BK4MA2 Final Assignment

Analysis and Advice for Haag Wonen

The building densification and sustainability objective at Robijnhorst, Mariahoeve

JIPC-Managers

Date : June 14, 2019
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CHAPTER 1 - INTRODUCTION AND SUMMARY

As the past decades show, major cities of the Netherlands are expecting to see a rising population growth for the coming years, awaiting an increased number of households and dwellings (CBS, 2018) Next to this, government policy is progressing to include enhanced sustainability aspects such as energy neutrality and gas-free building guidelines (Renovatieteam Lindenhove, 2015). Within the dense Randstad hub of The Hague, these building densification and sustainability objectives are particularly crucial. As consultants, JIPC-Managers team is therefore reaching out to housing corporation Haag Wonen to recommend how to densify and sustainably redevelop/develop a building ensemble in their dominion at Robijnhorst, Mariahoeve.

The above stated building ambitions are not only design issues, but are also process based goals that are largely influenced by techniques in building economy, requirements, management, and organisation. This report will achieve its above stated intention by carrying out analyses and subsequently recommending an approach (advice) to the themes of building economy (chapter 3), building requirements (chapter 4), construction management and process (chapter 5), and construction organisation (chapter 6). The analyses are based on a preliminary design vision as set forward in chapter 2. In chapter 7, considerations about the feasibility and the ethical aspects behind the proposed methods are presented. They are followed by reflections of the team dynamic and personal goals and development.

To summarize the most significant analysis and advice for Robijnhorst, Mariahoeve as per indicated theme (chapter 3-6) and for the building densification and sustainability objectives facing redevelopment/development projects (Gemeente Den Haag, 2009), the following matrices (table 1-4) have been created. The analysis sections of the matrices outline the key features and most important characteristics of the preliminary vision/design, specific to the theme. The advice sections of the matrices outline what the preceding analysis means for the approach to the preliminary vision/design, specific to the theme. Note that each individual chapter goes further into depth about these and other analyses and possible recommendations.

Chapter 3 : Building Economy	**3.1 - ANALYSIS**	**3.2 - ADVICE**
Building Densification	• Total direct construction cost: € 5.928.282,66 • Investment cost : € 10.042.898,66 (169% of direct construction cost)	• Compare calculated rent for dwellings (new) to current rent of dwellings (owned)) to see feasibility of project • Get a financial expert
Sustainability	• Extra investment is needed to make the project close to energy-neutral	• Take target groups into consideration and see their financial situation and preferences of energy-saving measures

Table 1: Summary of analysis and advice for chapter 3 building economy.

Chapter 4 : Building Requirements	**4.1 - ANALYSIS**	**4.2 - ADVICE**
Building Densification	• Allocation plan: no changes to current situation allowed (densification ambition obsolete; full adjustment)	• Argue with municipality for deviation (integrated environmental permit) • Plan B: court or demolishment
Sustainability	• Welfare brief: cohesion required for facade design (consequence for insulatory working, glazed surfaces)	• Seek partnership with facade design specialists; focus on object specific criteria

Table 2: Summary of analysis and advice for chapter 4 building requirements.

Chapter 5 : Construction Management and Process	**5.1 - ANALYSIS**	**5.2 - ADVICE**
Building Densification	● Construction of the renovation and the new parts occur partially simultaneously ● Divide the tasks in 4: New building and extension -> renovation -> topped-up mass ● Densification brought with 25% by new building and 75% with the extension of the existing	● Planning based on integrated organisation method in order to save time and budget ● Constructor should be involved from the Technical Design phase ● Residents should move after the construction of the new-construction and the extension construction phase
Sustainability	● Thermal Energy storage and winter gardens installed during the first phase of construction ● Solar panels, solar collectors and roof community garden installed at the last phase of construction.	● Professional advisors on sustainability in the built environment should start to be involved from the phase of Project Definition ● Clean-energy and landscape architects should be well integrated in the project planning and the first phases of design

Table 3: Summary of analysis and advice for chapter 5 construction management and process.

Chapter 6 : Construction Organisation	**6.1 - ANALYSIS**	**6.2 - ADVICE**
Building Densification	● Project is complex and contains a lot of stakeholders hence project risks meaning collaboration is required between the various involved parties.	● Apply the DB process and procurement strategy. ● Implement the ALDB process within the DB process
Sustainability	● Project contains both a renovation and new building construction project, hence management of resources needs to be efficient and well organised	● Implement the cradle to cradle model, building waste segregation/recycling, efficient management of materials; form a joint venture or consortium of stakeholders

Table 4: Summary of analysis and advice for chapter 6 construction organisation.

CHAPTER 2 - PRESENTATION OF THE PRELIMINARY DESIGN

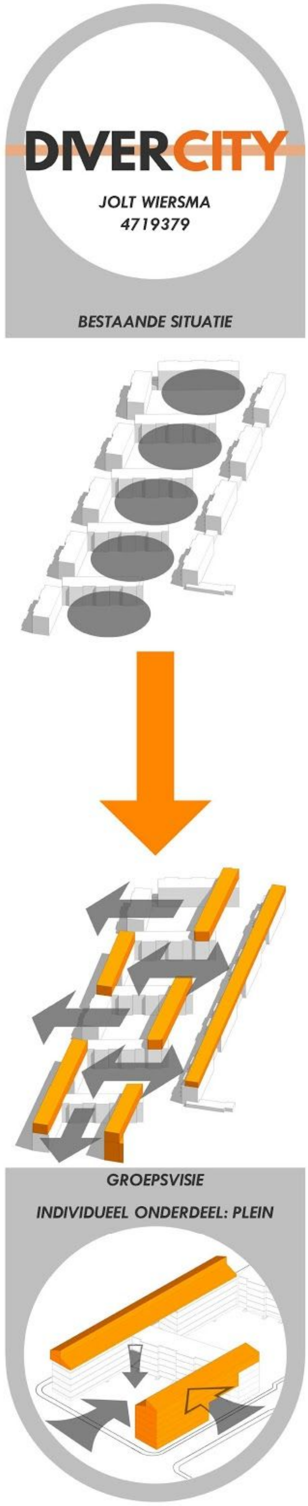

Figure 1: Preliminary Design

In order to recommend advice for building densification and sustainability ambitions for the Robijnhorst, Mariahoeve area, a preliminary investigation of the herewith needed transformation interventions was carried out. This initial research was done by individuating the current situation to identify its qualities and problems. The qualities include the segmentation of public and private spaces, accessibility of facilities and services, and currently housed target groups. The problems include undefined public space and outdated materialization. Of course, the need for target group densification and sustainable interventions is opportunistic.

Based upon this initial analysis, our team created a vision with the theme DiverCity. With the application of topped up building mass as illustrated in Figure 1, an urban image is created that invites surrounding target groups inside to coexist with current groups in the greenness of public space. Ultimately this makes the societal building densification and sustainability objectives applicable for Robijnhorst, Mariahoeve. At building block scale, the transformation takes place at the first block of the ensemble (see bottom of Figure 1). Since it is oriented towards the street network of Mariahoeve and surrounded by buildings it fits well in the vision as a green residential square. It then also acts as an entrance gate to the residence area and functions as communal open space for the community. The square thus invites a diverse set of target groups such as starters, expats, singles, couples, families, and seniors.

The plan involves a renovation of the existing buildings in order to improve the aesthetic and functional values for current residents. Technical and sustainable interventions such as improved facade insulation and winter gardens , green-energy production from solar panels, sun collectors, and thermal storage systems, and energy/waste reduction by means of community gardens are key features (Appendix S.3). The goal of the facade design (Appendix S.5) is to bring the composition together. Moreover, construction adjustments are implemented in order to allow the existing load-bearing structure to annex the topped up building mass and for the creation of an additional connection-way onto the square.

For what concerns the new construction, the plan involves the affixation of new buildings, and extension and topping-up of existing buildings. With the addition of these new dwelling units, the plot is densified by approximately 63% (from 40 to 65 dwellings). With this operation the various target groups are allocated a variety of different living typologies (see Appendix S.2 Table 1). A subsequent result is a renewal of accessibility points and links. With the exception of one porch entryway, all are maintained with the addition of two lifts. The new construction is accessible via two gallery connections.

Regarding further detail and graphical explanations of the above mentioned interventions related to building densification and sustainability ambitions for Robijnhorst, Mariahoeve (such as diagrams, tables, drawings, typologies, floor plans, etc.), see section 1, 2 and 5 of the Appendix.

CHAPTER 3 - BUILDING ECONOMY

3.1 - Analysis

With the help of *Bouwkosten.nl* (2019), the building costs and investment costs of the renovation components and new-construction components of the project at Robijnhorst, Mariahoeve have been calculated. Figure 2 differentiates between these two components in terms of number of dwellings and floor area.

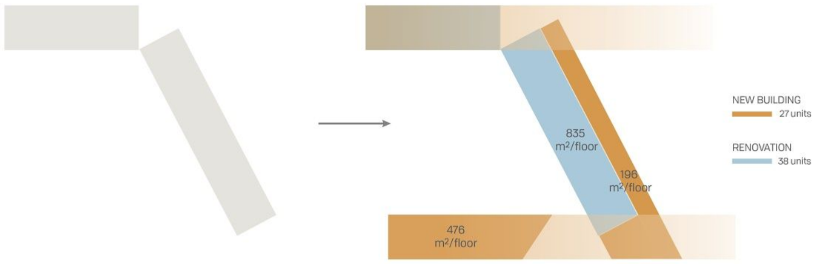

Figure 2: Segmentation of construction components

To calculate the building costs and investment costs of the renovation component, three example projects have been compared with the preliminary design. These projects have been analysed based on similarities in housing design, architectural work as well as for resemblances in floor plan layouts and the porch-entrance design (typology) meaning an average of the characteristics of these projects corresponds to the renovation component preliminary design. The three projects are:

1. *Hull* renovation, Klarenstraat, Amsterdam
2. Renovation and large scale maintenance housing corporation flats, Haarlem
3. Middle-level renovation, Complex 208, Rotterdam.

See Appendix S.4.1 for the composition of the construction costs for these projects. Taking an average of the direct and indirect construction costs for the reference renovation projects, the estimated construction cost per dwelling is calculated (see table 5). For further analyses, the cost based on the number of dwelling is used because it is better to overestimate the cost (the cost based on dwelling is higher than based on floor area).

Renovation component	Cost (based on 38 dwellings)
Direct construction cost	€ 2.247.969,54
Indirect construction cost	€ 436.463,32
Total construction cost	€ 2.684.159,86

Table 5: Cost breakdown based on renovation reference

For the new-construction component, which will result in the densification of the number of dwellings in the entire plot by 62%, three example projects are analysed based on similarities to housing density and architectural work of the Robijnhorst, Mariahoeve project. Again, an average of the characteristics of these projects corresponds to the new-construction of the preliminary design. The three example projects are:

1. Housing-flat with 40 apartments, Zwolle
2. Apartment complex of 44 apartments, Parkwachters, Boskoop
3. Apartment complex of 12 apartments, Vogelbuurt, Tiel

See Appendix S.4.2 for the composition of the construction costs for these projects. Here, since the preliminary design consists of an extension added to the renovation component, the estimated direct and indirect construction cost is calculated by means of the gross floor area (GFA, /m^2). Taking an average of the direct and indirect construction costs for the reference new-construction projects, the estimated construction cost per GFA is calculated (table 6).

New-construction component	Cost based on 4528,00 m^2 (GFA)
Direct construction cost	€ 3.680.313,12
Indirect construction cost	€ 541.852
Total construction cost	€ 4.222.165,12

Table 6: Cost breakdown based on new-construction reference

Combined, the direct construction costs for the renovation component and new-construction component equal to approximately € 5.928.282,66. The investment costs (which include the total of the *direct construction costs*, 23% of the direct construction cost as *taxes*, 25% of the direct construction cost as *additional costs* (de Jong & Koppels, 2019), the *land acquisition costs* (€ 500/m^2), and the total of the *indirect construction costs* (€ 978.315,32)) are calculated to be € 10.042.898,66.

3.2 - Advice

Dividing the total investment cost by the number of dwellings after the building densification (65), the construction cost per dwelling becomes € 154.506,00. This is more expensive than the costs for the reference renovation projects but cheaper than two of the reference new-construction projects. From this housing price, *Haag Wonen* Housing Corporation can use their internal rental price calculation to determine the rent price for each dwelling. In comparison with the rental price of current dwellings rented out by *Haag Wonen*, the feasibility of the investment can be determined. If the calculated rent price is greater than current rent prices, there may be a risk associated with the successful completion of the project. However, if the calculated rent price is lower than the current rent price, the corporation will profit. Consequently, this profit can be used to invest on sustainability objectives of the preliminary design or the costs associated with the movement of residents during the completion of the project. One important note is that only some dwellings are social housings and some are for the private sector market. This means that *Haag Wonen* does not need to rely solely on the monthly rent paid by the residents to cover the investment costs. The investment cost does not include the construction costs needed for the residential square, a public space financial specialist is recommended for this aspect. Financial cooperation with the municipality in this aspect (public space) will be effective in reducing risk.

During the expansion phase of the construction (as described in chapter 5) *Haag Wonen* will need to find a temporary residence for the current residents until construction completed, which cold take around 8 to 10 months. The costs of this may be covered by the expected profit. Construction issues or suppliers inefficiency cause extra costs.

In order to meet the sustainability goals of the project, which are set to make the plot (close to) energy-neutral, rather intensive investment on energy saving measures are needed. With the help of *CSR Manager* (CFP Green Buildings, 2019), few energy saving measures that have great impact on the overall energy performance of the project are implemented. Since the new-construction component includes sustainable interventions as stated in Appendix S.3, and are thus part of the investment costs for it as described above, there are no extra costs on the topic of the sustainability objective needed. For advice in this section, the renovated block is analysed. Although general interventions such as an additional insulation, the replacement of existing boilers with more efficient HR107 kettles, and addition of HR++ glazing, is also already included in the renovation component of the investment costs, there are additional interventions on the topic of sustainability needed to make it up to standard to that of the new-construction. These additional major energy saving measures as per *CSR Manager* (CFP Green Buildings, 2019) are as follows:

- 700m^2 solar panels on the roof (€ 115.000)
- electrical heat pump (€ 31.100)
- heat recovery system (€ 2.700)
- Replacing old light bulbs with LED light bulbs (€ 6.100)
    - The total investment cost of these measures add up to € 154.900

These costs are additional to the investment costs of the construction. In order to minimize the additionally needed investment costs for the sustainability objective, it is advised that *Haag Wonen* apply for government subsidy such as the energy tax rebate (Rijksoverheid, 2017). Meeting the highly-ambitious energy-neutral goal is expensive but compared to overall construction cost of the project, it makes up only a small percentage of the total cost. For a housing corporation, this initial investment cost may still seem a little high but it is important to note that many of these energy-saving measures do earn back in the long run. Also housing corporations can usually charge up to around 5% more for energy-efficient housing than less energy-efficient housing if they are informed about the advantages of energy-efficient housings and many clients are willing to pay more for these kind of housings as they can save money through paying less energy bill (de Jong & Koppels, 2019). At this point though, it is recommended that the needs, desires, and financial possibilities of the main target groups are determined. The target groups do consist of a large younger population, who are more likely to be interested in more environmentally friendly lifestyles so it could be an added bonus for advertising. Nevertheless, the financial stability of these groups, and therewith their possibility in affording possible higher housing prices with these sustainable interventions, should be researched.

In order to increase the financial feasibility of the project, the design needs to be further refined to use, for example, cheaper construction methods or more economical sustainable interventions. Having a well-balanced, well-integrated design is important on not just design standpoint but also the financial standpoint. Thus it is advised, the architect needs to refine the preliminary design further and make it more efficient.

CHAPTER 4 - BUILDING REQUIREMENTS

4.1 - Analysis

Building interventions within the built environment, such as those described in the preliminary design, must meet the therewith required specifications and conditions. In 2017, The municipality of The Hague has put forward new architectural welfare requirements that stimulate creative innovation in the building densification and sustainability ambitions of society (Gemeente Den Haag, 2017). The urban vision of the preliminary design, with the application of alternatingly placed topped-up building mass (Figure 1), allows for the utilization of various interventions on sustainability, thus reflecting the objective of the welfare brief. Adjustments to the initial vision are therefore not essential since it has negative retroactive effects in application of sustainability. Further, the welfare brief of The Hague primarily focuses on promoting architectural, urban, and cultural-historical cohesion, in itself, with its surroundings, or the awaited development of the surroundings. The preliminary vision, since it emphasizes coexistence between the building plots within the Robijnhorstt ensemble and also orients itself to the surroundings, follows this requirement. As the welfare brief by The Hague thus requires, the urban situation with its valuable characteristics is utilized in the vision (Gemeente Den Haag, 2017). Again at this scale level, there are thus no adjustments needed on the topic of building densification (orientation of topped-up building mass) and sustainability (in this case social sustainability). However, the general requirements within the welfare brief also include the display of cohesion in material usage, colour usage, proportions, scales, detailing, and other articulations. Due to the complex accessibility situation that arises in the design, cohesion in these aspects is important. In the design of the facade, for example (Appendix S.5), consideration is given to both the grouping of the windows and the contrast of material usage. Although the facade has been studied in two window distribution variants, both do not elicit a sense of cohesion with the totality of the architectural design as required by the welfare brief (Gemeente Den Haag, 2017). Next to this, the material contrasts as illustrated results in an overloaded or restless facade. Thus, in order to facilitate the required cohesion and mutual support, there are adjustments needed in its design with special attention given to material usage, proportions, and scales. These changes also lie in the articulation of detailing. However, these aspects are component of the facade it may resulting in modifications to the sustainability objective, for instance a variance to the capacity of required facade insulation and glazed surface area. In turn, this affects the energy-neutrality ambition of the design.

In addition to the welfare brief, in 2013, the municipality of The Hague has put forward an allocation plan for the area of Robijnhorst, Mariahoeve (Appendix S.5) (Ruimtelijkeplannen.nl, n.d.). Next to this, however, no other development frameworks have been introduced. Within this allocation plan, it is required that the main buildings be located within the designated building space (Gemeente Den Haag, 2013) as indicated on the planning map. Additionally, the building height within this designated building space must not extend past an elevation of 14 meters (Gemeente Den Haag, 2013). It is clear that the new construction and building extension, as well as the topped-up building mass, as indicated in the preliminary design, does not meet the allocation requirements. Essentially, the current plan allows no changes to the existing situation at Robijnhorst, Mariahoeve. This has considerable consequences to the composition of the design and the ambition for building densification with the application of sustainable building practices. Nevertheless, to meet these requirements, the preliminary design can be adjusted to allow only enhancement of the current situation. This aspect lies in the transformation of the facade (increased insulation) and the addition of solar and sun collector panels, such that the sustainability objectives are to some extent obtained. Another component of the allocation plan is the application of green spaces between the building blocks. While the preliminary vision does include plots specified for specific green use, the preliminary design of the square is a non-building building-work that incorporates less green. For this design aspect the allocation plan requires that its height be no greater than 3 meters (Gemeente Den Haag, 2013). The allocation plan is, however, from 2013, indicating that deviations in application of building mass and other interventions of the design that stand in conflict to it can be argued.

4.2 - Advice

Since the preliminary design embodies a transformation project, an important aspect to it from the architectural welfare brief is the object specific criteria outlining requirements for replaced, adjusted, extended, and additional building elements, connected to or detached from the existing buildings (Gemeente Den Haag, 2017). In this case, since all are applicable, it is recommended that this section of the brief be interpreted thoroughly. It is advised that the design of objects such as balconies, roof eaves, windows, and the facade (as indicated in section 4.1) be given special attention in order to facilitate mutual cohesion and ensure that the excess-ruling of the brief is not put into effect. Robijnhorst, Mariahoeve is not part of a protected cityscape or located near a monument and it is thus advised that development does not focus on these components of the welfare brief. While the deviations to the welfare brief (facade incoherence) are design questions requiring partnership with facade design specialists, the conflicts with the allocation plan (allotment of all new building mass) require further assessment and development consent by the municipality of The Hague. Also indicated in section 4.1 is the fact that the allocation plan, not allowing modifications of the current situation, should be argued against since the analysis of the vision shows clear qualitative benefits to the surroundings. This is a legal action instilled within the Wet Algemene Bepalingen Omgevingsrecht (Wabo). Herewith lies the recommendation to obtain an integrated environmental permit instead of many smaller permits (Bouwkunde Afdeling Management in the Built Environment (MBE) TU Delft, 2018) which may allow the prescribed deviations from the allocation plan (Ministerie van Infrastructuur en Waterstaat, n.d.). This is in line with reasons as to why an integrated method management/organisational approach is advised (see chapter 5, 6). Since this is a complex project with possibly much risk for the surroundings, this permit obtaining process may take up to a maximum of 6 weeks longer than the regular 8 week review period (Bouwadvies Nederland, n.d.). The segmentation of the project into building phases, as advised in chapter 5, is an approach that may aid in making this process more time-efficient (Bouwkunde Afdeling Management in the Built Environment (MBE) TU Delft, 2018). Mayor and City Council Members will then only have to assess the permit applications for the new building-works (the new-construction, topped-up building mass, and extension) while a permit application for the block renovations, since it is not in conflict with the allocation plan, can easily be granted straightaway and construction started without delay. Nevertheless, prior to the permit application it is advised that Haag Wonen housing corporation seeks consultation from building authorities about the possibility that the council does not allow components of the allocation plan to be repealed (integrated environmental permit denied). In this case, they may be advised to seek legal protection of the design and object the permit denial. This appeal to the Mayor and City Council Members must be submitted within 6 weeks of the rejection (Bouwkunde Afdeling Management in the Built Environment (MBE) TU Delft, 2018). If the appeal is again denied, the next step in the process is to appeal at municipal court. At this point, to impede further objections, the municipality may feel compelled to allow admittance of the deviation to the allocation plan. One of the fundamental reasons as to why it is very likely that the municipality will grant the integrated environmental permit is the fact that in 2009 it has set forward a document advocating for inner-city building densification. Herein, it is stated that The Hague must adjust itself for new spatial developments in order to strengthen and better make use of the existing housing supply (Gemeente Den Haag, 2009). Ultimately, the objective is to create a variety of housing typologies for a broad range of target groups, a goal that is fully reflected in the preliminary design as constituted in chapter 2. (Re)acquainting the municipality with this document will assist in reinstillinging their building densification ambitions, therefore also allowing for the sustainable innovation associated with it. The municipality should also be advised that this is an ethical opportunity since it works for the greater good of society. There is, next to the above processes, the alternative Plan B to demolish the whole of the ensemble at Robijnhorst, Mariahoeve, in which case the plots are declared as new-construction plots and the location becomes free of the requirements of the welfare brief (Gemeente Den Haag, 2013) and a new allocation plan would have to be instilled (VNG, 2017). Of course, a demolishment permit is required for this action.

CHAPTER 5 - CONSTRUCTION MANAGEMENT AND PROCESS

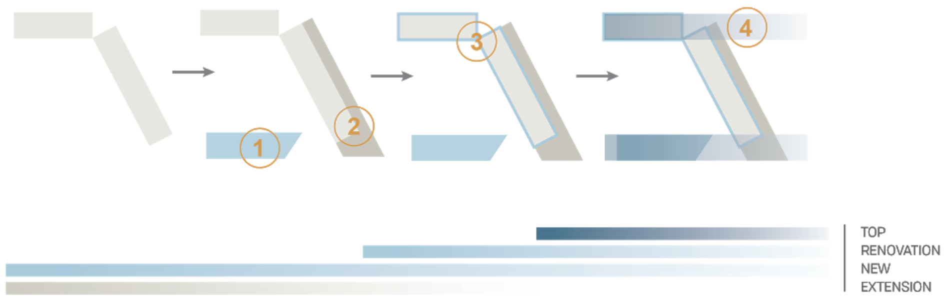

Figure 3 - Building process and related timeline

5.1 - Analysis

In the proposed preliminary design for Robijnhorst, Mariahoeve (chapter 2), there are four types of construction interventions that need to take place: a renovation of the existing blocks, an extension of an existing building, the addition of a new-construction, and the addition of topped-up building mass. Figure 3 illustrates how these actions would sequentially take place in the construction process. To realize the building densification and sustainability goals in this process it is needed to build as much as possible simultaneously. In this way, the building costs can be reduced by means of less time spent on site and less renting time of necessary equipment. Moreover, the required sustainable interventions can be more efficiently integrated between the different constructions. However, in turn, this leads to an increase of stakeholders that are at one time involved with on site developments, thus increasing the need for good planning and management of the construction.
A possible planning solution, as Figure 3 illustrates, begins with the construction of the extension and the new-construction building (step 1, 2). This choice is explained by the fact that these interventions need more technical work and are therefore more time intensive. The municipal densification objective (Gemeente Den Haag, 2009) also necessitates this first phase. Further, ground and soil redemption and disposition of the foundation are activities which require significant time on the construction timeline of the project (Hofstadler, 2010). This is also the moment at which sustainable interventions such as the winter gardens (Appendix S.3.1) and solar/sun collector panels can be implemented (Appendix S.3.2). Additionally, during the construction of the new building it will be possible to directly install the Thermal Energy Storage System (Appendix S.3.4) and connect it with the existing buildings in order to provide the whole block with independent energy production. Next to the implementation of a great deal of the sustainable ambitions, within this first construction phase, the new-construction will bring the level of densification to 25% of completion, with the addition of the extended construction it will be at 75%.
During the extension phase the renovation of the existing building can start (step 3) and with it the current residents will begin to move out for the remaining interventions of the construction process. Walls adjoining the expansion will need to be reinforced and improved during the construction to ensure both support for the topped-up mass (additional building densification) and the implementation of a new facade (sustainability). At this point the overall re-insulation of the existing facade can also take place. The heat resistance (Rc-value) of the whole block can be brought to present-day norm levels. The situation of the renovation phase at this point within the process is crucial because it is required to complete course of densification: the load-bearing structure needs to be reinforced and upgraded in order to host the new thereabove placed topped-up mass. When the renovation phase is completed, the ending phase of topping-up can take place with thereafter the phase of delivery (step 4). With this new mass the densification will be fulfilled at 100% and the sustainability interventions can perform at their highest efficiency.

5.2 - Advice

A balance between the densification and sustainability objectives and a well managed process is needed. Consequently, this is why Figure 3 and the associated analysis focuses on a start with the new construction. Figure 4 illustrates the proposal for the planning of the project at Robijnhorst, with the phases of Figure 3 advised to converge within this same timeline (see Appendix S.8, Figure 3) for this timeline with phases of new construction and renovation included).

Within this section, the phase of Initiation and Feasibility is disregarded for the reason that advice given in chapter 6 recommends the integrated organisational method whereby the programme brief is created with full stakeholder involvement. Also, the design brief is already a product of the housing market analysis, the research of the urban context, target groups, and needed building mass, that has created the preliminary design of this report. It is advised that if adjustments to the design are needed (a possible recommendation out of other chapters) that Haag Wonen Housing Corporation seek advising by stakeholders of these aspects of the design brief.

During the Project Definition (2 months), Haag Wonen will need to consult financial advisors in order to analyse more in detail the status of the housing market and which costs and profits can they aspect to fully establish the design brief.

Further, comes the phase of Structure Design (1 month) when the client involves the architect, landscape architect and technical advisors (acoustic, mass construction, climate, sustainability). The project starts to have its first shape and concept.

After this point the client has to proceed with the bureaucratic process regarding the Integrated environmental permit (see also chapter 5). The municipality thus takes part in the conversation and the execution of the project. This phase is the Preliminary Design (1 month), which is defined by a direct discussion between client, architects and advisors where the draft design is compared with the design brief and vice versa.

The Definitive Design (3 months) involves the same stakeholders listed in the previous phase and it's about the finalisation of the design and about finding a decisive agreement between the designers and the client.

The Technical Design (3 months) involves all the earlier parties with the addition of the constructor. The financial advisor, concerned already in the Project Definition, participates now to create a final budget with which the constructor can also base the Technical design on and with which he can start to organise the call of the contractors.

The next step is then to call the different contractors needed for the construction. At this point it is of great interest for the project to choose contractors who are specialised in renovation and others who are specialized in Clean-Energy installations.

At this point we are at the end of the first year of execution of the project, phase of Construction Design. The plans and drawings are ready to be revised by the head-constructor in order to be shared on construction site and to be shown to the Municipality of The Hague for the final approval and release of the Integrated Environmental Permit.

In chapter 5.1 we analysed the design vision and we proposed a solution for the Construction phase.

If the building permits allow to proceed, the current residents can be moved for the following year into another house and the construction can then start with the laying of the foundations and the Thermal Energy Storage. Further, it will progress as already described in the previous chapter.

At construction completion, the Delivery phase can take place. The responsibility falls now again to Haag Wonen, which, as housing corporation, will move the old residents back in the newly renovated dwellings and the new residents in the expansion.

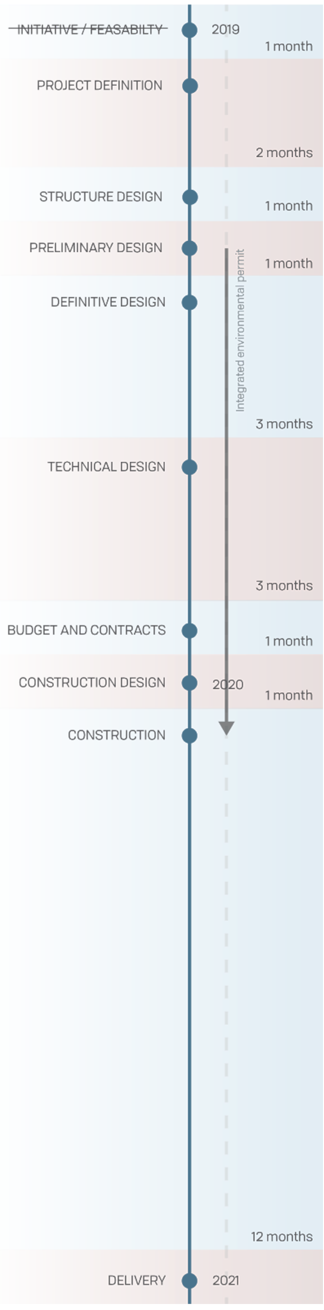

Figure 4: Planning

To Haag Wonen it is advised to continue with this planning set-up, although the framework as it is now it is very time-restricted. Around another year can be added to the planning for the facilitation of adequate final results. The Municipality is a relevant time-variable, as noted in chapter 4.2. Changes to the allocation plan are perhaps necessary or simply the permits are not granted at first, therefore adjustments to the planning might also be needed.

CHAPTER 6 - CONSTRUCTION ORGANISATION

6.1 - Analysis

Within the construction organization there are various workflows and stakeholder processes that need to be coordinated. In this section, the focus lies on the analysis of risk, sustainable approaches to building densification, involvement relations between the client and contractor, the market-structure of the construction industry, and the role of the current/future households and the municipality. These aspects are then assessed in the section for advice (chapter 6.2) based on the two forms of construction workflows that can be followed for construction: the traditional (Design-Bid-Build) method and the integrated (Design-Build) method.

Due to the complexity of the project (see chapter 2), the construction at Robijnhorst, Mariahoeve requires the participation of various stakeholders. Involvement of all parties will help see its successful completion. These main stakeholders are the client (Haag Wonen), contractors, architects, residents and the municipality.

- CLIENT: As the client, it is the duty of Haag Wonen Housing Corporation to create the design brief for the project. The preliminary vision as described for this report helps direct these project requirements. Because of the project complexity, the budget, construction time allotment, and acquirement of resources are also significant. This has consequences for the building densification and sustainability objectives as they are essential ambitions of the municipality (Gemeente Den Haag, 2009).
- ARCHITECT, CONTRACTOR: The contractors along with the architects help in creating the design that both visualizes the vision of the client and makes it realistic through technical drawings. The preliminary design includes both new-construction, renovation, and a mix (the extension) suggesting the need for nonsegregated workflows. For, again, the building densification and sustainability objectives, there are consequences as the two ambitions are mutually integrated in the design (chapter 2).
- RESIDENTS: As suggested in chapter 5, cooperation from current dwelling residents is needed. Further, the new-construction, since its development is for a variety of target groups and the public function of the plot is as residential square (chapter 2), suggest cooperation from future residents. Design of these spaces without integration of these groups is riskful to the success of the design brief as set forward by Haag Wonen Housing Corporation, especially the densification objective.
- MUNICIPALITY: The municipality's role within the whole project is to see the project’s feasibility in relation to among others the welfare policy and allocation plans (see chapter 4). The municipality then also helps, in conjunction to the application for the integrated environmental permit, to draw up land use and zoning plan designated for the built environment. Only then can the building densification and sustainability ambition of The Hague be fulfilled (Gemeente Den Haag, 2009).

The construction industry is never a fully green-sustainable market (World Green Building Trends, 2018). Nevertheless, the project at Mariahoeve aims to make the process of renovation and construction as sustainable as possible. Organisational approaches within the renovation component include the cradle to cradle model and performing building waste segregation/recycling. The sharing of construction materials between the renovation and new-construction components (for example with excess material) also apply to these desired models. Ultimately, this suggests a need for inter-cooperation. In addition to these sustainable practices, the inclusion of various interventions such as the winter gardens, solar panels and sun collectors, roof community gardens, and the Thermal Energy Storage System (See Appendix 3 S.3.4) on both the renovation and new-construction component of the preliminary design, also requires a form of collaboration.

The market structure of the construction industry is very much dependent on the project scope and size of the local market (Foulkes & Ruddock, 2019). The market structure thus influences the procurement strategy for the project as it is complex and a member of the stakeholders are the prescribed construction material suppliers. Again, for the time efficiency as described in chapter 5 and the fact that the project has both renovation and new-construction components, supplier partnerships may be imminent. In this way, a good procurement process that involves minimal expenses, time, and effort in order to acquire the most capable workforce (of contractors, firms, consortiums and subcontractors) can help to achieve the clients project requirements in the most effective and efficient way possible.

6.2 - Advice

When comparing the DBB and the DB methods (see Appendix, Section 7, table 2) it is advisable for Haag Wonen Housing Corporation to follow the DB process as the pros outway the potential project failure that could arise within the DBB process. This suggestion is also made as, with the management of the project (chapter 5), it is advised that for time efficiency and due to the densification objective, there are points at which the renovation and new-construction occur simultaneously, requiring the cooperation of various stakeholders. Since maximum risk of project failure and delays exist at the end of the Definition phase and at the beginning of the Realization phase in both the DB and DBB process (Gardner, 2015), close collaboration and communication is recommended between all disciplines and parties involved. It is the DB process facilitates this requirement and will allow successful achievement of the project at Robijnhorst, Mariahoeve. This integrated strategy helps to mediate risk and apply the continuous engagement between the client, the architect and the contractor, and residents:

- CLIENT: In the DB work process the client has a continuous involvement within the design and construction phase ensuring the building densification and sustainability objectives are constantly followed. The clients' task in determining the budget, project scope, project time, and thus project risks go in hand with the tasks of the other stakeholders, with a conjoint procurement strategy being opportunistic. The analysis shows that this is beneficial for the building densification and sustainability objectives of the municipality.
- ARCHITECT, CONTRACTOR: The complexity of the project, especially it's multiple construction phases (chapter 5) suggest collaboration within the contracting team. Within the therefore advised DB process there are two approaches by which an architect and contractor can work together. (American Institute of Architecture, 2017). There is the Architecture lead Design Build (ALDB) process or the Construction lead Design Build (CLDB) (Construction lead Design Build) process. In the case of the preliminary design this report advises that the ALDB method should be the approach as the project revolves around renovation and new building conception both of which need initial planning and technical drawings instated by the architect. In correspondence with the constructors, the feasibility of the project can be decided and the management method as described in chapter 5 can be more efficiently followed. Herein, the feasibility of the densification and sustainability objectives is established early on in the design process.
- RESIDENTS: The success of the design brief by Haag Wonen Housing Corporation, as discussed in the analysis, implies maximum user involvement and therefore the recommendation of the DB integrated method. Herein these stakeholders can voice their wishes for the design brief. Along with the client, the residents therefore help to set the vision and thus make crucial decisions as to how much budget, time and resources can be made available for the project. The procurements then also ensure that deviations to the wishes of the residents can be appealed. The vision of chapter 2, encouraging various target group intake, will with this organisational form also be assured.
- MUNICIPALITY: Based on the analysis, the municipality plays a critical role in overseeing and supervising the completion of the project at Robijnhorst, Mariahoeve. Like the collaboration needed between client-architect-constructor-residents, the additional cooperation that is essential with the municipality results in the advisement of the adoption of the integrated design (DB) method.

To allow for the sustainable practices, it is advised that Haag Wonen Housing Corporation form partnerships with all its suppliers. The creation of a joint venture or consortium is therefore a suggestion. This includes partnerships with materials suppliers. Financial aid is therefore also established from the consortium (Gardner, 2015). Building Information Modelling (BIM) is during the design process also an advisable aspect since it aids in creating a sustainable workflow as all project members can easily share, edit and validate their models against local regulatory and project codes (Aibinu & Papadonikolaki, 2019). This way, the cost of building materials and construction methods can also be easily analysed, ensuring financial feasibility through the entire process.

CHAPTER 7 - REFLECTIONS

7.1 - Reflections and conclusions on the building management plan

Understanding the feasibility of the action plan with regard to the actual design can be challenging. When we examine the project on a financial level, we compare the investment power to the foreseen building costs. If the investing costs are lower than the construction expenses, then the project is financially feasible. It is important to note that the final costs we got are rough estimates because the project design is still in its preliminary state. Due to this limitation, the calculations were based on the average costs of example projects that were similar in terms of building density, architectural style and layouts. Therefore, the final calculation that would be carried out in the future when the design is finalized might differ from the estimated costs of this report.

Understanding the building regulations informs us that the preliminary design needs adjustments in the facade and the acquiring of permits to deviations to the allocation plan. With this, there is the introduction of risk on a design standpoint. Even though the analysis of the welfare brief shows that the current design does not violate most of the regulations, the continued development of the plan necessitates more attention to the requirements. Nevertheless, the management process, since it recommends the integrated process and thus the advising of multiple parties, these aspects are efficiently organised meaning the project feasibility is less risky.

Regarding the building management and planning, unforeseen circumstances could elongate the estimated timeline. The project could appear more complex than expected due to various factors. The complexity of the project could also decrease the attractiveness for a contractor to take on this project (Gardner, 2015), as we advised that all the project risk of constructing should be put on the general contractor (team) instead of on the client. Even during the construction preparation, phase setbacks could be faced because of several reasons: archeological findings, poor weather conditions, budget restrictions, supplier or materialisation restrictions, etc. All these points may result in delays to the whole process, with additional financial consequences.

In order to limit great delays it is imperative for Haag Wonen Housing Corporation to maintain a clear and open conversation with all the parties involved from the Definition Phase. A clear design brief, for instance, assures the precise understanding of designers and advisors on what the client goals and ambitions for the project are. The design brief helps achieving a definite design concept which automatically translates to a detailed and well-structured design. Good communication is essential also for the guarantee of the building permits by the municipality. Expressing precisely what the message of the project is, what will it add to Mariahoeve and the city of The Hague, how will it improve the lives and the housing situation of the present residents, are topics which interest the municipality beyond the respecting of the Allocation plan and general building regulations.

In the worst case, the whole project cannot be achieved, for example, in the case permits cannot be obtained. In that case it is possible though to change the design and apply again for a permit, but this also means delaying the project and having additional cost.

The risk of project failure is substantial, though we advise to use the integrated Design Built (DB) method, of working to complete the renovation and new building construction for the Mariahoeve Project. Subsequently, since the DB process is being followed, the point of responsibility and accountability falls towards one common consortium. Thus the motivation and commitment in seeing the successful completion of the project will be far greater than seeing its failure.

Having a good procurement strategy and market awareness, also help to mediate the risk and help promote the project in the local housing market. The use of innovative building technologies, such as BIM, can also help increase the overall collaboration between the various parties involved within the project (chapter 6). The Cradle to Cradle Model along with the LEED standards as suggested for this project helps to make a sustainable, efficient, and economic renovation and new building expansion.

7.2 - Team-work Dynamics

At our first meeting regarding the project at Robijnhorst, Mariahoeve, we stipulated a collaboration agreement (*Samenwerkingsovereenkomst*, SOK) between us team-mates of JIPC-managers. The SOK imposes what our commitments and goals for this assignment are:

- Work in a team environment to improve our communication skills and the adaptation flexibility.
- Understand the construction management process in order to help us receiving a better overall picture of the building management industry.
- Encourage each other by working together on specific parts of an assignment to help gain insight on each other skills and work ethic, helping each other improve weaknesses and develop already affirmed strengths.
- Ensure that each assignment is completed to the highest degree of quality possible within its designated timeframe.

To help us achieve the goals established by the *SOK* we met periodically at the Faculty of Architecture of TU Delft. During each meeting we analysed the weekly literature, lecture material and elaborated mind maps which would help us to better understand the themes surrounding management of the built environment. This rigorous work-method and planning, helped us tackle uncompleted tasks and assigning the responsibilities evenly among the team. Further, we regularly asked each other about the status of completion of each task and helped each other to ensure that the assignment was completed at best of our competence.

During this assignment we used twice a tool of team evaluation (*SCORION*) with which we would score each other on certain aspects of the group dynamics such as *communication*, *initiative*, *competence*, etc.
The *SCORION* assignment enabled us to reflect systematically on the set goals of the SOK agreement . Within the assignments we followed up on last meetings discussion and literature after which we would discuss the literature and assignment of the current week. The literature was in turn divided amongst each other per chapter and was summarized in the mind map assignments.

During our reflection of the *SOK* agreement within the *SCORION* assignments we clearly understood that we are able to relate and work with each other as a team. From our reflections we saw that each one of us was able to adapt and take up someone else's role (leader, initiator, creative etc..) within the team every week.

Working together as a team helped us not only to improve our communication skills, but also helped us to push each other to learn more about the building management industry and enabled us to break free from our comfort zone.

Reflecting on the design vision, construction methodology and timeline gives us the following ethical dilemmas that we need to focus on for future decisions about the management project:

- What happens to the residents of the renovation project? Does the client ask them to find temporary accommodation or are they asked to vacate the building and seek other accommodation individually?
- Must the municipality help finance for alternative temporary accommodation for the residents?
- Will the rent for the rental properties within the renovation block be the same or will it increase due to the improvements in living-standards? Are the residents expected to pay a higher rent?
- What do you do when someone is not able to seek temporary accommodation due to financial, emotional or medical problems (as for example for the target group of seniors)?
- Will the residents of the surrounding neighbourhood face degraded living standards due to the construction of the new building, even if the welfare brief is followed?
- Are the short term inconveniences worth the long term financial benefits and better living standards for the residents of the neighbourhood?

All of the above points and more are some of the types of ethical dilemmas that can affect the renovation and new building construction project of Mariahoven by the Haag Wonen wooning corporation.

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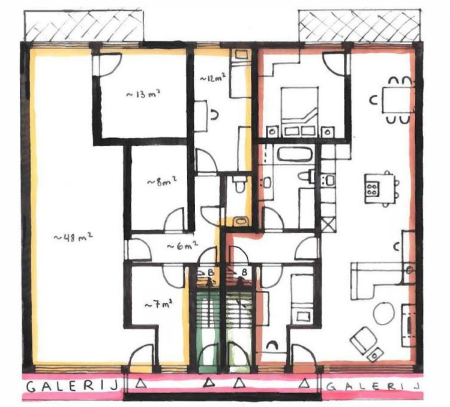
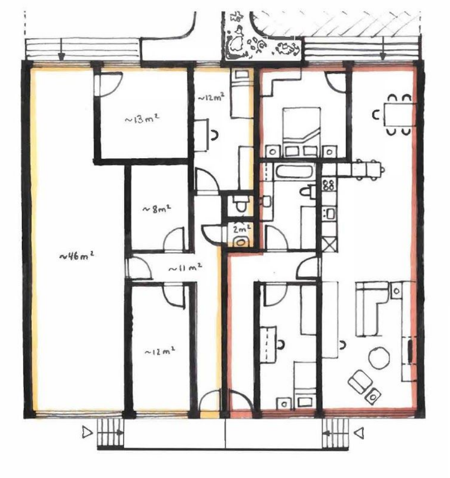
APPENDIX

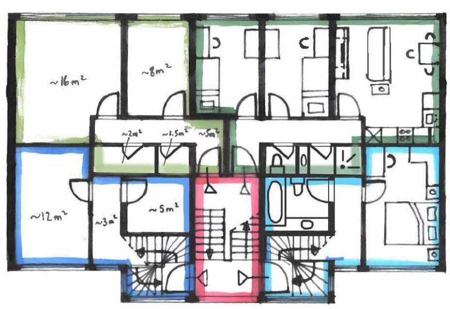
Section 1 - Building Densification Objective

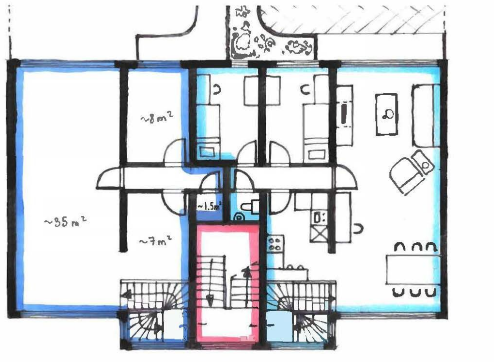
Floorplans of (currently) worked-out dwelling unit typologies

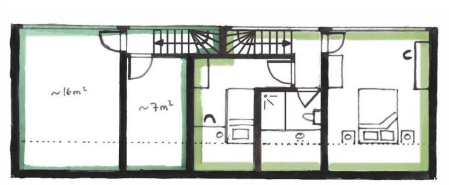
Transformation Block 2	Transformation Block 1	New Construction - Topped-up
Apartments (yellow + brown) 1+ bedrooms	Studios (green + light green) Maisonettes (blue + light blue) 1+ bedrooms	Maisonettes (green + light green) 1+ bedrooms

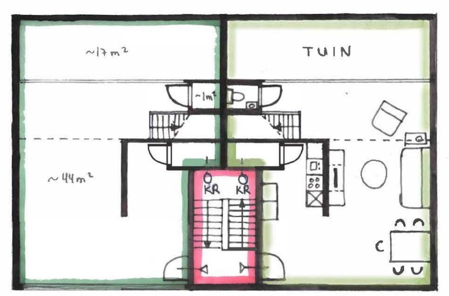












Section 2 - Dwelling Typologies and Target Groups

Description of dwelling typologies related to the target groups

Table 1	**Target group**	Seniors	Singles	Familie s	Couples without children
Dwelling Typology					
Apartment (1+ Bedrooms)	(16) 25%	✓	✓	✓	✓
Maisonette (1+ Bedrooms)	(35) 54%			✓	✓
Studio	(10) 15%	✓	✓		
Penthouse (1+ Bedrooms)	(4) 6%			✓	✓
Total	**(65) 100%**				

Section 3 - Sustainability Objective

Regarding the sustainable aspects, four main features are added to the block:

1. Winter Gardens: these work to both promote the building densification and sustainability goals of the building process. During the winter season, they act as an insulation layer for the dwelling due to the internal process of thermal convection (Renovatieteam Lindenhove, 2015). During the summer season, their large glass surface area allows the interior of the dwelling to cool and further provide additional space for residents.
2. Solar Panels and Sun Collector Panels: these provide clean energy production which can be used for the heating of shower water or other warm tap water sources.
3. Roof Community Gardens: these create a pleasant semi-public space for the residents and also contribute to increased insulation for under roof situated dwellings. Next to this, they allow for the collection of rainwater which can subsequently be used for the flushing of the private toilets. The roof gardens are also implemented to compensate for the removal of green on the ground level square.
4. Thermal Energy Storage: this system grants a non-fossil, fully green and independent energy source for the whole ensemble.

Section 4 - Cost composition of reference renovation and new-construction

4.1 - cost composition of example renovation projects (based on Bouwkosten.nl

Klarenstraat Amsterdam (30 housings)			
Gross floor area (GFA)	4.541		
Net internal area (NIA)	4.205		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	1.943.790	64.793,00	428,05
Installaitons	406.405	13.546,83	89,50
Layout	21.600	720,00	4,76
Site	8.860	295,33	1,95
Total	**2.380.655**	**79.355,17**	**524,26**
Indirect construction cost			
General	181.765	6.058,83	40,03
Operating costs	174.555	5.818,50	38,44
Profit and risks	110.310	3.677,00	24,29
Total	**466.630**	**15.554,33**	**102,76**
Total	**2.847.285**	**94.909,50**	**627,02**

Corporatieflats Haarlem (40 housings)			
Gross floor area (GFA)	4.548		
Net internal area (NIA)	4.027		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	1.691.945	42.298,63	372,02
Installations	678.385	16.959,63	149,16
Layout	38.810	970,25	8,53
Site	58.720	1.468,00	12,91
Total	**2.467.860**	**61.696,50**	**542,63**
Indirect construction cost			
General	310.225	7.755,63	68,21
Operating costs	122.335	3.058,38	26,90
Porift and risks	20.090	502,25	4,42
Total	**452.650**	**11.316,25**	**99,53**
Total	**2.920.510**	**73.012,75**	**642,15**

Complex 208 Rotterdam (320 housings)			
Gross floor area (GFA)	27.400		
Net internal area (NIA)	23.704		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	7.732.990	24.165,59	282,23
Installations	3.115.725	9.736,64	113,71
Layout	775.805	2.424,39	28,31
Site	29.755	92,98	1,09
Total	**11.654.275**	**36.419,61**	**425,34**
Indirect construction cost			
General	988.150	3.087,97	36,06
Operating costs	976.105	3.050,33	35,62
Profit and risks	463.600	1.448,75	16,92
Total	**2.427.855**	**7.587,05**	**88,61**
Total	**14.082.130**	**44.006,66**	**513,95**

4.2 - cost composition of example renovation projects

Woontoren Zwolle (40 housings)			
Gross floor area (GFA)	5.680		
Net internal area (NIA)	4.568		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	3.674.795	91.869,88	646,97
Installaitons	697.020	17.425,50	122,71
Layout	77.880	1.947,00	13,71
Site	29.605	740,13	5,21
Total	**4.479.300**	**111.982,50**	**788,61**
Indirect construction cost			
General	500.015	12.500,38	88,03
Operating costs	345.975	8.649,38	60,91
Profits and risks		0,00	0,00
Total	**845.990**	**21.149,75**	**148,94**
Total	**5.325.290**	**133.132,25**	**937,55**

Appartments Boskoop (44 housings)			
Gross floor area (GFA)	6.766		
Net internal area (NIA)	6.022		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	3.860.010	87.727,50	570,50
Installaitons	1.087.350	24.712,50	160,71
Layout	123.000	2.795,45	18,18
Site	92.235	2.096,25	13,63
Total	**5.162.595**	**117.331,70**	**763,02**
Indirect construction cost			
General	435.215	9.891,25	64,32
Operating costs	336.985	7.658,75	49,81
Profits and risks	192.045	4.364,66	28,38
Total	**964.245**	**21.914,66**	**142,51**
Total	**6.126.840**	**153.171,00**	**905,53**

Appartementencomplex in Vogelbuurt te Tiel (12 housings)			
Gross floor area (GFA)	1.405		
Net internal area (NIA)	1.281		
Direct construction cost	**Costs**	**Per housing**	**Per GFA**
Architectural work	878.995	73.249,58	625,62
Installaitons	309.310	25.775,83	220,15
Layout	18.345	1.528,75	13,06
Site	39.235	3.269,58	27,93
Total	**1.245.885**	**103.823,75**	**886,75**
Indirect construction cost			
General	54.480	4.540,00	38,78
Operating costs	40.430	3.369,17	28,78
Profits and risks		0,00	0,00
Total	**94.910**	**7.909,17**	**67,55**
Total	**1.340.795**	**33.519,88**	**954,30**

Section 5 - Facade Design

Figure 1: Facade elevation view with window grouping variants and materials and contrast therein

Section 6 - Allocation Plan

Figure 2: Allocation plan (Dutch: bestemmingsplan) for Mariahoeve area (Ruimtelijkeplannen.nl, n.d.)

Section 7 - DBB vs DB Process at the Mariahoeve Project

Design-Bid-Build (DBB)	**Design-Build (DB)**
• Separate contractual relations between client and members of contracting team based upon a tendering process taking place after the creation of the design specifications document by a design team	• Contractual relations between client and members of design/contracting team created together at the initiation phase of the design process but after the creation of the clients' design brief
Cons	**Cons**
• During the design process the client retains control over the process but loses much input for the construction • The potential for delays and conflicts to arise due to interference between the client, the designer and contractor are greater than the DB process, hence the risk of the project failing is also grater. • No one individual or party can be held responsible, toward the project failure.	• During the design process the client retains limited control over the process. • The DB process is relatively more expensive to follow than the DBB process.
Pros	**Pros**
• The DBB process is a relatively cost-efficient process to follow in comparison to the DB process.	• Client deals with a single team that sees towards the successful delivery of the project. • The potential for delays and conflicts to arise due to interference between the client, the designer and contractor are less than the DBB process, as all involved parties work together throughout the DB process. • Since only a single team see towards the successful delivery of the project hence only one point of responsibility exists.

Table 2: Indication of Pros and Cons of the DBB and DB work process at Mariahoeve (based on Gardner, 2015).

Section 8 - Planning and Management

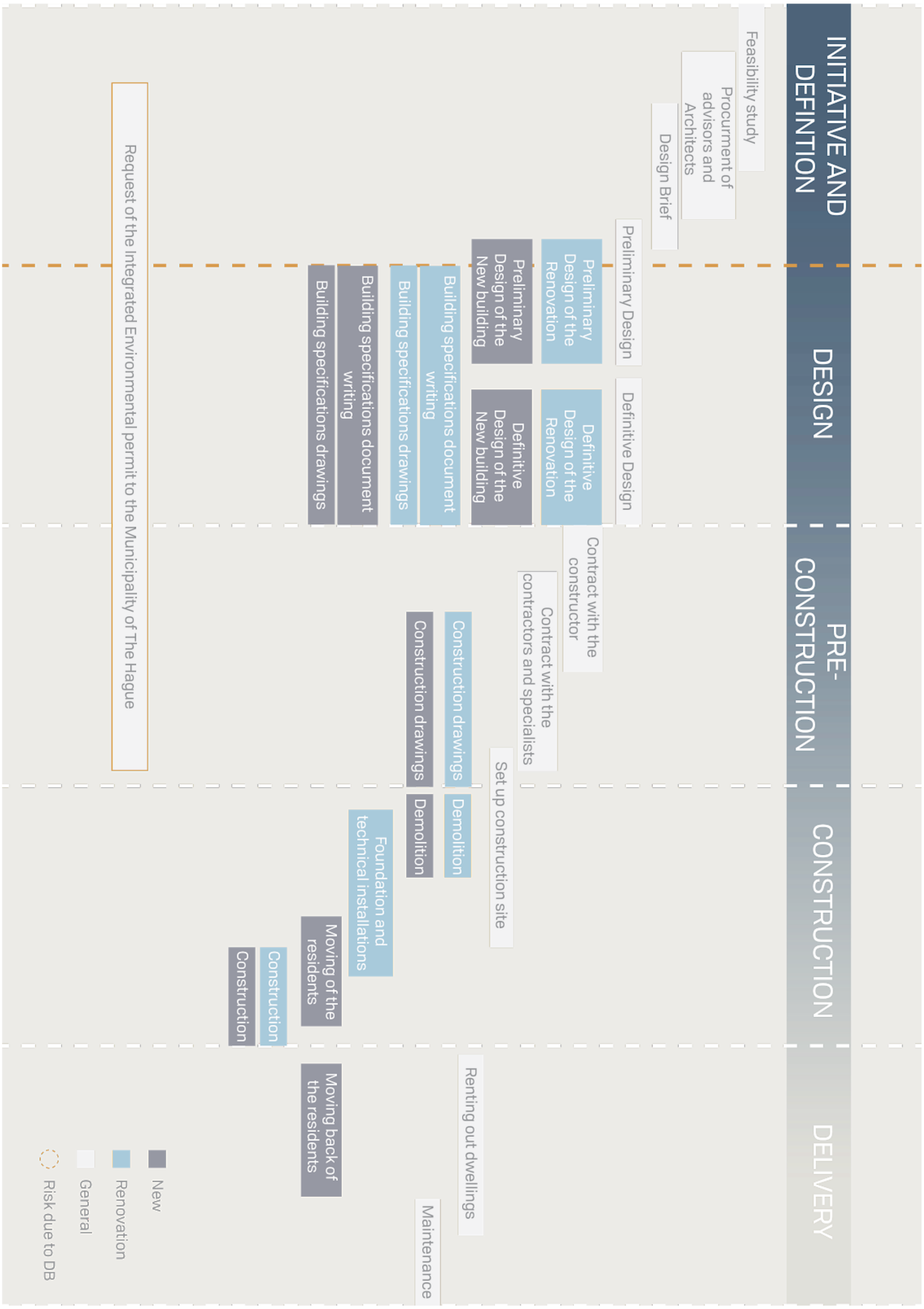


Figure 3 : Planning, timeline and tasks divided by renovation and new building