Cycling Parking Facility Model

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Summary

In bicycle storage study we have tried to establish the influence of cycle storage on increase of cyclists in modal split. In order to establish the effect of cycle storage, detailed treatment of research area is required. Research study was based on practical and theoretical methods, including new method of finding and analysing with the help of GIS tools and new technologies of research surveys. Study also presents possibilities of Internet or e-mail surveys research. It includes compact method of analysis of existing state and determination as well as error abolishment and monitoring of our study case, which was analysed during one year period, partially proofed and compared to a new found situation in a following year. Our goal was to present a new approach to solving a problem of cycle storage facilities in urban areas as shown in our research of city centre of Slovenian capital. By showing the treatment of macro and micro city centre area we have proven assumption of traffic (cycling) infrastructure's influence on percentage of cyclists in modal split. Based on the theoretical research study we have estimated the amount of increase in cycling traffic that could be expected in the research area in case of partial or total improvement of conditions at cycle storage facilities.

1. Factors contributing to increase in the number of cyclists

COHERENCE, DIRECTNESS, ATTRACTIVENESS, SAFETY, COMFORT.

In five factors system, which directly influence the increase in the number of cyclists, cycle storage is absent.

Storage?

Our thesis adds the importance of cycle storage and its direct influence on the increase of number of cyclists.

2. Cycling in Ljubljana, the capital of Slovenia

All the research has been done on the model of cycling study of Ljubljana, being presented in summary.

2.1 Presentation of basic facts

Size of the city centre:	0,94 km2
Geographic configuration:	flat
Number of inhabitants:	290.000
Number of cycle ownership:	172.500 or 595 cycle/1000 inhabitants
Number of car ownership:	156.000 or 540 cars/1000 inhabitants
Cycle lanes and paths:	76.5km, 328.00km to be constructed
Regulations:	Cycle storage regulation is not available

Transport Mode	%
Walking	26.34
Cycling	10.26
Motorcycle	0.68
Car-driver	32.64
Car- passenger	8.92
Public transport	21.16

Table1: Modal split inside the city

Figure 2.1: Ljubljana cycle network (existing and planned)

3 Cycle storage facilities in Ljubljana

We have decided against researching cycle storage facilities in our city on the same basis as better cycling developed cities (i.e. Amsterdam); there they are trying to improve the quality of public areas with better infrastructure (for cycle storage). We have decided to pursue this study to attract a greater number of bicycles to the public areas. In this “beginners phase” we have an opportunity to avoid the problem of having too many stored bicycles on public areas (pedestrian pavements), that could present obstruction to the other traffic participants. It is very important to be able to consider findings of better cycling developed cities when choosing right cycle racks. About 60 % of Ljubljana’ s population own bicycles, however only 10 % use them regularly. Is one of the reasons lack of storage facilities?

3.1 Main requirements for cycle storage facilities

Main requirements for cycle storage facilities can be summarised in following five points:

- COHERENCE
  - Finability
  - Consistency in quality
- DIRECTNESS
  - Detours
  - Delay
- ATTRACTIVENESS
  - Social Safety
- SAFETY
  - Subjective Safety
  - Complexity of riding

- COMFORT.
  - Weather impediment
  - Traffic impediment

3.2 Research of macro area of cycle storage facilities

3.2.1 Determination of an area

The determination of study area is decided on basis of requirement for area arrangement. Research area size is not limited.

In our case we have chosen the strict centre of Ljubljana. The area includes practically all major traffic generators and different activities (business, residential, culture, education,…)

It also includes a bus station, a train station, a large number of government and City buildings, a market place, 3 faculties, 6 high schools, a number of cultural objects of state importance: Cankarjev dom, National Museum, National Gallery, 4 cinemas, a courthouse, state parliament, 3 theatres, television studio (RTV), 6 hotels, business facilities and shops. Concentration of all this activities in city centre attracts 63% of all city travels, regular (workers, students, pupils,…) as well as periodic (moviegoers, shoppers, visitors of administrative buildings, tourists, etc.).

In a relatively small area we have a large number of different interests for frequenting city centre, which make the biggest need for cycle storage. Therefore, we can truly talk of representative sample for the analysis of cycle storage facilities in Ljubljana.

Figure 3.1 Research area

3.2.2 Area analysis

Before we proceed to the detailed study, we need to collect additional facts about the area itself. They are: existing cycling network, location of cycling stores, location of repair shops, location of Park and Ride facilities, number of day trips in the area itself and in the area of research.

3.2.3 Determining location and the number of cycle storages

The location and the number of existing cycle storages can be determined using theoretical and practical methods. In the following passages we will concentrate only on practical methods, since our research was fully based on them. They yield more realistic and comparable results of the existing state.

3.2.4 Analysis of macro research area and evaluation of survey results

When counting we use the newest cycling map, which should have marked bicycle-stands and other cycle storages. There is no such map for Ljubljana, so we were forced to find those locations in the field.

From local authorities we gather basic facts (location, storage capacity, etc.)

From legal entities in the research area, we have to obtain information about internal cycle storages or “secret spots” where bicycles are stored.

Our visit should be announced at least a day before the actual counting takes place, to give time to the super to arrange an access to these storages, so we can count bicycles stored there as well.

Regarding objects in the research area, whose owners are persons (apartment buildings) it is better to inform the manager of the building, who could provide additional information.

Using visual counting we can directly asses needed locations and number of cycle storages. The best season for counting includes the months of May, June and 1st half of July or September. The counting should take place at different time intervals. The most convenient time are working days from 12:00 to 15:00. All the used and available cycle storage capacities as well as total number of bicycles stored outside the designated storage areas should be counted. Locations with at least 3 bicycles should be included in the analysis. Every location where people live, where social, cultural and other activities take place, should be bicycle accessible. It should be connected directly to the next point in ideal cycling network. Therefore, adequate number of cycle storage capacities should theoretically be provided on every place of origin or/and destination. The number of storages should reflect the number of cyclists as determined on the basis of theoretical models.

3.2.4.1 Basic parameters, determined at the research area:

- Determining locations

Locations were determined based on research methods, namely house to house surveys, roadside surveys and visual counting.

- Storage mode

On this level of research determining the storage mode is demanding. At every larger cycle storage, additional research with longer observation (measuring cycle storage time) should be done. There we could place computer camera at neighbouring buildings, from where the action could be simultaneously observed on multiple locations, which is made possible by computer camera system via Internet. It is necessary to take 5-6 photos per hour.

- Capacity

Capacity is easily determined with visual counting or counting of individual racks. When counting, a map should be used, to enter a number of counted racks in the proper location. It is important to count all the stored bicycles in addition to capacity, separately stored in racks or outside racks.

- Types of cycle racks

When counting we should also differentiate between different types of racks, which will be used for analysing existing cycle storages. In our case 2 types of racks appeared, which were purchased and placed by the City without any expert foundation or instruction, which is due to the lack of any legal regulation in this area.

Figure 3.2 Common metal bicycle rack

Figure 3.3 Common concrete bicycle rack

- Placement and distancing of racks

It is necessary to evidence differences between rack placements, distances among them and distances from the neighbouring traffic areas.

One of the GIS tools should be used in research, since it is the only way to process data for exactly defined location. Individual locations are applied to city maps (preferably cycling maps), where all the measured attributes are added, as well as photos of the cycle storage location. When the data is prepared, GIS tools are used to obtain analysis, which can give us basic characteristics of individual cycle storage (occupation, rack types, capacity, storage mode in relation to location, etc.).

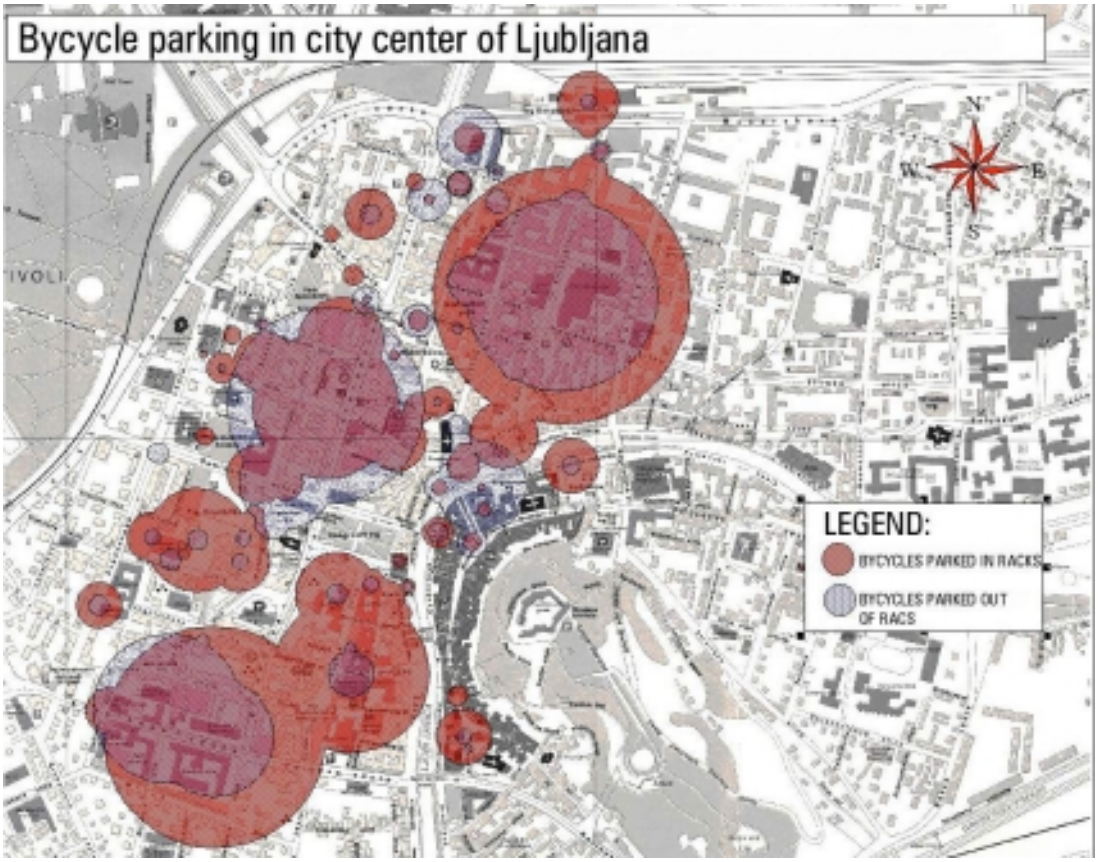


Figure 3.4 Presentation of data analysis using GIS tools

It is meaningful and useful to a city to establish a cycle storage manager (to give out concession), when getting the first GIS analysis, with intent to improve it with future GIS analysis.

3.2.4.2 Surveys

House to house survey

For additional information about travel habits and views about cycle storage we conduct surveys. Survey results can give us information about travel requirements.

- Divide research area into smaller regions with wider influence areas; in our case we examined city centre, which served as a region, influence areas were represented by 4 administrative areas, that surround city centre in 10 km radius.

- Number of surveys is determined with subjective evaluation and divided to different regions and influence areas; in our case we distributed 200 surveys to legal entities in research area and 200 surveys to persons in the same area, as well as 100 surveys in each of 4 administrative areas.

- The easiest way is to send surveys to randomly chosen addressees by mail. Random addresses can be obtained from on-line phone books. Return envelopes with pre-paid postage are also included with the survey.

- In order to obtain the maximum number of answered surveys we can organise a competition handing out prizes. We should take in to the account the state legislation that prescribes distinction between competitions and lottery (in Slovenia: Competition Protection Law).

Roadside surveys

In the research area we can carry out a survey among the cyclists with the help of voluntary cycle societies and organisations. In our case we have distributed surveys by inserting them in envelopes and leaving them on bicycles in the research area (120 surveys), where the amount of stored bicycles (including wrongly stored) was the largest. Each envelope should be carefully marked, not to be mistaken with advertisements and thrown away.

Internet surveys

In surveying we used so called electronic surveys, which are incorporated into a web site. These surveys were the same as the ones sent in envelopes. Randomly chosen e-mail addresses were sent an e-mail with explaining text, which included link to web sites with our survey. It is important to urge addressees to forward our e-mail to their friends, business associates et al., living in our influence area. With intent to increase the number of visitors to our web site, we should advertise our survey on local search engines.

Advantage of electronic surveys is, that results are directly entered into a database which is then easily processed using different programs (i.e. Microsoft Access).

Within two weeks we have received 209 surveys (22,7%) by post and 483 surveys by Internet. 28,7% of non cyclist would use bicycle to reach the city center if they have secured bicycle storage. In our research we have helped us with Data Base programs such as Microsoft Access and Excell.

3.3 Findings and improvement suggestions

On this level of processing we can add basic instructions for:

- new cycle storage location,

- determining the storage mode (long-term, short-term),

- number of racks; only for evaluation of investment, for more precise data micro processing is needed (chapter 4)

- types of cycle racks; it is important to present suitable type of racks to the local authorities (if we are dealing with an enclosed city area it is recommended to invite urban planners and street designers as well)

- placement of racks; present basic suggestions and point out critical points.

Visual counting was done on 01/06/1999 by counting all the cycle racks, bicycles and occupation of individual racks.

In research area there is a lack of 460 cycle racks for daily storage use. Our suggestion is to increase the existing capacity by 40%, that is 627 cycle racks. Suggested number is bigger than needed by approx. 35%, taking into account the increase of number of cyclists with better storage facilities. After a month, another analysis should be conducted in order to correct the number of storage places. Due to the fact that cycle storage is very poorly connected to the existing cycling network, we should anticipate that the number of cyclists will increase with construction of new cycle-tracks. According to the data of travel characteristics research (PNZ-1994) Ljubljana has approx. 10% of different cycle travels. If our goal is to increase the cycle travel to 20-30% by constructing new cycling network (City Studio-1999; Long term plan for regulating system and cycling network in city of Ljubljana), we would still have to deal with cycle storage in city area in order to succeed.

A small number-about 50%-of cycle racks are occupied, despite their shortage. Stored bicycles are mostly found in places where racks are found, so we can conclude that existing cycle racks are inappropriate, and therefore cyclists tend to avoid them. It confirms the fact that the racks, which only support cycle wheel and do not enable locking of the wheel and frame to the rack, are not user friendly. In the whole research area existing cycle racks should be replaced with new

ones. We recommend double-sided basic racks. In places where street design allows, we suggest the use of more sophisticated cycle racks. With detailed analysis and surveying, as shown in the next chapter, we can assess a very accurate number, type and location of needed cycle storages.

4. Research of micro area of cycle storage facilities

Following macro analysis of the area, when basic requirements of cycle storage facilities are assessed, a micro analysis of specified generator from the area can be done. With detailed research we determine:

- placement,
- capacity,
- storage mode,
- type of racks.

The following mode can be applied to analyse and reconstruct cycle storages for any individual object or smaller group of objects, disregarding the macro research, since micro research practically consists of solutions to cycle storage problems, as described in existing literature.

After we have decided on a particular object (apartment building, school, business offices,…) we have to gather more information, which is easily obtained from the building manager. Basic facts needed for analysis are object gross surface, number of occupants (regular users), number of visitors, connection to the cycling network.

Analysis of micro area is conducted in the following way:

Determining location and number of cycle storages

Conduct visual counting as in macro area. Existing storage should be checked according to 5 requirements for cycle storage facilities. Time of counting is chosen as in macro research: from 12:00 to 15:00. We process the neighbouring location of buildings and storages (in radius up to 250 m), if we believe that neighbouring locations influence our location and if we had not conducted macro analysis in the area. Since we are processing only one object we have more time for analysis and observation, therefore getting better results. The counting is repeated in 10-20 days during the same time and similar conditions.

Survey

A survey should include at least 10% of regular users and visitors (periodical users). Survey is conducted personally or by e-mail involving randomly chosen participants. It is important to concentrate on the explaining text, where the purpose of survey should be stated. Conscientiousness of participants answering is achieved by informing them about public presentation. With survey we collect basic facts about modal split, cycle ownership, view of the existing state, and at this stage we can evaluate the possibility for cycle storage improvement.

Evaluating results

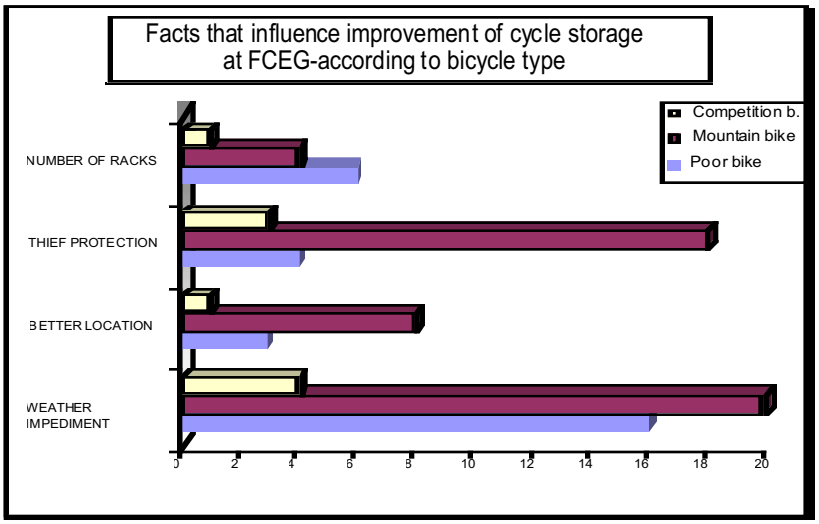
Planning table for calculating the number of storage facilities for cyclists is in most cases inadequate for precise determination of cycle storages, therefore additional research in form of surveys is needed for individual objects at specific location. The best results are achieved by surveying all the employees, occupants… who inhabit or are visiting particular building. Good results can be also obtained by using sample case of 15-20%.

4.1 Case of micro area analysis

On 01/06/1999 we counted and observed the cycle storage of Faculty of Civil Engineering and Geodesy. At the faculty, opposite the main entrance, on asphalt surface are few concrete cycle racks, which are used for cycle storage. The total number of racks was 21. None of which were fastened. At the northern entrance there is no cycle storage (no racks), although on the day of counting 8 bicycles were present. Total number of stored bicycles was 56.

On 06/10/1999 we conducted a survey among randomly chosen faculty students. 79 students were surveyed, which amounts to approx. 18% of all students or 14% of all (students+employees).

The purpose of survey is to determine the actual number of bicycle users, to determine the main problems of cycle storage and to determine the future number of cyclists if cycle storage problems were solved.



Graph 4.1 Facts that influence improvement of cycle storage at FCEG-according to bicycle type

Figure 4.1 Stored bicycles 01/06/1999

Figure 4.2 Stored bicycles 18/04/2000

- *Findings and improvement suggestions*

We suggested placing 86 cycle racks, which should accommodate then present need, if we presume that approx. 15% of all employed or students would cycle. During that time the number consisted of 12,5% according to counting, 9,1% regular cyclists and 13,6% periodical according to surveys. Presuming, that with the new storage a number of cyclists would consist of 9,1% regular cyclists + 40% periodical cyclist + 0,5% of those who never use bicycles, a total number would be 15% or 86 racks. 101 racks were placed.

- *Monitoring*

After 11 months we conducted monitoring of the treated cycle storage, where by visual counting we counted 72 stored bicycles, almost all in racks. The number of stored bicycles has increased in comparison to a previous year by 30%. Since there was no intervention in the existing cycle infrastructure in the area, with the exception of cycle storage improvements, we can conclude, that the increase in number of stored bicycles can be attributed to this improvement.

5. Research results and measures for improving existing conditions

In countries saturated with motor traffic, bigger consideration will have to be given to cycle storage, to assure basic and strategical goals of national cycling and environmental programs. Basic goals of national programs include encouragement of cycling interest and increase of cycling potential with appropriate assurance of better safety requirements and basic cycling infrastructure. Cycling storage should be included, under basic cycling infrastructure. Construction of cycling network (in Slovenia 2000 km in 25 years) will not be able to sufficiently increase cycling potential, if the infrastructure at the place of origin and/or destination is not adequately taken care of. Again, we are at the basic premise stating that a bicycle spends 96% of its lifetime in storage, which puts importance on cycle storage.

Basic principles for improving the state of cycle storage are:

-->change of traffic policies

-->setting up cycling network

-->planning cycle storages in urban documents

-->determining cycle storage location

-->determining the number of racks

-->choosing storage mode

-->choosing appropriate rack mode

-->appropriate placement and marking of racks

-->appropriate informing by inclusion of cycle storages in basic tourist and cycling maps

-->monitoring and correction of state.

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