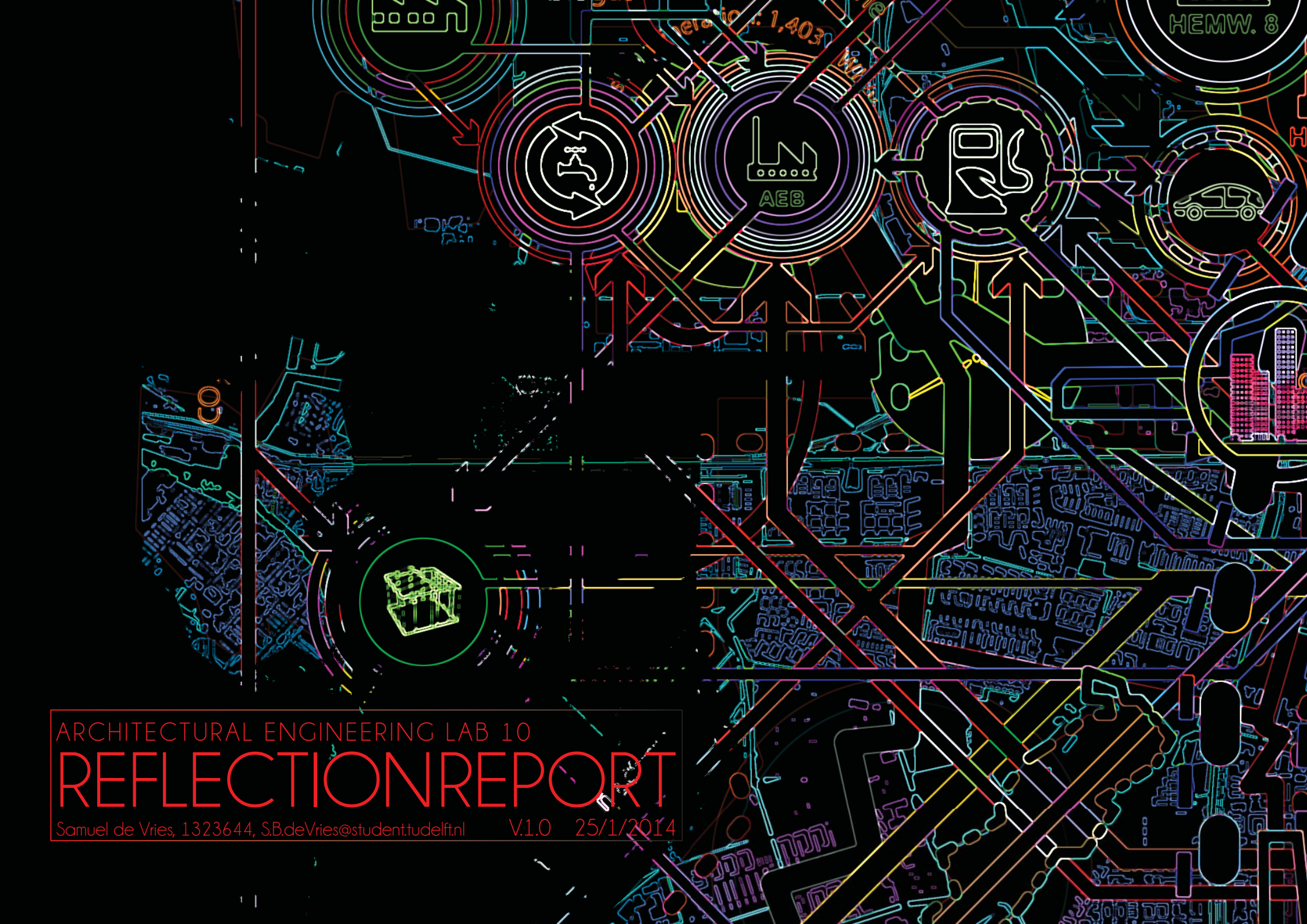


ARCHITECTURAL ENGINEERING LAB 10

REFLECTIONREPORT

Samuel de Vries, 1323644, S.B.deVries@student.tudelft.nl V.1.0 25/1/2014

INTRODUCTION

In this report you will find a reflection on my graduation project. In the following paragraphs I will subsequently reflect on my design product, my design process and my project planning. In doing so I hope to discover if I followed the right aproach and if not to learn from this.
My graduation project is part of the Architectural Engineering studio. In this studio we start the graduation project by writing a research paper on a technologically innovative subject. Although we do some prelimminary design work during this research the most dominant part of the design activities take place after the research is completed. The priliminary design work which takes place parallel to the research project is meant to give direction to our research. This is to make sure the eventual research paper offers us the required tools to complete a technologically innovative design. In this report my main focus will be the relationship between research and design.

Description of design product.

My design encompasses an agricultural complex which is part of a 4F farm. A 4F farm is a term I coined to describe an agricultural enterprise which produces food and harvest energy wilst maintaining a closed cycle of nutrients (fig. 1.1). A 4F farm balances the production of food, feed, fertiliser and fuel in that respective order of importance. The 4F complex houses most proffesional food production enterprises required to fullfill the human diet, including: a fruit orchard, a field farmer, a poultry farm, a tilapia farm, a mushroom grower, greenhouses for growth of fruits and vegetables as well as a beekeeper (fig. 1.4). These different functions utilise each others waste streams. Waste is used as feed for instance. Waste material which cannot serve another function is codigested in a biogas plant where nutrients and energy are retrieved.
To communicate the increasing problem of resource scarceness to the public as well as make optimal use of space and energy, I chose to integrate a recreational route through this productive landscape. (fig. 1.2 and 1.3) A series of architecural objects or 'specials' along this route exhibit the productive function of the building as well as the problem of resource scarceness. Their expression overexagurates their function. The architecture of these spaces brings to mind the atmosphere of a theme park. I therefore titled this recreational and agricultural as 4FFland.
The most dominant space along the recreational route is a subtropical greenhouse where waterhycacinths are used to filter wastewater and regain its nutrients. This space houses three types architectural specials: a water column, a solar chimney and mushrooms which act as rainwater collectors, passive cooling device and air inlet respectively (fig. 1.5 and 1.6). The chimney and water column are constructed out of bamboo elements.

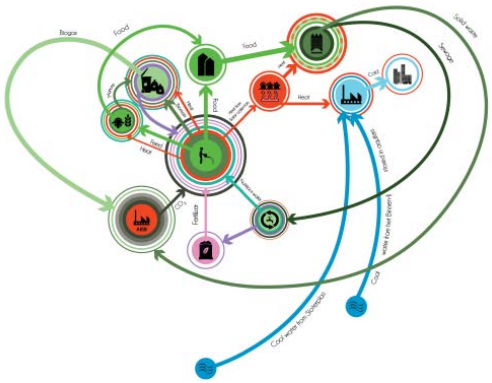


Fig. 1.1 Closed cycle of nutrients.
The 4F farm (center + sheep and waste icons top left) is anchored in the industrial ecology of the area. Nutrients are recovered from waste streams both internally as well as via the industrial waste plant and the waste incineration plant.

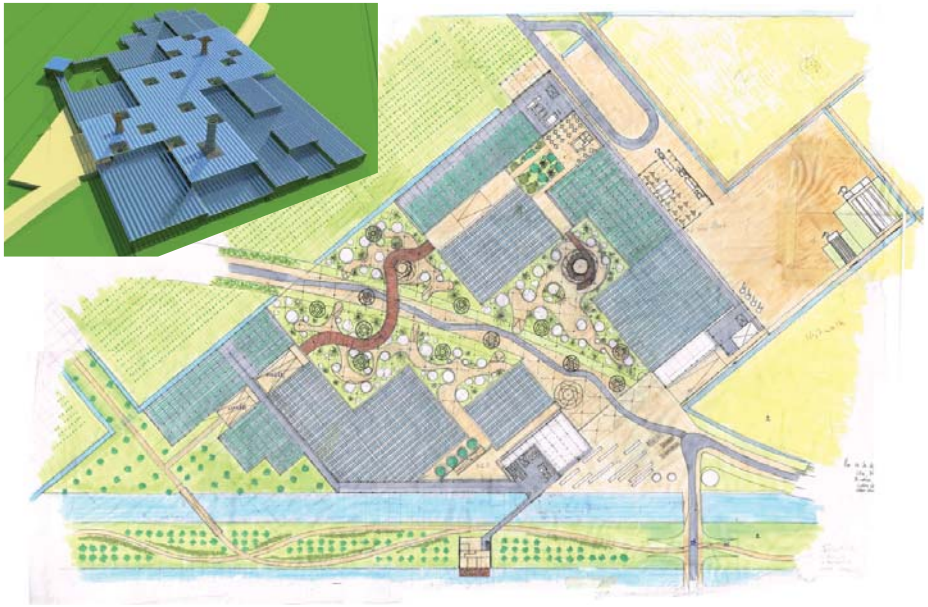


Fig. 1.2 Floorplan 1st floor.
Shows the recreational landscape which flows through the productive landscape.
N.B.: Image is outdated and will be replaced for the P4.

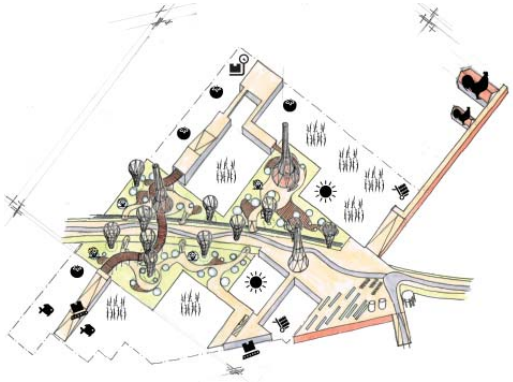


Fig. 1.3 Axonometric projection of the recreational landscape.
Shows the recreational landscape which flows through the productive landscape.
N.B.: Image is outdated and will be replaced for the P4.

Fig. 1.4 Functional layout ground floor.

N.B.: Image is outdated and will be replaced for the P4.

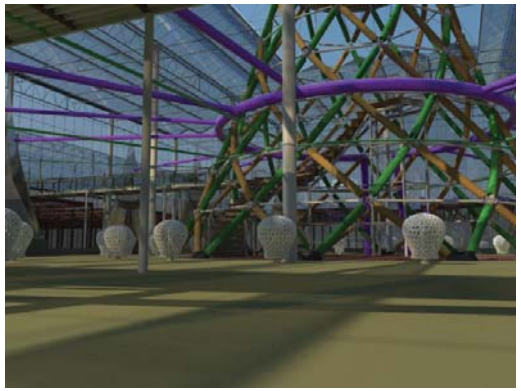


Fig. 1.5 Impression of the recreational landscape.
The white mushrooms are air exhausts which let in air precooled by an air to earth heat exchanger. The air is pulled in by the large solar chimey.
N.B.: Image is outdated and will be replaced for the P4.

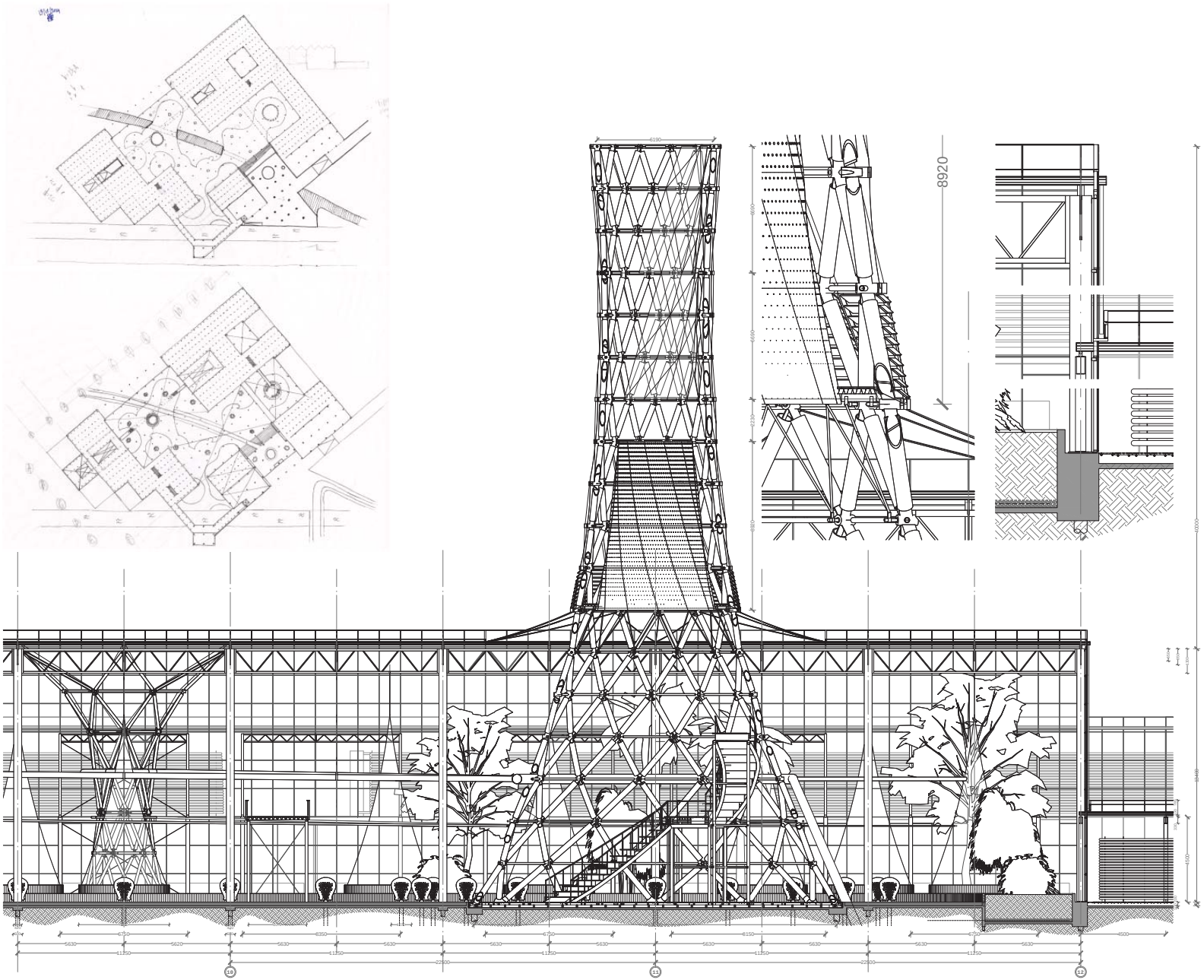


Fig. 1.6 Scaled 1:500 floorplans and 1:50 and 1:20 sections through large chimney.
The white mushrooms are air exhausts which let in air precooled by an air to earth heat exchanger. The air is pulled in by the large solar chimey.
N.B.: Image is outdated and will be replaced for the P4.

Relationship with societal context

The design adresses the societal problem of recource scarceness. Phosphorus, a nutrient detrimental for our global food supply, is currently mined from phosphorus rocks which are depleting rapidly. (Cordell, Drangert, & White, 2009) Altough this recource is becomming increasingly scarce we are still treating it wastefully, litterly flushing it down every time we go to the bathroom of throw something in the waste dispenser. Also on a larger industrial scale this valuable material is still largely wasted. My design hopes to respond this context by suggesting an alternative manner of treating our agricultural nutrients.

My design also responds to the societal problem of climate change. In we are too tackle this problem we will have to make a transistion to renewable energy sources. As these sources have very low energy density, that is they require more space than fossil sources, integration within our built environment and agricultural landscape will become detrimental. (Tester 2005, 411; Stremke and Van den Dobbelsteen 2012b, 3)

This final notion also touches upon antoher societal problem: that of the scarcity of scape. Increasing population numbers and urbanisation will cause dwelling and recreational functions to increasingly conflict with agricultural or energy harvesting functions. From an energetic perspective however much could be gained by integration of these different functions. The points of future direction are also given by the Dutch SIGN (stichting innovatie glastuinbouw) a foundation focussed on innovation in the greenhouse industry. As points of departure for innovation they name, amongst others: the stacking of functions, integration of energy production, reciprical relationships with other functions, energy storage and closing the H2O and CO2 cycles. (Ruijgrok & Braber, 2002) All these aspect are adressed in some form in my design.

Finally another problem within the societal context can be discerned. Compared to earlier times we have become more detached from our agricultural, or in a wider sense our productive, domain. The realm of consumption is completely seperated from that of production. This not only causes consumers to be unaware of the before mentioned problems but also causes a state of alienation in a moral sense.

PROCESS

Relationship between research and design

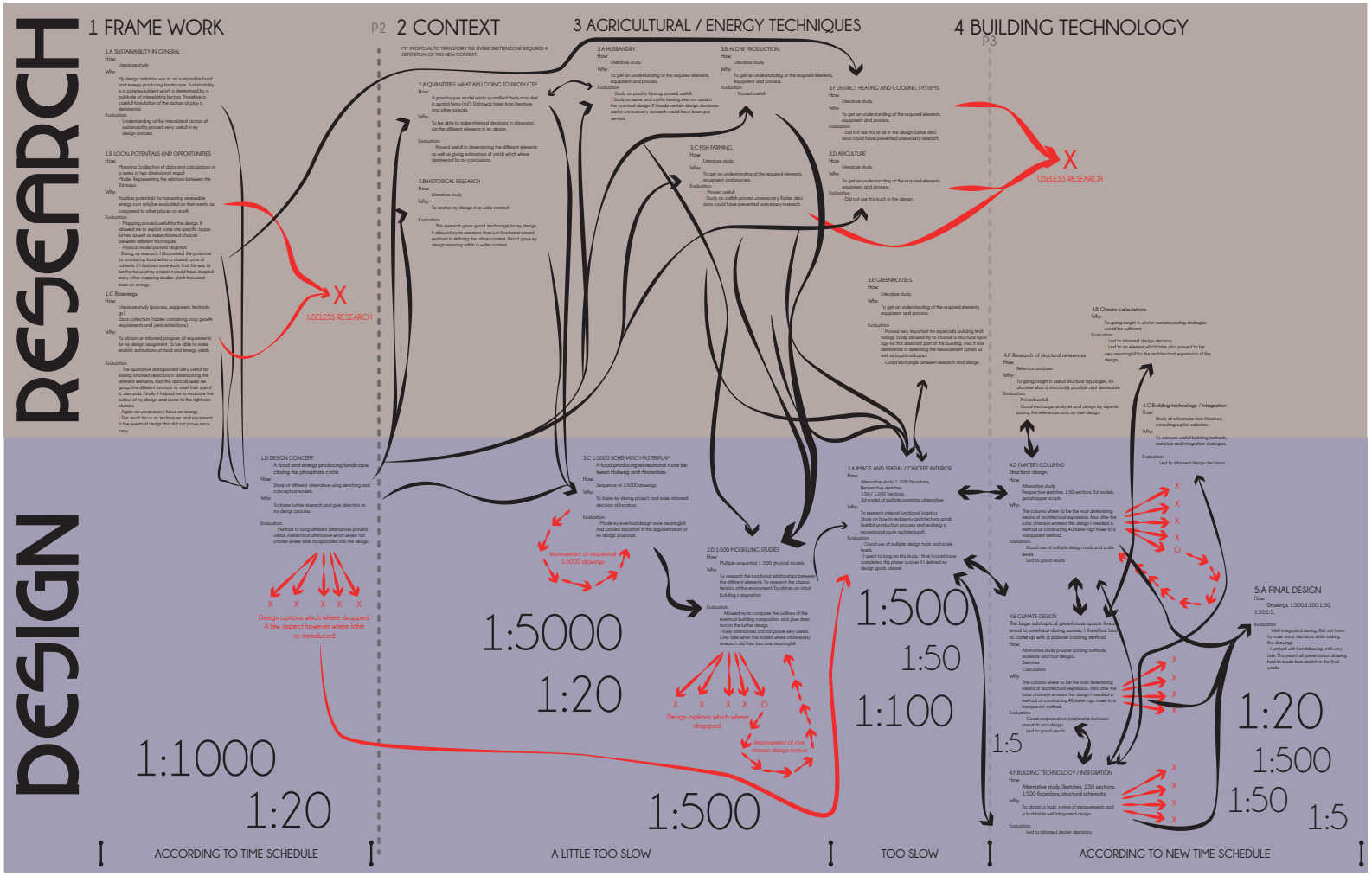
In order to uncover the retionship between research and design during my design process I have made a schematic of my research and design process (fig. 2.1). A larger version of the schematic can be found in the appendices.

From the schematic it can be seen that I did research throughout my entire design process. Although it is common in our design studio to complete the research at the P2 I did additional research parralel to design activities after the P2. The reason for this was that I required additional information for my design as my design assignment had shifted its main focus subject. My initial goal was to design was to design a landscape which harvested renewable energy. From my research however I could conclude that their was much more potential at the location for a 4F farming landscape where energy production was just one of many of the landscapes functions. I than changed my design accordingly. My research paper however focussed too much on energy production and consequently it was only partly usefull for my design. Also it contained some aspects which were not usefull at all. This is can also be seen in the schematic (red arrows leading to a large red cross). An example of this unutilised research is the research I did into district heating and cooling systems.

Here we encounter an error in my research and design strategy. From the schematic it can be seen that my initial research led to a multitude of design concept alternatives. I then continued with one of these and it framed the additional research I did after the P2. In retrospect however it would have been more efficient if worked in a more cyclical manner, letting my design reframe my original research question more. (fig. 2.2 and 2.3) Perhaps if I would have reframed my research question earlier I would not have to do additional research after the P2.

I did use this second strategy for the building technology research at the end of my design project. Here I used a series of alternatives as input for climate calculations and analyses of reference projects. The most viable alternatives I then cotinued to vary upon whilst designing. This strategy proved more succesfull and I completed this part of my project relatively quickly.

Finally it can be seen from my schematic that whilst designing I sometimes utilise an alternative study (red diverging arrows) and sometimes a more itterative design approach where I subsequently improve upon a certain design motive. I have experienced that the alternative method is most suited for generating concepts or when working on segments of the design. I feel the itterative method is most suited when integrating results of dispersed design studies to a whole.



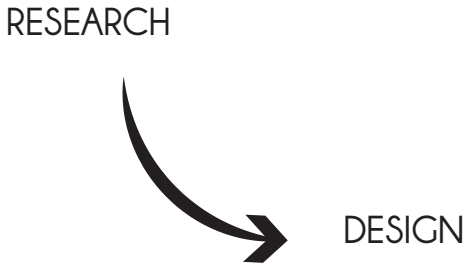


Fig. 2.2 Research and design strategy which sometimes led to unbalanced results.

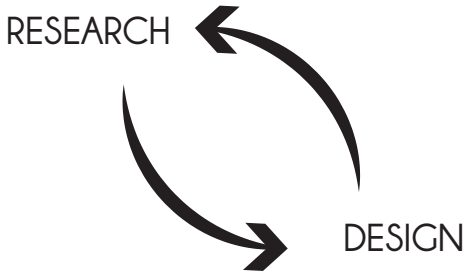


Fig. 2.3 Research and design strategy which sometimes led to more unbalanced and less time consuming results.

In the appendices mutiple planning schematics that I used throughout the design process can be found. With none of these schematics I managed to follow them completely. Sometimes this was caused by delays such as those that I mentioned earlier. Othertimes I planned studies which later proved not to be needed anymore. The somewhat unbalanced relationship between research and design can also be found in my deviations from my schedule. The biggest delays took place between my P2 and P3, a period when I spend a lot of time on additional research.

Even though I devaited a lot from my planning schedules I experienced making them as usefull because it forced me to structure my design activities. I have experienced that for me schedules tend to get out dates in about two weeks, that is: they fail to represent the most essential design questions at that moment. In the future it might therefore be usefull to utilise two schedules. One for the entire design project which only gives rough outlines and one more precise schedule which is changed every two weeks.

LITERATURE

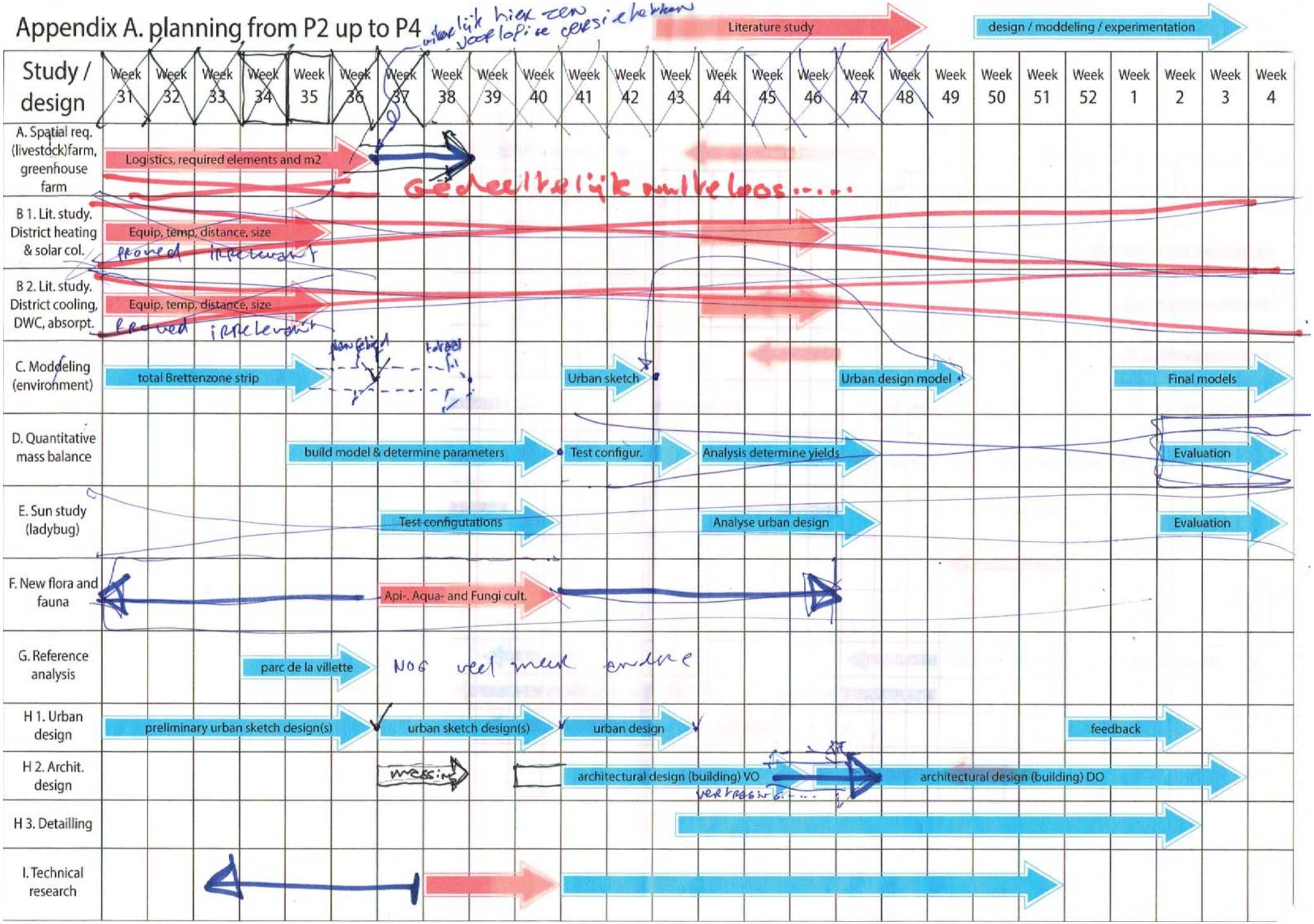
Cordell, D., Drangert, J.-O., & White, S. (2009). The story of phosphorus: Global food security and food for thought. Global environmental change, 19(2), 292-305.

Dobbelsteen, A. v. d., Broersma, S., & Stremke, S. (2011). Energy potential mapping for energy-producing neighborhoods. International Journal of Sustainable Building Technology and Urban Development, 2(2), 170-176.

Ruijgrok, W. J. A., & Braber, K. J. (2002). Kas als energiebron, inspirerende strategieën voor de glastuinbouw. Den Haag: SIGN, KEMA sustainable energy, Innovatienetwerk Groene Ruimte en Agrocluster.

Tester, J. W. (2005). Sustainable energy choosing among options. Cambridge: MIT Press.

Appendix A. planning from P2 up to P4



november 2013

Agenda

zondag	maandag	dinsdag	woensdag	donderdag	vrijdag	zaterdag
27	28 10:00 Begeleiding Arjan BK - AE lab	29	30	31	nov 1	2
3	4	5	6	7 Mail maken voor klimaat advies: wee moet ik hebben?	8 inleveren [struck through] PG AANVRAAG.	9
10 Studie stramien maken. → klimaat advies	11	12 Af [struck through] P3 VO Design: 1:500 plan 1:100 section AA 1:1000 [illegible] Anne 10:30	13 bereid m² & mass balance voor. technieken & plan van aanpak.	14 11:30 Begeleiding Arjan BK - AE lab [struck through] Schets varianten voor constructie & klimaat plan	15 10:00 maken bespreek welke constr. • Maak afspraak klimaat deskundige & eventueel Andrew.	16 Begin aan 3d model!!
17	18 Alles gedimensioneerd: · begin aan klimaat berekening	19	20 11:00 Joop	21	22 klimaat berekening af!! [struck through]	23 Af 1e versie 3D
24 tekeningen constructie varianten af!!	25 Af 1:500 in situ	26 16:00 Begeleiding Arjan BK - AE lab	27 Af 1:200	28 Af 1:50 sketch 1:20 sketch	29 10:00 maken	30 Start final products

februari 2014

Agenda

januari 2014						
z	m	d	w	d	v	z
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

februari 2014						
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maart 2014						
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30	31	1	2	3	4	5

zondag	maandag	dinsdag	woensdag	donderdag	vrijdag	zaterdag
26	27 1:500 Model Studie	28 stevonds proc boek..	29	30 bouwk Schema af!! Schets wat details van chim!	31 Overleg maarten & Anne; Wouberg str. eten luc	feb 1 idem; varianten af!!
2 Overleg Anne & maarten wouberg str. Pres af!!; stevonds process boek af	3 Chimney Geometry Research; uiteindelijk process boek af!!	4 13:30 P4; Af!!	5 10:00 Begeleiding Arjan BK - AE lab; Chimney Geometry Af!!; 3d model Sketsen	6	7 bespreking Anne. bespreek foto beelden; verdere met 3d model	8 Anne & Maarten werk... ; Chim afmaken
9 met foto's bij A&A. Begin aan laatste versie 1:500	10 Research Chim material details 1:50; Bouw tech	11 bouwtech 1:50	12	13 af!! Af!! uit losse hand.	14 bespreek Anne & maarten. 3d model af....	15
16	17 Onderzoek Gevel	18	19 10:00 Begeleiding Arjan BK - AE lab	20 1:50 Af; 1:5 Schets; renders Gevel.	21 Bespreek Anne	22 Final 1:500 Af!!
23	24 Final 1:500; Final 1:5000	25	26	27 Aff!!; Af!!	28 Bespreek A&M.	mrt 1 Renders Aff.

Peint Maquette

Peint maquette

Volumes maquette af...

maart 2014

Agenda

februari 2014						
z	m	d	w	d	v	z
26	27	28	29	30	31	1
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maart 2014						
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april 2014						
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27	28	29	30	1	2	3
4	5	6	7	8	9	10

zondag	maandag	dinsdag	woensdag	donderdag	vrijdag	zaterdag
23 Renders Af!! maquette volumes af....	24 finalize; finalize	25 1:50; 1:100	26	27 Analyse plasties; Fin	28 Analyse tkeeltjes	mrt 1 flexibele dag...
2 Presentatie PP	3 presentatie PP	4 11:30 Begeleiding Arjan BK - AE lab; 13:30 P4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19 10:00 Begeleiding Arjan BK - AE lab	20	21	22
23	24	25	26	27	28	29
30	31	apr 1	2 10:00 Begeleiding Arjan BK - AE lab	3	4	5

december 2013

Agenda

zondag	maandag	dinsdag	woensdag	donderdag	vrijdag	zaterdag
dec 1 Af 1:5000	2 Af fin 1:500 plan B2200 Af 1:200 plans / sec Section	3 Af 1:200 plans p4 voorb?	4 Af 1:200 plans cross sect Af 1:50	5 Af 1:20 p4 voorb? met Arj & Anne	6 Af fin 1:50 Af 1:20	7 Af: 1:5
8 Presenvation	9 Presenvation.	10 P4 !!!	11 9:30 Begeleiding Arjan BK - AE lab	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	jan 1	2	3	4