ENABLING VEHICLE INTERACTION WITH TRAFFIC MANAGEMENT

Taskforce on Micromobility and Network Management

Endreport

September 2021

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Executive Summary

The TM2.0 taskforce on Micromobility and Network management has researched the alignment of emerging micromobility services and the domain of Traffic management. In this report the taskforce shows the variety in definitions and approaches in the domain of micromobility, and identifies five main themes of interest where a true win-win between these two domains could be further explored. These themes are (1) Implementing micromobility modes in order to increase the impact of UVAR schemes and policies, (2) Micromobility as way to increase mobility equality, (3) using non-financial incentives to promote the use of micromobility modes in general, and further exploring the potential of micromobility services for traffic management in the fields of (4) effective and balanced use of public space and (5) additional insights from data. Results show that these five themes show clear potential for achieving a win-win ecosystem, however also show that additional work is needed to find that balance with regard to these themes.

1. Introduction

This report describes the process and findings by the TM2.0 taskforce on Micromobility and Network Management as researching the goals and topics as set out by the ERTICO TM2.0 innovation platform Steeringbody. The following chapters will describe the relevance and scoping of the taskforce, the working process and the findings. From these findings, the conclusions are extracted and elements for further research are defined.

TM 2.0

The ERTICO Traffic Management 2.0 innovation platform consists of over 40 public and private European ITS stakeholders, with a joint mission to extend the mobility domain state of the art towards true interactive traffic management. This vision on true interactive traffic management ("Traffic management 2.0") is founded on the belief that digitalisation and increased connectivity capabilities will enable direct interaction between traffic management stakeholders and mobility end-users, and therefore more dynamic, tailor made and interactive traffic management schemes and operations. From this joint starting point the platform extends its vision, knowledge and experience through a series of vision development and researching taskforces as well as R&D innovation projects.

Task force on Micromobility and Network Management

Micromobility has seen a steady growth in the last couple of years with a sharp rise last year during the Covid-19 pandemic. It can no longer be defined as a temporary and non-impactful phenomenon and there is an important need for it to be considered into the wider mobility framework. Understanding where micromobility stands within traffic management will allow us to plan our traffic and mobility systems better. Data on micromobility (use and impact) will help us contribute towards ensuring safer road networks. Ever since its introduction, the public as well as mobility actors have had mixed feelings towards micromobility. To some it is a revolutionary way of transport that allows convenient and quick rides which also bring a joyfull and healthy trip every time they are used. Others question the safety and sustainability of these tiny vehicles as well as their wider impact on the mobility system.

It is speculated that micromobility is only at the beginning of its exponential growth. Through continuous innovation, micromobility is expected to become more sustainable and adapt improved designs and sharing models. There are however still many unknown aspects of micromobility that require significant investigation. The regulations around micromobility and its influence on traffic management and road safety being only a few of them.

Upon these findings and expectations the TM2.0 Steeringbody decided to initiate a taskforce on this topic. This taskforce had the goals to research how micromobility affects traffic management and how it can best be aligned and/or managed within traffic management and its physical and digital infrastructures. The taskforce has been started in march 2021 and concluded in July 2021, sharing its research results at the ITS congress 2021. The taskforce consisted of the members Jop Spoelstra [Technolution, Chair], Sascha Westermann [City of Hamburg], Gerhard Gruber [Austriatech], Anna Antonakopoulou [ICCS], and Pedro Barradas [Armis].

2. Working process

The TM2.0 taskforce on micromobility and network management took a three-step approach. First, through a series of (virtual) roundtables we discussed the scoping and definition of micromobility and its relation with the domain of TM2.0. Second, we discussed the several subjects that we experienced or forsee in either becoming an obstacle or being a potential synergy in aligning TM2.0 and micromobility, and came to a list of five themes. Third, we had dedicated meetings on each theme to research the theme, discuss it within the taskforce and draw conclusions. According to these steps, the following chapter will describe the taskforce findings.

3. Taskforce findings

This chapter will describe the results that were reached by the taskforce in our step by step approach.

Considerations for taskforce scoping regarding Micromobility

In line with the wide variety of micro mobility vehicles and travel modes that hit European streets lately, the domain of micromobility knows many forms and definitions. In order to scope the work of this taskforce and identify the main challenges faced in the alignment of the TM2.0 and micro mobility schemes and operations, the taskforce has considered the following previous considerations and definitions in coming to a joint scoping decision.

The MaaS alliance, a public-private partnership for Mobility as a Service schemes, approaches the domain of micromobility in terms of which size and characteristics of vehicles are considered:

> *"Micro-mobility refers to personal vehicles that can carry one or two passengers. Bicycles are probably the most common example. Other micro-mobility vehicles include small electric cars, electric bicycles, all sorts of scooters – generally small powered micro-mobility vehicles run on charged batteries."* (MaaS Allience, 2018)

EIT Urban Mobility, the Mobility innovation accelerator of the European Institute of Innovation and Technology (EIT) has performed further research in what e-micromobility entails and how the concept is seen from different stakeholders in the (urban) mobility domain. They consider how definitions should be approached based on the perspective from which the definition is required: Either from a Legistlation, regulation or commercial perspective, or from an Urban Planning perspective. From the viewpoint of the TM2.0 Micromobility platform both perspectives will be relevant. The considerations for a Micromobility definition by EIT Urban Mobility are described as following:

Legislation, regulations, commercial perspective

> *'When considering micromobility from the regulatory perspective, it must be clear, measurable, and enforceable. The framework should cover most of the devices and services, which are available in the market. A commercial perspective is quite the same as the regulatory 7 perspective, since manufacturers and service providers (ideally) would like to produce and operate legally. Two concerns should be considered: Devices. a legislative definition should and must describe what is a micromobile with given range of size, weight, driving force, etc. Services: a legislative definition should describe, who is a micromobility service provider.'* (EIT Urban Mobility, 2020)

Urban Planning perspective:

> *'For urban planners, micromobility definition should be rather fuzzy or intangible and must be inclusive for unknown future solutions. In this way, visions and strategies can play their part'* (EIT Urban Mobility, 2020)

As part of the EIT Urban Mobility report, a survey was held among 20 participants from the e-micromobility MOBY project, which resulted in a ranking of six vehicle characteristics that should be included in a micromobility definition. In order from most important to least important these vehicle characteristics are: Size, Weight, Capacity, Speed, Range and Number of wheels. (EIT Urban Mobility, 2020)

Moreover, both the SAE and the International Transport Forum have attempted to define micromobility based on the vehicles that were seen as within and outside the definition with the main difference of whether the vehicles are powered or not.

> *The SAE International set of terminology for describing micromobility vehicles is: (1) Fully or partially powered, (2) Curbweight up to and including 500 lb (277 Kg) and (3) Topspeed up to 30mph (48 km/h)* (SAE International, 2019)

> *The International Transport Forum define micromobilty vehicles as: "Microvehicles with a mass of no more than 350 KG and a design speed no higher than 45 km/h".* (International Transport Forum, 2020)

Given the background of the TM2.0 innovation platform, the related taskforces are focussing on how the domain of next generation traffic and mobility management relate to new emerging paradigms, in the case of this taskforce the paradigm of micromobility. This brings us to a natural focus on which parts of the relation between these domains show potential challenges which need additional work to solve or potential synergies from which both domains can profit. Consequentially the approach was decided to primarily align with the more "fuzzy, intangible and inclusive" approach for Urban Planning in order to include unknown future solutions as well as retaining our high-level view as taskforce conclusions should be applicable European-wide. The main considerations for its focus for the taskforce therefore are:

- Micromobility forms that can be directly influenced and promoted through stakeholders involved in the TM2.0 ecosystem. This primarily means that this taskforces focuses on commercial MaaS-like propositions for Micromobility vehicles and services in contrast to privately owned micromobility vehicles by citizens.
- Micromobility forms that can be directly influenced and promoted through the use of services and assets available in the TM2.0 ecosytem. This mainly excludes active mobility modes that do not require dedicated mobility management such as walking, skating, skateboarding, etc.

Main themes of interest

Now that there is a joint understanding on what our scope of interest is, a series of roundtables within the taskforce has brought up a list of potential synergies and/or challenges that we either experience or forsee in the integration of the TM2.0 and the Micromobility paradigms. These different topics are shortly listed below and consequentially discussed one by one.

Urban Vehicle Access Regulations. A strong development in the field of TM2.0 is the increase in Urban Vehicle Access Regulation (UVAR) schemes that are considered and/or implemented within cities worldwide. These UVARs require a careful balance for local authorities for which micromobility could be a valuable asset: How could we restrict access to a specific urban zone for specific vehicles that are unwanted there whilst still retaining the overall accessibility and attractiveness of the zone for people and goods? Maintaining this balance means having appropriate alternative mobility modes available, and for this micromobility could be an important asset.

Mobility Equality and 'underserved' citizens. A continuing important theme for the TM2.0 domain remains to provide mobility opportunities for all societal groups. This is not always an easy challenge, as different modes have different effects in terms of equality. For example, car-based mobility provide a large geographical coverage but also requires a level of income to be able to afford a car. In contrast, public transport services are more affordable to citizens, however are not always economically viable to provide a broad geographical coverage to service all citizens. On the other hand, Micromobility MaaS services are often described as important asset in improving the mobility equality for cities and for 'filling the gap'. These offerings could indeed provide an 'extention' to the mobility ecosystem, and improving coverage without increasing costs for the end-user. Then again, in practice some examples are known in which also Micromobility services cope with equality challenges and gaps.

Non-financial incentives. When discussing promoting certain 'desired' mobility modes over other 'less- or undesired' modes, it often boils down to financial schemes and incentives. However this shows to be an challenging strategy as long as the societal costs of several of those 'undesired' modes are not calculated into the price of the end-user. Therefore, we discuss ways of using non-financial incentives to help micromobility modes 'compete' with modes that are less desired.

Network traffic management: Utilization of Public Space. One of the main pillars of traffic and mobility management is the allocation of often limited public space to mobility infrastructure as well as other public space functions. This is one of the main challenges related to car-centric urban mobility, and one of the largest sellingpoints for micromobility. Therefore this relation is further researched and discussed.

Network traffic management: Insights and data-sharing. Given the role and responsibility of local governments in shaping and balancing the local mobility ecosystem, as well as the new public-private collaborations that emerge in the context of MaaS, there is a strong need to be able to share data between micro mobility service providers, local authorities and end-users. This requires interoperability and standardisation, and the barriers and opportunities for this are discussed further within the taskforce.

Urban Vehicle Access Regulation

Within the urban mobility domain the concept of an Urban Vehicle Access Regulation (UVAR) scheme is becoming an increasingly popular method of managing vehicle flows through urban areas. These UVARs are a form of traffic management that regulates access in specific urban locations according to vehicle type, age, emissions category, etc. (ELTIS, 2020). From the eight most common UVAR policy objectives according to Polis (Polis, 2019), the taskforce has concluded that for six of them the alignment with micromobility services will provide a further push to achieve these objectives. These six are: *air quality improvement, congestion reduction, urban landscape preservation, climate change mitigation, noise reduction and redistribution of road space*. The remaining two, roadsafety and raising

revenues might also be achieved, however this strongly depends on the form of implementation. With regard to the three main risks that UVAR implementation might bring to cities according to the H2020 MOMENTUM project (MOMENTUM, 2020) two of three are found to be (partly) mitigated by aligning a UVAR implementation with micromobility offerings. These two are: *a UVAR being more restrictive to low-income population and small businesses*, and *affecting the commute of those outside of the UVAR whilst the external benefits are enjoyed by people living inside of the UVAR*. In general, for all access regulations for cities, the success lies in finding the right balance between limiting access for modes/vehicles that are undesired within the city and remaining accessible, open an attractive as a city for all other modes of transport. In finding this balance, the alignment and potential of micromobility could provide a mutual benefit.

When focusing on how the alignment of Micromobility services with UVAR implementations could strengthen the UVAR policy objectives, the taskforces forsees several opportunities. First, given the stage in which the micromobility currently is in with high levels of innovation and differentiations, micromobility could serve as a valuable sandbox to new approaches in finding the right balance between restriction and accessibility. Given that micromobility services can take different forms (stationbased vs. freefloating and uniform vehicles vs. a range of vehicle options) and these services prove to be dynamic and adaptable to the situation, these services could be aligned with UVAR induced mobility demand. This could be reached through a process of step by step trials in the local context, in close collaboration with citizens and mobility users. Moreover, given the tendency from micromobility services to closely monitor mobility demand/supply depending on place and time, these data insights could also help in understanding which effects UVAR implementations bring that would otherwise be unknown. And lastly, adapting the pricing scheme and trip fare of micromobility services could also make first/last-mile trips from a public carpark of using public transport more attractive, both of which will contribute to keeping undesired vehicles outside of the UVAR zone.

With regard to mitigating UVAR negative side-effects, the aspect of mobility equality will be discussed in the next chapter.

Mobility equality and 'underserved' citizens

Equal access to mobility for all is widely seen as a key factor in increasing social equality and inclusivity. It is no surprise that this topic is a dominant consideration in both the TM2.0 as the micromobility domain. The H2020 Inclusion project defines four main mobility factors that contribute to increased equality. The equal and inclusive mobility should be Accessible, Affordable, Convenient and Efficient (INCLUSION, 2020). In many ways, micromobility shows this potential, as most services are on pay-for-use bases, and these services are (better then public transport) able to service 'lower-demand' zones. With many micromobility schemes known the taskforce, these four aspects are also shown to be key in the 'salespitch' by micromobility services as well as explanations from local authorities on why MaaS and Micromobility services will benefit the city. As mentioned earlier, these micromobility offerings are seen as geographical extensions to public transport services (accessibility), are seen as requiring less capital from users (affordability), and diversify the range of vehicle options for the end user (convenience). However, over time multiple cities are confronted with the development that these micromobility services are constantly re-evaluating their businesscase based on their own data, often resulting in a reduction of availability in weak economic areas, and focus on high-density city centres and high-income neighbourhoods. From the point of view of the micromobility businesscase this is not surprising, as these location show not to be profitable, and the initial agreements with the

local authorities do not incentivise or demand specific service levels in certain neighbourhoods. From the point of view of the local authority and the local citizens however, this is a serious issue, as often this results in the micromobility services servicing the same locations as public transport, which (1) does not improve equality and inclusivity and (2) induces competition between the micromobility and public transport modes. Moreover, as the main method of payment for these services often is based on a creditcard, the financial barriers related to usage of a creditcard are particularly impacting potential users with a lower income level.

When we focus on how to support the potential of micromobility with regard to improving equality, the taskforce notes the following points. First, effectively aligning public transport and micromobility services is key. Both modes are affordable in most cases, they are relatively convenient and efficient, and when implemented in a good way can extend eachothers geographical scope (with micromobility providing a solution for small/medium trips, and public transport providing a solution for most medium/long trips). This means avoiding competition between these modes by use of active collaboration and well-designed service level agreements, as well as aligning fare policies (either through integrated trip fares, or price reductions when continuing a trip in the other mode). Second, service level agreements between micromobility services and local governments should be designed in such a way that they allow for a healthy businesscase for the micromobility service overall, whilst maintaining the obligation to continue services in economically weaker neighbourhoods as well as more rural neighbourhoods that are not sufficiently serviced by public transport. By keeping close collaboration, sharing data on mobility use and looking for new financing schemes from both sides, this is shown to be effective. And third, allowing a wider range of payment methods could reduce barriers for potential micromobility users.

Non-financial incentives

When designing policy for balancing the mobility scheme, the use of financial incentives to make one modality more attractive then the other is a much used method. This could certainly be the case with micromobility as well, where trip fares could be dynamic based on income, age, first/last-mile modality, time of day, etc. However, as the full societal cost of 'competing' modalities is most often not fully reflected in the trip fare, this competition has the tendency to be false. Moreover, making modalities that are less-desired more expensive provides an extra barrier to low-income citizens and will not affect higher income citizens.

For these reasons it makes sense to focus on the use of non-financial incentives that might make micromobility more attractive. From the taskforce roundtable the following strategies are raised. The most prominent strategy would be to focus on the 15-minute city paradigm, which leads to infrastructure being designed in such a way that most daily urban trips are short, that routes for active and micromobility often are faster then by car, and that this incentivises micro mobility (both privately owned and commercially operated) over other modalities. Moreover, in the category of indirect financial incentives, the use of reward schemes for use of micromobility services would highten the use for regular users, and fare discounts in combination with parking a car in certain carparks and starting/ending trips near public transport stations and mobility hubs would nudge towards more impactful use of the potential of micromobility.

Network traffic management: Utilization of public space

Another main pillar of Network traffic management is optimal utilization of roadcapacity, as constantly balancing of mobility (and space) demand with the available roadcapacity (and roadspace) is a main point of interest in the field. In the wider perspective of urban mobility management, not only roadcapacity is often limited to (peak) demand, but the same holds for public space in general (squares, curbs, loadingbays, parkingspaces, etc.). The use of micromobility has potential for both balancing demand for roadcapacity and for public space in general, as vehicles are smaller in size, are more dynamic both when moving and when parked, and can easily adapt to changing demand by changing the supply.

The concept of urban topology is central here, and goes beyond the tactical and operational effects of network traffic management. This involved longer term consideration of how local topology could solve local challenges, and how adjustments of infrastructure priorities induces other forms of mobility. In the shorter term, mobility management measures and related prioritization could have concrete impact on which mode is found to be more beneficial in local context. The several opportunities as identified by the taskforce are as follows. First, by incorporating micromobility as a serious aspect in differentiated traffic policy, local authorities are able to align active and micromobility modes with prioritizations and decisions in all related aspects such as infrastructure planning, mobility tenders, financial incentivation, alignment with public transport, etc. This means a transition from more car-centric mobility thinking towards concepts such as sharing space, ad policy differentiation per mode and per speed. Especially the alignment with public transport offerings is found to be a potential large win-win-win for all involved: authorities, service providers and end-users. Moreover, through datasharing with micromobility service providers authorities can better sense, predict and guide this mode across the infrastructure in different ways. This is further elaborated in the next chapter. Lastly, effective offerings if micromobility services can help absorb both short-term peak demand (rushours, events, etc) as well as longer-term peak demands (roadworks, roadclosures, etc.) as these services are well capable of adjusting according to real-time demand.

Overall, with the diversity in forms that micromobility services can take, there are a lot of buttons to turn related to effective implementation of these service and its impact on public space use. With regards to the space that these modes ‘take’, one could differentiate between freefloating vs station-based services, between where vehicles park and where they drive, where exactly these services are provided (fringe or central), etc. With regard to the space that these services might ‘enable’ one could think of potential reduction in required space for parking, as well as improved accessibility of low-mobility-demand neighbourhoods and more rural areas.

Network traffic management: Insights and data sharing

As mentioned earlier, the implementation of micromobility services in a region could provide additional insights into infrastructure use and mobility dynamics, however also call for close, dynamic and almost real-time collaboration between authorities and micromobility service providers in order to reduce negative impacts and retain a balanced and equal mobility scheme. Both these insights as well as the close collaboration calls for standardisation of sharing of data, for which several initiatives are known to the taskforce. For example, several of these opportunities are already addressed within the European framework of the ITS directive, the delegated act on static and dynamic data as well as the role of National Access Points (NAPs) in EU member states in terms of data provisioning. The taskforce distinct the high-level information-requirement per stakeholder group as follows:

Information need for Mobility manager / local authority:

- (aggregated/historic) data on mobility use for effective mobility infrastructure and public space design
- Understand the demand and use of micromobility services in public space (both driving and parking).
- Monitor 'commercial use' of public infrastructure and agreed upon KPI's in the service pevel agreement (parking locations, mobility equality, etc.)

Information need for the Micromobility Service Operator:

- Close cooperation and interaction with mobility manager in order to see how local policies as well as the businesscase of the service operator could best be aligned
- Sharing data based on contractual agreements with the local authority on (aggregated) use, parking, etc.
- Reliable information on local mobility policies to be able to best inform their end-users through their own platform.

Information needed by end-users and citizens

- Service related information (availability, pricing, subscription, rules, etc.)
- Local mobility and parking policies (speed limits, roaduse, safety precautions, etc.)
- Information on alternative modes to make the best fit-for-purpose decision
- Ways to provide feedback, complaints, enforcement with regard to parking, availability, etc.

When looking into known micromobility services, the information to be provided to the end-users and citizens often is taken care of through the service app, the service platform, or a governmental portal. With regard to datasharing between local authorities and micromobility service operators there is a strong requirement for standardisation, as only using data standards allow for scalability and interoperability and mulri-partner collaboration for all parties involved. The taskforce destincts several standardisation initiatives that have gotten international traction.

First, the SAE standards J3194 (Taxonomy and classification of powered micromobility vehicles) as well as the standard J3163 (Taxonomy and classification of shared mobility modes) provide a useful framework for both policymakers and micromobility service providers to differentiate mobility policies based on (1) vehicle type and (2) Micromobility service mode and model (given the diversity in which these services can be provided). By making use of these two standards mutual understanding can be a startingpoint to design scalable mobility policies as well as services that can be offered internationally.

Moreover, the standards General Bikeshare Feed Specification (GBFS) (NABSA, 2021) and its follow-up standard Mobility Data Spefication (MDS) (Open Mobility Foundation, 2021) show a data-protocol in which information could be shared on all required information. Especially the MDS standard shows potential for the information requirements as mentioned above. This standard is a set of API's in which data can be shared on a wide range of mobility services and modalities, and an overview of datafields is shown in the figure below. The standard distinct three main API categories: The provider, the policy, and the agency. The provider category allows private mobility companies to report data to cities on the number, location, status and ride history of devices in use. The policy category allows authorities to set rules for how and where different vehicles can operate, how many can operate, and other high-level policy initiatives and frameworks. The agency category allows for real-time mutual updates and collaboration between authorities and providers when complex city transportation problems demand dynamic solutions.

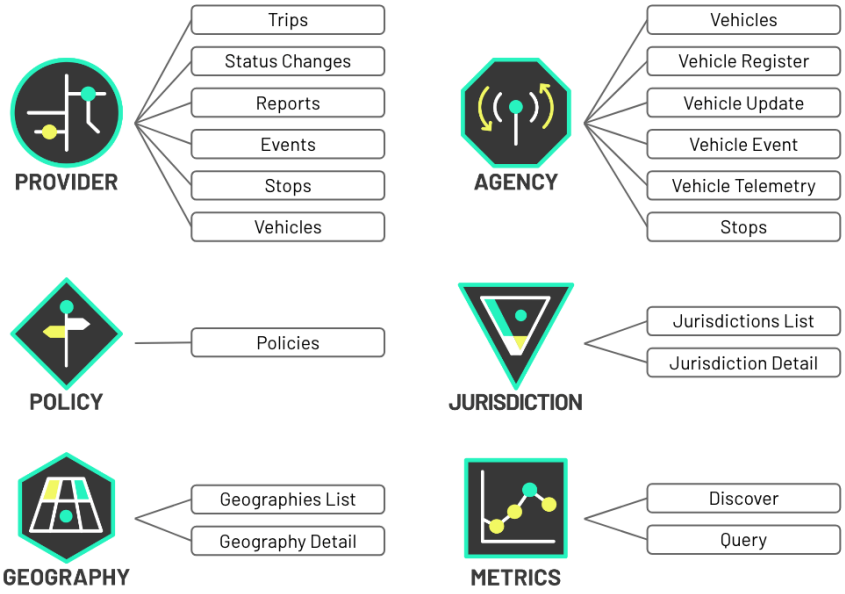

Figure 1: Overview of MDS API's (Open Mobility Foundation, 2021)

The MDS standard will surely not be the only standard available, as other initiatives have also been started within Europe such as the City Data Standard – Mobility (CDS-M) and others. These developments should be followed by the ecosystem and used/enforced when starting collaborations and mobility tenders.

4. Conclusions and implications

The work of the TM2.0 taskforce on micromobility and network management has lead to a range of insights on how the domain of (urban) micromobility and network management could naturally align, and which themes require additional work and effort in order to reach a true win-win dynamic between these two. The main themes in which the taskforce sees particular potential to achieve a win-win but which might require additional work and consideration are the field of Urban Vehicle Access Regulation, Mobility equality, non-financial incentives, utilization of public space and Insights from data. Especially in the theme of mobility equality more emphasis should be placed on finding the

best alignment between micromobility services and public transport and on how to truly enable low-barrier use of these services for all citizens.

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