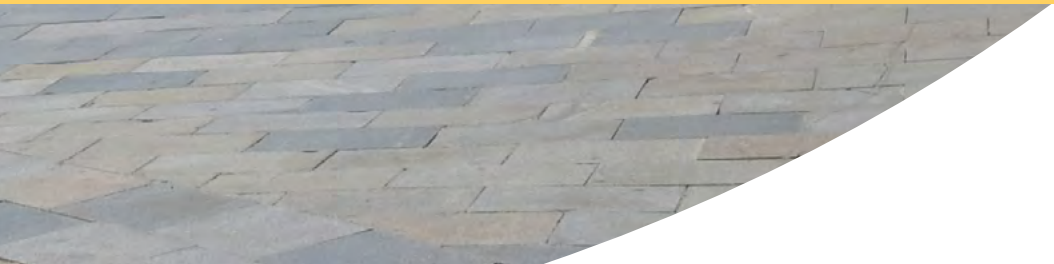
European Platform on Sustainable Urban Mobility Plans

Parking and SUMP

Using parking management to achieve SUMP objectives effectively and sustainably



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Executive summary

Although effective parking management has proven to be beneficial in promoting sustainable urban mobility in our cities, it is still one of the most underdeveloped elements within Sustainable Urban Mobility Plans (SUMP). In fact, good parking management can help free up valuable public space, which increases the attractiveness of cities, while supporting the local economy. Furthermore, managing the parking o of private motor vehicles can also reduce traffic, improve congestion, road safety and air pollution. Moreover, it generates revenues (from car parking fees and fines) to invest in sustainable mobility and urban improvements.

This topic guide is based on the outcomes of the Horizon 2020 project Park4SUMP (2018-2022) and focuses on the potential integration of parking management into SUMPs. The results are drawn from research in 14 EU countries and the experience of 16 partner cities in introducing/ adapting parking policies in their new and improved SUMPs with the help of ParkPAD, a new tool developed to support cities to implement good practices and innovative parking solutions.

This Topic Guide is structured in the following way. First, it reviews the benefits of parking management and provides strong arguments for these. At the same time it puts counter arguments to some of the main objections that are often raised to parking management. In this same chapter, three vignettes of city parking policies are presented. The Guide then explains how parking management relates to various stages in the SUMP Cycle, such as vision-setting, measure selection, monitoring and evaluation. The Topic Guide then goes on to give details of many different parking management measures that can be implemented, explains how they work, and gives examples of places where they have been implemented, and their impacts on travel, the local economy. A final chapter discusses innovation in parking management, and the process of its implementation.

The key messages of this Topic Guide are that parking management:

- Is a strategic tool to be used in SUMPs and not solely about facilitating the parking of motor vehicles.

- Has many benefits to the local economy, for improved safety, the better use of public space and so forth. These make powerful arguments for parking management and refute some of the arguments that are used to reject the idea of parking management.

- Because of its many benefits, it can be used to help to achieve many of the objectives of a SUMP and thus a more sustainable transport system.

- Is, of those measures that restrain the demand for car traffic and/or make car travel more expensive, the most politically acceptable.

- That there are ways to improve its acceptability during implementation, sand that politicians can decide to implement parking management and still prosper politically.

- Is one of the few tools that are available to most cities and regions to manage demand for motor traffic.This is especially important because if SUMPs are to change the way people travel and reduce dependence on the private car, demand management measures are essential.

- Can be implemented incrementally, at relatively low cost, and can be a source of revenue to be spent on other measures within the SUMP, or more broadly across the city.

The Topic Guide also provides many case studies of different forms of parking management, from which cities can select to include in their SUMPs. These are shown in Table E.1, below, and categorised according to their suitability for cities with different levels of existing parking management experience.

City's level of parking management experience	Parking strategy measures	On-street parking measures	Off-street parking measures
City new to parking management	Parking as part of SUMP Reducing overall supply Changing parking space to public space	Reducing overall supply Simple controls to improve turnover Parking for disabled people Improved enforcement	Reducing overall supply (Maximum) parking standards for new development
City with some experience of parking management	All the above, plus: Park and ride	All the above, plus: Controlled parking zones Parking for EVs Curbside management	The above, plus: Shared use parking
City with much experience of parking management	All the above, plus: Recycling parking revenues to spend on sustainable transport measures	All the above, plus: Differentiated tariffs	The above, plus: Parking management in socialist era housing estates and areas with high car ownership but little off-street parking

Table E.1: categories of parking management measures and suitability according to city's level of parking management experience

1. Introduction: why should parking management and SUMP be connected?

1.1 Parking problems

Cars only drive on average for one hour a day and the remaining 23 hours they are parked somewhere (Donald Shoup, UCLA, 2005). Urban space for stationary car traffic tends to be allocated in disproportion to its share in use. In the City of Graz, Austria, despite the fact that car accounts for only 47% of the mode share, it takes up 92% of the urban space used for stationary traffic. Meanwhile cyclists and pedestrians accounting for 33% of the mode share but only receive 5% of the urban space for stationary traffic (benches, cycle racks and so on).

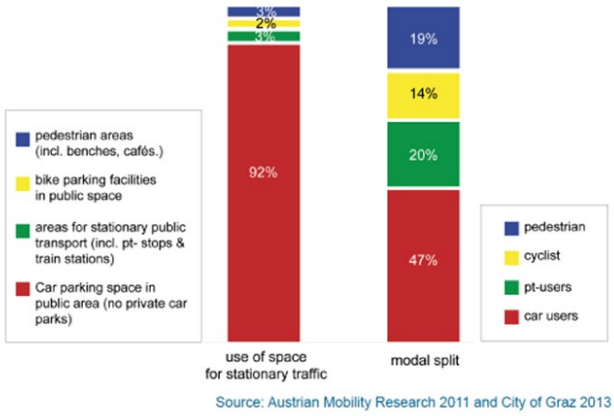


Figure 1.1: Urban space stationary traffic versus modal split

One can observe that parking demand increases in correlation to the traffic volumes. The search for a parking spot can increase frustration, overall traffic levels, and the probability of parking inconsiderately or illegally. 'Parking and loading spaces should be plentiful, close to the destination, high quality and preferably free of charge' is often the wish voiced by those residents, businesses and visitors who speak up. When businesses and retailers are faced with the introduction of controlled and paid parking, they often fear a loss of revenue. Parking controls and pricing are often perceived to be a measure solely implemented to generate income, causing resistance to and distrust of the organising authorities. Therefore, parking management is often perceived as a very contested topic, and one with potential for serious political conflict.

For these reasons, parking management has often remained a domain untouched by decision makers, unless parking problems have spiralled out of control and/or the city wants to gain financial revenue. This has led to a merely reactive and operational way of dealing with parking, mainly only responding when a specific problem occurs in specific locations, and defining parking management solely in terms of finding places for private vehicles to park. These isolated, ad-hoc approaches that deal with specific challenges are not sufficient to reduce the burden of the private car in cities. In short, a predict and provide mechanism –focussing on parking infrastructure provision – has dominated parking policy in many cities for many years. The results of such policies are clear: car-oriented developments and unstructured urban space dominates cities, while simultaneously further increase motorised traffic and negatively affecting liveability.

There will always be many operational aspects to parking management: how to collect income, how to define a maximum parking time, what to do at the boundaries of controlled parking areas, and many other factors. However, many cities have found that there are clear political, economic, social and environmental benefits to managing parking in a more strategic way beyond the immediate problem of citizens asking 'Where do I park my car?'.

The integration of parking management into a SUMP also implies that the nature of parking services can change over time, for example in terms of intermodal hubs, (e-) charging, or parking data and financing. Therefore, this topic guide aims to explain and highlight the potential benefits of an parking policy integrated with SUMP, and the various ways to implement it.

1.2 SUMP objectives and how parking management can address them

SUMP objectives are built around the sustainability triple helix of social, environmental and economic outcomes. More specifically, SUMPs will typically aim to achieve some or all of the following objectives (which are themselves a summary of the components of a sustainable transport system listed on page 11 of the EU SUMP Guidelines (Rupprecht Consult, 2019)):

- Better quality of life including quality of public spaces
- Improved safety
- Reduced global and local environmental impacts
- Improved social inclusion
- Improved accessibility for people with reduced mobility
- Improved population health
- Reduced congestion/improved accessibility to what people need
- Improved economic development

Objective	Contribution of parking management
Better quality of life and public spaces	Parking management frees up public space for other uses (including the plants and water infrastructure that are needed for climate adaption).
Improved safety	Parking that causes safety problems (e.g. at junctions) is eliminated.
Reduced global and local environmental impacts	Parking has a strong influence on how people travel. Almost all cities that have achieved modal shift have used parking management as part of their measure packages.
Improved social inclusion	Strong links to better quality of life and improved accessibility of streets. Dedicating revenues from parking to sustainable modes of transport will redistribute money from (on average) wealthier car users to (on average) less well-off people using other modes.
Improved accessibility of streets for people with disabilities	Elimination of inconsiderate parking on sidewalks and at crossings improves mobility for disabled people.
Improved population health	Parking's effect on mode choice will shift people to active modes, whilst space formerly used for parking can be dedicated to active modes.
Reduced congestion/improved accessibility to what people need	Careful management of parking, targeting scarcer parking for use by groups such as shoppers or residents, can positively impact accessibility.
Improved economic development	Improved accessibility and better use of public space can boost a city's image and economic performance. Many economically very successful European cities such as Freiburg, Vienna, Krakow, Ljubljana, Zurich and Stockholm also have strong parking management in place.

Table 1.1 Gives some indicative ideas of how parking management can contribute to the achievement of these objectives. Further chapters of the Topic Guide explain how to implement the measures mentioned in more detail.

1.3 Parking management, the Green Deal and New Mobility Framework

Parking management at the local level can contribute to the achievement of national and even international objectives. It can help the achievement of the planned outcomes of policies such as the Commission's New Urban Mobility Framework (UMF) and the EU's Green Deal, in the following ways:

- Parking is an important impact on modal choice. Modal shift to less carbon-intensive modes is essential according to the UMF.
- Parking takes up space which can be given to active mobility modes and public transport instead.
- Since most EU member states lack a national legislative framework that enables cities to set up road user charging systems, parking policy remains the only measure to (at least partially) internalise external costs of road use.
- Parking is inextricably linked to charging infrastructure, and investments in on- or off-street charging infrastructure, and choices about linking these to parking, can incentivise the purchase of cleaner vehicles.
- Parking standards for cars and bicycles in new buildings can drive provision of charging infrastructure for electric vehicles and shared mobility and can facilitate bike ownership. Car ownership can be reduced, if parking availability at home is limited.
- Parking standards provide a link between mobility and spatial planning – something that the UMF seeks explicitly.
- Better parking enforcement creates better environments for walking and cycling.
- Parking is a key part of mobility hubs and park and ride.

It is therefore fundamentally important that SUMPs, including those that are developed for TEN-T urban nodes, take a strategic approach to using parking management as a tool to achieve SUMP objectives. The rest of this Topic Guide explains in more detail how this can be done.

2. The benefits of parking management in SUMPs

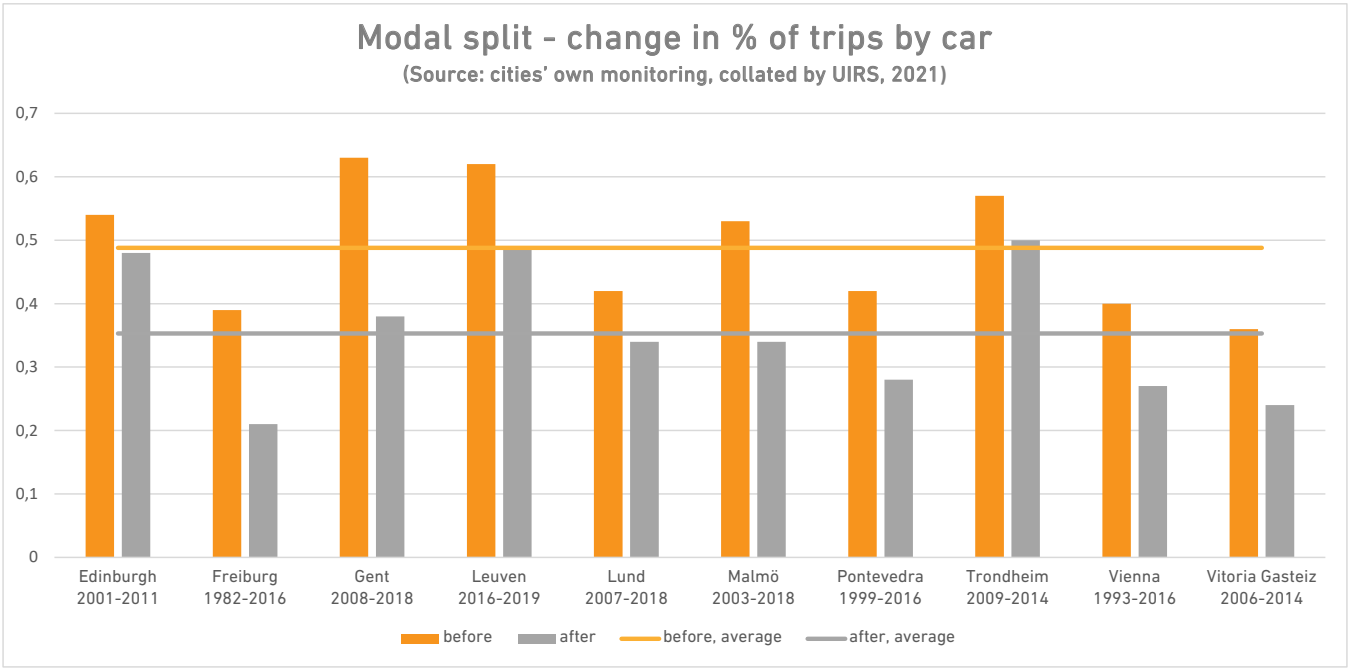
This chapter draws on the results of Park4SUMP and other projects to illustrate in more detail the benefits that can be realised by parking management.

2.1 Mobility and related benefits

Many cities set targets to shift travel from private car to other modes of transport as part of their SUMPs. Those cities which successfully realised this change, have always used parking management as part of a wider set of measures. Some changes in travel patterns are shown in Figure 2.1 below.

Where modal shift leads to reduced vehicle km by private car, then this leads to reduced congestion and pollution. Additional local benefits include the elimination of parking on the pavement, which significantly improves accessibility for physically impaired people, for delivery of goods, and for parents with prams. Due to these reasons, Scotland passed a law in 2018 to ban parking on the footway nationwide. Elimination of badly parked vehicles, on crossings, and around junctions, also improves visibility and hence road safety.

Figure 2.1: Modal Split



2.2 Planning and public space benefits

Providing parking has an opportunity cost, in that the space it occupies could be used for something else, as could the money required to build and maintain it. A more strategic approach to parking management recognises these opportunity costs and in certain circumstances changes them. For example, during the COVID-19 pandemic, the Italian city of Reggio Emilia removed 37 parking spaces on Via Roma, an historic arterial street, by converting the space into restaurant terraces and pocket parks. This measure, which led to a 14% reduction in parking space, left the restaurant owners and customers very satisfied, as 50% of a sample of residents interviewed rated the changes at least 'good' or 'very good'. This was part of a wider package of measures to convert on-street parking to public space across the city. Public space that was previously used for parking can instead be used for new green space and water features in the street, thus helping climate change adaptation.

In terms of parking in new developments, the city of Umea in northern Sweden has taken a flexible approach in recent years. Developers of new buildings inside the city are able to pay for centralised parking facilities to meet the City's parking norms, instead of building their own parking spaces in every building. Some of the revenues are used to fund the new parking facilities, but a portion is invested in environmental improvements. The provision of centralised parking reduce the cost of the buildings, thus making – in residential developments - housing more affordable.

A further example is the approach that was taken by the city of Ljubljana: the relaxation of parking standards in the historic core of the city. As a result, one off-street parking space per dwelling is no longer required as a minimum, and this has enabled derelict buildings to be redeveloped where it was simply impossible before. The change to parking standards has stimulated urban development, in the part of the city most accessible by sustainable modes of transport.

2.3 Retail/business benefits

There is frequently an assumption that, in order to be successful economically, a city should offer a large amount of free parking to attract visitors and companies, but the reality is more complicated. Inward investors take many factors into account when deciding where to locate, but the key factors are labour availability and cost of the site. The research on parking's influence on retail has focused mostly on larger towns and indicates that the key factor for comparison shopping is the retail offer (how good a choice of shops there is) and shopping "experience", but that parking plays a stronger role in the choice of where to make bulk purchases (Mingardo, 2012). Removing on-street parking from shopping streets and squares to improve the pedestrian environment can improve retail performance: since Fredrikstad in Norway converted two squares into public space, by removing around 110 parking spaces in 2016 and 2019 respectively, footfall and retail performance improved in the city centre (Fredrikstads Naeringsforening, personal communication with author, 2020).

Similar impacts were reported in Krakow, when the city centre's Grodzka street was fully pedestrianised and parking was eliminated in 2015. Even though retailers along this essential shopping street in the Polish city initially complained, turnover and rents quickly increased once the pedestrianisation was finished.

The English city of Nottingham is a forerunner in parking management in the UK. As well as an extensive on-street controlled parking zone and limited parking standards for new development, it levies an annual per space tax per employee parking space for employers that offer ten or more such spaces. Research on the economic impacts of this tax found that, in spite of its introduction, Nottingham's economy continued to grow more strongly than comparator English cities, whilst suffering lower levels of congestion. It is important to note that it invests the revenue from the tax in sustainable transport and used it to leverage in central government money to build a tram network that is unique amongst its competitor cities in England. More information can be found in Dale et al 2014, 2017a, 2017b and 2019.

2.4 Political benefits

Well-structured parking management can free up space that can help to provide space for car users with disabilities. Freed-up space can be repurposed for parks and recreational areas to foster urban liveability, as well as providing additional space for vulnerable road users. These improvements can have significant positive effects on local businesses. Many of the cities in Park4SUMP, inter alia Rotterdam, Trondheim, Sofia, Krakow, Reggio Emilia, and Vitoria-Gasteiz, have expanded their controlled parking zones. This is partly because, when residents of one area see the effects of new controlled parking in the neighbourhood next door, they ask their politicians for the same – such zones are popular with residents because they relieve parking pressure. However, it is also for strategic purposes in line with the SUMP: to gradually reduce parking opportunities for commuters, to encourage a shift to sustainable modes.

Cities, such as Nottingham (UK) and Sint-Niklaas (BE) see the political benefits of using parking as part of a package of measures to improve their local mobility system and local environment, and reap political rewards. There is a strong link between political buy-in to the SUMP in general, and parking management. The Belgian example shows that parking management (is directly linked to the city's vision to improve the quality of life and road safety in residential areas, by creating more human-scaled neighbourhoods, less dominated by moving and parked vehicles. For a strong statement in support of parking management by a local politician who was first elected as a councillor and who is now deputy mayor, watch the Park4SUMP video about parking management in the Belgian city of Sint-Niklaas, here. Parking management is one of the key focuses of its SUMP and has already been used to free up street space in the city centre. The introduction of these measures and of countless controlled parking zones in various-sized European cities show that parking management is not political suicide, but in fact supported by a majority of local voters.

2.5 Financial benefits

Parking management will raise income in anything but the smallest municipalities, where potential operating costs for enforcement might exceed revenues. In the largest on-street parking operations, such as the City of Westminster (a central borough the British capital of London) annual income can run into the hundreds of millions of Euros. In order to avoid criticism that such significant sums are just collected to boost the income of a city, the local administration needs to communicate a plan for reinvesting these additional gains. Transparency and thus acceptability can be increased by earmarking revenues from paid parking to finance other (sustainable) mobility solutions and environmental improvements, such as improved streetscape, or by improving off-street car parks. Earmarking of revenues can be a strategic plank of parking policy within sustainable urban mobility planning.

The objective of this mechanism is not only to regulate and manage parking, but to strategically manage traffic in a sustainable way. This leads to operational synergies – parking can include bicycle parking; enforcement could prioritise public transport routes; on-street parking can be supplemented by attractive park and ride; and enforcement staff could also offer information about the city and alternative modes, giving them a more positive image.

The city of Ghent (BE) already applies the earmarking principle with success.

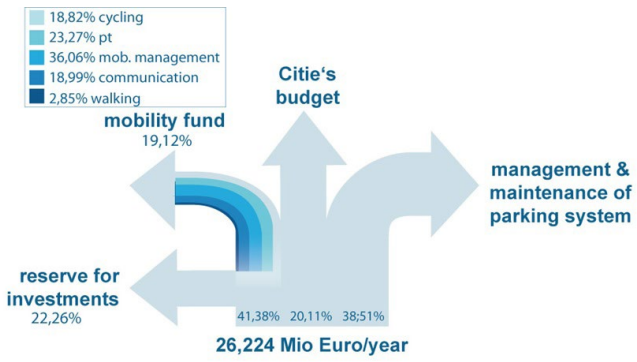


Figure 2.2: Ghent's Earmarking of Parking Revenues, 2013. Source: Push and Pull Project Final Evaluation Report

2.6 Cities that have seen the benefits of parking management

In this section we briefly review the experience of three cities, all partners in the Park4SUMP project, that have implemented parking management and have evidence that they have benefited from it.

2.6.1 Freiburg, Germany

Freiburg is a city in south-west of Germany with a population of more than 230,000 with a long-standing reputation as an environmentally friendly city that stretches back to the 1970s. It is also recognised as a pioneer in parking policy. By pursuing a compact city strategy, with strong neighbourhood centres and urban development along the main public transport arteries, it aims to reduce demand for car travel and support sustainable modes.

This strategy has had remarkable results. Between 1999 and 2016 cycling mode share increased from 27% to 34%, walking from 23% to 29% whilst public transport remained stable at 16%. Remarkably, car trips fell from 32% to 21% meaning Freiburg has almost achieved its target modal split of 80% percent by sustainable modes and only 20% percent by car.

Park4SUMP implementation and limits

Controlled parking in Freiburg was extended to the centrally located "Brühl-Beurbarung" district, which is the home of around 3,400 people. Thanks to its proximity to Freiburg Central Station, the district suffers from commuter parking. Based on a citizen consultation process, 232 spaces were transformed to paid parking to deter commuters. Furthermore, 200 spaces were eliminated in the two most centrally located zones and fees were increased by 28% and 62% respectively.

Since the Park&Ride facilities were already operating at capacity, an expansion was planned to connect more car parks to the dynamic guidance system to provide live information on available spaces. Three new car parks were connected and an additional five are planned to be integrated.

Pioneering policy development continued. An impact assessment was undertaken of reduced maximum parking standards that were introduced in 2016 and areas for future improvements. Meanwhile a "Climate Protection Plan 2030" is being developed, partly as a SUMP, but with the main focus on CO2 reduction.

Impact of measures in the Brühl-Beurbarung district

The occupancy rate of on-street parking spaces in this neighbourhood prior to the introduction of paid parking was 97%, a level which significantly increases the search time for parking spots and therefore generates traffic (this will occur at occupancy levels over 85%). A significant improvement was recorded after the implementation of measures, as the occupancy rate fell to 79%.

Across the whole city, parking spaces have been removed to create more public space for outdoor dining, play streets and other measures to promote active mobility. A good example of this is Hermannstraße, where 90 parking spaces were transformed into a bicycle path. Additionally, 30 parking spaces were removed for a bicycle rental system and a further 20 were removed and parking facilities for privately-owned bikes were put in their place. Overall, the removal of parking spaces is a measure that can be seen to be directly aligned to Freiburg's wider city plan and sustainable mode share ambitions.

The process of measure planning and implementation

Paid parking was successfully introduced to 232 spaces in the Brühl-Beurbarung district; however the original plans were for a larger scheme covering more spaces. For several years there had been demands from some citizens to implement parking management and opposition from others because of the associated costs. To agree a way forward, the city decided to survey the citizens. One particularly vocal shop owner, who was against paid parking, was influential in getting people to vote against the plans. The results of the survey were 46% in favour and 54% against. The responses were studied in detail and it could be seen that acceptance varied across the surveyed areas and in the southern area of the district the scheme was clearly accepted, so its implementation was limited to that area. This shows the challenges of taking a participatory approach to the introduction of parking management.

2.6.2 Gdansk, Poland

The city of Gdansk is part of the tri-city metropolitan area in Poland consisting of Gdańsk, Gdynia and Sopot. The city

is well-connected to major international and national transport corridors. Although the city's area is 262 km2, it stretches out along the coast of the Baltic Sea, resulting in longer travel distances than in radial cities. It is home to about 471,000 inhabitants with more than 120,000 commuters entering and leaving the city each day by car.

Modal split in Gdansk was last assessed in 2016 when an increase of car trips (41%) and bicycle trips (6%) was observed at the expense of public transport (32%) compared to 2009.

During the course of the Park4SUMP project Gdansk doubled its Controlled Parking Zone (CPZ) to over 1,000 additional spaces in the city centre and earmarked 80% of the revenue to be spent on sustainable mobility. The CPZ was split into several sectors with different prices and hours of operation. This in turn prompted comprehensive organisational and technical changes to the enforcement system, including the introduction of an Automatic Number Plate Recognition (ANPR) 'scan car'.

Furthermore, a detailed analysis of the Park & Ride (P&R) network identified problems and opportunities. Following this analysis, a new P&R facility was planned at one train station and measures to grant exclusive access to drivers with public transport tickets at another (this element has still to be implemented). In addition, P&R signs were introduced to clearly indicate the intended function of the car park and were supported by an information and education campaign including dedicated pages on the city's website.

Other measures have included the introduction of social participation tools in parking management, the reallocation of parking spaces and developing a system of coach parking near tourist attractions.

Impacts of what was implemented

The city undertook detailed monitoring of occupancy rates, parking turnover and traffic levels both before and after the implementation of the changes to the CPZ and the improvement to the P&R. In the CPZ, despite an 11% reduction in the total number of spaces available, the occupancy of those spaces also reduced and recorded traffic volumes were slightly lower. The post-implementation data was collected in September 2020 and is likely to be severely impacted by the influence of COVID-19 on travel patterns and so the longer-term impact on occupancy may change. The same applies for the P&R data. However, one impact is certain. The changes to the enforcement system have improved the operational efficiency of the CPZ as data collected shows that the 'scan car' supports the human enforcers to check more cars, more quickly.

The process of measure planning and implementation

Legislative changes in Poland gave new opportunities for Gdansk to plan measures in paid parking by relaxing the previous cap on maximum parking fees. Politically, there were concerns about the acceptability of these measures. These concerns were overcome through consultations, a unified message from the city authorities, the support of the district councils and by highlighting that 80% of the revenues were to be allocated to sustainable mobility measures.

The ideas shared in the project provided an inspiration and the implementation of solutions that work elsewhere were considered with less trepidation. Furthermore, the ParkPAD audit involved many stakeholders, and this facilitated the successful implementation of the recommendations as all stakeholders were clear about the reasons behind the measures. Regular team meetings were also central to the successful implementation of the measures in Gdansk to allow ongoing communication about the progress of the implementation.

2.6.3 Trondheim, Norway

Trondheim, with a population of 205,000, is a city in central Norway, located by the sea and surrounded by the Nidelva river. It has a long history of transport demand management measures, having introduced paid parking to the city centre in 1968 and a toll road scheme in 1992. The objectives of the current SUMP are to achieve a change in modal split in favour of public transport, bike and walking, and a reduction in car use. Amongst car users a higher proportion of electric vehicle use is also an objective. Other SUMP objectives are safety and environmental improvements, as well as increasing open spaces and pedestrian zones.

Park4SUMP implementations

Three new residential parking zones were planned which would cover 600 spaces and that also incorporate spaces for car-share vehicles, EV high-capacity charging spots and an increased parking tariff at high demand locations.

These measures would go hand-in-hand with a city-wide enhanced, digitalized, enforcement model which aimed to improve efficiency, increase job satisfaction amongst enforcers and improve the reputation of parking management in the city.

Furthermore, 'scan cars' using 'automatic number plate recognition (ANPR) technology had previously been piloted in the city. During the project a comprehensive test of this technology was undertaken and payment via smartphone was introduced. The city worked to allocate six percent of public space to EV parking, a standard that was set by the Norwegian national government. Only one of the three new planned residential parking zones was implemented by the end of the project due to delays caused by COVID-19.

Impacts of what was implemented

The new residential parking zone saw a significant reduction in the parking spaces available, from 400 to 300, which lowered circulating traffic by 38%. In those high demand locations where the parking tariff was increased, the turnover of cars using the spaces was found to double.

The digitalisation of parking has been a success. During Park4SUMP, the smartphone application took 95% of parking payment transactions and digital residents permits were introduced. This has contributed to the improvement of the reputation of parking management in the city and enforcement efficiency as the data is available to enforcers via their hand-held device. This time taken for parking wardens (enforcers) to complete a patrol reduced by 25% in the summertime and halved in the wintertime. The enforcers have reported better satisfaction scores and less sick leave has been recorded.

The share of electric vehicles increased by 4% per annum during the Park4SUMP period 2018 to 2021. The EV public space allocation has been carefully considered and there has been some increase in the number of EV parking spaces, but the market is evolving quickly as the new EV models have larger battery capacity and charging tends to take place at separate high speed charging stations.

The process of measure planning and implementation

The PARKPAD process took place inside the framework of the SUMP planning process as a new and extra element. Whilst stakeholder involvement was already embedded in the regular planning process, the involvement of politicians as part of the PARKPAD was a change to that process. The interviews and workshop undertaken was a best practice example of stakeholder involvement and allowed a shift towards a higher level of consensus on some issues.

When new regulated parking zones are introduced there is the risk of knock-on effects in neighbouring zones as people search for an alternative free location. This will continue until the benefits of the car compared to alternative modes of transport are gone, which is closely related to the distance that people are prepared to walk from where they park to their final destination. (Research examining this question can be accessed here.) This is where Trondheim found that the integration of parking into SUMP was really beneficial, because parking management proceeded hand-in-hand with the improvement of public transport and cycling measures. Parking activities are more of an integrated part of the municipal urban development organization today compared to 2018. This is evidenced in terms of organization, planning capacity and joint project implementations.

2.7 More detail on arguments for parking management

The EU PUSH & PULL project detailed and documented '16 good reasons for parking management[1] (2015), listed below. These evidence and fact-based information sheets provide information and convincing arguments for parking management in cities. They are all based on the central tenet that **Parking Management is key to managing urban mobility;** and they all try to address the main arguments that are often heard against parking management. The good reasons are as follows:

1. Public space has a high value and therefore should be paid for if used for parking.
2. Parking management contributes to a more sustainable modal choice and therefore quality of life.
3. Parking Management leads to less park search traffic.
4. Parking management has a good impact – acceptance – ratio compared to other demand management measures such as road pricing.
5. People usually complain before new parking management is introduced but initial opposition turns to support when they realize its positive impacts.
6. Parking management protects European historic cities from an "invasion" of parked cars.
7. Parking Management does not kill the high street - it can support the local economy.
8. User-friendly parking areas within walking distance of key locations are acceptable.
9. Parking Management will not stop companies investing in your city.
10. Guaranteed parking spaces at workplaces influence modal choice significantly.
11. Parking Management contributes to road safety.
12. Enforcement of parking violations is necessary – and not harassment of car users.
13. Carefully chosen parking standards can have a positive impact on housing and other real estate projects.
14. Correct rates, prices and appropriate fines are key to the success of parking management.
15. Parking Management can raise municipal revenue that can be used to encourage sustainable mobility.

For some case studies of these different measures, see the PUSH&PULL Catalogue of Parking Management Case Studies; in addition, the remainder of this Topic Guide covers more examples, drawn from the Park4SUMP project, in Chapter 4.

[1] For more advantages & arguments for 'good parking policy', see the Push&Pull brochure : '16 good reasons for parking management", 2015

3. The SUMP principles in the context of parking management

In this chapter the key points in which there is a relationship between sustainable parking policy and the SUMP process are presented. This is intended to help you find the right points in the SUMP process at which to adopt – step by step - a more holistic and strategic approach to your parking policy and to then place it in the context of your SUMP. The SUMP cycle is shown below in order to show where these different parts of the SUMP process occur.

Figure 3.1: the SUMP Cycle. Source: ©Rupprecht Consult 2019

3.1 Plan for sustainable mobility in your city

Parking management can contribute to a sustainable vision for your city, and therefore for the objectives of your SUMP, when it is approached strategically. The key point regarding parking in sustainable urban mobility planning is that it has to be seen not simply as something to facilitate parking a vehicle, but as a core and strategic measure for managing travel demand and achieving SUMP objectives.

To approach parking in a holistic and strategic way, start with an overall vision, strategy and goal(s) (see SUMP Cycle step 5 & Milestone (MS) 2). A vision for parking policy could be, for example, that it is the cornerstone of improvements to public space and creating a more liveable city. Subsequently, translate the vision into operational action plans (see SUMP Cycle step 7) using a mix of parking measures.

Parking policies are well suited to be implemented incrementally (see SUMP Cycle steps 7 & 10). Particularly when taking your first steps in parking management, begin in the heart of the city or in other areas where parking problems are at their worst, such as around schools; and implement parking management in small steps. Step-by-step you can broaden your ambitions and geographical scope (→SUMP Cycle step 2.1).

Park and ride (P&R) or bike and ride (B&R) at the edge of the city or, even better, in the area where commuters live, can provide excellent access to the heart of the city by public transport. At the same time the number of parking spaces in the centre must be reduced, otherwise P&R will only create additional supply that will result in additional car traffic. In this way, one measure benefits the other, but one does not work without the other.

Parking management, because of its impacts on travel demand, is a powerful measure to implement across your city or (if local politics permits) across a functional urban area. However, because it is politically controversial, it can be difficult to reach agreement between different administrations across the area. If you do try to work with your neighbouring authorities on parking matters, start with somewhat less controversial issues such as park and ride, parking guidance, and parking standards for new development, and then if that succeeds, move on to more difficult issues such as the price of parking in neighbouring jurisdictions.

The graph below illustrates a logical development pattern for the development of cities' parking policies, a development that should also be reflected in second, third and further generations of SUMP in a city.

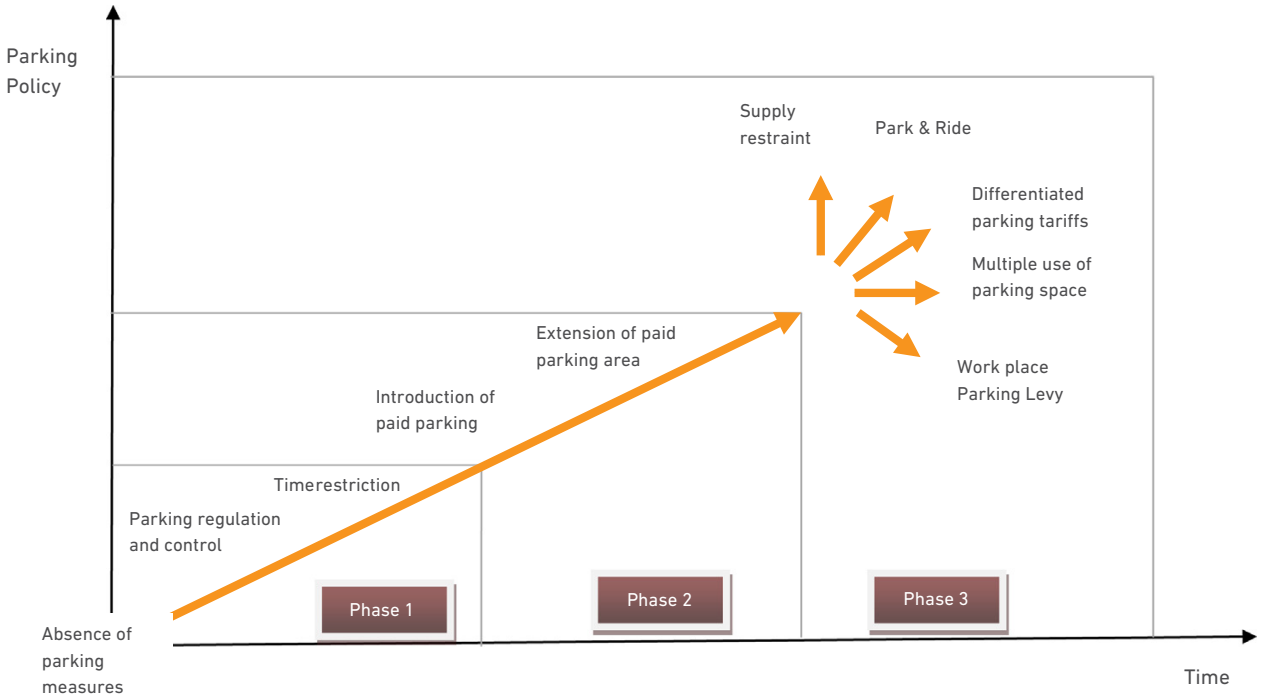


Figure 3.2: Development of Parking Policy. Source: Push&Pull Training Material "Setting the framework for parking policy" by Prof. G. Mingardo, Erasmus UPT. http://push-pull-parking.eu/index.php?id=55. Taken from Mingardo, Rye and Wee (2015), p 272.

3.2 Develop a long-term vision and a clear implementation plan

Parking policy appears throughout the SUMP planning cycle. It is an element in the long-term vision for transport and mobility for the entire urban agglomeration, covering all modes and forms of transport: public and private, passenger and freight, motorised and non-motorised, as a practical measure and as a source of revenue. The latter will become important when searching for funding of your SUMP, see 3.3. and especially 4.2.

The formation of a vision, problem definition and the parking task (an ambition formulated as a strategy to guide measure selection and implementation) are strongly related. The development of a vision provides answers to questions such as: "For which target groups do I want a high-quality parking offer? Do all cars have to be off the streets? How can I guarantee excellent overall accessibility of my city centre but discriminate in favour of certain modes?" A clear **definition of the parking task (→SUMP Cycle steps 4,5,6)** is closely related to the vision.

The best **timing for starting with a sustainable parking policy (→SUMP Cycle step 2)** is when you are starting the SUMP process, when you prepare a next generation SUMP, or even when you are faced with a new situation (e.g. national SUMP guidelines). Make use of this starting position to integrate both timing and the process. The following checklist sets out a number of questions, the answers to which will help to develop your parking policy.

Sustainable parking policy checklist[2]

- ✓ What is the vision for the development of my city and how does current and future parking fit to it?
- ✓ Is public space fairly distributed?
- ✓ How can I make my city more accessible for pedestrians, cyclists or public transport?
- ✓ Does my parking policy support walking, bicycle use or public transport?
- ✓ Which target groups are more and less welcome to travel by car into my city?
- ✓ Where and for whom do I wish to create a high-quality parking offer?
- ✓ How do I want my public spaces to be used?
- ✓ How can I avoid overspill parking in neighbouring zones as I gradually expand on-street parking management?
- ✓ How much should my parking policy cost?
- ✓ How much revenue could parking management generate (that could be used to finance sustainable modes or other improvements to local transport and the environment)?
- ✓ How do I link my spatial planning policy to my parking policy?

[2] Flanders (BE) Guidance to Sustainable Parking policy (Vademecum Duurzaam Parkeerbeleid), 2007. The guidance document was developed as a topical Annex of the existing L-SUMPs Decree/legislation of 2003.

3.3 Assess current and future performance

In the **analysis phase (→SUMP Cycle step 3)**, existing data about parking offer and parking demand are very valuable. **Additional research (→SUMP Cycle steps 2.4 and 3.1)** might sometimes be needed to understand not only the objective situation (numbers and occupancy of parking spaces) but also people's perception and knowledge of parking in your municipality, as these often differ from reality, as people are often not aware of prices of parking schemes or number of available spaces.

Data on parking capacity and occupancy can help to indicate the parking demand for different types of parking facility. They can vary according to the type of area, functions (and their sphere of influence) and also with existing parking regulations. In addition, the mobility characteristics of users, such as modal split and car ownership, help determine parking needs. A key issue, however, is that there should not be an automatic assumption in all situations that parking demand should be provided for; the SUMP is an opportunity to consider in a strategic way how demand for parking can be managed and used to influence travel behaviour. The strategic objectives of the SUMP must take precedence over factors such as providing a minimum level of service in off-street car parks (for example), unless that factor helps to measure the achievement of a strategic SUMP objective. When speaking about integrated urban transport policies, the "interoperability" of data collection and use should be encouraged. Data standardisation can also support this integration of parking with mobility. Shared data models and integrated data platforms for replicability of smart parking/mobility solutions are becoming more important to support the roll-out of mobility management measures such as free-floating car sharing solutions that help to provide people with a more bespoke alternative to their own private car.

For more information on different types of parking research, ITS and data interoperability supporting a sustainable parking & mobility policy, the authors of this Topic Guide recommend several separate publications.[3]

In addition, the use of the ParkPAD tool (www.parkpad.eu) is recommended as a means to audit parking policies to identify priorities for improvement and new parking measures to achieve these. Developed in the Park4SUMP project and tested by 25 cities during the project, the tool was found to give its users a unique opportunity to evaluate their parking policies in a participative and reflective way, and led to further actions including the use of the tool to review the success of parking policy in the future in several Park4SUMP cities (see also Section 3.8).

3.4 Develop all transport modes in an integrated manner

Although parking seems – most logically - primary focused on private vehicles, especially cars, smart parking management is an important leverage factor to a more balanced and integrated development of all modes, while especially encouraging a shift to sustainable modes, by aiming to, for example, 'nudge' drivers' choices (→SUMP Cycle steps 7 and 12.1). A good example would be integrating parking management and town centre management by giving smart discounts on parking to shoppers. Park and ride (see examples in Chapter 4) is another example of integrating parking and public transport.

More and more SUMPs pay attention to improved cycling policy[4], which is also directly linked to parking, as an increased number of bike trips taken to the city centre will automatically lead to a higher demand for bicycle parking, as cyclists wish to have safe and secure locations to lock their bike. Chapter 4 of this Topic Guide provides specific examples of bike parking policies.

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[3] The EU adopted early on the so-called ITS Directive 2010/40/EU (European Parliament and Council of the European Union, 2010). Among other areas, it encompasses the provision of EU-wide Real-Time Traffic Information (RTTI) services (European Commission, DR 2015/962/EU) and Multimodal Travel Information (MMTI) services (European Commission DR 2017/1926/EU). The availability, through National Access Points (NAPs), of accurate and up-to-date data is crucial, but also data sharing of information such as availability of parking places is key, as well as ensuring some degree of data format standardisation and interoperability (e.g. applying DATEX II standard for road transport).
Further guidance on ITS can be found in the Practitioner briefings on the role of ITS in Sustainable Urban Mobility Planning. (https://www.eltis.org/guidelines/second-edition-sump-guidelines).

[4] Further guidance on Cycling and SUMP can be found in the Practitioner Briefings on Cycling (https://www.eltis.org/guidelines/second-edition-sump-guidelines).

Figure 3.3: Bicycle parking regulations and creative good practice solutions fit into SUMP policy by Mobiel 21 (2018)

Also, the complex operations of urban goods transport[5] and the variety of problems that they cause, further complicate policy-making in the area of urban mobility. Parking (and loading/unloading) is among the most significant challenges in this field.

In the framework of EU Urban transport demand management policies, parking management is currently also categorised as one of the several accompanying measures of Urban Vehicle Access Regulations[6].

[5] https://civitas.eu/news/european-commission-study-on-urban-logistics-the-integrated-perspective-available
Further guidance on sustainable urban logistics planning can be found in the respective Topic Guide. (https://www.eltis.org/guidelines/second-edition-sump-guidelines).

[6] https://www.eltis.org/sites/default/files/uvar_brochure_2019-09-26_digital_version_v2.pdf

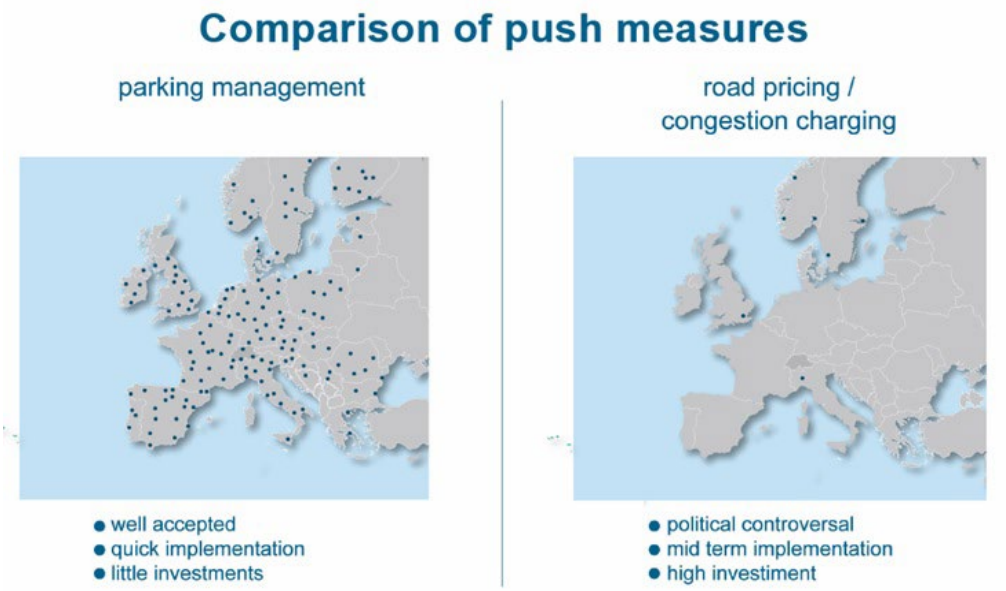

Figure 3.3: Cities with parking management (indicative) compared to cities with road pricing

Source of graphic: Push&Pull, 16 good reasons for parking management (2015).

It is important to note that users of different travel modes experience very different levels of service, with car users normally getting the best. Parking policy can help to change this balance. **Highlight the benefits of parking policy (→SUMP Cycle steps 1.3, 8.1. and 8.4)** at an early stage in your SUMP. For example, the **earmarking of parking revenues is very cost-beneficial to SUMP (→SUMP Cycle step 8.2. and 9.2)** and can provide the means for improvements in accessibility as well as the quality of neighbourhoods, but it also makes parking management more acceptable by making the use of the revenue transparent.

Integrated parking policies (→SUMP Cycle step 7.2) go beyond car parking, but also facilitate bicycle parking and even regulate parking for vans, tourist buses and trucks[7].

3.5 Cooperate across institutional boundaries

Strong political leadership is – for reasons of successful buy-in the SUMP process – of utmost importance. However, **cooperation between different institutional actors →SUMP Cycle step 1.2 and 2.2)** is also important. Parking involves not only the municipal mobility department, but often the police performing some or all enforcement. In some cases, there are (semi-) private parking companies either contracted to the municipality or independently operating off-street parking. Meanwhile, higher levels of government define regulations and law on parking that can facilitate or hamper more effective parking management. In some bigger cities also cooperation between district levels and surrounding (more) rural municipalities are needed to prevent overspill parking from one area to another.

Looking at **institutional reorganisation**, it is clear that metropolitan areas (for example Vienna) try to centralise competences in the field of parking. This then enables metropolitan parking planning and management. These centralisation processes take a great deal of time and meet resistance from municipalities within the metropolitan area (although they will take less time if the

[7] https://sstpa.eu-study.eu/results/

centralisation is the result of regional **legislation (→SUMP Cycle steps 2.1 and 2.2)).**

In a best-case scenario, cities establish municipal parking companies or agencies. Several authorities seek to cooperate and pool resources between them, to increase efficiency and reduce costs. One may provide the "back-office" functions for the parking operations of several authorities, which is a common practice for example in the Scottish City of Edinburgh, which provides support for several neighbouring municipalities.

Another way to increase efficiency is the principle of territorial management contracts. In this case the city issues a call for tender for an integrated offer of urban management activities. Besides the enforcement of parking policy, it can also include additional activities, such as the installation of street furniture, lighting and waste management. In this way, consortiums of **service providers (→SUMP Cycle step 10.2)** can find synergies between services that can **reduce costs**. Other examples of service integration can be found in cities that have given various responsibities, not just parking enforcement, to parking wardens. For example, in Trondheim parking wardens have safety, tourist information, parking information and parking enforcement responsibilities– thus creating multi-functional "city ambassadors", rather than staff whose only responsibility is to enforce.

3.6 Involve citizens and relevant stakeholders

Parking attracts the interest of different road users. These interests do not always coincide and quite often conflict. In areas and at times of day where parking demand exceeds supply, political decisions have to be made about which groups should have greater priority in accessing the available parking:

- Residents want an attractive neighbourhood, with good quality and safe urban space. They might also be interested in finding on-street parking close to home for short-stay use (loading and unloading) or for longer-stay use (night-time parking). Private parking space at home or close to home is not always used for car parking, creating additional pressure on the street parking capacity.

- Car-borne visitors – who can be shoppers, commuters, people engaging in leisure activities, tourists and so on - are interested in affordable parking close to their destination, but less frequent visitors will be prepared to pay for convenient parking. 'Free parking' does not exist. If a visitor of a specific city does not pay a fair price for parking in the city, than he/she is subsidised by the city. Local inhabitants and/or companies are paying for parking via their local taxes. Professional users of kerb space, such as urban logistics and delivery companies, need reassurance about the availability of spaces in order to conduct their activities efficiently.

- Commuters seek free parking as close as possible to their destination (their destination may include a railway station from which they travel onwards to work, and they use available parking space around the station as informal park and ride).

- Businesses in local neighbourhoods seek parking for at least their operational vehicles (vans, for example) and many also believe there is a very strong link between parking and the local economy.

- Specific user groups such as drivers with disabilities will need priority parking in order to be able to reach their destinations.

- Cities and towns with much coach-borne tourism (including cruise-ship destinations where passengers are taken by coach from the ship to local tourist attractions) will find pressure on parking from these tourist coaches.

The challenge for local authorities increased as these user groups do not share the same expectations of and needs from the parking system in terms of cost, (assured) availability and capacity. Some authorities have tried bringing these different groups together in consultation events to give them an opportunity to discuss their different points of view with each other.

Public acceptance (→SUMP Cycle steps 1.4 and 11.2) is perhaps the greatest challenge in parking management. The only feasible way to convince people to support change is to share the positive outcomes, be these from local pilot projects or from other cities. Be very clear about how those measures work and how much – if anything – people will have to pay, and explain what any new parking revenues will be used for. Bear in mind that public acceptance of parking management is low during the planning stage, but increases once people observe tangible improvements. The SUMP Topic Guide on Urban Vehicle Access Regulations gives a lot of advice on how to involve the public in that issue. As parking management is classified in that guide as a form of access restriction, it is not surprising that this advice is also relevant to public involvement on parking management. Making use of the ParkPAD tool is also an opportunity to involve stakeholders actively.

3.7 Arrange for monitoring and evaluation

Monitoring and evaluation are key instruments for parking policy. The use of data can help policy makers in the debate with the most important stakeholders in parking policy, namely citizens, retailers and the business sector. Rather than relying on feelings and emotions, data can provide policy makers objective information to frame the discussion. Not only can this allow for more constructive discussions but sometimes it can avoid drastic policy changes (and related costs) based on emotional responses to a (perceived) problem. For example, data on the availability, cost and occupancy of existing off-street parking can be invaluable in addressing the complaint that "there is not enough" parking. Data about who is using parking spaces currently, or how people travel to do their shopping, can do the same.

Parking research gains value if it is included in a **monitoring process**. An effective monitoring routine should include regular, consistent data collection and a clear link with policy, implementation and adjustment of the policy. An example is provided below.

At present, park and ride sites (P&R) have become very popular in many European metropolitan areas. However, the impact of this kind of parking infrastructure has been criticized by many, suggesting that P&R can have a "limited or even counter-productive effect on its policy goals, particularly those to reduce car use" (Meek et al, 2009, p. 468). Here we present the findings of a users' survey (N=738) conducted in nine rail-based P&R located around the cities of Rotterdam and The Hague (The Netherlands) in order to get an overview of their impact in terms of vehicle km travelled (VKT) and vehicle emissions (CO2, NOx, PM10 and SO2). Because some people who used to use public transport for their whole trip now switch to park and ride (because it is faster and/or cheaper with a more frequent service) then there can actually be some increase in car km as a result of the park and ride – obviously, not what was intended. To minimise this impact, park and rides should ideally be located close to users' trip origins (home, usually), not their destination.

Unintended effects P+R	The Hague 2008 (200 respondents)		Rotterdam 2008 (547 respondents)	
	Km	Kg CO_2	Km	Kg CO_2
Total km saved	-869.9	-172.3	-1,559.0	-308.7
Extra km abstraction PT	661.3	130.9	2,710.0	536.6
Extra km abstraction bike	32.3	6.4	121.0	23.96
Extra km (partial) abstraction bike	88.1	17.4	-	-
Total extra km	781.7	154.7	2,831.0	560.53
Net change	- 88.2	-17.5	+ 1,272	+251.8

Figure 3.5: Impact of Park and Ride in two Dutch cities (based on data in Mingardo, 2013)

In addition, the question remains how to **measure success (→SUMP Cycle step 7.3)** in parking. This begs questions such as:

- What is success for cities? What are the policy and operational objectives in place? What are the most important factors that will help the city to show that its parking policy is a success?
- These will probably be related to the most contentious parts of parking policy: the impacts on business and the local economy, the challenge of finding a space, public satisfaction with parking, the number of fines issued and levels of compliance, and what the city does with the money generated and the space that is freed-up.
- Modern parking technology e.g. parking sensors or scan cars) can produce a great deal of data on occupancy, income per space, length of stay, compliance with regulations, parking turnover and so on. These data can be important for further sustainable urban mobility planning and for managing parking operations, but they will be less important from a public-facing point of view. With increased digitalisation of parking, cities can also start building new **indicators (→SUMP Cycle step 6.1)** to better understand the parking situation, such as (peak) occupancy, cumulative zonal occupancy, revenue, returning visitors, origin of visitors and others. This can lead to more informed urban development and SUMP activities and more informed decisions about land use, building regulations and new parking infrastructure. The data generated by parking (→SUMP Cycle steps 7.3, 11.1 and 12.1) can be merged with other data sets to establish a detailed picture of actual mobility needs and patterns at specific sites. This can inform decisions about parking standards in buildings, new construction of public off-street parking and so on.

3.8 Indicators for parking management

Indicators that help to monitor progress towards parking-related objectives in a SUMP can be an important complement to a city's monitoring and evaluation efforts related to parking. As this Topic Guide emphasises, parking is a measure that can be used to achieve many SUMP objectives and so indicators that measure progress towards such objectives, such as modal split or congestion, will help to show how effective parking is as a measure.

These are core indicators in the European Commission's SUMI Indicator set. Nonetheless, parking-specific indicators themselves can be helpful operationally, to inform the implementation of parking management measures. It is important not to expend excessive time and effort gathering data on these indicators, but key information includes:

- Number of controlled on-street parking spaces (those with time limits and/or charges).
- Number of uncontrolled on-street parking spaces.
- Cost per hour of most expensive on-street parking spaces.
- Cost per hour of most expensive off-street parking spaces available for public use for payment.
- Cost of a single one zone public transport ticket.

3.9 Assure quality

ParkPAD was developed as a new tool within the Park4SUMP project to ensure quality. It provides an audit scheme for cities to review the quality and comprehensiveness of their parking policies and the organisational set-up for delivering them. Further, it helps cities to achieve consensus on improvements by developing an action plan for parking management that aims to increase overall quality and that can be used as part of their SUMP.

ParkPAD includes the collection of information about the overall mobility and parking situation in the city. A key aspect is to establish an "audit group' (consisting of elected politicians, city authorities, lobby group members, transport users, retailers, etc.), all of whom undertake their own assessment of the city's parking policy using a standardised questionnaire covering 13 different topic areas such as parking policy, bike parking policy, enforcement, and the involvement of the public in making parking policy and measures.

The results of the questionnaire are discussed at the first of two audit group meetings, attended by the Audit Group, who try to achieve consensus on what the city already does well in parking, and what it needs to improve. Guided by the auditor, the second meeting of the audit group identifies measures that should be implemented to help achieve the improvements in those areas of parking policy identified as priorities at the first meeting. This then results in a Parking Policy Quality Plan and ParkPAD Action Plan as part of the city's SUMP, comprising the priorities for innovative, effective, and locally acceptable package of parking management measures. The ParkPAD processes held to date in around 25 cities have had the following benefits:

- Strengthening the focus on parking management in the city.
- Bringing parking stakeholders together – unusual.
- Reaching agreement on what is good, what is less good.
- Setting priorities for improvement.

(→SUMP Cycle steps 7.1, 8.3, 8.4 and 12)

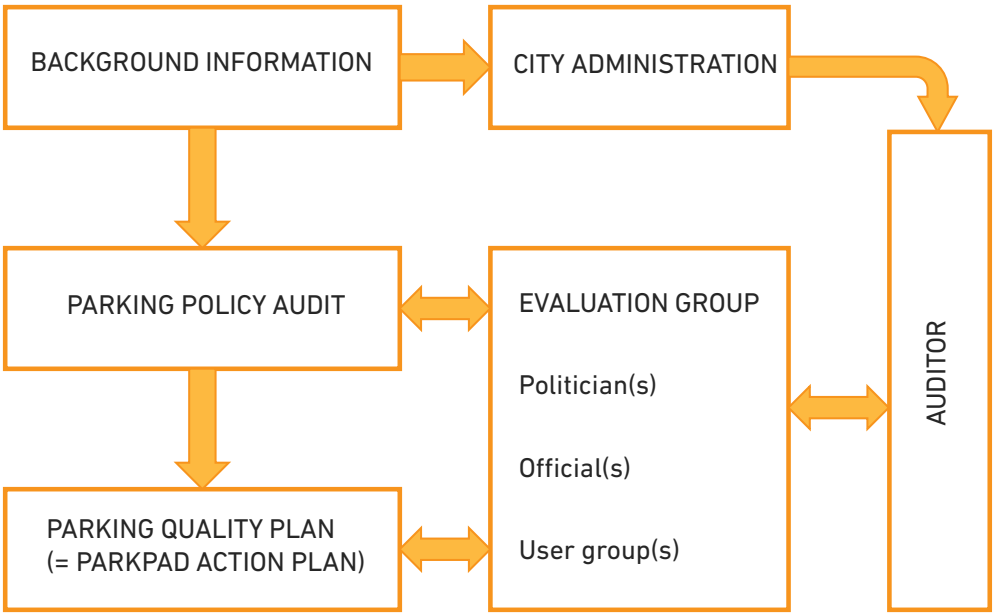

Figure 3.6: ParkPAD process in outline. Source: Park4SUMP project.

4. Parking management: fields of activities that make a difference

This chapter describes various parking management measures and provide examples and related impacts from Park4SUMP cities and beyond. We also discuss the process and challenges of parking management implementation. In order to facilitate the understanding of the following measures, a categorisation into seven different clusters[8] is helpful. These categories were selected by this project due to their importance for parking management:

1. **The extension of parking management** is the key if more car travellers are to be influenced by priced and/or time and space limited parking.

2. **Earmarking revenues** from paid parking to sustainable mobility measures should become a logical cost-benefit element for the integration into SUMP, while solving many financial SUMP support problems.

3. **Standards** for parking in new developments can have a big influence on mobility behaviour and car ownership.[9]

4. **Enforcement** is vital for parking management to function effectively.

5. Parking management – including data collection, exchange and smart interoperational use - has to become a **backbone of the SUMP** as it is the main push activity to tame steadily increasing car use.

6. **Accompanying – push & pull - measures** are supportive to behaviour shift of different target groups: residents, visitors, employees

7. **Technological and institutional/societal innovations** empower effective parking management at lower cost and more efficient enforcement, whilst safeguarding equitable access. (These are dealt with in more detail in Chapter 6).

However, for ease of use of the guide we have amalgamated these categories into three main types of measure, as shown in the table below, and categorised the measures dealt with in this chapter according to these types of measure, and their suitability for implementation in cities with different levels of parking management experience, as shown in Table 4.1, below.

	Parking strategy measures (1, 2, 5, 7 in the list above)	**On-street parking measures (1, 4, 6 in the list above)**	**Off-street parking measures (3, 4, 6 in the list above)**
City new to parking management	Parking as part of SUMP Reducing overall supply Changing parking space to public space	Reducing overall supply Simple controls to improve turnover Parking for disabled people Improved enforcement	Reducing overall supply (Maximum) parking standards for new development
City with some experience of parking management	All the above, plus: Park and ride	All the above, plus: Controlled parking zones Parking for EVs Curbside management	The above, plus: Shared use parking
City with much experience of parking management	All the above, plus: Recycling parking revenues into sustainable transport measures	All the above, plus: Differentiated tariffs	The above, plus: Parking management in socialist era housing estates and areas with high car ownership but little off-street parking

Table 4.1: categories of parking management measure and suitability according to city's level of parking management experience

[8] CROW – KpVV selected similar key categories of parking measures effecting behaviour.

[9] The ECF's Report 'Making buildings suitable for sustainable mobility' also determined where in Europe conflicting mobility incentives – in terms of regulations for both car and off-street bicycle parking are occurring. For Car Parking it showed that in 53% of all countries and 75% of the regions (in Belgium and Germany) have MINIMUM car parking requirements in place. For bicycle parking requirements this is respectively 25% and 30%.

4.1 Parking strategy measures

4.1.1 Parking as part of SUMP

Park4SUMP has showed examples of how parking management and policies can be embedded in challenging frameworks. In particular, the city of Slatina in Romania, as shown in the box, has been committed in making parking policies part of the local SUMP, providing insights and recommendations into how to effectively integrate parking policies and urban sustainable transport.

Parking as part of SUMP - Slatina

In 2017, the city of Slatina, a Romanian medium-size city of about 80,000 inhabitants (2021), adopted its first SUMP, developed in cooperation with 10 other local and regional authorities across Europe in the frame of the URBACT III project CityMobilNet. At that time, the SUMP included only a small section on parking management. But new developments have changed the approach, leading to the integration of parking management in the SUMP. Firstly, Slatina benefited from JASPERS' expertise and conducted a parking analysis. Then, through the Park4SUMP project, Slatina has implemented the ParkPAD methodology, which has led to the identification of four priority areas for improvement parking management and policy, integrating the new policies into an updated SUMP. More specifically, the four main areas of improvement are the following:

1. Regulation: setting the number of parking spaces in the central area and the space allocated to parking;
2. Enforcement: better control of parking in the central area of the city: restrictions on fee and time for on-street parking in the central area,
3. Special users: increasing bicycle parking places as a percentage of car parking spaces in the central area, and parking places for people with disabilities as a percentage of car parking places in the central area;
4. Parking standards: establishing a set of conditions for new buildings based on existing legislation and setting the maximum number of parking spaces per individual house / building according to specific new regulations.

Several other cities in the Park4SUMP project took steps to incorporate parking into their SUMP, often as a result of the ParkPAD audit process that they undertook. These cities include Reggio Emilia (Italy), Gdansk (Poland), Sofia (Bulgaria), and Tallinn (Estonia). In Freiburg (Germany) the new SUMP will be part of the city's Climate Protection Plan 2030, and the imperative to reduce car use increases the importance of parking management. Meanwhile, in Vitoria-Gasteiz (Spain), a section of the draft of the new (2022) SUMP integrates parking management measures with the superblocks scheme and the rest of mobility measures the municipality intends to develop in the near future. It also includes bike parking standards for new buildings.

4.1.2 Reducing overall parking supply

Parking space, whether on-street or off-street, has an opportunity cost: it could be used for something else. In addition, reducing parking supply will over time have an impact on car use and has been one of the measures used by all those cities that have achieved a less car-based modal split. Paris and Copenhagen have for many years made it a policy to reduce the total amount of public parking space available. Paris for example reduced controlled on-street parking spaces by 9% from 2003 to 2011, and the trend continues. Several cities in the Park4SUMP project have also reduced large numbers of parking spaces over time. These include:

Freiburg – between 2017 and 2022 around 200 spaces were replaced with space for walking, cycling, gastronomy, bike parking and play streets.

Sint-Niklaas - 68 spaces were removed as part of a street redesign scheme, and "replaced" by making existing off-street parking spaces available through a shared parking scheme at a local supermarket.

Gdansk - 40 spaces were eliminated as paid parking zone spaces formalised.

Rotterdam - 3000 parking places were removed between 2008 and 2022.

Trondheim - Removal of 285 spaces between 2017 and 2022, of which 85 were turned into bike lanes).

Umeå has made a political decision that there should not be any more workplace parking places built in the city centre.

Case study – City of Zadar

In 2016 the City of Zadar decided to remove car parking from its historic walls, supported by European and World Heritage Convention initiatives. According to the UNESCO webpage, between 2018 and 2019, Zadar municipality removed 157 parking spaces along the parts of the walls and a beautiful walkway was created there instead.

There was initial opposition from residents, shop-keepers and market suppliers because of a perceived shortage of parking and because of a need to supply the city centre and market with goods. These challenges were addressed in various ways: Firstly, by providing a few additional parking spaces in other parking lots nearby, as well as by growing the public bike sharing system as an alternative mode. Secondly, by developing and implementing a strategy for deliveries in the city centre, with a traffic regulation and surveillance system for delivery of goods, new loading/unloading bays and continuous monitoring of their effects. Thirdly, by developing digital solutions to divert traffic and parking demand to alternative parking lots more distant from the old city core.

Today, the urban park is used daily by locals and visitors, and hardly anyone even remembers that it used to be a road and how it looked before. There are no data as yet on actual visitor numbers, but the park is often very full, particularly in the early evenings. Its value and hidden potential were especially visible during the pandemic COVID-19 when additional open public space for inhabitants of urban areas was crucial for any type of sense of normal life. The project now nowadays has only positive impacts and it has been viewed as an example of good practice from many perspectives.

The new park overlooks the historical inner city and the harbour and helps to keep Zadar attractive for residents and tourists alike. It is a great public place to walk, to find out about the city's history, to rest and to enjoy.

Vitoria-Gasteiz - around 1200 parking spaces were removed from the streets in 2021 to improve or create new public transportation lines. Modifications of individual parking spaces are also made when that space is needed to install elements that improve streets, for example bicycle parking, or for example to increase visibility at intersections with pedestrian crossings.

Large amounts of parking need not be removed in one go, as long as there is a consistent policy in place to gradually convert existing parking space into other uses. If very small numbers of parking spaces are removed each year, large scale public consultation and participation may not be required. Vitoria-Gasteiz is an example where, on average, 40-45 parking spaces are eliminated per year to improve visibility at intersections with crosswalks and at entrances to under-ground parking facilities in residential buildings. Where entire car parks or streets of parking are taken out of the system, this should be preceded by public consultation and involvement as outlined in the SUMP Topic Guide on UVARs.

4.1.3 Changing parking space into public space

Under the umbrella of the term "tactical urbanism", recent initiatives have been progressively changing the urban landscape. Driven by citizens, local administrations, urban planners and NGOs, "tactical urbanism" initiatives aim to redesign urban spaces in the direction of more social inclusiveness, reduced dominance of motor vehicles, and a shared use of urban spaces. The key characteristic of these initiatives consists in using short-term, low-cost, and scalable interventions, nevertheless making long-term changes possible as well. Several co-benefits may arise these initiatives, such as a) creating safer and more inclusive public spaces, b) fostering economic development through urban places, c) transforming public spaces in more liveable places.

How can parking policies and management fit into this trend? Is there any role for parking management in transforming public spaces into inclusive, safer, and more liveable places? The Park4SUMP project has provided some answers, demonstrating how parking management can be part of this challenging and extremely rewarding topic, both for citizens and local administrators. There are several good examples of cities in the Park4SUMP project that converted parking space into other uses in the period 2017-2022:

Shkoder (Albania) - 79 spaces in the Shiroka neighbourhood were converted to public square (a 50% reduction) with increased enforcement at the same time.

Freiburg -. Removal of approximately 90 parking spaces in the Hermannstraße to construct an important bicycle route. From 2018 to 2022, five new play streets were implemented, and in three of these a total of 17 parking spaces was removed.

Reggio Emilia - 60 parking places were removed in front of schools across the municipal area and 37 parking spaces (-14%) were turned into public spaces for people in a city centre neighbourhood (Via Roma).

Changing parking space into public space – Reggio Emilia

Reggio Emilia is working on parking policies to limit the negative effects of high levels of car use and to increase quality of life and safety in the urban area. The COVID-19 pandemic had a huge impact on the mobility system and accelerated some implementation processes. The transformation of parking lots into spaces for people, families and children is one of these accelerated measures. The lockdown encouraged people to walk and cycle more inside their neighbourhood, realizing that they needed more high-quality space. To meet this need, a pilot project was implemented in 2020 and 2021. Popol Giost square used to be a car park located in one area of the inner city, is now completely emptied of parked cars. After the first waves of COVID-19 in September 2020, the municipality organised an event to transform, temporarily, half of the car park into meeting space for the local community. A low-cost, but effective project was developed by the Municipality and implemented directly by residents: they coloured the asphalt with painted stencils to indicate its change of use, and , installed seats and plants. A second phase was started in Spring 2021 which helped to free-up the other half of the square, thus enabling local restaurants to increase their terrace space. This approach, called tactical urbanism, has allowed citizens to develop a greater sense of ownership and experiment how a space can change, but with limited timing and resources. This was made possible thanks to the strong engagement processes promoted by the Municipality in the past few years and citizens' readiness to collaborate with the Municipality in the post-pandemic context.

Rotterdam - 3000 parking spaces were removed or transformed into public space for pedestrians and cyclists.

Trondheim - 15 parking spaces were transformed into a new public park area.

In the following box we see in more detail how the city of Reggio Emilia has shown how conversion of parking places can be placed at the heart of new and socially inclusive public spaces.

4.1.4 Recycling parking revenues to support and encourage sustainable mobility

Parking management can contribute to raise municipal revenue without increasing - or in some cases even reducing - the fiscal pressure on residents and, at the same time, improve the quality of alternatives to car use. These revenues should be earmarked (at least partly), as a standard part of a city's transport budget, for funding sustainable mobility measures. This provides a reliable source of funds for these measures and helps to increase the acceptability of parking management by showing that

Earmarking parking revenues for sustainable transport – Krakow

Since 2019 a new Polish law, lobbied for over many years by some Polish municipalities, has come into force to give cities of over 100,000 population the option to spend a very high proportion of their parking revenue on sustainable transport and green space: at least 65% of the income from parking fees, and 100% of the income from fines, when they declare a so-called "inner-city parking zone". Because the policy fits well with its emerging SUMP, and because the city wants to highlight the link between parking and sustainable transport, Krakow has embraced the new law. In spite of reduced parking revenue due to COVID, including a period of 2020 when parking charges were suspended altogether, it is now planning in its draft 2022 budget to spend 70 million PLN (about 15,5 million Euro) on sustainable transport measures, funded from parking. Around 42,5 million PLN will go on supporting public transport and 25 million PLN on environmental protection, but the balance will be used for more innovative measures including bike-sharing, pocket parks and several travel awareness campaigns. This is not an insignificant amount when it is considered that the city's 2020 budget for public transport subsidy was 580 million PLN.

the money raised is spent on specific transport-related activities, not just absorbed into the general municipal budget. Cities like Amsterdam and Ghent pioneered this approach, and it is also standard practice (required by law) for all English local authorities that manage parking to publish an annual report showing how much revenue was raised and what it was spent on. A country that has recently made this approach legally possible is Poland, and the example of Krakow, Poland, is shown in the box.

4.1.5 Park and ride

Park&Ride facilities (P&R) can support a range of policy goals like lowering congestion levels, overcoming pollution levels and eliminating parking pressure. It can be an effective measure to reduce the number of cars entering the city and to improve urban accessibility, if implemented strategically. Park & Ride schemes are a more technological and infrastructural intervention to relocate (mass) parking from the most economically valuable urban areas towards peripheral zones. At the same time there is a need to offer alternative modes for travellers to reach the city sustainably, like in Groningen (NL) (bus) or Oslo (NO) (metro, train, tram). The facilities should be reliable interchanges for local public transport (local buses, trains, metros, taxis, rideshare) and logically planned to also make use of active mobility modes for local access. To achieve an effective mode shift, Park & Ride facilities should be strategically located at the edge of the city or in areas where commuters live. The Greater Dublin Area extends those strategic locations to places where a substantial amount of people with limited access to high quality public transport, limited facilities for active modes or people in need of specific mobility services (e.g. the elderly or mobility impaired people) can easily switch modes. The construction of such facilities must therefore proceed simultaneously with reducing the number of on-street and off-street parking spaces in the city centre. If not, Park & Ride will only create additional supply that will result in additional car traffic and a counterproductive impact on parking policy objectives.

Park & Ride facilities in support of smart parking strategy – City of Rotterdam

Car traffic is more and more restricted in and through the inner city of Rotterdam to provide more public space, increase multimodal accessibility, improve traffic safety for vulnerable road users and deliver better air quality.

In recent years, the Dutch port city has removed some 3000 on-street parking spots in the city centre. To overcome additional parking pressure in municipal and commercial garages in the city centre, Park & Ride facilities on the edges of the city near high-quality public transport connections are being expanded, designed to be more pleasant, and provided with shared facilities. Crucially, other elements of parking policy encourage the use of Park and Ride.

Parking for residents in new developments is offered less and less as on-street parking, as a result of lower parking standards. Pricing policy makes on-street parking much more expensive than off-street parking facilities, and there are increasing numbers of on-street spaces with restrictions on parking duration. The lower cost of off-street parking at parking garages and Park & Ride schemes is subsidized with the higher revenue from on-street parking charges. Nevertheless, people also need to be encouraged to use these "off-street" facilities, bearing in mind that all these measures contribute to an attractive and liveable city centre.

Figure 3.7: Park & Ride Noorderhelling. Source: City of Rotterdam

4.2 Parking management measures on-street

4.2.1 Simple on-street parking controls to increase turnover and/or improve safety and reduce congestion

When cities begin to experience parking demand exceeding supply, they start to think about parking management. Experience with the less advanced cities in Park4SUMP shows that this is best done within the context of the SUMP, where the measures to manage parking are also seen as things that will support the achievement of SUMP objectives. An example of this is Shkodra, Albania.

Shkodra is renowned as the city of bicycles in Albania, where most trips were made on foot and by bike and where car ownership was not the first priority. That was true 10 years ago but now, with growing car ownership, this cycling culture is under threat. Car traffic has become problematic and finding a parking space is not easy as it was 5 years ago (certainly not in the summer when the Skhodra lake attracts additional tourists).

In 2018 Shkodra Municipality started work on its 'Study-Plan for Traffic and Mobility'. During the process, it was observed that the wide roads in Shkodra which previously were used as a shared space for bicycles and cars became mostly used as a double parking space. The lack of a Mobility Plan and a parking policy has created an overload of traffic on some axes but no traffic in some other places.

The local SUMP, which is currently under development, offers the implementation of protected cycle lanes on both sides of the street (which were suffering from illegal parking) and parking lanes (in one or both sides of the streets) to narrow the car lanes, to stop double parking and to create safer pedestrian crossings. The Plan prepared a strategy for all the main streets and all the crossings, creating safer roundabouts with wider sidewalks.

Due to a political crisis this plan did not get approved. Still Shkodra Municipality continued by working in two directions. Firstly, a detailed project for the busiest axis of the city ("Bulevardi Zogu i Parë") was prepared for investment: two protected and renewed cycle lanes, two narrower car lanes, and a parking lane (with a 30% reduction in parking spaces) with sidewalk pockets for safer pedestrian crossings. Secondly, another study and a legal document for implementation of controlled parking has been done as a first step to introduce paid parking, with 'feasible' prices for the main North-South axis of the city. This document divides the main city in three zones with different parking prices per zone. The approval of this document will enable further implementation of regulated parking and enforcement.

4.2.2 Controlled parking zones with permits for certain users

One of the basic tools of on-street parking management is the implementation of controlled parking zones (CPZs) where on-street parking is zoned for different uses and different users: some exclusively for residents, some exclusively for short-stay parkers, some for both, and some for vehicles loading and unloading. The zone exists to give priority to certain types of users (usually, especially, residents, at the expense of long-term parkers from outside the area). Furthermore, such zones should help to reduce occupancy rates to facilitate the search for empty parking spots and therefore reduces congestion. Residents, local businesses, and craftsmen may be able to purchase a monthly or annual permit to park or can get discounts.

Cities often have several CPZs and those with a permit to park in one cannot usually park in another with that permit. Operating hours usually reflect the times when demand is at its highest, although it is still not unusual to find zones that do not operate at weekends even though demand may still be high on those days. CPZs by definition have a boundary, and this may sometimes lead to boundary effects where the zone itself is empty at its edge, but just beyond the boundary, where there are no controls, all the parking is completely full. Some cities such as Edinburgh in the UK have introduced "light touch" controls, where only short sections of the kerbspace are controlled, to soften this boundary effect. Obviously controlled parking zones have to comply with local and national law in the way that they are set up and operated, and they rely on effective enforcement.

Controlled parking zone in Sofia, Bulgaria

A good example of a city with a growing CPZ is the Bulgarian capital of Sofia. In December 2021 it expanded its central blue zone from 5,000 to 13,000 spaces, with a further 21,000 in the more peripheral green zone. The blue zone operates from Monday to Saturday from 8.30 am to 8 pm and the green zone from 8.30 am to 7.30 pm on weekdays and from 10 am to 6 pm on Saturdays, with hourly rates of two and one BGN per hour respectively. Businesses can purchase a subscription for a parking permit of up to five parking spaces at one address (previously, some business had the use of free reserved spaces, but this is no longer the case). Residents of the green zone pay 100 BGN a year for a permit, and those in the blue zone 150 BGN. When the CPZ was first introduced in 2010, it was associated with a significant drop in traffic levels in the city centre, including parking search traffic.

4.2.3 Improved enforcement

Increasingly, municipalities and parking operators are moving to payment and enforcement based on car number plates, so that it is no longer necessary for the operator to issue, nor for the driver to display, a physical permit or ticket on the vehicle. Instead, the driver enters the car number plate when paying for parking at a meter or online, or provides the number plate and proof of ownership when applying for a permit. The legal possibility to do this does vary from country to country depending on particular interpretations of privacy laws, but it is now possible in the majority of EU Member States.

Enforcers check number plates and their enforcement equipment communicates with a back office database that "knows" in real time whether the number plate has a valid permission to park. If not, enforcement action can be taken – and this can be more sophisticated, since the enforcement system also "knows" whether the vehicle in question is a repeat offender or new to the area. For example, to improve acceptability of newly introduced parking management measures, a decision may be taken, where it is legally possible, to issue those contravening the new regulation for the first time with a warning or advice note about the new regulation, rather than a fine. Equally, repeat offenders may be towed immediately whereas first or second offenders might be issued only with a fine.

A further development of number plated based digital enforcement of this nature is the scan car which, automatically reads number plates and checks them against the database while driving along streets through a parking zone. Based on a second drive past or by alerting manual enforcers to incorrectly parked vehicles, fines can then be issued. The use of scan cars increases efficiency and the size of the area that can be enforced with the same resources. As well as Gdansk (see below), in the Park4SUMP project, the cities of Rotterdam and Trondheim use scan cars, and several others tested them during the project.

Implementing enforcement by scan car

Gdansk in Poland has 6129 controlled parking spaces and 329 parking meters. In summer 2020, it began investigating the possible use of a scan car to improve the efficiency of enforcement of its controlled parking zone (CPZ). After 6 months of technical dialogue and a further 6 months of procurement, a contract was awarded in July 2021 and the system went into operation four months later, with a scan car purchased for about €34 000 and associated operations provided by a private supplier at a cost of about €8 000 a month. The car does a double scan of each street, so as not to fine drivers who are just in the process of buying a ticket. Photos of cars found to be contravening regulations are checked manually and if verified these cars are fined (so there is no manual on the street enforcement to back up the scan car). The scan car checks about 500 cars per hour and on average about 1 in every 25 cars is issued a fine, so it has significantly increased enforcement in Gdansk.

4.2.4 Bicycle parking

An important element of encouraging cycling is to make it easy to park your bike. This requires a strategic overview, analysing and anticipating demand in different areas of the city (and steering demand away from areas where large numbers of parked bikes are perhaps not wanted), but also flexibility, to implement new parking quickly where demand exceeds supply. Regular on-street bike counts as well as knowledge of the city's major trip generators are required to deliver this. Cities that have taken such an approach include: Freiburg – where 30 on-street parking spaces were removed for the bike rental system (Frelo) and 20 for new bicycle parking facilities, and where its newest city

district has a bicycle parking standard of 2.5 spaces per residential unit. Meanwhile, Krakow installed 5820 new bicycle racks in the city (some of them covered) between 2018 and 2021.

Vitoria-Gasteiz is the capital of the Basque country in Northern Spain and has a long history of sustainable urban planning. The city has made use of different innovative solutions including the creation of superblocks, where public space is re-ordered resulting in a network of priority roads and "islands" of traffic calming. This planning approach led to a significant reduction the use of the mode share of the private car in favour of more sustainable modes. Bicycle modal split increased from 3.4% (2006) up to 8% (2019). To support the increased use of the bike and to encourage further increases the city took actions to extend and improve the existing infrastructure available for bike parking. The city sought to make changes to 'parking standards' regulations to increase the minimum required bicycle provisions and extend the requirement to provide bicycle parking to other land uses, e.g. industrial estates.

Parking standards are a long-term planning tool, so Vitoria-Gasteiz complemented this with the development of a smart and secure network of municipally owned bike parking facilities. This network provides secure parking in areas of high demand (city centre, sporting venues, train and bus stations) and residential areas with a shortage of parking. Launched in 2018, the network has now expanded to 10 locations with a total capacity of 557 parking spaces, some of them adapted for cargo bikes and with charging points for electric bikes. Most of the locations comprise detachable modules with a capacity of 50 parking spaces located on public space, but there are also parking facilities inside buildings and in car parks. All facilities have a camera surveillance system.

Users can purchase monthly parking vouchers, through a mobile app, that allows them to park anywhere in the network. Users access the facilities via app or by entering a personal key on a keypad. Through the app they can also check occupancy in real time and report any problems with the service. Currently around 400 people a month use the service. Work is already underway on the next extension of the network, which will soon have 5 new facilities with a capacity of 585 spaces.

4.2.5 Differentiated tariffs for different types of vehicle

There are many reasons why municipalities may wish to encourage the use of different types of vehicles in their area: reduced pollution, reduced use of space, or to increase the provision of modes such as car-sharing. This means different charges according to emissions characteristics, size, or use of the vehicle. Charging these different vehicles differing amounts to park obviously only affects those vehicles which use parking provided for and charged by the municipality – through traffic, and those which park elsewhere are unaffected – but in (areas of) cities with little alternative parking it can have a gradual but significant effect on the vehicle fleet. Emissions related parking charging is seen in many cities now where electric vehicles receive free or discounted parking (in terms of countries, Norway was the pioneer in this area, followed by the

Parking charges related to emissions standards in various parts of London

Greater London, England, has a population of 8.5 million people. While many transport functions are the responsibility of a London-wide body, Transport for London, parking on local roads is still under the control of the 32 London boroughs (municipalities) that make up the metropolitan area. Several of the boroughs have experience of charging different rates for parking for more polluting vehicles, based either on the amount of CO2 they produce, or their emissions of particulates and oxides of nitrogen (which affect the EURO standard). The following Boroughs currently (2021) have emissions-based charging in place (date of introduction in brackets): Westminster (June 2017); Islington (January 2018); Camden (July 2018); City of London (August 2019); Tower Hamlets (April 2020); and Newham (August 2021). Others have advanced plans to introduce them, although others have withdrawn them due to public protest. In some cases, the charges are graduated, depending on emissions class; in other cases, such as in Islington, there is a flat fee for parking a diesel vehicle. Parking activity data show a fall in the numbers of more polluting vehicles paying to park, and other data shows falls in traffic levels and pollution levels not observed in Boroughs which do not have emissions related parking charges. More information is available from Local Transport Today at this webpage (accessed 1st February 2022).

Netherlands). More sophisticated schemes, where internal combustion engine vehicles pay for parking depending on their EURO standard and/or CO2 emissions exist for example in Madrid, Barcelona and Rotterdam. In Baden-Wuerttemberg in Germany it is now (2021) legal to charge different parking rates for vehicles of different lengths (to reflect the space they occupy), and Tübingen and Freiburg are cities that are about to implement this.

4.2.6 Curbside management for loading and unloading and new mobility modes

Commercial traffic accounts for around one third of traffic in cities. Loading of goods in the context of urban mobility can be divided into several categories: Delivery on a business-to-business level (B2B) and a business-to-customer level (B2C). Private households are another category, but the first two are a bigger challenge for municipalities. Private households' goods movements may in part be addressed by hire and subsidised purchase of cargo bikes.

The loading of B2B goods has changed over the past decades: high shop rents in inner city areas means storage rooms have been converted to sales rooms, leading to more but smaller deliveries. A lack of loading zones, or cars parked illegally in loading zones often encourages double parking. This leads to congestion and safety problems and increases the need for new loading zones and consistent monitoring and enforcement of parking violations in those zones. Time slot booking for loading zones is also strongly recommended: The City of Barcelona and the City of Rotterdam are providing solutions based on digital number plate recognition and APPs.

B2C deliveries have grown enormously especially since the pandemic. The share of the so-called "last mile" deliveries in the volume of goods transported in the city in general by so-called CEP companies (courier, express and parcel service providers) is only 2% (Frauenhofer IML + LNC results report, 2020), but the transporters cover 21% of the recorded routes for this purpose. Double and other obstructive parking has increased as a result, especially in dense residential areas.

Microhubs – initiated by Municipalities - can be one solution to solve the "last mile" challenge: Micro depots are set up at the edge of the delivery area or centrally in the delivery area and are supplied by CEP service providers with larger transporters - up to 3.5 tonnes or 7.5 tonne trucks. They are mainly used for the transfer of goods consignments to cargo bikes, which deliver to end customers (B2B, B2C) from here. A micro depot requires at least 15 to 25 square metres of space and is used by logistics service providers to enable the delivery of goods over the last mile (Bulwiengesa, 2017, p. 18ff.).

Implementing micro-hubs in Munich

In a pilot project in the City of Munich the "big player" UPS set up micro depots (Micro hubs) for all deliveries in city centre neighbourhoods. Three containers placed on former car parking spaces receive deliveries by a truck. From these depots, UPS exclusively uses cargo bikes (conventional and electric) to deliver the packages to homes. This saves 65 tonnes of CO2 per year in the study area. According to its own information, UPS has already saved 14 diesel vehicles in the Bavarian capital by setting up the micro-depots and sees potential to expand the concept to the entire city area, even after the end of the project period.

4.2.7 Parking for electric vehicles

There is a widespread move in European cities to encourage the take-up of electric vehicles(EVs) for climate change and energy independence reasons. But this has implications for parking: how many on-street and off-street charging points are required (which are at the same time parking spaces)? What business model and private-public collaboration is required to fund and implement on-street charging? What discounts on parking charges should be given to EVs, if any? How to ensure that a vehicle parked in a space next to a charger is actually charging? Many of these questions are dealt with in new guidance from the Sustainable Transport Forum Report Recommendations for public authorities for procuring, awarding concessions, licenses and/or granting support for electric recharging infrastructure for passenger cars and vans (or a condensed version, the STF Handbook).

Norway has incentivised purchase and use of EVs for many years, with large tax breaks for buyers and major discounts on parking, bridge road and ferry tolls, and access to bus lanes. This has led to a situation where 340,000 of the country's 2.8 million private passenger vehicles were BEVs in 2020, and new car sales are now around 80% electric.

The case of Trondheim, Norway

In Norway's third largest city, Trondheim, in common with other Norwegian cities, users of ZEVs were not charged for

parking until 2020 when prices increased to 50% of the rate of combustion engine cars. Until recently, ZEVs were also exempt from any road tolls in Trondheim. There are 87 charging stations in the city, the majority off-street, but with 20 on-street. As a result, the use of EVs commuting to the central city increased very significantly and many parking spaces were occupied all day by EVs.

To address this, in 2019 the city reduced the maximum parking time for ZEVs to three hours and adjusted the parking fees to the prices of combustion engines, although this was only temporary as national legislation decreed that the maximum charge for ZEVs could only be 50% of that for ICE vehicles. This national decision was counter-balanced by adjusting the toll charges for the Trondheim ring road to the same price as combustion engine cars.

The Trondheim and Norwegian experience shows that when planning incentives for ZEVs, including for parking, it is crucial to build flexibility into legislation so that the incentives can be modified as ZEVs become more popular, otherwise ZEVs may undermine other transport policy objectives (congestion reduction, for example).

4.3 Off-street parking

4.3.1 Shared use parking

The concept of shared used parking spaces aims to use existing parking facilities more efficiently. It takes advantage of the fact that most parking spaces are only used certain parts of the day: by an individual driver or a particular group (e.g. employees of a warehouse), following predictable time patterns (such as 7am-3pm daily) and resulting in a significant amount of places unused. Parking can be shared amongst groups of users like in Seestadt Aspern (City of Vienna), where short-term parking spaces are offered in addition to permanent parking spaces for residents. Besides, parking can also be shared amongst different buildings or facilities in a certain area, taking advantage of different peaks in demand. Schools and theatres located close to each other have respectively complementary day and evening peak periods. In such cases, parking information is important to remove uncertainty for end-users. On-street parking has an increased pressure on scarce public space in today's urban areas. The multiple use of public parking space by different modes offers a flexible solution to create liveable streets in robust city districts (e.g. combining shop&go parking spots with bicycle parking spots). An alternative approach is making use of off-street parking facilities, like in Vauban (Freiburg). Public off-street parking spaces are mostly less conveniently-located, catering for the long-term parking demands of residents, visitors or employees. Private off-street parking spaces can potentially take advantage of geographic density and clustered activities. Sint-Niklaas followed a similar approach to tackle its short-term parking policy and resident parking facilities on-street and off-street.

Shared use parking principles – Sint-Niklaas (BE)

Sint-Niklaas' city centre is gradually transforming from a zone with high parking pressure to a residential area, prioritising active modes. The impact of parked vehicles from residents, visitors of the local theatre and teachers of the art school, with the presence of school traffic, resulted in many unsafe traffic situations. A reduction of the initial 101 on-street parking spaces in the very city centre to a new total of 36 was an initial step, but it did not in itself guarantee the disappearance of parking pressure. The main focus of Sint-Niklaas' parking policy is to further shift on-street parking spaces to off-street parking facilities. The strategy is not to create new or extra parking capacity in those off-street parking facilities, but to make use of existing but underused public and private parking lots. The aim to reduce on-street parking pressure supports the city's vision to make streets and neighbourhoods more liveable, traffic safer, with more greenery and fewer private cars.

A first agreement has already been reached with a private company, willing to rent a part of its private parking to the city, which will use this parking space exclusively for residents. Negotiations are now ongoing with other private owners to provide parking space for the art college staff and for visitors to the theatre. In addition, the concept of shared parking was implemented in Vijfstraten, one of the main corridors into the centre. Segregated cycle ways on Vijfstraten could only be created by removing on-street parking spots, used by residents. An agreement between the city and a supermarket located on that street now allows residents of Vijfstraten to park in the supermarket off-street car park, as peak parking demand from both residents and shoppers do not coincide. By 2023, Sint-Niklaas will have 6 such shared car parks.

4.3.2 Parking standards in new developments

Parking spaces are normally provided in new buildings, normally to a minimum prescribed in local, regional or national building regulations. However, because of the strong link between parking and mode choice, it is possible to influence the way in which the users of those buildings travel by providing less or even no parking (as long as there is no access to cheap or free alternative parking nearby). Cities such as Oxford in England have used such a policy since 1973, meaning that employment in its city centre grow significantly, whereas almost no new off-street parking has been added. However, many cities around Europe are limited in using this policy because national or regional law requires that a minimum number of parking spaces are provided. Increasingly, both cities and developers are trying to challenge such policies, because they drive up the cost of new buildings, and in certain areas there is less demand for parking than the minimum parking requirement.

Freiburg: a more flexible approach to minimum parking standards

From July 2016 to March 2019 12 building projects with a parking space reduction (constructing fewer spaces than allowed by state building regulations) were approved by the Building Law Office of the City of Freiburg. Under new regulations in the state of Baden-Wuerttemberg, this is possible if the building project is well connected to the public transport system and if a mobility plan for the development is put in place. The mobility plan must include for instance a bicycle rental system nearby, discounted public transport tickets for residents, and/or access to car sharing

4.3.3 Parking in socialist era high rise housing estates

In many European cities that were part of the former communist or socialist countries of the Soviet Bloc or former Yugoslavia, major parking problems have developed in the housing estates, often on the edge of town, made up of formerly state-owned high-rise blocks with very little off-street parking, due to the huge growth in car ownership since the transition to a market economy. In Tallinn in Estonia for example, car ownership rose from 161 per 1000 inhabitants in 1991 to 520 cars per 1000 inhabitants in 2017.

The case of Tallinn, Estonia

In Tallinn, these apartments are now privately owned apartments, but they sit on commonly owned land, and homeowners – organised in flat owners' associations (FOAs) - have the right to use the common areas. The City of Tallinn took a two-pronged approach to trying to resolve the problems of parking in these areas - a refurbishment programme for FOA courtyards and providing municipal land to individual FOAs. The first programme, which was launched in 2006, supports around 70 projects annually, from the installation of a bicycle storage, playgrounds for kids or the creation of a parking spaces. Unfortunately, it covers a maximum of 70% of the costs and the maximum financial support per project is around 16.000€. The second programme is acquisition of municipal land by the FOAs for the 'personal right to use', which is a freely given 15-year rental agreement with the city for the utilisation, including maintenance and renovation of parking spaces on municipal land. A key lesson is that the problem of parking in these areas is not only one of demand exceeding supply, but also of governance, and so it has been essential for the Tallinn City Council to step in.

5. Implementation of and innovation in parking management

In this final chapter we turn to the issues of the implementation process for parking management measures, and ways in which to innovate in parking management.

5.1 Barriers to implementation and overcoming them

There are barriers that hold back policy makers and city administrations who might wish to introduce parking management to its full extent in their cities using a strategic and integrated approach, as a crucial part of their SUMPs. Some of these barriers are very similar to the ones that have been seen to affect **SUMP-take up**[10]. In summary:

- Lack of (general) awareness about parking management and its benefits
- Lack of understanding of the parking management concept, its process or how it fits into a SUMP
- Lack of institutional support (either at a higher level or absence of horizontal cooperation)
- Lack of financial capacity (both horizontal as vertical)
- Inconsistencies with, or limitations resulting from other policies and/or legislation that hamper a holistic approach to parking management
- Lack of public participation when developing parking policies.
- Lack of political buy-in and fear among politicians that they may be rejected by their voters.

5.2 How to overcome barriers and implement parking management measures

The biggest barrier to the implementation of parking management measures is normally the problem of public acceptability. Some members of the public, or key stakeholders such as local businesspeople, will be opposed to managing parking because they are accustomed to it being available to them at no cost, for as long a time as they want to use it; and/or because they fear that it will harm their business or make it more difficult to access the activities they want.

There are ways, however, to address these concerns and the almost inevitable complaints that will be heard when new parking management measures are proposed (although bear in mind that once the new measures are implemented, experience shows that almost all these complaints will die away as people realise that the measures work). To be prepared, however, the following points need to be taken into account:

- The phrase "there is not enough parking" will come up. It is important therefore to have carried out some basic surveys to measure parking occupancy in the busiest streets and off-street car parks at different times of day; but also in the general (within 5-10 minutes' walk) of these busiest areas. Invariably this shows that whilst in the busiest areas there are times of day when demand exceeds supply, it also shows that there is almost always spare capacity (including off-street car parks that few people are aware of). It can also show that long term parkers occupy space that could be used for shoppers and visitors.

- It is crucial to communicate the changes in parking management fully, including the reasons for them and the expected benefits.

- The planned parking management measures need to be easy to understand. If they are not, misunderstandings will occur and these will create myths about the new scheme which will make them more difficult to implement.

- For the two reasons above, cities may wish to consider contracting in some specialised marketing and public relations assistance – people who know how to "sell" a message, and also who know how to deal with negative reactions, particularly on social media.

[10] Previously described in several publications on SUMP, e.g. in Ch4llenge Project, CIVITAS SUMPs up and CIVITAS PROSPERITY

- The planned parking measures should be as easy as possible to use: there should be multiple ways to pay, to appeal a fine, to find out about parking availability and costs, and so on.

- Fees and regulations should be related to scale of problem – high fees in a small town where only one or two streets have parking measures are not reasonable. Times of operation of parking management should reflect the times when demand really exceeds supply.

- Alternative transport modes need to be available, but in smaller towns and cities, the alternative will often be parking a bit further away from the destination and walking the rest of the way.

- If a charge is to be introduced, consider whether it would be possible to allow the first 15 or 30 minutes of parking free (as long as a ticket is issued) to allay shopkeepers' concerns about customers who just pop in for a short while to collect a specific item.

- Enforcement should be consistent so that everyone knows that everyone has the same probability of getting a fine if they break the rules. Consider when new regulations are introduced whether a first offence should not be fined but just receive a warning.

- Fines should not be punitive and should relate to the seriousness of offence, so for example someone who has paid but returned to their car a little late should not get the same fine as someone who parks on a bus stop.

- Earmarking: Make clear where money raised will go – even if it goes into the general municipal fund, specify how much is raised, and equate that with the cost of providing parks and green space, or road maintenance, to show how useful the money is.

These points are not a "magic bullet" that will eliminate all the opposition to parking management measures that a city will experience, but they will help to smooth the implementation path. More information on building public acceptance of parking and other traffic restraint measures can be found in Topic Guide on UVARs.

5.3 Costs of measures

Cities do not often release implementation costs of measures, so it is only possible to provide here a few examples.

For a controlled parking zone: these 2011 figures come from a small municipality in England, and were originally in British pounds (£1 = €1,16 as of 29/06/2022). The authority has 100 km of on-street parking regulations (most just regulations limiting maximum length of stay for parking and loading, but with a small area of 1000 blue zone spaces as well, where charges are levied 0830-1730 Monday to Friday). The scheme at that point was estimated to need 8 on-street enforcers and two administrative staff. Operating costs were estimated at £250.000 per year and income at £320.000 per year, allowing investment costs (shown in Figure 5.1, below) to be repaid in a little over 2 years. It should be noted that since then, investment and operating costs are likely to have fallen since the increase in use of mobile phone payment means that fewer ticket machines are required, and there is less cash to be collected from the machines.

Amend TROs[3] & Upgrade signs & Lines to comply with regulations	£55.268,00	€ 64.110,88
On-street. Hand held ticket processing hardware & uniforms	£16.962,00	€ 19.675,92
Off-street. Hand held ticket processing hardware & uniforms	£3.581,00	€ 4.153,96
Ticket Processing - Accommodation, Office set up hard/ software	£35.179,00	€ 40.807,64
Publicity & Consultancy Advice	£23.934,00	€ 27.763,44
Stationery, Telephone, Training, Web-site & Cash processing	£19.413,00	€ 22.519,08
TOTAL	**£154.337,00**	**€ 179.030,92**

Figure 5.1: set up costs of English controlled parking zone, 2011 (note: TRO = legal orders defining parking restrictions)

More recent (2022) data from Rotterdam, Netherlands (source: Gemeente Rotterdam, personal communication, 2022), for the costs of a notional 1,000 space extension to its existing controlled parking zone are as follows. The table shows additional annual operating costs; on top of these, ticket machines (10.000 Euros per machine, one machine per 200-250 spaces), signs (200 Euros per sign, one sign per 5 spaces) should be added. BCO costs are an internal overhead within the City Administration, and third-party costs are the other departments that work on behalf of the parking department. The expected income from permit and ticket sales for the 1000 spaces would be about 4 times the annual operating cost.

Costs	
Staff	€ 1.025
Maintenance department	€ 22.864
Support department	€ 6.013
Product management	€ 8.983
Fiscal control	€ 70.383
Third-party costs	€ 116.017
BCO overhead	€ 32.780
Maintenance	€ 6.559
Total	**€ 264.624**

Figure 5.2: set up costs of controlled parking zone in Rotterdam, 2022 Source: Gemeente Rotterdam, personal communication, 2022

Another example is related to the above: the cost of a scan car in Gdansk, Poland, to patrol the considerably increased size of the controlled parking zone in that city. The investment cost of the car was almost €34.000 and the monthly operating cost of the systems needed to use the car for enforcement is about €8.000.

Finally, in Reggio Emilia, Italy, the cost of new tactical urbanism measures used to convert about 97 parking spaces into public space and restaurant terraces during 2020 and 2021 was in total €25.000 (see also Section 4.1.3).

5.4 Forms of innovation: technical, organisational, social

The role of innovation in parking management is widely acknowledged, specifically those technological innovations driven by digitalisation. The digitalisation of parking management tools, from the use of camera and sensors for reading license plates and supporting enforcement, to the development of web-based applications allowing for remote payments and parking slot booking, is becoming a powerful driver of innovations in the sector, providing parking management with new solutions and new actors: smart parking industry operators, communication operators, spin-offs in data management, etc.

However, in the context of Park4SUMP, a broader concept of innovation, including organisational and social dimensions, was considered. This is basically for two reasons: the first one is specifically related to the Park4SUMP project and the second one relates to the more general conceptualisation of innovative processes.

- Concerning the former, it should be noted that the urban areas in Park4SUMP, both leader and follower cities, are highly varied in their key characteristics, such as population (from Slatina (RO) with 79,000 inhabitants to Sofia (BG) with 1.6 million inhabitants) and other socio-economic parameters, such as revenues from parking management. Focusing exclusively on technological features would have favoured those Park4SUMP urban areas with a stronger financial position and/or background activities in the field.

- Concerning the latter, literature on the adoption and take-up of innovative practices in industry and organisations shows that innovation should not simply be fostered via technological R&D but that it is also important to improve the institutional framework and the opportunities for interactions at social level, in order to better incentivise innovation[11]. At an EU level, the broad framework

[11] https://www.imperial.ac.uk/media/imperial-college/research-centres-and-groups/icept/Innovation-review---ICEPT-working-paper-version-(16.05.12).pdf

underpinning innovation is mirrored in the concept of National Innovation Systems, in which innovation stems from the interactions among networks of institutions in the public and private sectors involving social, institutional, economic, and financial activities.

The insights from the implementation of parking management measures carried out in Park4SUMP confirm the need to adopt a multifaced approach towards innovation. During the implementation of parking management measures in Park4SUMP, forms of innovations have been found in cities with different characteristics and types of parking management policies: from the definition of parking standards to new forms of tactical urbanism and parking enforcement.

Several of the new parking policies and measures in Park4SUMP have addressed the key dimensions of innovation at various levels: technological, organisational and social.

1. Some of the technological innovations relate to data collection and processing. Examples include the use of parking sensors for real time information on occupancy rates, digital recognition (by license plate number substituting traditional parking tickets) and scanning cars for a better enforcement. These types of innovative tools may be the result of an industry's main business activities or can evolve from the industry's efforts to comply with or respond to health, safety, or environmental regulations and pressures.

2. Organisational innovation deals with changes in management attitudes, capabilities, and incentives since these are important determinants of the ability of the municipality or parking operator to change. As in the case of the integration of parking management into SUMP, mutual learning and coordination of actors involving suppliers, consultants, trade associations and so on are needed for the smooth integration of parking management into the overall vision of mobility.

3. Social innovation means the setting up of a valid interface between social and organisational/institutional innovations, which includes the increasingly important role of both labour and public participation in parking management. All the wide range of the so-called accompanying measures addressing awareness campaigns (focus groups, informational campaigns) falls under this category.

More specifically, the following table shows examples of innovative parking management policies examined in Park4SUMP, by type of innovation categories.

Organisational	Technological	Social
New standards for parking in new settlement areas (City of Freiburg)	ICT enabling innovative parking management (smart parking (City of Rotterdam)	Changing parking space into public space (City of Reggio Emilia)
Smart double use of existing parking spaces (City of Lisbon and Sint-Niklaas)	Scan car usage for digital enforcement (City of Gdansk)	Campaigns to raise awareness of existing parking opportunities and prices (City of La Rochelle)
Integration of parking within SUMP (City of Slatina and Vitoria Gasteiz)	The use of parking slot for electric mobility (City of Trondheim)	

Figure 5.3: Organisational, technological and social innovations in the Park4SUMP project

What lessons can be drawn from the implementation of innovative measures in Park4SUMP? The most important lesson is that pursuing innovation in parking management generally implies some forms of integration across the three innovation domains.

Organisational and social innovative measures are generally intertwined: socially innovative measures such as awareness campaigns are often associated with some organisational innovations, such as the creation of new agencies or committees involving citizens and other stakeholders. Conversely, some innovative organisational measures, such as the integration of parking management in SUMP, may need the involvement of social groups and actors.

Technologically and organisationally innovative measures show the same interrelationship. The implementation of digital services for booking and paying for parking slots, the use of scan cars to support enforcement, the possibility to recharge EVs at parking slots: all these fundamentally technological measures involve organisational innovations, at different levels of complexity, from the set-up of the organisational framework for data management to the governance of the cooperation among different actors. Sometimes, social innovations are also needed, such as in the involvement and training of the parking staff in the use of new technologies.

In conclusion, the insights from Park4SUMP indicate that innovation in parking management is a complex task, which can be fulfilled through the adoption of a holistic view on innovative practices.

6. Conclusion

This Topic Guide on the subject of parking management conveys a number of key messages that will be useful for any municipality preparing its SUMP.

The first and most important is that parking management is a very powerful measure to include within a SUMP, since it can be used to manage the demand for car use. There are few such tools available to municipalities in most parts of Europe, and this makes parking management all the more important.

The second message is that parking management brings with it benefits in terms of achieving a number of SUMP objectives: it can reduce congestion and pollution by reducing car use, but also it allows public space to be converted to other uses and, when implemented carefully, it can increase accessibility for all transport users. At the same time it has political benefits, as parking management that functions well is generally well-accepted by users, and residents in particular demand that parking restrictions are extended so that they do not have to compete for parking space with other users.

The third key message of the Topic Guide is that parking management is widespread in towns and cities across Europe – although often not used strategically, as a measure within SUMP – and widely-accepted. Implementing parking management is not synonymous with political suicide, as the experience of Park4SUMP cities such as Sint-Niklaas illustrates. Implementing parking management is politically sensitive, but there are steps that can be taken to increase support for it and to increase its public acceptability.

A further key message is that the relationship between parking management and the success of the local economy is not straightforward: having more, cheaper, parking does not mean that local economies will prosper, and the opposite is also the case – parking management can be a part of successful local economies.

The Topic Guide gives many examples of parking management measures that have been implemented by cities across Europe, and their impacts. It gives helpful advice on innovation in parking management, on the implementation process, and on the costs of measures. Finally, it provides links to much related useful information.

Even in the smallest towns and cities, parking management must be a part of the SUMP. This Guide shows you how.

7. Other relevant SUMP guidance

Parking as part of the SUMP toolbox
Parking is a multi-faceted topic. Parking measures can support other SUMP measure fields. To be fully aware of the interlinkages between parking policy and the SUMP toolbox, we invite the reader to review the following SUMP guidance:

The second edition of the European Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan (SUMP) (Rupprecht Consult, 2019) provides the essential background to understanding the role of parking policy in the SUMP. Introducing parking measures can be the starting point for strategic and integrated urban mobility planning. GUIDELINES FOR DEVELOPING AND IMPLEMENTING A SUSTAINABLE URBAN MOBILITY PLAN

This guidance is complemented by a specific topic guide to address planning in uncertain times when a major crisis is triggering significant changes in all areas. An immediate crisis can cause further long-term changes and increase the impact of other major trends, such as climate change.
TOPIC GUIDE: PLANNING FOR MORE RESILIENT AND ROBUST URBAN MOBILITY (with a specific reference to parking on page 71, Measure fields, transport demand management, Parking).

Parking as enabler for energy transition:
Car parking can offer EV charging opportunities. EV charging infrastructure deployment needs to be carefully planned as part of the SUMP and the Sustainable Energy and Climate Action Plan. Two guidance document detail the interaction between SUMP, energy transition and EVs.
TOPIC GUIDE: HARMONISATION OF ENERGY AND SUSTAINABLE URBAN MOBILITY PLANNING

TOPIC GUIDE: ELECTRIFICATION: PLANNING FOR ELECTRIC ROAD TRANSPORT IN THE SUMP CONTEXT (with a specific reference on page 36, Policy measures to support the electrification of transport).

Parking policy to manage public space, and to enable multi-modality
On and off-street parking space offers opportunities beyond the mere static storage of cars. Urban logistics services and shared mobility services need public space to operate. Parking management can play a role in that regard.

TOPIC GUIDE: SUSTAINABLE URBAN LOGISTICS PLANNING

TOPIC GUIDE: INTEGRATION OF SHARED MOBILITY APPROACHES IN SUSTAINABLE URBAN MOBILITY PLANNING

Parking also comes into view when cities want to enable better conditions for cycling and walking. The best cycling and walking strategy, is a car strategy! Parking policies are also close to the overall regulation of vehicle access to cities, as managed by implementing Urban Vehicle Access Regulations.

PRACTITIONER BRIEFING: CYCLING - SUPPORTING AND ENCOURAGING CYCLING IN SUSTAINABLE URBAN MOBILITY PLANNING (with a specific parking reference on page 15).

PRACTITIONER BRIEFING: WALKING – SUPPORTING AND ENCOURAGING WALKING IN SUSTAINABLE URBAN MOBILITY PLANNING (With best practices from PARK4SUMP cities Rotterdam, Lisbon, Vitoria-Gasteiz and Krakow).

TOPIC GUIDE: UVAR AND SUMPS REGULATING VEHICLE ACCESS TO CITIES AS PART OF INTEGRATED MOBILITY POLICIES. The sections in this Topic Guide on public consultation and participation are particularly recommended as they are wholly relevant to parking management.

Governance and financing
Parking policy can be specifically challenging in small and medium-sized cities. It also can determine to a large degree how neighbourhoods are perceived, and how local neighbourhood mobility functions. Two guidance documents look at these specific issues:

TOPIC GUIDE: SUSTAINABLE URBAN MOBILITY PLANNING IN SMALLER CITIES AND TOWNS. Specific reference to parking on p 67, parking management for a vibrant city centre.

TOPIC GUIDE: SUSTAINABLE NEIGHBOURHOOD MOBILITY PLANNING

Paid parking is an essential - if not the only – mechanism that cities can put in place to price local mobility. More information about pricing about and funding mechanisms can be found in this document TOPIC GUIDE: FUNDING AND FINANCING OF SUSTAINABLE URBAN MOBILITY MEASURES

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