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Bicycle parking for office buildings in Frankfurt Main/ Germany

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Abstract

Until the end of 20th century new big office buildings in Germany – even in the central business district CBD – didn't provide any or much too less facilities for bicycle parking. Since then the already existing state and municipal regulations have been enforced and new ones exist which define the mandatory number of bicycle parking lots for new office buildings. But now it can be seen that too many lots are required, the real demand is in many cases – and will be in the foreseeable future – much lower. With data from EU and German sources the situation in the Frankfurt am Main CBD is described: political goals for sustainable traffic by enforcing bicycle usage; municipal regulations for the number of bicycle parking facilities; comparison between (politically defined) requirements and the expected real demand. Today's and future modal-split data for bike usage at office buildings from empirical traffic surveys and assumptions in Frankfurt are presented. Examples of bicycle parking facilities for already existing and planned office buildings in Frankfurt are provided, showing as result a compromise between city's regulation and the expected demand for bicycle lots.

Keywords: *bicycle traffic, parking facilities, urban traffic, modal choice, trip generation*

1 Introduction

The Central Business District of Frankfurt am Main is situated just in the inner circle of the ancient merchant town (Fig. 1), dating back till the year 794. Because of many banks and skyscrapers there; Frankfurt is sometimes also called "Bankfurt" or "Mainhattan". Frankfurt municipality has approximately 745.000 inhabitants (2018, it is expected to be 810.000 in 2030) and 700.000 employees (2018), the wider metropolitan region (radius 30 km) has about 3 million inhabitants. Due to the very high number of workplaces in Frankfurt and their concentration in the inner city, there is a very high number of commuters entering the city every day

(375.000). Only about 1/3 of employees are living in Frankfurt, which is much less than in other towns in the Rhein-Main metropolitan area (e.g. Wiesbaden and Darmstadt over 50 %). As the goals of reducing CO₂ force the municipalities everywhere to reduce car-traffic, it is necessary to get as much commuters as possible to use bikes and feet on their way to and from work. The official goal for "2030+" therefore is to be a "City of short distances" with higher percentage of bike and pedestrian traffic [1]. To enforce bike use it is therefore necessary to provide a sufficient – but not overcalculated – number and a good quality of bicycle parking lots for commuters at or near their workplace. As this article concentrates on office bicycle parking in the CBD, the other necessary provisions to improve bike traffic are not discussed (e.g. bike lanes, signalization ...).

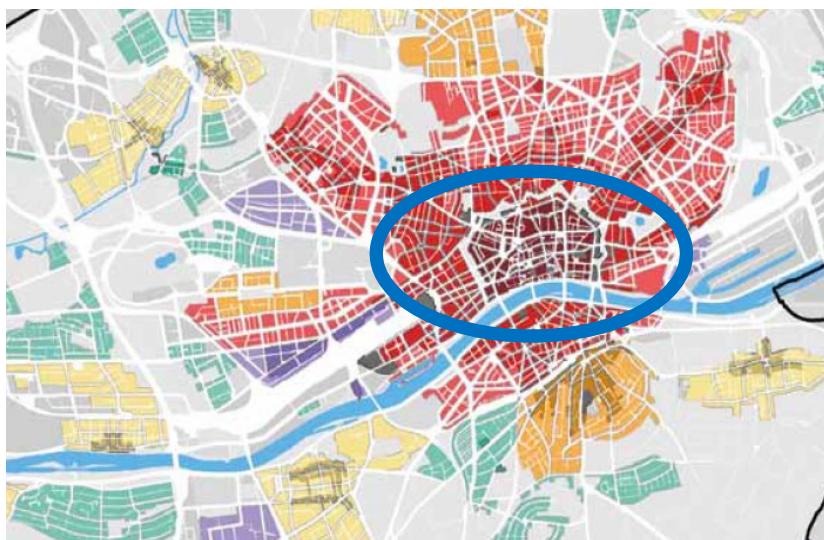


Figure 1. Inner City of Frankfurt Main and CBD [2]

2 Regulations for the number of bicycle parking lots at office buildings

The following does not mention lots of available recommendations made by NGOs or bicycle clubs but – with the exception source [4] in chapter 2.1 – only "official" recommendations, guidelines or legal requirements.

2.1 Regulations on EU level

There could be found only one EU-paper which mentions the recommended number for bicycle parking at office-buildings [3], based on Swiss recommendations: 1 bicycle lot per 5 employees.

A compendium of regulations in certain European countries as drawn in Table 1 [4] shows a wide range for the required number of bicycle parking stands at office buildings and differs greatly regarding the referred basic, e.g. number of employees or office space (assumed: m² GFA).

Land/ City	1 bike lot/ ... m ² GFA	Other regulation 1 bike per ...
Bulgaria, Hungary, Croatia	100	
London	90 (long stay, inner city)	
Malmö / S	55	
Copenhagen	25	
France		1,5 % GFA or 15 % of empl.
Styria/ A		20 employees

Table 1. Some regulations in the EU [4]

2.2 Regulations in the Federal Republic of Germany

On federal level there are no mandatory regulations but recommendations from the German FGSV [5]:

0,3 bicycle lots per 1 employee (= 1 lot per 3,3 employees).

On state level (16 states) for most of the states there are no state-wide regulations regarding the required or mandatory number of bicycle lots at office buildings [6]. Instead the state laws empower the municipalities to define such regulations.

2.3 Regulations in German cities

There is a wide range, mostly based on the useful floor space [m²] [7]:

1 bicycle lot per 40 m² ... 100 m² useful floor space.

The city of Frankfurt Main followed those numbers till 2016, which in most cases led to 1 bicycle lot per 80 m² useful floor space. The new regulations since 2016/2020 [8] defines the mandatory number of bicycle parking lots at office buildings based on the Gross Floor Area (GFA) [m²]:

1 bicycle lot per 125 m² GFA

The GFA is usually much easier to define in an early phase of planning as the useful floor area. Most of the city regulations allow to reduce or increase the resulting number if it can be shown by a traffic expertise that the really required number (demand) for such lots differs from the regulation. With the typical space of approximately 30 m² GFA per office employee in the CBD, the rule of 1 bicycle lot per 125 m² GFA would mean that about ¼ of all employees would need a bicycle parking lot, i.e. the bicycle mode choice would be 25 %. Hence today's and future bicycle mode choice have to be realistically assessed.

3 Bicycle parking at office buildings in Frankfurt Main

3.1 Bicycle mode choice of employees

To calculate the demand for bicycle parking at an office building in the inner city / CBD of Frankfurt the mode choice of the employees has to be assessed: What percentage of employees on a workday will use their own bike as mode of transport with trip end / begin at the office? Rent-a-bike trips are not included, because rental bikes usually do not have parking lots on the building's property.

While there is usually data available regarding the mode choice of a city's resident population, there is only a very limited number of data available which tells about the mode choice of employees, a great number of whom are commuters and are therefore not included in the data for the resident population. In very bike-friendly cities, like in the Netherlands, usually around 25 % of all employee-trips are done with the bicycle as the main mode of transport with an additional percentage of commuters combining public transport and bicycle [9].

The bicycle mode choice for Frankfurt resident population on a workday has risen from 6 % in 1998 to 13 % of all trips in 2013 while the private car mode choice decreased from 40 % to 35 % 2013. Of trips up to 1 km 12 % were done by bikes; trips 1 to 3 km were 27 % bikes; 3 to 5 km were 12 % bikes; 5 to 10 km were 9 % bikes, over 10 km only 1 % were bike trips (all figures: last available data 2013 [11]). As mentioned in Section 1 only about 1/3 of employees are living in Frankfurt. The main residential areas are between 3 and 5 km distant from the CBD therefore one can assess a current bicycle mode choice of 12 % for trips to and from the city center.

As there is no "official" published data available for the mode choice of employees in the city of Frankfurt, especially employees in office buildings, some data has been collected during the last 10 years in the framework of student's diploma thesis for the office skyscrapers shown in Fig. 2. The results regarding the percentage of bicycle as the main mode of transport for employees are shown in Table 2.

Table 2. Empirical data for employees in Frankfurt office buildings using bicycle as mode of transport to come/ go to work

Building	Number in Fig. 2	Bicycle as mode of choice [% of all trips from/ to work]	Median trip distance [km] or origin	Year of survey	Source [-]
Kastor	1	7 %	--	2009	12
Skyper	2	7 %	--	2009	12
Taunusturm	3	6 %	88 % loc	2016	13
Opernturm	4	6 %	--	2016	14
Junghofstrasse	5	6 %	3,0	2016	14



Figure 2. Skyscrapers No. 1 ... 5 referred to in Table 2 and construction site of skyscraper „Omniturm“ No. 6 (picture source [15])

3.2 Demand of bicycle parking at skyscraper “Taunusturm”

The office skyscraper “Taunusturm” is shown in Fig. 2 as No. 3. It has been finished in 2014. The Gross Floor Area GFA for the offices is appr. 81.000 m².

At the time of the construction permit (2010) the number of mandatory parking lots for this office building had to be calculated with the ratio of 1 bicycle lot per 80 m²

useful floor space (see above Section 2.3). With the new regulations since 2016 the ratio is 1 bicycle lot per 125 m² GFA:

81.000 m² GFA/ 125 m² per lot =~ 650 bicycle lots required, which is occasionally the same result as with the former regulation due to the ratio GFA/ useful floor sp.

To get a permit to build much less bicycle lots than the figure following the city's regulation, a traffic expertise had to be done. In short the calculation is:

Estimated number of employees * daily attendance rate * trip per day * percentage of bike usage / turn around rate of one bike lot = demand number of bicycle lots

In this example it leads to the following result:

Estimated number of employees: 3,5 empl./ 100 m² GFA

3,5 empl./100 m² * 81.000 m² /100 =~ 2.800 employees

Attendance rate: 0,8 at a workday; trips: 1,1 daily trips per direction

Mode choice for bicycle: today 6 %, estimated in future 10 %, considering that only 1/3 of employees come from Frankfurt, a lot of them using public transport, rent a bike or feet.

Turn around rate: 1,1 daily per lot

2.800 * 0,8 * 1,1 * 0,1 / 1,1 =~ 225 bicycle lots as future demand.

As a compromise between the figure resulting from the city's regulation and the expected demand some 300 bicycle lots for the office employees have been **built** in the underground levels of the building (Fig. 3), still leaving space for future increased demand. A traffic survey [7] done on a workday in June 2016 has counted 92 occupied office bicycle stands (occupancy rate ~23 % of the ~300 lots). The access to the garage level is made easy for bicycles by providing a 1,20 m wide walkway along the garage ramp, thus users who do not want to use the ramp can push the bike up along.



Figure 3. Bicycle parking in underground Garage "Taunusturm" [7]

3.3 Demand of bicycle parking skyscraper “Omniturm”

The multi-purpose skyscraper “Omniturm” is shown in Fig. 2 as No. 6. It has been finished in 2019. The Gross Floor Area GFA for the offices is appr. 51.000 m².

At the time of the construction permit (2016) the number of mandatory parking lots for this office building had to be calculated with the ratio of 1 bicycle lot per 125 m² GFA, following the new regulation (see above Section 2.3).

$$51.000 \text{ m}^2 \text{ GFA} / 125 \text{ m}^2 \text{ per lot} = \sim 410 \text{ bicycle lots required}$$

To get a permit to build much less bicycle lots than the figure following the city's regulation, again a traffic expertise had to be done. Following the same calculation as with “Taunusturm”, but with some other assumptions, the result was:

Estimated number of employees: 3,0 empl./ 100 m² GFA

$$3,0 \text{ empl./100 m}^2 * 51.000 \text{ m}^2 /100 = \sim 1.530 \text{ employees}$$

Attendance rate: 0,8 at a workday; trips: 1,1 daily trips per direction

Mode choice for bicycle: today 6 %, estimated in future 10 %, same as Taunusturm

Turn around rate: 1,1 daily per lot

$$1.530 * 0,8 * 1,1 * 0,1 / 1,1 = \sim 125 \text{ bicycle lots as future demand.}$$

As a compromise between the figure resulting from the city's regulation and the expected demand and to have additional space for increasing future demand, some 180 bicycle lots are provided on the underground levels of the building. The access to and from the garage levels is made easy for bicycles by a direct and wide walkway from street level to a big elevator, leading to the garage levels (Fig. 4).

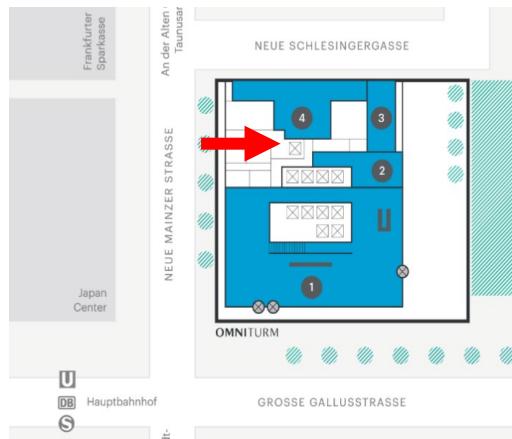


Figure 4. Ground floor plan with bicycle access to elevator (picture [15])

4 Conclusion

The number of employees working in an office building in the CBD using a bike and thus demanding a parking lot can vary widely depending on density (employees per 100 m² GFA), kind of office work, mode choice ... The overall regulations (e.g. in Frankfurt 1 bicycle lot per 125 m² GFA) can only give a rough estimation and therefore have to be adapted to the local situation.

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