Soft Measures with Strong Impact: Mobility Management for Sustainable Urban Transition

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Abstract. In the context of growing environmental concerns and urban mobility challenges, mobility management has emerged as a key regulatory tool for promoting sustainable mobility. As a synthesis of recent research projects in this field, the present study highlights the interaction between mobility management, the reallocation of public spaces, and the appeal of sustainable modes of transport, particularly public transport. These domains of mobility management tools and measures are derived from the matrix, which was synthesised in parallel with the standard categorisation of *push* and *pull measures*. The key lesson learnt is that the integration of these dimensions within mobility management strategies enables a deeper and more general understanding of travel behaviour. By combining infrastructural investment with soft measures, mobility management can ensure that urban mobility systems and networks become not only more efficient and make cities more liveable, inclusive, and resilient.

Keywords: mobility management · sustainable transport · behavioural change · transport policy · urban mobility

1 Introduction

The concept of sustainable urban mobility planning (SUMP) places sustainability at the centre of transport planning in urban areas. The approach is characterised by mobility management (MM). Rather than focusing solely on infrastructure, MM adopts a demand-oriented perspective, encouraging travellers to adopt more sustainable behaviour. It does so through a range of soft measures: information provision, pricing strategies, organisational travel planning, and the reallocation of urban space.

The goal of this paper is to explore mobility management in the context of sustainable transition. It reviews the conceptual foundations, categorises the key measures, and presents evidence on three critical aspects: *(1)* transport pricing, *(2)* public space reallocation, and *(3)* the potential of activities during travel (travel-based multitasking) that shape user preferences when choosing transport modes. By highlighting these dimensions, the paper underscores that soft measures—though less visible than large-scale infrastructure projects—can deliver disproportionately strong impacts in transforming mobility behaviour and making urban systems more sustainable.

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2 Methodological Approach

This paper is based on a synthesis of literature, European policy documents, and empirical findings presented in recent research projects. The methodological approach is not empirical in the sense of primary data collection but analytical and integrative. It follows three main steps.

First, a theoretical review was conducted to clarify the concept of MM and to distinguish it from infrastructure-based hard measures. Key definitions, principles, and typologies were identified from the literature [1, 2].

Second, case-based evidence was synthesised, drawing on examples presented in previous research and policy evaluations. These include congestion pricing schemes in major cities, projects supporting urban liveability, and analyses of travel behaviour and activities. The focus was placed on these three thematic areas based on their current relevance in the Hungarian context: transport pricing, the evaluation (assessment) of urban public spaces, and the utilisation of travel time via travel-based activities.

Third, the analysis applied a comparative lens: the thematic areas were examined together to identify common drivers, barriers, and success factors. This synthesis of theory, empirical evidence, and comparative analysis provided a strong basis for discussing the effectiveness and limitations of MM in supporting sustainable transition.

3 Conceptual Framework of Mobility Management

Mobility management is best understood as part of the broader framework of Sustainable Urban Mobility Planning (SUMP), i.e., integrated plans that combine land use, environmental, and transport objectives to improve accessibility, safety, and quality of life. SUMP is an integrative tool that seeks to influence all elements of the transport system, the full spectrum of demand and supply management tools, and even decisions and characteristics that go beyond mobility. In this approach, MM in its broad sense covers the scope and reach all the tools and measures that affect mobility itself.

Within this model, MM focuses specifically on influencing demand rather than supply. The core principles of MM include:

- *Demand-side orientation*: reducing unnecessary travel, shifting demand to sustainable modes, and smoothing peak loads of travel demand.
- *Behavioural change*: influencing individuals' decisions not only through regulation but also through incentives, communication, and cultural shifts.
- *Integration of transport modes*: connecting different transport modes and services into seamless, multimodal journeys.
- *Sustainability*: aligning transport with environmental, social, and economic goals.
- *Participation*: engaging local communities, businesses, and institutions in co-developing mobility strategies.

These principles reflect a shift from mobility understood as the movement of vehicles to the possibility of reaching destinations. As Gehl [3] argues, cities should be designed for people rather than cars, with walkability and liveability as fundamental objectives.

Mobility management is a toolkit for demand and supply management. Its primary objective is to promote the use of sustainable transport modes, while reducing the role

and volume of private car use. The main message of MM is that travel choices can be substantially shaped not only by the physical design of transport facilities and infrastructure, but also by social and individual perceptions, attitudes, and values. The impact of these factors on travel patterns is potentially far-reaching [2]. An important element of this framework is that people's mobility is not merely a technical and route planning decision, but a consequence of influences deeply embedded in social structures, identities, and daily routines. For example, car use is dominant not only because of its (perceived) speed or convenience, but also because it symbolises social status, autonomy, and a sense of security [4, 5]. The aim of MM is therefore to offer options and influence choices and decisions by reflecting these latent aspects.

4 Mobility Management Measures: Typology and Methods

4.1 Strategies of Mobility Management

Pull MM Measures. Fundamental purpose of *pull* or *supportive measures* is to *encourage the adoption of sustainable transport modes* that are favourable to the development of desirable mobility patterns. Examples of such tools and measures include:

- Positive *financial incentives* that may be implemented in the form of reduced-price access to sustainable transport modes, the provision of mobility packages, or even a compensation for sustainable travel.
- *School or workplace mobility schemes* may involve or result in the organisation of transport groups (e.g., school buses, pedibus and bicibus, car-pooling).
- Measures and tools that *prioritise public transport* (PT).

These measures have been found to be primarily effective for younger generations, who do not yet make decisions according to established mobility patterns [6, 7].

Push MM Measures. Push or restrictive measures and instruments are typically aimed at promoting the reduction of private car use or motorised transport in general.

- A variety of strategies have been implemented to *manage urban congestion,* including congestion charges and restrictions on access to city centres.
- A variety of *parking regulations and management systems* are in operation. These include the implementation of more expensive charges and/or limited-time parking.
- The introduction of *speed reduction measures* and the designation of *car-free zones* (e.g., pedestrian-only streets) are also two such measures often applied.

It is well-documented that such MM measures are frequently met with considerable social resistance. Research suggests that they may be more effective in the longer term if combined with positive incentives [8].

Combined MM Measures. The implementation of combined measures facilitates the execution of moderate transitions, thereby allowing their refinement and customisation based on the experience accumulated during the intervention process.

- The *reallocation of streets and public spaces* is a key component of urban planning strategies aimed at promoting sustainable transport options by repurposing areas previously designated for motorised vehicles.
- *Information and awareness-raising campaigns* on the impacts of mobility needs and the (usage) characteristics of available transport options.
- Provision of *personal mobility advice*, the presentation of transport alternatives that are tailored to the specific mobility needs of the individual.

Studies found that such programmes tend to be most effective when combined with targeted communication, grassroots involvement of local communities, and long-term, consistent strategic support [9, 10].

4.2 Location and Context Dependency, Constraints

The efficacy of MM tools is determined by their ability to adapt to the specific characteristics of the local social, economic, and spatial context [9]. Consequently, it is not feasible to transfer measures and interventions from one location to another without the risk of diminishing their effectiveness. The following factors have been identified as significantly impacting the efficacy of interventions:

- The *transport culture* and *previous experience of the population*, as well as the degree of *dependence on private car use* [11].
- The availability of *alternative transport modes* (e.g., the presence of an integrated PT network, with sufficiently dense service and coverage) [12, 13].
- The *economic incentives* applied and the *price sensitivity* of the residents [14].
- *Political and institutional support*, in conjunction with *consistent regulation* [9, 15].

Soft, incentive-based mobility management measures are often characterised by a lack of urgency and are not sufficient to achieve a significant reduction in road traffic. It is therefore important that soft incentive measures are integrated into the wider transport planning and management system and linked to general and urban policy instruments (e.g., parking management, public space use), which can be more effective in achieving sustainable mobility goals, including physical and infrastructure improvements (e.g., reallocation of public spaces).

5 Results

In the framework of the mobility management tools and measures, a different approach was adopted in the categorisation process. The categorisation was constructed on the type of the MM measure and the transport mode(s) involved, as illustrated in Fig. 1. This method not only demonstrates the orientation of the impact of the tool or measure, but also incorporates the guiding principle of the impact mechanism and the range of transport modes affected. In this paper, this approach is applied to three MM measures to illustrate their functionality and possible implementation.

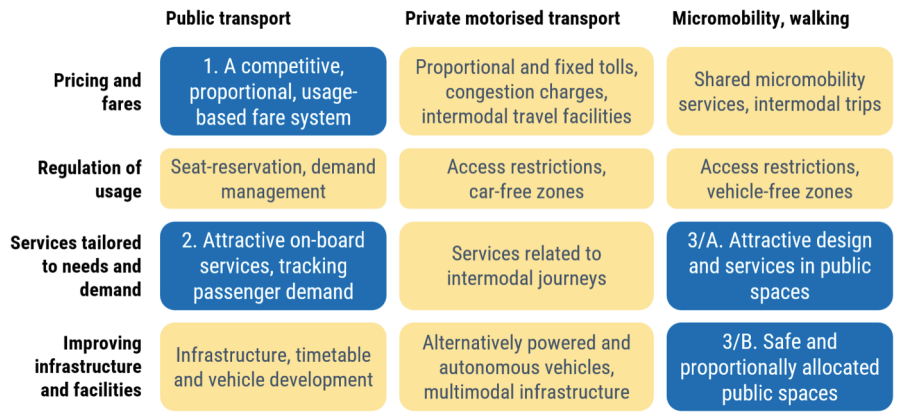


Fig. 1. The applied matrix of mobility management tools and measures—source: own editing

5.1 Transport Pricing as a Regulatory Tool

Pricing is among the most effective yet contested MM measures. Congestion charging in London and Stockholm demonstrates how road pricing can reduce traffic volumes, improve air quality, and generate revenue for sustainable transport [16, 17]. Despite initial opposition, these schemes *often gain public acceptance once benefits become visible.* PT fares also influence mode choice. *Integrated* and *simplified fare systems*, as in many European cities, *lower barriers* and make PT more attractive. *Subsidising passes* for students or employees are another widely used measure. *Parking pricing* further regulates the use of scarce public spaces, discouraging long-term occupation of valuable central areas.

In our preceding study [18], we sought to optimise the allocation of state subsidies to transport providers by extending the model of Parry and Small [19] to encompass the adverse effects of on-board crowding on PT services. The study confirmed the negative externalities of road congestion and guided the optimal subsidy towards PT service providers. In Hungary, political feasibility of congestion charges or differentiated pricing, even in the case of PT, remains a subject of debate. Nevertheless, *without pricing mechanisms*, demand management remains incomplete, as *relatively cheap car use and parking continues to externalise environmental and social costs.*

5.2 Travel Behaviour and Activities During Journeys

A novel dimension of MM also considers how passengers spend their travel time. The conventional perspective regards travel time as wasted utility, which should be minimised. However, recent studies suggest that activities carried out during travel can transform travel time into productive or even enjoyable time [20].

This is particularly relevant for PT. Unlike when driving a car, passengers on buses or trains can use their travel time for other activities. These *opportunities can reshape our perception of time*: a 30-min bus journey may be more acceptable if it allows us to read or work, compared to a shorter car trip that requires constant attention.

We carried out surveys in Budapest, Hungary to analyse the impact of activity patterns aboard PT vehicles [21], with the aim of supporting the application of MM measures. Structured observations were conducted to determine the most substantial activity groups, in addition to observing passenger and travel characteristics. The objective was to identify correlations between socio-demographic aspects and activity choice, since we hypothesised that transport mode choice is not solely determined by factors such as speed or cost but is also influenced by qualitative perceptions of factors including comfort, productivity, and experience.

5.3 Reallocation and Assessment of Public Spaces

The reallocation of public space has been proven to be a clear manifestation of MM. Historically, the dominance of motorised traffic had a markedly negative impact on pedestrian and cyclist safety and mobility. However, many cities are now reclaiming space for active travel and social life. Evaluation frameworks, including walkability indices and liveability assessments, offer systematic approaches for analysing these transformations. These frameworks demonstrate that, *in addition to technical adequacy, perceived attractiveness is a decisive factor in shaping mode choice* [22].

In our preceding research [23, 24], we targeted to develop a comprehensive public space assessment system that can facilitate a detailed evaluation of the functioning of public spaces, their network function, their role in local everyday life (e.g., commerce, tourism), and their walkability. In the case of Budapest's inner quarters, for instance, the implementation of widened sidewalks and traffic-calming measures has been demonstrated to enhance infrastructural elements and promote safety. However, survey results suggest that the absence of green space and the neglected state of buildings act as impediments to the walkability of streets within the central urban area, as they fail to enhance the appeal of these spaces. This underscores the *necessity to integrate infrastructural investment with comprehensive place-making strategies.*

6 Conclusion

The literature and the three themes explored highlight several broader lessons about mobility management.

1. *Integration* is essential. Isolated measures rarely deliver transformative effects. Pricing without attractive alternatives risks social backlash; reallocation without quality improvements may not achieve modal shift.
2. *User acceptance* determines success. Many MM measures face resistance if perceived as restrictive or unfair. The establishment of legitimacy is greatly dependent on transparent communication, participatory processes, and demonstrable benefits.
3. *Social equity* must be considered. Pricing may disproportionately affect low-income groups unless mitigated by subsidies or improved PT. Similarly, reallocation must consider the needs of businesses, residents, and vulnerable users.
4. *Evaluation* should broaden beyond modal split. Indicators such as air quality, noise level, public health, and social cohesion provide a fuller picture of impacts.

5. Finally, *digitalisation* enhances mobility management. Intelligent transport systems, real-time information services, and Mobility-as-a-Service platforms make sustainable modes more convenient, supporting behaviour change.

The concept of mobility management signals a paradigm shift in transport policy. By focusing on soft, demand-oriented measures, it addresses the behavioural and cultural aspects of mobility that infrastructure alone cannot change. In the context of the sustainable transition, mobility management provides effective solutions for alleviating congestion, reducing emissions, and decreasing car dependency.

A sustainable transition necessitates technological change, as well as institutional and behavioural transformation. The combination of infrastructural investment with soft measures has been demonstrated to enhance the efficiency, liveability, inclusivity, and resilience of urban mobility systems.

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