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Urban Design Interventions Towards a Bike Friendly City

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Abstract

This paper`s goal is to present findings of the research project titled Bikeability, funded by the Danish Research Council, concerning the investigation of how Urban Design interventions in consolidated urban areas can promote cycling – with a special focus on alterations in the urban fabric and design qualities of the streetscape.
The research focuses on a bike infrastructure with a distinct typology: Hans Broges Gade in Aarhus where a dedicated bike lane function as an extension of a bicycle route linking the suburb to Aarhus Central Station. Based on the data collected and analyzed, it was possible to identify the design qualities of the intervention and the impacts of the intervention in the travel behavior of the cyclists.
A conjugation of sources of data was used: questionnaires, interviews with key actors, visual analysis of the site, counting, etc.
The findings highlight important factors such as the relevance of fast connectivity, the aesthetic value of the streetscape and the safety for cyclists. Therefore, these three qualities are strategic dimensions of a design solution that must be taken in consideration by architects, planners and engineers.
Bridging research and policy, the findings of this research project can also support bike friendly design and planning, and cyclist advocacy.

Aarhus And Its Vision For The Future

Aarhus is the second largest Danish municipality and in 2010 it had a population of 307.119 inhabitants (Statistikbanken, 2010). The municipality is located in the east side of the peninsula named Jutland and it is part of the Central Jutland Region.
In the Municipal Plan 2009, Aarhus Municipality announced its new vision of Aarhus as an environmental and energy sustainable city. Within its vision, there is a goal to become carbon neutral by the year 2030 (Aarhus Municipality, 2009b). In order to achieve this goal, Aarhus aims to offer this scenario in the year 2030:
“Aarhus Municipality`s infrastructure offers optimal conditions for both cyclists and the public transportation. Moreover, Aarhus municipality is known internationally as a bicycle city” (Aarhus Municipality, 2009b).

According to an interview with Pablo Celis, a civil engineer at Aarhus Municipality, the Aarhus vision focuses on the concept of carbon neutral city and one of the main strategies for that is to increase of the use of bike as transportation mode.
In that context, the Aarhus Bicycle Action Plan highlights six major focus areas for development of bike infrastructures. The major one is the development of a more comprehensive and permeable bicycle network. Other focus areas are: to make road intersections more bike friendly, to improve safety conditions, to create more and better bicycle parking facilities, to optimize the combined use of cycling and public transport in order to expand the bicycle outreach and to improve dialog between cyclists and municipality (Aarhus Municipality, 2010a). All in all, the Cycling Action Plan embraces projects totaling DKK 250 million.

Aarhus` Bike Network

Aarhus Municipality has approximately 450 kilometers of bike tracks and lanes. Considering its 307.119 inhabitants (Danske Kommuner, 2009), Aarhus Municipality has 1,46 meters of bike lanes and tracks per inhabitant. In comparison to other large Danish cities, Aarhus` ratio of bike tracks and lanes per inhabitant is the double of that of Copenhagen and slightly smaller than Odense's.
Aarhus has a coherent bike network plan that is structured by seven major bike routes linking the core of the city to the suburbs (Århus Kommune, 2010).

Hans Broges Gade

Hans Broges Gade is a street, located in the Aarhus` inner city ring, which crosses a dense neighborhood. The street was constructed with a light curve which was one of the major ideas under the concept of creating a more diverse streetscape and living experience. The plan of the street thereby rejects the monotony that was part of the streetscape at that time of the construction. The area surrounding Hans Broges Gade consists mostly of residential apartments with some commercial business establishments in the ground floors of the buildings. Hans Broges Gade acts as a main traffic corridor filtering a flow of cars, cyclists and pedestrians into the core of the city. (Figure 1)
The planned effect of greater diversity becomes visible when passing through the street. The curved facade line limits the visibility, but when moving through the street new perspectives gradually open up to new experiences.
The majority of the buildings in Hans Broges Gade is four story and were erected between 1900 and 1910. Most of the buildings are designed with facade details incorporating bay windows together with corner towers and spines.


Figure 1: Bike path and sidewalk

The area is predominantly residential with some commercial buildings. The sidewalk has been divided into a space shared between bike parking, a pedestrian path, bike path and a grassed area that separates the bike path from the road where cars are parked. The street is around 430 meters long, and contains a garden square with some shops and residential apartments.
Hans Broges Gade`s bike track is a section of Holme bike corridor that connects the suburbs of Holme to the city core of Aarhus. Moreover, there is a pedestrian life from mostly local residents that use the local commerce.
The purpose of the intervention in Hans Broges Gade was to improve a bicycle route connecting southern suburbs of Holme to the center of the city. Hans Broges Gade was one of the few sections of the corridor where there were no dedicated lanes for cyclists.
The construction work of Hans Broges Gade was conducted between the 1st of December 2009 and the 15th of July 2010. Aarhus Municipality hired the engineering consultancy firm Grontmij Carl Bro to develop the project and manage the construction. The entire improvement of the Holme corridor had a budget of DKK 14 million. As part of the Holme corridor, the retrofit of Hans Broges Gade amounted to DKK 2,8 million.

The Retrofit Of Hans Broges Gade

Hans Broges Gade used to be a street with broad lanes for motorized vehicles and car parking facilities in both directions just next to the sidewalks. Before the retrofit, cyclists had to ride their bikes in the street next to the rows of parked cars together motorized vehicles; especially busses were problematic. In streches of up to 150 meters, cyclists, who parked their bikes on the sidewalk, had difficulty accessing the road because of the many parked cars.
During the field observation, several elderly residents mentioned that before the retrofit it used to be unsafe to walk on the sidewalks, because cyclists preferred to ride their bikes on them, which made it unsafe for the pedestrians.
The overall concept of the intervention promotes a new hierarchy of flows where pedestrians and cyclists are the priority and have higher passability in comparison to motorized vehicles.
In order to create space to implement bike tracks in both directions of the street, one of the car parking rows was removed.

Moreover, the cars need to go up to the level of the cyclist to cross the cyclist path. As the cyclist has priority when crossing the road, the car must give way to the incoming flow of cyclists and pedestrians.
The flow of cyclists and pedestrians in Han Broges Gade is going in both directions on either side of the road. Looking south down the streetscape, the sidewalk is divided into three spaces. Beginning from the building across there is a space for bike parking and shop signs. The pedestrian path lies directly next to the bike path divided by a small drainage gutter. The grass area separates cyclists from the parked cars and the street. On the opposite side of the street, there is no car parking and no grass area separating the cars from the cyclists (Figure 2 and Figure 3).
In the morning the flow of traffic is quite busy as people are heading into the city for work or school. Cyclists are very eager to get to their destinations and understand how to navigate the bike path with other cyclists and oncoming pedestrians in the sidewalk next to them. The pedestrians walking on the sidewalk do not disturb the flow of cyclists and vice versa.
Respondents were asked if there were issues with boundaries of bicycle paths, sidewalks and lanes. A little over half of the respondents (51%) said it was not a problem. Thirty-three percent stated that is was a bit of a problem, 9% claimed it was problematic, 3% said it was quite a problem and 2% responded that it was a major problem. 2% gave no answer on whether passing space was an issue. This range shows that sidewalks can be a confusing space, and that almost half of the respondent saw it as problematic.

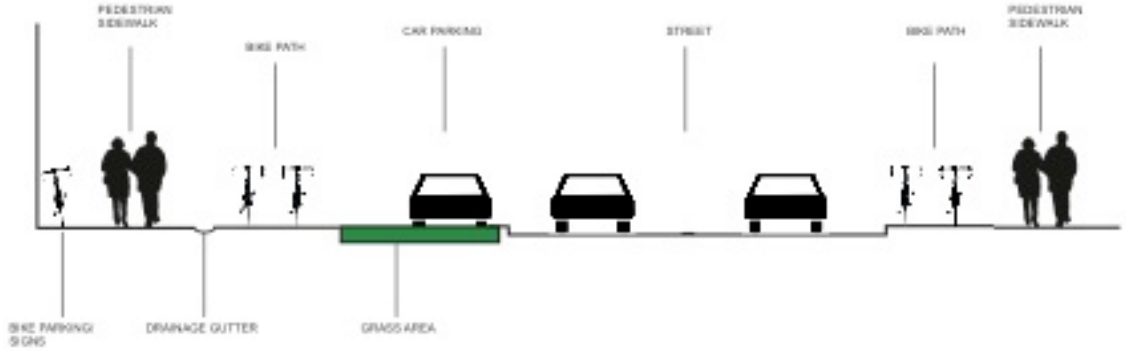

Figure 2: Hans Broges Gade`s section

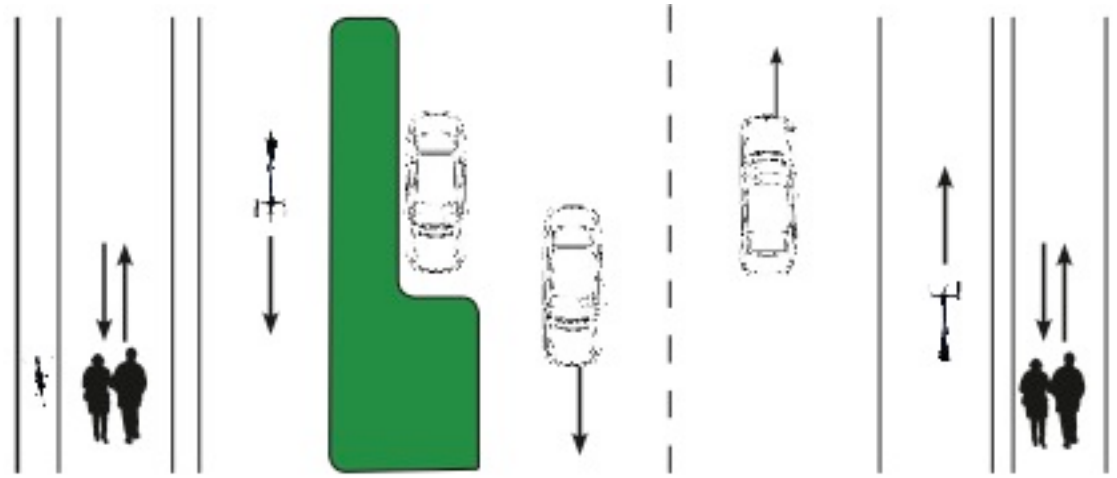
Figure 3: Hans Broges Gade`s plan

The sidewalk and bike path is a combination of concrete tiles, stone tiles and asphalt. The sidewalks are a lighter color in contrast to the dark bike path creating a clear division between the spaces.
In order to guide the cyclists into the correct lane, a white symbol of a bike has been painted at the road crossings, which also alerts car drivers that this is a lane dedicated to cyclists (Figure 4). A small asphalt ramp has been applied to the gutter so the cars and cyclists can more easily pass over the bike path and pedestrian sidewalk.

Figure 4: White symbol of a bike

Since the bike path is dedicated solely to cyclists they can go quite fast (see Figure 5), they can also ride comfortably next to each other while having a conversation (see Figure 6).

Figure 5: Individual riding his bike at a high speed

Figure 6: Two individuals riding their bikes next to each other while talking

In search of a solution to minimize accidents in the crossings (usual risk areas for cyclists and pedestrians), the implemented design induces the cyclists to navigate around the curved bend in the bike path which slows them down and helps alerts them to cars passing over the bike path. However, cars must give way to the flow of cyclists crossing the road. Complications can arise when the cars do not give way to the flow of cyclists therefore possibly.
There are a few crossings and intersections that cyclists must navigate to ensure a safe ride. These include the main entrance where the path begins and the curved intersections that act as a bridge over the side streets. Also the small bike ramps that enable cyclists to leave the path and cross the road (see Figure 7 and Figure 8) are safe alternatives.
Taking in consideration the concept of passability, being able to move quickly through the traffic, the design focuses on increasing passability at the intersections. Moreover, improved passability in intersections also contribute significantly to making cycling easier, faster and safer.

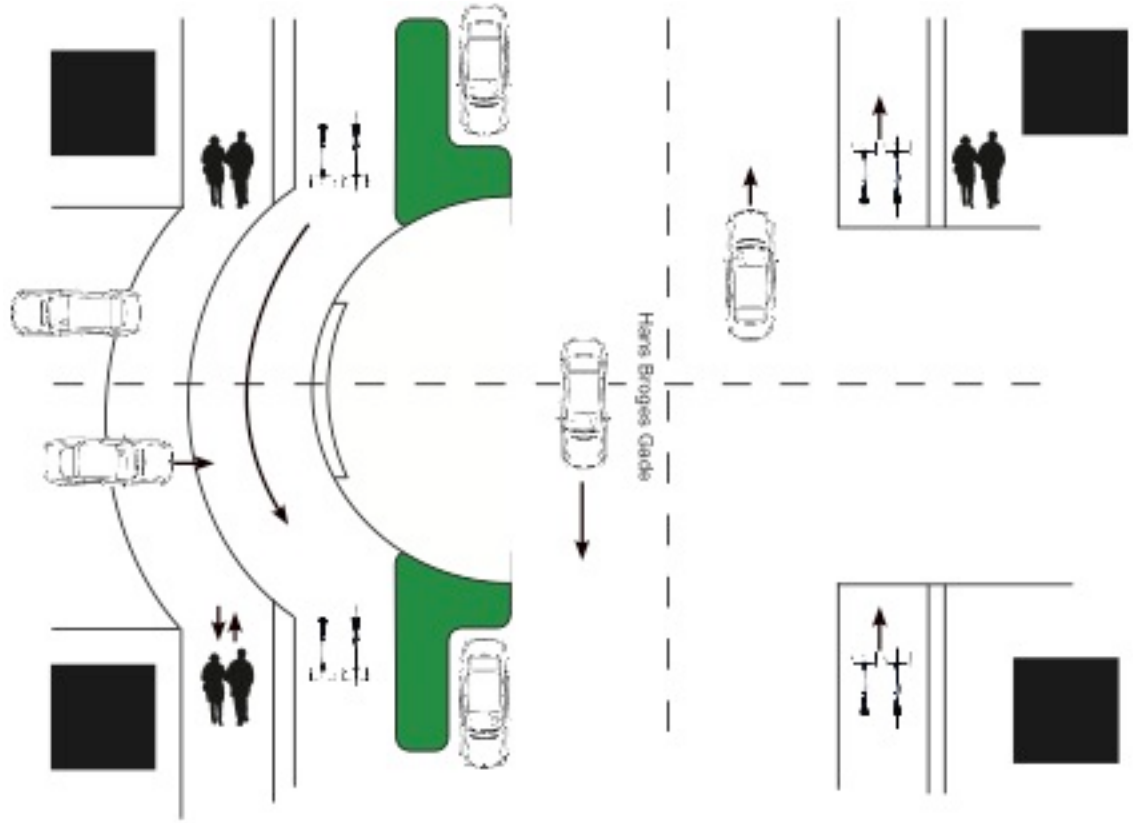

Figure 7: Plan of a crossing at Hans Broges Gade

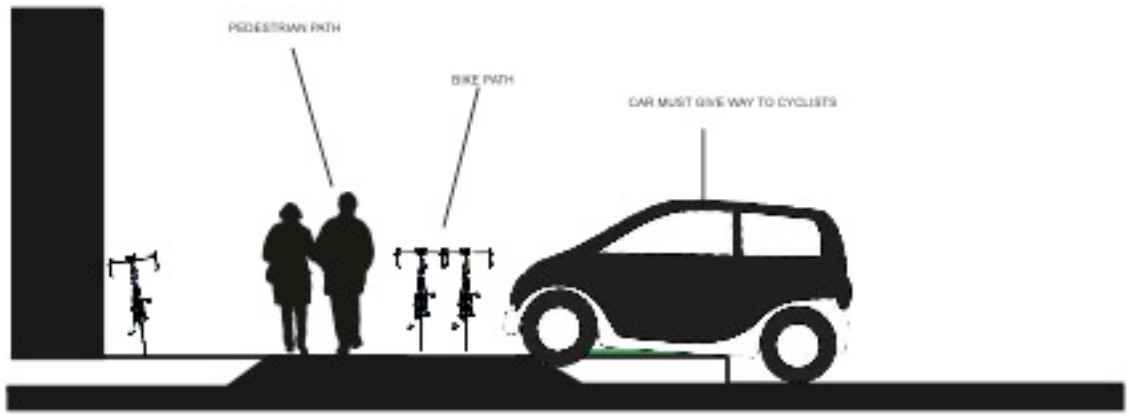

Figure 8: Section of a crossing at Hans Broges Gade

Cyclists can ride at consistent speeds along the bike path, but they must slow down at the curves in the path where they cross the side street (Figure 9 and 10). Pedestrians do not present any problems to the infrastructure as they move slowly, however, they must pay a lot of attention to fast moving cyclists and cars at the intersections. Conflicts can arise when people are riding slowly; this can become unsafe when faster riding cyclists try to pass the slower riding ones by riding onto the pedestrian path.

Figure 9: Cyclist riding down while entering the bike lane.

Figure 10: Cyclist slowing down at the crossing

Users were asked about the quality of the safety measures of the infrastructure. The largest portion of respondents thought the design did a good job. Thirty-two percent answered that it did a very good job, 47% that it did a good job, 13% were neutral on the issue and only 5% said that they thought it did a bad job and 1% a very bad job. Two percent gave no answer. The majority of the respondents are therefore very satisfied with the safety issues at Hans Broges Gade.
Cyclists must be weary of cars passing through the bike path even though the cyclist has priority when crossing the path. A big problem regarding signage is when cars park over the bike symbol making it difficult for the cyclist to cross the road as they cannot see the bike ramp or the bike symbol. Figure 11 highlights a few problems where there is either no signage or the signage and ramp has been covered by parked cars.

Figure 11: Car covering bike signage

In some places there are no ramps for cyclists to cross, therefore, they are not able to cross the road and ride onto the bike path in the other side of the street, which leads to cyclists riding up the wrong side of the road. Other problem is the location of ramps only in few places, creating a lack of permeability. This leads to cyclists taking shortcuts and riding up the road instead (see Figure 12).


Figure 12: Bike signage and covered ramp and cyclist crossing in an alternative way

Velocities

Hans Broges Gade has high and low peaks of traffic during the day. Peak hours, where the bike path is most populated, are in the morning from 7am to 10am when people are on their way to work or school. Other peak hours are in the afternoon and evening from 4pm to 7pm when people are on their way home from work and school. During these times, it is more difficult for cyclists to go very fast as the bike path is more crowded. However, outside peak hours cyclists can go faster as there are fewer cyclists, this is typically between 10am and 3pm, 7pm and 7am and on the weekends.

Impact Of The Design On The Travel Behavior

A total of 163 individuals that were riding their bike at Hans Broges Gade on September 2, 2010 answered the questionnaire during the period between September 2 and October 1.

Based on a Aarhus Municipality count done in September 2009, on average there are 1251 bicycle trips in Hans Broges Gade from 7am until 7pm – including both directions – on weekdays. Estimating that 35% of these cyclists ride their bikes at least once per day in the infrastructure, it was stipulated a total of 813 individuals ride a bike at Hans Broges Gade per day.

A total of 605 flyers were distributed to individuals riding their bikes in the infrastructure from 7am until 7pm and from these total 163 answered the questionnaire.

Based on these figures, the respondents represent 20,04% of the total of individuals riding a bike per day in the infrastructure and 26,94% of individuals that collected the flyer while riding a bike in the infrastructure on the 2nd of September 2010.

When asked whether they bike more often after the opening of Hans Broges Gade, 86% said they have not biked more, while 13% said yes. One percent gave no answer. A small number of the respondents are biking more often after the opening of Hans Broges Gade, from which we can derive that the new design has improved the bikeability of the site and the number of bikers.

When the respondents were asked which aspect of the intervention make them ride their bike more often, the largest portion of users stated that safety (24%) was an important factor, where 20% responded that

wide bicycle lanes made them ride more and 13% stated that maintenance made an impact for them. Eleven percent stated they rode more because Hans Broges Gade was a nice experience, and because faster bike lanes made a difference for them. The most important factors for the bikeability at Hans Broges Gade is therefore safety issues and the conditions of the bike lanes such as the proportions of the lane and the maintenance of it.
Finally, users were asked, how important street design is to their decision to ride their bicycle. Twenty-five percent of the respondents were neutral on the issue, 25% said it was not important, and 23% said it was important. Twenty percent of the respondents stated that it was not important at all and 7% that is was very important factor for them. These figures show that while streetscape is not a critical factor in bicycle use, it is still important and noticed by users.

Conclusion

Many aspects and ambiguities influence the urban design discipline. Working in a broad sense with the built environment, we seek to add qualities to both the process and product of urban design, and we deal with spatial as well as the technical, social and cultural aspects when shaping visual qualities and organizing and managing urban territories.
The results of this study indicate that safety, fast connectivity and attractive landscape – in this order of relevance – are strategic dimensions of a design solution that must be taken in consideration by architects, planners and engineers.
When deciding to implement or improve bike infrastructure, the particular qualities and potentials of different bike typologies should be analyzed in order to decide what kind of bike infrastructure would be appropriate to implement.
Today there is a need to look at the built environment as a fluid landscape of different forms, experiences, times, flows, structures, lifestyles, communities and cultures. The intricate urban landscape demands new urban design interventions that can realize its potential and deal with its challenges.
Different typologies or a conjugation of typologies can be efficiently used for commuting. Again, what seems to be important is how fast the infrastructure connects the cyclists, how attractive is the landscape and how safe it is to ride a bike in the infrastructure.

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