1. INTRODUCTION

The City of Vienna is in constant pursuit of increasing its cycle-route network through the bridging of gaps. The Spittelau area is located in the northern part of Vienna, lying at a corner where the 9th, 19th and 20th districts meet, right next to the Danube canal. It has long been dominated by transport and its facilities, such as the Franz-Josefs railway, the federal roads No. B221 (Gürtel) and B227 (Donaukanallände), major Vienna roads and the two U4 and U6 underground lines with the interchange station of Spittelau, meet there. Additionally, large-scale buildings like a municipal waste incineration plant, the municipal transport administration and police building and the University of Business Administration are located there. The 19th district to the north is a predominantly residential area for a higher income population, whereas the 9th (to the south) and the 20th (to the east, the opposite bank of the Danube canal) districts are mixed use ones.

From the beginning of Vienna’s public transport – the old “Stadtbahn” – there were two viaduct structures made of brick, which are now, due to a different routing of the underground lines, out of use. But due to their status as listed and protected monuments and the resulting obligation of conservation, they have to be maintained. Due to these various mechanized transport structures and the topographical features – beginning with a slope from the Danube basin to the Vienna woods – the conditions for cyclists and pedestrians are bad, as the barriers and obstructions are numerous. The City of Vienna has therefore started to build a “Skywalk” for pedestrian and bicycle use, which is going to bridge the gap of niveau differences and the heavily loaded Gürtel road between the 19th district and the Spittelau underground stop. One of two historic brick structures – the other one being included in an office building – descends from the elevation of the Spittelau station building southwards to the shore of the Danube canal – in between the right-of-way of the U4 underground line and a cycle path that runs along the canal shore.
The municipality thought about redesignating this unused brick ramp as a high-quality bicycle path – a "cycling highway" – for providing a safe and convenient bicycle connection from the 19th district south-eastwards and vice versa. The task in the present project was to estimate the number of potential future users of this new cycling highway.

2. SURVEY

The survey was split into three different parts. The first one was a census of cyclists to gather the order of magnitude of the cyclists concerned. This census was carried out at twelve spots on the existing bicycle route which runs somewhat parallel to the proposed one and the cycle route along the canal.

The second part involved interviews with cyclists at the census points. They were asked for the significant data about the origin and destination of the trip, its purpose (e.g., commute to work, school, sports activities, etc.) and if the new link would increase the attractiveness of their trip for them and if they would use the new path.

Both parts took of the survey place on a Thursday and Sunday at the beginning of October with very suitable weather conditions for cycling – i.e., sunny skies, mild temperatures and a light wind.

The third part was the gathering of objective data of bicycle path features like width, length of sections, inclination, coating material and condition, delays at intersections and the type of use on both sides of the cycling infrastructure.

The data gathered – a questionnaire sample of 1285 interviews – was analysed and used for the estimation.

3. ESTIMATION OF USE

Because an estimation of the potential user numbers should not be based on only one method alone, the survey was designed to acquire data which could be used for multiple methods. In order to providing a foundation for a stable estimation, the following five methodical approaches were used:

- In the interview, two questions regarding the usefulness of the new supply structure and if the cyclists would use the new route were asked. The results of these two questions were taken as the first indicators of potential usage. (see Fig. 2)
- A special reduced O-D-matrix was derived from the complete questionnaire data, where the addresses of the trip origin and destination, were asked. This special O-D-matrix included the geographically relevant districts and their connections in regard to the new cycling path – the cycling highway has a distinct north-west to south-east orientation. All the other relations were ignored. In order to provide another base number for the estimation, the numbers of cyclists on these relations were summed up.
- The questionnaire included a map of the survey area and its surroundings, where the interviewees were asked to mark their route through the area. The huge number of often significantly different routes through the area were classified into 17 generalized routes. This means that the core routes are single lined, but have a rather wide area of straying at the outside, (see Fig. 3). For the routes, that the new cycling highway could prove of value due to the coinciding direction, the numbers of cyclists were added.
From the collection of quality parameters of the existing and future routes, an estimation of the potential re-assignment by a comparison of the changing in attractiveness was carried out. The parameters were width, material, state of paving, length and inclination, the velocity of car speed to the left and/or right and the intersections. The width of the cycle paths and their attractiveness was elaborated on in [2], where a 0 to 100 percent (points) attractiveness scale was used. Therefore, for all other parameters, a scale of 100 points for the best conditions was also chosen, e.g., as in [3] for a combination of length versus the inclination. The lower the quality value, the lower the attractiveness for cyclists. In the case of intersections, as when a path with the least amount of possible hindrances would be valued highly, traffic signs like yield or waiting times in front of traffic lights were given a negative number of points. In that case the higher the quality value the stronger the “hindrance”. For both routes the comparative quality values then were calculated (see Fig. 4) and the number of cyclists counted was distributed accordingly (see Fig. 5).

\[
Q_{\text{route}} = \sum_{j=1}^{n} q_j \cdot \frac{f_j}{l_{\text{route}}} \quad \text{with} \quad Q_j = \sum_{i=1}^{n} q_{ij} \cdot g_i \quad \text{[-]}
\]

and

\[
l_{\text{route}} = \sum_{j=1}^{n} l_j \quad \text{[m]}
\]

Fig. 4 The algorithm for comparing the quality of the cycle route, with weighting factors \( g \) and parameters \( q_i = \text{l} - n \); sections \( j = 1 - k \). Source [4].

From the questionnaire data the distribution of the trip lengths was calculated and differentiated according to the point of measurement and the trip’s purpose – in order to get a grip on the data’s representativeness, since the leisure trips tend to elongate the distribution of the whole sample (see Fig. 6 and 7).

As the survey was carried out at the beginning of October, the timelines of the nearby permanent automatic cyclist census point (on the Donau canal cycle path) were used, to derive the numbers for summer. Here, the factors defining the minimum and maximum numbers of the summer months of May to September were put into relation with the numbers of October for the years 2003 until 2005.

Fig. 6 Trips by trip purposes on both days, weekday and weekend. Source: [4].

Fig. 5 Cycle traffic load on workdays on the cycling highway. Source: [4].
for weekdays and weekend days. The "point of time factors" for reducing the summer peak numbers from the October values were calculated as the average of those three years (see Fig. 8). As a result, each of the five methods delivered a numerical value for Thursday and Friday. By using the "point of time factors" a maximum and minimum value for both days was calculated for each of the five methods (see Fig. 9). From this table the result of the basic load of 400 to 600 daily cyclists in the summertime was derived.

4. CONCLUSIONS

The task was to make a rough estimation of the bicycle rides to be expected if the unused previous "Stadtbahn" ramp is to be adapted for bicycle and pedestrian use. This was done by a small-scale survey and census and different methods of analyzing the resulting data. No comprehensive survey including all other transport modes on a wider scale has been performed, no profound conclusions for generated cycle traffic and shifts from other modes could be made. It would be advisable to carry out a follow-up examination some time, e.g., in two to three years, after the completion of the cycling highway, so that the results of this examination can be verified and the methodology for bicycle forecasting can be refined for future cycle infrastructure planning, as the bicycle will play a significant role in the future to implement sustainable transport regimes in cities.

<table>
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<tr>
<th>factors of time</th>
<th>1. Q of attractiveness</th>
<th>2. Q of usefulness</th>
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<tbody>
<tr>
<td></td>
<td>min</td>
<td>max</td>
</tr>
<tr>
<td>Thursday</td>
<td>1,87</td>
<td>2,3</td>
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<td>Sunday</td>
<td>2,65</td>
<td>3,06</td>
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<th>3. O-D-graph</th>
<th>4. relevant routes</th>
<th>5. traffic reassignment</th>
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<tbody>
<tr>
<td>survey</td>
<td>min</td>
<td>max</td>
</tr>
<tr>
<td>Thursday</td>
<td>290</td>
<td>542,3</td>
</tr>
<tr>
<td>Sunday</td>
<td>192</td>
<td>508,8</td>
</tr>
</tbody>
</table>

Fig. 7 Cumulative trip length distribution by trip purpose, e.g., leisure trips longer than shopping trips. Source: [4].

Fig. 8 Timeline of cyclists on Donau canal cycling route in 2005. October and June highlighted. Source: modified form [5].

Fig. 9 Table with factors of point in time and min and max estimation results. Source: [4].
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