5) covers the exchange of information describing an incident, typically an unplanned event such as a disruption, but also planned events that affect public transport or its use, such as engineering works, or major public events that will affect the use or availability of transport. The SIRI-SX service was originally designed to be, as far as possible, consistent with the DATEX II and TPEG standards, which also include situation and public event representations.*
- *The SIRI Facility Monitoring service (EN 15531-4) covers the exchange of information concerning the current status of facilities (corresponding to kind of Transmodel EQUIPMENT). It provides a short description of the facility itself, the availability status and specifically the impact of the availability status for various categories of disabled or incapacitated people.*

Both Situation Exchange and Facility Monitoring services encompassed extensions to the Transmodel 5.0 conceptual model on which they are based. Transmodel 6.0 has taken these extensions as input change requests, and the reference model has been updated accordingly to support them."

We also want to work closely with CEN to ensure that the development of CDS-M as a whole co-aligns with the Transmodel definitions.

¹⁶ <http://www.transmodel-cen.eu/standards/siri/>

More on this standard will be provided in future versions of this Blueprint.

4 Scope of the CDS-M

4.1 The MaaS Eco-System

The MaaS eco-system provides a wide mix of mobility options to consumers. Within the MaaS eco-system there are several parties who participate within the management and delivery of these services.

The three main parties involved are the following:

- MaaS Providers
- Transport Operators
- Government (local and national)

For the purpose of the development of the CDS-M we are concerning ourselves with the last two parties, Transport Operators and Government through a B2G collaboration.

4.2 The role of data

Data is always at the heart of any smart city solution. Having meaningful data is paramount to ensure that the sharing of data produces benefits rather than unnecessary overheads for all involved.

Due to the highly sensitive nature of the data that is being shared by TOs and cities within this B2G collaboration, there must be a very clear definition on how data can be communicated (The Standard) and how the data must be treated or used (The Agreement).

The purpose of the CDS-M is to look to help develop MDS within our members and the OMF in order to develop The Standard in an EU context. Additional work will be carried out in a series of planned and open meetings to further define The Agreement through the CDS-M working group.

There are several forms of data that are required in order to facilitate the management of transport services within a city's boundaries. These cover things such as city boundaries, asset and station information of a TO, policies that must be followed, etc.

This exchange of data occurs between cities and TOs at regular ongoing intervals to provide benefit to both parties at either side of the exchange.

This exchange of data, when standardised, gives cities an opportunity to analyse the usage of their infrastructure within the public right of way by transport providers. Through standardisation the data can be cross compared from the different TOs to build up relevant and insightful data with a reduced amount of effort.

Standardisation also means that cities can share, where possible, their own data sets with partner cities, to gain a greater understanding of transport models and patterns across a wider geographic area.

For TOs the opportunity presented by a standardised data format is again a reduction in overhead towards the development and management of data requirements when dealing with multiple cities.

This creates a much lower boundary to entry for TOs into new markets, and also for cities to adopt and grant licences to new modalities that may arise and become desirable in the future.

Without data being shared in this manner you create huge fragmentation through diversity of data sets which presents a major burden for all parties involved in the provision of either infrastructure or transportation solutions.

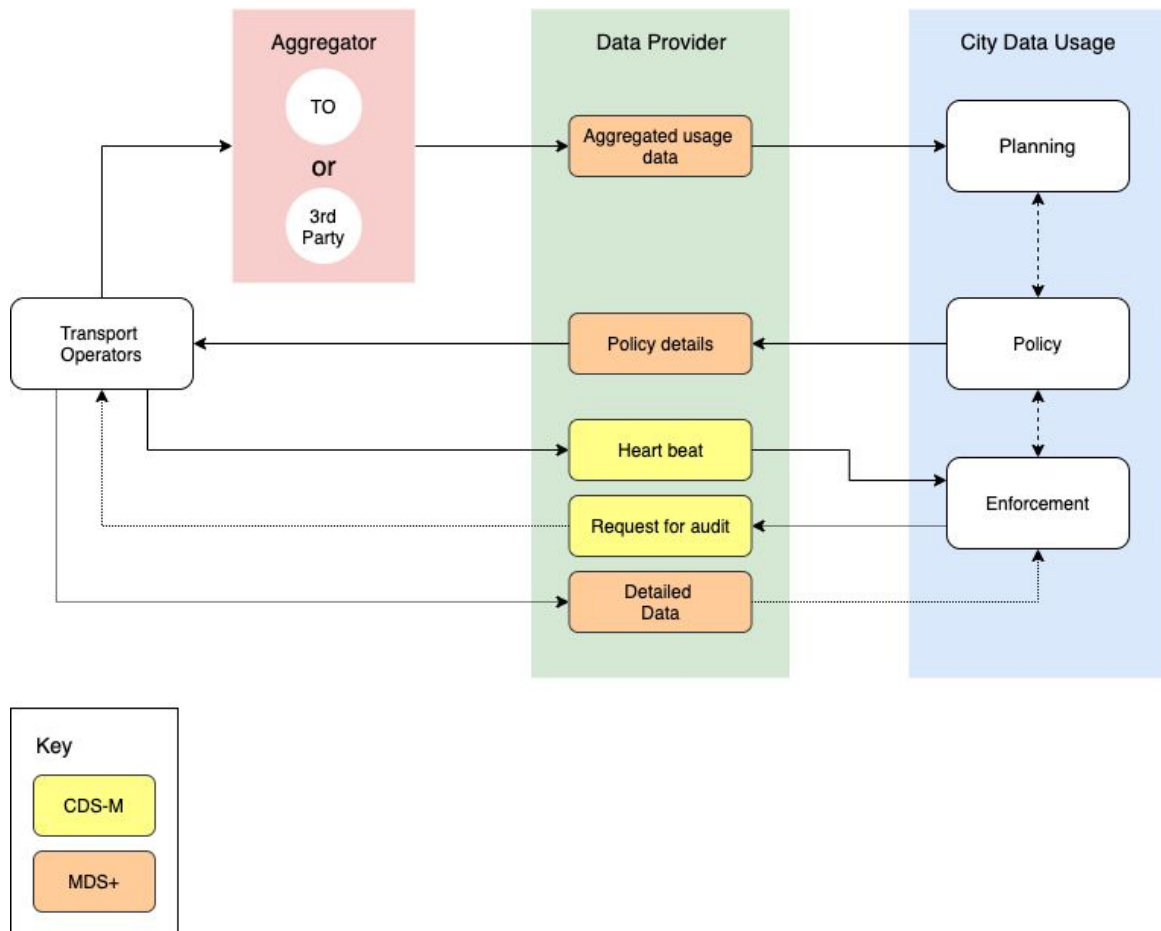
We should at all times consider the GDPR guidance on the use of some of this data being necessary and proportional to the end objectives of the collection of data.

Under EU law we must also be aware that the collection of data is done in such a way that

Within the CDS-M there are three key objectives for the exchange of data. They are:

- Planning
- Policy
- Enforcement

CDS-M Dataflow Diagram



4.3 Planning

Planning data requires very specific information about usage of a form of transport across two vectors, time and geographical area.

For the purpose of planning, and to be consistent with GDPR requirements, data should be aggregated in a form that ensure longer term privacy for the end user and the protection of commercially sensitive information.

When a user's personal data is not part of the exchanged data relating to an assets state (e.g., in a booked state), then there are limited privacy concerns. Planning data gains no benefit from being provided in a real-time or raw data format, providing the aggregation of data is done to such a level that all known use cases can be covered.

These aggregated data sets allow cities to see geographical areas that may have overcrowding or under supply of certain modes of transports. It also enables cities to design urban spaces better suited to the modality that is being provided by a TO.

Insights gained from this aggregated data can also be used to form new policy in relation to use of public rights of way by TOs and their users.

4.3.1 Aggregated trip data

Aggregated trip data is provided as a set of metrics from the transport operators. This data is either aggregated at the TO level or by an optional 3rd party before being passed to the city itself.

This requirement is also highlighted by the EU in their guidance on the collection of data for ITS.

"13 Anonymisation as one of the principles of enhancing individuals' privacy should be encouraged. As far as data protection and privacy related issues in the field of ITS applications and services deployment are concerned, the Commission should, as appropriate, further consult the European Data Protection Supervisor and request an opinion of the Working Party on the Protection of Individuals with regard to the Processing of Personal Data established by Article 29 of Directive 95/46/EC.

14 The deployment and use of ITS applications and services, and notably traffic and travel information services, will entail the processing and use of road, traffic and travel data forming part of documents held by public sector bodies of the Member States. Such processing and use should be carried out in accordance with Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information.¹⁷

For the purpose of the definition of a standard for the objective of planning we feel the Metrics API supplied by MDS is suitable as a candidate. Any work changes proposed by the CDS-M to the series of MDS Policy APIs will be presented back to the MDS standard as a pull request.

■ Metrics¹⁸

The Metrics API endpoints are intended to be implemented by regulatory agencies, their third party appointed representatives, or city designated partners for requesting historical calculated core metrics and aggregations of MDS data. The Metrics API allows viewing of aggregate report data derived from some MDS endpoints that may be used for use cases like compliance, program effectiveness, and alignment on counts. The metrics methodology definitions may be used by providers and third parties in their own calculations.

¹⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0040>

¹⁸ <https://github.com/openmobilityfoundation/mobility-data-specification/tree/dev/metrics>

4.4 Policy

Policy information is often changing. This can be due to real-time events, such as route closures, or changes to policy for the improvement of spaces and traffic flows. In order for compliance this information needs to be communicated to the Transport Operators in a clear and timely manner.

Policy will primarily relate to defined geographic regions. These regions also need to be communicated to transport operators.

For the purpose of the definition of a Policy API the Mobility Data Specification provides a solid implementation. Any work changes proposed by the CDS-M to the series of MDS Policy APIs will be presented back to the MDS standard as a pull request.

■ Policy¹⁹

The Policy API endpoints are intended to be implemented by regulatory agencies and consumed by mobility providers. Providers query the Policy API to get information about local rules that may affect the operation of their mobility service or which may be used to determine compliance.

■ Geography²⁰

This specification contains a collection of RESTful APIs used to read Geographies (descriptions of geographical information, e.g. multi-polygons, currently represented via GeoJSON).

Geographical data has many applications in the context of mobility, such as the description of municipal boundaries, locations for pick-up and drop-off zones, and areas of temporary closure for special events or emergencies. This API is intended to support a variety of other APIs, including the Policy API.

Geographical data will be stored as GeoJSON and read from either `geographies.json` or the `/geographies` endpoint, referenced by UUID. Geography data once published through this API shall be treated as immutable, to ensure that any rules or regulations referring to the boundaries cannot be retroactively changed. A Geography may be deprecated and replaced by an updated version with a new UUID.

Within the CDS-M we will look to suggest an extension to the Policy API to be compatible with the EU specific DATEX II standard.²¹

By incorporating DATEX II where possible we can look to remove replication of data services and requirements within the EU in relation to this model.

¹⁹ <https://github.com/openmobilityfoundation/mobility-data-specification/tree/main/policy>

²⁰ <https://github.com/openmobilityfoundation/mobility-data-specification/blob/dev/geography/README.md>

²¹ <https://docs.datex2.eu/>

4.5 Enforcing

The area of enforcement by cities in relation to policies is a strongly contested topic. One of the main areas for discussion is the right to collect data for the purpose of enforcement when an individual personal data is involved.

4.6 Enforcing

By definition a user's location in itself is also deemed to be personal data²². There have been many case laws that have emphasised this when contested.^{23 24}

However, there is legislation that stipulates that a government body may collect data under certain conditions.

This is highlighted in two articles from GDPR law shown below

"According to Article 9(2) of the GDPR and Article 22 of the Act, the processing of special categories of personal data is permitted in cases where:

- *the data subject has provided explicit consent for the processing of its personal data for one or more specified purposes;*
- *the processing is necessary to protect the data subject's vital interests or another natural person where the data subject is physically or legally incapable of providing consent;*
- *the processing is carried out in the course of its legitimate activities with appropriate safeguards by a foundation, association or any other not-for-profit body with a political, philosophical, religious, or trade union aim and on condition that the processing relates solely to the members or to former members of the body or to persons who have regular contact with it in connection with its purposes and that the personal data is not disclosed outside that body without the consent of the data subjects;*
- *the processing relates to personal data that is manifestly made public by the data subject; or*
- *the processing is necessary for the establishment, exercise, or defence of legal claims or whenever courts are acting in their judicial capacity.*

According to Article 9(2)(j) of the GDPR and Article 24 of the Act, the prohibition on the processing of special categories of personal data is not applicable in case:

- *the processing is necessary for scientific research, historical research, or statistical purposes in accordance with Article 89(1) of the GDPR;*
- *such research serves a public interest;*

²² <https://gdpr.eu/eu-gdpr-personal-data/>

²³ <https://iapp.org/news/a/spanish-supreme-court-overturns-phv-data-sharing-obligation/>

²⁴ <https://gdpr.eu/data-anonymization-taxa-4x35/>

- *obtaining explicit consent is impossible or would require a disproportionate effort; and*
- *safeguards are provided to ensure that the data subject's privacy is not disproportionately adversely affected."*

One of the other cornerstones relating to real time data collection is that the collection of data must be proven to be both proportional and necessary for the use case that the data is to be used for.

While we propose a structure for the communication of real-time data below when the above EU regulations have been fulfilled, we do recommend further discussion on this topic to ensure accountability by all parties in this exchange of data.

Our proposed data format for the sharing of data for real-time purposes is shown below.

There must be a strong consideration for the three key themes within the CDS-M when asking for and using real time data: User Privacy; Commercial Sensitivity; Auditability.

We feel that the proposed definition below removes some of this concern, but not all, in relation to these themes.

4.6.1 Asset Heartbeat (non-standard definition)

The asset heartbeat allows a data collector to monitor assets within its geographical boundaries. The design of this heartbeat tries to limit the potential for identifiable information by the reduction of data shared at this point. Further anonymisation may be achieved by implementing differential privacy by adding noise to these frames of data, while still making them relevant. This again requires further discussion within the CDSM-WG with involvement from the Dutch DPA and other legal bodies.

```
1.  {  
2.    "msg_id": "UUID",  
3.    "location": {  
4.      "lat": "GeoJSON",  
5.      "lon": "GeoJSON",  
6.    },  
7.    "speed": "number",  
8.    "assetClass": "string",  
9.    "assetSubClass": "string",  
10.   "provider": "string"  
11. }
```

4.6.2 Request for Audit (non-standard definition)

A Request for Audit enables an entity to apply for additional information from a TO in the case where there has been a breach of policy relating to law. This enables TOs to keep track of all requests that may be made by a city in relation to a breach of policy.

CDS-M Blueprint

This is an improvement on the MDS standard as it only provides full trip data once a reasonable request has been made by a city.

```
1.  {  
2.    "msg_id": "UUID",  
3.    "policyId": "number",  
4.    "auditReason": "string"  
5.  }
```

5 Use Cases

To be further completed via communication with members of the G5 in order to cover proper proportionality and necessity for use of a CDS-M standard.

City Planning

Definition	Meaning
Item	3.1.1
As a	City Planner
I need to know	How many journeys are taken on a specific mode of transport within a geographically defined zones within my city boundary
In order to	Make an informed decision about where to allocate additional resources for the management of these transport types
Data	
Outcomes	
Comments	

Regulatory Management

Definition	Meaning
Item	3.2.1
Who	
What	
Why	
Comments	

6 Additional Considerations - WIP

While the definition of a standard brings many benefits, there are also multiple considerations to be had in relation to the processing and storage of that data.

Ger Baron (Gemeente Amsterdam, CTO) made the following statement of the collection of data within standards such as CDS-M.

"Collecting too much real-time data could be useless to cities... We don't need to know where everybody is the whole time... We do want to know, is it a real business model? Is it ruining the city?... Is the data being stolen?... Many city governments could lack the technical expertise to manage personal information in large volumes of data and comply with the GDPR..."²⁵

At the heart of all data exchange there are certain criteria that need to be met. At a fundamental level a user's privacy should always be the highest priority due to ongoing and real risk of data leaks.

By storing a large volume of amassed data presents issues relating to the above points. It also creates an issue with regards to data leaks.

While this risk cannot always be completely removed, the mitigation of risk is a desired outcome. Knowing a user directly is not relevant for the purpose of city management in most use cases. However, there are short term exceptions to this when relating to breaches of regulatory policies.

The most common mistakes that companies do when it comes to data protection include:

- Lack of an Information Security Plan
- Only viewing data security as an IT issue
- Relying on firewalls, antivirus and anti-malware software without updating them
- Inadequate training of employees and other users of data
- Not knowing where data is
- Lack of knowledge into various encryption types
- Business plans that lack security
- Transferring unencrypted and encrypted data
- Poor password control - only having one solution
- Assuming that employees care about security
- Forgetting about social engineering

²⁵ <https://www.wsj.com/articles/uber-braces-for-clash-with-eu-cities-on-scooter-data-11579861802>

6.1 User Privacy (GDPR) - WIP

Aleid Wolfson, chairman of the AP: "It is a great asset to be able to move freely in public and to know yourself unobserved. The digital tracking of people in (semi-) public places is an invasion of privacy that is permitted only in exceptional cases. It must always be based on legislation that is sufficiently clear and precise and the application of which is always sufficiently predictable.

The AP applauds the innovative use of data for added value in public space, provided that the privacy of citizens is sufficiently guaranteed. The Smart City applications must meet the requirements of the GDPR. Ensuring privacy in the development of Smart City applications provides sustainable solutions with added social value that fall within the limits of the privacy law. "

<https://autoriteitpersoonsgegevens.nl/nl/nieuws/waarborg-privacy-de-ontwikkeling-van-smart-cities#subtopic-1680>

When using data within the EU, we must be very mindful of doing so against the regulations of data usage as defined by GDPR laws. The following articles from the GDPR definitions outline reasons why and how we must be considerate to our end users privacy.

Definition of Personal Data (Art. 4.1)

'personal data' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person;

Principles of processing personal data (Art. 5.1 b, c, e)

Personal data shall be:

- b. collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes; further processing for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes shall, in accordance with [Article 89\(1\)](#), not be considered to be incompatible with the initial purposes ('purpose limitation');

- c. adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed ('data minimisation');
- e. kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the personal data are processed; personal data may be stored for longer periods insofar as the personal data will be processed solely for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with [Article 89\(1\)](#) subject to implementation of the appropriate technical and organisational measures required by this Regulation in order to safeguard the rights and freedoms of the data subject ('storage limitation');

6.2 Commercial Sensitivity - WIP

There is a real need to consider the TOs commercial sensitivity in the request for data. Competition in the market place by market parties is crucial to a better end user experience. By asking TOs for data against their business model, we open the opportunity for outside market parties to use that data for their own gain within the market place. The CDS-M must therefore ensure that any data that is requested from a TO is handled in a secure and reliable manner for the purposes that are defined by the CDS-M only. That is to improve and ensure good usage of a cities infrastructure.

Consider the high entry costs related to entering into a data-sharing partnership. As the experience gained by each and every data collaboration is not shared, this leads to duplications of effort. As some Member States, aware of these bottom-up approaches and their limitations, are putting in place structures and procedures to provide guidance, they risk producing further costs and in particular barriers to sharing cross-border datasets, thus preventing scalability and sustainability.

competition law (can a B2G data-sharing collaboration be unfair to competitors?)

7 Appendix

7.1 List of terms and definitions

Term	Abbreviation	Definition
Transport Operator	TO	Some
Mass Transit		Large-scale public transportation with high carrying capacities, such as buses, subways, and trains.
Multi-Modal Travel	MMT	Travel using more than one travel mode.
Public Transport Operator	PTO	A transport operator that is publicly owned or funded.
Mobility as a Service	MaaS	Mobility as a Service
Application Programming Interface	API	An interface to provide services through http endpoints
European Committee for Standardisation	CEN	
General Transit Feed Specification	GTFS	
Intelligent Transport Systems	ITS	
Data Collector		
Data Provider		
GDPR	GDPR	
Transmodel		

7.2 Content Sources

<https://www.dataguidance.com/notes/netherlands-national-gdpr-implementation-overview>

<https://www.nextgeneration.city/news/smart-city-strategy-the-netherlands.html>

https://denhaagfm.nl/wp-content/uploads/2017/01/NL_Smart_City_Strategie_Executive_Summary.pdf

<https://autoriteitpersoonsgegevens.nl/nl/nieuws/update-onderzoek-ap-naar-smart-cities#subtopic-1680>

<https://autoriteitpersoonsgegevens.nl/nl/nieuws/waARBorg-privacy-de-ontwikkeling-van-smart-cities#subtopic-1680>

<https://ec.europa.eu/digital-single-market/en/news/meetings-expert-group-business-government-data-sharing>

CEN/TC-278 - European Standardization in support of Urban Intelligent Transportation and Mobility

US DoT MATSA - Comparison of Existing Efforts to Standardize On- Demand / Demand Responsive APIs (2020-04-20)

ICTU - Data requirements from TOMP-API perspective - A blueprint for facilitating a MaaS ecosystem (version 20201009 vo.3)

Bird & Bird - Memorandum on data sharing through the Mobility Data Specification (2020-02-06)

Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport Text with EEA relevance -
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0040>

<http://www.Transmodel-cen.eu/overview/use-of-the-Transmodel/>

[https://movement.uber.com/explore/amsterdam/travel-times/query?si=30&ti=45&ag=wijk&dt\[tpb\]=ALL_DAY&dt\[wd;\]=1,2,3,4,5,6,7&dt\[dr\]\[sd\]=2020-03-01&dt\[dr\]\[ed\]=2020-03-31&cd=&sa;=&sdn;=&ta;=&tdn;=&lang=en-US](https://movement.uber.com/explore/amsterdam/travel-times/query?si=30&ti=45&ag=wijk&dt[tpb]=ALL_DAY&dt[wd;]=1,2,3,4,5,6,7&dt[dr][sd]=2020-03-01&dt[dr][ed]=2020-03-31&cd=&sa;=&sdn;=&ta;=&tdn;=&lang=en-US)

<https://www.wsj.com/articles/uber-braces-for-clash-with-eu-cities-on-scooter-data-11579861802>

Towards a European strategy on business-to-government data sharing for the public interest -
<https://ec.europa.eu/digital-single-market/en/news/meetings-expert-group-business-government-data-sharing>