POLIS

CITIES AND REGIONS FOR TRANSPORT INNOVATION

Digitising Traffic Circulation Plans: The Road Ahead

November 2024

POLIS RTTI Task Force

KpVV CROW

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I. About the organisations

POLIS is the leading network of European cities and regions working together to develop innovative technologies and policies for local transport. POLIS members meet regularly in Working Groups to exchange best practices and share knowledge on sustainable urban mobility. The Traffic Efficiency Working Group addresses the broad subject of multimodal network management from both a strategic and technical perspective, with a focus on Intelligent Transport Systems (ITS) and how they can help cities and regions deliver their policy goals. In 2023, a task force was established within the Working Group to focus on implementing the RTTI Delegated Regulation. Known as the POLIS RTTI Taskforce, this group is composed of local authorities collaborating to drive the implementation of the regulation forward.

CROW-KpVV is a non-profit organisation in the Netherlands, working collaboratively to develop smart and practical solutions for infrastructure, public space, traffic, and transportation. CROW regularly engages with external professionals to share knowledge and best practices, ensuring effective policy development and implementation. The organisation focuses on safeguarding and disseminating collective knowledge, addressing a broad range of issues from policy to management, including work and safety. As an independent non-profit knowledge organisation, CROW invests in present and future knowledge, with expertise in procurement and contracting to support the needs of local authorities.

II. Why this position paper?

Real-time traffic information services play a crucial role in modern transportation, providing real-time updates on traffic conditions, enabling better information and navigation for road users, improving traffic management, and enhancing overall road safety and efficiency.

Real-time traffic information provides drivers with important information on their specific journey, helping them to make it safer and smoother, while reducing the burden on society.

Data provision for Real-Time Traffic Information is regulated by the European Commission under the Intelligent Transport Systems (ITS) directive (Directive 2010/40/EU, supplemented by 2023/2661/EU) and in the Real-Time Traffic Information Delegated Act (DR2022/670). This Regulation establishes the specifications necessary to guarantee the accessibility, exchange, re-use and update of data by both data holders and data users to facilitate the provision of EU-wide real-time traffic information services, and to ensure that these services are accurate and available across borders to end users.

Both road authorities and service providers are data holders. Policy objectives, formulated by road authorities, and service providers, serving their users, should work together in a fair and reasonable playing field to provide information for travellers that serves both overarching public policy objectives and individual consumer needs.

One of the key data items in the RTTI delegated act concerns traffic circulation plans (TCP). The revised Delegated Act of the RTTI stipulates that service providers must incorporate TCPs, when these plans exist, in a digital format and be made available through a national or common access point by the competent authority. However, different public bodies and road authorities have different interpretations of what a TCP is, posing challenges to service providers operating at an international level as well as hindering the achievement of desired policy goals.

Incorporating TCP measures into the digital realm requires consistent road classifications, functional road classes, network regulations, agreements on the operationalisation of the information, and the establishment of fair rules for network access and usage within TCPs. Only then will a TCP provide standardised communication, enabling optimised traffic flows, fewer disturbances in urban areas, better user information on regulations and infrastructure, and the promotion of sustainable transportation modes, thus contributing to safer and optimal road use.

This position paper, collaboratively prepared by POLIS, its members, and CROW, aims to enhance our understanding of TCPs and presents a road authority's vision for their usage, setting the stage for further discussions within NAPCORE. Currently, TCPs are not clearly adopted in applicable data standards (DATEX II/TN-ITS) and need further alignment, following the definition of policy objectives by road authorities and the establishment of conditions by service providers. This ongoing dialogue within NAPCORE will benefit from the input provided in this position paper, which outlines the initial conditions proposed by road authorities.

II.I How to read this position paper?

The paper is structured to guide the reader through the topic of digitalising Traffic Circulation Plans:

- **Section 0** briefly overviews the affected ecosystem, offering background on the key components involved
- **Section 1** explains the concept of TCPs from the perspective of road authorities
- **Section 2** highlights the current challenges in the journey toward TCP digitalisation
- **Section 3** introduces the legislation driving the digitalisation process
- **Section 4** aims to bridge the gap between different TCP visions

In Section 4, we conclude that harmonising Functional Road Classification (FRC) schemes is the first step in facilitating TCP digitalisation. We propose three use cases demonstrating how digitalising TCPs can address specific needs, such as avoiding certain areas, using main routes, and setting preferred routes based on transport mode and purpose. These use cases show how to balance individual travel needs with broader societal goals like safety, health, and environmental improvements.

The paper concludes with recommendations on the next steps. Two annexes provide an overview of current interpretations of TCPs in European cities and background on the RTTI regulation.

0. About the ecosystem

In the context of real-time traffic information services, the term ‘ecosystem’ refers to the interconnected network of various stakeholders, technologies, and processes that collaborate to provide, regulate, and utilise traffic data.

This ecosystem plays a crucial role in ensuring that real-time traffic information is accurate, accessible, and effective in balancing the improvement of navigation systems, traffic management, and overall road safety.

Key Components of the Ecosystem

Regulatory Actors and Frameworks:

- **European Commission:** Develops overarching regulations and directives, such as the ITS Directive and the RTTI Delegated Act, to standardise and oversee the provision of real-time traffic information services across the EU.
- **Real-Time Traffic Information (RTTI) Delegated Act (DR2022/670):** Specifies the requirements for data accessibility, exchange, and usage, ensuring that real-time traffic information services are reliable and consistent across borders in the EU.
- **Intelligent Transport Systems (ITS) Directive (Directive 2010/40/EU, supplemented by 2023/2661/EU):** Establishes the framework for the deployment of Intelligent Transport Systems in the field of road transport and interfaces with other modes of transport in the EU.
- **National Access Points (NAPs):** Established by Member States to facilitate the access, exchange, and reuse of traffic and transport data as mandated by the ITS Directive and its Delegated Act, NAPs are coordinated nationally by an appointed competent authority, serve as centralised hubs where data from various sources can be accessed by stakeholders, and play a crucial role in ensuring the interoperability and harmonisation of traffic information services across Europe. **NAPCORE** (National Access Point Coordination Organisation for Europe) is the name of the formed organisation to coordinate and harmonise more than 30 mobility data platforms across Europe.

- **National, Regional, and Local Authorities:** Implement and enforce national policies, regional policies, and local regulations, ensuring compliance with EU directives while addressing specific national, regional and local needs. In terms of network policy, a rough distinction is made between the TEN-T network (EU), the national road network (non-TEN-T), other roads with a regional function, and roads with a local function. Road functionalities must be aligned with the functions of the TEN-T, the national road network, and the regional road network, respectively. Coordination among road authorities is crucial to maintain consistency. This can be different only for local roads managed by the same road authority.

Data Holders and Users:

- **Road Authorities:** Governmental bodies responsible for managing and maintaining road networks. They provide (available) data as specified by the national implementation of the mentioned European regulations.
- **Service Providers:** Companies and organisations that collect, process, and disseminate traffic information to end-users. They rely on data from road authorities and other sources to deliver accurate real-time updates, making them both data holders and users.
- **End-Users:** Individuals and entities, including road users such as drivers, cyclists, commuters, commercial operators, and emergency services, who utilise traffic information for safer and more efficient travel.

Data Standards

- **DATEX-II/TN-ITS:** A standard for information exchange between traffic management centres, service providers, and road operators. It ensures that data related to traffic conditions, incidents, and roadworks are consistently formatted and shared across different systems and stakeholders.

Find more information on the RTTI Delegated Regulation in **Annex II** of this paper.

1. Traffic Circulation Plans in short

Traffic Circulation Plans (TCPs) are a cornerstone in traffic management—they are implemented by local and regional authorities to enhance transportation efficiency, alleviate congestion, improve safety, promote accessibility for all modes of transportation, and enhance livability.

Cities and regions use these plans to guide traffic along desirable routes (e.g. socially, traffic management, road safety), aiming to balance liveability with access for residents, businesses, and visitors. Typically, this could involve making certain areas less accessible to cars, limiting or prohibiting vehicle traffic, particularly in city centres, while also indicating where traffic can be redirected.

TCPs can encompass various measures for public transport, cyclists, pedestrians, cars, and freight transport, and apply to both regional and interlocal traffic management, as well as in local residential areas and neighbourhoods, industrial areas, shopping districts, school zones, and more. Moreover, a traffic circulation plan is usually made by road authorities.

The specific elements, regulations and strategies may vary depending on the characteristics and needs of the area under consideration. Ideally, these plans are supported by the Sustainable Urban Mobility Plan (SUMP) methodology.

Additionally, road authorities have the competence to set up rules and regulations on the use of public space/roads. A TCP is an essential tool for implementing these regulations, documenting them thoroughly, and tracking any updates or new developments.

TCPs are essential tools for urban planners and road authorities at local and regional levels, facilitating effective management and monitoring of traffic and pedestrian patterns.

Their primary goal is to pave the way for future transportation system improvements, addressing challenges posed by new multimodal and sustainable network developments.

POLIS members agree that a Traffic Circulation Plan, as a policy-based framework, should:

- Guides traffic flow based on policy objectives;
- Establishes a framework to optimise the transportation network and provide access to key destinations, offering more desirable routes and redirecting unwanted through traffic, without resorting to road closures or other regulative measures;
- Aligns with existing regulations, road signs and physical infrastructure.

Additionally, a TCP in a digital format should:

- Be communicated through a standardised communication language for service providers and offer reliable data through traffic information providers;
- Improve service for mobility network users by providing clear information on available routes and their intended use (functional road classification).

Find a brief overview of TCP approaches in Europe in **Annex I** of this paper.

2. The issues

One of the key challenges with a TCP is that it is often not widely known or accessible to service providers or the general public. Even when known, it may not fully align with the diverse needs and preferences of individual users. A Traffic Circulation Plan is not the sole determinant of the routes that different mobility users ultimately take. Mobility network users choose various modes of transport based on their personal circumstances, preferences, and options available. Road users might either make their own route choices, depending on their local knowledge and the information provided by local authorities via apps, social media, and VMS or use a navigation service to help reach their destination. It should be noted that an increasing number of drivers are using navigation systems due to the information about current conditions that is processed and provided in navigation. As a result, the influence of navigation on the (daily) routes familiar to travellers is also growing.

It is important to understand that public policy serves society collectively—also safeguarding the interests of non-travellers—while service providers serve individual customers on the go. Therefore, there may be a difference between the policy-preferred route, the most efficient route for road users in terms of travel time, convenience and cost, and the ultimate choice made by individuals based on preferences and past experiences.

This complexity is evident at various scales. At the neighbourhood level, initiatives like Low Traffic Neighbourhoods (LTNs) and superblocks aim to reduce through-traffic and promote local sustainable mobility options such as active travel. In city centres, traffic circulation plans are crucial for managing congestion and improving safety, while at the level of the Functional Urban Area (FUA), integration with the TEN-T (Trans-European Network), access management, and preferred inward routing from highways play significant roles in coordinating regional and inter-urban mobility. Understanding these different scales helps clarify how different traffic management strategies and individual choices interact, highlighting the challenges and opportunities in creating clean, efficient and equitable transportation systems.

Despite the long-standing development of traffic circulation plans by local authorities, there is currently no common definition, which is leading to different interpretations across Europe of what a TCP constitutes. Historically, cities have developed TCPs in text format as needed, with traffic routes qualitatively described and occasionally accompanied with maps for clarification.

Since there is no single way to develop a TCP, there is also no standardised method for digitising them, and therefore no uniform way to provide information to navigation service providers.

With the growing penetration of navigation service providers in daily mobility, effectively integrating information about Traffic Circulation Plans into these services becomes crucial. Navigation services are increasingly relied upon by users for real-time route planning and traffic updates. Therefore, ensuring that these providers have accurate and up-to-date information about TCPs is instrumental for the effectiveness of the plans. If navigation services lack this critical data or do not communicate about it appropriately, the benefits of TCPs—such as reduced congestion, improved safety, and enhanced accessibility—could be undermined. In the future, TCPs will form the foundation for the routing of autonomous vehicles.

Where human drivers are not always committed to route advice, autonomous vehicles will probably follow these routes. We believe that in the coming decade(s), we will learn and prepare for different types of mobility systems that may appear in cities.

3. RTTI Delegated Regulation and ITS Directive facilitating TCP digitalisation

The issues outlined earlier underscore the need for a unified approach to digitalising Traffic Circulation Plans. Addressing these challenges, the revision of the Real-Time Traffic Information (RTTI) delegated regulation in 2022 and the supplement of the Intelligent Transport Systems (ITS) directive in 2023 provide critical frameworks for the standardisation and digitisation of TCPs.

The RTTI revision mandates that when existing TCPs are available in a machine-readable format, road authorities must make this data accessible via the National Access Points (NAPs) established by each Member State. Furthermore, the regulation requires service providers to integrate this data into their relevant services once it is available. This is essential, as the growing reliance on navigation services for real-time route planning means that having accurate and up-to-date TCP information is crucial for the plan's success. It is equally important that these TCPs are based on high-quality data and are aligned with other relevant datasets to ensure consistency and interoperability across different systems and regions.

In parallel, the ITS directive mandates that local authorities developing a TCP after 2028 must provide the corresponding information in a digital machine-readable format. [1]

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[1] Provision applicable to the core and comprehensive trans-European network for roads, other motorways and sections of primary roads, where the total annual average daily traffic is more than 8500 vehicles, and all roads in the cities at the centre of each Urban Node as defined in Article 3, point (p), of Regulation 1315/2013 and listed in that Regulation, including those administered by the cities. The Member State may choose to limit the coverage in cities at the centre of Urban Nodes to streets where the annual daily traffic is more than 7000 vehicles. The Member State taking that decision shall notify the Commission thereof by 31 December 2028.

Additionally, the European Commission plans to publish new specifications to establish a deadline for the digitisation of TCPs developed before 2028. This harmonisation will ensure that navigation service providers receive consistent and reliable information, enhancing the overall effectiveness of TCPs and contributing to improved traffic management and urban mobility.

While we recognise the value of both the RTTI DR and ITS Directive, significant work remains to be able to implement them effectively. Cooperation with service providers is key to achieving a harmonised approach to digitising and communicating high-quality TCPs. The RTTI delegated act provides a broad framework for what a TCP should be, but its practical application requires operationalisation through agreed-upon use cases. This paper presents a road authority's vision of TCP usage, setting the stage for further discussions within NAPCORE. By taking incremental steps and developing practical and impactful use cases, we aim to create an effective roadmap towards widespread TCP use for navigation.

4. Harmonising the definition of Traffic Circulation Plans

As mentioned in the previous chapter, the focus of this position paper is to further operationalise the definition and scope of a traffic circulation plan as included in the RTTI DR. Looking at RTTI DR2022/670, we find a first definition for a TCP:

> **RTTI art. 2.21:** 'traffic circulation plans' means permanent traffic management measures that are designed by traffic managers to control and guide traffic flows in response to permanent or recurring traffic disturbances.

Our interpretation of this definition is that traffic circulation plans are developed by public bodies (policies) and that they are used for traffic management purposes. They should guide traffic flows in static situations (permanent, basic situations), as well as in commonly encountered traffic situations during certain periods of the day (such as congestion at rush hours). Traffic circulation plans are based on the road classification (1), describing specific road functions that relate to traffic flows, but they can also contain specific scenarios for specific periods (2) or, when relevant, planned (road works, events) and unplanned disturbances (3) (incidents). However, it is essential to first establish the static situation properly before dynamic or specific situations can be addressed.

This means that, according to the RTTI, a TCP contains a basic circulation plan for traffic, as well as scenarios for specific periods and/or scenarios for disturbances.

To elaborate a more detailed definition of a Traffic Circulation Plan, aligning with the RTTI definition and the vision of road authorities, it is useful to break it down into its key components:

- A Traffic Circulation Plan is a comprehensive approach to managing traffic. It involves creating a strategic framework that outlines specific measures to control and guide the movement of all transport modes on roads.
- The primary goal of a Traffic Circulation Plan is to guide traffic flows according to policy objectives. This means ensuring that road users can move smoothly and safely through the network. Additionally, these plans take into account the fact that traffic disturbances can be both persistent and recurring. These include factors such as heavy congestion during rush hours, frequent accidents at certain intersections, or other issues that affect the flow of traffic (such as unintended through-traffic).
- To address these challenges, traffic managers develop a set of strategies and measures such as adjusting traffic signal phase timing (e.g. to prioritise buses, emergency vehicles, cyclists...), creating designated lanes for specific types of vehicles (e.g., buses or bicycles), closing off lanes, implementing speed limits, or re-routing traffic during special events or emergencies.

In essence, a Traffic Circulation Plan is not only a responsive, but rather a proactive approach to traffic management, designed to maintain order and efficiency on roads while considering the potential challenges and disruptions that can occur over time. It is a crucial tool for ensuring that transportation systems operate smoothly and safely in both urban and suburban environments and will contribute to a healthier and safer environment.

Considering this, we proposed a harmonised definition for TCPs in Europe:

A Traffic Circulation Plan (TCP) is a set of permanent traffic management measures designed by traffic managers to control and guide traffic flows in response to permanent or recurring traffic disturbances. This plan must guide traffic flows based on policy objectives, provide a framework for optimizing the transportation network, and align with existing regulations and infrastructure. Additionally, it should be communicated in a standardized language, define the functionality of roads based on a Functional Road Classification, and support navigation services in promoting sustainable and efficient routes.

4.1. TCP: From definition to functional description

In this chapter, the definition of a Traffic Circulation Plan (TCP) from the RTTI delegated act and the vision established by road authorities serve as the foundation for developing a more functional description and ultimately outlining initial use cases.

How can the harmonised definition and foundational elements be translated into a digital Traffic Circulation Plan? We believe the answer lies in **functional road classification**—a system that categorises roads according to their intended function and importance within the road network.

A functional road classification can serve as the backbone of a digital TCP, defining the role of each road segment within the broader network. This classification helps to:

- Identify primary routes for through traffic and secondary routes for local access;
- Determine suitable routes for different modes of transport, such as cars, trucks, bicycles, pedestrians and public transport.

In addition to functional classification, other valuable elements can be incorporated into a digital TCP, including:

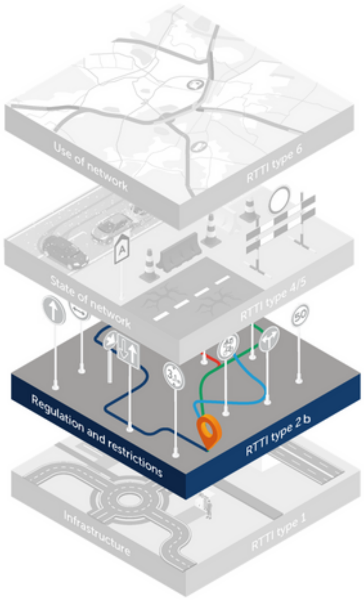
- Information about regulations, such as one-way streets and specific traffic laws;
- Areas with restricted access to motorised traffic, such as pedestrian zones;
- Conditions affecting routing, such as events, roadworks, and weather conditions;
- Preferred routes per transport mode and road user.

Many of these elements are already considered distinct data types within the RTTI framework. To simplify the integration process, **we propose that the most basic form of a digital TCP should focus on the functional classification of roads**. This approach provides a clear and structured way to convey essential routing information to navigation service providers and road users alike. By starting with a functional road classification, a foundation is created upon which more complex elements can be built. This incremental approach allows for the gradual development and refinement of digital TCPs, ensuring that they remain practical and effective tools for traffic management.

The RTTI is roughly built on:

- The available network
- Regulations and restrictions
- State of the network
- The actual use of the network

A traffic circulation plan is **RTTI data type 2b.**



RTTI data type 2b: Traffic Circulation plan: FRC + use cases

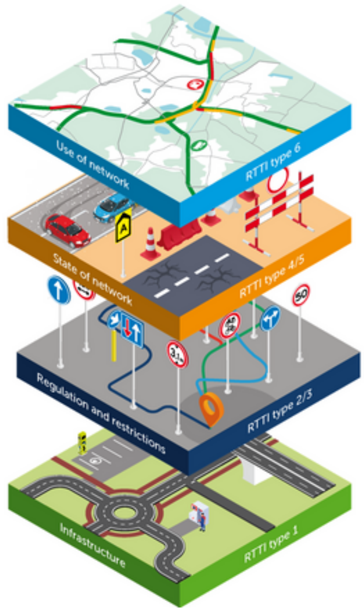
A Traffic circulation plan could be related to other data types of the RTTI, like:

- The infrastructure road classification (RTTI data item 1b)
- Regulations and restrictions like road sings (RTTI data type 2a and 3b)
- Temporary situations like road works or road closures (RTTI data type 4 and 5)

RTTI Data Type 4 and 5 about the State of the Network

RTTI Data Type 2a: Static and dynamic traffic regulations, where applicable
RTTI Data Type 3b: Static and dynamic traffic regulations, where applicable, other than regulations referred to in point 2

RTTI Data Type 1b: Road classification



To avoid duplicating data, a Traffic Cirulation Plan consists of the Functional Road Classification, potentially supplemented with additional data relevant to specific use cases (as outlined in this paper in section 4.3) that further support policy objectives. Elements like traffic signs, roadworks, or other data already present in the RTTI dataset should not be repeated in a TCP.

A digital TCP should therefore focus specifically on the functional role of a road from a policy standpoint and the intended influence on route selection within navigation services. While road authorities may use an extended TCP internally, with additional elements and functions, a standardised digital TCP for navigation providers should contain only the Functional Road Classification and the use cases detailed in this paper.

4.2. Harmonising Functional Road Classifications

POLIS advises finding agreement at the European level on the functional road classes used, which should then be compatible with accepted data standards as DATEX II (Data Exchange Model for Traffic Telematic Applications) and INSPIRE [2] (Infrastructure for Spatial Information in the European Community) for digitisation. RTTI data items such as Road Classification (RTTI data item 1b), Regulations and Restrictions (RTTI data items 2a)- see Annex 2 for an overview of RTTI data types. This ensures that the function of a road or road segment is consistent with traffic regulations and restrictions. It is important to have a uniform basis to develop a European interoperable system. At the national level, deviations from policy considerations can be made by introducing subclasses, but a solid and uniform basis is necessary for route selection by service providers. POLIS argues that the FRC in INSPIRE could provide a good foundation for this, although further work is necessary to account for multimodality.

In INSPIRE and DATEX II, the concept of Functional Road Class (FRC) refers to the classification of roads based on their intended function and importance within the road network. FRC is an important attribute used for various transportation and traffic management purposes. INSPIRE and DATEX II are two separate initiatives, each with their specifications and standards. INSPIRE focuses on spatial data infrastructure for Europe, while DATEX II is a European standard for exchanging traffic and travel information. In the context of DATEX II, Functional Road Class is a key attribute used to describe the characteristics and properties of roads within the traffic information exchange model. It provides information about the role and significance of a particular road segment within the road network hierarchy. The specific classification scheme and definitions for FRC in DATEX II may vary, but typically, it includes categories such as motorways, primary roads, secondary roads, local roads, etc. These classifications help to understand the road network's structure and support various applications in traffic management, routing, and navigation.

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[2] The INSPIRE Directive establishes an infrastructure for spatial information in Europe to support Community environmental policies and activities impacting the environment. INSPIRE addresses 34 spatial data themes needed for environmental applications, ensuring compatibility and usability of spatial data infrastructures across the EU through common Implementing Rules. More info at: https://knowledge-base.inspire.ec.europa.eu/legislation/inspire-directive_en

For a Traffic Circulation Plan, the FRC within INSPIRE could potentially be used. These classes are in line with the TISA [3] proposal regarding RTTI speed limits, road works, and road closures. However, it's worth noting that, as of now, the use of FRC classes for specific TCP requirements has not been explicitly addressed.

FRC	INSPIRE	Description
0	Motorways; Freeways; Major Roads	All roads that are officially assigned as motorways
1	Major Roads less important than Motorways	All roads of high importance, but not officially assigned as motorways, that are part of a connection used for international and national traffic and transport
2	Other Major Roads	All roads used to travel between different neighbouring regions of a country
3	Secondary Roads	All roads used to travel between different parts of the same region
4	Local Connecting Roads	All roads making all settlements accessible or making parts (north, south, east, west, and central) of a settlement accessible
5	Local Roads of High Importance	All local roads that are the main connections in a settlement. These are the roads where important through traffic is possible e.g.,: • arterial roads within suburban areas, industrial areas or residential areas • a rural road, which has the sole function of connecting to a national park or important tourist attraction
6	Local Roads	All roads used to travel within a part of a settlement or roads of minor connecting importance in a rural area
7	Local Roads of Minor Importance	All roads that only have a destination function, e.g., dead-end roads, roads inside a living area, alleys: narrow roads between buildings, in a park or garden
8	Other roads	All roads used to travel within a part of a settlement or roads of minor connecting importance in a rural area

Figure 1. Possible Functional Road Class conform INSPIRE

[3] TISA is a global, non-profit membership association dedicated to the implementation of traffic and travel information services and products based on established standards.

Whilst we consider this list a good starting point for motorised traffic, it does not sufficiently cover the multimodal aspect of the mobility system. Future harmonisation efforts should consider this multimodal aspect to ensure that active mobility and public transport are not forgotten in our path towards digitalisation.

The proposal is to develop a widely supported European Functional Road Classification (FRC), national network frameworks can then be aligned with this European classification in terms of function. This does not mean that the national framework needs to change, but rather that a connection is established between policy functions and the functions we share digitally for navigation services.

After all, more functions may be required for policy purposes than those included in the European Functional Road Classification. In the Netherlands, initiatives towards this are already underway.

4.3. TCP: From functional description to use cases

Developing a Traffic Circulation Plan cannot be done in isolation from road classification, as the two are closely interconnected. Both elements are addressed separately by the RTTI (data types 2b and 1b, respectively).

The first step is to establish a road classification that reflects the structure and design of the existing road network. In step two, specific functions are assigned to each road. These functions must align with the physical characteristics of the roads to ensure compatibility with the desired policy objectives. Ideally, these functional assignments should be digitised according to a European standard format.

Although standards exist at the European level, their implementation varies significantly between countries, with some nations developing their own national approaches and others not implementing them at all.

In cases where standard implementation does occur, especially in urban areas, it is often unclear whether cities have been adequately involved in the process.

If the established functions involve preferred routes for different transport modalities, which are essential for route planning and navigation, this information can be integrated into the TCP using use case 3 (described in page 23).

By completing steps 1 and 2 (and optionally use case 3), a comprehensive overview of the road network and its intended functions—potentially categorised by preferred routes for each modality—is created, forming the foundation of a basic TCP.

This overview serves as the basis for route planning by service providers. If the outcomes of steps 1 and 2 do not fully achieve the desired policy objectives or optimise traffic flow, use cases 1 and 2 (outlined below) can be applied. At this stage, measures such as avoiding certain routes, prioritising main roads, or promoting alternative transport modes may be incorporated into the overall Traffic Circulation Plan.

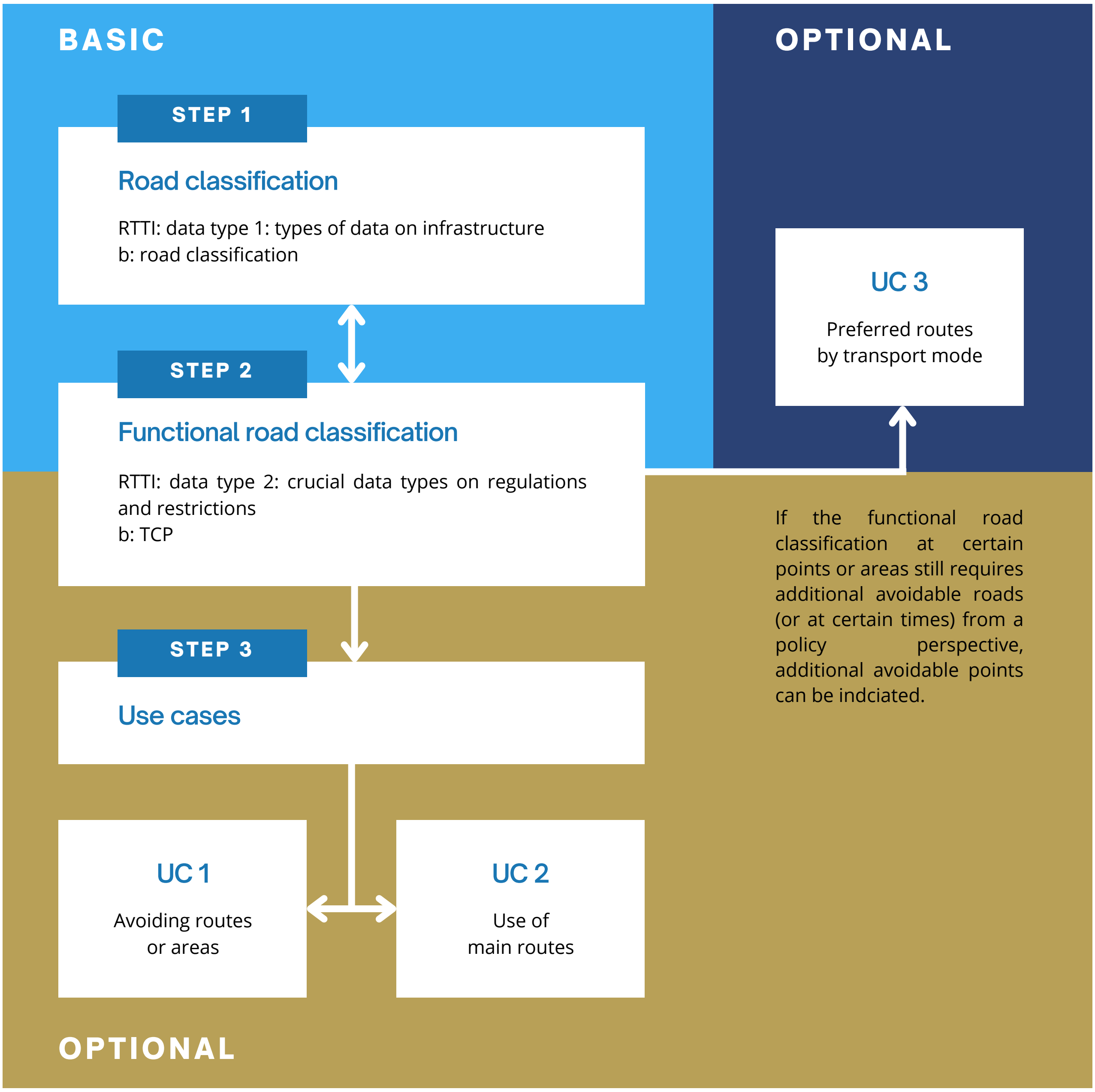

Figure 2. Step-by-step process to digitalise a Traffic Circulation Plan

UC.1 Avoiding routes or areas for certain transport modes

Service providers and local road authorities collaborate to identify areas with traffic problems that require alternative routes. In cases where two route options have similar lengths and travel times, road authorities may request that one be avoided by certain transport modes to protect interests such as road safety, air quality, and noise reduction.

Such problem areas are ideally discussed on a local or super-regional level so that the entire network can be assessed. Measures must be coordinated to ensure seamless transitions between areas managed by different road authorities. In this use case, some areas or routes may be restricted to certain transport modes, to address policy concerns, such as:

- Road safety, such as restricting motorised vehicle traffic around school zones on school days, during times that children arrive at or depart from school;
- Environmental: referring to measures taken to reduce air pollution or noise, such as restricting access to certain roads or areas in high-sensitivity zones;
- Liveability, such as avoiding certain routes for motorised traffic to enhance the quality of life in residential or urban areas;
- Optimalisation, such as spreading traffic across available routes to prevent early congestion, particularly when several routes offer comparable times.

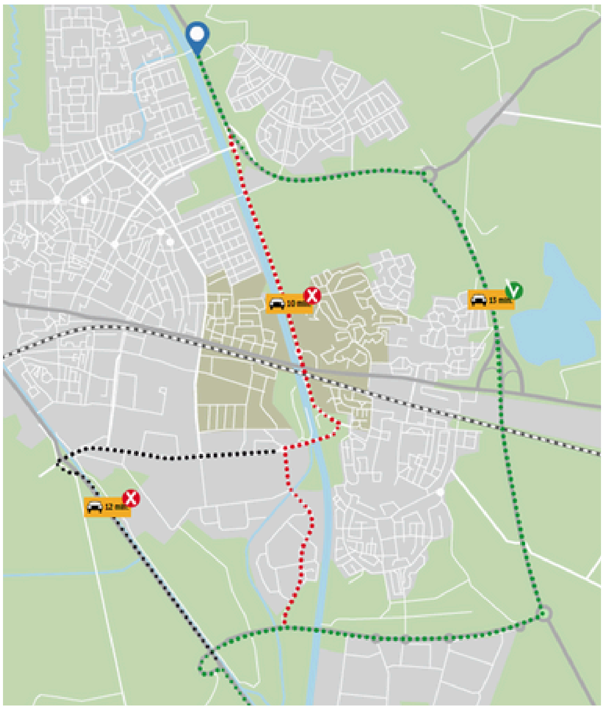

Figure 3. Use case application - avoiding certain routes

Figure 4. Use case application -- avoiding certain areas (e.g. school zones)

UC.2 Use of main routes

Once on the main road, traffic should remain on it. Real-time information about the length and estimated duration of congestion should be readily available. Route recommendations aimed at avoiding heavily congested motorways and main roads should be significantly restricted, as this can negatively impact the traffic safety, environmental quality, liveability, and efficiency of the underlying road network and more residential neighbourhoods.

Traffic near the origin or destination may use alternative routes if necessary to reach their destination. This routing could be both static and dynamic, provided it is clear when a scenario is activated. For now, these dynamic elements are probably for future use.

Conditions for changing detours in case of incidents need to be established, ensuring that incoming traffic is diverted broadly using the main road network according to its categorisation. These conditions could also specify when it is acceptable to use a lower Functional Road Class (FRC) as a route and determine acceptable detour lengths in both time and distance.

UC.3 Preferred routes by transport mode and purpose

A preferred route can be specified for each mode of transport, accommodating both passenger and freight mobility needs. The goal is to optimise traffic flow while considering specific local strategies and contexts. The goal is to optimise traffic flow while considering local strategies and conditions. In some cases, road authorities aim to separate different traffic flows as much as possible to enhance unimodal efficiency and overall safety.

In other cases, they encourage traffic flows to converge, particularly where multimodal exchanges are logical, such as at transport hubs, or where shared space is favoured, such as in neighbourhood areas. The principles for determining these preferred routes per mode of transport include indicators like desired use for motor vehicles and the actual use by active modes. For public transport, these routes are generally fixed.

The aim is to reduce conflicts between different traffic flows. For active modes such as walking and cycling, a different preferred route might be designated during nighttime if social safety is important. This way, users are provided with the safest option. These preferred routes can be prioritised at traffic lights, making them even more efficient.

Naturally, preferred routes should be in line with the Functional Road Classification, regulations and restrictions, and local road signs. Coordination between various road authorities and regions is necessary to ensure these preferred routes connect seamlessly in adjacent areas. Internationally, in border areas, agreements may also be needed. If preferred routes are defined as part of a traffic circulation plan, service providers must integrate these into their routing and provide information about these routes when relevant.

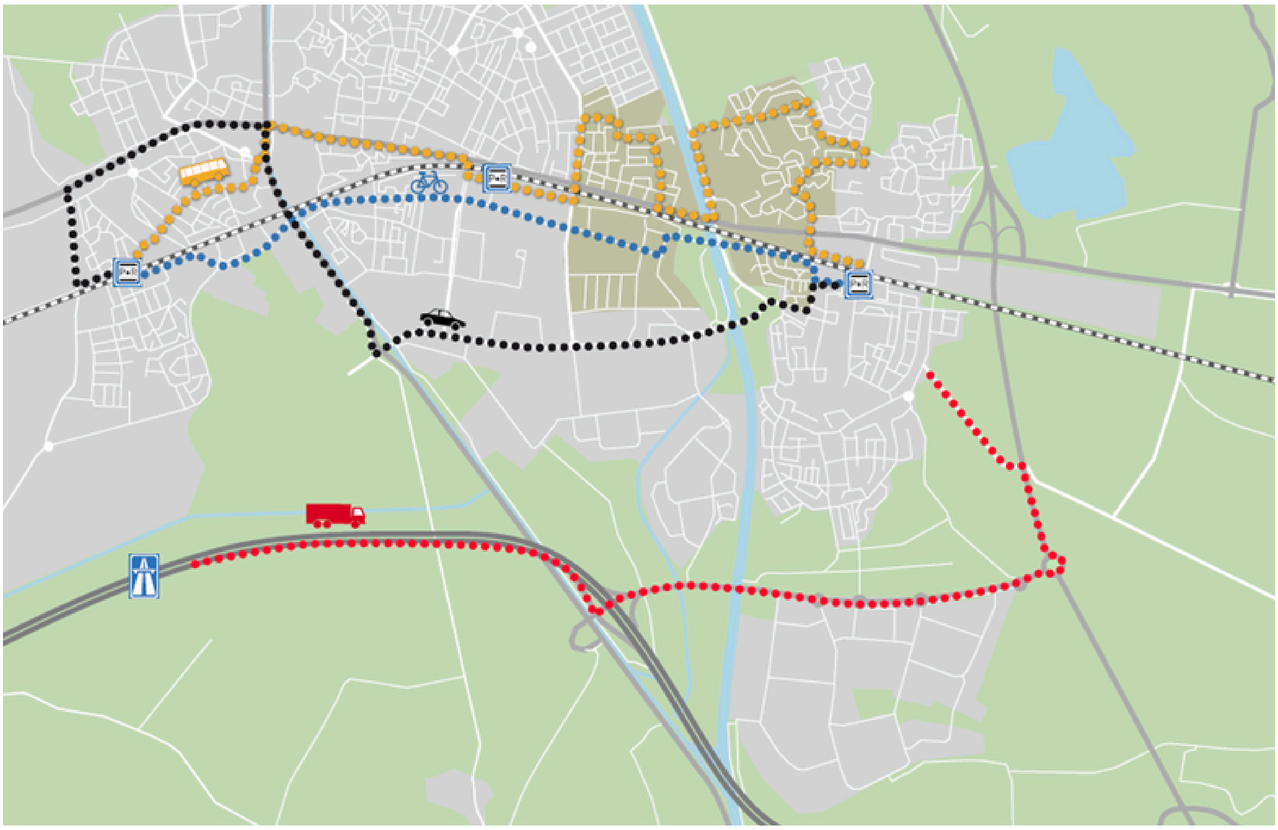

Figure 5. Use case application - preferred routes for each transport mode

5. Conclusions and Next steps

The EC defines a TCP in the RTTI Delegated Act as

‘permanent traffic management measures that are designed by traffic managers to control and guide traffic flows in response to permanent or recurring traffic disturbances’

and sees it as the TCP’s goal:

> “ to improve the benefits for road users in terms of increased road safety and less traffic congestion, these services should also reflect the priorities of road authorities, as expressed for example through digitally accessible traffic circulation plans.

According to local authorities, the traffic circulation plan as a policy-based framework should:

- Guide traffic flow based on policy objectives;
- Establish a framework to optimise the transportation network and provide access to key destinations, offering more desirable routes and redirecting unwanted through-traffic, without resorting to road closures or other regulative measures;
- Align with existing regulations, road signs and physical infrastructure;

In addition, a TCP in a digital format should:

- Be communicated through a standardised communication language for service providers and offer reliable data through traffic information providers;
- Improve service for mobility network users by providing clear information on available routes and their intended use (functional road classification).

The Traffic Circulation Plan should be based on a **Functional Road Classification**, which is essential for digitalising the plan and defining the role of each road segment within the broader network.

This classification helps identify main routes for through traffic, designate secondary routes for local access, and determine appropriate routes for various modes of transport, including cars, bicycles, and public transport.

In parallel, navigation services should:

- Help to prevent congestion by supporting policy-based smart routing or encouraging alternative options;
- Encourage sustainable journeys by prioritising sustainable alternatives in these services when possible.

These underlying priorities of road authorities in terms of controlling and guiding traffic flows are made concrete through a first set of use cases, which aim to:

- guide traffic flow in line with policies;
- reduce negative impacts like noise and pollution;
- ensure safe and optimal road use;
- promote sustainable modes of transportation.

Our proposal for a harmonised definition for TCPs in Europe:
A Traffic Circulation Plan (TCP) is a set of permanent traffic management measures designed by traffic managers to control and guide traffic flows in response to permanent or recurring traffic disturbances. This plan must guide traffic flows based on policy objectives, provide a framework for optimizing the transportation network, and align with existing regulations and infrastructure. Additionally, it should be communicated in a standardized language, define the functionality of roads based on a Functional Road Classification, and support navigation services in promoting sustainable and efficient routes.

5.1. Next steps

This document outlines the operationalisation of the TCP definition provided in the RTTI delegated act by the Commission from a road authority perspective. The next steps include:

- Developing a similar position paper from the perspective of service providers;
- Establishing a final common view of TCPs across road authorities and service providers, with road authorities taking a leading role and services reflecting the priorities set by road authorities;
- Co-creating a set of definitions, interpretations, and agreements between road authorities and service providers regarding TCPs and Functional Road Classifications (FRCs); recommending the EC to initiate a new task force or working group to facilitate these discussions, ensure alignment, and promote consistent implementation across member states;
- Harmonising (multimodal) FRCs, which may be included in the NAPCORE initiative.

ANNEX 1. A Brief Overview of Traffic Circulation Plans in Europe

1.1. Ghent

When traffic counters revealed that nearly 40% of motorised traffic in the city centre of Ghent consisted of through-traffic, the city decided to take action. With the implementation of an ambitious circulation plan in 2017 that prevents through-traffic from entering the city centre, Ghent reclaimed public spaces for its residents, resulting in a more accessible, liveable and safer urban environment.

In the circulation plan, the restricted traffic area (or so-called pedestrian area) was expanded, and the surrounding area of the city centre was divided into 6 sections. Travelling by car from one section to another became impossible without using the inner ring road (e.g. by changes in driving directions). This prevents through-traffic from non-residents and discourages short drives in favour of cycling and walking.

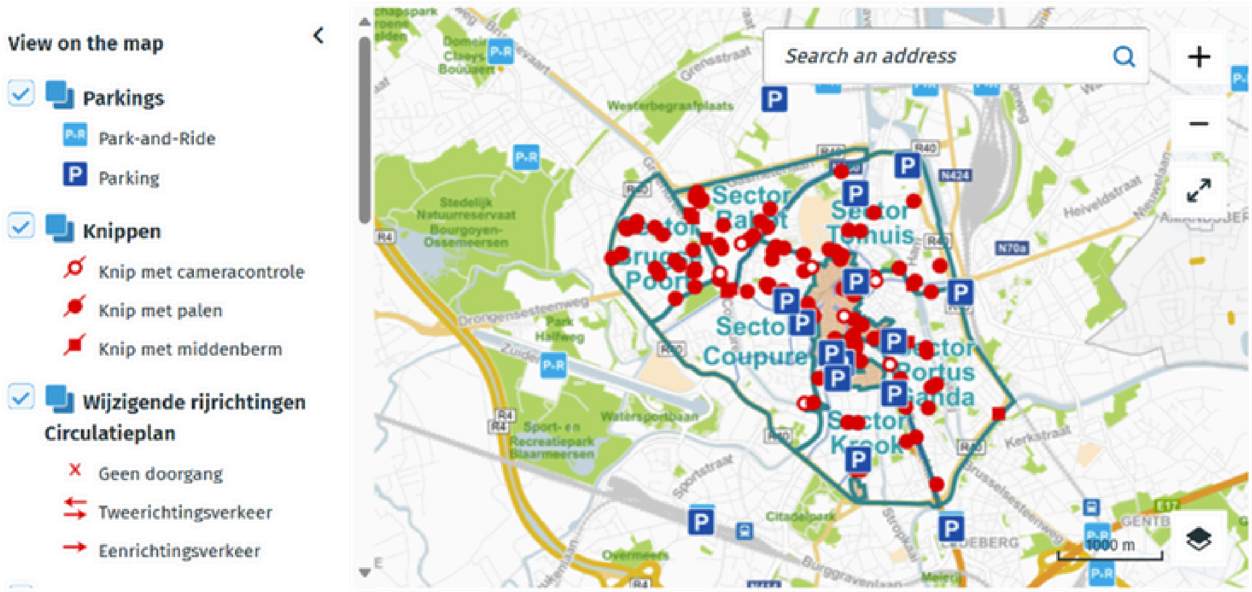

Figure 6. Different sections of the Ghent circulation plan, parking facilities, P+Rs, bike routes, public transportation, etc—digital map available here

In 2024, the City of Ghent further elaborated this Circulation Plan, by implementing smaller circulation plans in sub-municipalities. The different neighbourhoods that surround the city centre face the same challenges: improving the quality of life for residents, managing local traffic flows, reducing through-traffic, etc. These smaller 'neighbourhood circulation plans' also include changes in driving directions.

1.2. Gothenburg

Gothenburg's current traffic circulation plan reflects the changes the city has gone through in the past decades. From the 1960s, as the number of workers who needed to reach the city centre grew, congestion also increased quickly. The city invested in a suspended bridge in 1966 and a new tunnel in 1968 to ease traffic. In the 1970s, the city faced various challenges, such as air pollution (with dangerous levels of carbon monoxide), noise pollution and safety. This resulted in a new traffic circulation plan.

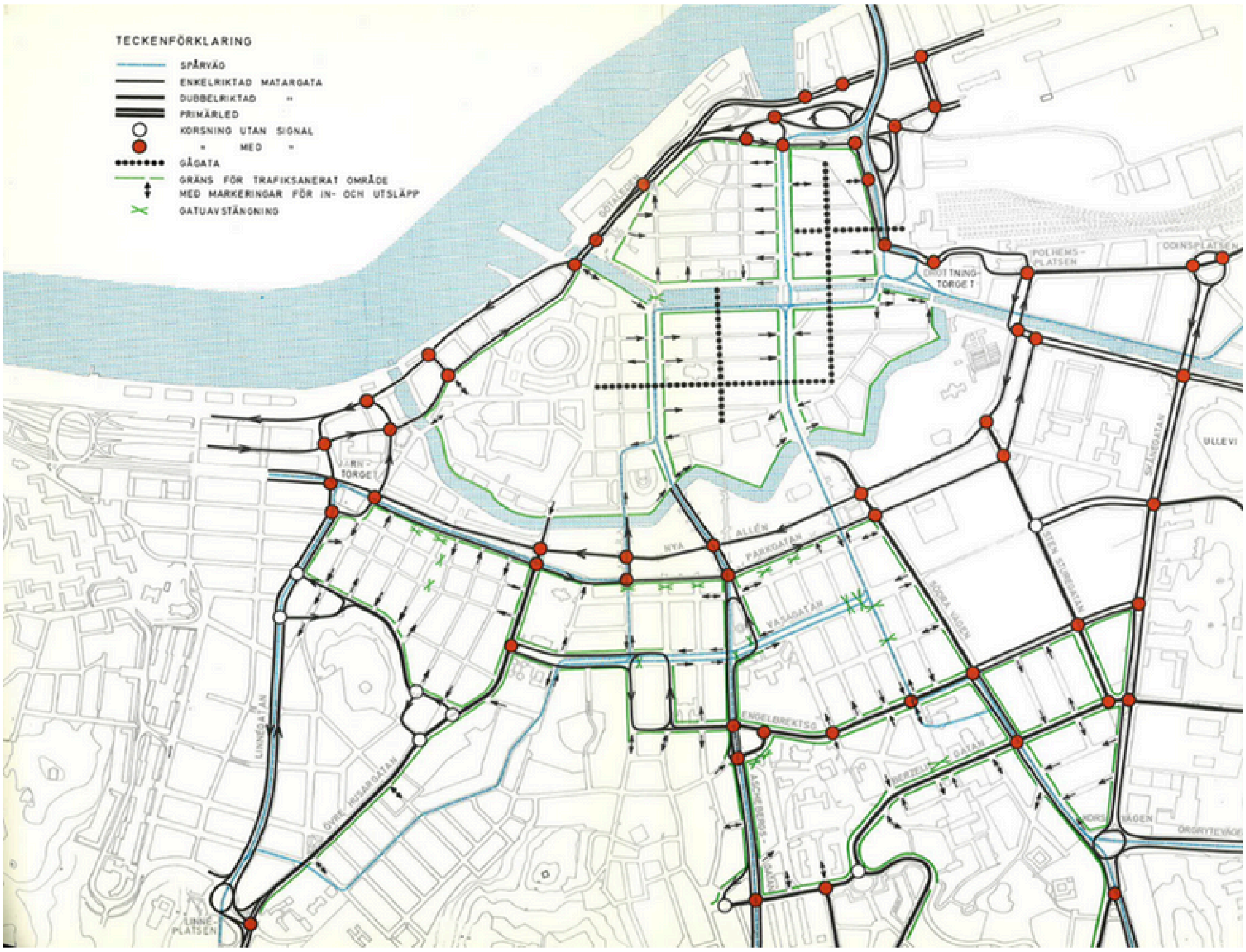

Figure 7. Gothenburg's zones

The city centre was divided into 5 distinguished zones to prevent citizens from going directly from one zone to another and encourage them to use the ring road. At the same time, many streets were pedestrianised and new public transport lines were introduced. In the 1980s, the city continued experimenting with traffic zones, turning the areas south of the city centre, Vasastaden and Kungsportsavenyen, into two new traffic zones. These zones were evaluated by the OECD, showing a return on investment.

In the late 1990s, the city came to a new plan with shared-space streets to prioritise pedestrians, removal of on-street parking, and a new bypass with a road tunnel. A rail tunnel is also currently under construction to complete the road one. In recent years, the city has been evolving, transforming the urban space to adapt to new challenges, such as the increase of e-commerce and deliveries, hybrid working patterns which change commuting habits and the free choice of school.

1.3. Amsterdam

The Amsterdam mobility plan was built in line with the modal split in the city: cycling and walking are the most popular modes for locals, representing 35% and 30% respectively. Car users account for only 20%, and public transport users account for only 15%. This distribution is reversed for the millions of visitors the city welcomes every year (25 million stays counted in 2023). 50% use their cars, 30% use public transport and less than 10% use bikes.

Traffic congestion is most severe in Amsterdam's historic city centre, where research has shown that 40-60% of the traffic is 'through traffic'—those travelling to destinations outside the area. To address this, the city government is taking steps to reduce through-traffic in the city centre while maintaining accessibility for residents, visitors, and suppliers. Measures include relocating heavy traffic to the outskirts of the city and removing 10,000 car parking spots, alongside implementing a Low Emission Zone. This began in 2020 with Euro 4 criteria for diesel cars and camper vans, followed by Euro 6 in 2022, while in 2025, diesel cars will need to be Euro 5. Finally, from 2030, all petrol and diesel vehicles must have zero emissions.

One strategy to ease bike circulation and reduce pollution is redirecting car traffic to the ring road surrounding the city centre. Drivers using shortcuts through residential areas are subject to fines. The city provides a map for residents and visitors to check permissible driving zones based on their vehicle registration number.

These policies are facilitated by two key frameworks that constitute the Amsterdam TCP and that establish the priority routes and areas for cars, public transport, walking and cycling: the Environmental Vision for 2050 and the traffic network framework.

1.4. Stuttgart

The Traffic Circulation Plan in Stuttgart consists of a set of documents and data that contain all information needed to understand the road network, the road classification, the rules & regulations, the policies and the available physical infrastructure and to regulate and manage the multimodal traffic on this road network.

The main incentives for implementing traffic management measures in Stuttgart are the reduction of road crashes, the new city development goals, the renovation of urban quarters, and the optimisation of the traffic flow. Many stakeholders are involved in the traffic management of the city: the traffic authority, the traffic control centre (Integrierte Verkehrsleitzentrale, IVLZ - working as an integrator), the police, the public transport operator, the road operators, the city planning department and the fire department. In order to take the right measures, several elements are considered: traffic data (the number and speed of vehicles, crashes), site visit observations, political decisions, traffic laws and regulations.

For the digital version of the TCP, the city used various tools to add layers of information to the original plan. Firstly, plans are initially created as CAD plans and information is added via geoinformation systems (GIS).

This digital plan can provide e.g. the primary and classified roads, the electric vehicle charging points, and the pedestrian zones. Secondly, Stuttgart uses GIS-Software applications such as 'VIZneo' and 'Digital Traffic Flow Optimisation' (DVFO), which use digital TCPs to fulfil various tasks linked to road-use-permissions and traffic management. Additional digital tools are being created, such as a digital twin on traffic information, and a digital application for the approval of the process for road works.

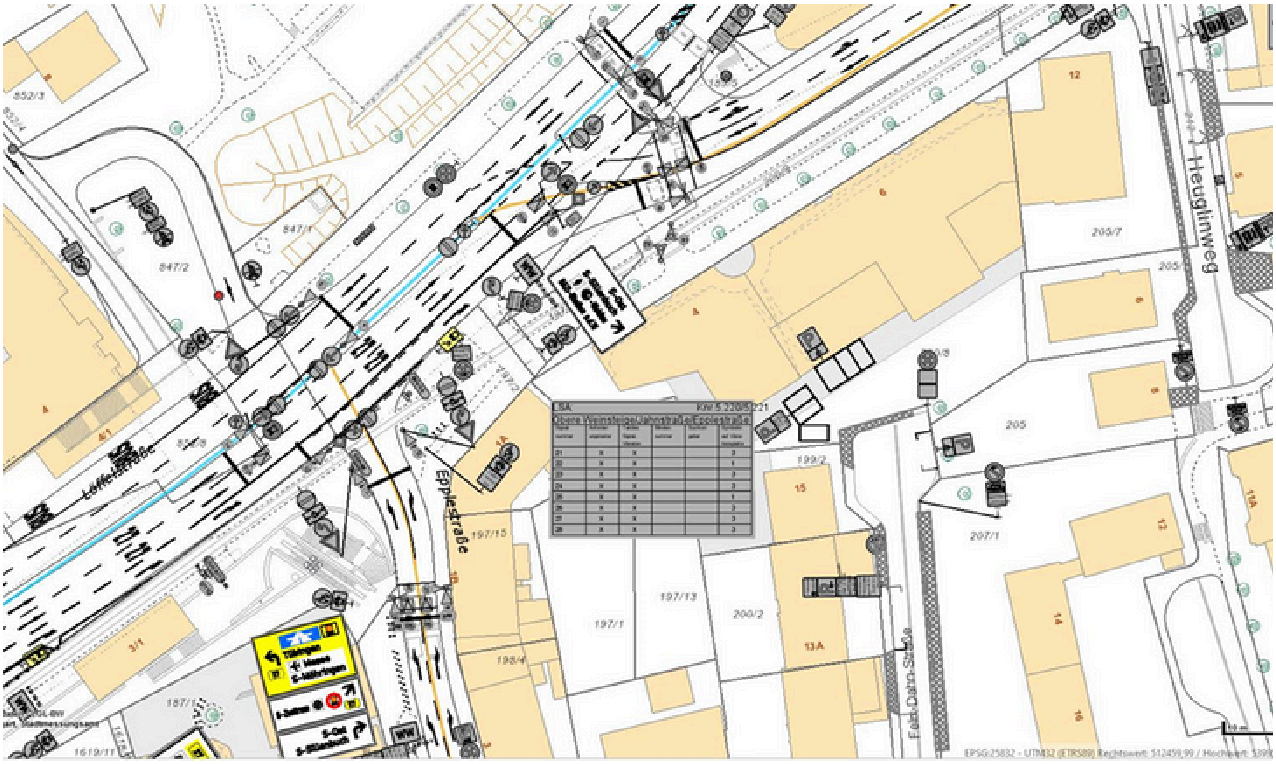

Figure 8. Plan that shows the rules and regulations (e.g. static signs and road markings)

These tools help to simulate and implement traffic management strategies. Different datasets are collected and analysed, such as real-time vehicle data, traffic signal data, environment/weather data, and data on road crashes. This data can be integrated directly into the digital maps and then be made available through national access points. Furthermore, the city produces heat maps for emissions, immissions and traffic.

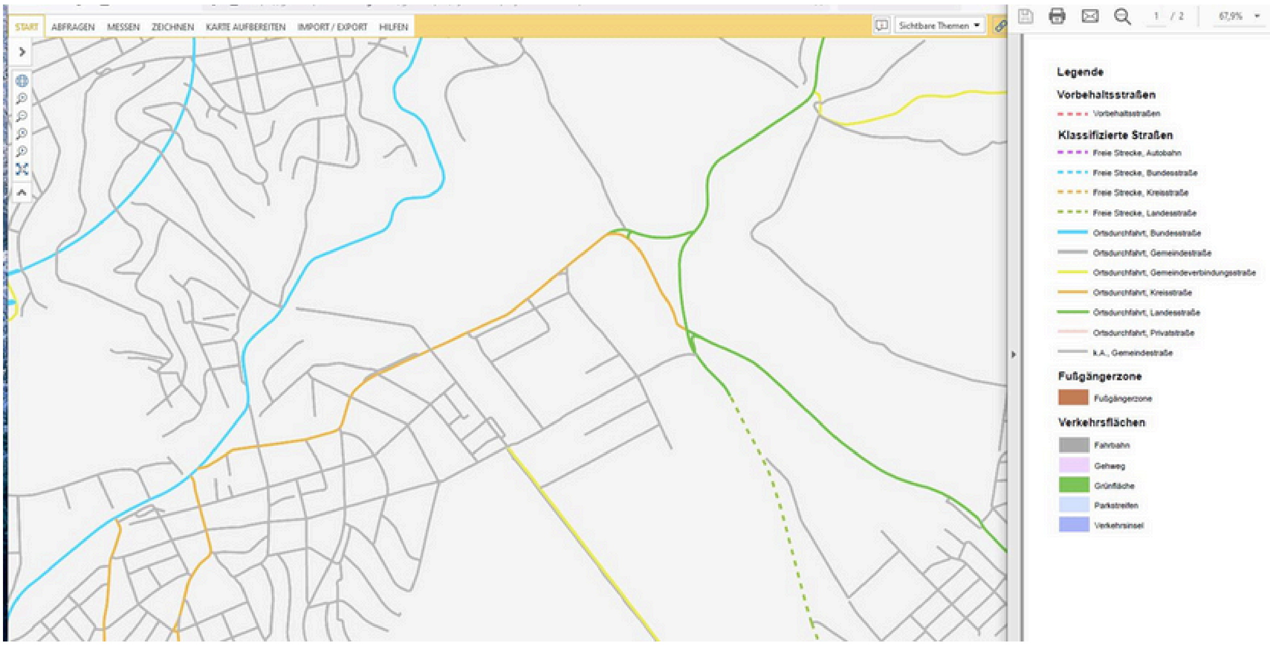

Figure 9. Road classes in Stuttgart

Figure 10. Example of a restricted area (pedestrian area) in Stuttgart

1.5. Helmond and Groningen—Multimodal network framework

The city of Helmond is actively involved in the regional cooperation of local and provincial road operators under the flag of Smartwayz.nl. Within this region, a multimodal network framework was developed and published digitally. The roads were classified along the Dutch approach of 'sustainable safety', which provides a uniform framework for traffic engineers in terms of the appearance, the function and the use of a road type.

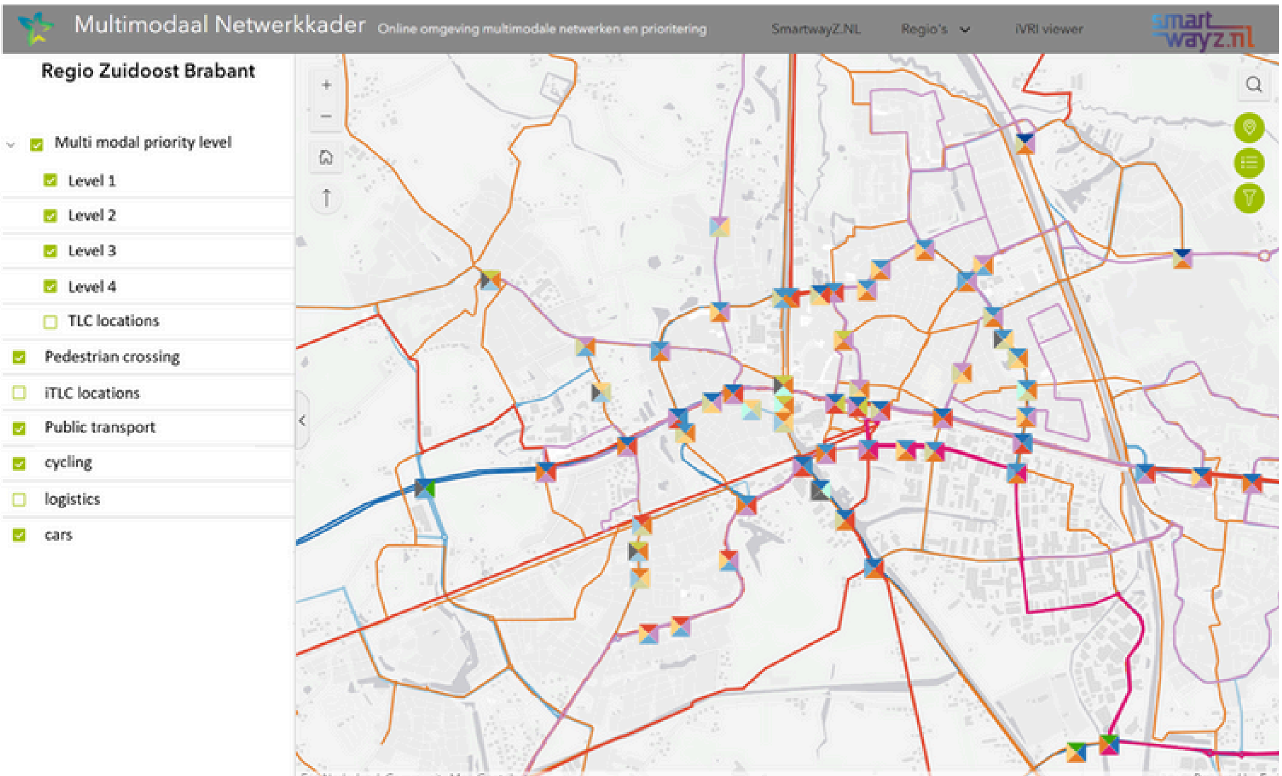

Figure 11. Multimodal network framework, Smart Wayz, province of North Brabant, city of Helmond area

All map layers shown on the map above are available digitally, however not always in a format that can be provided to an NAP yet.

The city of Groningen mapped out the preferred routes for traffic to and from the most important destinations within the city in the Multimodal Network Framework Groningen (2023). These are the routes over which traffic between areas is preferably directed as much as possible. Functional profiles describe, among other things, which type of relationship and which type of user is facilitated. The result is ultimately a multimodal functional map, to have each road section function as described in the function profile. An important part of the MNF is the multimodal priority order.

This order applies when measures are deployed. This priority for walking, cycling and public transport was a political choice and the Traffic Lights Policy Plan (2023) also translated into a new control strategy with shorter waiting times at traffic lights.

The priority to walking, cycling and public transport was a political choice and was in the Traffic Lights Policy Plan (2023) translated into a new control strategy with shorter waiting times at traffic lights.

ANNEX 2. Insights into the RTTI Delegated Regulation

This annex contains a brief introduction to Real-Time Traffic Information services, looking at the service, the regulation, and the policy context.

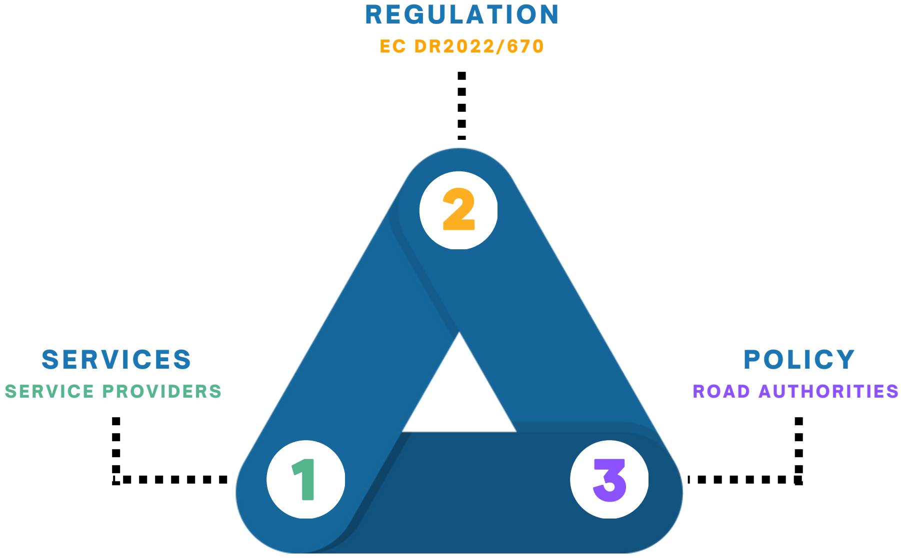

Figure 12. The 3 axis of Real Time Traffic Information

2.1. Real-Time Traffic Information Service

Real-Time Traffic Information (RTTI) refers to the process of collecting, processing, and disseminating up-to-date traffic data to provide real-time information to drivers and transportation management systems. RTTI systems use various data sources, such as sensors, cameras, GPS data, vehicle data and mobile apps, to monitor traffic conditions and generate timely information. Real-time traffic information can include details about traffic congestion, road incidents, construction sites, road crashes, weather conditions and other factors that may affect travel time and route planning.

Such information is typically made available to drivers through various platforms, including navigation systems, mobile applications and variable message signs. RTTI systems have become increasingly important in effectively managing and optimising transportation networks. They contribute to improving and managing traffic flow, reducing harmful emissions and noise pollution and enhancing overall road safety. By providing drivers with real-time information, they enable more informed decision-making, allowing drivers to choose alternative routes, avoid congested areas or adjust their travel plans accordingly.

Additionally, transportation management systems and traffic authorities can utilise RTTI data to monitor and manage traffic flow, optimise signal phase timings and implement effective incident management strategies. This can result in improved traffic management, reduced congestion, lower emissions and noise levels, and enhanced overall efficiency of the transportation network, fostering more sustainable and liveable city environments. It is worth mentioning that specific implementations and the overall availability of RTTI can vary by region and country. Different transportation authorities, service providers, and navigation systems may have their own methods and standards of collecting and disseminating real-time traffic information.

2.2. Real Time Traffic Information Regulation DR 2022/670 by European Commission

To promote the sharing of available data for Real-Time Traffic Information, while safeguarding fair and reasonable conditions, the European Commission recently updated its RTTI delegated Regulation. This update introduces new data types and significantly broadens the geographical scope. Through this regulation, the Commission aims to improve the provision of reliable traffic information across Europe.

Data holders keep and maintain certain types of data. The Real-Time Traffic Information (RTTI) Delegated Regulation focuses, inter alia, on these data holders, affecting road operators and authorities. While initially appearing as an additional workload and responsibility for public authorities, RTTI can also support the sharing of data that helps articulate local policies. Consequently, data stewardship emerges as a critical tool in helping road authorities attain their policy goals.

The RTTI 2022/670 is a Delegated Regulation under the ITS Directive, which grants the European Commission the authority to establish detailed specifications through delegated regulations:

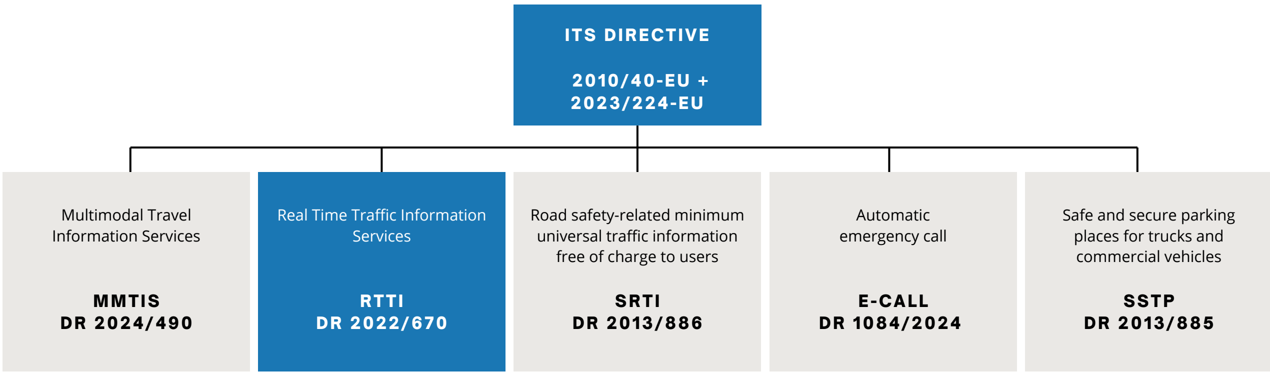

Figure 13. Overview of the Specifications under the ITS Directive - (Original graph provided by CROW and re-elaborated by POLIS)

The requested datatypes in the RTTI DR annex are based on 4 data types:

- Data on infrastructure—about the physical available network
- Data on regulations and restrictions—about the policy-defined use of the network
- Data on the state of the network—about planned and unplanned disruptions in the network
- Data on the real-time use of the network—about the usage and capacities of the network

Based on these four layers, certain types of data are listed. Road authorities should publish this data when it already exists in a machine-readable format, although the DR does not impose that still undigitised data should be digitalised more actively. The specified data types can be found in the RTTI delegated Regulation annex on pages 15 and 16. If a road authority has a data set, its availability can be published on a designated national access point for mobility data (NAP).

Please find additional information on the CROW website/RTTI.

2.3. Real-Time Traffic Information and Policy

The revised RTTI delegated act obliges service providers to incorporate policy indicators from road authorities when these are available. In the RTTI (18), it is pointed out that real-time traffic information services need to be accurate in terms of reliability and timeliness to provide the best possible information to end users. To improve the benefits for road users in terms of increased road safety and less traffic congestion, these services should also reflect the priorities of road authorities. This alignment can be achieved by incorporating digitally accessible traffic circulation plans.

By RTTI (20), these specifications do not oblige road authorities or road operators to define or implement digitised traffic circulation plans and data on temporary traffic management measures. Moreover, they do not oblige service providers to share any of their data with other service providers. Service providers are free to conclude commercial agreements between themselves for the re-use of relevant data.

2.4. Data types in RTTI DR 2022/670 related to traffic management

In the following page, we collected all data types that are included in the annex of the RTTI (**highlighted** are the data types relevant to Traffic Management):

1 TYPES OF DATA ON INFRASTRUCTURE

a) road network links and their physical attributes:
i. geometry; iii. number of lanes; v. junctions.
ii. road width; iv. gradients;

b) **road classification**
c) location of tolling stations
d) location of service areas and rest areas
e) location of recharging points for electric vehicles and the conditions for their use
f) location of compressed natural gas, liquefied natural gas, liquefied petroleum gas stations
g) location of refuelling points and stations for all other fuel types
h) location of delivery areas

2 CRUCIAL TYPES OF DATA ON REGULATIONS AND RESTRICTIONS

a) static and dynamic traffic regulations, where applicable:
i. access conditions for tunnels;
ii. access conditions for bridges;
iii. permanent access restrictions;
iv. speed limits;
v. freight delivery regulations;
vi. overtaking bans on heavy good vehicles;
vii. weight/length/width/height restrictions;
viii. one-way streets;
ix. boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones;
x. directions of travel on reversible lanes.

b. **traffic circulation plans**

3 OTHER TYPES OF DATA ON REGULATIONS AND RESTRICTIONS

a) the locations and identification of traffic signs reflecting traffic regulations and identifying dangers:
i. access conditions for tunnels;
ii. access conditions for bridges;
iii. permanent access restrictions;
iv. other traffic signs reflecting traffic regulations;
25.4.2022 EN Official Journal of the European Union L 122/15
b) static and dynamic traffic regulations, where applicable, other than traffic regulations referred to in point (2)
c) identification of tolled roads, applicable fixed user charges and available payment methods (including retail channels and fulfilment methods);
d) variable road user charges and available payment methods, including retail channels and fulfilment methods

4 CRUCIAL TYPES OF DATA ON THE STATE OF THE NETWORK

a) road closures
b) lane closures
c) roadworks
d) **temporary traffic management measures**

5 OTHER TYPES OF DATA ON THE STATE OF THE NETWORK

a) bridge closures
b) accidents and incidents
c) poor road conditions
d) weather conditions affecting road surface and visibility

6 TYPES OF DATA ON THE REAL-TIME USE OF THE NETWORK

a) **traffic volume**
b) **traffic speed**
c) **location and length of traffic queues**
d) **travel times**
e) waiting time at border crossings
f) availability of delivery areas
g) availability of recharging points and stations for electric vehicles
h) availability of refuelling points and stations for alternative fuel types
i) price of ad hoc recharging/refuelling

Figure 14. Data items in the Annex of the RTTI DA (Original graph by CROW, re-elaborated by POLIS)

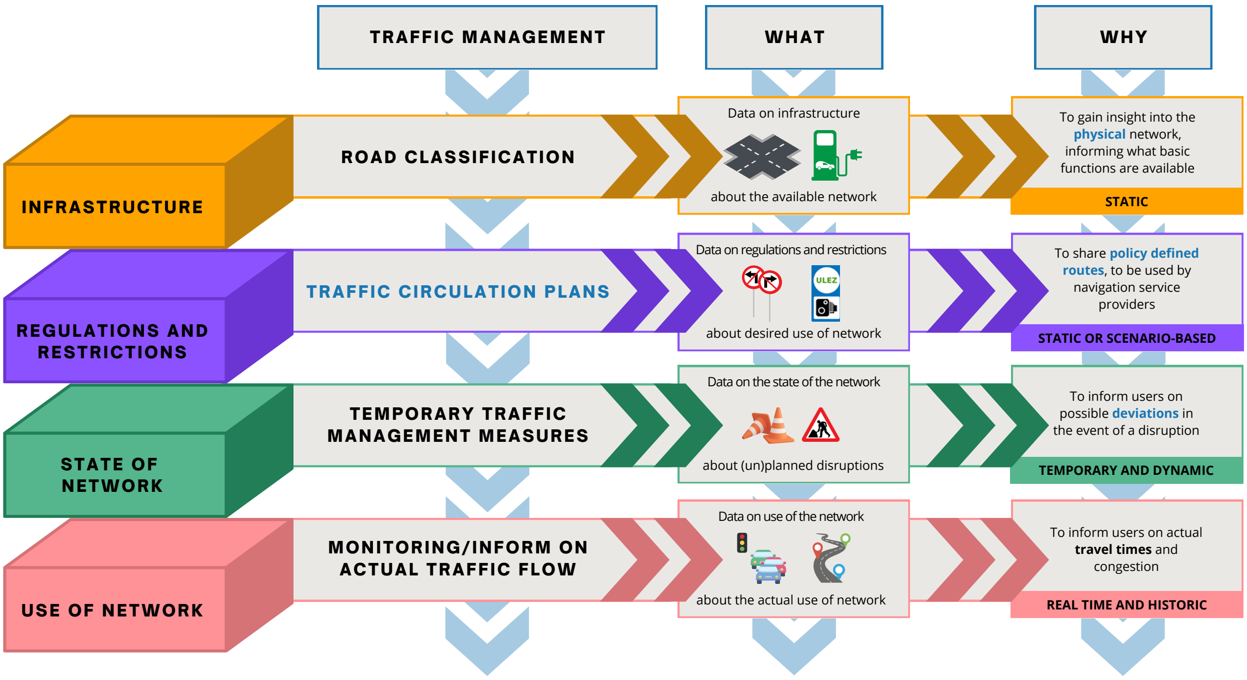

Figure 15. Traffic management data items in the RTTI DA (Original graph by CROW, re-elaborated by POLIS)

When focusing on traffic management, each of the four layers, mentioned in Figure 15, has at least one data type that can be linked to traffic management issues. Most of these data items are measured and assessed on an operational level (monitoring) and a tactical level (reporting), both of which are linked to mobility policies (strategic level).

The infrastructure-related data types (1) contain, among others, data on **road classification**. This involves static information about the physical network, describing the physical and functional attributes of road segments and intersections, such as width, number of lanes, slope, geographical location, and driving direction. Traditional road classification frameworks have typically centred around motorised traffic, emphasising car-centric Traffic Management and Traffic Circulation Plans. However, alternative systems that integrate multimodal road functions align more effectively with multimodal traffic management.

Crucial data types that concern regulations and restrictions (2) can be used by traffic managers to communicate **traffic circulation plans**; This data is crucial to articulate policy-defined routing, facilitating navigation service providers to offer routes based on either, static information or dynamic, scenario-based routing, such as varying routing options depending on the time of day.

Crucial data types on the state of the network (4), can provide information about **temporary traffic management measures**. These measures aim to inform road users about alternative routes in the event of an unplanned disruption, like a traffic accident, or a planned event, such as a football match.

Finally, data on the use of the network (6) is associated with data items such as **traffic volumes, traffic speeds, location and length of traffic queues and travel times**, enabling providers to inform road users about current travel times and congestion, and to monitor network performance (also historical).

Acknowledgements

'Digitising Traffic Circulation Plans: The Road Ahead' is a position paper elaborated by POLIS, its members, and CROW.

It aims to enhance our understanding of TCPs and presents a road authority's vision for their usage, setting the stage for further discussions within NAPCORE.

For more information on the POLIS Traffic Efficiency Working Group, click here.
For more information on POLIS, click here.
For more information on CROW, click here.

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