Mobihubs design guideline

Why we need mobihubs and how to design them

JIP SCHELLING

This booklet is for policy makers, local planners and designers involved in the implementation and design of mobihubs. It serves as an inspirational and practical document, starting out with a plea about why we need mobihubs and followed by a set of guidelines for the design and implementation of a mobihub, illustrated through examples for different types of locations.

All chapters are summarized with a specific goal. Where the first chapter focuses on insights and requirements, the other chapters formulate the conclusions as design principles. These conclusions will be presented at the right-hand column of each spread.

As a follow-up to this booklet, a toolbox was made to facilitate conversation about the mobihub. It is a modular model in which you can play around with the facilities of a mobihub at your location of choice. This toolbox can be used during a initial sessions with the involved stakeholders -like residents and the municipality- and help to identify everyone's demands and wishes for a specific location. In this toolbox findings from this guide can be applied directly.

This all is the result of a graduation project by Jip Schelling from the faculty of Industrial Design at the TU-Delft, for and in collaboration with Advier. For more background information about this project, please consult the graduation report.

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MOBILISEERT

TU Delft

Figure 01 Mobihub impression

What is a mobihub?

A 'mobihub', short for mobility hub, is a physical, recognisable place that offers different shared modes of transport combined with useful facilities and informative features to both attract and benefit the traveller (see figure on the left for a drawn impression). The purpose of a mobihub is to increase the use and visibility of shared and sustainable modes of transport, with the additional benefits of reduced car use. Mobihubs convert space previously used only for private parking to environmental zones, waiting areas and additional facilities, which create both a better travel and city experience for the user. In addition Mobihubs help to solve the issue of managing "street clutter" from dockless / free floating micro-mobility services (1).

Mobility gives us freedom but also burdens us with numerous problems. These problems cannot be tackled with one simple solution; only through a combination of innovations can a transition be set in motion that answers to these issues. Before we discuss the role the mobihub plays in this transition, it is important to define what the problems of our current transportation system are. This research was conducted within the scope of the city and passenger transport, hence the problems are described from this perspective.

Pollution

If you look at the CO2 emission of Europe, you will find that 20% is produced by passenger transport. 2/3 of this ridiculously large share can be billed on cars - which comes down to 12% of the total emission of Europe! (2)

Next to heating up the earth, driving around in cars also pollutes the air we breathe. With road traffic as the main polluter, the air we breathe in per day in Rotterdam is comparable to secondhand-smoking 7 cigarettes (3,4).

There is even more pollution due to road traffic: the noise it produces. This causes sleeping and health problems for many inhabitants of the city. 'For 26,000 citizens of Amsterdam, the noise was so bad that it even disturbed their sleep'(5).

Total CO2 emission Europe

12%

Vroom
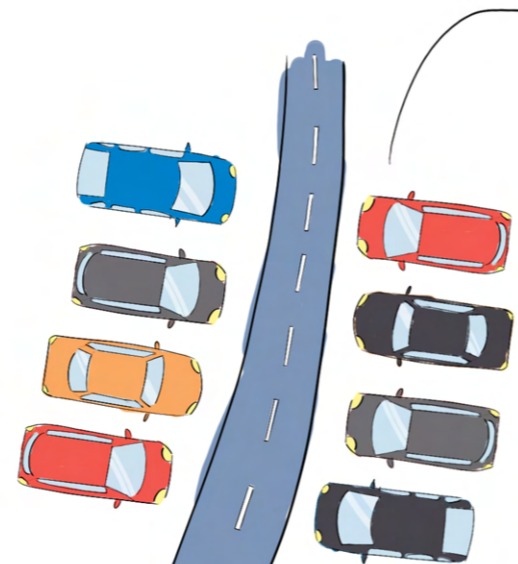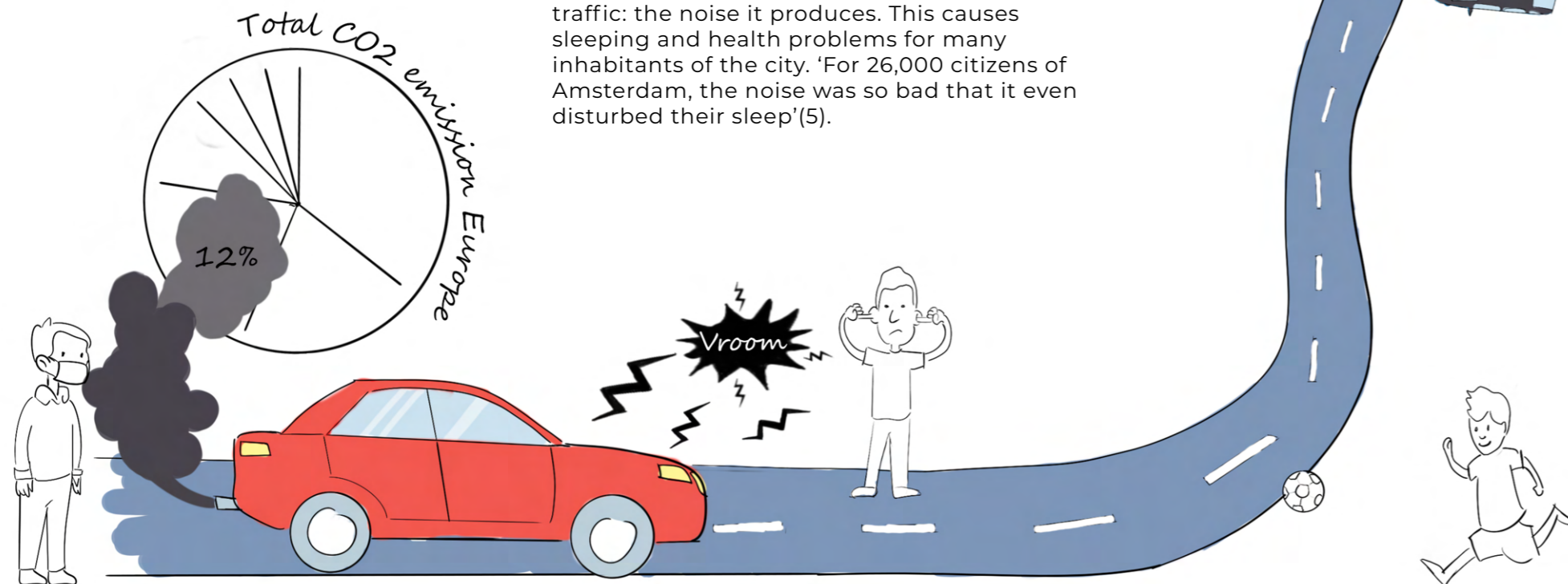
Space

The way our public space is organized is heavily influenced by the way we transport ourselves. An average city devotes over half of its space to transportation (6,7). Same as in the case of pollution, cars are responsible for a large share of this space. The space consumed by a driving car is 50 m², compared to only 5 m² for a journey by tram or bike (8). Adding up the fact that a parked car still consumes loads of space, the streetscape becomes primarily car centred.
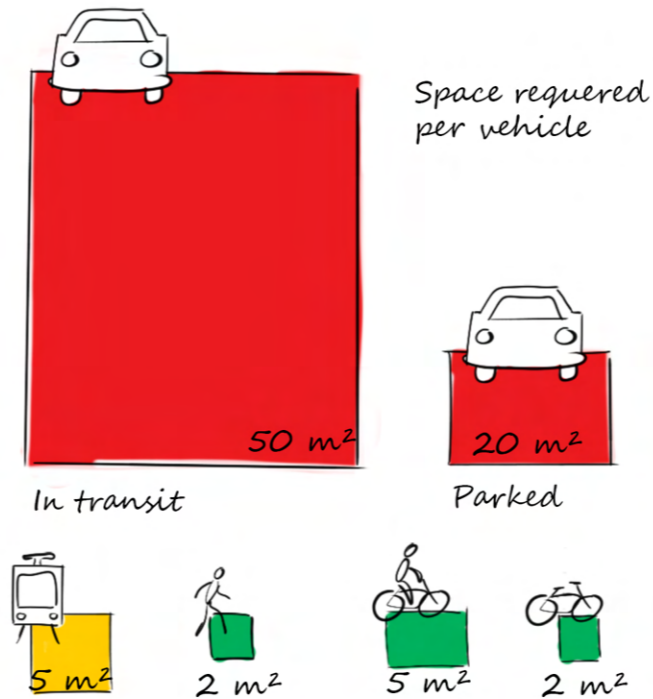
To cope with expected parking demands, The Hague needs 32 football stadiums of extra space in 2030

Growing cities & urban heating

Cities are becoming larger and denser at a rapid pace. If the current trend in car ownership stays the same it will be a huge challenge to accomodate them. Pick an average city like The Hague; to cope with the expected parking demand of the coming ten years you need to squeeze in at least 32 football stadiums full of parked cars (9). Instead of adding more asphalt to the city we should add more green - not only from an aesthetic point of view but also to make the city more climate-resilient and prevent urban heating (10).

Is the car the right choice for our mobility needs? One may question this. The next pages therefore discuss other options.

Space required per vehicle

50 m²

20 m²

In transit

Parked

5 m² *2 m²* *5 m²* *2 m²*

- For most trips in the city, cars are not the right tool. This because:

- The emissions of cars cause problems in many different aspects. Health problems due to air and noise pollution & environmental issues due to the CO2 emission.

- Driving and parked cars consume a large part of the public space

- The expansion and densification of cities can not cope with the current car use

Sharing as a solutions

Solving the issues presented in the previous chapter requires a transition within mobility. Shared mobility can play an important role in this transition, because results in fewer parked cars and supports different and more sustainable substitutes. How and why exactly will be discussed in this chapter. The rest of the manual focuses on how the mobihub can facilitate this movement. On the right-hand column the conclusions from this chapter are formulated as design requirements.

Shared mobility

Sharing cars is a great solution to the overload of parked cars. Study shows that one shared car can replace up to 8-16 privately owned car's. Sharing is a rather logical option if you take into account the fact that an average car in the city is parked more than 90% of the time (11). But shared mobility has more potential that only solving the parking issue.

Expenses
A more hidden effect of sharing is the reduction in use (12), this has multiple

reasons. First of all, nowadays most people have a distorted view of how expensive a car is. Without realizing most people work one day per week just to cover the expenses of their car (13). There are a lot of sunken coast like cost of purchase, road tax and maintenance, these coast are often not added up to the coast per trip. This is for many a great incentive to use the car as often as possible. Sharing makes use of the pay-per-use model, which makes people more consciously use the car. Next to this, a shared car is often a little further away from your front door this makes the bike or walking for really short distances more attractive.

Encourage different mode
As stated in the previous chapter cars are not always the right tools, so replacing cars with solely shared cars is also not the right solution. Shared mobility is offering a range of vehicles so people can use the right tool for

their trips without the need of purchasing all different vehicles. For example cargo bikes, scooters and e-bikes could be shared as well. This could make your total travel coast lower than while owning a car.

Supporting the shift toward electric cars
When shifting from ownership towards shared mobility, it is recommended to do this in conjunction with the shift towards more sustainable vehicles. Electric cars depend on specific charging infrastructure, this creates a boundary for an individual. Although when this shift is made with a group the infrastructure becomes less of a hurdle.
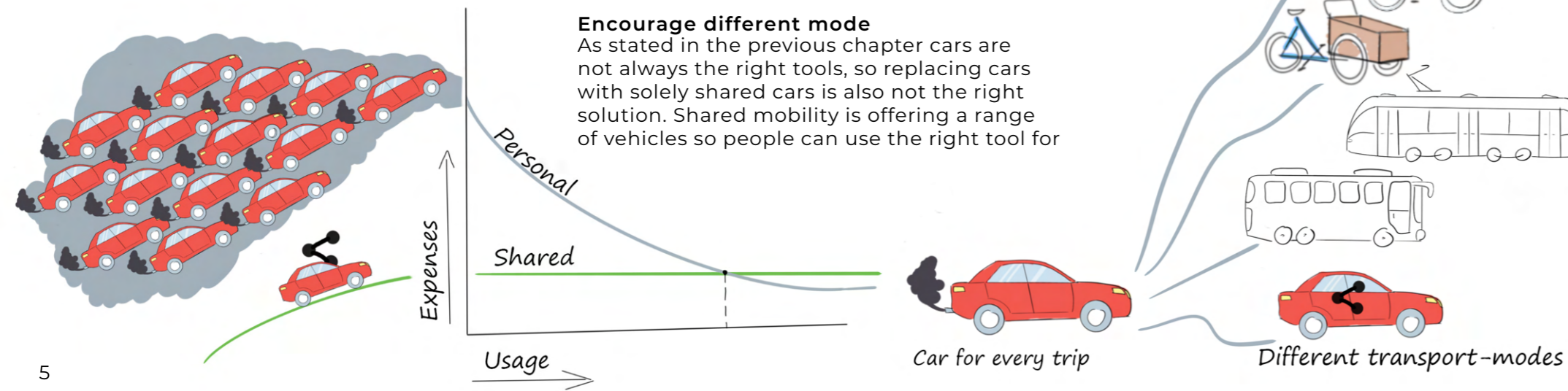
Different forms of sharing

Sharing can be done in many ways, understanding the basic and advantages of each form is useful when making a design for a mobihub. Therefore three main form are explained in this chapter.

Free floating
This type of system allows users to pick up and drop a vehicle at any point and any time within a specified operation area. The advantage of this form is that you do not have to bring the car back to its original location, which provides a lot of freedom. This gives the an advantage over private cars.

Back to base
Also called roundtrip or station base, this is the most classical form of carsharing. You pick it up at a location and bring it back to that location. This gives less freedom to the user but is easier to manage for the providers.

Community based
When a group of people shares a number of cars it is called community based sharing. This form is in most cases the cost-efficient option. Another benefit is people feel more responsible for the vehicle, the lack of ownership can cause problems in other forms.
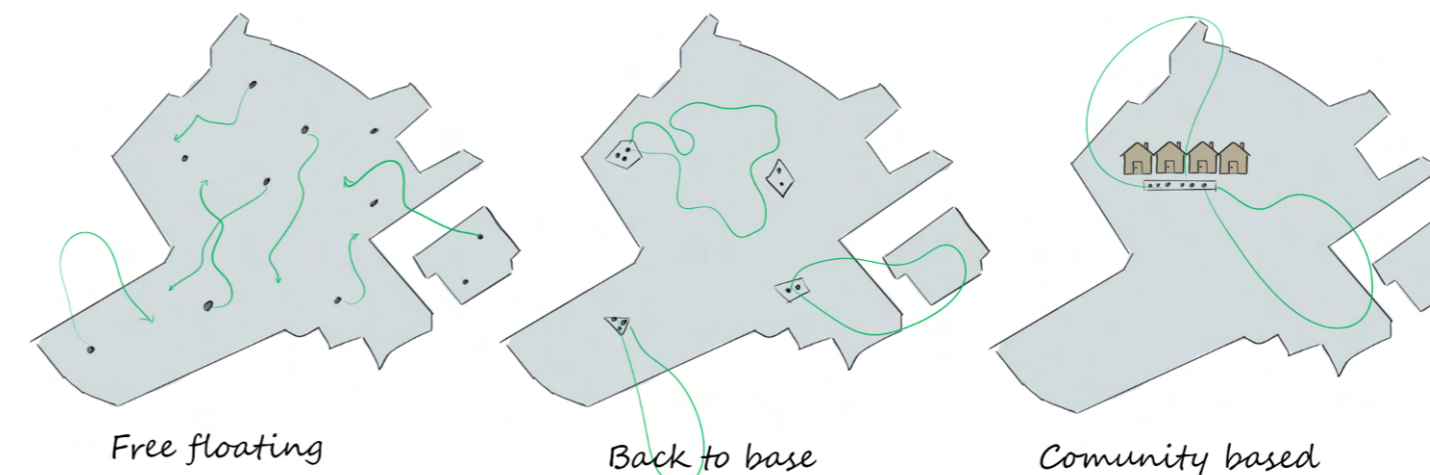
The mobihub should facilitate & promote shared mobility

The mobihub should facilitate different forms of mobility

The mobihub should facilitate sustainable type of vehicles

Expenses / Usage — Personal / Shared

Car for every trip

Different transport-modes

Free floating

Back to base

Comunity based

To make sharing possible, digital and physical infrastructure is needed. Where app's and fleet management are part of the digital side, the mobihub takes care of is the physical side. This physical infrastructure facilitates, promotes and organise shared mobility. In addition to this focus on transportation, the mobihub can house other facilities linked to neighbourhood services, such as the parcel locker, waste collection and recreational facilities. This all, making the hub a lively part of the neighbourhood. This chapter will focus on the function of a mobihub and translate the conclusions in design principles.

The digital infrastructure

Digitalisation and ongoing connectedness provide many opportunities for a different approach to mobility. Instead of owning a car, you can share one via an app or easily plan a trip with multiple forms of transportation. In other words, ownership is shifting to service. To facilitate this service, information about vehicles needs to be widely available and translated to the users. This topic of mobility as a service is (MaaS) is increasing rapidly

-obviously an important topic to understand when facilitating shared mobility- although the focus of this report will be on the physical side.

The physical infrastructure

In conjunction with these digital tools, physical elements are responsible for the functioning of shared mobility. These elements can be found and are gathered

at the mobihub. This hub has a view main functions, which will be introduced here and discussed in more depth throughout this booklet.

Facilitate
The main purpose of a mobihub is to facilitate shared mobility.

Promote
Although shared mobility already exists sometimes, it is not yet a concept known and used by many to its full potentials. The mobihub should make shared mobility more noticeable, thereby the hub needs to be recognizable.

Centralize
At the moment shared mobility is spreading over the city, there is a positive but also negative reaction to this movement. The

negative is mostly about the random dropoff points of mostly micro shared-mobility, like scooters and steps. The mobihub has to focus on organizing this and other forms of shared mobility and facilities.

Showing the benefits
Shared mobility can bring many benefits, the mobihub should translate and emphasise these benefits in the design and layout. Saving space is the main benefit that the mobihub could show. Where now people complain about shared mobility littering the city, the mobihub should convince them of the opposite. This by giving back the gained space to other purposes. Greenery & social, play or sport facilities at the space previously owned by parked cars could be a clear translation of these benefits.

Ingredients of a mobihub

As already mentioned the mobihub can offer more than just mobility. A list of possible ingredients will be discussed here. Important is that not all ingredients have to be used at every mobihub, the image on the below shows a rather basic one where the image in the introduction presented a extended version.

Mobility
The mobility facilities form the basis of the mobihub. This could includes, shared cars, bicycles, charging facilities and a connection to public transport.

Information
It is important that the neighbourhood hub is visible and findable in the in the neighbourhood. This involves, for example a recognition point such as a column and travel information on the hub.

Facilities
The mobility related facilities are complemented by practical facilities, such as a parcel locker, water tap, waste bins, ext. This gives the mobihub a central function of the neighbourhood instead of just a travel node.

Socially & neighbourhood improving
In addition, there are the visual, social and community functions. These are facilities that contribute not only to the traveller, but also to the neighbourhood itself. These are things like a picnic table, sports equipment, and more green.

- **In conjunction with all the shared mobility & MaaS apps the mobihub should facilitate and promote shared mobility. This can be done by making the hub a visible and recognizable place**

- **To prevent littering of the streetscape the mobihub should centralize all facilities**

- **The hub should show the space saving benefits of shared mobility**

- **Let the hub become more than a travel node by adding non mobility related facilities**

- **Choose de facilities depending on the needs of a neighbourhood**

Digital

Physical
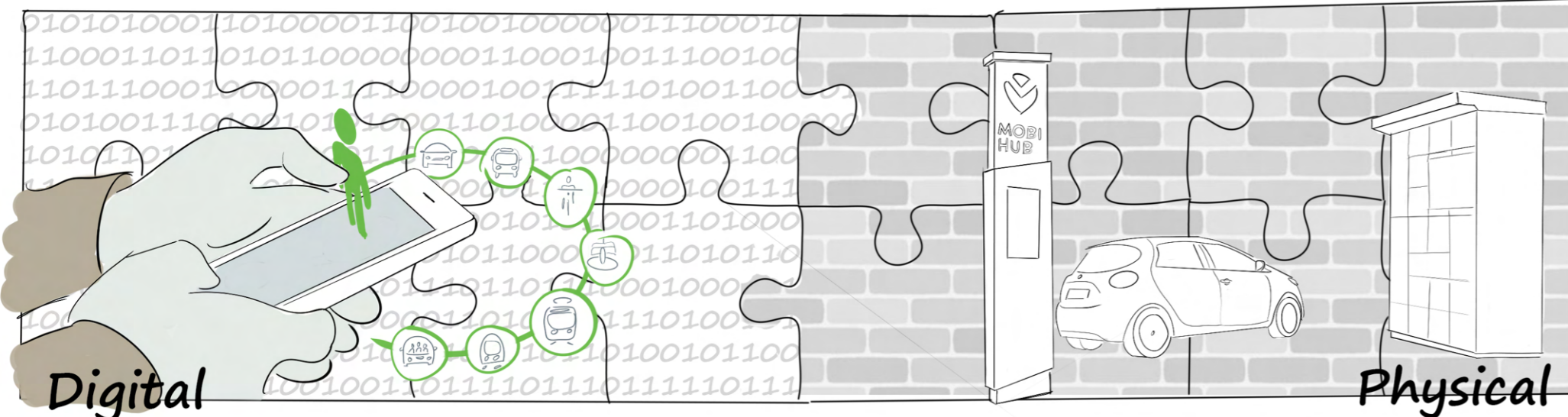
Different view on streets

The advantages that shared mobility can provide should be strengthened and guided by the mobihub. One of the examples that has been named in the previous pages is saved space. In this part, we zoom in on how this can be translated into the design. When all facilities are spread chaotically around the neighbourhood, they won't realize their full potential. When they are properly organized the mobihub becomes easier to use and it becomes possible to utilize the saved spae. These aspects allow us to reconsider the complete layout of a neighbourhood. Is it still necessary to dedicate every street primarily to transport, or could we design our streets for living by making use of shared mobility?
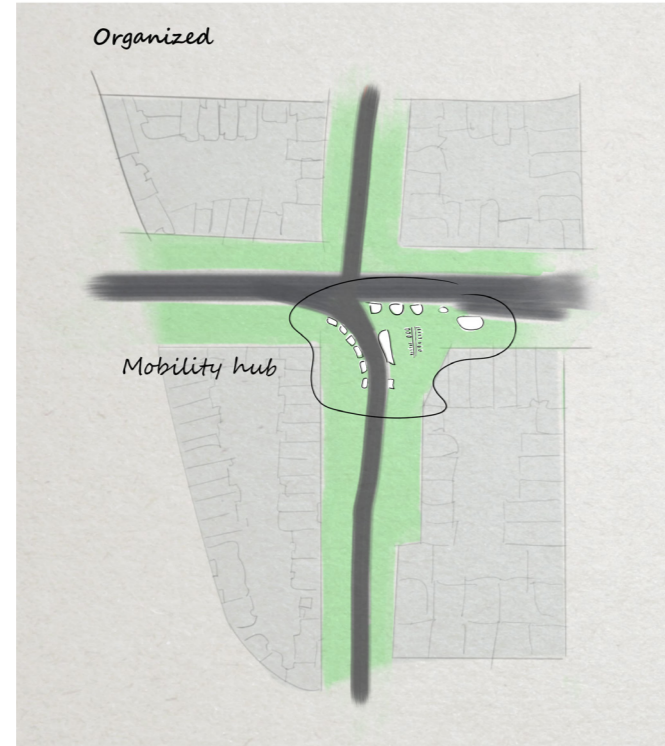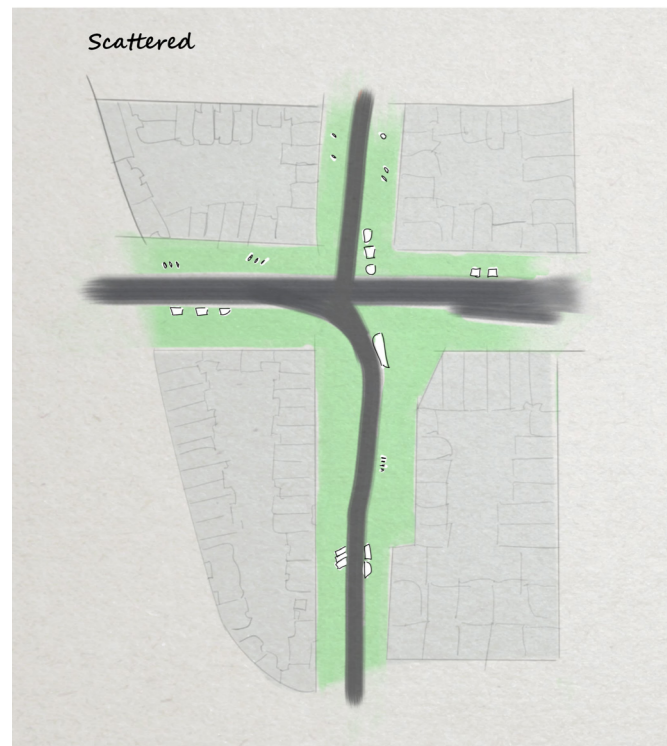
Against fragmentation

Many new objects enter the current streetscape, like charging infrastructure for electric cars, free-floating micro-mobility, and non-mobility-related objects like parcel lockers. All these things clutter up our streets if not properly organized. The mobihub brings these facilities together, keeping the neighbourhood more organized and making these facilities easier to find.

When all facilities are clustered, the mobihub becomes a place to start your trip, end your trip, pick up packages etc. Due to the many activities, the mobihub can become a lively place. To support a good ambience it should not only be a travel node but also support interactions between people. Thereby it could fulfil the role that a central square in a small town has; bringing more cohesion in the neighbourhood.

Focus on the saved space

You could argue that the main reason why we need shared mobility in the city is the unfair distribution of public space. With the efficiency of sharing vehicles and the mobihub, our mobility needs can be fulfilled without occupying all public space.

The kind of environment a person lives in plays a major role in his or her life - there is a direct negative correlation between the number of social interactions in the street and the amount of traffic (11). Houses with a

front garden or lots of greenery in the street have a much higher (sales) value. Since switching to shared mobility is a barrier for many, it will help the implementation of mobihubs to immediately impact people's living environments by using the saved space for, for example, social interaction and extra greenery.

In addition, it is also necessary to have something other than road and tiles in the city as urban heating is becoming an increasing problem. With the growth and densification of cities, the public space will become an increasingly crowded place. When this becomes even more crowded with traffic instead of more crowded with social activities, the city will become a less pleasant place to live in.

Transition Area

So how can we demonstrate this territory gained from current inefficient mobility habits? The image on the right illustrates this.

Because all facilities have been moved to the corner of the street, there is hardly need (apart from emergency services) to drive into the street. Shared cars are now parked on the corner instead of covering the complete street, and on top of that delivery services and waste collection services no longer need to enter the street. In this way, a difference is made between the transport street and the space behind the mobihub.

This is inspired by the Superblocks concept from Barcelona and the Dutch/Belgian experiment of the The Living Street "leefstraat" in Dutch (14, 15).

With this approach, not only the mode of transport is changed, but the entire layout of the streetscape is redesigned. The mobihub becomes a transition space from transportation to recreation area. Mobility facilities face the area of the street where transportation is central, social facilities face towards the street where people use the street for outside living.

- If the location allows, the hub should be designed in such a way that it can function as a transition area between transportation and living. At the hub the two meet

- Crossings between side and main streets work well as transition area. In that case the side street can become a low traffic area.

Scattered

Organized

Mobility hub

living street

Mobility hub/ Transition area

Living street

Mobihubs can add something to many different type of locations, ranging from city centres to the countryside. Per location the function and implementation differs. This project focused on cities, but even within the city there is a wide spectrum of locations. Two extremes of each other are analysed here in more depth to provide a wide perspective on the possibilities. The first is to redesign a classical narrow street in the city centre, versus the implementation at an apartment complex in construction. These two locations will be discussed in this order, both focussing on the implementation and possible design opportunities. We first analyse the implementation in an existing street, which is a complex process with many different stakeholders involved.
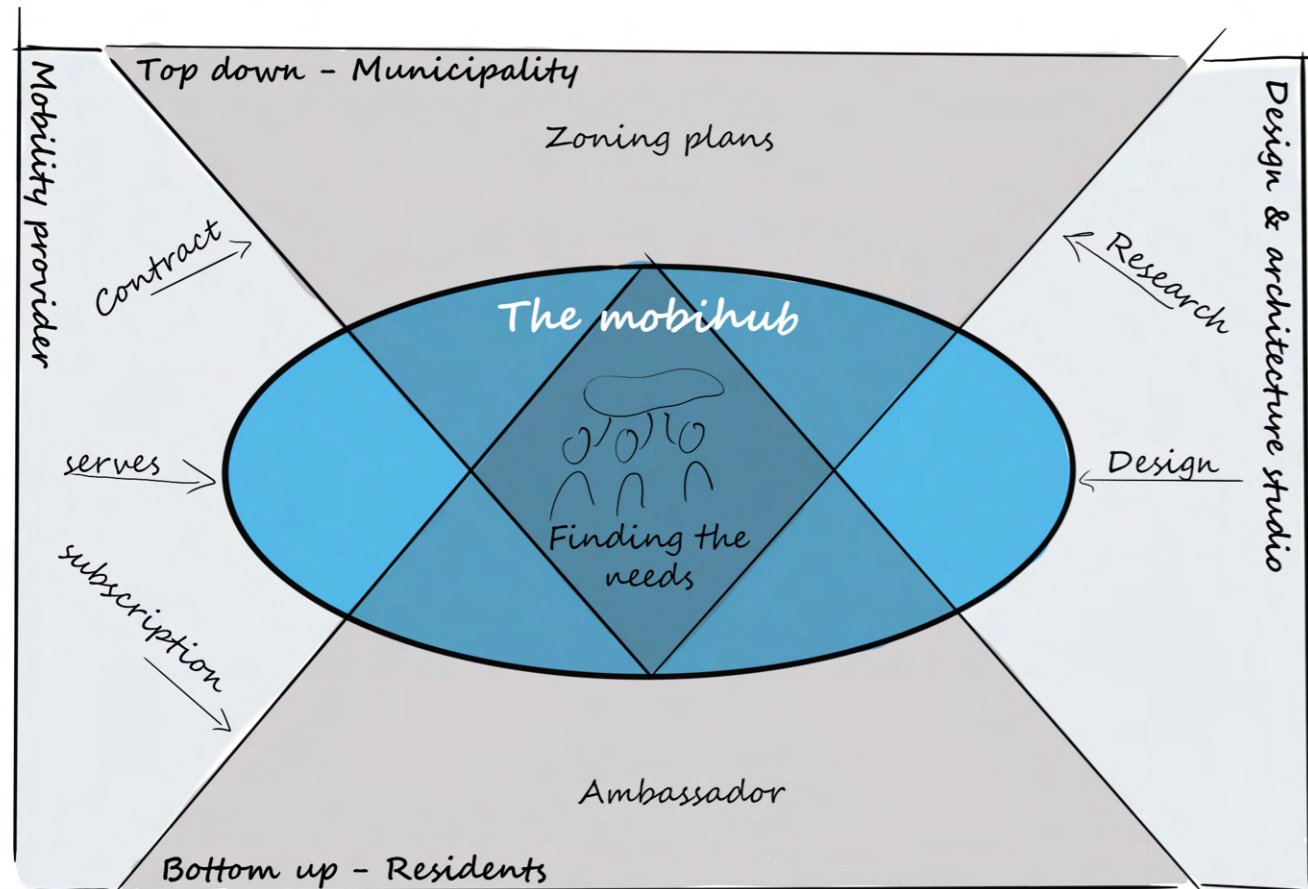
Process

Change always meets friction. People are used to the way things are, which makes it difficult to convince them of the benefits of another system. To make sure the implementation goes smoothly and all benefits of the mobihub reach their full potential, it is important to get to know the stakeholders. Within my project, I explored this process and had conversations with different stakeholders. Here on the left -in a systematic representation- you can find an overview of the outcome of this exploration. Two key players are identified: the municipality and residents. In my opinion, the best way to implement a well-functioning mobihub is through a collaborative approach. If the needs are only defined from one side, there will never be a fully functioning mobihub.

First of all, the municipality is responsible for the long term zoning/spatial plans on the street, neighbourhood and city level. Without the motivation to change the behaviour in mobility on the long term, the mobihub will not contribute much. Another important factor for a well-functioning mobihub is that the user feels connected to the mobihub. Sharing vehicles will work better when there is a feeling of responsibility and shared ownership. To achieve this it helps a lot if the initiative comes from within the community instead of top-down. If there are one or more residents enthusiastic about this concept, it helps to let them explain the benefits to their neighbours. These people function as ambassadors of the mobihub, and will have more authority than the municipality.

Slowly spreading an area

This approach to constructing a mobihub -certainly with the living street included- can not be done overnight. Without informing and including all stakeholders things would go wrong. Most residents would be angry about their parking spot being taken away, since they didn't have the time to switch to sharing vehicles. Similar projects have been approached with a temporary setup. In an evaluation about this setup it was mentioned that due to the temporary nature people did not fully commit to the switch(16).

This is why a small but permanent change is favourable. It is extra important to make the benefits clear through the design. That way the rest of the street will notice the benefits and be more open for this change as well. In the image below you can see how this is slowly spreading a street.
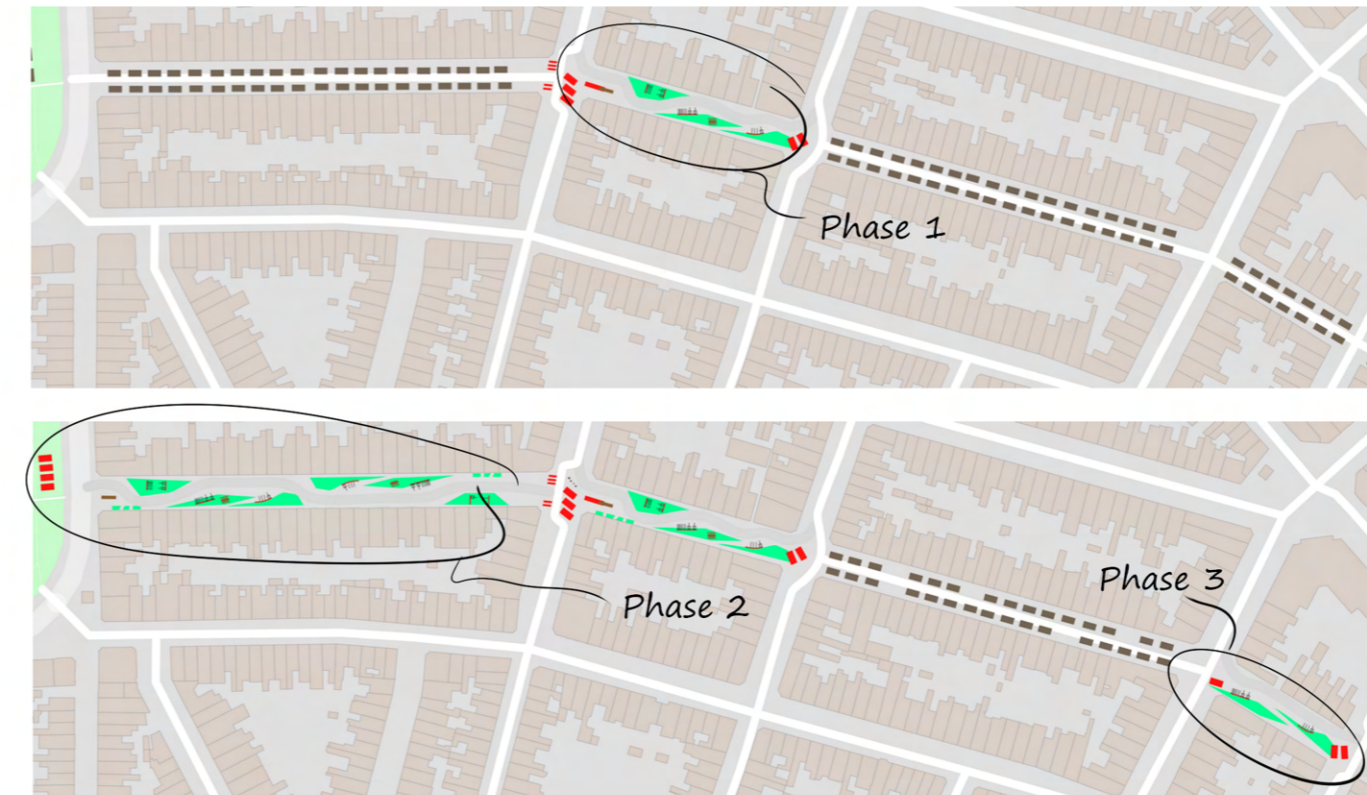
- **A mix between a top down and bottom up approach is recommended**

- **First step is getting everyone on-board and check people their needs and zoning plans of the municipally**

- **Redesign one segment of the street, with a aim of explaining and promoting**

- **When the street is ready redesign more segments**

Ingredients

Adaptable
The building blocks of the mobihub must be able to fit in at different locations and should be able to change according to the needs of the residents. Adaptability and modularity are important requirements for the design. They allow the mobihub to start small and continuously grow over time. To realize this a product portfolio should be designed that offers the blocks in multiple sizes.

Coherent furniture
The mobihub should be coherent because when gathering all these facilities, it would be nice to prevent it from becoming a collection of many different styles and colours. Therefore a form language is important. Next to a shared form, the integration of multiple facilities into one piece of furniture would also create a less chaotic street image.

Form of sharing
As a basis of the mobihub community based sharing is recommended. This is the form closes to owning a car, which will make the transition easier. This form gives the users a feeling of shared ownership, which contributes to more connectivity with the mobihub. Next to this an area for free floating should be appointed. In collaboration with the providers it can be stimulated to park in those areas. Similar approaches can be seen with Go sharing (17).

4.25m
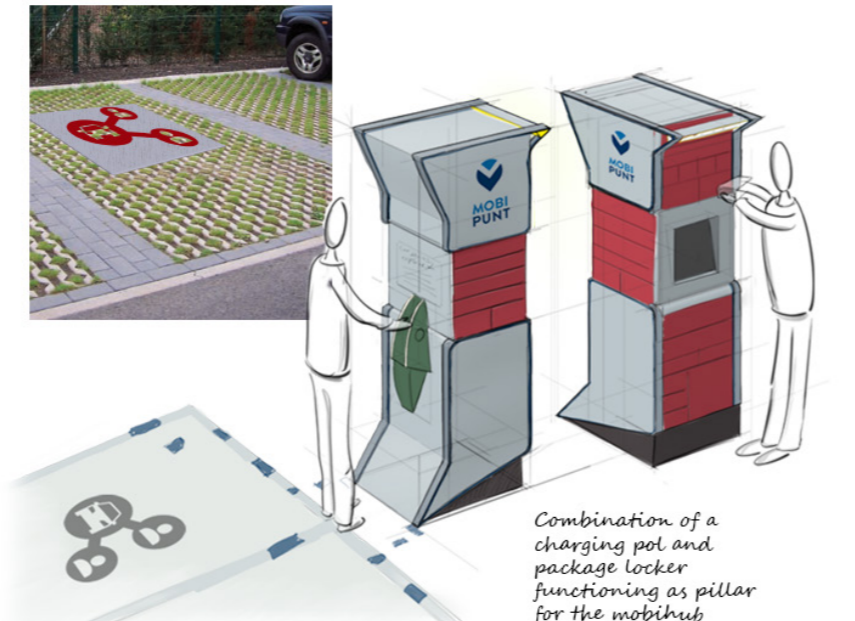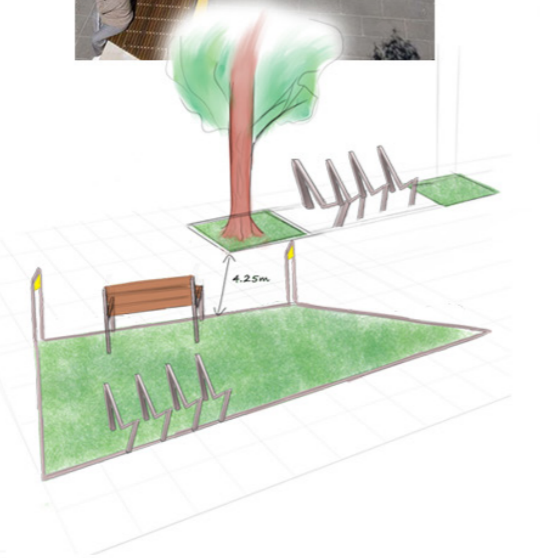
Combination of a charging pol and package locker functioning as pillar for the mobihub
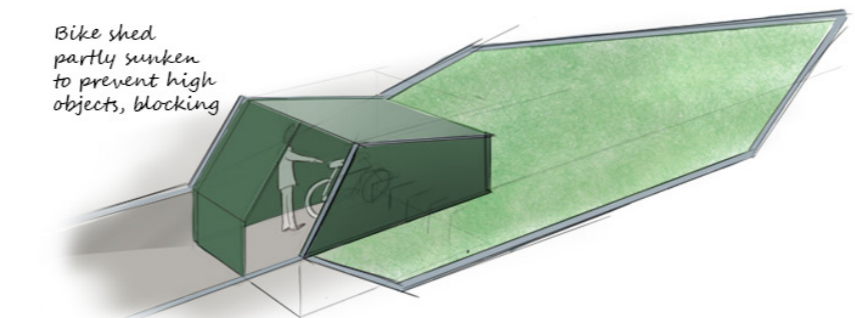
Bike shed partly sunken to prevent high objects, blocking

Street in action

The street is arranged in such a way that the facilities that need to be connected to the road, such as the parcel locker and parking spaces for shared cars, are placed at intersections. They simultaneously become a transition area to the rest of the street in which living is prioritized over transport. After you pass the mobility related facilities there is more space dedicated to social, recreational facilities and greenery.

The street itself has actually become a large pavement -filled with a lot of green- where pedestrians are prioritized. In an exceptional case cars can still drive into the street, and it is always wide enough to allow emergency services to pass through. The street is indicated by the blue tiles that smoothly fade into the rest, indicating that it is shared space.

As this is the first part of the street to be redesigned, it also demonstrates to other residents how things can be done differently. That is why it is extra important to make it clear that mobihubs are the enablers of this change.

Design the hub with one product family instead of from many different providers

In this product family should be modular to adapt to changes in needs and be able to grow

Community-based sharing as a basis

For clear connection between the facilities, linking them with colour or grass could be an option.

In this chapter, a different type of location is studied, namely a new construction project for an apartment complex. One of the biggest differences is the fact that instead of making changes to improve the current state, in this project the ideal situation can be built from scratch. On top of this, the chances that residents have like-minded thoughts about sharing vehicles is higher since these apartments will/could be advertised with the mobility story included (16). These factors allow considering larger adjustments to the current system.

Sharing and parking a large fleet

When a large share of the residents of the apartment complex makes use of the shared mobility facilities, the number of shared cars can become rather large. This means you can treat it more like a fleet, which in turn allows for alternative methods for parking and charging. The larger the fleet the more efficient things can be arranged. The classical way of parking, for example, is rather space-consuming. This is because it is designed in a way that people can easily manoeuvre. If you would let a system manage the parking lot the required space would decrease. Multiple solutions are possible, of which the most used option at the moment are the automatic storage lifts. Another option is cars equipped with self-parking features. This autonomous parking feature can park cars way more efficient since the parking lot just needs the dimensions of a car instead of humans. (18)

In synergy with self-parking, the charging for electric vehicles can be offered in a more efficient way. A normal charging pole is often occupied way longer than it takes to charge the car. With a system controlling this, cars can be rotated. On top of that, with more and more energy coming from natural resources the time of energy consumption becomes of more value. The advantage of a fleet against a single car is that you have more freedom in the time of charging. A single car always has to be charged as quickly as possible, but a fleet can be charged based on a prediction of usage in the coming days. On top of that, the batteries of the fleet could be used as energy storage for the apartment. This extra feature is possible with bi-directional charging. (19)

Integration of the other facilities

On the previous page, the focus had been on how to integrate carsharing with the apartment. As discussed throughout the rest of the report carsharing is not the only feature of a mobihub. An offer of different mobility options is needed to make a shift in the excessive car use of today.

In this design for the apartment complex, the more healthy and sustainable transport options are in closer reach than the car.

Mobihub is idealistically located in the area between the front door and the existing road infrastructure. Which makes this hub a transition area from transportation toward the open and green space that is now possible due to smarter use of mobility. In other words the closer you get to the front door of the apartment complex the less transportation you encounter.
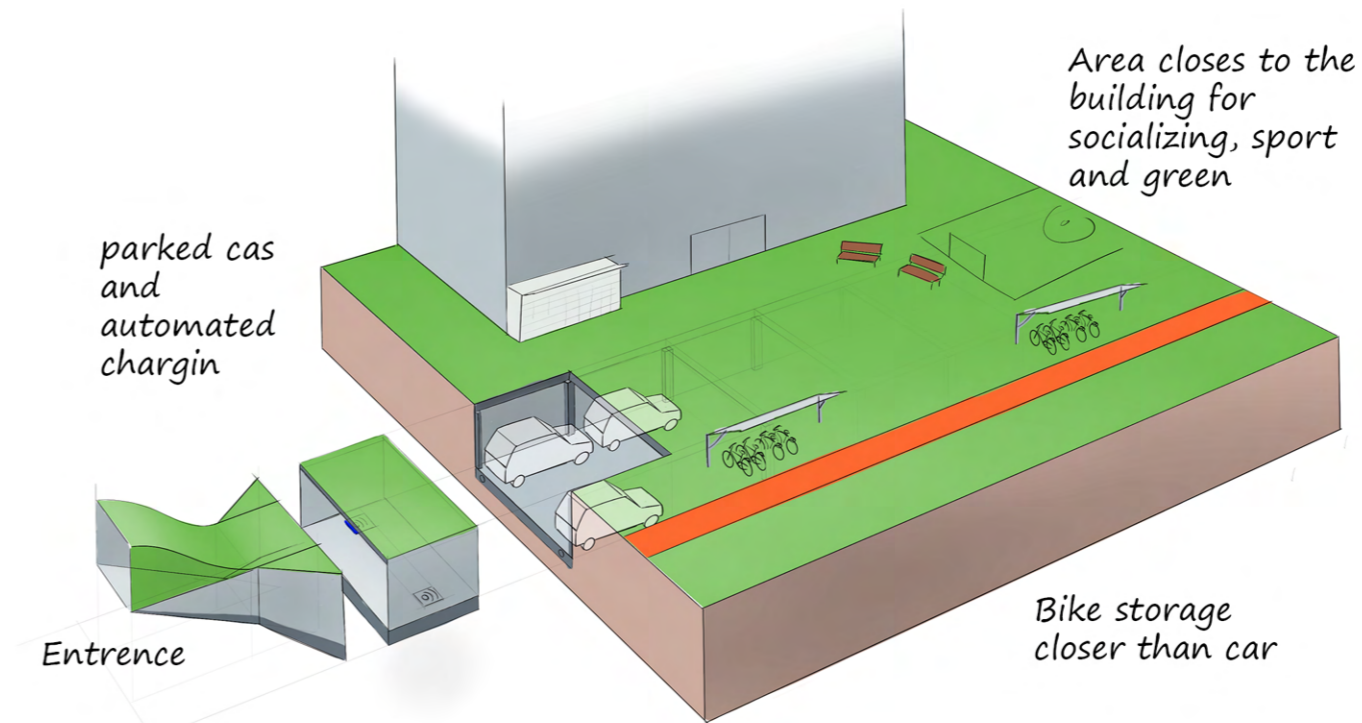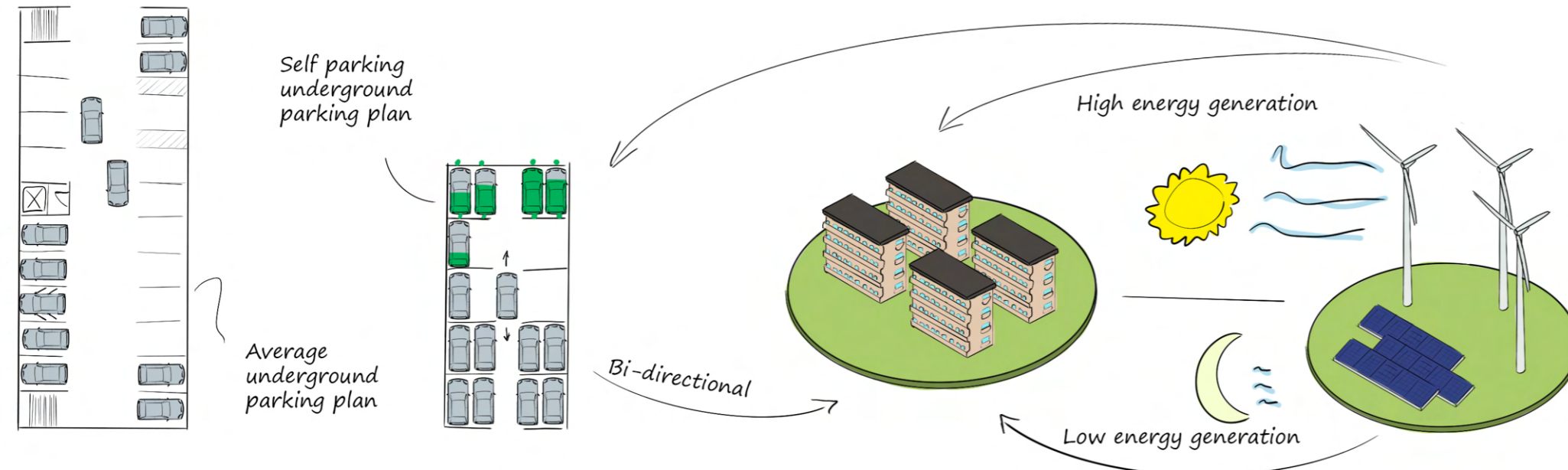
- **Integrated with the building**

- **Mobihub should be the transition area between the public space in the middle of the complex and the existing road infrastructure.**

- **Smaller and more sustainable vehicles parked more in reach**

Self parking underground parking plan

Average underground parking plan

Bi-directional

High energy generation

Low energy generation

Area closes to the building for socializing, sport and green

parked cas and automated chargin

Entrence

Bike storage closer than car

This guideline document explores how a mobihub can change the city, which is a massive process with countless stakeholders. To take the first actual step, it is important to map out the specific needs of the residents at each specific location and make a design based on these needs. To facilitate this first step, a toolbox has been created that facilitates the discussion about the layout of the street. With the use of this modular scale model cars can be replaced for other facilities. This facilitates an interesting conversation and visualisation, to see if people are willing to share when these benefits are proposed.

Goal of the toolbox

The toolbox can be used in the starting phase when interest in developing a mobihub is shown. It will speed up the conversation between the different stakeholders and visualize the benefits of and changes needed for the mobihub. The main purpose is to facilitate the conversation about what residents want with the public space around their house. The information from this guideline can be used as inspiration and the toolbox will help people to see this in the context of the street/area they want to redesign.

During the session the needs of participants will come to light and accordingly the requirements for implementing all their wishes.

Participants

Sessions are held for the redesign of a specific area. It is favourable for the outcome of the session to involve a diverse mix of participants.

A session leader with experience about shared mobility and mobihubs is required. He or she will steer the design process with the design principles from this guide.

Additionally, someone who is responsible for the planning of this area should be present, preferably someone from the municipality.

The residents of the area should be involved right from the start. Since they will be the end users, their needs should be the driving force in the design. If it turns out no one of the location is ready for a mobihub, the neighbourhood will not improve by realizing one.

Program of toolbox session

Step 0. Finding wishes
The residents are asked to write down their wishes about the neighbourhood in advance without any restrictions.

Step 1. Update shared mobility
A briefing about shared mobility is given to the residents, so that everyone is aware of what the possibilities are. This briefing should focus on the advantages for the individual and the neighbourhood.

Step 2. Interested in shared mobility
After the briefing, a rough indication of the percentage of people who are willing to switch to sharing can be made. This, together with the wishes written down before, serves as guidance during the session.

Step 3. Street in the current situation
Set up the current situation on the model. (the only limitation is that it should fit within the 19 m by 32 m).

Step 4. Space saved
Based on the percentage of residents that are interested in sharing, a number of cars can be taken off the board. Now it is time for the discussion on how to fill in this space. For this, all the models can be used and everything can be shifted freely. This process should be guided by the session leader who applies the principles from this guideline book.

Step 5. More idealistic version
In case there are many wishes for the neighbourhood unfulfilled a higher number of cars can be taken away as an experiment.

Use the toolbox to facilitate a conversation about the possibility and specific needs of the neighbourhood

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