NEW HERITAGE
GRADUATION STUDIO

IDENCEY

ADAPTIVE REUSE OF CAR PARK HAKFORT
IDENCITY
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NEW HERITAGE

The studio New Heritage focuses on the existing housing stock within Amsterdam Zuidoost:

"Many neighbourhoods face social problems of liveability and demographic changes. Moreover, this housing, like all of our stock, should meet the future standards of energy performance, which leads to an urgent need for energy upgrading. The question arises if keeping this housing is feasible, when taking into account the complexity of technical, social, economic and aesthetic issues." (New Heritage, 2020)

During this studio the aim has been to develop an answer on the housing stock of H-Buurt, an area within Bijlmermeer, and if it is suitable for further use or not?

To make decisions on this, value-based design shall help to extract existing values as well as challenges to get a good understanding of the needs of H-Buurt.

THE PROJECT

IDencity is located in Hakfort as part of H-Buurt in Amsterdam Zuidoost. The project addresses the non-used car park Hakfort. The car park has been built as part of the expansion plan of Amsterdam in the mid 70’s and was originally connected to the high-rise dwelling Hakfort. The once facilitating function to society is nowadays not given anymore, since the car park finds itself empty and faces demolition in 2022 in order to make space for a new development driven by the municipality of Amsterdam. As original part of Bijlmer’s master plan, the car park incorporates the characteristics of the functional city approach, which puts the car into the centre of the city and gives Bijlmer part of its identity.

Therefore, IDencity aims to draw an alternative solution to the demolition by analysing its value from an environmental, social and economic perspective. Programmatically, the project proposes an adaptive, low-carbon transformation of the existing structure into a social hub, while offering an answer to the national housing shortage by adding 120 dwellings.

In summary, IDencity aims to push circularity on both a building and a society level by creating places and spaces where the existing is complemented by additions to serve both environment and society.

RESEARCH QUESTION

How can the adaptive reuse of car park Hakfort offer solutions to current challenges while strengthen the genius loci?

Sub question 1: How can the transformation provide an answer to the national goal of carbon neutrality by 2050?

Sub question 2: What possibilities of serving the one million homes challenge can be achieved while keeping the existing car park’s structure?

Sub question 3: How can the adaptive reuse enhance the buildings’ value to society?

CONCLUSION

Environmental challenges as well as societal needs have been extracted as key elements of the proposed project. To deal with an existing structure, which is currently not used and to re-dedicate it to society can show value in keeping existing buildings rather than demolishing them. Additionally, environmental goals, like carbon neutrality and circularity can give impulses to confront oneself with the building in depth. In the framework of “New Heritage”, this results in a value based design that extracts values, enhances them and can result in valuable proposals that helps to transition towards a more sustainable built environment.

In the case of car park Hakfort, high environmental value of its structure, historical value as part of original Bijlmer, as a functional city, can be used to develop a highly connective building, which interacts with society and surroundings.

With its holistic approach, the project tackles relevant themes while offering flexibility to its solution.
2. H-BUURT

2.1 HISTORY

2.2 ANALYSIS

2.2.1 URBAN ANALYSIS

2.2.2 STAKEHOLDER ANALYSIS

2.2.3 SOCIAL ANALYSIS

2.3 URBAN ID
The urgent need of housing in the mid 20th century made a quick solution necessary to build affordable and efficient housing estates (Wassenberg, 2013). The construction of the Bijlmermeer with its recognisable honeycomb buildings began in 1966 and ended after constructing over 13,000 dwellings in 1975.

After the second world war a strong influence on urban planning and architecture was visible. The CIAM-movement (Congrès Internationaux d’Architecture Moderne) and its most famous member Le Corbusier presented an answer for Europe’s housing shortage during the 4th convention in 1933 (Wassenberg, 2003). The idea of massive high-rise buildings and the idea of the “functional city” were supposed to solve all urban and social problems in a specific way. Combined with the idea of Howards’s Garden city the ideology of the perfect city was born: A strict separation of traffic was achieved through elevated levels. Parking garages connected to the housing estates put the car as the central element of the city. Facilities and workplaces are supposed to be outside of the residential areas (Wassenberg, 2003).

The concept of collectivism was meant to create a socially included neighbourhood (Blair & Hulsbergen, 1993), which couldn’t be achieved and resulted in an increase of social problems (Wassenberg, 2003).

Nevertheless, Bijlmermeer was the first city developed on large scale with the full range of CIAM ideologies incorporated (Wassenberg, 2003) – the geometric high-rises within parks, the strict division between living, traffic and functions as well as the approach of communal living – and is therefore an important pilot and example of the post-war movement in architecture and urban planning.

Since then, Bijlmermeer has gone through a long time of change and renewal. Social problems and vacancies lead to the demolition of a significant number of high-rise buildings (see Figure 2). Many starters living in the affordable flats lead to a transformation of use as it was intended in the first place. A lack of cars resulted in empty parking garages. Changes in the traffic organisation resulted in lowered streets bringing pedestrians and cars back to the same level. “The argument of social safety wins over traffic safety” (Wassenberg, 2003). Nowadays, many of the original 31 parking garages were transformed or demolished, making space for new housing or other amenities (Wassenberg, 2003). Additionally, an architectural counter movement of the 80’s within the Bijlmer created a strong border between the high-rises and the low- and mid-rise dwellings of H-Buurt (Wassenberg, 2003). The diverse architectural language of the time lead to strongly independent identities within the areas. The variety in appearances, as intended, splits the H-Buurt in segregated sub-neighbourhoods, which is perceived by residents and other stakeholders as problematic and desirable for change, as research shows.

The major changes in the urban tissue, made in the 90’s, seem to lead towards a total change of identity of Bijlmermeer. An identity that tells a story about housing shortage in the second half of the 20th century and its proposed solution(s).
2.2.1 URBAN ANALYSIS - H-BUURT

BIJLMERMEER | PARTLY DEMOLITION OF BIJLMERMEER
Original Bijlmer has been constructed including 31 car parks (1 for each high-rise). Nowadays, many of these car parks have been demolished and turned into open-sky parking lots with no quality. Only a handful of parking structures are still used. World of foods has been the first car park that has been transformed into a new function serving society (Lingotto, n.d.). In general, the car parks are situated along the main roads, which make them very well connected and offer high value for a transformation into a different function. Out of the remaining car parks 4, including Hakfort, are designed with the same structural concept, which make them highly transformable. The remaining car parks offer a sum of over 25,000m² which can be used for communal or social functions for the area of Bijlmermeer.
HAKFORT I SITUATION

SCALE: 1:20000
DATE: 21/1/14

HBU_02_01.002
Bijlmer’s concept as a functional city put the car in the centre of the urban layout. Therefore, Bijlmer is surrounded by several highways which provide opportunities to reach over-regional destinations quickly. This high connectivity of highways is continued within the district by large streets that serve the high traffic and act as distribution for all traffic that arrives via highway.
Additionally to the well connected street connections, Bijlmer is also connected to the regional and over-regional public transport network. With Bijlmer-Arena, the area has a good connection to trains reaching all of the Netherlands. A metro-station close to Heesterveld (Station Bullewijk) offers opportunities to reach Amsterdam central station in under 20 minutes.
A well connected bus network connects smaller parts of the area to the larger distribution networks, i.e., metro and train. Amstel III, as a new development area is well connected towards H-Buurt and the new developed connection towards Holendrecht complements the north-south connection coming from Bijlmerplein. Metro and Train are reachable within 10 minutes walking distance (H-Buurt).
Bijlmerplein, Hoptille and Heesterveld/Hakfort position itself along multiple routes. The main connection leads along Hoptille from north to south and is accessible via bike and as a foot path.

Being just a transitioning space the path does not lead towards main squares or how Christopher Alexander describes the need of meeting places in *A Pattern Language* as connectors between gateways and restricted areas like residential areas. These meeting places do not exist in the current urban layout or are not sufficiently designed to fulfill this function. IDencity aims to be part of a new connective routing through H-Buurt and beyond by creating an urban node between Hoptille and Hakfort that connects the area on a regional scale and creates the needed meeting places for society to connect.
2.2.2 STAKEHOLDER ANALYSIS - H-BUURT

H-BUURT (COLLECTIVE RESEARCH)

To kick off the graduation studio, the group divided into four smaller groups. Each was appointed a Maker according to Howard (2003) in order to cover different perspectives in the area. The division was as followed: Insiders/Outsiders, Owners, Makers, and Government.

A collective strategy and method were developed to create comparable results across all groups. Different methods can be used by the groups to achieve an in-depth overview of important attributes, which have been translated into Codes in a later stage. The coded attributes and values lead to an overview over all stakeholders and enabled an analysis on important matters within H-Buurt.

CONCLUSION

After gathering all this information, conclusions can be made. The first method was the value matrix. The matrix shows the attributes on the y-axis and the values on the x-axis. The matrix connects the two. Based on the collective photos that have been shown to different stakeholders, there will be an analysis of the codes and put into the matrix. Tangible and intangible codes will be either red (high value), orange (mid value), or green (low value). By putting all the photos into the matrix, one can see which attributes and values are important relating to that particular photo.

A second method is more quantitative. This is a table based on the previously mentioned value matrix, a value table so to say. This table shows how often certain attributes and values were mentioned and can give insights on the importance to stakeholders.

All mentioned attributes and values will be translated into the most important themes for all stakeholders, e.g., the topic of distinctive neighbourhoods. This can analyse alignments and discrepancies between stakeholders’ opinions and values to define the most pressing matters needed to be enhanced or tackled. Results imply a needed improvement of public spaces with a stronger vision. Furthermore, the diversity of dwellings, especially the spaciousness, is appreciated by both residents and owners. The Government, on the other hand, would like to diversify the dwellings even more and introduce more mid-income housing. The distinctive identities of H-Buurt have been worked out as a key-element which needs to be maintained but more connected to each other to soften the boundaries between sub-neighbourhoods.

The full research including tables and sources can be found in the collective research paper.
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**STAKEHOLDER RESEARCH I METHODS**
STAKEHOLDER RESEARCH | CHARACTERISTICS H-BUURT (RELEVANT THEMES HAKFORT)

- distinctive neighbourhoods
- mono-functional neighbourhood
- "no eyes on the street"
- human scale
- unintended use of spaces
### 2.2.3 SOCIAL ANALYSIS - H-BUURT

<table>
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<td>REDESIGN OF STREETSCAPES</td>
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</table>

- extensive green spaces
- large building footprints
- wide streets
- qualitative green spaces
- smaller building footprints
- pedestrian and cyclist streets
- multifunctional public spaces
- reuse of existing building footprints
- sharing economy
- 3D mix of functions
- reuse of existing structures
- more efficient use of spaces
- qualitative green spaces
- design of social spaces
- building up on existing identities
- redesign of streetscapes

**“MORE HELPS MORE”**

**“THE SMALLER THE BETTER”**

**“LESS IS MORE”**
## Socio - Cultural Analysis

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¹Wassenberg, 2013  
²Bocagri, et al., 2015  
³Meijering et al., 2014  
⁴Kreuzer et al., 2018  

LITERATURE RESEARCH

RESIDENTS STATEMENT
### Social - Spatial Improvements

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¹Gemeente Amsterdam, n.d.  
²Gemeente Amsterdam, 2011  
³GVB, n.d.  
⁴Kreuzer et al., 2018  
⁵Munger, 2016  
⁶Stora Enso, n.d.
2.3 URBAN ID

The Urban ID portrays significant elements of the urban tissue and urban connectivity. Divided in six elements, the elements show parts of the street scape, landscape and the existing buildings.

Together these elements define a visualized identity of the urban tissue.

The height differences between Car Park Hakfort and high-rise Hakfort are inevitable visible and don’t present architectural coherence. The emphasized entrances of high-rise Hakfort clarify the position of the building’s access, even though the architectural quality is questionable. The angled corners at the ending of the building creates interesting urban spaces that can define the urban tissue. The closed plinth of Hakfort creates safety problems within the area and needs attention. Heesterveld, as a renovated building ensemble, is very much visible due to its coloured facade and modular appearance.

To provide some value to the mentioned elements, the attributes are colour-coded. Elements that are favourable to keep during a transformation are coloured green, unfavourable elements are coloured red. This give opportunities to the later design stage and the importance of the existing urban tissue.
3 CAR PARK HAKFORT

3.1 HISTORY

3.2 URBAN ANALYSIS

3.3 BUILDING ANALYSIS

3.4 VALUE ASSESSMENT

3.5 BUILDING ID
The already mentioned honeycomb building type can also be found in Hakfort, which is situated next to Heesterveld. The large high-rise complex houses around 400 apartments and has been part of the 31 housing estates, which were part of the original layout of Bijlmermeer. Hakfort as well as the high-rise of Huigenbos have been connected to car parks, which were connected to the elevated roads of the Karspeldreef (see Figure X). Both buildings, High-rise building and car park, have been constructed in 1975 and were one of the last honeycomb buildings built. Hakfort, as part of H-Buurt, has been part of many redevelopment process within the area. The buildings have been renovated and connect to the Bullewijkpad, which is part of the larger bike-network of the west-east axes between Mandela park and the business district of Bullewijk. Furthermore, Hakfort is situated right next to the Heesterveld Creative Community (HCC), which has been a major redevelopment by the owner Ymere to transform the poorly performing dwellings into a cultural hotspot.

The connection between the dwelling complex and the car park has been removed, so the car park stands alone.

Deriving from the functional city approach, the housing complex had direct access to the elevated street network of the Karspeldreef via the car park Hakfort.
3.1 URBAN ANALYSIS - CAR PARK HAKFORT

First on an urban scale. The area is very well connected on a regional and district level and is situated along main movement axes from west to east and north to south. The new development of Amstel III as well as the connection towards Holendrecht improves those axes and enhances the creation of urban nodes.
Those central areas are already the functional highlights of the area but need further attention to gain more significance and quality. These urban nodes are placed between Hoptille and Hakfort and can act as the needed meeting places that Alexander introduces in his book *A Pattern Language* (1977) to enhance the urban connectivity.
The two urban centres put Hakfort into the centre of several districts. The current Bullewijkpad does not represent this importance but can be redeveloped into a boulevard with a vibrant function. Therefore, it has to be dealt with the closed plinth adjacent to the Bullewijkpad, the street scape that does not provide urban functions and the non-emphasized corners of the current building.
The current routing starts and ends with the lower level for cyclists and pedestrians. The upper level towards Karspeldreef is only possible through hidden routing and non-accessible stairs, which disturbs the urban tissue. To connect the overall district, the disconnection between the upper and the lower level has to be solved.
3.3 BUILDING ANALYSIS - CAR PARK HAKFORT

SITE
The building currently connects on two levels to its urban surroundings: A ground-floor level with shops connects to Bullweijkpad, which is mainly used by cyclists and pedestrians, while the first level connects to the elevated street level of the Karspeldreef and therewith to the regional street network. A close by bus station as well as the metro station makes the building very connective within the H-Buurt as well as on a regional level.

SPACE PLAN
To offer parking opportunities to the high-rise building, the car park represents itself with a footprint of more than 5000 square meters for over 500 cars. Each level measures roughly 100 times 50 meter. The ground-level (Bullewijkpad) has a split use: The southern part is used for shops, while the north-facing part of the building is used for parking. The first level (Karspeldreef) as well as the roof level are entirely used for parking.

STRUCTURE
The structure of the building is made of 132 pre-stressed concrete frames in a basic grid of 4,80m, which are connected via floor slabs. The concrete frames are prefabricated and span over one bay of 16m. 120mm thick floor slabs allow a standard floor-to-floor height of 2,80m with an usable height of 2,68m (in between beams) or 2,14m (below beams). An exception is the shop area of the ground-floor, which is with 3,80m one meter higher than the other levels.

The central bay is mainly used for the circulation ramp. The top ramp leads to the roof level.

designed for a later extension, the top ramp could be connected to a third level. Column caps on the roof allow a load-bearing connection of a new level of concrete frames to the existing frame structure.

This extension has not happened.

SKIN
Being mainly a car park, the envelope of the building is rather limited to fences and railings. Later added materials, such as polycarbonate sheets, single glazing and aluminium sheets are supposed to offer a differentiation of storage units towards the outside. The glazed stair-cores are adjacent to outside air and offer solely wind protection.

The shop level, on the other hand, is being used for mainly food stores and therefore requires a thermal envelope. Yellow garage doors and small scale glazing framed by a brick wall represent the identity as a car park, but do not offer a representative front for the shops.

There is no insulation present in the facade built-up.

The facade grid is not aligned with the construction grid.
EXISTING MATERIALS

Car Park Hakfort, constructed of concrete and other carbon intensive materials presents itself as a massive carbon “storage”.

The original car park is made of prefabricated concrete frames, which are the main structure. They span over 16m with a 4.8m grid. In-situ concrete slabs with a thickness of 120mm connect the frames. In total, 132 concrete frames of the same size hold up the whole building.

Later during minor renovations other materials have been added. Additionally to the already existing single glazing that shields the existing stair cases, steel fences have been added around the first floor. Because added materials are connected via dry connections they have a high re-use potential which is backed up by the high embodied carbon.

To analyse the environmental value of the building’s structure, a carbon calculation shows that the building embodies almost 1000 tons of carbon, which is, so to say, already paid off by the environment.

Therefore, the reuse of the existing structure can lower the environmental impact, compared to a new-built, immensely.

DESTRUCTION

The existing layout of the building is very efficient for the use as a car park. Nevertheless, the non-use in the current stage shows that parking facilities are not as much needed as during the time of construction in the mid 70’s. This is backed up by research that show that not even 50% of the households in H-Buurt own a car (Wassenberg, 2013). The adaptive re-use of the car park, on the other hand, comes with minor demolitions of the existing structure. New stair cores, installation shafts and the opening of the central area of the ramp result in a quantity of around 200m³ demolished concrete which equals around 68 tons of embodied carbon or 7% of the buildings embodied carbon. Part of the demolished elements can be re-used for the new development. The concrete slabs, for example, can be reused for new stair cores, which have to be, according the European fire regulations, still of non-combustible materials.

The following graphic shows the materials that are available for re-use or recycling after dismantling the building and preparing it for the building intervention.

MATERIAL INVENTORY
**Embodied Carbon Calculation**

<table>
<thead>
<tr>
<th>BUILDING PART</th>
<th>QUANTITY</th>
<th>M³/QUANTITY</th>
<th>KG CO²/M³</th>
<th>TOTAL CO²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONCRETE FRAMES</strong></td>
<td>132 pcs</td>
<td>4.56 m³</td>
<td>465 kg</td>
<td>274 t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONCRETE SLABS</strong></td>
<td>14.850 m²</td>
<td>0.12 m³</td>
<td>350 kg</td>
<td>623 t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STEEL</strong></td>
<td>1.125 m</td>
<td>35 kg</td>
<td>2 kg</td>
<td>79 t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SINGLE GLASS PANES</strong></td>
<td>280 m²</td>
<td>-</td>
<td>28 kg</td>
<td>8 t</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>984 t</td>
</tr>
</tbody>
</table>
EXISTING FLOORPLAN | 01 DEMOLITION
3.4 VALUE ASSESSMENT - CAR PARK HAKFORT

CAR PARK HAKFORT EXISTING

The value assessment of the car park has been done in addition to the collective research on the H-Buurt where the car park has not been part of.

The value assessment takes an adapted version of the combined Heritage value table by Clarke and Kuipers (Clarke and Kuipers, 2017). Here the Building ID comes into place. Important elements of the car park have been structured after the adapted version of Brand’s “six 6’s” (see page XX) to define tangible attributes of the car park.

Those defined attributes are now analysed by its values defined by Riegl’s adapted value scheme. Therefore, values between 0 (low value) and 5 (high value) determine the attributes importance to the building and its surroundings. A comparison of the existing condition and the state after the intervention can reveal the efficiency of the intervention and therewith the added value of the project.

The relevant attributes chosen for the building are: Surrounding/Setting, Site, Skin, Structure, Space Plan, Surfaces (Interior), Spirit of Place, while the following values are analysed by its impact: Age value, Historical value, Economic value, Use value, New-ness value, Art value, Social value, Environmental value.

BEFORE INTERVENTION

AFTER INTERVENTION
**SURROUNDINGS / SETTING:**

**ELEVATED ROAD (KARSPELDREEF)**

**AGE value:** The Karspeldreef has been part of a major renewal of the areas access system and therefore has rather low age value. The intervention does not influence this value.

**HISTORICAL value:** The elevated road as part of the original plan as a functional city has high historical value. The intervention does not influence this value.

**ECONOMIC value:** The elevated road acts as a major connection between west and east Bijlmer, which is used by all kinds of traffic. The new connection to shops and the mobility hub increases the economic value further.

**USE value:** The Karspeldreef is a highly frequented road, which connects H-Buurt to the regional network. The intervention integrates several functions to support this value.

**NEW-NESS value:** No major changes over time result in a low newness value that results solely on the used materials of the road. The changed layout of the street access influences this value positively.

**ART value:** Art can be found in the large underpasses of the road. The intervention does not influence this value.

**SOCIAL value:** The social value is high due to the connection within the neighbourhood.

**ENVIRONMENTAL value:** The transformation to a sustainable mobility hub creates new value to the street with its adapted use.
SITE:
DIFFERENT ENTRANCE LEVELS

AGE value: There is low age value found in the entrance levels. The new urban connection lowers this value further.

HISTORICAL value: The differentiation between functions can be found in the separation of levels and has high historical value, which is kept with the new functions.

ECONOMIC value: The different entrance levels allow a connection of fast speed traffic (cars) and low speed traffic (pedestrians) to the shop level. An enhanced connection and added functions create an economic hub within the former car park.

USE value: A currently low value is due to then non-use of the car park and seen as a threshold. The intervention connects the different level on both an urban and building level, which results in a high use value.

NEW-NESS value: The new-ness value is low right now but is influenced by the new landscaping of the urban tissue positively.

ART value: There is no art value found.

SOCIAL value: The different entrance levels are seen as a threshold and have low value according to residents and isolate the car park, which is resolved by various connections between Bullewijkpad and Karspeldreef.

ENVIRONMENTAL value: The environmental value is given by the green buffer zone between residential area and street. The value is not influenced by the intervention.
SKIN:
SHOP FACADE BULLEWIJKPAD

AGE value: The façades have been replaced and don’t show significant age value. The intervention lowers the age value further by adding new elements to the facade.

HISTORICAL value: The garage doors have a high historical value due to its meaning. The intervention introduces new elements, which refer back to the original facade to keep the historical value.

ECONOMIC value: The current shop facade has low economic value due to its limited exposure for the shops. The new facade will provide the needed exposure to create value for the shops.

USE value: The current facade is closed off and cannot be utilized as representative facade for the shops. The new open facade allows lively interaction between building and surroundings.

NEW-NESS value: The new-ness value of the current facade is low and will be enhanced through modern elements.

ART value: The yellow garage doors have high art value and connect to the yellow columns. The new window frames translate this value in the new facade.

SOCIAL value: The social factor of allowing connections will be influenced positively

ENVIRONMENTAL value: The reuse of existing elements will enhance the value of the facade.
**STRUCTURE:**

**PREFABRICATED CONCRETE FRAMES**

**AGE value:** The structural frames have a medium age value due to their age. The intervention does not influence this value.

**HISTORICAL value:** The car park as part of functional city Bijlmer has high historical value and with it the concrete structure. The intervention does not influence this value.

**ECONOMIC value:** The economic value is currently not used due to the car parks non-use. The new functions and the addition will create massive economic value to the structure.

**USE value:** Currently not used, the reused structure offers high use value with new functions.

**NEW-NESS value:** The yellow painted frames have some new-ness value and are not affected by the intervention.

**ART value:** The yellow columns have medium art value and will be kept. The exposed concrete can influence the art value within the new functions.

**SOCIAL value:** There is no social value within the concrete frames.

**ENVIRONMENTAL value:** 900t of embodied carbon found in the structure have high environmental value, which is kept through reuse.
SPACE PLAN:
CENTRAL CIRCULATION (RAMP)

AGE value: The ramp has signs of its age, the concrete needs improvements in some areas. Some gasoline stains show the function of the car park. The intervention lowers the age value slightly by keeping the existing as much as possible.

HISTORICAL value: The ramp does have some significant historical value due to its function, which is not affected by the intervention.

ECONOMIC value: The central ramps has currently low economic value due to its non-use. The usage as a event space increases the economic value of the space significantly.

USE value: Since the car park is currently not used as such, the ramp has low use value. The intervention increases this value by creating a gathering space for the neighbourhood.

NEWNESS value: The rather used materials result in a low new-ness value. Small additions improve this value.

ART value: There is no current art value found, but added by the new use. The ramp as a social space with the material mix has medium art value.

SOCIAL value: The social factor of allowing connections will be influence positively. The aim is to create a space where people can and want to connect.

ENVIRONMENTAL value: The reuse of existing materials will enhance this value.
SURFACES (INTERIOR):

EXPOSED MATERIALS

AGE value: Surfaces of the existing car park show signs of its age, which relates back to its former use, which shall be kept during the intervention.

HISTORICAL value: The concrete as major construction material in the area relates to the functional city approach, which has some value and will be kept as much as possible during the intervention.

ECONOMIC value: There is no economic value found in the exposed materials.

USE value: A simple structure with no coverings allows a very efficient building, the use value is high. The idea of un-covered materials will be kept during the design.

NEWNESS value: The new-ness value can be limited to added materials like fences inside the building and are low. The redesign tries to showcase materials as much as possible and increases this value.

ART value: “Brutal Concrete”, which has rather low art value now, but can be increased by changing the setting of the function within.

SOCIAL value: There is no social value found in the exposed materials.

ENVIRONMENTAL value: No wall and floor coverings means also lower material use, which results in medium value (high, with no concrete). The redesign tries to enhance this value by reusing a maximum of the materials.
**SPIRIT OF PLACE:**

**FOOD SHOPS**

**AGE value:** The food shops have been added rather recently, which results in a low age value, which will be decreased by the redesign.

**HISTORICAL value:** The shop function on the ground floor derives from the original layout, which has a high historical value and will be kept.

**ECONOMIC value:** The international food shops have a medium value at the moment due to its limited exposure. The makeover will increase the economic value and will create good possibilities to both resident and shop owners.

**USE value:** The use function is high, even though the shops have more opportunities for its functionality. The redesign focuses on opening the shops, so this functionality will be given.

**NEW-NESS value:** There is currently no new-ness value found. The new shops will have new street façades, which increased’s the newness value.

**ART value:** There is art value in form of a variety of food specialities found in the shops, which will be kept.

**SOCIAL value:** The social factor of offering services to society is high and will be increased with a better connection with the surroundings.

**ENVIRONMENTAL value:** There is no environmental value found in the food shops.
**3.5 BUILDING ID - CAR PARK HAKFORT**

The Building ID shows - as the Urban ID - significant elements of the building and its direct surroundings. Divided in six elements, the Building ID uses Brand’s 6 S’s to define one significant element of each “layer”. Together these elements define a visualized identity of the building.

The building is clearly defined by its two different entrance levels, which connect towards Karspeldreef and Bullewijkpad. The facade towards Bullewijkpad is clearly defined as a store front, which is currently closed off. The central ramp gives the building its car park identity and is a crucial part of the inner circulation. The existing materials of the building provide an industrial character which is even enhanced by the regular structural grid. Even though the shop facade is currently closed off, the food shops represent the cultural diversity of the neighbourhood with several different culinary options.

To provide some value to the mentioned elements, the attributes are colour-coded. Elements that are favourable to keep during a transformation are coloured green, unfavourable elements are coloured red. This give opportunities to the later design stage and the importance of the existing building.
4 IDENCITY

4.1 PROBLEM STATEMENT | RESEARCH QUESTION

4.2 THEORETICAL FRAMEWORK

4.3 DESIGN VALUES

4.4 URBAN CONCEPT

4.5 BUILDING CONCEPT

4.6 REFLECTION
The existing housing stock – rental and owned – counts around 8,000,000 homes in 2020 (CBS, 2020). Around 70,000 new homes have been built in 2019 (CBS, 2020), but space for new housing is getting rare. The solution for the housing shortage, especially in metropolitan areas, cannot be to rely on new built homes only. Change to the existing housing stock is unavoidable to be able to house the increasing number of citizens. Both redevelopment and renovations can offer a sustainable solution to tackle the short-term housing shortage and improve both social and spatial quality (Van den Dobbelsteen, 2004 and Ungers, 1977). Nowadays, we know that the construction of anonymous high-rise buildings, like the Bijlmermeer, was only the solution to the extreme housing shortage but resulted in other – also severe social – problems (Wassenberg, 2003). On the other hand, the innovative (contrasting) approach of the 80’s part of H-Buurt didn’t solve all problems at once but introduced new problems to the area that needed to be solved and changed the intended use and function of buildings (Wassenberg, 2003). Therefore, the current topic of new housing needs to be addressed on basis of mistakes that have been made in the past, while using the past’s identity to build up on.

The history of the Bijlmer derives mainly from ideology of “the functionalist city” that has been defined during the 4th CIAM convention in 1933 (Mumford, 2002 and Wassenberg, 2003), which put the car as the central element of a city and strives for a strict separation of functions within the city (Gemeente Amsterdam, 2007 and Wassenberg, 2003). This functional approach on city planning is still visible in the current layout of the Bijlmer. Elevated streets and the huge housing complexes still define today’s urban tissue, which gives the district identity on the one hand, but lacks in today’s relevance of multi-functional buildings and an integrated urban plan, which connects various elements of the city on different levels (Alexander, 1977).

Identification plays a major role in the development of new housing, since the genius loci needs to be taken into account to merge old and new (Moore, 2003). The placement of new buildings can enhance identity but can also result in disorder. Therefore, it is key to define a clear identity of an area before intervening in the existing or non-existing building stock to make sure that redevelopment projects unite areas instead of dividing them.

Almost 1,000,000 homes are needed until 2030 in the Netherlands (Government, 2020). This housing shortage is something that has to be solved on a national scale while achieving carbon neutrality by 2050. Almost 75% of the Dutch rental housing stock is regulated. This housing is meant for people with an income up to 37,000€ and have a rent cap at currently 737€ (Government, 2020). Since a vast majority of the overall rental housing stock are either low- or high-priced rentals, the Netherlands is facing a mid-priced rental shortage (Government). This evolution of housing shortage can be correlated back to the 60’s when post-war Netherlands was also facing a lack of dwellings. A quick answer to this problem was the construction of replicable and prefabricated buildings. One of those examples is the Bijlmer. Solutions based on the functional city have been chosen and were supposed to relief the need of housing quickly (Wassenberg, 2003).

H-Buurt, as the chosen neighbourhood of intervention, offers many opportunities to redevelop and strengthen both on a building level and a social level, yet one of the most critical aspect which has been worked out through research is the lack of identity within the overall neighbourhood. The disconnection between the three areas within the H-Buurt has been addressed several times during the collective research of the area. Multiple stakeholders mentioned the issues of lacking sense of ownership by residents, a missing overall vision for public spaces and an unintended use of spaces throughout the neighbourhood. The original plan of Bijlmer had all these topics covered within the approach of a functional city, but unforeseen problems led to unintended use of spaces and a lack of qualitative greenery. Furthermore, the destruction of large areas and buildings during the last decades resulted in a fragmented character of various
planning concepts and styles. The combination between functional city, its intended efficiency and the innovative “anti-Bijlmer” (Wassenberg, 2003) of H-Buurt created both variation in the urban tissue and a stronger disconnection between individual areas. Combined with the challenging society living in the areas, an intended identity was not only not achieved but even inverted and resulted in unsocial areas within the Bijlmer with a weak identity (Wassenberg, 2003). The challenge of enhancing identity has to be accomplished on a neighbourhood scale.

RESEARCH QUESTION

How can the adaptive reuse of car park Hakfort offer solutions to current challenges while strengthen the genius loci?

Sub question 1: How can the transformation provide an answer to the national goal of carbon neutrality by 2050?

Sub question 2: What possibilities of serving the one million homes challenge can be achieved while keeping the existing car park’s structure?

Sub question 3: How can the adaptive reuse enhance the buildings’ value to society?

PROJECT AIMS

Therefore, IDencity deals with matters of the current identity, possibilities of densification while pushing sustainability towards carbon neutrality and a circular economy. Following design questions shall be addressed:

Identity - What is?
The local identity faces major changes due to new developments which seem unconnected with the current genius loci - How can the reuse of car park Hakfort strengthen the local identity by dealing with the existing?

DENsity - What could?
The national housing shortage aims for densification measures in the area of intervention (Gemeente Amsterdam, n.d.) - How far can the development of Hakfort in its current condition – including its environmental and social factors – be pushed „in order to calibrate the intervention according to the context’s spare capacity and the possibility to improve the quality of the urban context.“ (S. Fatone, E. Conticelli & S. Tondelli, 2012) to contribute to the municipal densification strategy?

CITY - What should?
H-Buurt faces challenges on both an urban and a building level, which need to be addressed - How can IDencity impact those challenges in a suitable way that considers economical, ecological and social needs to improve the overall area?
Europan’s winning competition entry *Foam of production* proposes a small scale building ensemble next to the demolition of car park Hakfort. The concept introduces new types of buildings and a urban tissue that do not relate to Bijlmer’s past as a CIAM city. Furthermore, added functions that seem not be needed raise the question of appropriateness. IDencity takes this point of departure to...
...DEVELOP A BUILDING - BASED ON ITS PAST AND CURRENT IDENTITY - THAT SERVES AS A SOCIAL HUB THROUGH ITS VIBRANT AND CONNECTIVE FUNCTION WHILE SHOWCASING AN OPTION TO KEEP THE CURRENT STRUCTURE OF CAR PARK HAKFORT IN PLACE.
The goal for this project is to develop a solution on how to deal with the existing building stock to make them both future proof and offer good quality housing. Since the topic of social housing is closely related with social, ecological and economical topics, research will be made based on a realistic focus including a vision on future living in a city. The Bijlmer as an example of a functional city needs to adapt to both current needs of its residents and the future needs of the environment. The change from a mono-functional and segregated structure towards a multifunctional and integrated one is inevitable to tackle the status quo (Alexander, 1977 and Wassenberg, 2003). A clear theoretical framework shall help to make decisions based on “needs” rather than “wants” while still merging functionality and aesthetics to an integrated design with following sub-research themes, which need to be related back to the two main themes of densification and identification. The answerable question would therefore be e.g. “How does Densification serve the societal needs?”:

SOCIAL NEEDS – WHAT DOES SOCIETY NEED?
“Zuidoost wants to be a district where residents feel at home. One with a diverse and balanced population composition that varies in income, life phase and lifestyle. One with a population that feels involved, who wants to work for its neighbours, street, neighbourhood and district.” (Woonvisie Zuidoost 2020)

This research will be mainly based on information gained through in-person interviews, articles and other research, which is solely based on the resident’s perspective and has been conducted in Q1. This could include housing types, public transport, public spaces, amenities and other elements which seem important to residents. This research will be vital to define an identity of the neighbourhood. This defined identity will give the main impact on the design solution. What seems to be the identity of the area? What elements can be neglected? How can the existing identity be translated into a future proof design (socially and ecologically)? What is essential to spread the identity further and how much densification is acceptable for both the neighbourhood and residents?

Furthermore, theories on city planning down to a building scale like A Pattern Language by Christopher Alexander (1977) as well as Jan Gehl’s Life between buildings (2011) will guide an intervention so it becomes not only socially compatible but also gives something back to society and surroundings.

This aims for a theoretical research framework implementable in different post-war neighbourhoods to give a strong basis for the design development.

ECOLOGICAL NEEDS – WHAT DOES THE ENVIRONMENT NEED?

“In order to achieve the emissions reduction target for 2030 […] in the built environment, roughly 1.5 million existing homes will have to be made more sustainable” (Klimaatakord, 2019)

Resilience and new ways of energy use play a major role within the built environment. Therefore, it is crucial to find innovative ways to adapt or create a future proof building stock. This study will be based on research into innovative materials, systems and construction methods, as well as passive solutions which impact the micro climate of the direct neighbourhood. This combined with the existing building drawings can be developed into a future proof building, which supports environment but also a healthy society through smart construction and spatial use (Van den Dobbelsteen, 2004 and Wassenberg, 2003). Sustainable Building Adaptation (2014) written by Sara J. Wilkinson et al. can facilitate the decision-making process on an ecological basis and draws concepts for adaptive re-use of buildings while building up on the existing building rather than transforming it entirely. An ecological approach shall include the question on how much densification does ecologically make sense where a line can be drawn between what is inevitable to shift towards a carbon-neutral built environment and elements that are “nice to have” but not indispensable.

The aim of this research part is to translate the defined identity into technical solutions that both fit into the neighbourhood and
strengthen recognisable (design) elements.

ECONOMICAL NEEDS – WHAT ARE THE FINANCIAL POSSIBILITIES?

“The world is changing increasingly rapidly due to global trends, geopolitics and technological innovations, and as uncertainties become a fact of life, organisations will need to adapt more quickly and constantly modify their scenarios for the future.” (Bouwinvest)

This part of the research will focus on how to combine the social and ecological needs into a viable project. The goal is to find a solution which is not only innovative, but also feasible out of a stakeholders perspective. Identity is hardly measurable in numbers, but socio-economic research can help to set up a financial frame not only for owners, but also for residents to find a balance between added value for residents (identity) and profit for owners (densification). A financial model will be facilitating design decisions, backed up with feasibility studies and cost estimates to find the sweet spot between all three needs to form a real integrated project. Information will be extracted through literature review (i.e., Yearly business reports, cost analyses, investment strategies) and the involvement of real stakeholders to understand their needs and possibilities.

The economic framework is supposed to support design decisions rather than revise them.
4.3 DESIGN VALUES

CHOICE OF DESIGN VALUES
Discussing existing values of the car park and its surroundings, connected to societal, environmental and economic needs can define key values for the design. The aim of those values is to streamline the whole project, so each design decision is to enhance the value of the intervention. Furthermore, by defining these values, it can be made sure that the project aims for relevant topics on a larger scale, like carbon neutrality and the housing shortage in the Netherlands.

Deriving from introduced values and important topics on a regional and national scale, the design values are:

CIRCULARITY, ADAPTABILITY AND AFFORDABILITY

CIRCULARITY
Bijlmermeer, with its functional city approach, relates back to a linear economy and a quantitative design. Nowadays, we are seeing a change of those attributes. Climate change and resource scarcity forces the built environment to define solutions to fight environmental challenges. By 2050 the built environment has to have become carbon neutral, but this can only be achieved by changing the way we build. Taking this as a starting point I will introduce several elements which shift IDencity towards a circular re-use project. Based on Kramer’s 10 Rs (see Figure X), the projects priority is to reduce, reuse and then recycle elements.

ADAPTABILITY
Rigid and inflexible building (structures), as we see can them within Bijlmermeer, push towards demolition as soon as needs change. This, on the one hand, allows for new and innovative buildings concepts to be realised, but, on the other hand, create a massive environmental impact due its demolition waste and result in the change whole neighbourhoods and with it their identity. Therefore, to serve both the societal need of flexible housing units and the needed flexibility of other functions, I take adaptability as one of my main values to access design choices.

AFFORDABILITY
Affordability can be seen out of different perspectives. There is for example an user side or the owner’s side, which can result in very different concepts that might not serve both parties equally. Furthermore, circular ways of construction and business models allow both adaptability and circularity while offering huge opportunities to make a product financially viable. By this, I aim to use affordable design solutions to find a sweet spot between added value out of different perspectives.

These design values will not be the only values for decision making but are aiming to design a future proof building concept. On the following pages several key aspects of the project are discussed in further depth.

Figure X: 10 R’s of Circularity, Jaqueline Cramer
circularity*
- reduce
- redesign
- reuse

adaptability**
- flexible spatial design
- multiple use of spaces
- demountable

affordability***
- innovative construction methods
- adequate housing options
- sharing economy

* 10 R's by Jacqueline Cramer, 2015
** Space use optimisation and sustainability by A. van den Dobbelsteen
*** Tomorrow 3.0 - The Sharing Economy by Michael C. Munger
4.4 URBAN CONCEPT

The current connection between the plaza and i.e., the bus station on the level of Karspeldreef is insufficiently accessible. Various urban functions aim to turn the public space into a vibrant area, while urban landscaping aims to create a smooth transition between the two levels. By this, an overall district connectivity can be achieved with the central car park Hakfort.

plaza

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URBAN CONCEPT | CONNECTION PLAZA

1Alexander, 1977
Car park Hakfort presents itself currently as a barrier between Karspeldreef and Buliewijkpad. By transforming the building into a porous building that allows connection between exterior and interior, the direct surrounding can become more lively and impact the overall neighbourhood. The aim of an extended public space within the building will be shown in the next chapter.
URBAN CONCEPT I NEW SITUATION
4.5. BUILDING CONCEPT

CHOICE OF DESIGN VALUES
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Rigid and inflexible building (structures), as we see can them within Bijlmermeer, push towards demolition as soon as needs change. This, on the one hand, allows for new and innovative buildings concepts to be realised, but, on the other hand, create a massive environmental impact due its demolition waste and result in the change whole neighbourhoods and with it their identity. Therefore, to serve both the societal need of flexible housing units and the needed flexibility of other functions, I take adaptability as one of my main values to access design choices.

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These design values will not be the only values for decision making but are aiming to design a future proof building concept. On the following pages several key aspects of the project are discussed in further depth.
3.5 PROJECT ID - IDENTITY

The Project ID shows significant elements of the building and its direct surroundings that will be considered during the design. Divided in six elements, the Project ID uses Brand’s (adapted) 6 S’s to define one significant element of each “layer”. Together these elements define a visualized identity of the project.

The design shall include the two different entrance levels in an aesthetic as well as functional way. The central circulation of the car park shall define the central area of the building and will be reused. The connectivity of the surroundings shall define the functions of the transformed building. The existing shops define the building on the Bullewijkpad side. Therefore, their function will be kept. Aesthetically, the existing concrete structure presents itself extroverted and can provide the transformed building with its past character.

In general, the different elements understand themselves as a first proposal and not as a must-have. Therefore, the level of significance and integration can vary.
### DESIGN PROGRAMME

<table>
<thead>
<tr>
<th>PART</th>
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<tbody>
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<td><strong>WHY?</strong></td>
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</tr>
<tr>
<td>INCLUSIVE SOCIETY</td>
<td>CLIMATE GOALS</td>
<td>RESILIENT APPROACHES</td>
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<tr>
<td>CONNECTING SOCIETY</td>
<td>HONOURING CIAM</td>
<td>SHARING MOBILITY</td>
</tr>
<tr>
<td>SHARING KNOWLEDGE, EXPERIENCE, ETC.</td>
<td>ADAPTING USE TO FUTURE NEEDS</td>
<td>CONNECTIVE FUNCTION OF BUILDING</td>
</tr>
<tr>
<td>FLEXIBLE USE OF SPACES</td>
<td>USE STRUCTURE TO EXTENT LIFETIME</td>
<td>TRANSFORM FORMER USE INTO FUTURE USE</td>
</tr>
<tr>
<td><strong>HOW?</strong></td>
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<tr>
<td>COMMUNAL FUNCTION</td>
<td>ADAPTIVE REUSE</td>
<td>SHARING ECONOMY</td>
</tr>
<tr>
<td>CAFÉ</td>
<td>EXISTING SHOPS</td>
<td>CAR SHARING</td>
</tr>
<tr>
<td>COMMUNAL SPACE</td>
<td>EXISTING ELEMENTS</td>
<td>BIKE SHARING</td>
</tr>
<tr>
<td>CO-WORKING</td>
<td>EXISTING RAMP</td>
<td>RIDE SHARING</td>
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<tr>
<td><strong>WHAT?</strong></td>
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<tr>
<td>COMMUNITY CENTRE</td>
<td>REUSE OF CAR PARK</td>
<td>MOBILITY HUB</td>
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<tr>
<td>“ACTION” RAMP</td>
<td>REUSE MATERIALS</td>
<td>PARK + RIDE</td>
</tr>
<tr>
<td>ROOMS ON DEMAND</td>
<td>GF FACADE</td>
<td>CHARGING STATIONS</td>
</tr>
<tr>
<td>FLEXIBLE WALLS</td>
<td>CONCRETE STRUCTURE</td>
<td>REPAIR SHOP</td>
</tr>
</tbody>
</table>
THE HELLING
the helling: concept

Demounting the ramp brings light into the central part of the building and can result in a better interaction between building and surrounding. By opening the space of the new routing, double height public spaces, emphasised access points and the needed circulation for the housing can enable the liveliness of building and boulevard. But the character of the former function as a car park seems lost. Therefore, I propose to use the demounted concrete frames to give back some of its identity. By lifting them up to the same level an interesting space can be created that serves connective purposes.

With its connective function the space also needs to be designed in a connective way. With over 1500 square meter, the space needs to serve both a communal but also more individual use. Because of the large space, I looked into the design of public spaces and how to create space to linger and ways of separation.

1. demount upper ramp
   In this way, the lower ramp, which connects the ground level and the first level is exposed.

2. expose public routing
   The floor-to-floor height of the existing building does not provide comfortable spaces. Therefore, the public routing along the ramp will be double-height by partially removing the intermediate floor.

3. “new” structure public routing
   By reusing the demounted concrete frames and lifting them to the same height, the ramp becomes a large public place and can act as a connective space.
the helling: concept

A split floor space creates a circulation route on one side, while the other part will be transformed into stairs that bridge the inclination of the ramp. Those steps offer a flexible use on normal days as a communal space and meeting point. Moveable curtains offer some privacy, if needed, while flexible furniture offers a solution to changing needs. Built-in benches offer functional quality along the “facade”. Cabins offer space to change to the event mode. The space can be transformed into an event hall for 160 people that is closed off by a heavy acoustic curtain. The upper space of the ramp is now a multifunctional space for a venue or exhibition.
THE HELLING I EVENT MODE
THE HELLING I FLOOR PLAN
building science
The scale of the ramp brings some challenges with it. With over 70m lengths, the space needs to fulfill high acoustic demands. Therefore, sound absorber, sound deflectors and sound reflectors offer high quality sound for all uses. Speaking of challenges. The stair area should be light over day, but dimmed during events, while the circulation space should always be bright. Skylights above the routing bring in daylight, while reflective surfaces on ceiling and floor reflect the surroundings into the interior. Bigger skylights above the upper and lower ending of the ramp bring extra light in to alternate lighting and spatial qualities along the way.

acoustics sound absorption, sound deflection and sound reflection

lighting skylights, reflective surfaces
**THE HELLING | CONSTRUCTION**

---

**THE HELLING: materiality**

The materiality will refer to the past with its concrete appearance and be completed by low-carbon materials. Standardised, demountable materials secure a circular design. The wooden steps as well as the in-built furniture will bring softness into the space, while the translucent polycarbonate sheets will act as a lively border to the adjacent spaces.

---

1. **skylight** walkable glass, green roof

2. **transfer structure** kerto lvl ceiling, connected to existing structure
THE EXISTING
structure: timber frame facade with aluminium mullions
infill: triple glazing
embodied carbon: +114 kg/m²
use: community centre facade (west, east, north)

structure: timber frame facade with aluminium mullions
infill: double glazing (inside), single glazing (outside)
embodied carbon: +103 kg/m²
use: community centre facade (south)

choice materiality
Currently, the car park has a open first floor. A visual connection to the inside is still possible and exposes the concrete structure of the building. For the new facade, those basic concepts shall be kept, by adding a demountable glass facade which still allows a connection between exterior and interior. The demountable glass facade has standard measurements of 2800mm x 1200mm and glass dimensions of 2400mm x 950mm, which makes the glass panes highly reusable (Beurskens et al., 2017). The timber frame as well as the aluminium coverings can be reused or recycled and allow a sustainable glass facade. The double facade uses existing single glazing (280m² available, embodied carbon: 7.8t) to lower the carbon footprint of the facade.
MATERIALITY EXISTING | INTERIOR WALLS

choice materiality

The demountable, low-carbon timber frame walls follow a standardised grid of 1200mm and allow a high re-usability. The exposed timber follows the concept of the existing car park with honest materiality. The variable facade coverings are adapted to the proposed function behind the wall. Open spaces will have a transparent (or translucent) glass infill, while quiet or office spaces will have single or double planked timber boards to allow higher acoustic quality and visual disconnection.
interaction
liveliness
porosity

URBAN PLAN | CONNECTIVITY VS. ARCHITECTURAL INTEGRATION
THE ADDITION
A load capacity calculation revealed the opportunity for an additional five building layers, which would create a medium between Heesterveld and high-rise Hakfort. Based on the existing grid of the car park, a block layout creates a central courtyard, which is situated above the community hub and connects to a new circulation system. A shading study revealed that five layers result in a mostly shaded courtyard, which would not offer any quality. Adaptations resulted in a stepped roof shape of the addition, which connects the two different building heights of Heesterveld and Hakfort as well as letting light into the courtyard.
## Load Capacity Calculation

<table>
<thead>
<tr>
<th>BUILDING PART</th>
<th>LOADS</th>
<th>TOTAL</th>
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</thead>
<tbody>
<tr>
<td><strong>EXISTING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• based on construction documents</td>
<td>DEAD LOADS</td>
<td>LIVE LOADS</td>
</tr>
<tr>
<td>• based on concrete density: 2.4 t/m³</td>
<td>6.451 t</td>
<td>6.066 t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LOAD CAPACITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• based on possibility of additional 3rd layer</td>
<td>DEAD LOADS</td>
<td>LIVE LOADS</td>
</tr>
<tr>
<td>• additional 10%</td>
<td>2.150 t</td>
<td>2.022 t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADDITION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• based on timber construction with 1.04 kN/m²</td>
<td>DEAD LOADS</td>
<td>LIVE LOADS</td>
</tr>
<tr>
<td></td>
<td>0.254 t/m²</td>
<td>0.255 t/m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LOAD CAPACITY FOR ADDITIONAL STRUCTURE</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
choice

Even though a core accesses 4 units per floor, there would be 5 cores per building block needed to access all units. On the other hand, a gallery access with two cores accesses all 15 units within the 30m reach of escape routing.

To allow private outdoor spaces (balconies) to the south, the gallery will face north.

Staircases faces the street access side. Half of the core space can be used for communal functions (laundry).
FLOOR PLAN | SECOND FLOOR
housing: concept

The housing units are based on the concept of living space towards the facades and functional core-modules. This way the modules are getting light from two sides and the central installation core is stacked above each other. With a widths of 4,8m, the modules offer enough space for one spacious room on each side. With a room height of 2,65m the units have enough space to be transformed to office spaces later on, which creates a certain flexibility of the units.

The hones materiality with light timber allows high adaptibility to various living types for a diverse society.

Connected by a gallery, the residents can connect with each other, while still keeping their privacy of their living spaces.

1. extend stair cores

The ramps' demounted concrete slabs will be reused for the construction of the new stair-cores, which have to be of concrete to comply with the fire-safety rules. The five stair-cores are situated within a distance of max. 30m to each other.

2. timber modules

Connecting to the stair-cores, the added timber modules are situated around a courtyard and have a consistent size of 12.0mx4.8m. LVL as structural material allows lightweight, but strong elements, which can carry up to 5 storeys.
**dwelling modules**

Due to weight limitations for the addition, the added modules have to be designed as light-weight structure, which can be added to the structure of the existing car park. With 0.5t/m² (see load capacity calculation) a timber frame structure complies with the maximum weight added to the structure below.

Hollow floor ceiling elements allow an efficient use of installations and high quality sound insulation. The structure of one module has a negative carbon impact of -500kg (based on embodied carbon calculations), which makes the bio-based structure highly environmentally friendly. Circular claddings, like aluminium and polycarbonate assure circularity of the whole module.

**bio-based structure**

**circular coverings**

-500kgCO²/module*  

*according to LCA of main materials
**single unit:** The single unit offers the central installation core with one bedroom and a spacious south-facing living room. In total, 41 m² offer space for single households (i.e., starters) and couples.

**duplex unit A:** This maisonette has a large open living and dining space on the ground floor and two (or three) bedrooms upstairs. Suitable for families.

**duplex unit B:** This type connects living and working. The ground floor offers a little office for two people, while the upper floor offers the same layout as the single unit.

**double unit:** This unit are two connected single units, which offer a large living and dining space and an additional three rooms. This unit is also suitable for bigger families.
usage zones housing
The modules will have three functional zones. The middle zone will be used for modular bathrooms and modular kitchens. The facade oriented spaces will be used for living space, while the north-facing side will be the access side and the south-oriented facade will locate a private balcony.
Two connected single units form a double unit (flexible living).
private outdoor space housing

The south facing balconies will be cantilevered out from the facade. The reused railings will offer possibilities to grow plants and allow more light into the unit.

The single unit, as well as the duplex have 8 m² usable space, while the double units (as connected single unit) offer 16 m² space. The horizontal appearance of the balconies refers to the gallery flat Hakfort and will be interrupted through the duplex units, which have no balcony on the first floor. This aims to adjust the scale of the long facade to human scale.
Dwellings | Duplex Unit

**IDC_03_00.003**

Installation core

8m² on 2 levels

80m² on 2 levels

8m² private outdoor space

Home-office

Home

91
2 single units à 41m²

1 double unit

**DWELLINGS I SINGLE/DOUBLE UNIT**
FACADE | MATERIALITY

- **Railings**: Reused fence, industrial character.
- **Shop windows**: Reused window frame, accentuated (garage doors).
- **Double facade**: Reused single glass panes, “open” first floor.
- **Facade cladding**: Reused/new polycarbonate sheets, adaptive character.
Reused fence as railings for balconies

**MATERIALITY ADDITION | CIRCULAR DESIGN**

Source: Author
Car Park Hakfort, Amsterdam

Toni Gironés Social Housing Salou, Tarragona

Gallery, made from reused materials

Fence, 1st floor of car park Hakfort
560m² available, embodied carbon 8.60t

Reused fence as railings for balconies
**FACADE 1 CLIMATE ACTIVATION**

- **winter mode** low sun inclination
  - warm air south -> north side

- **summer mode** high sun inclination
  - cool air north -> south side -> HRV

- **air pipes** insulated tubes integrated in hollow floor, air inlet
  - **HRV**

- **air pipes** insulated tubes integrated in hollow floor, air outlet (HRV)
Neutral, climate activated facade
Ventilated polycarbonate sheets

Facade, renovation
A ventilated climate facade can heat the facade (winter) and cool it (summer) with help of a TES (old bricks).

Facade, existing
Insufficient insulation causes heat loss (winter) and overheating (summer).

Heating demand [kWh/m²/a]

273
11

Winter mode
Summer mode

Source: DBZ Fondation Kybernetik, Dwelling, Mannheim

FACADE ADDITION | TECHNICAL INFLUENCE
Facade, addition

The facade with a polycarbonate cladding uses the ventilated gap of 100mm to build up a buffer zone between outside temperature and inside temperature (unit). In winter the buffer zone will be heated up by the low-inclined sun and will flow - per level - from south side (left) to north side (right) or from west to east. A per-story-supply is needed to prevent (even in winter) overheating of the buffer zone. The air flow will be secured by low-energy ventilators. This way the north-oriented facade will get preheated and the overall energy demand will be lowered. In summer, the balconies prevent the south-oriented facade from overheating, while cool air will flow from the north facade towards south and will cool down the building. An exhaust vent lets the warm air out after a heat exchanger extracts the heat for warm water preheating.

Note: This facade type does not reach the needed RC-value of high-performing (and insulated) façades, but achieves a very low heating/cooling demand of the building due to the buffer zone and minimised temperature differences between outside and inside. The level of passive house standard can be achieved (Fondation Kybernetik, 2014).
FACADE I CONSTRUCTION

1. double facade reused glass pane
   green roof

2. modular balcony clt
   reused fence for railing

3. wall timber frame
   climate activated pc cladding

4. attic kerto lvl ceiling
   green roof
## Energy Demand Calculation

<table>
<thead>
<tr>
<th>BUILDING PART</th>
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<tr>
<td><strong>ENERGY DEMAND EXISTING</strong></td>
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<td>• NFA = 80% of GFA</td>
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<tr>
<td>• equals passive house plus</td>
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<tr>
<td>NFA</td>
<td>PRIMARY ENERGY DEMAND</td>
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<tr>
<td>7.006 m²</td>
<td>60 kWh/m²/a</td>
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<tr>
<td><strong>ENERGY DEMAND ADDITION</strong></td>
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<tr>
<td>• NFA = 80% of GFA</td>
<td></td>
</tr>
<tr>
<td>• equals passive house premium</td>
<td></td>
</tr>
<tr>
<td>NFA</td>
<td>PRIMARY ENERGY DEMAND</td>
</tr>
<tr>
<td>8.304 m²</td>
<td>30 kWh/m²/a</td>
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<tr>
<td><strong>ED TOTAL</strong></td>
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</table>

### Energy Gain

<table>
<thead>
<tr>
<th>ROOF SURFACE</th>
<th>ENERGY PRODUCTION</th>
<th>TOTAL ENERGY DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.550 m²</td>
<td>154 kWh/m²/a</td>
<td>392 MWh</td>
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</table>

### Energy Additionally

• covered by other renewable ways of energy (i.e., GSHP)

277 MWh
4.6 CONCLUSION | REFLECTION
CONCLUSION
During the process, environmental challenges as well as societal needs have been extracted as key elements of the proposed project. To deal with an existing structure, which is currently not used and to re-dedicate it to society can show value in keeping existing buildings rather than demolishing them. Additionally, environmental goals, like carbon neutrality and circularity can give impulses to confront oneself with the building in depth. In the framework of “New Heritage”, this results in a value based design that extracts values, enhances them and can result in valuable proposals that helps to transition towards a more sustainable built environment.
In the case of car park Hakfort, high environmental value of its structure, historical value as part of original Bijlmer, as a functional city, can be used to develop a highly connective building, which interacts with society and surroundings.
With its holistic approach, the building tackles relevant themes while offering flexibility to its solution.
The low-carbon and circular design offers a solution to achieve environmental goals while dealing with existing buildings. The presented proposal keeps over 90% of the existing building in place, while over 95% will be reused, which equals the saving of over 1000t of embodied carbon or in other words...a car trip 160 times around the world.
78. To draw a bigger picture: If the already 25 demolished car parks would’ve been transformed in a similar way, over 20,000 tons of carbon could have been kept in place while around 2,000 dwellings and over 150,000 square meter of rentable space could have been created...
Which brings me to my next point: IDencity can be much more than a transformed car park. 120 dwellings fit the densification strategy of the municipality and while being adaptable the building can adjust to changing needs. Furthermore, 10,000 square meter of flexible communal space can have a positive impact on the lives of residents within the district by introducing functions and high quality public spaces inside and outside of the building. Lastly, Identity. IDencity takes the buildings pasts identity of serving society and translates it into a concept that honours the history as a functional city and future proofs an area that undergoes major changes.
The point of affordability is especially important in an area where the average income is below the national meridian. Affordability is also an indicator, if a project is viable or not. By adding 120 dwellings with an average of mid-income rent level, the addition creates not only value to its new residents by providing bright, modern and comfortable units, but also provides a solid return on investment for owners, while the existing structure can enhance the buildings value by providing spaces for people to meet and exchange experiences, skills and knowledge in a surrounding that showcases the value of existing structures.

PERSONAL REFLECTION
Firstly, as in every project I faced challenges and dilemmas. This refers to both design and research. I feel that the size of the project was challenging to work out all parts in the detail, I would’ve liked. Secondly, I understand now that a design can only be as good as its research, which makes IDencity focus on one topic more than another and can not solve all challenges equally good. Lastly and most importantly, I learned that sustainability is much more than implementing green roofs and timber structures. Replacing concrete structures with low-carbon buildings might not be the most sustainable solution, if including the demolition waste of a building. Therefore, this project got me very much interested in exploring options of circular construction and transformation to make use of embodied carbon and being able to build up on the existing identity of buildings and surroundings.
IDENCITY | AFFORDABILITY

IRR of 8.3%*

*according to financial model with €1650/m² construction costs and €850 rent/unit
VISUALIZATIONS
5 APPENDIX

5.1 REFERENCES

5.2 FINANCIAL MODEL

5.3 SOURCES
5.1 REFERENCES
MULTIFUNCTIONAL CAR PARK JAJA ARCHITECTS, DENMARK

REFERENCES | MULTIFUNCTIONAL USE
CULTURAL ACTIVITY CENTER OF BEIJING MAT OFFICE, GUANG’ANMENNEI COMMUNITY

REFERENCES | BOX-IN-BOX
WORLD OF FOODS TED SCHULTEN & HARVEY OTTEN, BIJLMERMEER

REFERENCES | ADAPTIVE RE-USE
GRIDGROUND SQUARE OPENFABRIC + DMAU, AMSTERDAM

REFERENCES | URBAN FUNCTIONS
5.2 FINANCIAL MODEL
## Financial Model

### Development Costs
- **Housing**: €12,959,100
- **GFA**: 7854 sqm
- **Development Costs per sqm**: €1650

### All-Inclusive Development Costs

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<th>Basis</th>
<th>Amount</th>
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<tr>
<td>1-16</td>
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</table>

### Annual Management/Maintenance Costs
- €3,256,616

### Management/Maintenance Costs/Apartment
- €1,930,690

### Depreciation Basis
- €6,479,550

### Annual Depreciation
- €215,985

### Residual Value
- €6,479,550

### Operations Income and Expenses

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### Operations Income

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### Operations Expenses

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### Loan Balance

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### Interest Payments

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<tbody>
<tr>
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### Total Tax Liability

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<td>1-16</td>
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### Total Debt Service

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<td>1-16</td>
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<td>€1,103,579 - €1,103,579</td>
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### Equity Investment

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<td>-</td>
<td>-50%</td>
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### Debt Service

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### Net Equity Investment

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</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Financial Model

The financial model is based on a time-frame of 15 years and includes the development costs of the housing, including maintenance costs and all financial related expenses. Income is generated via the rented apartments on basis of a mid-price rent level. The IRR - with ≈8% - implies that the proposed intervention is viable.
5.3 SOURCES
LIST OF FIGURES

Figure 1: Demolition Plan Bijlmermeer (n.d.). Retrieved from: https://failedarchitecture.com/the-story-behind-the-failure-revisioning-amsterdam-bijlmermeer/

Figure 2: Hakfort 109 t/m 953 (n.d.) by M. Alberts. Retrieved from: https://archief.amsterdam/beeldbank/detail/ecab9f99-bf0d-87e5-4233-cf3c0b796641/media/e0f9ba80-1875-edda-1d9c-7dc8675c0ff d?mode=detail&view=horizontal&q=hakfort&rows=1&page=1

Figure 3: Hakfort 109 t/m 953 (n.d.) by M. Alberts. Retrieved from: https://archief.amsterdam/beeldbank/detail/ecab9f99-bf0d-87e5-4233-cf3c0b796641/media/e0f9ba80-1875-edda-1d9c-7dc8675c0ff d?mode=detail&view=horizontal&q=hakfort&rows=1&page=1

Figure 4: Foam of production, winning entry europan, Retrieved from: http://www.europan.nl/results-e14/#winlocation3

LITERATURE


**FACILITATING LITERATURE**


Lease Plan Corporation (2020). Car Cost Index 2020. N.d.: Self-Published


PricewaterhouseCoopers B.V. (2019). The Road to Circularity: Why a circular economy is becoming the new normal. N.d.: Self-published


Stora Enso (2016). *Building Systems by Stora Enso: 3-8 Storey Modular Element Buildings*. N.d.: Self-Published