ARTIFICIAL LANDSCAPES IN HIGH DENSE ENVIRONMENTS

new ground levels, multiple use of space in order to intensify the urban environment
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# Table of contents

1| Introduction p.4  
   - Design location  
   - Reason for research  
   - The new ground level  
   - Research multiple use of space  
   - Problem statement  
   - Thematical approach  
   - Research projects  

2| The gradient: From high dense mixed environments to rural environments p.11  
   - Range of application and combination of functions  
   - Multiple vs. single  

3| Research projects, case studies p.13  
   - Office Cap Gemini Ernst & Young, Utrecht-Papendorp  
   - Shopping mall Bilgaard, Leeuwarden  
   - Vivaldi A10-zone, Amsterdam-Zuis-As  
   - Het Zuidplein, Amsterdam-Zuid-As  
   - Chasse terrain (parking garage), Breda  
   - Chasse terrain (park apartments), Breda  
   - The high line, phase 1, New York (USA)  
   - Stadshart, Almere  
   - Vondelparc, Utrecht  

4| Conclusions p.31  
   - Relation between FSI, OSR en GSI  
   - High urban dynamic character  
   - Mix of functions  
   - The social aspect of space  
   - Users quality  
   - Accessibility  
   - Safety  
   - Traffic, parking  
   - Sustainability  
   - Vegetation  
   - Image  
   - Multiple use of space, the future?  
   - Long term quality  
   - Zeeburgerpad  
   - Final conclusion  

5| Attachments p.41  

6| Endnotes p.44
**Introduction**

**Design location**

The Zeeburgerpad in Amsterdam (Centre-East | Zeeburg) is a unique compact strip or island in the urban structure of Amsterdam. It’s a piece of land, with dimensions of 30m width and 1.6km long, surrounded by water. This strip is like a needle which is trying to penetrate the centre-ring (singelgracht) starting from the periphery. The linear movement from periphery to city-centre is crossed by four infrastructural elements, three roads and a railway bridge.

After an extensive analysis we concluded that the Zeeburgerpad can be seen as a gradient from an urban green structure towards a high dense mixed urban environment. There are 4 environments which we defined. These environments are divided by the four infrastructural elements mentioned above. The four environments are: An urban green structure, a living environment, a mixed urban environment and a high dense mixed urban environment. The final design location is situated in the high dense mixed urban environment.
Reason for research

Water is an important theme for the location Zeeburgerpad. Visiting the location nowadays will show that the water is not visible much, the experience of the water is missing. The building blocks and the living boats are blocking the water. The knowledge that the level of the Zeeburgerpad is lower than his surroundings is also not an advantage for experience the water.

The experience of the water in combination with the density, suitable for a high dense mixed environment, could lead to the idea of an artificial landscape. This artificial landscape is seen as a second ground level. So the idea of creating functions under a artificial landscape next to and directed to the water which gives a opportunity to have also direct relation to the water on the artificial landscape. At the new level you could walk on the living boats which widen the Zeeburgerpad at several points. Below the artificial landscape there could be more public facilities and the problem of parking can solved for the neighborhood as well for the city. Perhaps it is possible to integrate some storage facilities which are located at the Zeeburgerpad at the moment. Buildings are penetrating both ground levels and can be connected.

The new ground level

Designing new ground level projects a good economic strength is important but also the question how to integrate several social goals:

- the social aspect of space, the meeting possibilities and the involvement with the space;
- the high urban character with enough dynamics;
- the sustainability, decreasing the environmental pressure, increasing the quality of the living and working environment and take care of an flexible urban structure;

To achieve all this we need to create effective groups of actors. A central question in a new ground level project is which social surplus value it gives. Why do governments and project developers decide to create a new ground level project? What are the surplus values on national, regional and municipality level? What are the profits for the settled companies, the occupants and the people living in the surroundings and the users of the public space?\(^1\)
Research multiple use of space

To create a high dense mixed urban environment it is needed to have a specific Floor Space Index. With the knowledge of having a location with a limited width and a limited height related to the surroundings I want to research on the theme of multiple use of space with a focus on new ground levels. A higher, second or new ground level with the goal of creating an acceptable Floor Space Index (density) for the high mixed urban environment.

Multiple use of space and intensive use of space are not always connected. Intensive use of space is related to the building density and multiple use of space is related to the combination of several functions. But in practice they often overlap each other.²

- Intensive use of space:
The number of intensity of a specific area, with the surrounding space, same scale, as reference.

- Multiple use of space:
The use of a specific area for more than one function in space or time, where combination can occur and the function can be used independent.

- Mixed use of space (second dimension):
The use of a specific area for more than one function horizontal defined.

- Layered use of space or multiple use of land (third dimension):
Realizing several function on top of each other on a specific area.

- Multiple use in time (fourth dimension):
The use in time of a several functions in a specific space.
**Problem statement**

Over time the lack of space will be grow more and more. Multiple use of space is a way to deal with this problem and intensify the urban environment. A new ground level or artificial landscape is a form of multiple use of space, but creates its own problems as well. The main question of this report is:

*What are the focus points for the design of a new ground level and what are the pre-conditions for creating a new ground level?*

**Thematical approach**

The following themes and sub questions will be the guideline for the research. At the hand of these themes and questions conclusions will be formulated.

- **Relation between FSI, OSR en GSI**
  
  Multiple use of space has the goal to create a higher density, but what is the proportion or relation to the open space. Is this different to the ‘normal’ projects? With the introduction of a new ground level new open spaces are created and the density is higher.

  *What is the range of density needed for a feasible design of a new ground level?*

- **High urban dynamic character**
  
  The relation between below and above an artificial landscape and the relation between inside and outside can work out as a very dynamic design with spacious qualities. The question is how to achieve these qualities.

  *Which interventions are needed to create relations between all the facets of a new ground level plan?*

- **Mix of functions**
  
  The term multiple use of space is strong related to mixing functions. The main question on this theme is which function can or must be connected. And even important is which measurements of mixing of functions are interesting for future developers.

  *What are the surplus values to mix functions in case of a new ground level?*

- **The social aspect of space**
  
  Because of a new ground level, which contains public facilities connected to living and working, there will be involvement with the space. It can be a meeting space and through social control a safer space will occur.

  *What is the relation between scale and the social aspect of space?*
- User’s quality
The basic idea of a new ground level is building under the ground. This knowledge says us that it is important to look at the user’s quality. Are there facilities to reduce the wind problematic, can sunlight penetrate the underground spaces and what are the facilities to create a very transparence space without dark corners?

Which elements should be introduced to create a good user quality level?

- Accessibility
Several stacked levels results in differences in heights. The accessibility has to be maintained. Several options must be researched.

What are the options for the access points of a new ground level?

- Safety
To the social safety multiple use of space has influence on the social control. Because two or more function are connected, the environment will be visited more which results in more social control. Important here is the use of space over time. Technical safety is about the cables and shafts, but also the fire safety (connection with accessibility).

How is it possible to create a safer environment on social and technical field?

- Traffic, parking
The reachability is the main word. How can you reach several levels, functions, spaces and parking areas?

New ground levels can deal with the traffic and parking problem, but how can you organize the flows of traffic?

- Sustainability
The sustainability can be integrated in the design. An analysis has to prove its feasibility. The adaptability of the design is important to integrate sustainable elements.

An actual theme like sustainability could give a surplus value to the project, but what are the main things to think of with a new ground level?

- Vegetation
With the introduction of an artificial landscape it seems difficult to create a green landscape with trees and grasses. The trees give the most problems, because of its roots. Grasses and small green structures are easier.

What are the possibilities in creating green structures on a new ground level?
Research projects

The projects where my focus goes to are, in the best case, a combination and stacking of functions, such as dwellings, offices, public facilities and infrastructure (parking). So hybrid building environments. In this case I also choose for projects which deal with a specific problem. A problem that can be useful for my research and design.

The following projects or casestudies are treated in this research, with a argumentation as endnote:

- Office Cap Gemini Ernst & Young, Utrecht-Papendorp

  An interesting project because of its underground landscape (below artificial landscape) which connect five office towers. This is a big office location and nowadays only in use by one company. The connection below the artificial landscape is important to research. Single function

- Shopping mall Bilgaard, Leeuwarden

  Very public environment, attractive for a wider range of area around the project. A stacking of functions is what it is about. Shopping below an artificial landscape and dwelling on top. The livelihood and usability of the space is important, but also the difference between living and working. Mix of two functions

- Vivaldi A10-zone, Amsterdam-Zuis-As

  A mixed urban environment in Amsterdam with as his main goal to create a very high FSI value. Separating public and private is of importance. Mix of two or more functions

- Het Zuidplein, Amsterdam-Zuid-As

  A large square with a high-end solution for vegetation on a artificial landscape. It deals with a specific solution which can give a surplus value. Single function
- Chasse terrain (parking garage), Breda

This project is mainly interesting because of the diverse interventions in order to make the parking garage as light and safe as possible. This project concerns with slightly the same problematic as an artificial landscape. Single function

- Chasse terrain (park apartments), Breda

A semi underground parking garage is connecting five dwelling towers. The result is a very intimate collective space. Similarity with our design location is the higher landscape which connects several buildings. Single function

- The high line, phase 1, New York (USA)

A high urban solution or transformation of a former railway. The plans discuss and try to find solutions to connect the lower and higher worlds. A higher ground level deals with the same problems. Mix of functions

- Stadshart, Almere

This is a good example of a high urban environment with a new ground level. The scale of the project is of another gradation, but the basic principles are the same. Parking, infrastructure, shopping, working, living and leisure are situated next and on top of each other. High mix of functions

- Vondelparc, Utrecht

A new ground level in a living environment to camouflage the parking and introduce public/collective spaces. The main focus here is how it is possible to let dwellings profit of this new ground level. Single function
The gradient: From high dense mixed environments to rural environments

Range of application and combination of functions

To get an overview of the applicability of multiple use of space there is once made a inventarisation of already known and less known mix of functions. Infra Consult + Engineering did develop a scheme where, within a geographical context, the several mix of functions are arranged. I put in this scheme because we cross all the environments announced in the scheme. This scheme shows us the mix of functions applicable for the environments.

- City center
  Combination of functions, shopping, culture, recreation, living and working,
  High use of public transport,
  Fine structure of slow traffic infrastructure,
  Public space for meeting and manifesto,
  Layered car infrastructure, parking, public transport, slow traffic and distribution,
  High density, mix of function and stacking,
  Concentrated green in street profile and parks,
  Intensive use in time.

- Multifunctional joint
  At border city center,
  Public transport, transferee, leisure, huge retail and public facilities,
  Offices at main infrastructure / ring / city network.

- Living neighborhood
  Differentiated quality,
  High density and living with green,
  Living and working combinations,
  Neighborhood store and facility center,
  Car density with layered solution,
  Green in street profiles, city parks and inside building blocks,
  Partly use in time.
-Office area
Stacked, small scale,
Large degree of flexibility to work shop, office or house,
Located at main infrastructure of city,
Small scale supplying
Reuse of energy

-Green structures
Sport, recreation and green, water storage,
Silent and educational functions, for example aside the former radial structure
Villa parks, ecological transport zones

-Rural area
Water and agricultural functions,
Recreation parks, nature and silent areas,
Main infrastructure till the border of the city

Multiple vs. single

With applying of multiple use of space the main issue is not the sum of all the qualities of all the parts of the project, (sum of single qualities), but the surplus value of the chosen multiple use of space or combination of functions (multiple qualities). A focus point should be that the whole is more than the sum of all parts. Basically this could be: one entrance in stead of two with as result a meeting place, one restaurant in stead of two canteens, etc. Because two functions can develop surplus values you can also speak in terms of quality in between.
The urban plan of Papendorp is designed by a team of designers of OMA and West 8. Papendorp exists of 5 different areas. Cap Gemini is build in the area called Cope Nord. The Cope Nord and the Cope South are designed as parks with trees on a lawn. The view towards its surroundings must guarantee visibility of the poplars, aside the Amsterdams Rijnkanaal, and the kanaleneiland.

The Architecten CIE and Veenendaal Bocanet & Partners are the designers of the terrain of Cap Gemini in Utrecht. The Architecten CIE took care of the office buildings and Veenendaal Bocanet & Partners did the interior spaces. The terrain exists of 35,000m$^2$ offices, 15,000m$^2$ congress spaces and 1,000 covered parking places. The plan is based on flexibility in use. The landscape design of Cap Gemini was developed by Delta Vorm Groep Landschapsarchitectuur en Stedebouw in combination with the designers mentioned above. The terrain has an area of 6,5 hectares, with 3 hectares of green roof.
On the terrain 5 office towers are standing in a green landscape. The most important is the head office tower. Inside this one a restaurant and a congress room is situated. Also a large plaza is part of this building. This is a central entree hall which is the connector of all the five towers. Besides all this there is a separated congress building. This congress building exists of a foyer, auditorium, nine congress rooms, meeting rooms and administrative rooms. The other three building are office buildings.

Important to look at in this project is the main plaza. This is the space underneath the artificial green roof. The Architecten CIE designed this space as light as possible, from both sides light is penetrating. Due to the relief in the landscape a dynamic ground level is created. The plaza does not only connect the towers but also the 5 parking garages. To get light inside these garages, large voids are designed which functions also as fire escapes. Further on there are large stairs at the borders of the terrain. These stairs will lead you to the roof scape but provide also in the needed fresh air for the underground world.
On 24 August 2006 shopping mall Bilgaard in Leeuwarden was burned down. The shopping mall was very important for the neighborhood, all the facilities needed were present. Besides doing your shopping’s the mall was a meeting place for the people of the neighborhood, it was the heart of the neighborhood. The shopping mall was valuable on the scale of the neighborhood but also on the scale of the city Leeuwarden. There where even a lot of people from surrounding villages.

On initiative of the municipality architectural office Arons en Gelauff made, in October 2006, a new master plan for the shopping mall. The task was to maintain the strong point and strengthen the weak ones. Their design started from the same basis, but with some important changes and additions. The building will for example be more facing outwards with more front facades and entrees on the outsides. There will be a larger number and wider entrees and the South-Eastern entree will be designed as a small square. At the roof of the shopping mall a new ground level will be introduced. Different dwelling types will connect to this roof, a unique living environment for all kind of people. This area gives social control to the design.
The shopping mall will be elaborated from 7800m$^2$ to 9500m$^2$. The accessibility of the shopping mall will be better with the new entrees and the central square of 1000m$^2$. On the roof the dwellings will be built, approximately 90 to 100 dwellings for diverse financial budgets. For the new dwellers their will be parking places and green on the roof. The dwellings will be built in several layers. Overall the shopping mall will be more open and friendlier. The municipality will improve also the public space.

The shopping mall is, as already said, more than only a neighborhood facility. It has economic value for Leeuwarden as a whole. There are people from all over the area coming to Bilgaard. Because of the fire there is a chance to make an optimal combination of living, working, care and shopping. A new ground level is the solution at this place.
Vivaldi A10-zone, Amsterdam-Zuid-As
Stedebouw: Gemeente Amsterdam, Foster + Partners
Architect: Foster + Partners

Vivaldi is the most Eastern part of the Zuidas project in Amsterdam. The area lies between the A10 and the Boelelaan, the Europaboulevard and the intended central city park of the Zuidas. Vivaldi is part of the inner dike Buitenveldertse polder.

Vivaldi will be transformed in the following years. With the built of the first projects this transformation is already visible. The rather old and broken offices will be transformed into a mixed urban area which will accommodate not only companies but also about 700 dwellings and several facilities. The total program in Vivaldi will be 412.500m² gross, whereas the area today is only 94.000m². The intended program exists of approximately 20% dwellings, 65% offices and 15% facilities. The facilities will be in the plinth of the ground level and especially besides the main infrastructure. Vivaldi will be built with a high density, the Floor Space Index will be around 4.

The A10-zone is the most Northern part of Vivaldi. The urban plan for the A10-zone is developed by the municipality of Amsterdam in combination with architectural office Foster + Partners from London. The concept is some kind of stage or podium with four towers on it. The podium is about 4 meters high and spreads the whole area. A new ground level is born. The four towers next to the highway A10 mark the Eastern entrée of the Zuidas and are landmarks for Vivaldi. Three of the four towers are almost 90 meters high, the fourth about 50 meters. In the new ground some voids are cutout. These voids can work as patios and facilitate in space for entrees of the surrounded buildings. Water basins can also be an option to have a place in the voids. At the south of the new ground level a porch is created to block the rain. This porch is the border between public and private and is a connecting element in the street profile of the Scarlettilane. At the first building plot the new headquarters of Ernst & Young will be built. Foster + Partners did design this building.
The Zuidplein lies at the beginning of the Minervalaan, a famous urban axis from the plan of H.P. Berlage from 1917.

The renewal of the parking garage underneath the WTC and the housing of several technical facilities appear to lead to less parking places. By using the space under the Zuidplein this loss could be compensated. This option could also fulfill the wish of the WTC to make a ‘dry’ connection between the old and new buildings. After the agreement of the municipality, for a underground parking garage below the WTC (two storey’s) and a new bicycle store, the renewal of the Zuidplein could be started. Architect Yushi Uehara was hired to design the underground part. He worked together with Michel Desvigne who was responsible for the design of the public landscape. The complex exercise results in a very original but difficult design. Too difficult, because in January 2002 the municipality decided to quit the work with Uehara and Desvigne. The design did have too much technical and management problems. Fire safety, grow circumstances of trees, a very complex connection between upstairs and downstairs and wind problems where the arguments for quitting the process.

In a very short period of time a new design must be created, because their was an agreement to finish the project in the summer of 2004. DRO was approached to make a new design for the ground level. Architectural office KPF in combination with M/V Architects where hired for the underground part.

For the introducing of trees on an artificial landscape the design team got advice of BSI tree service. These advices lead to ideal growing places for a careful selected group of trees. There is a guarantee for 15 years of after-care and re grows insurance. With a special SMS technique nutrition, air, water and control is fully automatic monitored from a office of BSI in Baarn.
The total of 70 trees stands in square pots of 2 by 2 meter. This is relatively not much space, but with a special fabricated multi-layered growing soil, an optimal air- and water monitoring is realized. The trees will not grow toward their original size, but they will get a normal crown. To manage the eventual wind loads the pots are mounted to the ground level.
The Chasse Park is situated at the former military terrain at the border of the city centre of Breda. For this almost 13 hectare terrain a campus vision was formulated by Rem Koolhaas and Xaveer de Geyter in 1996, a green area with at his borders, commercial and cultural spaces. In the green area there are dwelling units or buildings randomly placed. Because of the formulated campus vision it is possible to maintain the already existing green character. This is reached with a high Floor Space Index (50 dwellings per ha) in combination with a low Ground Space Index (28% of the ground space). Another way to reach the vision was the solution for the cars. The parking places are all under the buildings.

The Chasse terrain is almost car free and has mainly bicycle and pedestrian paths. Beside more informal routes there are several roads which lead to the parking garages under the buildings. With the minimum of roads is tried to minimize the traffic as much as possible. So it is not possible to use the Chasse terrain as short-cut, to get faster from A to B. Parking at ground level is almost impossible. Private parking is as already said underneath the buildings. And further a large public parking garage is designed. The roof of this garage is the main square of the terrain.

This central parking garage is designed with the thought to create a place which is surrounded by light, an open space in which people feel save. There are no dark corners, walls or holes which could hide dark figures. Daylight is entering the space through 13 patios. Every design decision is tested with the clients and users wishes.
The parking garage facilitates 670 parking places on a total of 18500m$^2$. The 70 degree parking principle is used, because with this system it is easy to get in and out. Everything is one-way organized and getting lost is no option.

The construction is based on a grid of 14,2 by 7,5 meters. The roof construction, with a public square is on top, is 50cm thick concrete constructed in triangles. The triangles are not placed horizontal but vary in degree from 3 to 13 degree. Because the floor or roof has a slight slope the clearance lies between 2,3 an 6,3 meters. This leads to an open and spacious experience. This experience has some consequences for the fire safety. 2,5 meter long push ventilators, which are mounted at the roof, push air and smoke toward one of the three exhaust systems at the borders of the open area. With this technique there are 3 fire compartments of approximately 5000m$^2$ created.
Xaveer de Geyter designed within the campus concept of the Chasse terrain five dwelling towers situated at the eastern side of the park at the Chasse single. The towers are standing on a semi-underground parking ring. Inside this ring a public and collective garden is created. In the dwelling towers there are 137 apartments of several dimensions. This varies from 1 dwelling to two or four dwellings per floor. The dimensions of the towers are 19 by 19 meters and 19 by 30 meters and do have 13 floors. At the public inner garden you can enter the towers.

The towers are place tight together with all there own orientation. The orientation related to each other is designed as result of the view to the inside and outside, the sun, the parking ring, the inner garden and finally the transparency of the whole composition.

Three of the five towers have 2 apartments per floor, the fourth has 1 apartment per floor and the fifth has four apartments per floor. For plans see the attachments. Every apartment has a winter garden which can be used as outer space, but also can be seen as extension of the interior spaces.
The changing context of the towers has as result that all the plans are slightly different. Also for the facades the context is influencing. The facades at the inner garden are made of shiny with bricks to reflect the sun. The Facades at the outside are made of anthracite prefabricated concrete panels to create a more closed view. A third type of façade is a glass façade with a diagonal concrete structure at the inside.

Above you see the main plan with clear distinction between parking ring, inner garden and dwelling towers.

This is the parking floor with 255 parking places. The garage sticks 1,5 meters above the ground and is made of transparent material. The roof is for example made of translucent polyester.
The New Yorker High Line is a former train platform, at a certain level, and crosses the city. This was built to solve dangerous traffic situations. Because of new transport facilities this route is not in use anymore for over 25 years. A design competition was organized and people from all over the world signed in. Finally they decided to transform this 1.5 mile long train route into a city park with space for art, cafes, galleries and a pedestrian zone. Past years they started with building it and this year (2008) it should be ready. There are more cities with such parks like the High Line. Paris has the Promenade Plantee and in Rotterdam the Hofpleinlijn has the same opportunities.
For the High Line people did lots of research into solving the problem of vegetation on this former railway. Piet Oudolf is a Dutch Landscape designer and also part of the design team. He presented six examples of percentages of green which are possible to create.  

1. PIT 6% : 100%
2. PLAINS 40% : 60%
3. BRIDGE 50% : 50%
4. MOUND 55% : 45%
5. RAMP 60% : 40%
6. FLYOVER 100% : 10%
Other sketches (sections) where the search for relation between upstairs and downstairs are important can be found with the Attachments.

To realize all the sketches and ideas the design team started with the basic structure as it was in the past. On top of this structure there will be always a new top layer existing of several concrete and rubber layers. If there will be vegetation on top an extra set of layers will be added to make it possible for trees to grow. If there will be only a pathway a under structure with wooden planks will be added. The pictures below shows you these principles and the layering of materials.
In 1992 a City plan for Almere was made. This plan has 5 main themes: increases of the economy, a stable grow of population, an attractive city center, a better accessibility and a attractive living city. A new plan was necessary because of the fast growing city. Here for there was a need for extensions of the existing facility level. A new city center, city heart and business centre is completed the past years. In the city heart a large extension of the shopping center with cinema, restaurants, museum, theatre and dwellings are realized. In the master plan of OMA was chosen for a large account of facilities on a small area.

Because of the introduction of a new ground level the stacked functions and the dwelling can be accessed. This new ground level is realized with a very long slope so the connection with the surrounded and lower ground level will be fluently. The big advantage of a new ground level in this case is the creation of a down and upper world. At the level of the upper world all the shops have there entrée. Some shops are penetrating the down world and do have also an entrance at this level. At the down world there is space for infrastructure, the roads, pedestrian and bicycle paths and the bus lines.

This construction makes it possible to facilitate 2400 cars under the new ground level. This account is spread out over 8 parking garages. Lorry trucks are not allowed. The approximately 125 new shops must be supplied that’s for sure. At five places under the new ground level and at the borders will be areas for supplying. In these covered spaces lorry trucks can leave there goods at a large platform. From these spaces a system of tunnels are connecting the shops. This system is also the emergency exit for the shops and the area.
Openings and a higher altitude lead to enough light, air and space. Even green patios could be realized. In this layer approximately 5000m² of shops are projected. Connection with the new ground level is solved with stairs, slopes, escalators and elevators. Across the centre 10 access points are created. Five of them got special attention. One of them is illustrated below.

In the plan a spacious differentiation is designed with the following forms:

- inside or down world, the space below the new ground level
- waterfront, event terrain, people, living towers
- water square, social cultural functions, pier and wharf

With realizing this plan a complete new city centre is born. It has its own identity, because of the urban plan dealing with a new ground level, a special architecture and a spectacular skyline.

The city heart of Almere is redeveloped with the goal to give Almere, which grows very fast to a city of 300,000 inhabitants, a beating heart. The surplus value of this project works on the scale of the whole city.
Vondelparc, Utrecht
Stedebouw: Mecanoo
Architect: Mecanoo

The Vondelparc is the redevelopment of the former school at the Vondellaan. The urban plan of the Vondelparc deals with the theme of being one of the secret places in Utrecht. As part of the redevelopment all the monumental buildings are restored. The buildings at the Vondellaan are transformed into multiple office buildings. The original buildings at the Jutfaseweg facilitates in youth housing. This combination connects to the vision of the municipality, the mix of functions.

Because of a underground parking garage for occupants there will be place for public green space on top of this garage. This space can be used for sports, gaming and leisure. Existing trees and some additions creates this new city park.

Mecanoo arhitecten did design within this masterplan the ‘Groene Hof’. This ‘Groene Hof’ exists of three units, a apartment building and two clusters of 20 dwellings, separated by crossings with a wooden deck.

The dwellings are a bit higher than the ground level. The height difference, approximately half a storey, is solved with a continuous open wooden deck. This difference is not only a form, but an intelligent parking solution. The dwellings of the ‘Groene Hof’ are standing with there feet in the semi-underground parking garage. The roof of the garage is at the same time the floor of the outer public space and at the front and back made out of wood.
In the roof there are made several voids to get light into the garage. All the dwellings do also have a window at the level of the parking garage. This will improve the social control.

The voids are placed in the outside public areas as well in the inner yards of the two building blocks. Here terraces are placed around a lowered inner garden. With trees some privacy is created.
Conclusions

The themes mentioned at the introduction will be the red wire in this chapter of conclusions. The case studies will be there as input.

Relation between FSI, OSR en GSI

With the introduction of a second or new ground level there are made several large interventions. First of all there must be analyzed in which urban environment the design location is situated, this environment is very often related to the Floor Space Index. It has shown us that a new ground level is only realistic in a high dense mixed urban environment. Here the interventions are of value because of the lack of space. Another facet is the density related to the intervention. If the density is high developers are more willing to invest in a design, because they can build more rentable spaces. The Floor Space Index for a new ground level project has to be around the 2,5.

The case study Vivaldi, part of the Zuid-as is designed with a FSI of 4, but that’s logical with the identity the Zuid-as has. Lots of office towers on a relative small area with a very high FSI. The surroundings are facilitating a very high FSI. The question related to the new ground level is than: How far can you go in raising the FSI? Are the proportions in good relation with the surroundings?

The park apartments in Breda seem to be not so high dense build, but do have a relatively high FSI, because of the five high-rise towers. The high FSI makes the intervention of the semi-underground parking garage reasonable.
As mentioned, in the beginning of this report, there is a difference between multiple use of space and intensive use of space. A new ground level is a type, to realize multiple use of space through stacking and mixing functions. When introducing multiple use of space it is not necessary true that the FSI is high. This is normally related to the FSI of the surroundings, which is related to the urban environments. It is often proven that multiple use of space is used as tool to raise the FSI in high urban environments. My own design as reference shows us a FSI of 3 with a new ground level and around 2 without one. This difference fluctuates with the projects. In my case I got more usable open space and extra space under the new ground level directly related to the water.

- The density must be high to make the investment feasible, approximately 2.5.
- A new ground level is preferable in a high dense mixed urban environment.

High urban dynamic character

The city hart of Almere is the example for a high urban dynamic character. With the introduction of a new ground level a very welcome slope is created. Almere lies in a polder landscape and this slope gives some relief to the landscape. The raising of the ground level creates an underground world and a upper world. Infrastructure and parking below and shopping and living above the new ground level. The starting point of this intervention comes from the municipality of Almere. They are having the desire to integrate the cars into the new city center on a good way. OMA designed the final solution. To connect both worlds, divided by the new ground level, the points where you can go up are the most important. In Almere they have all the possibilities, stair (several types), escalator, elevator and the slope. Important for designing is the space around such places. Large voids are welcome to create more light and lead to more dynamic in the city. A special type of stair is created at one of the main squares. This stair is also some kind of tribune or stage for multiple uses. Talking about relation between inside and outside, some buildings in Almere are penetrating to the underground world with as result that you can walk from the supermarket directly to your car for example. At these very dynamic places down, up, inside, outside come together. These places are at one hand very complex but at the other hand very clear.

Another case study, the Highline in New York, is a total integrated design. This is related to its former function, infrastructural. At this design the main focus lies within the research of connection under and above in order to create relation between them. A plan was made for all the points where a good connection could be made. These points must be created in a small range of very public spaces.

- Large voids give possibilities to connect several levels in a dynamic way.
- Integration with the qualities of the surroundings leads to a dynamic character.
Mix of functions

The Dutch town and country planning seems to be based on the conviction of separating functions in order to optimize its productivity. This should lead to (economic) progress. Progress is made in terms of efficiency and the factor of time plays an important role in all this. With saving time costs can be minimized. Time can be saved with designing a space for one typical function. The spatial consequences can be seen in our build environment. As result of this separating of functions activities must be arranged in time so individuals can only participate in an activity, one at a time. A second result of separating functions is the flexibility of a space. Places are designed for a particular function and this makes it difficult for other function to use these spaces.\footnote{18}

Multiple use of space is a solution to deal with the problem stated above. The mixing of functions gives the possibility for individuals to spend their valuable time as optimal as possible.

The case study Vivaldi is designed on a mix of living 20%, offices 65% and facilities 15%. The choice was made to make the new ground level also the divider between public and private. Below the artificial landscape shops and other facilities will be created. On top a green park will be available for collective use for the dwellings.

- **The mixing of functions gives the possibility for individuals to spend their valuable time as optimal as possible.**
- **A new ground level can facilitate in mixing of functions and at the same time give the possibility to separate them.**

The social aspect of space

With the possibility of stacking functions it is very important that the public space can develop as a meeting place for all people available.

In Almere the scale is of such a large scale that almost the whole city can be involved with the centre, but this group of people will not take care of it. This center will be seen as device for connecting people. A city center is too impersonal and the municipality must take care of this area.

On a smaller scale such as the shopping mall in Leeuwarden we see that a smaller group of people is using this area and these people are more involved with the place.

The social aspect of the dwelling area Vondelparc is maintained by designing semi-private courtyards. Privacy is important for designing dwellings.

At the office area of Cap Gemini in Utrecht a plaza is created which connects all the five office towers. All employees can meet each other at the plaza, but they will be less involved with the space, because it is a working space and not a living space.

- **Involvement with an area will lead to respect and livability.**
- **The scale of an area needs to be adjusted to the amount of people using it.**
**User’s quality**

One of the most important facets for success of a new ground level is the user’s quality. This will make or destroy the project. Problems such as wind, shadows, lightness, transparency and openness must be take care of or must be maintained.

The project Vondelparc is dealing very well with these problems. Below a wooden deck cars are situated and the dwellings are partly related to these semi-underground spaces. The use of large voids is very positive for the user’s quality. The voids aside the dwellings are the best example because you don’t feel the presence of the wooden deck. A direct relation between downstairs and above is realized. These interventions realize light, transparency and openness.

Shopping mall Bilgaard in Leeuwarden tries also to give quality to the public space by introducing large voids. The rest of the ‘underground’ area is not designed with these voids, but the problem is solved by program. Shops are the solution, shops are already internal functions which don’t need as much light as a public space.

The parking garage of OMA in Breda shows us a good example of an underground space which is not a very dark closed space. The points of access are designed to let daylight entering the underground space. And at the borders large openings are created. The roof which is some kind of a wave gives this opportunity.

User’s quality is also about street furniture. Is it possible to sit in the sun, and are there enough trees which create the needed shadow, when it’s to hot? The Highline project in New York gives us a solution which is fully integrated with the artificial landscape. This is a subtle way to create a meeting place.

- The use of large voids is very positive for the user’s quality.
- Access point can be used to give special qualities like daylight and transparency.
- Availability of meeting places.

**Accessibility**

The introducing of a new ground level gives some problems for the accessibility of both levels. It can decrease the accessibility, but the main goal must be that a new ground level increases the accessibility.

Almere is a good example where this is designed on a good way. Because the motorized traffic is located below the artificial landscape it is much easier for the pedestrians to enter.
the city center. The connection between both worlds is designed very open and the capacity of access is very good. This example shows us that it is possible to increase the accessibility.

- A new ground level stands above the car and improves the accessibility.
- Accessing several layers can be done by stairs, escalators, slopes and elevators.

Safety

For the social safety of a new ground level project is the social control is important. Because several functions are connected the area has the opportunity to be visited more. More people results in more social control. Important is that the functions are used over time. Technical safety involves the solutions of cables and wires (mostly a central tunnel), but also fire safety.

The parking garage in Breda has as focus point to create one large open space. To achieve all the regulations, they had to deal with several problems. A number of fire compartments are created by the use of large ventilators at the ceiling. These ventilators are pushing the air to the exhaust systems at the corners. Criminality is reduced to the minimum by making the walls as flat as possible and to avoid dark places where persons could hide.

The shopping mall in Leeuwarden will be tested very well on the fire safety, because the former mall was burned down. The new design is much clearer because of its planning. At the ground level walls are bended to lead you to a specific route. Problems may occur in the evenings and the nights, because the shops are not open 24h and the dwellings are on top. The social control, which is available during the day, is missing at these times. If they close the mall some of these problems could be avoided.

- Social control will not lead to a safer area 24h a day.
- Technical safety can be organized, but differ per project.

Traffic, parking

Basically traffic and parking are arranged below the new ground level. The problems in normal situations can be avoided. Parking is gone at street profiles and the traffic pressure on the public life is reduced.

The office building of Cap Gemini in Utrecht contains 5 parking garages linked together under a green roof. Through a well organized system of roads these garage are reachable. In practice there are not enough places under the roof so the cars are also aside the roof. This was clearly not the concept of this building. Everything was designed to move the cars out of sight.

The parking garage in Breda is a normal concept. Underground and meant for people visiting the city and a theatre. Safety and openness are themes worked out very well.
The top level of the city heart in Almere is totally without cars, but the cars are there under the ground. Because of a special design the car is integrated in the city center. The vertical stacking realizes relations. The traffic stream are disconnected and connected at the same time. The new ground level is a device to achieve this.

- A new ground level can organize traffic flows in such a way that they are central, but does not give any problems like parked cars.

Sustainability

Sustainability is involved with the improvement of the environmental quality and the increasing of the quality of live. For sustainability and future values a flexible urban and architectural framework is needed to adapt the future.

Flexible and adaptable frameworks are easy to integrate sustainable solutions.

Vegetation

Case study Zuidplein is clearly a example for vegetation, because of its unique system to make it possible to grow trees on a artificial landscape. BSI tree specialist in combination with Streetlife developed the Treetec system. In Delft, at the Bastiaans square, some trees are grown at the same principle.

There are two systems of Treetec. The one has a water reservoir inside the bucket and the water is irrigated from below. The other has a central water reservoir and the water is irrigated from the top. See next page.

With the application of tree-pots on artificial landscapes and roof gardens the first concern is the maximum equally divided load. The weight of the grow medium (aprox. 1700kg/m³), the weight of the tree + pot and the distribution of the weights are parameters to take into account. At some projects the wind loads in relation to type and height of the tree are influencing the choice. I put in a table with several tree types related to the size of pots. See attachments.

The Landscape architect involved with case study Zuidplein in Amsterdam, Michel Desvigne designed a special roof garden in Tokyo. The garden on the roof of a new building at the
Keio-university is perforated and in these cut-outs grasses and small trees do grow. The garden is a composition of areas and pass-through’s in different densities where you can move in between.

Case study Highline in New York gives us also some possibilities to integrated green structures on an artificial landscape. The search for relation between downstairs and upstairs is tried to manage with green. Tree-pots with voids underneath.

Green on an artificial landscape is defiantly a possibility.

- **Automatically controlled tree-systems give a solution for vegetation on a new ground level.**
- **Small green structures will grow on a very small bed of earth.**

*Image*

With the decision making of complex projects like a new ground level or artificial landscape are a lot actors involved. De factors and decision making processes are complex and it is almost impossible to make any financial choice. The economic importance can cross the borders of the project where image plays a big role. Image can work as device to make a success of the project, by connecting investors and companies. Image can also increase the social and spatial impact of the project on the city and its region.  

*Multiple use of space, the future?*

Many cities in the Netherlands do not satisfy in terms of the definition multiple use of space. If we look in terms of intensity of use of space, for example the density of living, there is only
one city, Amsterdam, with an higher than the average of 70 dwellings per hectare. This with the note that the nineteen century neighborhoods exceed this average and the post-war neighborhood are below the average. About the third dimension I can be very short (vertical stacking). Dutch urban planning has no tradition in high-rise and underground buildings. For buildings under the ground it has all to do with the composition of the soil (high ground water level and soft soils). Seen from another side it is evidence for typical Dutch thinking of urban planning.

Long term quality

Because the spatial quality of multiple use of space is still seen as a result of the project quality, it is a fact that this quality depends on short time feasibility. The long term goals can’t be realized on that way. An intended mix of functions with infrastructure or landscapes in combination with flexibility is from the beginning not certain. To have a real chance it is needed to connect the area and project factors to make each other stronger which lead to advantages for both. A first challenge would be to name the factors which lead to long term and area orientated qualities. Here it is the re-interpretation of existing qualities for example redeveloping areas and the development of a new area quality. Dealing with high investment projects like infrastructure, stacking ground levels and storage of energy and water it is important to start from the quality which you want to achieve. When formulating long term goals it is also important to have a financial economic vision. Quality pays itself back, but not on short term.

Zeeburgerpad

The design location, Zeeburgerpad, situated in the city parts Centre and Zeeburg, exists of small scale industry, offices and some ateliers. The whole area is surrounded by water and lies lower than its surroundings. There is, because of the width and a relatively large road, not much space. A railway is crossing the Zeeburgerpad which gives some noise problems.

The knowledge of the urban design we made our selves gives us some pre-conditions. We made a gradient from a high urban mixed urban environment to a rural park environment. Our location lies in the high urban mixed environment and this was the first step in thinking about a new ground level. The design concerns a small strip and to get an acceptable FSI you need to build relatively large quantities. It is however also desirable to have open spaces. A higher new ground level or second ground level at the ‘roofs’ of functions can give a variable open urban landscape.

This new ground level improves the relation with the water and gives the opportunity to get an acceptable FSI on a small (35m width) area. It is a way to separate the infrastructure but integrate at the same time. The new ground level can be used as intervention to decrease the noise problem and with the interaction of up- and downstairs a diverse and dynamic environment will be created. With the use of new technologies it is also possible to integrate vegetation on artificial landscape project.
In my opinion the Zeeburgerpad will be cleaned like KNSM, Java and Borneo Sporenburg, because it is a former industry area. The soil must be excavated and this gives us the opportunity to increase the parking capacity of Amsterdam. The already excavated area can be used as or transformed into a parking garage. When approaching Amsterdam from the East this parking garage will be the first at the ring road (singelgracht). Perhaps visitors of Artis could use this parking garage also.

**Final conclusion**

The new ground level decreases the barrier, which infrastructure is, and makes a quick and logical transformation between different traffic forms possible. The quality of the public space of the surroundings will increase because of blocking the traffic. The other side is that shadow, wind and a stony character can decrease the quality. The high densities make it possible to intensify the area, result is more activities in a high urban environment. A high density makes it also possible to invest at a high level and this can lead to a better image of the area, a better economic feasibility and better sustainable solutions. Making a new ground level increases the density which also leads to more space for dwellings related to open space.

Over time the lack of space will be grow more and more. Multiple use of space is a way to deal with this problem and intensify the urban environment. A new ground level or artificial landscape is a form of multiple use of space, but creates its own problems as well. The main question of this report is:

*What are the focus points for the design of a new ground level and what are the pre-conditions for creating a new ground level?*

Above a copy of the problem statement with question formulated at the introduction. The introduction of a new ground level can solve a lot of problems which are at the design location, but this intervention will lead to new problems. The thematically approach of this report did show us these problems and I realized that these themes are also the main focus points for the design of a new ground level. Earlier this chapter I wrote about this. I recommend the following things for designing a new ground level:

- The density must be high to make the investment feasible, approximately 2,5
- The future value is important to keep in mind with decision making
- Flexible approach of architecture and sustainability can be valuable in the future
- The image of a project in the city should not be underestimated
- The social advantages are different per project, but certainly important
- Because of 2 levels it is important to take a good look at the access points (mainly vertical)
- The safety must be maintained constantly, mix of function can help

- Openness, transparency and lightness are aspects which are positive for the project

- Patios or voids improve the livability and accessibility.

- Private and public is mostly separated by the new ground level

- Public space at 2 levels is possible, but has to be specific in use

- Green structures are possible at an artificial landscape

- A green roof gives possibilities for sustainable solutions

That leaves us with the pre-conditions for creating a new ground level. In decision making there are some main things to think about. These pre-condition for creating a new ground level are:

- The location must be part of a high urban mixed environment

- The new ground level must be a surplus value for the location

- A good vision of the future must be available or formulated

- A good analyses of ground circumstances and surroundings must be available

- The image of the location must be compatible with a new ground level
Attachments

A | 98m² bruto, 72m² netto, 11m² terras
B | 121m² bruto, 90m² netto, 11m² terras
C | 124m² bruto, 93m² netto, 9m² terras
D | 103m² bruto, 78m² netto, 8m² terras
E | 160m² bruto, 114m² netto, 14m² terras
F | 160m² bruto, 115m² netto, 19m² terras
G | 360m² bruto, 242m² netto, 24m² terras
Bomen tabel

Een juiste keuze uit het beschikbare sortiment is een essentieel onderdeel van een project. Vaak zijn bomen ook in omwendingen beschikbaar, bijvoorbeeld meerstamig, laagvertakt of in knovert. Sortimentadvies is een van de specialiteiten van BSI Bomen service. Samen met de opdrachtgever komen we tot de optimale keuze voor toekomstig succes.

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G: Groei dek, afmeting: 200 x 200 x 90 cm (L x b x h)
M: Middelgrote dek, afmeting: 170 x 170 x 90 cm (L x b x h)
K: Kleinere dek, afmeting: 150 x 150 x 90 cm (L x b x h)
L: Lichte of windbeschutte plaats
B: Bloei- en
W: Wortel droog
K: Klimplant, lichte en vochtige voeding
L/V: Geschikt voor teelt oorboom
H: Hardhout
W: Sluierende in de winter
S: Waarder
Endnotes


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