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KEY ELEMENTS FOR THE IMPLEMENTATION OF A MOBILITY CONCEPT FOR INNER-CITY PROJECTS

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Abstract

Inner-city projects such as office buildings and mixed-used buildings (in this case: office and residential) require a certain amount of parking lots for personal cars and bicycles. The number of these in most cities is defined by certain local or regional regulations. To reduce the motorized traffic volume, to avoid an overload of parking lots for cars and to reduce the cost of – mostly underground – garages a mobility-concept for the project can be an adequate solution. A toolbox with key elements is presented, e.g. substitution of private parking with car-sharing vehicles; free-floating parking management instead of reserved parking lots; bicycle infrastructure provisions, subsidy of public transport tickets for residents and employees; information management app. For some of the certain key elements the potential reduction of parking demand is already possible to calculate based on empirical data and experience from existing properties. Other elements must work together to get a reliable estimation of the possible reductions of private parking. An example shows the possibility of the implementation of a mobility concept for a hypothetical project in the central business area of Frankfurt am Main, Germany: Starting with the number of parking spaces required without the mobility concept the reduction of the certain key elements is proposed. As a result, the number of car parking spaces to be built is defined.

Keywords: mobility, urban areas, parking demand, traffic assumption, behaviour of users

1 Introduction to and goals of mobility measures

The starting point is the required number of parking spaces as defined by the parking space ordinance and the official parking space calculation based on the usage of the project and the related gross floor area. Within the approval procedure, the number of parking spaces may be reduced to a lower value, provided that this value is derived in a transparent and comprehensible manner. The mobility measures proposed in the following sections thus are intended to determine the actual demand for car parking spaces that can be justified from a transport planning perspective thus they can be used in the official approval procedure. The overall objectives are to ensure mobility quality for all users through:

- demand-oriented reduction of motorized individual transport and car parking spaces
- promotion of non-motorized modes of transport, particularly cycling
- provision of alternative mobility services.

There is only limited scientifically validated evidence on how individual mobility measures directly influence modal choice decisions. Statements assigning fixed percentage reductions to most single measures would therefore be purely speculative, e.g.: „providing showers and dressing rooms for bicyclists will reduce the demand of car-parking lots by 5 %".

However, some measures are already (well) documented or politically fixed. These measures are presented as A... measures in section 2.1.:

- Compensation potential of car-sharing. One car-sharing vehicle can replace between four and ten privately owned vehicles, depending on local conditions [1].
- In Frankfurt am Main, five car parking spaces may be replaced by one car-sharing or pool vehicle space under the applicable guideline [2].
- In the State of Hesse/ Germany, up to 25% of required parking spaces may be compensated by additional bicycle parking facilities [3].
- Workplace mobility measures such as job tickets show a significant reduction potential. Empirical studies indicate a reduction of between 15% and 20% of required car parking spaces when high-quality public transport and job ticket schemes are available [4].
- A further compensation potential is assumed for subsidized tenant public transport tickets in combination with car-sharing services, but no specific compensation values are stated in the literature [5].

Except for car-sharing, additional bicycle parking facilities, job tickets, and shared parking use, no direct compensation values can be assigned to individual measures (A... measures in section 2.1). Nevertheless, professional consensus confirms that a combination of multiple measures reduces car use and parking demand while improving mobility quality. These measures are presented as B... measures in section 2.2. The measures in the following section 2 do not present all possibilities, further measures can and will be developed.

2 Mobility concept measures

2.1 A-measures with individually quantifiable reduction effects

2.1.1 Measure A1: Job ticket (employees) and tenant ticket (residents)

Target group: office and residential tenants; expected reduction: 15% up to 30% of required parking spaces.
Description: Documented findings are available regarding corporate mobility measures. If a job ticket is offered in conjunction with high-quality public transport accessibility, the demand for parking spaces decreases significantly. Based on empirical studies conducted to date, the potential of a job ticket to reduce the number of required parking spaces, as defined by local parking space regulations, ranges between 15% and 30% [6]. Contractual arrangements are to be established to provide office and residential tenants with attractive job ticket and/or tenant ticket offers. This must be legally secured within the building permit procedure.

2.1.2 Measure A2: Parking management and shared use of parking spaces

Target group: employees, residents, visitors/customers; expected reduction: up to 30% of required parking spaces.
Description: The parking spaces are not assigned on a fixed basis but are managed using a free-floating system. Employees, customers, tenants and visitors are granted access to the garage during specific time windows defined by the operator based on operational experience. The garage is intended to be operated using a digital parking space management system.

Such systems are generally based on license plate recognition at entry and exit, implemented in compliance with data protection regulations. With AI-supported analysis, utilization can be predicted increasingly accurately over time, as regularly occurring license plates become known. Physical barrier systems can therefore be omitted. Billing is handled via subscription models (e.g. for tenants) or via an app (e.g. for customers). A detailed description of the available options can be found, for example, from the provider Scheidt & Bachmann [7]. The exact level of savings strongly depends on the specific context – e.g. time of day, user groups, urban structure, and technology deployment – but on average frequently ranges between 30% and 50%.

2.1.3 Measure A3: Car-sharing vehicles

Target group: residents, visitors, employees; expected reduction: a compensation of five parking spaces required under statutory regulations per car-sharing vehicle is considered realistic.
Description of the Measure: Car-sharing vehicles are provided by an experienced operator who is contractually obligated accordingly. The compensatory potential of car sharing is well documented. The German Environment Agency (Umweltbundesamt) and the German Car-Sharing Association (Bundesverband CarSharing) refer to this and state that one car-sharing vehicle can compensate for four to ten conventional parking spaces [8]. In addition, bicycles, e-bikes, and cargo bikes should be offered.
Availability of vehicles can be checked, and bookings can be made via an app. As car-sharing vehicles are, by definition and common practice, publicly accessible, it cannot be guaranteed that a vehicle will always be available at the desired time. During further project development, it may be examined whether project-specific pool vehicles could be provided instead of generally accessible car-sharing vehicles. This would prevent the vehicles from being used by persons not associated with the development. The compensatory potential of car-sharing vehicles and pool vehicles is of approximately equal magnitude.

2.2 B-measures with combined reduction effects

The combined effect of the following measures is assumed to reduce the required number of parking spaces by 10%, depending on the quality of bicycle infrastructure and public transport.

2.2.1 Measure B1: information material

Target group: Prospective tenants and investors
Description: Public transport accessibility and cycling infrastructure are highlighted already during tenant acquisition.
Print-outs and internet websites are provided [9].

2.2.2 Measure B2: mobility portal / information point

Target group: All users
Description: A digital mobility platform provides access to public transport, shared vehicles, carpooling, visitor parking, and charging infrastructure.
To support the implementation of mobility measures, a mobility management system in the form of a largely automated mobility portal can be provided. This portal allows all users to inform themselves about available options and manage necessary procedures via an app or display monitors in the foyer, e.g.:

- use of car-sharing or pool vehicles
- offers/requests for carpooling (ridesharing)
- reservation of vacant parking spaces for short-term use
- rental vehicles available in the surrounding area

An example of the user interface (UI) for such an application can be found in [10].

2.2.3 Measure B3: Secure bicycle parking, showers, and changing facilities

Target group: Tenants, employees, residents
Description: The bicycle parking spaces are allocated to residents and employees, for whom a theft-proof, dry, and convenient facility is provided. Charging stations and power outlets are provided within the storage areas. Changing rooms and showers for cyclists should be planned in accordance with the requirements of a selected certification body (e.g., one shower per 20 parking spaces; one locker per 10 parking spaces) [11]. These measures will significantly increase the attractiveness of cycling.

2.2.4 Measure B4: Bicycle service station

Target group: Tenants, employees, residents, visitors
Description: A bicycle service station allows self-service repairs and professional maintenance.

3 Example (hypothetical)

An office building in the central business district in the city of Frankfurt am Main, Germany will have 60,000 sqm gross floor area. The city of Frankfurt requires one car-parking space for each 50 sqm gross floor area [12]: 60,000 / 50 = 1,200 car-parking spaces
If the investor guarantees to provide certain mobility measures to improve the non-motorized traffic usage, the number of car-parking spaces can be reduced. In this example-case – using the reduction assumptions in section 2 - the reduction of car-parking spaces can be calculated as follows:

Parking-spaces without reduction		= 1,200 sp
Mobility measure	reduction [%]	number [sp]
Reduction A 1 Jobticket	15%	= - 180 sp
Deduction A 2 Parking management	30%	= - 360 sp
Reduction A 3 car-pool-vehicles 6 cars		
1 car-pool veh = 5 sp. ⇢ 6·5 -6 (for pool veh. Itself)		= - 24 sp
Reductions B 1, B 2, B3, B 4	10%	= - 120 sp
Sum reduction		= - 684 sp
Number of spaces to build: 1,200 – 684		= 516 sp

4 Conclusion

As mentioned in chapter 1 there is only a quite limited number of scientific research regarding the numerical effects of mobility measures on the demand for parking spaces. The results are mostly based on assumptions, professional experience and political guidelines. There is a lack in before-and-after evaluations, e.g. "Does one sharing car really compensate x private car parking spaces"? To get more of such data it could be a good idea to make it mandatory for an investor to provide empirical date with scientific studies after the object is finished and in operation.

References

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[8] https://carsharing.de/sites/default/files/uploads/bcs_factsheet_3.pdf) / https://www.umweltbundesamt.de/umwelttipps-fuer-den-alltag/mobilitaet/carsharing#hintergrund

[9] An example in the city of Darmstadt, Germany, can be find here: https://www.lincoln-darmstadt.de/mobilitaetskonzept/

[10] https://veomo.com/mobilitaetsmonitor

[11] https://www.fahrradfreundlicher-arbeitgeber.de/

[12] Stellplatzsatzung der Stadt Frankfurt am Main, 2020.