Reflection
This section will serve as a reflection on the research and design process, the success and relevance of the final result and my personal experiences of this project.

Process
During the P2 I drew up a research framework to structure the project along its course. It consisted of four phases:
1. Analysis: A study of bridge design in general
2. Sketch design
3. Definitive design
4. Detailing
This mainly described the design process as it narrowed itself from large to small scale. Also, part of this framework was a list of tools and methods that would be best suited for each phase. Specifically software: Grasshopper (parametric design) for the sketch phase and Rhino (nonparametric design) for the definitive design phase.
In practice this was much more complicated. As so much of the requirements of this design case are based on the urban context, the larger scale design was much more important, and stayed important throughout the process. Even as the design progressed, each decision would put into question the bridges position and interaction with its complex surroundings. For this reason, most of it was done in grasshopper in the end, because grasshoppers parametric design allowed me to continue making changes to the larger scale layout while the smaller details were filled in. By switching from Diana to Karamba, it also allowed me to perform the finite element analysis within the adaptable model.
The main drawback of using parametric design is that creating detailed models is very time inefficient. At a certain point you have to step back to nonparametric design to work on a smaller scale. By diverting from the initial framework, it was very hard to find the right time to make this switch. Therefore, the balance between large scale design and small-scale engineering is rather lopsided to the first in comparison to the intended framework.
This underlines the importance of selecting the correct tool for the correct job.

Results
Despite the complexity of the case, the final design does seem to adhere to all the requirements. However, I am not sure if it is a completely pleasing design.
As this is a research project, I set some specific ambitions and made some decisions to ensure the project would provide some interesting challenges. Coupled with my already very analytic style of designing, this put the project very much at the far end of the ‘Design by research’ spectrum, rather than at the ‘research by Design’ end. This meant most of the complex problems in the design were approached by first determining all the possible limitations, some of them self-inflicted, and only then trying to find the shape of the blanks that were left. By limiting the possibilities like this, eventually some decisions must be made that are never fully satisfactory.
An example: By setting the split deck shapes as the leading design guideline for the columns underneath, the Java Island side became very crowded with constructions in a very small space. The desire for a clean, neat look of the bridge decks was fulfilled, but the overall design became more chaotic.

The main conclusion from this regarding the existing Java bridge project is that the last thing this already over-complicated case needs is more restrictions from the designer’s own ambitions. Also, starting from ideas and concepts and whittling these down to a feasible design may have more satisfactory results than starting from the limitations and trying to locate solutions.

Relevance
This project was purely a design case study, without any explicit initial focus such as a specific design method, building material or construction technique. This greatly limits its value as a contribution to general knowledge on bridge design.

It will be of some relevance to the design case that it addresses: the current development of the Java bridge. However, during my graduation project changes have been made to the existing case, and I have also made several decisions mainly based on creating and interesting and challenging graduation project. This widens the gap between graduation project and reality, again limiting its relevance.

There is however one area where I think this project shines an interesting light and poses some important questions, even though this was not initially intended to be its purpose. As the case study is set in a politically and socially controversial atmosphere, and a very complex urban setting, the effect that different priorities have on the development of urban areas becomes clear.

There is a consensus that we need to improve the sustainability of our society, including its transport networks, both for environmental purposes and allow further growth without catastrophic congestion. Large infrastructure projects like the Java bridge are required, even though they may conflict with other interests such as marine infrastructure and local residents trying to protect their current surroundings. In the present time it is very hard for government officials to find the middle ground between all these interested parties without encountering controversy and resistance at every step, as is being experienced in the current Java bridge project.

Independent studies like this graduation project have the freedom to explore solutions that would not be feasible within official projects, but that nevertheless might be off help in determining where the correct middle ground should be. It can help pose and answer general questions such as ‘What is the value of efficient infrastructure design as opposed to maximum protection of existing surroundings?’ or ‘Does the benefit of better aesthetic design justify reducing consideration of other priorities?’

As part of the master track building technology these results may seem rather far from home. However, I think that this is very much an integral part of the building technology track, as even though these relevant questions are not technical in itself, in order to answer them the case needs to be explored from the perspective of an engineer, amongst others. This illustrates the connection between building technology, architecture and urban design.

Personal reflection
This project has been mostly enjoyable for me, and though I don’t feel that the resulting design is a perfectly pleasing design for this case, it does represent the best I could achieve in the time I had and along the path I had chosen. However, there are some very important lessons I have to reflect on for myself.
The most important one is the importance of producing materials and moving the design process forward, even though I’m not sure about the solutions. When in doubt of a certain problem, I would find myself in a form of analysis paralysis where I would discard almost all possibilities before putting anything down on paper or in the computer. Then, without any physical products to show, I would hesitate to ask for help as I’d have nothing to ask help about. Before each meeting or deadline, when I could force myself to start producing materials, the speed of progress would multiply tenfold, for the simple reason of creating physical products. Also, then I would be able to receive feedback, which always proved useful to find new angles into problems that first seemed unsolvable.

This whole experience wasn’t helped by my limited drawing skills: as I was not able to draw sketches good enough to give me some helpful insight, most of the work had to be done by computer. This takes more time and always feels more permanent, making it harder to simply try out different things.

**Future work for P5**

In order for the design to be a fully finished product, the structural design and the detailing need some more work. However, as this is a 9-month project on something that would normally take a team of engineers a few years, it doesn’t need to be a perfect solution. Therefore, in consultation with my mentors, I decided to direct more attention to better illustrate the final design and its interaction with its surroundings. Until the P5 presentation I will limit the work on the structural design to optimizing the existing structure based on a model with better boundary conditions. After that most of the work will exist of creating better illustrations showing the final design within its surroundings and improving the presentation to better explain the steps that lead to the final decisions, rather than just the actual outcomes.