Master's thesis
Parking Management - an efficient Transport Demand Management measure. Forecasted impacts in a medium sized city where parking is currently free

Supervisor:
Prof. dr. Davy JANSSENS

Laura Panea
Thesis presented in fulfillment of the requirements for the degree of Master of Transportation Sciences
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Preface

My interest for mobility management related topics was raised about 8 years ago, when freshly off the university benches I started working as a junior management consultant for a R&D firm in Bucharest that was involved in many EU-funded projects. As the main field of expertise of the company was in transportation, it wasn’t long before I was introduced to topics such as mobility, sustainable development, smart growth, smart cities, and so on. I was impressed by all the positive impacts that different measures targeted towards sustainable urban mobility were having in various locations around the world that were confronted with different problems and I always thought about what I would do if I had the choice of implementing whatever measures I considered fit in a city I knew.

Therefore, this paper has granted me the opportunity to propose a strategy for a city I love that could align it with the most performant urban agglomerations, and transform it in a liveable community that promotes public health, social interaction, economic efficiency and equity. I also believe the time is just right for a strategy in this direction considering the fact that a sustainable urban mobility plan is being planned for the city and that the public administrations are looking for solutions to make the city’s development more sustainable.

I’ve put in this paper all the knowledge I gained in these three and a half years of the Master Programme as well as all the practical knowhow gained during my work years. Writing the Master Thesis has been an interesting ride that has gained me more insights into the problems with which the city is confronted and has impelled me into finding possible solutions for them. Hopefully, the paper will serve as a starting point for the public administrations in their efforts towards improving the transport and mobility situation at the city level.

As I needed guidance in putting theory into a real-life context, I would like to thank my supervisor, Joris Cornu, and my promoter, professor Davy Janssens, for their assistance. I would also like to thank my family that has helped me every step of the way, from distributing questionnaires to all the patience they have shown.
Summary

Parking no doubt represents a central element of the transport systems and the manner in which it’s managed directly influences its well-functioning. The present paper is devoted to demonstrating the benefits that a strategic parking management strategy can have over influencing people’s travel choices and contributing towards attaining sustainable urban mobility objectives. The debate regarding the impacts of various parking management measures over the efficiency of the transport system is encountered in the first part of the paper, while a more specific application of a parking management strategy and is possible impacts in a medium-sized city from Romania where parking is currently free is discussed in the second part of the paper.

To most people parking serves just the function of storing a vehicle during periods of inactivity; however, if managed correctly, parking can play an important role in creating a new mobility pattern that is less car-dependent and much more oriented towards alternative means of transportation, positively influencing the environment, economy and society as a whole. But it has taken years for practitioners to reach this conclusion and act accordingly. Throughout time, parking policies have followed the same trends as the urban transport policies of which they were a part. Between the 60s’ and 80s’, the approach was all about supplying enough capacity to accommodate the ever-increasing demand generated by the spectacular increase in welfare and accompanying car ownership. Starting with the early 90s’ a shift in thinking started to take place and the authorities put a halt on the uncontrolled provision of parking and started administering better the already existing lots – through regulation and pricing. The trend towards an efficient use of the existing capacities has continued throughout the 2000s, with parking becoming a part of the Transport Demand Management policies promoted by local administrations. Therefore, the itinerary that parking policing has followed over the last 55 years has been from uncontrolled provision, to control and command, and in recent years to transport demand management.

Today, parking management can contribute to many important goals of sustainable mobility, such as: traffic and congestion reduction, clean air, energy conservation and sustainable cities amongst others. Such statement is supported scientifically as well as practically though the best practice examples that can be found all over the world. If some years back using parking management as a tool to rationalize private vehicle use was a pretty controversial topic that faced a lot of opposition from the general public and from the political lines, today the implementation of active and innovative parking management measures represents an essential element of a successful city.

Starting from this very positive assessment of the impacts that parking management measures have generated all over the world, the research conducted through the present paper was focused on determining whether such a shift in the way parking is approached could also be considered for Alba-Iulia, a Romanian city that is currently characterized by a strong car dependency, and if the impacts it would trigger are aligned with sustainable urban mobility objectives.

Alba-Iulia was selected as the city of analysis because in more than 70% of the cases, people’s choice of daily travel mode is the private vehicle. The reasons behind this decision are called comfort and convenience, and the fact that people do not bear the real costs of private vehicle travel, an important one being the cost for parking which bears high negative externalities. The local authorities carry a big
part of the blame because they have developed the entire transport system centred on the private vehicle and have struggled to provide the accompanying infrastructure, the supplying of uncontrolled free parking being a part of it. However, the traffic and mobility situation from the city is no longer sustainable given the high negative transport externalities and a change in the travel mode pattern has to be brought about.

Consequently, a parking management strategy inspired by international best practice examples was developed, with implementation targets for the short and medium-long term horizon. The strategy is rooted in the most stringent problems with which the city is confronted in terms of transport and mobility and also takes into account the community’s readiness to adopt it. Considering the fact that the travel habits of people are far from sustainable, in spite of the fact that the city is pedestrian friendly, many of the travel distances are walkable and that the transit service is one of the best from the EU in terms of quality (comfort, reliability, flexibility) offered, the objective of the parking management strategy is to rationalize private vehicle use and determine a significant shift towards alternative means of transportation.

Having this desideratum in mind, the strategy was built around three main measures, respectively: the elimination of illegal on-street parking, reduction of the amount of curb parking and implementation of parking pricing. These three measures directly target the factor that incentivizes the private vehicle use, respectively the existence of widely free and available parking all throughout the city. The rest of the measures proposed complement the central ones, making them more effective, efficient and increasing their acceptability level.

The synergetic effects envisioned through the implementation of the parking management strategy are supported by the outcomes of a public opinion survey that was conducted at the city level. The purpose of the survey was to better understand people’s travel choices, their opinion with regard to the traffic and congestion situation from the city and most importantly, their reaction to the implementation of various parking management measures that seek to disincentivize private vehicle use. The survey’s results clearly highlighted the fact that people are highly sensitive to price, consequently the prospect of having to pay for parking leading to as much as 76% of the respondents being willing to give up on using their private automobiles. But as mentioned, the proposed measures are complementary and act in a synergetic way, and as a prove, when people were presented with more disincentives to the private vehicle travel, such as a combination of a direct route by public transportation, parking pricing, the unavailability of parking near-by their destination and parking time limits, an overwhelming percentage of 99% of respondents showed their willingness to shift to alternative means of transport.

The results reverted by the public opinion survey support the choice of measures selected for the parking management strategy as well as the highly positive impacts they might trigger at the local level. Consequently, it is high time to stop the practice which allows the demand for parking to dictate the provision of capacity and turn things around. Parking management must be used in order to rationalize the private vehicle use and trigger a shift from such transport means towards more sustainable and active ones that positively impact the society, economy, environment and public health.
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<tr>
<td>CBD</td>
<td>Central Business District</td>
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<tr>
<td>CPZ</td>
<td>Controlled Parking Zone</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GRUP</td>
<td>General Regulation for Urban Planning</td>
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<td>HP</td>
<td>High Payment</td>
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<td>IDP</td>
<td>Integrated Dynamic Parking</td>
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<td>ITDP</td>
<td>The Institute for Transport and Development Policy</td>
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<td>LTS</td>
<td>Local Transport Strategy</td>
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<td>MPR</td>
<td>Minimum Parking Requirements</td>
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<td>P&amp;D</td>
<td>Pay &amp; Display</td>
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<td>PPP</td>
<td>Public-Private Partnership</td>
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<td>PT</td>
<td>Public Transport</td>
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<td>PV</td>
<td>Personal Vehicle</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>SFMTA</td>
<td>San Francisco Metropolitan Transport Authority</td>
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<tr>
<td>SULP</td>
<td>Sustainable Urban Logistic Plan</td>
</tr>
<tr>
<td>TDM</td>
<td>Transport Demand Management</td>
</tr>
<tr>
<td>TOD</td>
<td>Transit Oriented Development</td>
</tr>
<tr>
<td>UCLA</td>
<td>University of California, Los Angeles</td>
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<tr>
<td>VMS</td>
<td>Variable Message Sign/System</td>
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<tr>
<td>VMT</td>
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1. Introduction

Parking represents a central element of the transportation system, one that contributes to its well-functioning if managed correctly and equitably. Over the years the approach to parking has changed dramatically in the wake of modern life challenges, needs and trends. Parking policies have followed the same trends as the urban transport policies of which they were a part, drifting away from the ‘60s’ conventional approach that was auto-centric and which sought to supply capacity to accommodate the ever increasing demand for parking, towards more controlled and sustainable approaches. During the 60s-80s, personal vehicle travel was encouraged as it was seen as an engine of the flourishing economy. Starting with the late ‘80s a change in thinking fuelled by the negative externalities of the transport system has started to take place. The uncontrolled provision of parking spaces came to an end and it was mostly effected through regulation and pricing and substantiated by revenue-generating objectives. Today parking management is about contributing towards sustainable urban mobility objectives, is about creating smarter, healthier and more liveable communities.

Literature supports the implementation of active and innovative parking management measures as essential elements of successful cities, and practice has shown that despite all controversy surrounding the usage of parking management as a TDM tool, the highest performing cities around the world have adhered to such practices. The research conducted through the present paper was focused on determining whether such a shift in the way parking is approached could also be considered in a medium sized city from Romania that is currently characterized by a strong car dependency, and if the impacts it would trigger are aligned with sustainable urban mobility objectives.

Alba-Iulia was selected as the city of analysis because, as mentioned, people’s choice of daily travel mode is in more than 70% of the cases the private vehicle. While such a choice would make one believe that people are car captives, such a presupposition if far from the truth. The decision making process is explained by a propensity towards comfort and convenience, and by the fact that people do not bear the real costs of private vehicle travel, an important one being the cost for parking which bears high negative externalities. The local authorities carry a high share of the blame because they have developed the entire transport system around the private vehicle and have struggled to provide the accompanying infrastructure, the supplying of uncontrolled free parking being a part of it. However, the traffic and mobility situation from the city is no longer sustainable given the high negative transport externalities and a change in the travel mode pattern has to be brought about.

Many cities around the world have understood that people’s travel behaviour must be changed if the objective is to create smarter, healthier and more liveable communities. Efforts have been made towards disincentivizing private vehicle travel and shifting a considerable share of this travel mode towards alternative means of transport that have positive effects over the economy, environment, society and people’s health. Research has been conducted through the present paper in order to identify whether parking management could be used as a tool to achieve such objectives in Alba-Iulia city. The research is relevant considering the local authorities’ adherence to a Smart City initiative and their undergoing efforts of developing and implementing a Sustainable Urban Mobility Plan. The research results could be used as an indication regarding the appropriateness of various measures and the impacts they could trigger towards attaining the desired sustainable urban mobility objectives.
The research doesn’t have just theoretical relevance at the local level given the compilation of parking management measures that could bring about positive effects if implemented correctly and coherently, but it also bears practical relevance through the public opinion survey conducted that made possible a feasible assessment of the impacts that a parking management strategy could have at the city level.

Therefore, the main research questions that the present paper wishes to respond to are: whether parking management can be considered an efficient transport demand management (TDM) tool in general, whether it can be considered as such in the context of Alba-Iulia city, and what impacts are expected if such a strategy would be implemented citywide.

In order to respond to the above research questions the paper was divided in six main chapters plus one dedicated to conclusions. The first part of the paper is devoted to making the case for parking management as an efficient tool towards attaining sustainable urban mobility objectives in general. In this sense, the first chapter took a journey through some of the most relevant publications dealing with the topic and presented how a paradigm shift in thinking has been taking place in the way parking policies have been used throughout the years. The second chapter has the purpose to demonstrate with real life examples all that has been preached in literature with regard to the central role that parking management could play as a TDM tool.

As why parking management should be used in communities that wish to develop more sustainably was addressed in the first two chapters, the third one made a step forward towards the application of such a strategy at the local level. Alba-Iulia city was presented, highlighting the most important aspects that could play a role in the decision to adopt an innovative and active parking management strategy.

Based on the findings from the previous parts, chapter four highlighted the reasons for which a parking management strategy that acts as a TDM tools would be useful for Alba-Iulia city, and proceeded with proposing such a strategy outline with implementation targets for the short and medium-long term. While the strategy proposed was rooted in the transport and mobility situation and problems from the city, and was inspired by the positive outcomes generated by various measures in different locations around the globe, the next chapter supported such a strategy through the findings of a public opinion survey that was conducted at the local level. The survey was carried-out on a representative sample of 288 respondents in the period October-November 2016.

The last chapter made an interpretation of the findings of the survey and draw conclusions related to the benefits that the parking management strategy proposed for Alba-Iulia could have at the local level if implemented by the authorities. It also emphasized why the measures proposed are adequate for the city and explained how they support each other in obtaining the desired objective of creating a smarter, healthier and more liveable community.
2. Literature review

The changing paradigm of parking policy

There is quite a wealth of literature dedicated to the issue of parking management, especially parking pricing, and the effects in bears over improving the mobility at the city level. While the literature review conducted by the author might not be exhaustive, the most relevant publications on the topic have been addressed and there is no author that supports the idea according to which a well thought parking management strategy does not trigger positive effects over the mobility situation in agglomerated urban establishments and/or busy city centres.

As clearly defined by Litman (2013, p. 2), “parking management refers to various policies and programs that result in more efficient use of parking resources”. However, the choice to more efficiently use the available parking resources has not always played central role in urban transport planning. Actually, a paradigm shift has been taking place in the last decade in the wake of all the negative impacts that the transport system, parking included, has been generating over the environment, economy and society.

Parking policies have followed over the decades the same trends as the urban transport policies of which they were a part (van Wee et al., 2013, cited in Mingardo et al., 2015). Having emerged in the 60s, and up until the 80s, parking policies were about supplying capacity to accommodate the ever-increasing demand generated by the spectacular increase in welfare and accompanying car ownership. Back then, the negative externalities generated by car transportation were not considered a big problem, and the provision of parking continued to expand until the 90s when a shift in thinking took place. Local authorities put a halt on the uncontrolled provision of parking lots and started administering better the already existing ones – through regulation and pricing. The trend towards an efficient use of the existing capacities has continued throughout the 2000s, with parking becoming a part of the Transport Demand Management policies promoted by local administrations (Mingardo et al., 2015; Litman, 2013; Ison and Rye, 2008). Therefore, the itinerary that parking policing has followed over the last 55 years has been from uncontrolled provision, to control and command, and in recent years to transport demand management.

So, a fundamental change has been taking place in how the parking problem is perceived and what solutions are proposed and how they are evaluated. In short, the old paradigm was characterized by the provision of abundant free parking at most destinations. Urban planners would strive to ensure maximum parking supply and minimum prices, with the cost of the parking facilities being incorporated in the costs of buildings or subsidized by the government. The new paradigm promotes the efficient use of parking facilities and proposes a balance – too many parking spaces are as harmful as too little, as prices that are too low are as harmful as those that are too high. Another central aspect of the new paradigm is represented by the dynamic approach to the parking planning practices. Transport as well as the land use conditions are always evolving and consequently parking planning and management practices have to be quickly adapted to respond to the new circumstances. The new paradigm allows an empiric approach where new strategies are tried out without many prior proves of effectiveness (Litman, 2013).
The high external costs of parking
While public parking is considered by many people as a labour right, it actually generates high capital and operational costs that are being paid from the public pocket indeed, as well as high external costs that are being paid by third parties – namely the entire society, drivers and none-drivers. Private vehicles generate many external costs, but the external cost of parking in cities may be greater than all the other external costs combined (Shoup, 1999a). The negative externalities that the provision of parking generates are both direct and indirect. According to Feitelson and Rotem (2004), amongst the most important direct negative externalities generated by parking, there are the creation of an impermeable surface that increases water flows in urban areas, the degradation of the landscape and the contribution to the urban heat island (UHI) effect. While nobody is arguing that no parking should be provided for, various authors highlight the fact that just enough parking should be foreseen since excessive parking ruins urban planning purposes and promotes automobile dependency (Cutter & Franco, 2012, Shoup, 1997b, 1999a, Costa et al., 2014). It’s needless to say that the land used for parking reduces the open space dedicated to recreational activities and ecosystem services, as well as reduces the efficiency of alternative modes, such as walking, cycling and public transit use (Litman, 2013).

Vehicle drivers cruising for a parking space reduce the road capacity and cause congestion, lower the travelling speed and increase air pollution and noise (Costa et al., 2014). On-street parking decreases per se the road capacity and also leads to an increase in cruising for parking time. Actually, Shoup (2006) in his research regarding the effects of cruising for on-street parking in congested downtowns revealed that cruising vehicles can amount to anywhere between 8% and 74% of the total traffic and that cruising time can take between 3,5 and 14 minutes. Of course, these are just averages and it needs not be emphasized the fact that it’s not impossible for drivers to be confronted with the situation of not being able to find a parking spot at all in busy city centres during rush hours.

Free parking and Minimum Parking Requirements discriminate road users
Up until recent years, parking policy all over the world has been about establishing minimum parking requirements (MPR²) that require developers to provide a minimum amount of off-street parking space to accompany new or refurbished buildings. According to policy makers, such minimum requirements are needed in order to ensure that adequate parking is provided-for at a low price in order to limit local congestion, to avoid spillover parking near developments and to stimulate businesses at the local level (Shoup, 1999a). The problem is that the MPR are set according to calculations that are not representative for agglomerated urban areas that strive for sustainable mobility. According to Cutter and Franco (2012), Shoup (1999a) and Litman (2013), the MPR are usually established by doing measurements of parking and trip generation rates in suburban areas at peak hours with extensive free parking and no public transportation - such approach not relating parking needs to parking demand directly (Young and Miles, 2015). Moreover, imposing MPR

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¹ UHI is defined as the rise in temperature of any man-made area, resulting in a well-defined, distinct "warm island" among the "cool sea" represented by the lower temperature of the area’s nearby natural landscape. [http://www.urbanheatislands.com/](http://www.urbanheatislands.com/)

² Typically, MPR are tied to building uses and appear in codes as parking spaces per dwelling unit for residential units and spaces per square foot of gross floor area for offices. For office buildings, cities often require a minimum of at least one square foot of parking space for every square foot of building area. For example, the zoning ordinance for Wilshire Boulevard in Los Angeles requires three parking spaces per 1000 square feet of gross floor area for office buildings and other commercial uses (Shoup, 1999a).
discriminates those that do not own or use a private vehicle since MPR bundle the cost of parking spaces into the cost of development, and thereby increase the prices of all the goods and services sold at the sites that offer free parking. Whether MPR do indeed lead to the construction of more parking than otherwise would have been provided by the market is a subject that has been very slightly touched in literature by Shoup (1999a, b) and Willson (1995), and more recently by Cutter and Franco (2012) who did find a direct relationship between the two. Such a reality is not a desirable one because it implies that the public authorities are the ones behind a lot of the negative effects that the transport system, parking included, generates over people, the environment, economy, and so on. The provision of parking lots encourages private car ownership and therefore, indirectly, the public authorities would be preventing their own and others’ efforts to reduce congestion and the accompanying emissions of CO2 and other pollutants. Also, parking lots are placed on impervious surfaces that impact hydrology and the climate across cities; the rainstorms falling on such areas collect metal, oil and other pollutants abundantly lying on the ground and drift them into nearby waters making them dirtier and more dangerous.

Another problem with parking is also related to the fact that it is still widely free even in developed cities around the world, even today when the hot topic of scarce resources is on so many people’s minds. As indicated by Glazer and Niskanen (1992), parking has the characteristics of a private good, being both excludable and rival, and hence, as economic theory suggests, the marginal cost of pricing should be applied to parking (Mingardo, 2015). Therefore, parking should bear a fee that should equal the marginal cost of providing it – the cost of the land plus the cost of construction. But theory is far from practice, as Ommeren et al. (2011) suggested, very few cities around the world apply parking fees that reflect the cost of providing parking. Shoup(1995), Arnott et al. (1991) and Jansson(2010) take things one step further by emphasizing the fact that free parking and even the parking fees that are well below the marginal cost, represent one of the causes that lay at the foundation of an inefficient transport system.

According to Ferguson (2005) and Akbari et al. (2003), parking areas can end up covering 30% of the built area in residential neighbourhoods and as much as 60% in commercial areas. Imposing MPR on developers, the public authorities are actually imposing more expensive housing to people because the provision of parking increases housing costs. By carrying-out a comparative static analysis – between the marginal cost of an additional square foot of parking area and the marginal value of this additional square foot of parking area to measure the extent of oversupply of parking -, Cutter and Franco (2012) draw the conclusion that MPRs impose an indirect density cap, increase land consumption which leads to urban sprawl, oversupply parking and reduce profits per unit of land. Still, the authors recognize that precisely measuring the impact of parking standards on land use decisions is very difficult and indicate a parking management strategy that is superior to imposing parking standards and that is parking pricing.

From minimum to maximum parking requirements and market forces

Today a paradigm shift in parking planning and parking policy is taking place that is shifting the focus from continually increasing the parking supply in order to meet the demand, towards a more efficient use of the existing parking resources to control the demand (Shoup, 1999a, Litman, 2013, Mingardo, 2015). So instead of using the demand for parking to dictate the supply of parking, urban planners are starting to use the supply of parking to optimize the demand for parking, which indirectly means optimizing travel by personal automobiles to reach improved mobility indicators. Presently, several
Cities around Europe are reversing their parking policy and introducing parking maximums in order to stop the uncontrolled provision of parking places, as they consider the existing parking offer excessive. Countries like Switzerland, the United Kingdom, Portugal and Italy are good practice examples having already set maximum parking requirements as national guidelines (Kodransky and Hermann, 2011). In some cases, like the Netherlands, they were designated as a function of the availability of public transport (Feitelson and Rotem, 2004). Nevertheless, drifting towards maximum parking requirements has to be done on more solid grounds than the shaky ones on which MPR have come to life – as emphasized by Shoup (1999a), from nowhere and based on no academic research or training of the urban planner. Continuing to offer off-street parking for free in order to accommodate peak hour demand is clearly not an efficient and sustainable solution, not from an economic or environmental perspective.

It is Shoup again who in his work “The trouble with minimum parking requirements” (1999a) demolishes the practice of MPR and promotes instead market prices to allocate parking spaces among motorists in a logical and fair way. According to his theory, market forces alone can supply enough spaces to meet the demand for parking. When MPR are eliminated, the ratio of parking spaces to cars will decline, leading to an increased price for parking affecting both demand and supply. On the demand side, motorists will seek ways to economize on parking by starting to carpool, by using alternative means of transport, by shifting vehicle trips to off-peak hours and finally choosing in the long run to own fewer cars and take-upon healthier and more sustainable travel habits. On the supply side, developers will provide parking spaces in response to parking prices. Where the revenue from parking is high, there is where developers will choose to provide more parking spaces since their costs will be covered. The off-street prices will also serve the purpose of putting a ceiling on the price of the adjacent curb parking, keeping prices at reasonable levels. Therefore, these performance-based prices can balance a fluctuating demand with a fixed supply in the short run, and these prices will indicate where the supply can profitably be increased in the long run. So, letting prices determine the number of parking spaces will transfer to the market an important function that urban planners now perform, but they would still be involved in the regulation of other features of parking that affect the community, like: aesthetics, landscaping, layout, location, pedestrian access, provisions for the handicapped, setback, signage, and storm-water runoff.

Parking is a vital part of the transport system but urban and transport planners have excessively provided it on wrongful grounds which has led to the development of an urban environment built around the car and an accompanying dependency on the private vehicle that has ripped the space away from people and has rendered it to cars.

Under-priced anything creates shortages and parking is no exception. Not only does under-pricing create the demand for more parking spaces, adding more parking spaces increases other costs in the transportation system. Adding more parking spaces enables increased travel demand which in its turn increases the external costs of transportation, namely traffic congestion and air pollution. This phenomenon was demonstrated through the Environmental Impact Report (EIR) conducted for the University of California, Los Angeles UCLA’s 1,500-space parking structure built in 2003 (Shoup, 2011). According to the EIR reports, the new parking structure generated 5,360 one-way vehicle trips per weekday, the equivalent of 3,8 trips per day, implying a parking turnover rate in the structure of 1,9 vehicles / day / space. Assuming that the parking structure is used only 22 weekdays/month (no trips calculated for weekends which leads to an underestimation), each space generates 82,6 (1,9 x 22)
vehicle trips / month. The average distance for vehicle trips to campus is according to the EIR report 8.8 miles, inferring that each space generates 727 (8.8 x 82.6) vehicle miles travelled (VMT)/month/space, with the entire structure generating 1.1 million (727 x 1500) VMT/month. At this point, Shoup (2011) made a very pertinent observation comparing the external costs generated by transportation – the cost of wasted time and added fuel consumption caused by traffic congestion – in Los Angeles ($11.2 billion) to the total general revenue of all cities in California combined ($13.7 billion). This comparison highlights the seriousness of the situation, and while the vehicle miles added by the new parking structure might not be such a big issue for UCLA, they make the congestion situation from the region even worse.

The parking problems addressed by Shoup (2011) were caused by the provision of cheap parking on expensive land which inflated the demand for travel by car (left alone the faulty mechanism by which parking lots were awarded to those frequenting the campus). Granting parking permits according to some criteria established by the faculty (status, need, etc.) and pricing them at average costs painted the picture of disaster at UCLA - discrimination, unethical behaviour, encouraging of private vehicle travel. Analysing the parking schema that led to such negative effects, Shoup (2011) highlighted the difference that a performance-based parking pricing model could play in managing the limited parking inventory. By introducing flexible prices one can balance demand – which varies over time and space – with the fixed supply of spaces. Naming this winning approach the Goldilocks Principle of parking prices, it works as follows: if too many parking spaces are vacant, the price is too high, and if no spaces are vacant than the price is too low; when only a few spaces are vacant anywhere, then the price is just right.

Now the problem of appropriate vacancy rates arises and according to various authors (Shoup, 1999a, Mingardo, 2015, Millard-Ball et al., 2014), the recommendation is to keep about 15% of spaces always vacant in order to ensure easy access. Therefore, prices that lead to an 85% occupancy rate are widely considered as performance-based, and they are seen as such for two reasons. First of all, they determine the parking system to perform efficiently since most parking spaces will be occupied but drivers willing to pay the price can always find a vacant space. Secondly, these performance-based prices trigger the efficient performance of the entire transport system. Moreover, these prices are fair since they are established by the market following a very simple mechanism. While the supply is fixed, the demand fluctuates during the day so it’s only normal that demand-responsive prices will also fluctuate during the day in order to maintain the desired 15% vacancy rate. Shoup (2011) represented graphically in Figure 1 below how the performance-based prices for parking function if the objective is to ensure a 15% vacancy rate in spite of a fluctuating demand. Such an approach has been adopted in many places around the world with diverse set-ups, cultures, travel habits, etc. and in all cases the results clearly demonstrated the positive impact of such a parking policy over the mobility level.
When embarking on such an initiative of flexible/performance-based pricing, cities should make the best efforts in disseminating among the public the essence of the pricing policy which does not seek to gauge drivers or to maximize revenue – instead the right price of parking is the lowest price that will avoid shortages. Parking problems stem from mispricing not scarcity! Moreover, cities should be as transparent as possible when implementing a parking pricing policy in what concerns the destination of the revenues collected. The money generated from parking charges have to be used in order to pay for public services at the local level in order to attract people’s buy-in. Even those that don’t believe charging market prices for parking is a good policy, they will support it if it generates improvements at the local level, be it improved landscapes, urban furniture, pedestrian facilities, or very importantly, improved public transit services. This way the parking charges would go in a very visible manner back to the people, and it wouldn’t be just the local community who contributes to these improvements, but also strangers parking in the area (Shoup, 1999a).

Also, public parking should not be priced like private parking lots since commercial agents seek to maximize private profits, not social benefits. Still, areas where high parking demand leads to high parking tariffs clearly indicate the areas where more parking lots should be provided for. In the same way, areas where prices are low given low levels of demand indicate the zones where no efforts should be made in providing more parking spaces. Taking into consideration this additional benefit of performance-based prices, it is clear that such an approach to parking pricing can lead to a dynamic, self-correcting parking system that also helps to guide the allocation of scarce resources - land and capital.

The effectiveness of parking management as a TDM tool
Donald Shoup in his work “The politics and economics of parking on campus” debates the problems of parking management in university campuses, but the situation is very similar to the one experienced in busy city centres or cities in general. The performance-based pricing coupled with different schemas that encourage the use of Public Transit can contribute to many important goals of transport demand...
management, such as: traffic reduction, clean air, energy conservation and sustainable cities. Actually Mr. Shoup (2011, p. 148) makes a heavy statement in concluding his work by stating that only “few other transport reforms contribute to so many goals, produce such easily quantifiable benefits, and have such low costs” as parking management does. A similar statement was also issued by Higgins (1992, cited in Simicevic et al., 2013) according to whom “studies have shown that the most important factor in reducing car usage is the parking price” - hence parking management is an effective TDM measure.

The private sector also has to be part of the change and one of the easiest things they can do is to offer employees the option of parking cash-out, meaning employees can choose to cash the value of any parking subsidy offered, in lieu of parking itself. Employers usually bear a monthly cost for the parking spaces offered to employees for free, and these expenses – especially in case of large employers – can be as high as millions of dollars per year – as in the case of Pfizer Corporation at its laboratories in Kent, England (Shoup, 2011). Since many employers avoid charging employees for parking in an attempt to keep the rate of attrition as low as possible, an option would be to offer the employees who leave their cars at home a credit equal to the value of parking per day. Such a measure has the same effect as charging for parking without the political headache and the connected risks of diminished employer attractiveness. Moreover, offering commuters the option of choosing between free parking and the equivalent cash value shows quite clearly that there is an opportunity cost associated with free parking, and that is the foregone cash amount (Costa et al, 2014, Shoup, 2011). This daily cash option therefore encourages each commuter to consider alternatives to solo driving whenever possible. Such a program is fair and flexible and puts emphasis on equality among employees - not privileging those that commute by private vehicles.

Pricing public parking has been confronted with a lot of controversy throughout time and that’s because of the initial low levels of public acceptance accompanied by a lack of political support streamed from the desperation to keep voters happy. Still, public administrators need to face the fact that interpreting parking as a labour right discriminates the rest of citizens who do not use private vehicles. Without an adequate equity policy to compensate all the other people who travel by alternative means of transport, public administrators actually promote automobile dependency and such a practice is not sustainable in terms of mobility, environment and costs for society (Costa et al., 2014). The objections to charging for parking have been many, from financing the payment systems to the aesthetics of the system and so on. However, time has shown that through the technological advancements all these problems have been solved in the big majority. The only problem that still stands in the way of the “new urbanization” is the political support, but as emphasized a few paragraphs above, directing public parking revenue back to its neighbourhood can solve the political problem.

While parking pricing, and especially dynamic, performance-based pricing, has been labelled in literature - and proven in reality - to be an effective parking management measure that increases the mobility level through a reduction in congestion and consequently triggers many positive effects over the environment, economy and society, it is not the only approach to parking management that works as a transport demand measure. Parking regulations, such as limited parking time, can also play an important role in the management of the transport demand because it has an important impact over managing the user categories (Simicevic, 2013). If the scope of a transport policy is to increase the
mobility indicators in a city centre by reducing the number of employees commuting by personal vehicles, imposing time limits on parking will heavily impact this category of transport users.

Authors speak about a parking management strategy (Litman, 2006; Litman, 2013, Kodransky and Hermann, 2011; Willson, 2015) that is shaping the future of parking policy, and such a strategy encompasses economic mechanisms (such as pricing parking, workplace levies, etc.) as well as regulatory measures (parking supply caps, parking maximums, regulated location of parking, etc.), physical designs (bollards preventing parking, stripes delimiting parking areas, repurposing parking space, street geometry for increased safety, etc.), and quality of service contracting and technologies (PPP for more efficient and qualitative parking services). Cities with clear intentions of moving towards Transit Oriented Development (TOD) need strategic parking management to make those plans effective (Willson, 2015). But such a transition needs to be smooth in order to be accepted by the stakeholders and supported at a political level. A comprehensive assessment of the current situation needs to be performed in order to decide on the most suitable parking management measures to implement, and they need to be grouped in plans that are feasible for the near future as well as in plans that will work in the mid and long term.
3. Case studies

3.1. San Francisco SFpark – the ultimate best practice example

3.1.1. Overview
SFpark represents the name of a very ambitious large-scale parking management program in which the San Francisco Municipal Transportation Authority (SFMTA) embarked in July 2010 in a chase to increase the availability of on-street parking, reduce the cruising for parking time and consequently, the time and fuel drivers lose by searching for an available space. The motto of the program also says a lot about the benefits that the program was designed to trigger, respectively: “Circle Less, Live More”, directly tying the objectives of the program to a healthier life. The pilot project had been thoroughly thought-of and planned, with the SFMTA’s Board of Directors approving in November 2008 the legislation that supported the initiative.

The program addressed a congested area of San Francisco and included 256 on-street blocks, one surface lot and 14 parking garages. The program revolved around a central measure of parking management, respectively demand-responsive (or performance-based, market-based, dynamic, etc.) parking pricing, a measure highly sustained in literature by Donald Shoup, actually an adviser to the SFMTA in the mentioned program – the approach to the SFpark parking management rests on the intellectual foundation put forth by Mr. Shoup. The foundation that supported the implementation of this measure was represented by the use of extensive information, including real-time data regarding parking spots’ availability and location. The information regarding parking availability was collected by means of magnetic sensors installed in the asphalt, sent to a central management system by means of the sensors’ communication capability and further disseminated to drivers via the website dedicated to the program (SFpark.org), iPhone and Adroid applications, as well as cell phone. Not only were the available spaces communicated through such platforms to people, so was the price.

The smart parking meters that were installed had the capacity of varying the parking tariff according to location, time of the day (three time bands: meter opening time to noon; noon to 3 pm; and 3 pm to close) and day of the week (weekday vs. weekend). “These different block, day-type and time-band combinations create more than 1500 possible on-street price adjustments at each rate adjustment on the 256 pilot blocks” (Millard-Ball et al., 2014, pg. 79).

3.1.2. Parking management prior to SF Park
Prior to the pilot being implemented, paid parking was part of the parking policy at the city level; however, the parking rates and fines imposed were used in order to achieve different turnover goals and were not tied to a transportation policy goal. Rates at the on-street meters were the same all day, regardless of the time of the day, day of the week, location or demand. Moreover, the rates at on-street meters were lower than the rates at municipal garages, creating financial incentives for drivers to circle around to find on-street parking since it was cheaper.

The starting point was not that bad – the city already had paid parking and short time limits in place, but the goal of such a policy was to increase turnover (and hence revenues) and did not target increased mobility objectives. The parking policy was not convenient for drivers since it did not assure parking availability and did not contribute to broader transportation goals. Low parking availability triggers a lot of negative effects, beyond the pure inconvenience of drivers. Drivers who circle the block looking for a parking place are first of all distracted drivers causing safety issues for the other
participants to the traffic; secondly, cruising for parking results in wasted time and fuel. Drivers cruising for a parking space cause congestion on the roads because of their manoeuvres and decreased speed. They increase Vehicle Miles Travelled (VMT) and consequently produce Greenhouse Gas Emissions (GHG) that jeopardize everybody’s health. Often, drives looking for a parking space negatively affect the smooth travel of public transit, slowing it down and making it less reliable – a downside that already places a heavy burden over this travel mode.

3.1.3. The program – goals and objectives
As mentioned before, the parking management initiative targeted increased availability of parking for drivers by managing the demand for the existing parking supply. By making the parking availability and pricing situation available to people, if and when choosing to drive, they could always find an available parking space. The parking availability target for the project was set at a level of 15% - a percentage that ensured that a parking space was always available on each block.

The program was foreseen to be implemented citywide and it started with a pilot project in July 2010, after 2 years of thorough planning. The pilot encompassed 7 pilot areas with new policies, technology and significant data collection, as well as 2 control areas where the parking policy remained the old one (revenue driven) but intensive data was also collected. The study area contained 6.000 on-street metered spaces representing 25% of the city’s total, as well as 12.250 off-street spaces representing 75% of the off-street spaces managed by the SFMTA.

3.1.4. SFpark Parking management policy
The legislation that enabled SFpark put forth in November 2008 defined the program’s pilot areas and specified the ranges and limits for price rates, time limits and parking availability targets. The policy documents followed from this legislation.

The legislation allowed the city to “gradually adjust rates just enough – and not more – to achieve the desired outcomes” (SFpark, 2014) – of 60-80% occupancy rate. The policies used to set the rates in the pilot areas were:

On-street pricing
A Demand-responsive approach was used in order to adjust the parking rates at metered parking spaces in the pilot areas. The goals set were to:

- use the rates (demand-responsive pricing and off-peak discounts in garages and off-street lots) to decongest the traffic, improve the speed and reliability of public transit services, and achieve other transport-related objectives;
- achieve the parking availability targets so as to reduce double-parking and cruising for parking;
- have a consistent, simple and transparent approach for setting meter rates.

The rates at the metered parking spaces varied by: time of the day, day of the week and block. The adjustment of the rate was made based on occupancy data which was obtained from the parking sensors installed (in most) on-street parking spaces. As a starting point, the meters’ operational hours were split into distinct rate periods throughout the day, as follows: meter opening time to noon; noon to 3 p.m.; and 3 p.m. to closing time. Since parking trends differ significantly during workdays as compared to weekends, rates also varied accordingly.
Rates were changed gradually and periodically in order to make sure at least one parking spot is available per block, which means an occupancy rate of no more than 80%. The methodology for adjusting the rates gradually is described in the SFpark Pilot Project Summary and Lessons Learnt (2014):

- When occupancy is 80–100 percent, the hourly rate is raised by $0.25.
- When occupancy is 60–80 percent, the hourly rate is not changed.
- When occupancy is 30–60 percent, the hourly rate is lowered by $0.25.
- When occupancy is less than 30 percent, the hourly rate is lowered by $0.50.

The changes to rates were targeted on a per-block basis, therefore allowing rates to respond to rapidly changing parking demand patterns.

Typically, changes to the rates were made not more often than once per month during the period July 2011 - January 2014, thirteen demand-responsive rate adjustments were made. As a result, the average cost to park at metered spaces decreased from $2.73 per hour to $2.46 per hour, highlighting the fact that the rates that can lead to increased mobility indicators are not necessarily the highest ones but the right ones.

The occupancy rate was estimated using in-ground sensors installed in the pilot areas as well as in control areas. Based on such data, the 13 rate adjustments were decided. On top of these information, the pilot study also collected meter payment data from smart parking meters which could wirelessly communicate payment status. Using data from these two sources, the SFMTA came up with a model to estimate parking occupancy using meter payment data – the Sensor Independent Rate Adjustment model. This model would constitute the base for continuing the rate adjustments once the in-ground sensors reached the end of their useful life.

One of the main aspects of the SFpark program was to ensure transparency and increased communication. Consequently, each time a rate adjustment was decided upon, the SFMTA would notify the public of the price chance no more than seven calendar days before the change was actually effected.

Parking occupancy is set in most cities at 85% with measurements made at a single point in time and usually via manual observations. The SFpark program targeted a 60 to 80 percent occupancy rate seen as an average measured continuously over a period of time, typically of three continuous hours.

**Time limits**
Instead of focusing on imposing time limits to achieve turnover, the SFpark program focused on demand-responsive pricing to achieve parking availability targets. Before the program was put forth, the city would impose time limits of 1 to 2 hours which often proved inconvenient and unpredictable to people, and labour intensive for the control authorities. Consequently, the SFpark program extended the time limits to four hours in most pilot areas and even eliminated the parking control measure in others.

**Managing parking when and where appropriate**
According to this policy, it is important to manage parking when and where there is significant parking demand. The SFpark program, amongst others, demonstrated that managing parking when and where
there is significant parking demand delivers important benefits (even if no demand-responsive pricing or real-time information is in place).

Such a policy was put forth in order to cover using parking pricing even during time intervals or days of the week (weekends) that were usually free. Parking management needs to answer to the specificity of each location and not be devised following general norms. Consequently, after a detailed study, the SFpark program recommended that the parking meters hours of operation be extended also to Saturdays and Sundays, use demand-responsive rates and set time limits of 4-hours.

City and SFMTA employee parking

According to the SFpark program, in order for demand-responsive pricing to be efficient in managing parking, it has to apply to everybody. Consequently, the rules of the program were also imposed on SFMTA’s 5,000 employees - the rules were approved in their entirely and generated credibility for the policy.

Prior to the implementation of the program, the privileges for government employees and officials amounted to 3,000 free on-street parking spaces, depriving the access of the public to government services and nearby businesses. Such privileges also constituted a financial incentive for the government employees to commute by private car, many times by themselves. The influence that the price of parking and availability of parking has over people’s travel mode choice was investigated through a survey conducted in 2005 by the Metropolitan Transport Commission. The survey targeted commuters from the Bay Area and the results clearly showcased the differences in travel behaviour between commuters who had access to free parking and those who didn’t. The difference is graphically represented in the Figure 2 below.

![Figure 2 - Bay Area commute decisions](Source: Commute Profile 2005³, cited in SFpark Pilot project summary report (2014))

<table>
<thead>
<tr>
<th></th>
<th>With free parking</th>
<th>Without free parking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>75%</td>
<td>57%</td>
</tr>
<tr>
<td>Transit</td>
<td>5%</td>
<td>43%</td>
</tr>
</tbody>
</table>

³ a Survey of San Francisco Bay Area Commute Patterns. RIDES for Bay Area Commuters, Inc. August 2005. Region-wide telephone survey of 3,600 commuters sponsored by the Metropolitan Transportation Commission (MTC).
The SFMTA therefore applied the same rules to city and governmental employees both for on-street and off-street parking as for the general public, with very few exceptions. The purpose was to show that the rule applies equally to everybody, and also to discourage single occupant work trips by car.

**Off-street parking**

As with on-street parking pricing, demand-responsive prices were also applied to off-street parking places (garages and surface lots). Atop of this measure, off-peak discounts were also granted in order to decrease congestion during peak hours.

As with on-street parking pricing, the rates in garages varied according to the time of the day, day of the week and garage location. To ensure coherence and ease of understanding, the policy proposed a single set of rate periods (time bands) as for on-street pricing – permitting the drivers to make comparisons. The rates were set in accordance with workday commuter parking demand patterns so as to become a useful instrument in managing demand, hence congestion. Aside from the demand-responsive pricing, off-peak discounts were also put forth with the aim of encouraging users to drive during times of the day that are less congested and remain parked during high congestion hours when the public transit needs to have speed in order to ensure reliability and attractiveness.

The methodology for gradually changing the rates for off-street parking, usually quarterly but not more often than monthly, is described below, as indicated in the SFpark Pilot project summary report:

- When occupancy is 80–100 %, the hourly rate is raised by $0.50.
- When occupancy is 40–60 %, the hourly rate is not changed.
- When occupancy is less than 40 %, the hourly rate is lowered by $0.50.

The starting point for setting the demand-responsive prices was the hourly tariff that was used before the SFpark program was implemented. Also, limits for charging in garages were imposed through the program in a range of $1,00 to $10,00 / hour. A very important aspect of the program was represented by the fact that garage rates were always set below the rates of the near-by meters, giving drivers a financial incentive to go directly to garages and not cruise around on the streets (and cause congestion). As in the case of on-street pricing, the SFMTA notified the public 7 days in advance of any rate change.

The off-peak discounts were offered only for drivers who would park for more than 3 hours so as to prevent short-term parkers from benefiting from free parking. Moreover, these discounts were valid only for those paying hourly, and not daily or monthly parkers. The time periods for which the discounts were in place were set for: midnight to 8:30 a.m. and 6:30 p.m. to midnight. Setting these discount periods too far away from the peak hours would not work since garage occupancy at such times was very low. Off-peak discounts were in the range of $0,50 and $2,50 per time period.

**3.1.5. Parking Technology**

As mentioned in the beginning, the SFpark program rested on two main measures: real-time parking availability information supplied via different platforms to drivers, and demand-responsive rate adjustments. Both measures were made available through the deployment of a collection of tools, some representing state-of-the-art in terms of technology. The suite of tools used in the pilot project was:
- **Parking space inventory tool**
  
The asset management system created by the tool allowed the tracking of parking inventory and to quickly create analysis of parking and related attributes. The tool permitted the centralized storage of relevant info. As such, the SFMTA was able for the first time to store information related to geospatial elements, asset management, operating schedules, and hourly rates – current and historical. The system also allowed the incorporation of real-time data from parking sensors and smart meters, to make frequent and large-scale changes to rates and operating configurations, as well as conduct analysis of all these centralized data. The system’s functionalities were wide and comprehensive, for example: inventory of all attributes of the metered areas, associating sensor, meter and citation data to the correct parking space, managing the rate adjustment process (including communicating new rates and configurations to meters without sending field staff), enabling pay-by-phone, ad-hoc analysis capability, etc.

- **Meters and meter management systems**
  
The smart meters installed for the program’s purpose were cutting-edge technology. The meters were endowed with wireless communication. They accepted payment by credit card and phone (new payment methods as compared to the old system), and had the ability to transmit payment data to a central server in real time. The meters also allowed new rates and displayed information that was programmed and deployed remotely.

- **Garage occupancy and payment data tools**
  
The equipment put in place in order to deliver such functions required higher standards of accuracy and detail as compared to the one already in place. It also needed to ensure the capability of broadcasting this data to the central SFpark data warehouse, which meant servers were necessary - capable of handling minute-by-minute data feed on garage computer systems. Data reporting and accuracy was vital since rates were adjusted based on occupancy levels.

- **Parking sensors**
  
The pilot project used for 8.000 parking spaces wireless in-ground parking sensors that detected when vehicles arrived and departed. The information collected by the sensors was sent through a mesh network via pole-mounted communications systems. The parking sensors represented a new technology meant to provide real-time parking availability data. Such data collected and sent along by the sensors was used to calculate demand-responsive meter rates, to provide real-time parking availability info on different platforms and also to evaluate the pilot projects.

- **Real time data acquisition, data warehousing and business intelligence tools**
  
Data from many sources was collected through the SFpark pilot project, analysed and used to operate and evaluate the program. The data collected, as mentioned above, was put to various uses from adjusting rates and providing real-time parking availability to users, and all the way to evaluating the program’s components. Business intelligent tools were used in order to interpret the vast amounts of data and present it in a manner that aids decision-making.

The various sources of data, their management, usage, interpretation and further dissemination by SFMTA is graphically represented in Figure 3 below. The warehouse data, once collected, was interpreted and disseminated to users/drivers through the following platforms:
Mobile applications – during the pilot tests, while the wireless sensors were in place, on- and off-street parking availability and rate information was sent to users via iPhone and Android applications. After the sensors went off, the applications no longer supported info about on-street parking availability.

Web application – Sfpark.org offered info about real-time availability and pricing.

Text message – a text message service was also in place that sent availability information. However, due to low usage, the service was interrupted.

- **Parking guidance**

  Guidance to off-street parking was also part of the program with the aim of getting drivers looking for a parking space off from the streets as soon as possible and on to (often) underutilized surface lots and garages. On-street guidance was offered through variable message signs (VMS) and wayfinding signs.

3.1.6. **Communication**

The SFpark program brought a major change in the way parking management was seen at the city level, a change highly supported in literature by Prof. Donald Shoup, from a revenue generator to a demand management measure. As such, a strong communication strategy – well planned and executed – was mandatory. Since the program addressed an issue of high interest to people, the communication strategy needed to make sure the initiative was wrapped by a user-friendly brand. The main aspects enclosed by the wisely implemented strategy, included:

**Figure 3 - Data Flow Diagram**
The manner in which the SFpark program was communicated

Hosted under the logo “Circle less, live more”, the program had to be explained to its audience in terms of the problems it was devised to address and how it was supposed to solve them. Clear materials were created by the project team in order to deliver to its stakeholders a consistent and coherent message about the project’s vision, goals and approach. The communication strategy also focused on the benefits that the program would bring in terms that were relevant to common people and not to transport professionals (i.e. driver comfort instead of congestion management).

The project team also focused on clearly framing the program. A distinguishable name and brand differentiated the initiative from everything else that was done before. The goal behind the brand and product design was so that the drivers’ interaction with the program to be simple, smart, easy to use and convenient. Supplementary, the branding was the deliberate result of the decision to adopt a customer-centric approach to parking management so as to increase public acceptability.

Outreach

In order to ensure the program was well understood and received by the stakeholders, during the planning stage, the SFMTA project team carried-out various actions. Through such activities delivered to local government officials, SFMTA colleagues (and commuters in the study area), neighbourhood and merchant groups, and drivers, a high level of transparency and open communication was delivered. The dialog also presented the stakeholders with the possibility to raise their concerns and ask questions. Aside from these consultations carried-out while in planning stage, two weeks before the implementation, more aggressive communications were deployed, such as flyers distributed, e-mails sent to all contacts from the affected neighbourhoods, door-to-door information for merchants, updated content on the program’s already functional information platform – Sfpark.org.

Press relations

The project benefited from significant local, national and international media coverage thanks to all the efforts carried-out in this sense. Events, press-releases and outreach to media were part of the efforts carried-out in order to make the program known and prepare the community for the changes it was about to bring.

Awards

The program received local, national and international recognition for the bold initiative it put forth. It has been awarded for various aspects it encompassed, from its state-of-the-art technology to its unique pricing policies, as well as for its innovative solutions to parking management, bringing more proof to the fact that a well thought and coherently implemented parking management strategy can act as an efficient transport demand measure.

Advertising

In order to launch the SFpark project, massive advertising efforts were conducted. The launching message was very simple and straightforward: “Go to Sfpark.org for parking availability and pricing” and was inserted all around the public space, inclusively on transit service vehicles. Benefits of the program to all road user categories were highlighted on the advertising materials.

Signage and decals
The design of signage and decals was meant to render the program as simple, friendly, smart and easy to use. The program’s elements were easy to identify and relate to.

- **Web, social media and apps**

  The web, social-media and mobile applications were used in order to extent the project’s outreach and communicate with the customers in a transparent manner. Such places were also important sources of info for drivers.

### 3.1.7. The SFpark program evaluation

At the end of the pilot project, the SFMTA performed an evaluation of the program in order to see if it delivered the benefits foreseen. The results are public (as are all the other aspects of the program) and are meant to stand as a good documentation for transport planners and managers from all over the world who wish to implement such measures.

The results of the evaluation are divided by the SFMTA reports in two parts: primary and secondary benefits. The primary benefits of the program are represented by an achievement of the program’s main objective – improved parking availability.

**Primary benefits**

While the program had manifold objectives, the main objective was to increase parking availability, aka the amount of time parking was available on every block and also improve the utilization of surface lots and garages. However, other benefits steamed as well from the increased availability, such as reducing cruising and VMT, double parking, GHG, etc.

The program triggered impressive results even in the face of the ever-growing economy, population and overall parking demand. The results obtained through the program are:

- The amount of time the target parking occupancy (60 to 80 percent) was achieved increased by 31% in pilot areas (compared to 6% in control areas where the policy measures were not applied).
- In High Payment (HP) areas, achievement of the target parking occupancy rate nearly doubled.
- The amount of time blocks were too full to find parking decreased by 16% in pilot areas (while increasing by 51% in control areas). In HP areas, this decrease was even more substantial – 45%.

Aside from the improved parking availability results, the program managed to achieve its objectives by charging lower average hourly rates at meters (by 11 cents, from $2.69 to $2.58) as well as in garages (by 42 cents, from $3.45 to $3.03).

**Secondary benefits**

- **Decreased cruising time**

  In the pilot areas the cruising for parking time decreased by 43%, while in the control areas the time decreased only by 13%.

- **Decreased traffic volume**

  Traffic volume decreased by 8% both in pilot areas and control areas where parking availability improved, and it increased by 4.5% in areas where parking availability worsened.

- **Decreased GHG emissions**
Before the introduction of the pilot project, the GHG emissions generated by drivers looking for a parking space per day amounted to 7 metric tons. The parking management policies led to a reduction of 30% in the level of GHG emitted by 2013, while this reduction was of only 6% in control areas.

- **Decreased congestion during the peak period**
  One of the objectives of the program was to improve parking availability when it mattered most, reason for which drivers were encouraged to drive at non-peak hours. The program’s measures led to an improved parking availability by 22% for on-street parking spaces during peak-hours, compared to a 12% improvement during off-peak hours. In the garages included in the program, morning peak entries rose by 1% while off-peak entries rose by 14% (traffic was shifted to off-peak hours). The evening peak exits rose by 3% while off-peak exits rose by 15% (again, a shift of traffic to off-peak hours). Such results clearly indicate that the program helped reduce peak-hours congestion which led to smoother flow for drivers and transit alike.

- **Improved traffic speed**
  Overall traffic speed decreased, however, in the areas with improved parking availability it did so by only 3% as compared to areas with worsened parking availability where it decreased by 6%.

- **Decreased VMT**
  Less circling and cruising for parking naturally led to a decrease in VMT, by 30% (from 8.134 miles/day in 2011 to 5.721 miles/day in 2013). The percentage decrease in control areas was of only 6%.

- **Decreased double parking**
  Double parking is usually associated with low parking availability levels (dramatically increasing when parking occupancy exceeds 80%). As a consequence of improved parking availability, in pilot areas double parking decreased by 22% as compared to 5% in control areas.

- **Improved transit speed (when double parking decreased)**
  The speed of transit services increased by 2.3% from 6.4 to 6.6 mph along corridors where reduced double parking was achieved, and it decreased by 5.3% from 7.1 to 6.7 mph along the corridors where double parking increased. The increased transit speed had a positive impact over the services’ reliability.

- **Increased net parking revenue**
  The program delivered its set (transport, social, environmental) goals and at the same time managed to increase the net parking revenue by about $1.9 million per year. It is considered that the revenue increase was determined by the possibility to also pay by credit card at the new meters, as well as by the longer time limits enforced.

- **Increased ease of payment and avoided citations**
  As mentioned above, the program sought to deliver a parking experience that is simple, consistent, easy to use and respectful. The experience of parking was enhanced by more diversified payment options and extended time limits. The many options of payment led to a higher level of payment and consequently fewer parking tickets. There were 36% fewer parking meter-related citations / meter than before the pilot project was implemented.

- **Economic vitality supported by improved parking availability**
Since customers gained better access to commercial districts because of the improved parking availability, the economy had to gain (the relationship cannot be demonstrated, the impact is assumed by the SFMTA).

- Safer streets given by the reduced VMT and less distracted driving
  Drivers cruising for a parking space are usually distracted. By reducing the circling, the risk of collisions is reduced as well.

### 3.2. Eisenstadt, Austria – bringing the city centre to life

The fact that parking represents a key element in transport demand management has also been demonstrated by the effects that the specific measures applied in Eisenstadt, Austria, have had over improving the urban landscape and increasing the city centre’s liveability and mobility. According to Knoflacher (2006), in 1975 the city of Eisenstadt was dominated by cars; each day the city centre was crossed by 10,000 cars while only about 6,000 pedestrians could be counted. Since the situation was no longer bearable, the city implemented a set of “scientific system-related transport principles, taking real human behaviour into account” (Knoflacher, 2006, pg. 389). The transport measures that were implemented brought two big changes. First of all, a pedestrian area was developed in the city centre and cars were no longer allowed to park on-street but only in garages. Traffic-calming measures were also implemented around the city centre and city taxis were put on the streets.

The results of the measures implemented clearly highlight the fact that human behaviour can be changed. Today on the streets of the city’s centre one can find between 24,000 and 40,000 pedestrians per day, no cars, and increased levels of mobility and business. Not only did such drastic measures bring the life back to the city’s centre, they have also increased the economic vitality. These results support the theory put forth by Knoflacher (2006) according to whom mobility is related to the purpose of a trip, and not to the means by which the trip is carried out. Other said, if the purpose of a trip does not change, mobility does not change. If a person decides to increase the number of trips by car per day, he will be performing fewer trips by alternative means of transportation in that day – hence, the number of trips / person / day remains constant (see Figure 4 below).

![Figure 4 - More car trips/day, fewer trips/day by alternative means](Source: Knoflacher, H, W, et al., 1985, cited in Knoflacher (2006, pg. 390))
3.3. Fringe benefit taxation of workplace parking in Stockholm, Sweden

Sweden can be used as a good practice example in what concerns innovative urban and transport planning towards sustainable development. Stockholm was among the first cities to implement a road pricing scheme in order to relieve the congestion in the city centre and also among the very few nations to promote a law targeting the taxation of commuters’ free or partly employer-subsidized car parking. Workplace parking subsidization was a hot topic whenever urban transport policy was debated, being considered an anomaly as long as the car was not used for business trips and was just a means to commute. Consequently, the Swedish Parliament decided to reform the market for reserved parking and has introduced a law according to which free or subsidized parking at the workplace was considered a fringe benefit subject to taxation. The employer had to declare the benefit to the local tax authorities – the benefit was added to the income-tax return of the employees. The value of the benefit was equalled to the price of public parking in the area. However, there were also exceptions to the applicability of the law, as it can be depicted below:

- the full taxable value of the benefit applied as long as the employee used the private car only to commute and for business trips during work less than 60 days / year;
- the taxable value was 0 when the employee had to use his/her private vehicle for business trips more than 160 days/year;
- for business trips with the private vehicle in the interval 60-160 days/year, the taxable value was inversely proportional to the number of business travel workdays;
- the employees that used a company car were excepted from this tax since they were already subject to taxation of such a fringe benefit (to avoid double-taxation of the same benefit).

This first form of the law was subsequently tightened. While bearing a high potential for relieving the city centre congestion during peak hours, as it was foreseen when planned, the initiative was introduced during a time when congestion charging was a much-debated subject that captivated everybody’s attention and consequently was not documented properly. A baseline study describing the situation before the introduction of the law was not carried out in order to have a solid basis for comparison. Still, some studies were conducted in order to gauge the impact of the law over a traffic volume reduction. According to an empirical study carried-out by Janssen and Wall (2002), if such a law designed to tax employees for free or subsidized parking was properly designed and introduced, it could reduce rush hour car traffic by as much as 10-20%.

A more relevant empirical study was conducted in 2007 by the consultancy firm SWECO VBB and reported in: “Fringe benefit taxation of workplace parking – effects on traffic” (Sjärnekull and Widell, 2008, cited in Jansson, 2010). The pilot study conducted, while returning very interesting results, lacks an adequate before-study, rendering it less relevant. The pilot study was focused on the modal split of a small sample of commuters to the central city area of Stockholm. The choice of travel mode of the employees was analysed together with some supplementary data concerning the situation of workplace parking. Concerning this latter issue, the commuters in the sample were confronted with one of the following situations: they either enjoyed free workplace parking, enjoyed workplace parking for a fee or no parking at the workplace was available. While the modal split between private car and alternative modes of travel at the level of the entire sample was 26:74, this ratio differed widely when commuting means were analysed according to the workplace parking conditions.
Table 1- Modal split for a sample of commuters to the central city of Stockholm in 2007 with respect to workplace parking cost and availability, percentages

<table>
<thead>
<tr>
<th>Mode of travel</th>
<th>Workplace parking cost and availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Free workplace parking</td>
</tr>
<tr>
<td>Car</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
<tr>
<td>All</td>
<td>16</td>
</tr>
</tbody>
</table>


As it can be depicted in the above table, when employees enjoyed free parking at the workplace, 63% commuted by car, while when they were not provided parking spaces at all and had to park in public spaces and pay the market price, only 16% of employees commuted by car. Even when employees had to pay a fee for parking at the workplace (below the market price), the percent that chose this option was very low (26%). The Stjarnekull and Widell (2008) case study also explicitly interrogated the commuters if the increased parking prices have borne an effect on their private car use, and the response was that 19% of commuters reduced their car commute because of it, while half of them declared they had stopped using their private vehicle to commute to work altogether.

These results are highly suggestive in demonstrating the effectiveness that imposing fees for workplace parking can highly reduce the amount of private car commuting. As rightfully emphasized by Jansson (2010, pg. 352) “fringe benefit taxation is worthwhile even with its present imperfect design as a measure for traffic restraint during peak hours”.

3.4. The City of Edinburgh wants to be a thriving, successful and sustainable capital city and parking management is a part of the solution

Transport policies and the corresponding measures are being organized at the level of the City of Edinburgh through the elaboration and implementation, every 5 years, of a Council Local Transport Strategy (LTS). The strategy is aligned with other national and regional strategies, and since the beginning of year 2000 it has been devoted to promoting sustainable transport measures that increase the life quality at the city level.

Between 2001 and 2010 the city has put forth different transport measures towards creating a thriving, successful and sustainable capital city (The City of Edinburgh Council, pg. 8, 2014), and the efforts have paid off. Alternative means of transportation, such as walking, cycling and PT have strengthened their role in peoples’ travel habits; commuting to work by bus had the highest share in the UK. A very important result of the measures taken in the reference decade is represented by the fact that, despite increasing affluence, the percentage of car ownership in 2011 was lower than in 2001. Another very representative result is graphically illustrated below, where it can easily be observed that the usage of the personal vehicle for commuting to work has decreased its share from 1999 to 2000, in the face of all the measures that the city has implemented.
The Council LTS for 2007-2012 as well as that for 2014-2019 had a unitary vision that supported the Council’s approach towards reducing the need to travel, encouraging the use of alternative means of transport, and seeking the reduction of emissions from motorized traffic. Moreover, the strategies sought to enable cars to be used efficiently but only for those purposes for which they are well suited and only during uncongested periods and within uncongested locations. Parking management had become a part of the LTS starting with 2007, having its dedicated strategy aligned with the greater transport policy.

According to Mingardo (2015, pg. 7), the Council LTS 2007-2012 states the objectives for parking policy as:

“The overall objective for the parking strategy is to manage parking to support wider Council economic, environmental and social policies, recognizing the competing demands for space. More detailed objectives are to:

i. Use parking policy to help to maintain and improve the economic vitality of the city centre and traditional district and local shopping centres, relative to other centres;

ii. Ensure that parking provision does not encourage commuter car travel, especially to the city centre, and relates to the ease of access by public transport, cycling and walking; ∖ Minimize the negative impacts of parking on the streetscape, especially in environmentally sensitive areas, and on public and private space in new developments;

iii. Improve road safety and reduce congestion and pollution;

iv. Facilitate access and movement by mobility impaired people, pedestrians, cyclists, public transport and its users, and motorcyclists;

v. Protect and, where possible, enhance residents’ ability to park and load close to their homes;
vi. Protect and, where possible enhance the parking and loading needs of businesses, trades people, carers and visitors;

vii. Facilitate the operation and expansion of Car Clubs’.

The parking policy that was set-out in 2007 and which is still followed, sought to discourage car travel given the high level of congestion and emissions it produces, but also because of its negative impact over the street environment.

The measures that were supported by the Council LTS 2007-2012 were put forth through the Local Transport Strategy’s Action Plan for 2007-2012 as presented by category below:

- **Marketing and public relations:**
  - Improved car parking signage;
  - Overhaul and extend the parking Variable Message System (VMS);
  - Target marketing actions towards improving knowledge about parking facilities in the city;
  - Continued training and monitoring of parking attendants to ensure best practice;
  - Customer friendly provision of information at parking machines and on signs;
  - Improved Traffic Regulation Order advertising for the notices that are posted on streets and advertised in the press – plain description accompanied by self-explaining diagrams;

- **Off-street parking**
  - Involvement of the public sector (car park owners and operators) to provide for off-street garages or multi-story car parks only in appropriate locations in the city centre;
  - At every new proposal of public off-street car parking, the possibility of removing the on-street parking lots is to be reviewed in order to achieve public realm improvements;
  - Encouragement of parking operators to meet the best practice standards in off-street parking provision for existing car parks; the same standards will be followed for new developments as well;
  - Negotiate with parking operators the use of off-street parking lots by residents at times of low demand;
  - Any new leases of public off-street parking will include a pricing structure that discourages all day and contract parking, while facilitating use of the facility by residents during the nights;
  - Review of development control parking standards so as to impose any new city centre off-street parking lot/garage to promote a pricing scheme that discourages all and contract commuter parking, while facilitating use by residents during the night.

*Park and Ride*:

- Expansion of the existing P&R network so that these developments take place as and when demand justifies them, and when it can be demonstrated they can relieve congestion without significant detriment to existing through bus service;
- Collaboration with public operators so that they develop and market competitive ticketing strategies for P&R facilities, such as family pricing or parking plus bus tickets packages.
On-street parking and loading

- Annual review of tariffs and occupancy rates in view of adjusting tariffs to increase availability of parking;
- Granting permission to vans and goods vehicles to load and unload in residents’ parking lots;
- Support city centre shops by allowing P&D bays in the Controlled Parking Zone (CPZ) free of charge for use after 5:30 p.m. every day;
- Provision of guidelines in order to inform decisions on the allocation of on-street parking spaces;
- Improvement of the layout of bays, signs and P&D machines on the streets with high numbers of successfully disputed Penalty Charge Notices;
- First steps towards the introduction of graduated penalty system according to the severity of the offence;
- Strengthen enforcement of parking regulations;
- Development of prioritized, costed programme containing effective parking restrictions so as to improve pedestrian accessibility and mobility at all times, to improve junction capacities and to reduce delays on bus routes; Introduction of citywide double parking ban;
- Introduction of citywide ban for parking on all footways;

Controlled Parking Zone (CPZ)

- Introduction of visitor permits for all residents in the CPZ;
- Introduction of tradesperson permit;
- Introduction of business permits for businesses in the Peripheral CZ and Extended CZ;
- Limitation of the residents’ parking permits to two / household; modification of the permit’s pricing structure; reduced cost for a first resident’s permit for environmentally-friendly vehicles;
  
  *Extend shared use*

- Consideration and prioritization of the need for new CPZs and/or supplementary extensions to the existing CPZs, subject to criteria such as minimum size, resident demand and financial viability.

The progress against most of the indicators that were set in the LTS 2007-2012 - which were supposed to be achieved by the implementation of the above measures - was reported positive, as highlighted in the LTS 2014-2019 – update for 2015. Accordingly:

✅ The share of trips to work by alternative means of transport (PT, cycle, walking) has significantly increased to 55%, placing Edinburgh on the first place at country level concerning the share of alternative means of transportation for commuting to work;

✅ The level of road traffic has decreased, from 3.040 million vehicle kilometres / year in 2008 to 2.885 million vehicle kilometres / year in 2010 (against a target of 3.100 million vehicle kilometres / year)

✅ The number of road traffic casualties (killed, seriously and slightly injured) has decreased by 23% from 2004 to 2011;

✅ The level of CO2 emissions has decreased from 786.000 tonnes in 2008 to 713.000 tonnes in 2010.
The Council LTS 2014-2019 is even more severe and proposes the introduction of parking and loading restrictions on the main road network also for Sundays, at least for part of the day. The strategy is also aligned to the Transport 2030 Vision and continues its support for discouraging the use of the private vehicle, by stipulating that the Edinburgh’s transport system should, amongst others, be “part of a well-planned, physically accessible, sustainable city that reduces dependency on car travel, with a public transport system, walking and cycling conditions to be proud of” (The City of Edinburgh Council, pg. 10, 2014).

In the period 2014-2019 the Council continues also the good practice of investing all incomes generated from on-street parking into transport projects and services (including PT), creating acceptance amongst the public for such charging practices.

3.5. Amsterdam, a City of Opportunity

According to PwC’s global “Cities of Opportunity” report issued in 2014, Amsterdam comes as the fourth City of Opportunity when compared to other 30 vibrant cities from around the world. Actually, the city tops the charts in what concerns the areas of Health, safety and security as well as in Sustainability and the natural environment. Such a ranking naturally implies a quality of life that has also been supported by the measures taken in urban and transport planning, which over the last years have targeted the reduction of emissions, the mitigation of congestion and the promotion of alternative means of transport.

Such transport policies have been introduced in order to counter decades-long of car-centric development that have negatively affected the quality of life at the city level. According to a report put forth by the Institute for Transport and Development Policy ITDP (2011), about 40% of air pollution in Amsterdam can be attributed to only 10% of cars. In order to improve the situation the Dutch government decided to impose the most rigid interpretation of EU’s directives regarding NO2 and PM10 emissions. In order to attain the reductions in emissions imposed by the directives, and also to achieve the objective of reduced congestion, the city has imposed a parking payment scheme that is rapidly encompassing the entire city. The city map with tariffs per region is presented in Figure 6 below. The different colours indicate different hourly fees / region. The map supplies an updated image of the hourly tariffs charged, as made public on the dedicated page for parking in the city: http://www.parkerenindestad.nl/amsterdam.

A dedicated authority in charge of parking management has been established at the city level; the authority is 100% government-owned, as opposed to the situation from other cities which have opted to go for Public-Private Partnerships (PPP) and transfer the parking management responsibility to private companies (for e.g., Stockholm). The Authority in Amsterdam was set up in order to better manage parking, to issue parking permits and to also communicate to the public all the changes that are being put forth through the policy which rests in the responsibility of the City Council.

The pillars of the parking policy are briefly discussed below:

- **Pay-and-display (P&D) Parking**
  The technology to collect the parking fares was initially represented by P&D machines; still, they have been gradually replaced by licence plate input technology to ease the payment
process. As it can be seen from Figure 6 below, on-street parking tariffs range from 0,9€ to 5,0€ per hour – representing almost the most expensive parking rate/h from the world. The highest tariffs are imposed in the historical city centre in order to keep vehicles away and improve its liveability since city centres need to re-become places of social encounter and activity. Still, most of the areas within the A10 ring do not allow for free parking. Even areas outside of the ring, which suffer from high parking occupancy rates, have been transformed in parking payment zones. For example, in an outer borough of the city, a 0,9€/h pay zone was introduced and in order to decrease the parking occupancy rate gradual rate increases have been enforced, with the charge level reaching the value of 1,3€/h.

(Source: http://www.parkerenindestad.nl/amsterdam)

Figure 6 - Map of P&D zones in Amsterdam

- **Blue Zones**
  Within the blue zones marked on the map, European parking disks 4 are accepted. This means that for the time interval indicated on the on-street sign, vehicles can park freely. The fines that are being charged in blue zones constitute revenue for the federal government, while the fines collected from the P&D zones go to the city.

- **10-Cent Zones**
  In order to allow people to access different commercial zones or cemeteries that reside outside of the city centre, on-street short-term parking for one hour is allowed. The fee charged per hour is of only 10 cents. People would normally not be permitted to park for more than 1 h in such zones, but breaches to the system do occur. For example, the only way to

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4 The European parking disk represents a time-limited, short-term parking management tool
detect drivers who re-park in the same location would be if they paid the parking spot by mobile phone. Because in these zones short-term parking is prioritized, cars with residential permits are not allowed to park in the time interval 9 a.m. to 7 p.m.

- **Residential Parking Permits**
  The parking policy permits three options for drivers who want a residential parking spot in the city centre:
  - they must apply for a parking permit which costs about 150 € annually and is extremely hard to get given the high demand for it; once obtained, the residential permit is valid only near the driver’s home and the P&D payment rules also apply for parking outside of the neighbourhood.
  - they can rent a spot in a garage;
  - they can buy a residential parking space which costs about 40.000€.

Since the parking policy put forth by the city has the objective to improve the congestion situation at the city level and decrease the emissions from transportation, the authorities continually try to find ways to promote the use of alternative means of transport. Consequently, starting with 2009, holders of residential permits can choose to exchange them for a one-year transit pass.

The city authority determines how many on-street parking permits to provide for by subtracting 10% from the total parking supply. The new developments usually offer garages for each apartment. If a new owner chooses not to secure a garage at buying time, the resident becomes ineligible to subsequently obtain an on-street permit.

- **Car sharing**
  The parking policy encourages the use of alternative means of transport as well as the more efficient use of the private vehicle, a.k.a. car sharing schemes. Dedicated on-street car-sharing parking spots are being awarded by the Authority to companies which detain a fleet of at least 10 cars.

- **Off-street parking regulations**
  Parking caps have been implemented in Amsterdam and accordingly, for each parking spot created off-street, an on-street parking space should be removed. Moreover, the parking norms for housing are determined on a project-by-project basis depending on the borough and the parking situation. Amsterdam is also among the cities that have chosen to switch from Minimum Parking Requirements to Maximum Parking Requirements. The norms usually used for the provision of parking include maximums such as: 0,6 spaces per public housing unit, 1,0 spaces per normal housing unit (plus 0,2 units per house added for visitors).

- **Park-and-ride (P&R)**
  P&R facilities are located at the outskirts of the city, offering commuters and those wishing to enter the city a safe place to leave their personal cars while they can continue their journey by public transportation. The message that the Authority wanted to send-out through the implementation of this measure is that people are welcome in the city centre, but cars are not. The initial scheme charged 6€ per car to park and the driver received a 24-hour public transport pass for up to five people. The transit pass could be extended to 48 and 72 hours. In 2011 the parking fee increased to 8€ per car and included the transit pass for only up to two people.
Wayfinding signage enhanced the P&R feature. In order to help people more easily find such facilities, on-street wayfinding signs have been placed. Additional to the traditional signs, Integrated Dynamic Parking (IDP) systems have been also implemented. Such signs more easily direct drivers to available parking spaces leading to a reduction in the VMT produced by cruising for parking.

Additional to the P&R, bike-and-ride facilities have also been supplied. In such places drivers can rent a bike to further continue their journey towards the city centre.

- **Pay-by-phone**
  This payment method was introduced since 2006 in order to ease people’s payment duty. There are three companies contracted by the Authority that handle the mobile phone payments, and from the revenues collected they receive a share of 4-5%.

- **Parking enforcement**
  Amsterdam is the first city worldwide to have introduced a very innovative parking enforcement system. A scan car with six cameras (three on each side) wonders around the streets and automatically identifies illegal parkers by scanning their licence plates by means of automatic licence place recognition technology. Initially, a small group of wardens would follow the car closely and issue parking tickets where the case. Now the entire process is digitalized.

  The company responsible with parking enforcement at the city level, Cition (city owned), uses a back-office system supplied by Agendum in order to automatically manage the entire enforcement process – from the signalling of parked vehicles and the checking of parking rights, to the monitoring of the process and all the way to issuing Penalty Charge Notices (PCN) delivered on the driver’s doormat. It is easy to understand that such an automatic system brings about a lot of savings given the reduction in human force involved in the enforcement process.

- **Direction of Parking Revenues**
  The money collected from parking goes to a parking fund that is used to invest in projects that benefit the entire community. The money that goes to infrastructure projects goes only to those projects that are part of the citywide mobility scheme. This fund is constituted from P&D charges, fines and parking permits.

- **Trucks and freight**
  Trucks over 3,5 tons have very stringent air quality norms imposed, resulting in many of them being forbidden the entrance in the city. Those that do comply with the requirements can unload for a maximum of 15 minutes in spots where they are not allowed to park. Where they are allowed to park, they are allowed to do so only before 10 or 11 a.m.

By 2011, the effects of the parking policy put forth by the city have been to decrease car traffic by 20% in the inner city, as well as to reduce the cruising for parking traffic by 20% (ITDP, 2011).
3.6. In the land of automobile producers, parking management decreases car travel – Munich, Germany

Munich has been one of the cities where parking management has been confronted with a high level of opposition, both from the public and from the political layers. It was only when congestion got so bad that it could no longer be ignored that the city decided to do something about it. There were mainly two issues that had to be urgently tackled, respectively congestion and long-term parking. In order to solve the problem, in 1995 a PPP was established between the City of Munich and BMW, under the name of the Inzell initiative. It took three more years of discussions and preparations before the first pilot project was launched – MOBINET – with the purpose of elaborating, implementing and monitoring a parking policy to be used in two chosen neighbourhoods of the city. 140€ million were allocated to the pilot project from federal funds.

The pilot project targeted three types of parking: residential parking, mixed parking and delivery zones. Each street from each neighbourhood was individually studied in order to come-up with the right mix of parking types that would promote the parking policy’s objectives of reduced congestion and reduced long-term parking. After just one year since its implementation, the parking management strategy had rendered major improvement to the parking situation. According to the data reported by the ITDP (2011), the number of parking spots taken by all-day parkers was reduced by 40%, while the number of parking spots occupied by overnight parkers was reduced by 25%. Great results were also obtained in what concerns cruising for parking and illegal parking.

The five-year pilot project ended in 2003 but thanks to the highly positive results triggered, the city decided to implement the parking management strategy citywide. It gradually integrated in the program all of its 58 parking areas, which by 2010 were all subject to paid parking. Drivers could pay for parking either at pay-and-display machines or through residential permits. The measures implemented through the parking management strategy, which targeted reduced congestion, public space reclamation and the promotion of alternative means of transport, were:

- Pay-and-display (P&D) parking
  On every workday, between 9 a.m. and 22 p.m. anyone wishing to park would have to purchase a parking ticket at a P&D machine, which allowed parking per hour or for an entire day. Usually the parking tariff amounted to 1€/hour or 6€/day in most areas except for the historic city centre where the tariff was 2,5€/hour. Also, only short-term parking for a maximum of 2 hours was allowed-for in the historic city centre. The rules and regulations instituted by the city were varied and mixed, as highlighted below:
  - Green zones = Residential parking zones, where drivers could park with a residential permit between 9 a.m. and 11 p.m.
  - Blue zones = Mixed parking zones, where drivers could park for free if they detained a residential permit; otherwise the P&D tariffs applied - 1€/hour or 6€/day for visitors.
  - Yellow zones = Short stay parking zones, where both residents and visitors had to pay 1€/hour and are time bound to 2 hours.
  - Red zones = No parking allowed.
  - Green/blue line = Alternating resident-mixed, which are actually shared parking spots. Between 9 a.m. and 6 p.m. residents could park for free if they detained permits and
visitors had to pay 1\(\text{€}/\text{hour}\) or 6\(\text{€}/\text{day}\). After 6 p.m. only residents were allowed to park.

- **Yellow-blue line = Alternating mixed-short stay**, where both residents with permit and visitors had to pay between 9 a.m. and 6 p.m. After 6 p.m. residents could park for free, while visitors had to pay the fee.
- **Brown lines = Mixed parking with parking disk**, where residents with permit could park for free, as well as those with parking disk but only for 3 hours.
- **Special parking regulations for Altstadtring**, where residents with permit could park for free, while visitors were required to pay between 9 a.m. and 11 p.m. a fee of 2.5\(\text{€}/\text{hour}\) for a maximum of 2 hours.
- **Yellow/green line = Special parking regulations for the ring road surrounding the old city**, where residents with permits could park for free after 7 p.m., but everyone had to pay 1\(\text{€}/\text{hour}\) from 9 a.m. to 11 a.m. and where time bound of two hours were imposed.
- **Red/green line = No parking and resident parking**, where residents were allowed to park but only after 6 p.m. (or 11 p.m.).
- **Alternating of regulations – no parking with mixed parking**, where mixed parking was allowed after 7 p.m.

- **On-street residential parking permits**
  Those that did not own a private residential parking spot could opt to request for a permit for on-street parking. Residents would have to pay 30\(\text{€}/\text{year}\) and businesses 120\(\text{€}/\text{year}\). Businesses were granted only one parking spot. The cost of a private spot was much higher, about 80 \(\text{€}/\text{month}\).
- **On-street parking for commercial vehicles**
  As mentioned above, businesses get only one parking permit / business, and not for a particular vehicle. In order to be granted the permit, the business had to prove it had no access to private parking spaces.
- **Minimum parking requirements for new developments**
  In 2008 a new building ordinance came into place which allowed new developments to provide for fewer parking spots. Non-residential developments were allowed to lower the number of accessory parking spots by 25% to 50%. For residential buildings, the developers were now permitted the option to buy-out from providing the imposed number of parking spots. A In-lieu fee was put forth depending on the area where the new development was build.
- **Park-and-ride (P&R)**
  In order to further discourage the car use within the city, P&R facilities were provided-for in different areas of the city. 120 garages were situated at rail stations outside of the middle ring road and their price varied according to their distance to the inner city. Those closest cost 1,5 \(\text{€}/\text{day}\) or 17\(\text{€}/\text{month}\); the next category cost 1\(\text{€}/\text{day}\) or 8,5\(\text{€}/\text{month}\), and the subsequent cost 0,5 \(\text{€}/\text{day}\) or 7,5 \(\text{€}/\text{month}\). The ones outside of the greater area of Munich were free of charge.

The parking management strategy in Munich was thought of in conjunction with some complementary measures that could support the shift from private vehicles towards alternative means of transport. Consequently, investments were made in the bicycle infrastructure and public transportation services. These coordinated measures have brought about significant improvements to the congestion.
situation in the period 2000-2008. In year 2000, when the parking management pilot project was just over and the decision to expand the strategy city wide was taken, about 42% of all trips were made by car, 32% by PT, 8% by bicycle and 18% by foot. After 8 years of parking management the situation changed for the better. The modal split was as follows: 36% of trips were made by car, 21% by PT, 14% by bicycle and 29% by foot. The most striking shifts were from the car use (a 14% drop) towards cycling (75% increase) and walking (61%). Moreover, in the same time period, each year 1,700 fewer vehicles were owned by residents in the inner city.

Such figures again make the point sustained throughout the thesis, respectively that a good parking management strategy can play a pivotal role in decreasing private vehicle use and increasing the use of alternative means of transportation which leads to a bevy of positive effects, from reduced emissions and all the way to increased life quality for residents.
4. Presenting Alba Iulia

4.1. A piece of history
From ancient times the territory of Alba Iulia has been the bedstone of human civilization where the Romanian specific folkloric traditions and habits exercise a distinct attraction for national and foreign tourists alike. Alba Iulia is the historical capital of the Romanian nation, symbol of unity since it represents the place where on 1st of December 1918 the Union of the Modern National Romania State took place. Alba Iulia hosts the oldest “Vauban” citadel from the country, built after the plan of architect Giovanni Morando Visconti in the period 1663-1736.

Figure 7 - Alba Carolina citadel

The citadel called Alba Carolina, with all its interior and exterior spaces and with its bastions, is included among the Romanian Monuments Heritage list and is also a part of UNESCO World Cultural Heritage. The citadel represents a binder between centuries of history, culture and successive European civilizations, preserving in beneath its walls the vitality and legacy of the generations that have continuously succeeded on the territory that today represents Alba Iulia municipality.

4.2. About the city and economic life
According to the last census that took place in 2011, Alba-Iulia has a population of 63,536 inhabitants and covers a surface of 103,65 sq. km. It is a medium sized city located in the centre-western part of Romania, and represents the seat of Alba County (see Annex 1 – Geographic positioning of Alba-Iulia city at the county, regional and national level). The city exercises an intense report of territorial and socio-economic cooperation with the AIDA zone, a territory formed of 11 administrative-territorial units grouped around the county seat. This territory, together with other cities, is part of the influence zone of the Alba-Iulia municipality. The city is also a polarizing centre for a rather high number of rural villages that are in the process of urbanization, and which are only a few kilometres away from the city. Looking at the bigger picture, Alba-Iulia municipality and these villages (pertaining to the administrative territory of other cities/towns) already present their selves as a territory in which multiple functions (inhabiting, work, services, entertainment, recreation) interact and complete each other, a territory who’s development requires a unitary approach/regulation. Taking all these into consideration, Alba-Iulia municipality has positioned itself as an important economic and administrative centre with influence at the regional level; the city is well connected within the territory and to the national and European transport network.
The economic life in the city is dominated by some renowned enterprises which export their products worldwide (such as IPEC, Portelanul, Incov, Saturn or Rekord). The total number of commercial enterprises amounts to 3,079, out of which 2,998 are privately held, 27 are integrally with foreign capital, 150 have mixed capital, and 81 are public. From the analysis of statistical data, it can be seen that in the last decade the city has registered an increase in the economic activity intensity, by attracting foreign investments and because of the increasing touristic activity. According to the Sustainable Urban Logistic Plan (2014), the economy at the city level is predominantly oriented towards the services and industry sectors. The most representative industries are: porcelain, textile manufacturing, food, casthouse and tourism.

The specificity of the economic activities conducted at the city level highly influences the traffic flows because of people’s travelling to access their work places (usually situated in the industrial areas), public services (placed in central areas) or commercial activities (to be found mostly in the central part of the city). The spread of the economic activities – production, commercial or public services – is depicted in Figure 8 below.

The increase in economic activity has led to more work places and increased standard of living for the inhabitants of the city and for those from surrounding areas. All these can be translated into higher mobility needs for the city residents as well as for those commuting from outside the city, reality that implies an increased number of vehicles at the city’s entrances and exits and higher traffic on the city’s main streets, with the accompanying need to improve the accessibility of the road network in the mentioned zones.

(Source: The Urban Sustainable Logistic Plan (USLP))

Figure 8 - The spread of economic activities on the administrative territory of Alba-Iulia
The intense traffic flow is a direct consequence of the increase in economic level which has triggered a considerable boost in the motorization level. According to the data from the Department of Taxes and Tolls from within the Alba-Iulia city hall, at the beginning of year 2015, the fleet of transport means at the city level was constituted by a total number of 29,308 vehicles, 74,05% being registered on physical persons and 25,95% on legal persons. Out of the total number of transport means, the most important category (75,96%) is represented by private vehicles. Only 0,10% of the total number of transport means is represented by buses, coaches and vans (public transportation). The structure of the fleet of transport means at the city level is represented in Figure 9 below.

Figure 9 - The structure of the fleet of transport means at the city level

According to the Sustainable Urban Logistics Plan (SULP) adopted by the municipality in 2014, it is expected for the motorization rate to continue to grow as the economic level of the city continues to improve. It is highlighted in the same document the fact that in some areas of the city the parking lots are not enough to respond to the parking demand, phenomenon which leads to drivers parking cars on sidewalks and green spaces. The resolution for this problem is seen through the strategic document as a better estimation of the parking demand and the provision of solutions that satisfy this ever increasing need and offering better traffic conditions for car travel. From this sentence alone, it can be seen that the so called SULP has nothing to do with sustainability given its support for private car travel and accommodation of the ever increasing demand for parking. The thinking behind the strategy is clearly not aligned to the shift of paradigm in parking management. However, the document does take note of the random parking spots placed on highly transited arteries which have negative effects over the traffic and over the city’s image.

4.3. The traffic situation at the level of year 2015

As a preliminary step towards the elaboration of a Sustainable Urban Mobility Plan which is on the city’s agenda, a Traffic Study was conducted in the period December 2014 – April 2015. The Study was commissioned by the Municipality to the Cluj-Napoca Technical University. The main findings of the Study are presented in the following paragraphs.
The city’s street structure is composed of 274 urban streets with a total length of 193 km, out of which about 70% are modernized. In what concerns transit traffic and heavy traffic, there is a ring road but only in the eastern part of the city, taking over just a part of the transit traffic. For all those others wishing to cross the city, they have to do it by driving on a few main arteries and mixing with the local traffic.

The traffic measurements conducted as part of the traffic study have indicated a series of particularities in what concerns the movement of vehicles at the level of Alba-Iulia city. A first remark is related to the fact that the interior traffic is characterized by a pendular effect with two significant peaks along the day representing morning and evening peak hours (Figure 10) - which ensures the population’s travel from home towards their daily activities and back home. This type of traffic is representative for collector roads which ensure the connection between residential neighbourhoods and areas characteristic to urban environments – work, commercial activities, services, etc. This is the most predictable way of travel and represents the traffic movement on more than 70% of an urban establishment’s road network.

There are arteries on which the traffic almost exceeded the infrastructure’s capacity, reaching a saturation threshold. On such arteries between 7 a.m. and 7 p.m., the traffic is close to maximum values constantly. For such traffic values, the average speed is under 40km/h and often under 30km/h, where the allowed speed is of 50km/h. Taking into account these facts, it’s easy to understand that such parts of the road network are highly congested.

A particular case is represented by Vasile Goldis Street (pictured in Figure 11 below) where the traffic flow has reached maximum values, at the limit of saturation, although it is not such an important artery. The one-way street is foreseen with one 3,5 m wide lane indicating the fact that it is a local-interest artery. Still, the high congestion is explained by the presence of many shops which attract aside the usual traffic, high levels of cruising for parking and parking for commercial as well as loading purposes.

(Source: Cluj-Napoca Technical University, Traffic Study 2015, Ch. 3, pg.49)
A very important aspect that was observed during the traffic monitoring activities, as mentioned in the Traffic Study, is represented by the development of a phenomenon of “voluntarily reducing the streets’ capacity” (Technical University of Cluj-Napoca, 2015, pg. 14) by tolerating parking on the first lane. Hence, instead of using the entire road capacity as it was designed to be used – two lanes per direction - in reality the traffic flows on only one lane per direction, halving the road capacity as illustrated in Figure 12 below. Not only do the authorities close their eyes when it comes to this situation, they actually encourage it, by sometimes declassifying the category of the artery in question – situation that according to law is only permitted when the artery registers a normal utilization index of under 50%; however, this is not the case for the arteries in question here. A map of all the city’s congested streets due to such voluntary reduction of the street’s capacity by on-street parking is presented in Annex 2 with details from each street presented in Annex 3.

The Traffic Study has also made a comparison of figures regarding the traffic volumes registered in 2000 and 2010 to those recently measured in 2014/2015. As it can be observed in Annex 4, traffic has fluctuated over the years and in most cases it has significantly increased since years 2000 and 2010, showing an increasing trend over the years. There are streets where the traffic slightly intensified over the years, but also ones where from 2000 till 2015 it has grown by as much as 500%.

In what concerns the modal split, the Traffic Study painted the picture of a very unsustainable travel behaviour. According to the continuous measurements carried-out for a period of 7 days on 14 road sections throughout the city’s territory, it was clearly evidenced that in all locations travel by personal vehicle is by far the predominant means of transportation. As it can be depicted from Annex 5, on all road sections included in the study, the percent of private vehicles (without a trailer) varies on average between 60% and 80%, to which at least another roughly 10% can be added from the counts of private
vehicles with trailers. Considering such figures, the share left to public transportation is insignificant\(^5\), despite the quality public transportation services offered at the city level, as presented in the next sub-chapter.

The traffic measurements also targeted the identification of the average speeds encountered on the study road sections. While average travel speeds in the range of 25 to 30 km/h would be justifiable, the study pointed out speeds of under 10km/h indicating areas of high congestions resulting from a poor traffic organization.

4.4. Public Transportation

4.4.1. Overview

The Public Transportation (PT) in Alba-Iulia has been in a process of continuous transformation starting with 1990 as a consequence of all the modifications that have emerged in the national economy – given the switch from communism towards democracy. Currently, the city enjoys high quality PT services certified by the fact that The Public Transport Company (STP S.A. Alba-Iulia) has won in 2013 the Excellency Award granted by the International Union of Public Transportation for the best bus transport operator from Europe - IRU Bus Excellence Award 2013. The award was granted on such grounds as: significant investments in a fleet of comfortable and ecological vehicles suitable also for people with disabilities, reliable schedule, integrated ticketing system, clients’ satisfaction level and passengers’ information policy.

The busses are no older than 7 years and offer a wide range of facilities such as: dual ventilators, on-board computers, dynamic information panels inside the vehicles, voice-box systems, Wi-Fi systems, air conditioning and GPS monitoring systems. Moreover, all vehicles are washed twice a day. The stations, in their big majority, offer: electronic display panels indicating in real-time the position of busses, voice-box systems, video monitoring systems, web portal information systems, kiosks, automated tickets selling machines.

In order to grant everybody the possibility to use the PT services, on one line or on multiple lines, the PT operator offers a wide range of possibilities for paying for the transport services, by acquiring:

- tickets – payment through SMS, directly at the driver, from the machines from the station;
- travel pass/subscription;
- magnetic cards.

The integrated quality management system that the transport operator has implemented allows for the possibility to optimize the structure of the public transport system by supplementing the vehicles on the routes, by adapting the speed to the traffic conditions and load, by monitoring the activities of the vehicles, PT vehicle drivers and passengers. Such an approach facilitates the auto-regulation and continuous improvement of the activity carried-out by the local PT service, in the conditions of restrictive finances.

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\(^5\) In Annex 5, TB2 and TB3 refers to truck/bus with 2, and respectively 3, axes (suggesting that the share of PT might be even smaller than the percentage awarded to TB2+TB3 in the modal split)
4.4.2. Public Transport Coverage and Quality

According to the data presented in Decision no. 260/2012 of the Local Council, on the surface of Alba-Iulia’s metropolitan area there are a number of 183 PT stations. There are 26 routes on which PT services are offered and their coverage is graphically represented in Figure 13 below.

![Figure 13 - Public Transport map in the Alba-Iulia metropolitan area](Source: STP website, 2016)

As it is highlighted in the Traffic Study (Cluj-Napoca Technical University, 2015), considering the physical coverage of the PT network, the level of the services offered and the PT operator’s management program, one can draw the conclusion that the PT operations are adequate and could absorb higher levels of transport demand considering the operator’s auto-regulation mechanism which offers the opportunity to periodically adjust the services offered – routes, frequency of vehicles, hours of operation, etc.

In order to assess the service level offered by the PT operator, in the period March-April 2015 a public opinion survey was carried-out. 143 passengers responded to a questionnaire containing 17 questions meant to identify the level of satisfaction with regard to the PT service at the city level. The most important findings of the survey are listed below:

- 56% of the respondents are young people under 20 years old; the next category (27%) are people between 30 and 60 years; it can be concluded from these percentages that PT is used predominantly for commuting to school and work;
- 55% of the respondents are women;
- 58% of the respondents indicated that they usually choose to travel by PT, while 42% usually travel by private vehicle;
- 62% of the respondents claimed they use PT more than occasionally (2-3 times a week, once a day, more than once a day); from this percentage it can be concluded that there is quite a propensity to use PT for daily urban trips;
- 76% of those surveyed have evaluated positively the quality of the PT services;
- 72% of the passengers surveyed have evaluated positively the frequency of the PT service;
67\% of the passengers surveyed consider the cost of using PT services to be high and very high; given this high percentage, the PT operator should consider evaluating its tariff policy;

- 80\% of those surveyed find the comfort of the PT service to be at least satisfying;

- 58\% of the respondents consider that there are enough PT vehicles at the city level to satisfy the citizens’ demands; still, a pretty big percentage consider the opposite, which indicates that the matter should be looked into since it might signal the existence of routes or time intervals not covered sufficiently;

- 81\% of the passengers surveyed consider that the PT network has a good coverage at the city level – the routes are well distributed;

- 78\% of the respondents didn’t know about the existence of special PT lines during the weekend that assure the access to recreational points;

- 86\% of the respondents have positively evaluated the safety level of the PT services;

The outcomes of the public opinion survey support the conclusions drawn by the experts in charge of the Traffic Study, as well as the awards received by the PT operator. The passengers’ satisfaction level with regard to the PT services is high, the only negative aspect being related to the fact that the cost of using the service is considered medium to high by the biggest majority.

### 4.5. The Parking situation and regulation at the city level

The parking supply at the level of Alba-Iulia city is extensive as illustrated in Annex 6. Aside from the designated parking spaces available, on-street parking in areas not foreseen for parking also takes place leading to a “voluntary” reduction of the streets’ capacity. As highlighted in the chapter dedicated to the traffic situation, the authorities encourage the phenomenon by downgrading the street’s category in order to allow for this capacity reduction although it shouldn’t be the case. Such resolutions are justified by the revenue-centred parking “policy” promoted by those responsible with the management of parking at the city level. Actually, there is no parking policy available, apart from some Decisions of the Local Council regulating different categories and aspects of parking, particularly focusing on residential parking.

Parking in Alba-Iulia is widely free with very few exceptions. There are the off-street public residential parking spaces that are entitled to the physical and legal persons living in the area, in exchange of an annual parking fee (parking permit), as established through Decision no. 41/2010 of the Local Council. Additionally, there is one public off-street parking lot which provides 88 parking spaces that are charged per hour or per month - for residential spots. All on-street parking is free of charge. There were periods in the past when parking in some off-street parking lots as well as in some on-street spaces was charged for, but not anymore. The current regime for parking and the organization of parking can be depicted from the local laws dedicated to the issue, as described in the section below.

Decision no. 41/2010 of the Local Council (HCL) sets the rules for the organization and functioning of residential public parking lots. The most important aspects laid down by the Decision are listed below:

- parking in a residential public space is allowed only in exchange of a fee which amounts to about 30€/year;
- the beneficiaries of a residential public parking spot have the right to keeping the space occupied 24h/day;
- the awarding of residential public parking spots is done by representatives of the city hall;
the awarding of on-street public parking spaces in the immediate vicinity of commercial spaces (hotels, malls, theatres, banks, public institutions, firms, etc.) is done by the Department of Public and Private Domain Administration; such places are granted for serving customers and the entities to which are granted must pay a monthly fee that is established in the local General Regulation for Urban Planning (GRUP). The number of parking spaces allowed for each entity is established by rules laid down in local Decisions - the equivalent of a Minimum Parking Requirements standard.

Handicapped people are entitled with priority to free residential parking, subject to availability.

Physical persons can benefit of a residential parking spot only if they can prove they live in the close vicinity of the parking spot required; only one parking spot / apartment is granted, regardless of the number of people inhabiting that apartment;

Legal persons can benefit of a residential parking spot only if they can prove they own/rent/lease a property in the close vicinity to the parking spot required and they own a car; only one parking spot / legal person is granted. If the number of residential public spots is higher than the number of legal persons in the area entitled to such a place, the supplementary parking spots will serve as public parking spaces;

Persons that own a garage (spot) on the public or private domain, or detain a yard, are not entitled to renting residential public parking spots;

People parking in residential spaces that are not theirs, are subject to fines which amount from 20€ to 45€;

Parking on-street is allowed only where there are specific on-the-ground markings.

The Rule for the organization and functioning of the paid parking system from the central zone – Tudor Vladimirescu Street – is set through the Decision no. 282/2015 of the Local Council. The public off-street parking lot is newly constructed and its access is regulated by means of barriers. The most important aspects foreseen in the Decision are briefly listed below:

- the entrance to the parking lot is permitted by the barrier once a bar code ticket has been released by a dedicated machine triggered by the driver;
- the driver can’t leave the parking lot (barrier at exit) without paying for the ticket acquired at entrance; after paying the tariff corresponding to the time interval he/she spent parked, the driver has 5 minutes to leave the parking lot;
- the functioning schedule for parking is from Monday to Sunday, 00:00 to 24:00;
- the parking tariff for the 70 public parking spaces is 0,25 €/30 minutes between 8 a.m. and 5 p.m., and 0,25 €/hour between 5 p.m. and 8 a.m.; the payment is made only by coins and bills;
- the subscription for the 18 public residential spaces amounts to about 25€/year/space (VAT excluded); the number of residential spaces can be increased if the mayor disposes so;
- there exists a fee of about 25€ in case the driver loses the bar code ticket;
- there are high sanctions in place in case drivers damage the parking lot and the corresponding facilities/equipment in any way;
- the revenue collected from the parking tariff and subscriptions goes to the local budget;
There are two other public off-street lots that according to law should allow only paid parking but in reality no tariff is charged. Decision no. 214/2014 of the Local Council foresees that all parking spaces from within the citadel area be charged-for; at the entrance of the area, barriers for access management are installed but are non-functional, as are the ticketing machines. The parking lot servicing the new dendrological park is also paid parking area according to Decision no. 253/2014 of the Local Council, however, in reality the parking spots are widely and freely available to everybody.

The number of parking spots requested by law to be ensured for each category of building according to its utilization is foreseen in the General Regulation for Urban Planning (GRUP) first put forth in 1996, with its subsequent modifications – the last one taking place in 2014. Annex 5 of the GRUP is devoted to listing the parking requirements for each category of building as a number of parking spots per number of employees (plus a percent for customers) or per surface (plus a percent for customers). The GRUP does not take into consideration any aspect like access by PT or alternative means of transportation, area walkability, shared parking, land use mix, demographics etc., aspects that could reduce the need for parking. Moreover, the GRUP does not mention anything related to parking requirements for bicycles, indirectly discouraging the use of alternative means of transportation.
5. Parking Management Strategy outline for Alba-Iulia city

5.1. The laying grounds for a Parking Management Strategy that acts as a TDM tool

Knoflacher(2006) in his paper “A new way to organize parking: the key to a successful sustainable transport system for the future” delivered a very straightforward assessment of the contemporary transport policies that are failing to attain their set objectives of increased mobility. The economic development has not meant in many countries a very efficient transport system. Of course, the means of transportation have multiplied, the infrastructure has expanded and improved, speed has rocketed and still the transport system has more and more negative effects: accidents, noise and air pollution, congestion, urban sprawl and higher subsidies needed for the operation of public transportation. The measures that are today put forth by national and local administrations are heavily influenced by a political agenda, being driven by populism instead of rationality. Moreover, the measures that are being proposed very often address symptoms rather than causes, alleviating the problem only on a short term.

Alba-Iulia represents a very good example of the belief according to which more cars will produce a growth in mobility and more trips per person per day. Consequently higher levels of motorization were encouraged both by providing an increasing number of (free) parking spaces to accommodate it as well as by allowing illegal parking on road lanes, reducing the road capacity. But as mobility is tied to a purpose and if the purpose doesn’t change mobility doesn’t change, the supported increase in the number of personal vehicles has led to more trips per day being conducted by personal vehicles instead of alternative means of transportation. All this, in the end, has painted the picture of a very congested city in spite of its potential of being a very liveable community.

The rising standard of living taken together with the modal share split clearly indicate the fact that people are choosing the comfort of private vehicles in the detriment of alternative means of transportation in spite of the high quality PT services or the pedestrian-friendly facilities offered by the city. Traffic has continued to significantly increase between years 2000 and 2010 and then from 2010 onwards, and the authorities’ response to this phenomenon was to try and provide better road infrastructure to accommodate the ever increasing number of private vehicles. While efforts were made to offer good alternatives for those who do not own or do not drive a car, such an approach was only meant to serve the mobility needs of all types of road users, and not to discourage private vehicle use. No measure was put forth with the purpose of acting as an incentive meant to convince people to leave their cars at home and opt for alternative means of transportation. Hence, a highly unsustainable travel behaviour has been supported over the last 25 years that is now awarding more than 70% of the modal share split to private vehicles in a city where many distances can be covered by walking or cycling, and where the PT provider is named the best bus transport operator from Europe by the International Union of Public Transportation.

Since it is clear that the status quo is no longer a solution given the fact that the traffic is becoming more and more congested, a paradigm shift in the way mobility is thought of has to take place. The authorities have started to realize that alternative means of transportation to the private car must be offered and demarches in this direction have been taken, but unfortunately they are isolated and uncorrelated. Cycle lanes have started to appear throughout the city but most of them are for recreational purposes since they are placed in parks or at the outskirts of the city. A plan to implement
a net of cycle lanes throughout the city exists but has not been started yet. The pedestrian facilities have been improved throughout the years, the biggest part of the city offering a pedestrian-friendly environment fragmented only by the inconvenient and illegal parking of cars on sidewalks.

The Public Transport Operator is a privately owned company that under a Public Service Contract assures the public transportation service at the city level. Being a for-profit company, the operator has at its core the interest to attract more passengers and has made considerable efforts in offering high quality services, reliability and flexibility. It also has the capacity to adapt to an increasing demand, both from the point of view of the area covered/routes serviced as well as the number of vehicles operated. Therefore, the alternative to the private vehicle exits, and is ready and prepared to take over the share of people switching from one mode to the other.

Measures have to be put in place that will determine people to choose to conduct trips by personal vehicles only if they are willing to park where it is permitted and for a cost is market-based and that varies with the distance to the destination. This is because an unsustainable behaviour has been encouraged by the authorities:

- through the constant provision of an increasing number of parking spots all throughout the city;
- by imposing minimum parking requirements for new or refurbished buildings;
- by allowing illegal parking on road lanes that were not designed for such purposes and on sidewalks;
- by not regulating parking;
- by not charging for parking;
- by not incentivising people to use alternative means of transportation instead of the private vehicle;

Parking is a derived demand, part of a larger decision-making process for an overall trip. Parking and even the trip per se, are not a purpose on their own, but a means for people to take part in a desired activity, regardless if it’s recreational or work related. According to Willson (2016), parking use is the aggregation of individual driver responses to a number of factors such as: parking facilities, services, rules and pricing scheme offered by private and public entities. It is needless to say that if people are offered abundant free and unregulated parking, the decision to use private vehicles instead of alternative means of transportation is not so hard to take. Such an approach offers them convenience and it incentivises them, painting the picture of a transport system that discriminates those that do not own or drive a vehicle.

Left alone the congestion aspect, a parking management strategy that acts as a transport demand management tool is necessary also because of environmental reasons. The provision of free and abundant parking facilitates private vehicle use and the associated negative environmental effects such as: congestion, energy consumption, air and noise pollution, and so on. Aside these indirect effects, parking directly contributes to the polluted groundwater runoff. As the actions to reduce GHG emissions have not been that effective so far, it is expected that drastic measures will be put in place that will restrict private vehicle use or will price it at a fair level, by internalizing the external costs of private transportation. In this context, parking management is expected to play a significant role in managing the demand for transportation.
Another aspect that must not be overlooked in the analysis of the factors that favour parking management instead of the continuous accommodation of parking demand is related to financial aspects. There exists an incredible high cost associated with the building of new off-street parking in the context of limited public budgets. Moreover, the high opportunity cost of using public right-of-way for curb parking must not be ignored either since it heavily weights on those stuck on congested road lanes. Summing up these two categories of costs that are being paid directly and indirectly by the society, parking management again emerges as the right tool for cutting such unnecessary expenses.

All actions carried-out by the authorities have been centred on providing enough parking spaces to accommodate the ever increasing number of vehicles on the streets. However, as parking is widely free and unregulated all throughout the city, the current levels of parking occupancy cannot be considered parking demand but parking use. Without charging market prices or prices that ration the demand patterns, the demand for parking spaces cannot be measured. Offering parking free and at all destinations encourages people to an unsustainable behaviour of private automobile use. It is only when people pay for the services they use at a fair price that they stop to think whether they need that service or not and start using it only when needed. In Willson’s (2016) words, parking demand represents the number of parking spaces occupied at a specific moment in time under conditions of market pricing.

Unfortunately the analysis conducted at the level of Alba-Iulia city has indicated that the thinking behind parking has remained the same since the 80s’. While strong alternative means of transportation to the private vehicle exist, the authorities are still struggling to supply more parking – legal and illegal, free and unregulated – to accommodate the ever increasing demand. While issues related to congestion are on the authorities’ agenda, no coherent initiative exists that is meant to shift a significant part of the share of people that use private vehicles towards alternative means of transportation. However, for the city’s own sanity and/or thanks to regulations imposed by the European Union, the local public agencies will have to give-up this traditional practice and adhere to more contemporary parking management strategies that rationalize private vehicle use and hence decrease negative transport externalities.

Active parking management has proven countless times to be the key to resolving problems related to congestion and parking in cities around the world while at the same time increasing their economic vitality and stakeholder satisfaction, as proven in the chapter dedicated to good practice examples. The same can be achieved for Alba-Iulia, as soon as the local public agencies stop building or requesting additional parking spaces and start using parking management measures that encourage people to use the private vehicle only when they need to.

5.2. Parking Management Strategy Outline

While the previous sub-chapter made an introduction into all the reasons for which a parking management strategy is needed at the city level, it also emphasized the fact that the current situation resembles a virgin land where nothing has been done so far. While not many good things can be said about the status quo, it actually represents an opportunity to obtain great results with basic measures.
Parking, public as well as private, is an important asset for which people compete daily and in order to be used efficiently it must be managed. With the adherence to a coherent parking management strategy that acts as a TDM tool, the local authorities must change the way in which the parking situation is currently handled. The continuous provision of parking lots must stop and instead all parking management measures put forth through the strategy must be exhausted before thinking about constructing new lots.

There is a wealth of parking management measures presented all throughout the literature and implemented in real life contexts as emphasized in the first two chapters. Starting from the specific situation of Alba-Iulia city, a set of parking management measures with synergetic effects will be put together in a strategy with implementation targets for the short and medium-long term. As the issue of acceptability at the political and public level is an important aspect in the strategy’s success, a gradual deployment of the measures is foreseen (from short-term to long-term), so as to ensure people have the time to accommodate to the changes and easily start adapting their travel behaviour and perspective accordingly.

The parking management strategy is designed to obtain two things:

- reduce the quantity of parking spaces all throughout the city;
- increase the efficiency with which the remaining parking spaces are used;

The measures put forth in order to attain the two objectives are both direct and indirect, monetary and non-monetary so as to target all categories of road users, current drivers as well as future ones. The strategy outline is just a starting point towards finding the right mix of measures that bring the best results in terms of improving the mobility indicators at the city level and re-orienting people towards more sustainable travel behaviour habits. The proposed strategy is not a one-time, fixed endeavour, but a flexible, gradual, adaptable and reversible process that needs to be addressed constantly and continuously to make sure it responds to the changing conditions and context at the city level.

There must be coherence in the implementation of the strategy and adherence by all entities with a right to supply parking. That’s because there is a common practice of looking after one’s own interests but if there is no alignment in decisions the strategy will not pay off and that’s not going to bring any benefit to anyone. Promoting self-interests attracts parking chaos in which stakeholders believe that there is a parking shortage when in reality the only problem is unmanaged parking. This situation leads to a vicious circle of unnecessary expenditures on building new parking facilities instead of the more cost-efficient option of managing better the existing supply.

This iterative process, in which improvements need to be constantly implemented, evaluated and adapted, has as starting point the current situation from city. The most important realities that dictate the measures proposed through the strategy are the following:

- there are no parking management measures in place; parking is free, widely available and unregulated; no shared parking practice is conducted in the city;
- illegal parking is allowed and even supported by the local authorities, especially on-street, reducing the road’s capacity;
- more than 70% of the modal share pertains to private vehicle travel;
private vehicle travel has been constantly increasing for the last 20 years, painting the picture of a highly unsustainable travel behaviour, in spite of the availability of high quality public transport services;

An effective parking management strategy requires meaningful and effective coordination and communication among all involved entities. Commitment from those entities is equally important because otherwise the strategy and its implementation plan are going to be worthless. As Willson (2016) put it, there is no magic answer to ensure the implementation of such a strategy but there are certain elements that increase its likelihood, the most important of which for Alba-Iulia being an acknowledgement and broad agreement on the urgency of a parking management strategy that rationalizes the use of private vehicles while at the same time increasing the liveability of the city. Additionally, it is also important to involve both the private and public sector in the process, to have an agency and city manager take over the leadership of the implementation, and to make sure that each phase of the implementation is aligned to the local setting context.

Once the strategy is agreed upon and implemented, it will need to be assessed constantly and continually in order to make sure it responds to the changing conditions, new opportunities and suitable emerging technologies. There are many changing conditions that surround parking management, starting with the fluctuating demand (hourly, daily, weekly and seasonally) and ending with the broader changes that take place at an economic and social level. Consequently, the strategy needs to be constantly adapted to the changing context and such adaptations need to be substantiated by the keeping of performance metrics – regular collection and analysis of relevant data.

In the paragraphs below, the parking management measures that have to be implemented as part of a strategy for the short and medium-long term are presented. The proposal of the measures starts from the traffic problems encountered at the city level and presents a high level view of their possible implementation. Fine-tuning of the measures based on a more detailed and location specific analysis will be necessary; however, for such an analysis a consistent budget and timeframe must be provided for, making the strategy proposal below an outline or starting point for a more documented strategy.

5.2.1. Short-term horizon – parking management strategy
The analysis of the current transport and traffic situation from Alba-Iulia has emphasized a number of problems that determine the current congestion situation from the streets, and they are of varied nature. The most important are highlighted in the next paragraphs:

- Downgrading of the roads’ category in order to allow (illegal) parking on the street’s right of way;
  This is one of the major problems allowed by the local authorities and it has let to congestion on the city’s major boulevards. Because of different pressures coming from citizens and the business sector, parking on the first lane on many streets that were not design for such purposes was allowed. Such a decision was highly flawed since the traffic counts have proven that especially at peak hours the road capacity is obsolete in comparison with the traffic level. Moreover, parallel parking was allowed but instead people park at an angle, sometimes partly taking inches from the width of the only lane left available for traffic, impeding the smooth flow of vehicles even more.
  Aside from creating traffic blockages, this practice has also encouraged people to park wherever they want to and not keep account if a space is designated for parking or not, or
what kind of parking is allowed. No law enforcement actions have been put in place, and consequently people have no fear of punitive actions. These decisions of the authorities have greatly incentivized people to use private vehicles since parking is widely available, unregulated, uncharged-for, and no punitive actions are applied.

- **Parking is widely free all throughout the city;**

  Regardless if it is on-street or off-street parking, no charging is put in place almost anywhere in the city. There are 3 public parking lots that were designed with payment-based access systems, however only one of them is functioning as such and it’s constantly empty. This is a pretty good indication of how willing people are to pay for parking and this is a fact that is going to be leveraged through the parking management strategy.

- **The existing parking regulation encourages private vehicle use;**

  The local authorities have given their best to ensure that residential parking is regulated and that all residents are satisfied with the parking supply. Green zones have been removed in order to make place for parking in residential areas so as to allow everyone with a car to have a parking spot reserved 24/7 in change of a frugal annual permit. This practice has led to a lack of access in the area to anyone without a paid-for parking permit for a specific spot, obliging people to park on-street and occupy a street lane, or avoiding these areas and decreasing the income generated by the local businesses.

These main problems will act as cornerstones for the parking management strategy outline, with the measures proposed being connected one with another and acting in a synergetic way. The strategy outline targets the entire city and not just certain zones; however, a differentiation of certain measures will have to be considered on zones. They are divided in direct and indirect, as well as monetary and non-monetary packages and are summed-up in Table 2 below.

**Table 2 - Short-term parking management strategy outline**

<table>
<thead>
<tr>
<th>Parking Management Measures</th>
<th>Direct</th>
<th>Indirect</th>
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<tbody>
<tr>
<td>Monetary</td>
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<tr>
<td></td>
<td>• Conversion of parking spots into bicycle racks;</td>
<td>• Parking pricing;</td>
</tr>
<tr>
<td></td>
<td>• Investments in alternative transportation means (public transportation, cycling, pedestrian facilities);</td>
<td>• Introduction of parking cash-out / transit benefits programs;</td>
</tr>
<tr>
<td></td>
<td>• Availability of car-sharing services;</td>
<td>• Unbundling of parking;</td>
</tr>
<tr>
<td>Non-monetary</td>
<td>• Elimination of illegal on-street parking;</td>
<td>• Marketing of alternative means of transportation;</td>
</tr>
<tr>
<td></td>
<td>• Restrictions of curb parking;</td>
<td>• Information/awareness rising campaigns about parking management initiative;</td>
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<td></td>
<td>• Shared parking;</td>
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<td></td>
<td>• Space designations;</td>
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<td></td>
<td>• Adjustment of parking requirements;</td>
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<td></td>
<td>• Enforcement of rules;</td>
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</table>
The measures proposed for the parking management strategy are all focused towards increasing the efficiency of the transport system by changing people’s travel behaviour, away from the massive use of the personal automobile and towards more sustainable means of transportation. The measures proposed are expected to have an impact over the choice of travel mode, frequency, destination and/or timing.

**Direct Monetary strategy**

The measures proposed under the direct monetary strategy seek to manage and reduce the demand for parking by direct investments in alternative means of transportation and connected facilities. Under such a strategy, the local authorities must make sure that all road user categories have access to high quality means of transportation that can compete with the comfort and convenience of private vehicles. The measures to be proposed under this strategy for the short term are listed in the subsequent paragraphs.

**Conversion of car parking into bicycle parking**

The provision of bicycle parking is a necessary prerequisite for the implementation of the network of cycle lanes that the local authority is planning for the entire city. In order to make cycling a means of transport worthy of consideration, parking in highly convenient places must be provided for as in the case of private vehicle parking. Under these considerations, a certain percentage of the automobile parking can be converted into bicycle parking racks and the initiative be included under a larger bicycle promotion and encouragement program.

The number of bicycle parking spots can evolve gradually once the adherence to the healthy habit of cycling increases among city dwellers. More automobile parking lots can be converted into cycle racks from the starters at destinations visited for recreational purposes and schools. Placing a higher emphasis on promoting cycling among young people is an important element towards creating the habit of using sustainable means of transportation for the future generations of drivers. This measure also targets an increase in the convenience and security of bicycle transportation.

**Investments in alternative transportation means**

While a direct monetary approach, this measure is seen as a complementary one to the more aggressive initiatives of prohibiting parking in areas where it highly congests the traffic and pricing it where it must be better managed. The objective of this measure is to ensure that those switching from private vehicle use have alternatives in order to achieve their mobility needs. A thorough analysis must be conducted in order to identify whether there are any personal vehicle captives and if they are, make sure they have access to public transportation, the cycle lanes network reaches them and that the pedestrian facilities in their area are appropriate.

Considering that currently the public transportation services at the city level are already providing a high coverage, comfort, frequency and reliability, and that the public transport operator has the means to adapt to an increasing demand, the premise for supporting a decline in personal vehicle share is in place.

The provision of alternative means of transportation, including cycling and walking, is an important factor in the strategy’s success since the more sites can be accessed by public transportation, cycling, walking, taxi, etc., the less parking is going to be needed and occupied. Other said, the more unattractive private vehicle use becomes, the more competitive the alternative means of
transportation become. However, an integration of the transit services with the cycle lanes has to take place in order to make the measures work together towards improving the mobility level and attractiveness of each measure on its own.

**Car-sharing services**
While the existence of car-sharing services at a city level is a decision usually taken by a private entity willing to invest if the demand for such services exists, the authorities can encourage such businesses by providing favourable conditions. On one hand, the parking management strategy thought-of as a TDM tool must be in place encouraging the shift towards alternative means of transportation, and at the same time, different financial incentives (for e.g., tax exemptions) can be granted to the car-sharing service providers in order to attract them to the city. PPP are also an option.

The purpose of this measure is to further offer people alternative options to the private vehicle. Car-sharing services are changing the transport landscape in many metropolitan regional across the world since they provide the benefits of personal automobiles without the costs attached to actually owning it.

All the measures enlisted within the direct monetary package are meant to support the monetary indirect and non-monetary direct packages of measures by laying the grounds for a less car-dependent lifestyle. Moreover, all these measures contribute to environmental objectives and are thus for sure elements to be found in the transport landscape of the future.

**Direct Non-Monetary strategy**
This package of measures resides on the more traditional side of parking management, which refers to the use of rules to regulate parking, enforcement of the set rules and usage of space designations. Such measures are necessary considering one of the most important problems with which the city is confronted, respectively illegal parking. The measures proposed complement each other and their synergetic effect will play an important role in the effort towards rationalizing the use of private vehicles.

**Elimination of illegal on-street parking**
It has been highlighted in the chapter dedicated to the current transport and traffic situation from the Alba-Iulia city that a very unsustainable practice of illegal parking on the first lane of streets is allowed by the local authorities. As emphasized in Annex 2, on-street parking has led to high levels of congestion both thanks to lanes being occupied with parked cars as well as because of drivers’ cruising for parking. Through the present measure, banning cars from parking on such arteries is going to be implemented. This is one of the measures that are expected to have a high impact over drivers’ behaviour and it’s also going to be confronted with a lot of opposition from the public.

The implementation of this action has to be supported by two complementary measures. Since it is expected for the measure to have an impact both towards reducing the number of parking spaces as well as towards a more efficient use of the existing ones, there are going to be people who will reduce the number of trips carried-out with personal vehicles while their mobility needs remain unchanged and others who will continue to use them as usual. Consequently, the demand for the illegal on-street parking that is going to be eliminated will have to go somewhere else, either to off-street parking locations or towards alternative means of transportation. Therefore, two other measures part of the present strategy will have to be implemented before this action can be effected, respectively:
- Provision of alternative means of transportation - measure proposed in the direct monetary package of measures - to take over the travel needs of those reducing the frequency of personal vehicle use;
- Shared parking as a way to provide off-street parking options for those who will continue to use the private vehicles in order to access areas subject to the prohibition of on-street parking;

**Shared parking**

As already mentioned, the only part of parking that is regulated at the city level is the residential one. All the space in between blocks has been transformed into residential parking with spaces visibly marked at the disposal of those willing to pay a derisory annual fee. Once paid, the parking spot allows its “owner” full rights over it, with no one else being allowed to park on it, not even for a short while. This practice has led to the situation in which block facades offering off-street parking being almost completely empty during the day while the facades offering illegal on-street parking being fully occupied and congesting the traffic.

A change must clearly be brought to this landscape in which illegal on-street parking is taking place because drivers are not allowed to park in off-street parking spaces from residential areas that lay empty until the evening. The law regulating residential parking must be changed in order to allow full rights over the bought space only during the evenings when people actually use their residential spaces. During the day the space must be shared with those wishing to access the area. A city wide rule that allows shared use of residential public parking spaces must be implemented in order to alleviate the city from illegal on-street parking and increase people’s acceptability of the measure.

Implementing shared parking will also aid local businesses since people are going to be granted access to areas otherwise inaccessible by car unless a resident. The picture below shows a representative situation which is encountered all throughout the city, in which cars are parked on-street and there seems to be a parking shortage when on the other facades of the buildings the residential off-street lots lay almost empty all day long.
Note: the boulevard is marked with a red line, while the off-street residential parking lots are represented with various colours.

**Figure 14 - Residential off-street parking on Revolutiei Bvd.**

**Figure 15 - On-street (left) vs. off-street (right) parking on Revolutiei Bvd.**

It can be easily observed in the pictures above that there are numerous options for people parking illegally on-street on the boulevard (marked with red) to park off-street in lots that are currently reserved for residential parking. While on the boulevard the traffic is congested because the first lane is occupied by illegal parking and because of drivers’ cruising for parking, in the residential off-street parking lots there are many free places unoccupied during the day.

Under such circumstances, on-street parking must be prohibited and enforced, and a shared parking regime for the residential parking spaces must be introduced at city level, allowing people to park on residential spots until 5 p.m. in the evening.
Reduction of curb parking
While the measure above addressed mainly the situations where the streets’ capacity was voluntarily downgraded by the local authorities to allow illegal parking on the first lane of many important arteries along the city, all curb parking throughout the city must be reviewed and all the places where congestion takes place - even only during rush hours - curb parking must be eliminated.

The situation pictured in Figure x above is encountered all throughout the city, where on-street parking is fully occupied and off-street lots are empty until 5 p.m. Even residents that detain off-street residential spaces park on-street during the day for a faster access. Such on-street parking habits must come to an end and this can be achieved by removing on-street parking in as many areas as possible – granted off-street options exist – and where it is not possible, pricing parking measures must be introduced to further rationalize the demand.

Adjustment of parking requirements
There are various factors that can be used in order to intervene towards reducing the parking requirements for different types of building, such as:

- Geographic location;
  Starting from statistics regarding vehicle ownership and use rates in different areas, parking requirements must be adjusted to reflect regional variations.
- Transit accessibility;
  Depending on the situation from location to location, if public transportation stops are located nearby, and the service is frequent and of quality, the requirements for parking (housing and employment) can be reduced by at least 10%;
- Area walkability;
  Depending on the quality of the walking environment, the parking requirements can be reduced by 5-15%;

The current parking requirements foreseen in the General Regulation for Urban Planning do not take into consideration any of the factors mentioned above, indicating the fact that those putting forth such standards do not understand the biases contained nor the problems caused by the supply of excessive parking.

Under the proposed parking management strategy, the existing parking requirements must be revised and reduced considering the factors listed above.

Space designations
While banning and restrictions on curb parking are important elements of the parking management strategy, awarding designations for some spots must also take place in order to allow priority activities to be carried-out or preferred users to efficiently use the parking resources. It is important for the beginning to keep the designation system as simple as possible in order to make sure people understand it and respect it, and gradually come up with new categories of users if such an approach leads to a more efficient use of the parking resources. When designating spaces for certain categories of consumers or activities, care must be taken that the outcome of it is more efficient use of parking resources and not the generation of wasteful vacancies or frustration of the public.

As a first steps, designating on-street spaces must take place for the following purposes:
- loading and drop-off;
- service vehicles;

Such activities imply short-term parking is available for priority activities in conveniently located spaces. For off-street public parking, designating spaces for handicapped users is a must in order to allow their easy access. Clear signage and markings must be put in place in order to easily distinguish the designated spaces. Gradually, other categories of users or activities can be added to the space designation schema in order to help effectuate the measures proposed through the strategy.

**Enforcement of rules**

A central element in ensuring the effectiveness and efficiency of the measures proposed all throughout the strategy and especially those from the direct non-monetary package is represented by the enforcement of rules. A change in the way parking is handled must take place and the change can only be warranted if the underlying rules are obeyed by the public.

So far, rules have not really been respected because they were very little enforced on the streets. The major fear of punitive actions was related to parking on residential spots and not much else. Aside from respecting space designations drivers will also have to park only where it is allowed, adhere to time-based parking prohibitions and time limits, pay when parking is charged-for and pay fines when rules are broken.

The change in approach is major so an objective and consistent enforcement system must be put in place in order to ensure that the strategy’s objectives are met and the desired shift in parking management is taking place. The enforcement officers while representatives of the law must present themselves as friendly characters applying the rules for the greater good of the community, safeguarding the liveability and safety of streets. A more lenient approach to the enforcement of rules and regulations has to be implemented in order to allow people to get accustomed to all the changes. Police officers have to give instructions and educate people with regard to the new parking management practice, allow first time irregularities to be forgiven but punish repeated offenders. Such an approach is permitted only for the short-term, for the long-run a more strict enforcement system being envisioned.

As new rules and regulations must be put forth in order to effectuate the parking management strategy, fines have to be defined for different types of offences. An inventory must be kept with regard to the rate of violating the rules by drivers in order to be able to draw conclusions with regard to the appropriateness of the level of fines. A conclusion that could be drawn if people keep on breaking the rules is that the level of fines could be too low and has little impact over people’s behaviour. In this sense, a target level of compliance has to be defined and the fines must be adjusted until the set target is achieved. Revenue generating objectives must not be placed on the enforcement activity, but setting a fine level system that achieves the target compliance level without burdening the drivers too much. Differentiating fines by the degree of public harm they produce is also a very important aspect of the system of fines.

All in all, considering the challenges that might appear, the best way forward would be to introduce progressive parking enforcement and fine adjustments until the parking compliance target is achieved. For the long run, increasing the level of fines in order to sustain the operational costs of the enforcement activity is foreseen. Openness to people’s suggestions regarding the clarity of the system
of rules and regulations, on-street signage and markings, has to be part of the effort to make the enforcement system fairer and more likely to be accepted by people.

**Indirect monetary strategy**

**Parking pricing**

Parking pricing is placed at the heart of the strategy, and this is for various reasons. First of all, people’s travel behaviour needs to be urgently changed towards more sustainable grounds, and second of all, because this measure sets the laying grounds for the implementation of other parking management initiatives. Moreover, because the real demand for parking needs to be identified, parking pricing will be the tool to do so.

Private vehicles transportation bears a high external cost that is being paid by the entire society instead of being paid by those actually incurring the costs. By imposing parking pricing, parking subsidies are being reduced since the end user is the one paying instead of the greater community. This directly translates into an increase in the total out-of-pocket cost for automobile travel, making the real costs true to the parker and at the same time making alternative means of transportation relatively less expensive. As the choice of transport means is primarily a function of time and costs, under such circumstances the demand for alternative means is expected to go up. This phenomenon also translates into higher economic efficiency of alternative transport means – higher revenues generated by an increased demand allow an augmentation of service frequency, increasing the satisfaction of all parties involved. In order to increase people's acceptability of the new parking pricing measure, the funds collected this way must be given back to the community in a very visible and transparent way, respectively by investing in better pedestrian facilities, cycle lanes, public transportation services, etc.

As the measure of paid parking will constitute a relatively new practice to the residents, it will have to be implemented gradually, from a basic and easy to understand schema (on the short term) to an advanced program (on the long run) that obtains the optimum results both towards reducing the parking demand and private vehicle use, as well as towards a more efficient use of the existing parking resources – increasing the turnover per space. Moreover, the measure has to be implemented gradually also in terms of physical coverage. In a first phase, the most popular areas for parking will be included in the plan, and gradually, as the community starts to observe the benefits, the practice can be widespread all throughout the city.

The first step in implementing the measure should be to impose parking tariffs for all on-street parking spaces – those that will be left after the current illegal parking on the first lane of streets is eliminated. Two levels of tariffs should be defined, as follows:

- a higher tariff – about 1 €/h - for parking on the major boulevards and in central areas (where there seems to be a parking shortage);
- a lower tariff – about 50 € cents/h - for parking in less popular areas (where available parking can usually be found);

For public off-street parking lots the hourly tariffs should be set slightly lower than what is charged for in the near-by on-street parking spaces in order to make off-street lots attractive for price-sensitive drivers. This will also ensure a more efficient use of the parking resources, since off-street lots are also
going to be used more frequently. For on-street parking as well as for off-street parking, the charging hours should be set in the time interval 7 a.m. to 6 p.m., every day of the week. In the long-run, parking pricing can be extended to weekends as well, in order to also target other types of trips, not just the work related ones.

Since many parking places will become subject to the current measure, investments in a few main areas have to be taken into consideration, respectively:

- the parking spaces have to be clearly marked and signalled to let people know where it is allowed to park and what are the conditions, aka applying regulation;
- a pay-and-display system with multi-space parking meters has to be introduced gradually throughout the city; the meters have to accept cash payment as well as payment by card;
- using the new technology has to be explained through an aggressive marketing campaign; police agents have to pose as “ambassadors” of the measure, enforcing the law while at the same time explaining to people its usefulness and also teaching them how to use the meters (the enforcement system has to be viewed by people as friendly as opposed to punitive);
- enforcement of the measure has to be supported on the long run, in order to make sure people gain the habit of obeying the law and that their private vehicle use becomes more rational;

For the beginning, the system has to be simple, both in terms of charging schema as well as payment options. Gradually, the payment methods have to evolve (payment by mobile phone or the Internet, etc.) in order to make sure people have all the options available at their disposal. The metering technology must support the long-term plans of introducing dynamic parking pricing. Since no meters were used so far, smart meters can be introduced directly in order to ensure the smooth transition into the more advanced parking pricing program foreseen for the medium to long term. Moreover, the technology advancements can play an instrumental role in helping the community skips some of the steps in the traditional transition from a basic parking pricing strategy to an advanced one.

It is trivial to take things one step at a time and get people acquainted with the parking pricing practice and gain their acceptance. In order to increase the acceptability of the measure, it is very important to set the grounds for its implementation right. In doing so, marketing campaigns among the public are important in order to explain how the measure will be implemented, how they will be able to pay and what benefits it will deliver to the community. This is strongly related to the idea of using the funds gathered from parking pricing in order to improve alternative means of transportation and the urban landscape in general.

Another justification for pricing parking is that it leads to a fairer system in which the parkers pay at least for the operational parking costs. By using general tax revenues to pay for public parking supply, maintenance and parking rules enforcement, those that do not drive and park are being discriminated. They are also being disadvantaged when private parking operating costs are hidden in rents, the cost of goods, lower wages and so on.

**Introduction of parking cash-out and transit benefits programs**
The two types of financial incentives have the purpose of discouraging people from using the private vehicles in order to commute to the work place.
– Through parking cash-out, employers offer employees the option to receive the cash value of parking rather than being granted a parking space. This is a milder version to the parking subsidy elimination.
– Through transit benefits, employers offer employees subsidized transit passes in order to persuade them into using public transportation instead of private vehicles for their daily commute.

Since money always make a difference, offering people such positive rewards acts as a persuasion mechanism into reducing private vehicle trips and the parking demand. Moreover, if people are price sensitive, these measures will bring even more benefits towards private vehicle use reduction.

Through the proposed strategy such a program must be disseminated city wide. This is one of the initiatives for which the private sector’s buy-in is a very important factor. However, as a first step in its implementation, the local authorities can give a good practice example and implement the two measures in all public institutions, educational ones included. Considering the fact that the wage level in such institutions is usually in the average category, the impact of the measure is expected to be considerable. Implementing the transit benefits in educational institutions will also determine young people to adopt a healthy behaviour and will hopefully lead to more sustainable travel choices in the future.

Unbundling of parking
Under this strategy, parking is sold or rented separately as opposed to the current practice of automatically including it in the building’s cost. This initiative will compel buyers/renters into thinking twice about the need to also acquire a parking spot and more importantly, it will eliminate the incentive to also buy a personal vehicle if the space bought or rented also offers a free parking lot.

In order to put forth the parking unbundling strategy, the private sector will also have to be involved. The authorities will have to reach out and highlight all the benefits associated with this measure, including the financial ones.

Indirect non-monetary strategy
The indirect non-monetary package acts mainly as support mechanism for the other measures proposed through the strategy. While they have power on their own in the fight towards reducing private vehicle travel, they are key elements in gaining the public acceptance of the more aggressive parking management measures. In order for people to understand a new way of managing parking, its purpose and expected benefits, information must be made available to them in terms they can understand. While the new measures to be implemented must be clearly communicated and explained, their effects must also be made public through transparent evaluations. Public opinion surveys before and after the implementation of the measures are always a good idea in order to see how people perceive the measures and their effects. The surveys can also be an important tool in identifying means through which the strategy can be better accepted by residents, such as improved pedestrian facilities, extended network of cycle lanes and connected facilities, more frequent public transport services, etc.

Under this package of measures, three parallel campaigns have to be started:
one informing people about the strategy and its measures,
one rising the awareness of the community with regard to the negative effects that the excessive private vehicle transportation have over the environment, over society as a whole and most importantly over their health, and
one promoting alternative means of transportation in order to let people know there are many healthier and more sustainable means of transportation at their disposal;

It is important to make clear the objective of the strategy and its benefits, and present it to people as a means to obtain a safer, smarter and healthier environment that better serves its residents and future generations.

**Information campaign about parking management initiatives**

Such a measure is an important factor in gaining the acceptability of people with regard to the parking management strategy. In a community in which private vehicle travel is so dominant, the efforts to change people’s travel behaviour have to be intense, coherent and sustained. Through this campaign, the objective of the strategy has to be clearly transmitted, as well as the measures foreseen, how they work and what effects they are expected to trigger. More technical information like how the technology that is going to be implemented has to be used, the areas affected by each measure, the level of parking charges and fines, etc., have to be transmitted so that people understand the extent of the initiative and what their obligations are.

A first step in gaining the acceptability of the community towards the strategy is to make people feel a part of it. It has to be clearly highlighted that the strategy was devised for their own good, in order to increase the liveability of the community and of the local businesses, to protect people’s health, and to provide a city that promotes a high life quality level. This campaign must also reach schools around the city because early education is a very important step in shaping the travel habits of young people.

A central element in the success of the parking pricing measure is letting people know that the money collected will be directed towards improving alternative means of transportation – public transportation, cycle lanes, pedestrian facilities, introducing car sharing services, etc., - road furniture, green spaces, social spaces, etc.

There must also be transparency with regard to the actual results obtained as a result of implementing the strategy. Measurements that highlight the impacts of the measures implemented must be communicated to the community in order to gain their acceptability.

**Awareness rising campaign regarding the negative effects of private vehicle travel**

An awareness rising campaign also has to be conducted simultaneously, one that highlights the negative effects that the private vehicle travel has over the environment, over the urban landscape and primarily over people’s health. Nowadays people are becoming more and more self-conscious and preoccupied about the choices they are making and how they are impacting their lives. Still, education about the negative effects of unsustainable travel choices over their health and the health of future generations is not that common. The campaign therefore will have the purpose of highlighting these aspects, and indirectly gaining the community’s acceptance of the parking management measures.
Marketing of alternative means of transportation
In order for the strategy to achieve its purpose of reducing private vehicle travel, alternatives means of transportation have to be made known to people. All the more so since public transportation in Alba-Iulia is of such high quality, reliability and frequency. Because plans of implementing a city wide network of bicycle lanes exists and will be started in the near future. Considering the size of the city, travelling from point A to B by bicycle is a feasible option that also contributes to a healthier lifestyle for all age categories.

5.2.2. Medium- & long-term horizon – parking management strategy
The parking management strategy has to be tailored to the community’s readiness to implement it (Willson, 2016). While the short-term strategy is meant to introduce the new concept of parking management, the long-term strategy has the purpose of promoting more advanced measures expected to reduce even more the parking demand, and at the same time the private vehicle use, while creating smarter, healthier and more liveable communities.

The measures proposed are a step forward from those included in the short-term strategy, either a more advanced version of those measures or separate ones that seek to complement them. Divided in four package types, they are listed in Table 3 below.

It is important to acknowledge the fact that the approach through the parking management strategy – short or long term - is an empirical one which means that during implementation, depending on the results obtained, the measures can be adapted, modified, or changed altogether. The scientific and technological advancements might change the long-term plans foreseen for the strategy, but not its objective of rationalizing the private vehicle use.

Table 3 - Long-term parking management strategy outline

<table>
<thead>
<tr>
<th>Parking Management Measures</th>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary</td>
<td>• Extension of cycle lanes (surrounding areas/villages); ↑</td>
<td>• Dynamic Parking pricing; Elimination of employee parking subsidy;</td>
</tr>
<tr>
<td>Non-monetary</td>
<td>• Space designations; • Adjustment of parking requirements; • Enforcement of rules;</td>
<td>• TDM marketing; Real-time information on alternative transport options;</td>
</tr>
</tbody>
</table>

Direct Monetary package

Extension of cycle lanes
While for the short-term strategy a network of cycle lanes for within the city was foreseen, for the medium-long term strategy the extension of the network even further is a must. The metropolitan area of Alba-Iulia city has expanded and has taken over surrounding villages which are generating high levels of traffic. The biggest majority of people living in the near-by villages either work in the city or frequently visit it for recreational purposes. While public and private collective transportation services are in place, commuting by personal vehicles is nevertheless the preferred mode of transport.

Under these circumstances, alternative means of transportation to the private vehicle have to be provided for in order to give people choices and flexibility. Given the small distance separating these
new neighbourhoods from the city, safe cycle lanes can be seen as a feasible option for the everyday travel, even for kids going to schools in the city.

**Indirect Monetary package**

Dynamic parking pricing

While things have to be kept simple at the beginning, once the practice of parking pricing has been introduced and understood, a target parking occupancy rate of 85% has to be established and effectuated through a dynamic parking pricing system. Differentiated parking tariffs will have to be established for different areas of the city, depending on the existing parking demand. Four types of tariff areas have to be defined and identified, and a starting tariff level set accordingly, as presented in Table 4 below:

<table>
<thead>
<tr>
<th>Area type</th>
<th>Area description</th>
<th>Hourly tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Parking demand is very high. Finding a free parking spot is a matter of luck</td>
<td>1 Euro</td>
</tr>
<tr>
<td>Yellow</td>
<td>Parking demand is high. At rush hours, finding a free parking spot is difficult.</td>
<td>0.45 Euro cents</td>
</tr>
<tr>
<td>Blue</td>
<td>Parking demand is moderate. Sometimes people encounter difficulties in finding a free parking spot.</td>
<td>0.30 Euro cents</td>
</tr>
<tr>
<td>Green</td>
<td>Parking demand is low. People usually find parking spots even during rush hours.</td>
<td>0.15 Euro cents</td>
</tr>
</tbody>
</table>

Establishing an occupancy target implies that regular evaluations and adaptations of the tariffs are performed until the set target is achieved. By adaptations it is meant that increases and decreases of the hourly tariffs are performed until the 85% occupancy target is achieved. At the beginning, the evaluation of the impact that the parking tariffs have should be performed more often until the target is achieved. As the hourly tariff approaches the market price level, the demand fluctuations also diminish and the interval at which the regular updates of the tariff have to be carried-out can be loosened.

According Willson (2016), common price elasticities range in between -0.1 and -0.4, meaning that a price increase by 10% determines a 1% to 4% decrease in demand. Given the negative elasticity that exists between price and demand, in order to achieve the 85% parking occupancy target, the hourly tariffs will have to be regularly increased or decreased by 15€ cents until the objective is attained. Other said:

- when the occupancy level is beneath 85%, the hourly tariff will be lowered by 15€ cents;
- when the occupancy level is above 85%, the hourly tariff will be increased by 15€ cents;

This mechanism ensures efficiency of parking usage in two ways: the turnover of the most popular spaces is increased since more short-term parkers will use them during the day while a better usage will be made of the spaces just outside the core area – usually underused – since they are going to be sought after by the more price-sensitive drivers. This spreading of the parking demand according to needs and possibilities will also alleviate the parking shortage perception since a more efficient use of the parking resources will be achieved.
Determining the occupancy level is an important factor in the implementation of the dynamic parking pricing scheme. Given the size of the city, investments in high-tech such as in-ground sensors to determine the average parking occupancy and trigger tariff changes might be too much of an effort. Instead, manually collected occupancy levels could be enough to vary the hourly tariffs. However, under this scenario enough human force should be assigned to take over the task.

With market-based pricing, a fair allocation of spaces is made since those seeking for convenience and reduced walking distance to destinations will choose the highest prices places, while the more-price sensitive will go for the less convenient spaces, yet all parker categories will be granted access to the desired destination. Moreover, dynamic pricing will also ensure that drivers will select the parking location according to how long they want to stay, how they value walking time, how many passengers are in the car (in the cases when the price is split), as well as other specific circumstances.

Market-based schemes ensure that there are always some parking places available on each block improving the accessibility, while at the same time rationalizing private vehicle use since prices are always going to be as high as people are willing to pay. Such a scheme also ensures coordination among the entities offering public and private parking; pricing on-street parking at high enough tariffs generates people’s interest for off-street parking options, which determines private off-street parking lots to open their doors to public parking when spots are available. This will lead to a more efficient use of the parking supply and will help alleviate the skewed perception that there is a parking shortage.

In order to be able to implement such a dynamic parking pricing scheme, a well thought plan has to be prepared and adhered to. Data collection on a regular basis has to be conducted and investments in supporting technology made. Depending on how ambitious the parking pricing scheme is, a more or less complex system has to be devised to support it (metering technology with multiple price structures, sensor technology, integrated data systems for management, pricing, enforcement and revenue control, etc.).

Elimination of the employee parking subsidy
Elimination of the parking subsidy is an important step towards further reducing the demand for parking for two reasons:

- first of all, it has a direct effect over those benefiting from free parking spaces at work or having their costs reimbursed, since commuting by private vehicle will no longer be incentivised;
- secondly, the parking pricing measure will have little to no effect over this category of people since they are covered by the subsidy.

The real costs of travel have to be made know to drivers so that they can make informed decisions about the most suitable mode of travel for their everyday trips. The elimination of parking subsidy for employees is also important so as to not discriminate those that do not commute by private vehicle. Discovering the real demand for parking is also aided by this measure.

Direct Non-monetary package

Adjustment of parking requirements
In the medium-long term, the parking requirements can be further reduced considering some supplementary factors:
- Availability of car-sharing services;
  A 5-10% or 4-8 parking spaces can be reduced for residential buildings where car-share vehicles exist.
- Demographics;
  The age and the physical condition of people can play an important role in the reducing the parking requirements. As such, the decrease can be of 20-40% for housing for young, elderly or disabled people, categories which are known to use private vehicles less.

**Space designations**
The complexity of the space designation scheme can be increased in the long-term once people have understood the basic one. Therefore, on the long run, to make the practice even more effective, more categories of users or activities could be added to the original schema, as follows:

- Differentiate between levels of disability in issuing disabled placards, with different access rules for each group;
- Convert designated spaces to general purpose use after a certain hour or in certain days of the week (service vehicles or drop-off spaces converted into general purpose ones after 6 p.m.);
- Designate parking spaces per tariff level area (colour scheme);

While the measure of designating spaces is not expected to trigger a reduction of the demand for parking, it is foreseen as a tool to more efficiently use the existing parking resources, to serve all types of activities and users. It is also a measure for better organizing the available parking pool.

**Enforcement of rules**
As the parking management measures become more complex, people’s adherence to the corresponding rules and regulations has to be verified and imposed in order to ensure the strategy’s success. While for the short-term strategy a more lenient approach to the enforcement activity was foreseen in order to get people accustomed to the changes, for the long-term horizon the enforcement has to become more objective and stringent.

Moreover, the revenue resulting from citations should cover all operational costs related to enforcement activities as well as future needs. Therefore, if for the short term strategy the more lenient approach where people were permitted to get accustomed to the new measures was foreseen, for the medium-long term a higher level of enforcement should be targeted.

Advantage should be taken of advanced technology in order to increase the efficiency of the enforcement system. There are many innovations in the area such as handheld computers and electronic ticket devices with various features such as record keeping, identifying repeated offenders, stolen vehicles, and so on.

Measures to compel those that repeatedly break the law and refuse to pay fines into complying with the enforcement system have to be found as well. The target parking compliance will never be achieved if measures to also punish the scofflaws are not found. In this sense, a solution could be to tow the cars of this category of drivers after a number of offences are committed and not paid for. Their car will be released only after all collected fines will be acquitted, as well as any other applicable taxes such as towing and storage charges.
**Indirect, non-monetary strategy**

**Real-time information on alternative transport options**

A mobile application that integrates all alternative means of transportation to the private vehicle and provides users with various options for reaching his/her desired destination is an important element in a society in which the concept of mobility is changing. Such an application can be a key element also in the education of young people, helping them get accustomed to making sustainable choices for their everyday travel. It is central in the long-term success of the parking management strategy to start the efforts towards changing the travel behaviour of people, considering that at the present moment more than 70% of road users travel by personal vehicles.

**TDM marketing**

Marketing campaigns have to be carried-out continuously in order to keep people informed about every novelty regarding alternative means of transportation. Whether is a new transport mode that is being introduced, a new service or an extension of already existing systems, they must be communicated to the community and advertised so that people understand the alleged benefits.

**5.2.3. Other considerations**

While the strategy outline above speaks about punctual measures to be implemented in order to direct the community towards more sustainable travel choices, there are many other aspects that must be taken into consideration in order to support the strategy’s objectives.

A very important factor is represented by the administrative structure. At the present moment there are various entities involved in the parking management area, with different roles and responsibilities. The public sector actors are the city hall, through a Technical Commission, the city’s local council and the road police. The execution of the feasibility study and technical project, as well as the construction works – subject to a public tender – are being done by different private firms.

In the current scenario the parking management responsibility is spread among different entities without any planned coordination. In order for the parking management strategy to succeed, parking management tasks should be consolidated within a single parking authority or parking department within one of the agencies already involved in the topic. The best choice would be a parking department within the city hall, backed-up by the city manager, given the fact that there already exists a preoccupation for sustainable development and mobility at this level. The parking management strategy should be part of the Sustainable Urban Mobility Plan that is on the cards.
6. Public opinion survey regarding possible parking management measures at the city level

In order to investigate people’s existent travel behaviour and attitudes towards possible parking management measures, a public opinion survey was conducted in the period October 2016 – November 2016 on a sample of 288 road users. The tool used for such purposes was a paper-and-pencil questionnaire that was distributed to approximately 600 people, out of which 288 have responded. The questionnaire which can be found in Annex 7 contains 21 questions, out of which 5 are open ended. The interpretation of the responses was done using the SPSS software for statistical analysis.

The purpose of the first 8 questions was to understand the typology of the respondents— their age and gender, wage range, ownership of a driving licence and personal vehicle, access to a company car, area of the city in which they live, etc. The next 6 questions investigated their travel patterns and behaviour. Correlating these first two parts, conclusions whether there is a connection between the salary level and vehicle ownership will be drawn. The last 7 questions were devoted to understanding people’s attitudes towards the traffic situation from the city and different parking management measures. The final questions will help in substantiating the expected impacts of the parking management strategy outline proposed for the city in the previous chapter. The most important findings of the public opinion survey are presented in the following paragraphs.

The respondents to the questionnaire are between 18 and 66 years old, the biggest majority (40.28%) being in the interval 30-45 years old, and only 2% being under 20 years.

![Figure 16 - Age distribution (percentage)](image)

As in can be depicted in Figure 17 below, the biggest majority of respondents (71.5%) live in Alba-Iulia, 22.9% commute to the city to participate to work activities, while 3.1% visit the city for recreational purposes or business-related ones.
Out of those that indicated that they live in Alba-Iulia, 70% do so in central areas, 26% in areas close to the central part of the city and only 4% in peripheral areas.

Of the 288 respondents, 52.8% are males and 47.2% are females. 3.8% of the respondents earn less than the minimum wage (about 250 Euro/month), while the biggest majority (92.7%) earns less than 3.500 Ron (about 780 Euro/month) – out of which 53.55% make less than the medium wage (about 600 Euro/month). All in all, it can be concluded that the salary level in the sample is relatively low, despite the fact that people from various institutions (public and private) and diverse ages were selected for the survey.

Table 5 - Gender distribution (in percentages)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>152</td>
<td>52.8</td>
<td>52.8</td>
<td>52.8</td>
</tr>
<tr>
<td>Female</td>
<td>136</td>
<td>47.2</td>
<td>47.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>288</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 6 - Monthly income distribution

<table>
<thead>
<tr>
<th>Monthly income</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1.000 Ron</td>
<td>11</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>1.000 – 2.000 Ron</td>
<td>143</td>
<td>49.7</td>
<td>49.7</td>
<td>53.5</td>
</tr>
<tr>
<td>2.000 – 3.500 Ron</td>
<td>113</td>
<td>39.2</td>
<td>39.2</td>
<td>92.7</td>
</tr>
<tr>
<td>3.500 – 5.000 Ron</td>
<td>17</td>
<td>5.9</td>
<td>5.9</td>
<td>98.6</td>
</tr>
<tr>
<td>&gt; 5.000 Ron</td>
<td>4</td>
<td>1.4</td>
<td>1.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>288</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

77.4% of those participating in the survey detain a driving licence. Despite the low salary levels, 73.26% of the respondents own a personal vehicle.

Figure 18 - Distribution of driving license holders (%) vs. Distribution of personal vehicle owners (%)

Aside from the percentage of respondents that detain a personal vehicle, those that have unlimited access to a private automobile, theirs or not, were also analysed. In this case, the share is even higher, amounting to 81.3%. The most important conclusion that can be drawn from the first part of the questionnaire is that regardless of the gender, the salary range at the level of the people surveyed is pretty low. Still, in spite of this fact and regardless of their residence location (mainly in the central parts of the city), the biggest majority of people owns a car.

Table 7 - Respondents’ access to private vehicles

<table>
<thead>
<tr>
<th>Do you have unlimited access to a vehicle?</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, personal vehicle</td>
<td>212</td>
<td>73.6</td>
<td>73.6</td>
<td>73.6</td>
</tr>
<tr>
<td>Yes, a company car</td>
<td>5</td>
<td>1.7</td>
<td>1.7</td>
<td>75.3</td>
</tr>
<tr>
<td>Yes, personal as well as company car</td>
<td>17</td>
<td>5.9</td>
<td>5.9</td>
<td>81.3</td>
</tr>
<tr>
<td>No</td>
<td>54</td>
<td>18.8</td>
<td>18.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>288</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
People’s travel patterns and behaviour are investigated in the next section of the questionnaire. It will also be evidenced whether their income, residence location and vehicle ownership have any impact on their travel mode and frequency choices.

*Figure 19 - Average number of daily work-related trips*

*Figure 20 - Average number of daily trips performed for recreational purposes*
In what concerns the average number of daily trips (two-way) conducted in a normal work day, the situation is as follows:

- For work-related purposes, the mean number of two-way trips is 3, with a standard deviation of 4,729.
- For trips conducted for recreational purposes, the mean number of two-way trips is 2,23, with a standard deviation of 3,272.

When asked about the means of transport most frequently used for conducting trips to work, the biggest majority of respondents have indicated private vehicles – either as drivers (highest share) or as passengers, using own or company automobiles. The usage of private vehicles appears in the answers of 76,05% of the people participating in the survey, either on its own (70,49%) or combined with other means of transportation, such as public transport, cycling and walking. Public transport alone detains only 8,68% of the modal share split, while active transport means such as walking and cycling alone detaining a share of 11,81% and respectively 1,39%.

![Modal share split for work-related trips](image)

*Figure 21 - Modal share split for work-related trips*

The modal share split presented in Figure 21 above is worrying on its own and even more so when considering the overall context. The biggest majority of people live in central areas, or areas close to the centre, where most of the economic activities are also concentrated, with the exception of industrial ones - as it was evidenced in Figure 8 - *The spread of economic activities on the administrative territory of Alba-Iulia*. Many of the distances to be travelled are walking distances given the size of the city, the road environment is pedestrian friendly and the public transport services are of high quality. Still, in spite of all these facts people prefer to carry-out the trips to work by private vehicles. Cycling is almost non-existent for such trips.
The situation is very similar also when referring to trips performed in order to participate in different recreational activities. Figure 22 below illustrates all the combinations of answers received from the participants to the survey. Again, private vehicle use is encountered in 81.25% of the responses, in 73.96% being encountered on its own. At the other side of the spectrum lay the alternative means of transportation such as public transport (5.90%), walking (9.38%) and cycling (1.04%). In 3 out of 5 variants in which people use different combinations of transport means, the private vehicles are present.

The percentage of trips conducted by private vehicles is even greater for recreational purposes than for work-related ones, despite the fact that such locations are predominantly encountered in the central areas of the city, or areas that are well serviced by public transportation. In the face of such figures, one can only draw the conclusion that aspects such as habit, comfort and convenience lay at the basis of the travel mode decision.

What is the means of transport that you most commonly use for carrying-out trips for recreational purposes (shopping, social activities, sports, etc.)?

![Modal share split for trips conducted in order to participate in recreational activities](image)

*Figure 22 - Modal share split for trips conducted in order to participate in recreational activities*

The congested traffic from the city – especially during rush hours – is also explained by the next questions (Figure 23 and Figure 24 below). Aside from the fact that the respondents are dependent on private vehicles, the frequency with which such means are used is also worrying.

- 54.93% of those participating in the survey use private automobiles one or more times per day, while only 7.04% never use such transport means in order to conduct their daily trips.
- Out of those that use public transportation, only 11.54% do so one or more times a day, with the biggest majority (52.10%) never calling on such alternative transport means.
Correlating the first two parts of the questionnaire a very important conclusion can be drawn; the biggest majority of respondents earn low salaries but despite such fact they own a personal vehicle and use it most of the times for their daily trips, whether to get to work or for participating in recreational activities. A very low percentage of people choose to commute by public transportation and an even lower percentage uses such alternative transport means in their free time. Cycling is almost inexistent, regardless of the scope of the trip.
The last section of the questionnaire comes to complete the picture by investigating people’s perception towards the traffic situation and attitude towards possible parking management measures to be implemented at city level. The first question from this part backs the idea behind the proposal of a parking management strategy at the city level that could act as a TDM tool. More precisely, when asked whether the free and abundant parking is an encouraging factor in their decision to use the private vehicle for trips inside the city, 50.87% of the respondents gave a favourable answer. The different answers to this question are presented in the graph below.

![Graph showing attitude towards parking availability](image)

*Figure 25 - Attitude towards parking availability*

Aside from the fact that there is quite a high share of people who admits they feel the parking availability and lack of charging represent an incentive for their personal vehicle usage, the next question demonstrates that they also bear, in their biggest majority, a price sensitivity. Other said, when presented with the situation in which they would have to start paying for parking, 67.17% of the respondents indicated that they would shift to alternative means of transportation for their daily trips. Details about their choice of transport means in the case of paid parking are presented in Figure 26 below.
It can be observed that the highest percentage of those willing to give up the personal automobile if they would have to pay for parking would switch over to alternative means of transport mainly for work related trips. Smaller price sensitivity is noticed for trips conducted for recreational purposes. A reason for this choice could be the smaller time interval for which they would have to pay for parking.

While the question above clearly demonstrated the fact that the sample surveyed is sensitive to price, the next question illustrated in Figure 27 below comes to support such affirmation even more. As people were presented with different levels of hourly parking tariffs for which they would be willing to give up on using the private vehicle for trips inside the city, an even bigger percentage of respondents answered positively. 76.28% of the people surveyed claimed they would not be using private automobiles for city trips if a parking tariff would have to be paid, a percentage that is even bigger than the one from the previous question. This inconsistency in answers suggests that even from those that originally said they wouldn’t be switching to alternative means of transportation if they would have to pay for parking, if a high enough tariff is imposed even those that seemed insensitive to price would reconsider their position.

Half of the respondents (53.28%) would stop using private vehicles for a parking tariff as low as 3 Ron/h (about 66 Eurocents/h). The two subsequent price segments seem to have a lower impact over people, with the last one (>10 Ron/h) affecting even some of those less sensitive to price. These answers show that parking pricing can be an effective tool in attaining sustainable urban mobility objectives.
The next two multi-choice questions addressed the impact that various TDM measures have over the sample surveyed. They sought to identify which measures have the greatest effect towards convincing people to give-up on using their cars for trips to work as well as for non-work related trips. The alternatives presented to people were:

a) You’d have a direct route with a public transport vehicle;
b) You wouldn’t be able to find a parking space at the destination or nearby (on a radius of 1 km);
c) You would have to pay a hourly parking tariff;
d) You would only be allowed to leave your car on a parking space for no longer than 2h;
e) There is no situation in which you would give up on using your personal vehicle.

The answers to these two questions were impressive as illustrated in the figures below. For trips to work, as well as for trips for recreational purposes, only approximately 1% of those surveyed would not be willing to give up on using personal automobiles if different TDM measures would be implemented. The proposed TDM measures seek to make alternative means of transportation relatively more attractive while disincentivizing private vehicle use and their effects - as individual measures or combined measures - have a great impact over the travel mode choices of the people included in the survey.

For the daily trips to work, the option that was most frequently selected as an alternative to private vehicle usage is the direct route with a public transport vehicle – encountered in 42,4% of answers received. The next two options selected that act as a disincentive to the private vehicle rank similarly amongst people’s preferences; 37,2% of respondents included parking pricing in their answers, while 32,6% indicated the lack of parking near-by their destination. The parking time limits seem to have the smallest impact towards convincing people to leave their cars at home for their daily trips to work.
For the daily trips for non-work related purposes, the situation is pretty similar. 1.11% of the respondents would not give-up on using their personal vehicles regardless of the TDM measures implemented. For such trips, the biggest disincentive to the private vehicle would be the impossibility to find a parking space nearby their destination (on a 1 km radius), as indicated in 40.3% of the answers received. In order of effectiveness, the next two measures that would make travelling by private
automobiles less attractive are: a direct route with a public transport vehicle, as encountered in 35.1% of the answers received, and imposing hourly parking tariffs, as encountered in 26% of the answers received. Again, imposing parking time limits has the lowest impact, which in this case is understandable as the trips for recreational purposes are shorter.

People’s acceptance of a more aggressive measure that targets a reduction in the number of available parking spaces was inquired through the next question. As parking on the first lane of streets represents a big problem both in terms of congesting roads as well as in terms of encouraging people’s unsustainable travel behaviour of private vehicle use, the question addressed the topic of eliminating such parking. The results are again encouraging as an overwhelming share of the respondents (86.1%) point-out their acceptance towards such an action as highlighted in Figure 30 below.

![Figure 30 - Respondents’ acceptance level of banning illegal on-street parking](image)

People’s attitude and/or acceptability towards certain TDM measures are framed by their perception of the traffic situation from the city. As marked by the last question from the survey, the biggest majority (88.54%) of respondents find traffic in the city to be mostly congested and especially congested during rush hours.
Given the outcome of the survey, the correlations between different answers was also analysed and the most relevant findings are presented in the subsequent paragraphs. In order to analyse the correlation degree between the variables analysed the Chi-square test of independence was used. The existence of the correlation is given by the Pearson coefficient. The correlation exists only if one can attribute a significance level (p-value) to the correlation coefficient that is smaller than 0,05 (the null hypothesis is rejected, the null hypothesis standing for no correlation between variables).

The first correlation that was analysed was between the income level and parking pricing variables in order to determine people’s sensitivity to price. In this sense, the following questions were submitted to the analysis:

Q3. Monthly income:
   a) Under 1.000 Ron
   b) 1.000 – 2.000 Ron
   c) 2.000 – 3.500 Ron
   d) 3.500 – 5.000 Ron
   e) Over 5.000 Ron

Q16. In the situation in which all public parking spaces (non-residential) from around the city would be charged (inclusive the ones from your work place), for which of the following options would you go?
   a) I would give up using personal vehicles for trips under 1 km;
   b) I would give up using personal vehicles for trips under 2 km;
   c) I would choose public transportation/cycling/walking for the trips to work;
   d) I would choose public transportation/cycling/walking for trips carried-out for recreational purposes (shopping, social activities, sports, etc.)
e) I would choose public transportation/cycling/walking for all trips inside the city;
f) I would continue using personal vehicles;

<table>
<thead>
<tr>
<th>Chi-Square Tests</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>43.137^a</td>
<td>20</td>
<td>.002</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>43.300</td>
<td>20</td>
<td>.002</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>5.677</td>
<td>1</td>
<td>.017</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>271</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We can observe that the p-value associated to the Pearson coefficient is \(0.002<0.005\) which means that at a significance level of 5%, between the variables analysed a medium intensity correlation exists. Therefore, the price sensitivity of those surveyed is demonstrated.

In the situation in which all public parking spaces (non-residential) from around the city would be charged (inclusive the ones from your work place), for which of the following options would you go?

- I would give up using personal vehicles for trips under 1 km.
- I would give up using personal vehicles for trips under 2 km.
- I would choose public transportation/cycling/walking for the trips to work.
- I would choose public transportation/cycling/walking for trips carried out for recreational purposes (shopping, social activities, sports, etc.)
- I would choose public transportation/cycling/walking for all trips inside the city.
- I would continue using personal vehicles.

**Figure 32 - Correlation between Income level and Parking pricing**

Figure 32 above illustrates the categories of wage earners that are most price sensitive, and as expected, those earning lower salaries are most sensitive to price. It can also be seen that the trips for recreational purposes are less affected by the introduction of paid parking, while the trips to work are highly impacted.

In order to understand whether there is any correlation between the parking price level and various other TDM measures – complementary effects - , the following questions were analysed:
Q16: In the situation in which all public parking spaces (non-residential) from around the city would be charged (inclusive the ones from your work place), for which of the following options would you go?

- a) I would give up using personal vehicles for trips under 1 km;
- b) I would give up using personal vehicles for trips under 2 km;
- c) I would choose public transportation/cycling/walking for the trips to work;
- d) I would choose public transportation/cycling/walking for trips carried-out for recreational purposes (shopping, social activities, sports, etc.)
- e) I would choose public transportation/cycling/walking for all trips inside the city;
- f) I would continue using personal vehicles;

Q17: Select the option for which the following affirmation stands true: I would give up using personal vehicles for trips inside the city if I would have to pay a parking tariff of:

- a) Under 1 Ron/h
- b) Between 1 Ron/h and 2 Ron/h
- c) Between 2 Ron/h and 3 Ron/h
- d) Between 3 Ron/h and 4 Ron/h
- e) Between 5 Ron/h and 10 Ron/h
- f) Over 10 Ron/h
- g) None of the options above is adequate. I wouldn’t give up on using private vehicles for trips inside the city regardless of the parking tariff.

Table 8 - Crosstabulation of questions 16 and 17

<table>
<thead>
<tr>
<th></th>
<th>Q17</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Q16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>b</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>d</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>e</td>
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<td>6</td>
</tr>
<tr>
<td>f</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>45</td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>102.382</td>
<td>30</td>
<td>.000</td>
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<tr>
<td>Likelihood Ratio</td>
<td>105.421</td>
<td>30</td>
<td>.000</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>59.402</td>
<td>1</td>
<td>.000</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>262</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We can observe that the significance level associated to the Pearson coefficient is 0.000 < 0.05 which means that at a significance level of 5% between the variables analysed there is a medium intensity correlation. Therefore, people are sensitive to price, and according to the parking price level people choose different alternative means of transportation. From Table 8 it can be observed that the parking tariffs of less than 3 Ron are the ones that determine the highest transport mode shifts, with the majority of people choosing to give up on using personal automobiles for distances under 2 km and for trips to work. The trips for recreational purposes are less influenced by the parking tariff.

The correlation between the perception of congestion level in the city (question 21) and the measure of banning parking on street lanes where parked vehicles obstruct/congest the traffic (question 20) was also investigated.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>15.741</td>
<td>2</td>
<td>.000</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>12.319</td>
<td>2</td>
<td>.002</td>
</tr>
<tr>
<td>Linear-by-Linear</td>
<td>7.574</td>
<td>1</td>
<td>.006</td>
</tr>
<tr>
<td>Association</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>288</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We can observe that the significance level associated to the Pearson coefficient is 0.000 < 0.05 which means that at a significance level of 5%, between the variables analyzed there is a medium intensity correlation.

From the Figure 33 below we can observe that people are impacted by the congestion level from the city, even if it happens mostly only during rush hours, and given the correlation just demonstrated, this explains their acceptance of banning parking on street lanes where parked vehicles obstruct/congest the traffic.
While the results of the public opinion survey were pretty self-explanatory, in the next chapter their impacts will be further discussed considering the wider context of the parking management strategy outline proposed for Alba-Iulia city.
7. Expected impacts of the Parking Management Strategy

The measures proposed through the parking management strategy outline were chosen starting from the traffic and parking problems encountered at the city level and were combined so that their synergistic effects would contribute towards attaining sustainable urban mobility objectives. While their selection was done by analysing the positive results they have triggered – either alone or combined – in different cities around the world, their positive impacts at the local level are supported by the results of the public opinion survey conducted.

Looking at the positive outcomes generated by the best practice examples documented in the literature and adding the results of the public opinion survey conducted at the local level, the measures proposed through the strategy are expected to contribute to creating a smarter, healthier and more liveable community. The target of the parking management strategy is to create a new mobility model that is more oriented towards alternative transport means. The measures are expected to contribute towards a shift in modal share split, away from the private vehicle, and this is done by, on one hand, reducing the parking quantity available, and on the other hand by increasing the efficiency with which the remaining spaces are used, as indicated in the table below.

Table 9 - Parking Management Strategy Outline affecting Parking Quantity and Use Efficiency

<table>
<thead>
<tr>
<th>Intervention over:</th>
<th>Measure proposed</th>
<th>Parking Quantity</th>
<th>Use Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking</td>
<td>Elimination of illegal on-street parking</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced quantity of curb parking</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Shared parking</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjustment of parking requirements</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Enforcement of rules</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Parking pricing</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Parking cash-out programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elimination of employee parking subsidy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unbundling parking</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conversion of parking spots into bicycle lanes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Space designations</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Alternative transport</td>
<td>Introduction of transit benefits programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Investments in alternative transportation means (public transportation, cycling, pedestrian facilities, car-sharing services;</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Marketing of alternative means of transportation</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Information and awareness rising campaigns</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>TDM marketing</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Real time information on alternative transport options</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

The objective sought by reducing the quantity of parking spaces is to lower the demand for parking and therefore the private vehicle usage. The measures that seek to increase the efficiency with which the parking spaces are used target an increase in the space turnover; they also represent a disincentive for private vehicle travel while at the same time increasing the relative attractiveness of alternative means of transportation. The effect that is expected to happen is for the overall mobility indicator to increase while the private vehicle usage decreases.
The scientific work carried out on the topic of parking management as an efficient TDM tool put forth some basic principles on which the selection of the measures for the present parking management strategy was done. The approach to the new parking management practice is an empirical one that allows for constant assessment, evaluation and improvement of the strategy until the desired results are obtained. Still the literature as well as the real-life examples have shown that consistency and coherence in the application of the new policies and programs is a must in order to obtain positive results, approach that is also foreseen for the proposed strategy.

All throughout the literature researchers and academics preach for the benefits of parking management measures as efficient tools in reducing private vehicle travel, with best practice examples from different places all around the world supporting such statements. Many authors have devoted articles, research papers and even books to document the impacts determined by the implementation of various such measures in diverse locations characterized by differing mobility indicators, various traffic patterns, different travel habits and heterogeneous cultures.

Chapter two of the present paper has presented some of these diverse best practice examples from Europe as well as the USA, and the impacts the more or less advanced measures implemented have triggered. Impacts always vary depending on economic, geographic and demographic factors, on the way in which the strategy is implemented, the public and political support, and so on. However, some of the conclusions that can be drawn from analysing these best practice examples are:

- Impacts are higher where there are more travel options. Making one travel mode (private vehicles) less attractive increases the relative attractiveness of the other modes, given there are such alternatives;
- Parking time limits have higher impacts over drivers commuting to work by private vehicles;
- Financial incentives impact more the lower-income consumers;
- Measures have higher impacts if implemented together than isolated, granted they are complementary. For example, removing parking subsidies increases the effectiveness of parking pricing;
- The impact of parking management measures increases over time. This may be the result of subsequent adaptations of the strategy to fit the local context, as well as because of people’s changing perception over mobility patterns.

Starting from these realities, and considering the answers received to the public opinion survey conducted, the impacts and benefits of the measures that were proposed for Alba-Iulia city will be discussed. The parking management strategy outline proposed is centred on 3 primary measures, while the rest have the role of support - making them effective, more efficient and increasing people’s acceptability level towards them. The central measures that are expected to trigger the highest impacts are:

- Elimination of illegal on-street parking;
- Reduced quantity of curb parking;
- Parking pricing;

The results of the public opinion survey have clearly indicated the fact that because parking is widely available and free all throughout the city, people are incentivized to use private vehicles. Reducing the number of parking spaces (especially the on-street ones) will decrease the attractiveness of using
private automobiles since parking spots will be harder to find and less conveniently located. Imposing hourly tariffs for all parking spaces around the city will also have a great impact considering people’s high price sensitivity as demonstrated through the public opinion survey and the examples from literature.

The way in which the rest of the measures will support the primary ones will be by making them more:

- **Effective**
  - the enforcement of rules is central in making people adhere to the measures proposed through the strategy;
  - the adjustment of parking requirements and the unbundling of parking are expected to further reduce the number of parking spaces while the space designations will make sure people park where they are supposed to and are aware of the rules and regulations that govern those spots;
  - the conversion of vehicle parking spaces into bicycle lanes will further reduce their number and will contribute to creating the infrastructure for an alternative means of transport that hasn’t been explored so far.

- **Efficient**
  - measures such as parking cash-out and the elimination of employee parking subsidy will make parking pricing more efficient since private vehicle usage will no longer be incentivized and everyone will be subject to the payment of parking;
  - offering people transit benefits will make parking pricing more efficient since public transportation use will become relatively more attractive and less costly both in absolute as well as relative terms;

- **Accepted**
  - shared parking will make the banning of on-street parking foreseen less outrageous, since people will still have where to park in order to access whatever area of the city, but parking will be less conveniently located;
  - the existence of alternative transportation means (public transportation, cycling, pedestrian facilities, car-sharing services) will increase the acceptability of the measures that seek to disincentivize private vehicle usage since people will have more option to choose from, that are convenient, comfortable and less costly;
  - measures such as: marketing of alternative means of transportation, information and awareness rising campaigns, and TDM marketing, will highlight the benefits of using alternative transport means and the negative effects of private vehicle use, while the real-time information on alternative transport options will make people aware of their choices;

The results of the public opinion survey have painted the picture of a city where an overwhelming percentage of people use private vehicles for trips to work as well as for travelling in order to participate to recreational activities. They do so because parking is widely available and free and the authorities have contributed to developing a transport system that is centred on private vehicle usage. Currently the approach is to supply capacity in order to satisfy the ever-increasing demand for parking given the continuously rising private vehicle ownership and travel. What the proposed parking management strategy seeks, is to stop the uncontrolled provision of parking and move towards more sustainable models of parking management. It is actually the same paradigm shift in parking policy
evolution that was debated in the first part of the present paper; the same trend that many performing cities around the world are embracing in order to impose a new mobility pattern that is highly sustainable.

Hence, the primary forecasted impacts of the parking management strategy proposed for Alba-Iulia city are as follows:

- **Shifts from private vehicle travel towards alternative means of transportation**

The most important effect of the parking management strategy, out of which other secondary benefits will follow, is that a significant share of private vehicle users will switch over to alternative transport means, especially for their work trips. This is expected to happen as a direct result of the measures that seek to disincentivize private vehicle usage and indirectly thanks to the measures the strategy targets an increase in the attractiveness of alternative means of transportation.

The analysis of the results of the public opinion survey has clearly emphasized the fact that an overwhelming majority of respondents use private automobiles for their daily travel (72%), and they do so because they can always find available parking spaces and because they do not bear the real costs of private vehicle usage. The results of the survey have also clearly indicated that people are highly sensitive to price – 76.28% of the respondents would shift to alternative means of transportation for their daily trips if they would have to pay for parking.

Moreover, the answers to questions 18 and 19 highly support the efficiency of the measures proposed through the strategy. For trips to work, as well as for trips for recreational purposes, an outstanding share of 99% of those surveyed would be willing to give up on using personal automobiles if different TDM measures would be implemented, such as:

- a direct route with a public transport vehicle would be available;
- no parking spaces would be available at the destination or nearby (on a radius of 1 km);
- the payment of an hourly parking tariff would be required;
- parking time limits of 2h would be imposed;

For trips to work, a direct route with a public transport vehicle represents the strongest disincentive to private vehicle use, as the measure is encountered in 42.4% of answers received. The next two options selected rank similarly amongst people’s preferences; 37.2% of respondents included parking pricing in their answers, while 32.6% indicated the lack of parking near-by their destination. The same three options were indicated for non-work related trips, with only a slight difference in percentages. The results obtained through the public opinion survey confirm the positive impacts supported by literature and demonstrated by real life examples from different parts of the world.

Considering the above, it can be concluded that the measures proposed through the strategy have a complementary and synergetic effect, leading to an even higher percentage of people being willing to give up on using personal automobiles than if the measures were implemented alone. Still, the problem regarding the existence of direct routes by public transport must be raised given the high number of respondents that have indicated it. While the transit services from the city are “certified” as being of high quality (comfort, reliability, safety), the routes’ coverage might be a problem that has to be further analysed and improved accordingly. As noted above in the conclusions from the international best practices, the impacts of parking management measures are higher where there
are more travel options. In this sense, in order for the parking management strategy to trigger the travel mode shifts extracted from the responses of the people surveyed, the following must be ensured:

- An adequate coverage of routes by transit services must be provided-for. A comprehensive National Household Travel Survey must be carried-out in order to understand people’s travel patterns and make sure the public transport services cover the needed routes, that the service frequency is adequate, and that the perceived quality of the transport service is high enough to compete with the private vehicle.
- The infrastructure for cycling must be created and advertised to increase the share of usage of this active transport means. Giving people this alternative that hasn’t been exploited so far might boost even more the effect of the TDM measures proposed.
- The penetration of car-sharing services must be encouraged at the city level. From tax exemptions and all the way to PPP, the authorities must encourage this alternative of using in common a limited number of automobiles in the detriment of each family actually owning private vehicles. In the long run, this measure is expected to lead to a decrease in the private vehicle ownership level.
- The improvements in pedestrian facilities must continue in order to increase the attractiveness and share of walking as an alternative means of transportation. Many of the distances to be covered in the city are walking distances and hence this measure has all the chances of success on its side.

Aside from the provision of transport options, the rest of the measures proposed through the strategy will contribute towards this shift in travel mode. Each measure has its purpose in ensuring the strategy is complete and comprehensive, that all road user categories have been taken into consideration, and that progressively the positive results generated will lead to a new mobility model that is aligned with a smarter, healthier and more liveable community.

Considering the primary main benefit of the strategy – the shift in travel mode choice towards sustainable alternative transport means - a bevy of other positive effects are expected to follow which are listed and briefly discussed in the next paragraphs.

➢ **Congestion reduction and travel time savings**

The measures targeted at reducing the number of parking spaces, as well as those that seek to determine a more efficient use of the spaces left, have the objective to decrease personal vehicle travel which directly affects traffic congestion.

According to VTPI (2016), traffic congestion is a non-linear function which means that even a small traffic reduction in urban areas can cause proportionally large reductions in travel time.

Reducing the traffic congestion will reduce the delays for motor vehicles as well as for cyclists and pedestrians, road user categories which are often overlooked in such analyses.

➢ **Improved traffic speed**

The traffic study that was conducted in 2015 at the city level has pointed out some serious congestion problems on a number of boulevards where traffic is obstructed by the “illegal” parking on the first
lane of streets. Since all such parking is foreseen through the strategy to be removed, traffic is expected to become smoother even on these road segments and the speed is expected to increase.

Not just the speed of private automobiles is expected to improve, but also that of transit vehicles which will result in positive impacts over the services’ reliability and hence increased attractiveness of public transport services.

- **Consumer savings**

Through the parking management strategy proposed, consumer savings are expected for various reasons:

- More and diversified travel alternatives to the private vehicle will be available to people, at lower costs compared to private automobiles; since the relative costs of these transport means are lower, consumer savings are expected;
- Reduced vehicle costs; since private vehicles are used less, their operating costs will also be reduced – fuel, oil, tire wear, repairs, etc. all of which increase with vehicle use. Moreover, aside from these variable costs, the vehicle direct costs (acquisition price), non-market costs (travel time and crash risk) and external costs (environmental impacts, congestion, accidents, road and parking facility costs, etc.) are also important aspects of the analysis which are often not considered.
- Through the parking cash-out and transit benefits measures, direct financial benefits are offered to those willing to leave their cars at home when commuting to work;

As evidenced through the public opinion survey conducted, people are highly sensitive to price. As alternative means of transportation will become relatively more attractive – because of smaller relative costs as well as because of absolute improvements – it is expected that a significant share of road users will switch from private vehicle travel towards alternative means of transportation. On the long run, the objective of the parking management strategy is to reduce the number of vehicles a household detains or to deter the replacement of an old vehicle with a new one.

- **Economic efficiency and equity**

An efficient market is one in which consumers are provided with a variety of options from which they can choose based on the combination of quality, quantity and price that is most suitable for their needs (VTPI, 2016). Since more transport options will be offered, improved access and opportunity is expected. This means that not just those owning a car will be able to participate at different activities or access various areas of the city.

- **Improved traffic safety**

Since traffic volumes and the congestion level are expected to decrease, and people are expected to make more choices in favour of alternative means of transportation for their daily travel, road accidents are expected to decrease. The liveable community that is being targeted is a pedestrian friendly one, with improvements in street furniture and even traffic calming measures that enhance the overall road safety and security of road users. Nonetheless, measures to ensure low speeds have to be implemented in order to make sure that while fewer accidents take place because of reduced traffic, those that do occur do not take place at higher speeds when the crash severity increases.
Also, since less on-street parking spaces will exist, drivers will become less distracted by parking and hence the risk of crashes will diminish.

- **Environmental protection**

The parking management strategy encourages shifts from private vehicle use towards alternative means of transportation as well as a more efficient use of private automobiles, all of which result in fewer private vehicle trips and hence a reduction in fuel and emissions.

Benefits are expected also given the reduction in the amount of parking spaces which have high negative effects over the environment given the impervious surface on which they rest - which increases water flows in urban areas, leads to the degradation of the landscape and contributes to the urban heat island (UHI) effect.

A control over how much parking is provided for also has positive effects towards a more efficient and environmental-friendly use of the land, because by reducing the amount of impervious surface devoted to parking more greenspaces can be created. Secondly, storm-water management costs are also reduced by a decrease in the number of parking spaces.

- **Public health**

Currently the transport situation in Alba-Iulia is characterized by an automobile dependency which is the result of comfort and convenience and not necessarily of a lack of alternatives. As evidenced through the public opinion survey conducted, people are sensitive to the TDM measures included in the questionnaire. Therefore, a shift from private automobiles towards alternative means of transportation, which represent more active transportation, is expected to take place.

According to Litman (2005), transport policies, facilities and activities can affect people’s health in many ways, including crash risk, physical and mental health, air and noise pollution impacts, transport related stress, and so on. By adhering to alternative means of transportation, primarily to non-motorized means, people will become more physically active which will decrease the risk of cardiovascular diseases, diabetes, hypertension, obesity, osteoporosis and some cancer types. Research conducted in the USA on the topic indicates that moderate physical activity leads to an increase in average longevity by 1.3 to 3.7 years (Franco, et al, 2005, cited in VTPI, 2016).

- **Revenue generated for the public budget**

While the objective of the parking management strategy is not centred on revenue generation, the strategy will produce such funds which will have to be used in order to support the investments needed for the measures to function, as well as cover the operational costs of the program. The way in which these funds will be used has to be very transparent in order to gain the acceptability of the people towards the strategy.

As it can be noted, the impacts that the strategy is expected to trigger are positive and are supposed to contribute to an urban environment that is liveable, healthy and sustainable. The positive impacts of the measures proposed though the strategy are supported scientifically as well as practically by the existent best practice examples, and most importantly by the results returned by the public opinion survey that was conducted at the city level. The strategy was thought-of as a unitary combination of
measures that are compatible and complementary, and are expected in the long run to lead to even better results as people change their travel habits and adhere to more sustainable mobility models.
8. Discussions and Conclusions
The present paper was devoted to making the case for parking management as a mandatory element of a successful city that is anchored in becoming a smarter, healthier and more liveable community. It has evidenced that the old travel patterns that were centred on private vehicle travel are no longer sustainable for many reasons and parking management is a central tool in attaining more sustainable mobility objectives. All around the world, the likes of academics and all the way to practitioners, have started to discuss the importance of implementing transport demand management measures in order to enhance things we care about such as: public spaces, urban design, economic development, the environment and our health. The highlight of the paper was about demonstrating how parking management is one of the most efficient TDM measures, supported by scientific research as well as practical implementations in different places around the world, and how it could positively impact the mobility situation from a medium sized city from Romania which is currently characterized by a strong reliance on private vehicle for daily trips, regardless if they are work related or not.

For many years in the past, parking management measures were not on the agenda of any local authority/agency whose only concern was to supply capacity in order to accommodate the ever increasing demand triggered by a boost in private vehicle ownership which was the symbol of prosperity and one of the most important factors of economic development. However, starting with the early 90s, a parking management concept started to emerge in the form of regulation and pricing with the purpose of generating revenue for the public pocket. Still, stakeholders were very fearful at the thought that such parking management measures, pricing especially, would increase the competition from suburban locations that disposed of high levels of parking that were free and unmanaged. Nevertheless, time and practice have proven that the most successful places around the world have implemented active and innovative parking management measures that are benefiting the society as a whole, from individual road users and all the way to local businesses.

It is high time to stop the practice which allows the demand for parking to dictate the provision of capacity and turn things around. Parking management must be used in order to rationalize the private vehicle use and trigger a shift from such transport means towards more sustainable and active ones that positively impact the society, economy, environment and public health. These outcomes are also expected to take place in Alba-Iulia city if a coherent parking management strategy is implemented, one that is rooted in the traffic and mobility problems encountered at the city level and inspired by the good practice examples from around the world.

The strategy that was proposed through the current paper is thought in such a manner and also considering the community’s readiness to adopt it. Even if the measures proposed were selected considering their positive impacts in various other places, their effectiveness, efficiency and acceptability at the local level are supported by the public opinion survey conducted on a representative sample of 288 people. The Transport and Traffic Study conducted in 2015 by the Technical University of Cluj-Napoca has reverted worrying facts like the huge percentage (>70%) of the modal share split being awarded to private vehicle travel. The same figures were reported by the public opinion survey conducted by the author in October-November 2016. The reality paints the picture of a highly car dependent community that has developed such travel habits because of comfort, convenience and costs in a city where most of the distances are walkable, the potential of cycling is huge and unexploited, and where the public transportation service is certified as being one of the best from the EU.
This situation was created because of local authorities’ parking policies that have been all about encouraging private vehicle travel. In this regard the city is still in the point where others have been in the 60s’-80s’ period, struggling to provide enough parking to accommodate the ever increasing demand generated by the private vehicle ownership rate that is on an ascending continuum. But this unsustainable trend must come to an end and a way to obtain this is by implementing a set of parking management measures that complement each other and bring about synergetic effects.

The parking management strategy proposed is centred on three main measures which are expected to trigger a significant shift away from private vehicle travel because they address the most important aspects that lay at the basis of people’s decision to conduct their daily trips by such transport means, respectively the fact that parking is widely free and available. The public opinion survey clearly highlighted the fact that people are highly sensitive to price, consequently the prospect of having to pay for parking leading to as much as 76% of people being willing to give up on using their private automobiles. But as mentioned, the proposed measures are complementary and act in a synergetic way, and as prove, when people were presented with more disincentives to the private vehicle travel, such as a combination of a direct route by public transportation, parking pricing, the unavailability of parking near-by their destination and parking time limits, an overwhelming percentage of 99% of respondents showed their willingness to shift to alternative means of transport.

The results reverted by the public opinion survey support the choice of measures selected for the parking management strategy as well as the highly positive impacts they might trigger at the local level, such as significant shifts from private vehicle travel towards alternative means of transport, and the accompanying connected benefits like: congestion reduction and travel time savings, improved traffic speed, consumer savings, economic efficiency and equity, improved traffic safety, environmental protection, public health, revenue generated for the public budget, and so on. Still, there are practical considerations that haven’t been taken into account when the author proposed the present parking management strategy and which should be addressed when analysing the context of implementing it. A more thorough analysis of the present transport and mobility situation in the city has to be conducted in order to understand in detail people’s travel patterns (NHTS). Literature as well as the responses from the public opinion survey have emphasized the fact that in order to trigger significant shifts from private vehicle travel, people need to have alternatives from which to choose and one of the most important is public transportation. Cycling is another option but in order to make it work in Alba Iulia, the infrastructure and culture for it have to be created which mean investments and time especially for creating the demand for it. Long story short, public authorities have to be prepared to invest funds in order to bring about changes in travel choices and must be prepared to make a commitment towards ongoing management, monitoring, and implementation. The strategy is not a one-time effort but a continuous one which needs engagement and support from all stakeholders. A few changes at institutional level must also be carried-out in order to ensure coordination and responsibility taking towards the strategy.

However, considering the fact that the city has already embarked on a Smart City initiative and is working on a Sustainable Urban Mobility Plan, the timing of the present strategy could become just right from financial reasons as well as from political ones. Moreover, through the participation in various EU funded projects on topics related to sustainable urban mobility, the local authorities are always voicing their concerns regarding the topic and their wish to have access to good practice examples and transfer knowledge in the area. In this context, the present parking management
strategy could serve as a very good starting point, with the actual measures being adapted and perfected along the way.
References


Shoup, D.C., 2011. The politics and economics of parking on campus.[on-line] Available at: <http://shoup.bol.ucla.edu/PoliticsAndEconomicsOfCampusParking.pdf> [Accessed 22 April 2016]


Annex I - Geographic positioning of Alba-Iulia city at the county, regional and national level
Annex 2 – Blocked arteries because of on-street parking
### Annex 3 - Details about blocked arteries in Alba Iulia city because of on-street parking

<table>
<thead>
<tr>
<th>No.</th>
<th>Localization</th>
<th>Details</th>
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<tbody>
<tr>
<td>1</td>
<td>Vasile Goldis Street</td>
<td>Longitudinal parking on both sides of the one-way street.</td>
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<tr>
<td>2</td>
<td>Ferdinand I Boulevard, between ACR and the intersection with Olteniei Street</td>
<td>On the direction towards the city centre, the first lane is blocked by parked cars.</td>
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<tr>
<td>3</td>
<td>Tudor Vladimirescu Boulevard, between Ampoi III and the BCR building</td>
<td>Of the two-lanes per direction artery, the lane next to the sidewalk is occupied by parked vehicles.</td>
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<td>4</td>
<td>Alexandru Ioan Cuza Street, the section prior to the Ampoi bridge</td>
<td>Segments from the street, especially in areas with shops, have cars parked on the first lane on both directions.</td>
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<td>5</td>
<td>Henri Coanda – A. Saligny Street</td>
<td>Between the BCR headquarter and 300m from the Saligny street, voluntary parking obstructs the traffic towards the intersection with the Saligny street (not enough parking spaces offered to the clients of BDC and Carpatica Bank).</td>
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<tr>
<td>6</td>
<td>Teilor – Calarasi Street</td>
<td>Because of the lack of markings to delimit correct parking, currently parking takes place randomly, burdening the traffic.</td>
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<td>7</td>
<td>Traian Street</td>
<td>Residential area where dwellers prefer to park their cars on-street during the day, alternatively on one side and another, provoking interruptions in the traffic flow.</td>
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<tr>
<td>8</td>
<td>Republicii Boulevard, between Emil Racovita Street and Gh. Sincai Street</td>
<td>On-street parking on the first lane in both directions, due to the presence of shops and apartment houses.</td>
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<tr>
<td>9</td>
<td>Republicii Boulevard, between Gh. Sincai and Alcala de Henares Streets</td>
<td>First lane occupied by on-street parking in both directions.</td>
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<td>10</td>
<td>Motilor Avenue, between the Republicii Boulevard and Ion Ratiu Street</td>
<td>Curb parking on both directions.</td>
</tr>
<tr>
<td>11</td>
<td>Motilor Boulevard, between Ion Ratiu Street and Horia Boulevard</td>
<td>Segments of the first lane are occupied by parked cars in both directions (up until the pedestrian crossing, determining safety issues).</td>
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<td>Closca Street</td>
<td>Alternative on-street parking on the first lane in both directions.</td>
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<td>13</td>
<td>Revolutie Boulevard</td>
<td>Voluntary reduction of the street’s category: alternation between dedicated parking spots on the first lane, with voluntary parking spaces.</td>
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<td>Incoronarii Boulevard</td>
<td>On-street parking by residents during the day, leading to a voluntary reduction of the street’s category.</td>
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<td>Motilor Street towards Micesti neighborhood</td>
<td>The first lane out of the two lanes per direction is occupied by parked cars.</td>
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<td>Musetelului Street</td>
<td>Residential parking during the day (encouraged by transforming the two-way street in a one way street)</td>
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<td>Gladiolelor Street</td>
<td>Conflicts between residential parkers (apartment blocks versus houses).</td>
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<td>Bucuresti Street</td>
<td>Bucuresti Street is an alternative for those wanting to reach the ring road. However, the street is packed with parked cars, alternatively, on both directions.</td>
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<td>Marasti – Gh. Doja Street</td>
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<td>Motilor Street, the stadium area</td>
<td>Voluntary reduction of the number of lanes due to on-street parking.</td>
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<tr>
<td>22</td>
<td>Aurel Vlaicu Street</td>
<td>Curb parking obstructing the traffic flow.</td>
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(Source: Cluj Napoca Technical University, Traffic Study, 2015, pg. 53)
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Annex 5 – Modal split (in percentages) according to traffic measurements conducted on 14 road sections in the period 25.11.2014 – 02.04.2015

Decebal Street (26.11.2014)

Personal vehicles = 71,7%
Personal vehicles with trailer = 13,3%
Busses/coaches (TB2+TB3) = 6,9
Traian Street (27.11.2014)

Personal vehicle = 38,7%
Personal vehicles with trailer = 25,9%
Busses/coaches (TB2+TB3) = 15,9%
Personal vehicle = 61,2%  
Personal vehicles with trailer = 8,9%  
Busses/coaches (TB2+TB3) = 10,6%
Ring Road (11.02.2015)

Personal vehicles = 46.8%
Personal vehicles with trailer = 7.4 
Busses/coaches (TB2+TB3) = 15.4%
Personal vehicles = 65.8%
Personal vehicles with trailer = 18.2%
Busses/coaches (TB2+TB3) = 11.9%
Personal vehicles = 82,2%
Personal vehicles with trailer = 8,9%
Busses/coaches (TB2+TB3) = 5,2%
Incoronarii Boulevard (10.02.2015)

Personal vehicles = 81,5%
Personal vehicles with trailer = 6,7%
Busses/coaches (TB2+TB3) = 5,8%
Motilor Avenue (11.02.2015)

Personal vehicles = 82.5%
Personal vehicles with trailer = 10.6%
Busses/coaches (TB2+TB3) = 4%
Alexandru Ioan Cuza Street (10.02.2015)

Personal vehicles = 81.5%
Personal vehicles with trailer = 6.7%
Busses/coaches (TB2+TB3) = 5.8%
Regimentul V. Vanator Street (11.02.2015)

Personal vehicles = 61.2%
Personal vehicles with trailer = 8.9%
Busses/coaches (TB2+TB3) = 10.6%
Vasile Alecsandri Street (03.03.2015)

- Personal vehicles = 80.9%
- Personal vehicles with trailer = 9.8%
- Busses/coaches (TB2+TB3) = 6%
Revolutiei Boulevard (03.03.2015)

- Personal vehicles = 64,6%
- Personal vehicles with trailer = 16,8%
- Busses/coaches (TB2+TB3) = 8,7%
**Ring Road (05.03.2015)**

- Personal vehicles = 85.9%
- Personal vehicles with trailer = 4.7%
- Busses/coaches (TB2+TB3) = 3.9%
Ferdinand Boulevard (03.03.2015)

Personal vehicles = 26,8%
Personal vehicles with trailer = 23,8%
Busses/coaches (TB2+TB3) = 50,9%
Personal vehicles = 57.8%
Personal vehicles with trailer = 13.4%
Busses/coaches (TB2+TB3) = 11.6%
Republicii Boulevard (05.03.2015)

Personal vehicles = 72,5%
Personal vehicles with trailer = 10%
Busses/coaches (TB2+TB3) = 7%
Personal vehicles = 75.5%
Personal vehicles with trailer = 12.6%
Busses/coaches (TB2+TB3) = 8%
Iasilor Street (02.04.2015)

Personal vehicles = 66.5%
Personal vehicles with trailer = 18.3%
Busses/coaches (TB2+TB3) = 11.4%

(Source: Cluj-Napoca Technical University, Traffic Study, Annex 4, 2015)
Annex 6 – Parking inventory in Alba Iulia city
Annex 7 – Public Opinion Survey Questionnaire

1. Year of birth

2. Gender: Male/Female

3. Monthly income:
   a) Under 1,000 Ron
   b) 1,000 – 2,000 Ron
   c) 2,000 – 3,500 Ron
   d) 3,500 – 5,000 Ron
   e) Over 5,000 Ron

4. Do you own a driving license? Yes/No

5. Do you own a personal vehicle? Yes/No

6. Do you have unlimited access to a vehicle?
   a) Yes, personal vehicle
   b) Yes, a company car
   Details (option to use it for personal trips): ..............................................
   c) Yes, personal as well as company car
   d) No

7. Which of the following affirmations describe best your situation:
   a) I live in Alba Iulia
   b) I commute to Alba Iulia to go to work
   c) I own a company in Alba Iulia
   d) I frequently visit Alba Iulia for recreational activities, for shopping, for business, etc.

8. In case you live in Alba-Iulia, in which part of the city do you live?

9. What is the average number of work-related trips (two-way) that you perform in a normal work day?

10. What is the average number of trips (two-way) that you perform in a normal work day for recreational purposes?

11. What is the means of transport that you most commonly use for carrying-out the trips to work?
   a) Own vehicle (as a driver)
   b) Own vehicle (as a passenger)
   c) Someone else’s private vehicle (as a passenger)
   d) Public transportation (bus, van, etc.)
12. What is the means of transport that you most commonly use for carrying-out trips for recreational purposes (shopping, social activities, sports, etc.)?

   a) Own vehicle (as a driver)
   b) Own vehicle (as a passenger)
   c) Someone else’s private vehicle (as a passenger)
   d) Public transportation (bus, van, etc.)
   e) Bicycles
   f) Walking
   Other details: ..........................................................

13. What is the frequency with which you use private vehicles (own property or not) for the trips carried out?

   a) Once or more times per day;
   b) 4-5 days per week;
   c) Once or twice per week;
   d) Never;

14. What is the frequency with which you use public transportation for the trips carried out?

   a) Once or more times per day;
   b) 4-5 days per week;
   c) Once or twice per week;
   d) Never;

15. Do you consider the free and abundant parking to be an encouraging factor in your decision to use the private vehicle for trips inside the city?

   a) Yes
   b) Sort of
   c) Not really
   d) No
   e) Other answer:
       ___________________________________________________________________

16. In the situation in which all public parking spaces (non-residential) from around the city would be charged (inclusive the ones from your work place), for which of the following options would you go?

   a) I would give up using personal vehicles for trips under 1 km;
   b) I would give up using personal vehicles for trips under 2 km;
   c) I would choose public transportation/cycling/walking for the trips to work;
   d) I would choose public transportation/cycling/walking for trips carried-out for recreational purposes (shopping, social activities, sports, etc.)
   e) I would choose public transportation/cycling/walking for all trips inside the city;
   f) I would continue using personal vehicles;
17. Select the option for which the following affirmation stands true: I would give up using personal vehicles for trips inside the city if I would have to pay a parking tariff of:

a) Under 1 Ron/h
b) Between 1 Ron/h and 2 Ron/h
c) Between 2 Ron/h and 3 Ron/h
d) Between 3 Ron/h and 4 Ron/h
e) Between 5 Ron/h and 10 Ron/h
f) Over 10 Ron/h
g) None of the options above is adequate. I wouldn’t give up on using private vehicles for trips inside the city regardless of the parking tariff.

18. You would agree to give up using your personal vehicle for trips to your work place in which of the following situations (you can select more than one option):

a) You’d have a direct route with a public transport vehicle;
b) You wouldn’t be able to find a parking space at the destination or nearby (on a radius of 1 km);
c) You would have to pay a hourly parking tariff;
d) You would only be allowed to leave your car on a parking space for no longer than 2h;
e) There is no situation in which you would give up on using your personal vehicle for trips to work.
Details: (for e.g., I have no other options, no PT, etc.) .................................

19. You would agree to give up using your personal vehicle for trips carried-out for recreational purposes in which of the following situations (you can select more than one option):

a) You’d have a direct route with a public transport vehicle;
b) You wouldn’t be able to find a parking space at the destination or nearby (on a radius of 1 km);
c) You would have to pay a hourly parking tariff;
d) You would only be allowed to leave your car on a parking space for no longer than 2h;
e) There is no situation in which you would give up on using your personal vehicle for such trips.
Details: (for e.g., I have no other options, no PT, etc.) .................................

20. Do you consider as proper banning parking on street lanes where parked vehicles obstruct/congest the traffic?

a) Yes
b) No
Other comments: ........................................

21. How would you describe traffic in Alba-Iulia:

a) Mostly congested;
b) Congested during rush hours (8:00 – 10:00, 16:00 – 18:00);
c) Not very congested;
Other comments: ........................................
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Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:

Parking Management - an efficient Transport Demand Management measure. Forecasted impacts in a medium sized city where parking is currently free

Richting: Master of Transportation Sciences-Mobility Management
Jaar: 2017

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Voor akkoord,

Panea, Laura

Datum: 12/01/2017