DPB310 Internship Report

Merijn Verhaak(1979140)
Hanneke Muller
Kevin Pfeil

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kennisplatform CROW

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

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Chapter 1: Executive Summary

Introduction & Goals

This report details my B31 internship experiences at CROW from September to December. Coming from last year of developing in Technology & Realization and Math, Data & Computing (having focused heavily on coding and making), my primary goal for this internship was to step out of my comfort zone. I aimed to develop my underdeveloped competency areas: User & Society and Business & Entrepreneurship.

I wanted to explore my growing interest in social design, moving beyond just "designing the next teapot" to address societal problems. My time at CROW challenged me to handle stakeholder incentives, research human psychology, and apply analysis models in a real-world, somewhat conservative sector.

Organization Context

CROW serves as the bridge between policy and practice in the Netherlands. While the government creates broad legislation, CROW operationalizes these laws into practical technical guidelines for infrastructure. This ensures that Dutch infrastructure maintains its high quality.

Key Projects & Deliverables

1. **Cyclists & Pedestrians: The Feasibility of Pink Signs**
   My assignment was to investigate the safety and feasibility of using pink traffic signs for temporary roadworks (intended to guide vulnerable road users).

   - **The Approach:** I investigated the psychological and technical aspects of the signs, comparing them to the standard yellow signs established by the Vienna Convention (1968).
   - **The Findings:** Despite the aesthetic appeal used by municipalities like Tilburg, my analysis showed that pink signs lack necessary contrast (luminance and color) and feedforward.
   - **The Outcome:** Prioritizing safety over aesthetics, I advised against their usage. I synthesized these findings into a clear factsheet for municipalities, learning to function efficiently within a professional role rather than just a "maker."

2. **Innovation & Automation: Incentivizing Change**
   I was tasked with finding ways to incentivize innovation in a conservative sector where "lowest price" tenders often kill R&D budgets.

   - **The Analysis:** Using SWOT and Stakeholder Onion maps, I identified the economic barrier preventing contractors from investing in new technology.
   - **The Solution:** I proposed a standardized process for assessing innovations and an Innovation Fund concept (inspired by London's model) to subsidize innovation costs in contracts.
   - **Methodology:** I adapted the Double Diamond process to fit CROW's specific process to create a visual roadmap for innovation. I proposed a Regulatory Sandbox

to create a legal safe zone for piloting technologies, supported by an Innovation Fund to subsidize R&D risks. This framework was adopted by the workgroup for further development.

- **Field Validation:** To overcome the limitations of desk-based policy, I conducted on-site research with operational stakeholders. This validated that strict guidelines are often compromised by physical site constraints, confirming that theoretical policy must be stress-tested against operational reality.

Conclusion

I am very content with how I developed my PI&V during my internship, moving away from a perfectionist mindset and reframing that to the art of Kintsugi: the art of imperfection. I wish to continue my development in interviewing stakeholders and move away from assumption-based design to evidence based design. I will continue to be a part of the innovation & automation workgroup.

Chapter 2: Introduction

Figure 2 Puzzle cube from Designing Connected Experiences

This report outlines my experiences and learnings during my B31 internship at CROW from September until December, where I worked on two main projects related to creating guidelines on temporary road working with various assignments alongside.

Figure 1 Mechanism from Designing Actuated Systems

My goal for this internship was to improve at my underdeveloped competency areas, which were User & Society and Business & Entrepreneurship, especially following a year focused on making and programming a lot of different projects (CBLP3, Designing Actuated Systems, Designing Connected Experiences) which thoroughly developed my competency in Technology & Realization and Math, Data & Computing.

To explore and develop my vision, I wanted to research a newfound interest in social design. This originated from doing more projects related to societal problems in CBLP3 with mental health, and in my Multidisciplinary CBL with e-waste. The goal was to develop and diversify my skills as a designer.

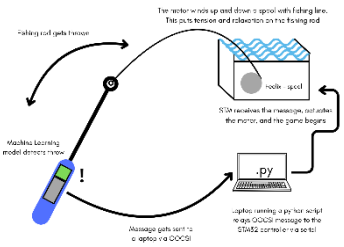

Figure 3 System Sketch for Designing Actuated Systems

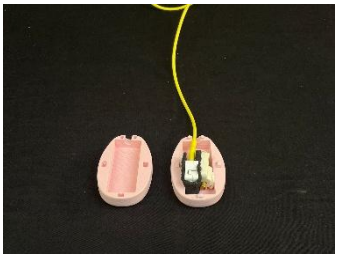

Figure 4 Pulsators for CBL P3

The internship challenged me in handling stakeholder incentives, researching human psychology, interviewing stakeholders, extracting constraints out of wishes and comments, and creating processes through analysis using models learned in Design Innovation Methods.

Although CROW's activities are complex to understand at first sight, my goal for this report is to present my learnings, work and implications through an accessible and clear narrative. This is also to develop my writing skills in storytelling. This report will detail the organizational structure

and activities of CROW, followed by my work within CROW and how it developed my competency areas, and a reflection on my PI&V.

Chapter 3: Company Description:

Founded in 1995, CROW is a independent, non profit knowledge platform in the Netherlands. They form the bridge between policy and practice. The Dutch Government creates legislation which describe broader legal requirements. CROW operationalizes these laws into practical, technical guidelines related to different parts of our infrastructure. This covers road construction specifications to urban greening standards.

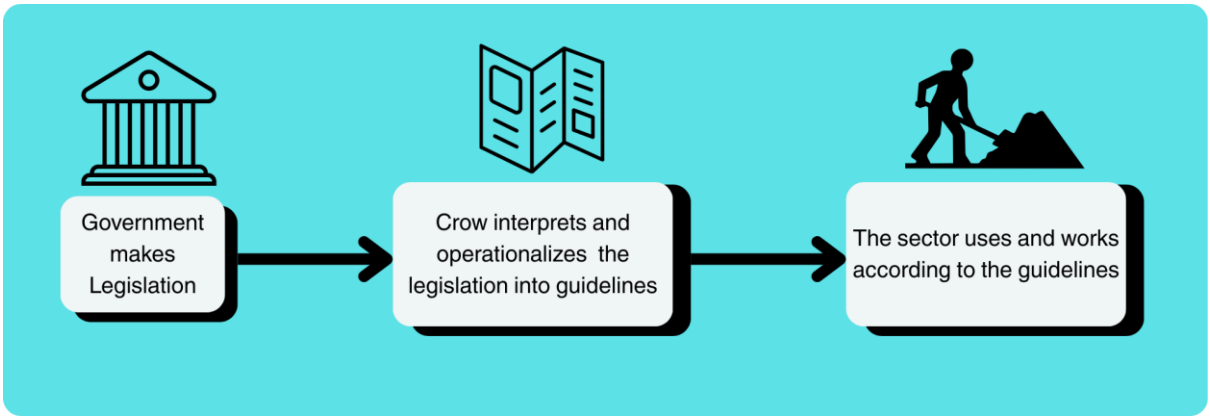

Figure 5 Role of CROW in the legislative system (CROW | Kennisplatform CROW | Over CROW, n.d.)

The guidelines are published and revisited cyclically to keep up with the times. These revisions follow a co-creation process, where stakeholders are invited to submit their issues, which will then be handled and prepared for a discussion in the groups. These stakeholders range from construction companies to municipalities to accessibility organizations.

Figure 6 Examples of Stakeholders I encountered (Brand Fetch, n.d.)

The accompanying revision I worked on was for the guidelines on Temporary Road Maintenance. This details for example which signs to use for creating a workspace for maintenance or how much you can reroute pedestrians / cyclists. In this area, the problems voiced all get divided up into common subtopics. These subtopics have workgroups tied to them, which is where the stakeholders join in. Of the 5 subtopics, I was part of two of them: Cyclists & Pedestrians and Innovation & automation.

- Cyclists & Pedestrians focuses on the safety and accessibility of vulnerable road users during roadworks. My specific assignment within this group was to investigate the feasibility and safety implications of introducing pink traffic signs.

- Innovation & Automation was a newly formed subtopic which my internship coach assigned me too additionally. The goal of this subtopic was to carve out or find ways to incentivize innovation.

Chapter 4: Goals

4.1 Starting point

In June I had made great strides in Technology & Realization, by making my own machine learning model and integrating it into a playful design for Designing Actuated Systems, while in Designing Connected Experiences I made an inter connected network of puzzles to design a sci-fi escape room experience, and for CBL P3 I made my first efforts in those connected experiences to make a Bilateral Stimulation device for an EMDR therapy.

Comparing my development to the Rubrics of where I need to be in June this year, I had almost done everything in T&R and M,D&C. As mentioned in the Introduction, I discovered my interest for social design, and that interest has been growing ever since. Doing CBL P3 felt fulfilling to work on, because I had a personal connection to the problem itself. Doing the Multidisciplinary CBL felt fulfilling because I was trying to solve a severe and overlooked problem with e-waste. Alongside that I had the realization that I don't want to just design the next tea pot.

4.2 Specific Goals

For my PDP, the goals were set up in a way that are aligned with the activities of my internship. This creates guidance and flexibility to create additional goals and achievements during the internship.

GOAL 1: I will conduct user research for 2 different infrastructure projects by interviewing at least 5 stakeholders and translate these insights into design requirements and constraints.

I participated in two workgroups, which meant that I will be given tasks for that group, and it is important to understand the situation coming in from an External perspective. I set this goal to gain experience in avoiding basing my work on only assumptions without interviewing the stakeholders. Assuming how stakeholders think leads to narrow designs and blind spots in my designs. If I want to design for societal benefit, understanding and speaking to stakeholders is relevant.

Goal 2: I will identify and propose solutions for 2 traffic infrastructure challenges during my internship, presenting each with problem analysis, multiple solution options, implementation feasibility, and measurable success criteria.

2 Infrastructure challenges are to incentivize a standardized approach for the projects that I would encounter during the internship. The intended goal is to utilize and apply the models I learned during Design Innovation Methods in order to make the iterative process of my work and translate into an easily understandable report for stakeholders.

Goal 3: I will actively participate in at least 2 cross-functional project teams during my internship and document specific examples of how I contributed to team problem-solving in my weekly reflection journal.

Reflection is part of most of my PDP's. Reflection is what's necessary to gain greater insights. It is an iterative process in my development. Especially, going into a new situation, it is very important to see how my vision and professional identity develop in a different environment than what I have encountered so far in ID.

Chapter 5: Work during internship

5.1 Deliverables

My completed deliverables that I did during my internship are seen in the diagram on figure 7. It's a good variety of topics, although most of my deliverables were reports, not so many designs.

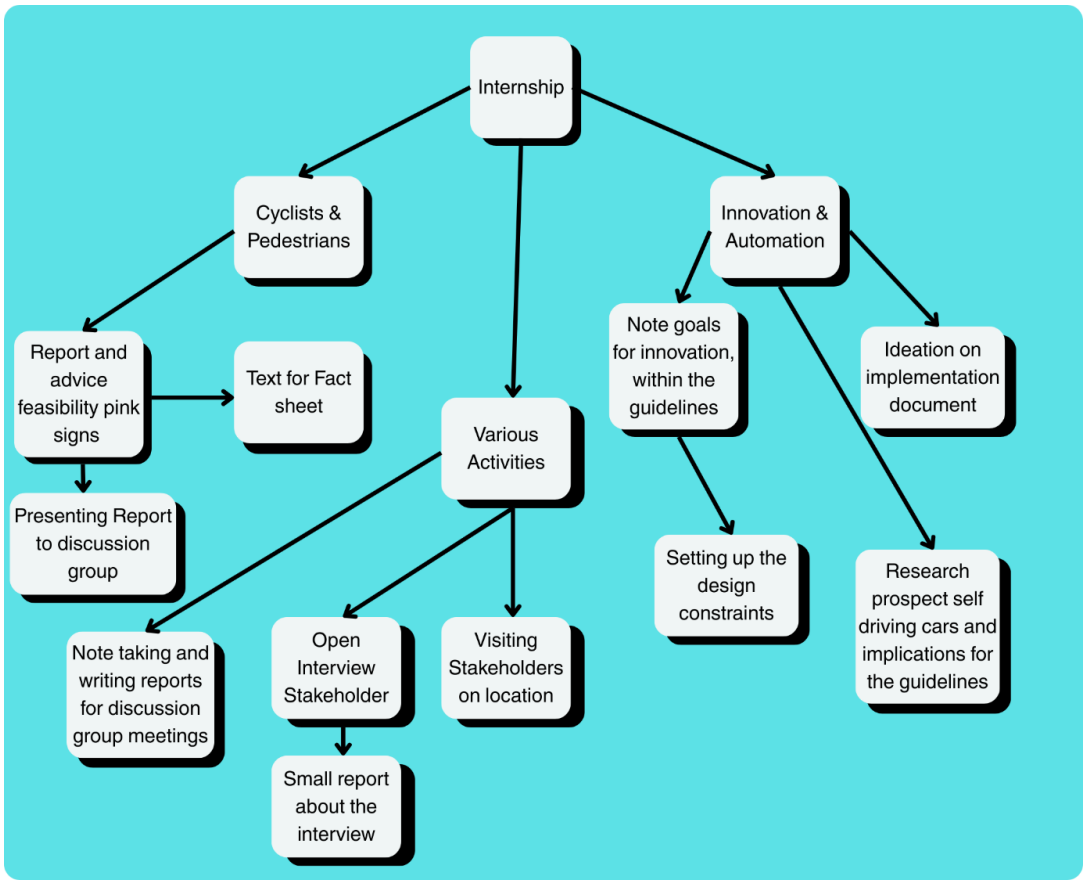

Figure 7 Completed Deliverables from me during Internship

5.2 The use of pink signs for temporary road work:

This project originated from municipalities such as Tilburg starting using pink signs to indicate they were meant for cyclists and pedestrians to follow. This would create more peace of mind for drivers and everyone the overall sentiment wasn't that positive within the workgroup, which were the sign manufacturers, the sign placing companies, but no one from gemeente Tilburg was there. I started out with the intent of finding a way to implement the pink signs, since that fits my maker and problem-solving identity.

Figure 8 Example of pink and yellow sign

Before I started, two people from the workgroup went ahead and made a technical comparison of pink signs compared to the standard yellow signs. Setting design constraints such as fluorescent (how well a sign reflects light), luminance contrast (how much a sign will stand out compared to the background), and

color contrast (how well one can read the text on the sign). Safety with pedestrians and cyclists is the highest priority in design constraints.

The overall result wasn't positive for the pink signs; this was due to a way lower color contrast between pink and black than yellow and black. This meant that it was more difficult to read text on the sign itself. Additionally, luminance contrast was poor compared to the signs which were tested with software from 3M (*3M VAS*, n.d.). Which you can see on figure X. The number of red means how well it pulls attention from the environment around it. And the yellow used is a more fluorescent color than pink.

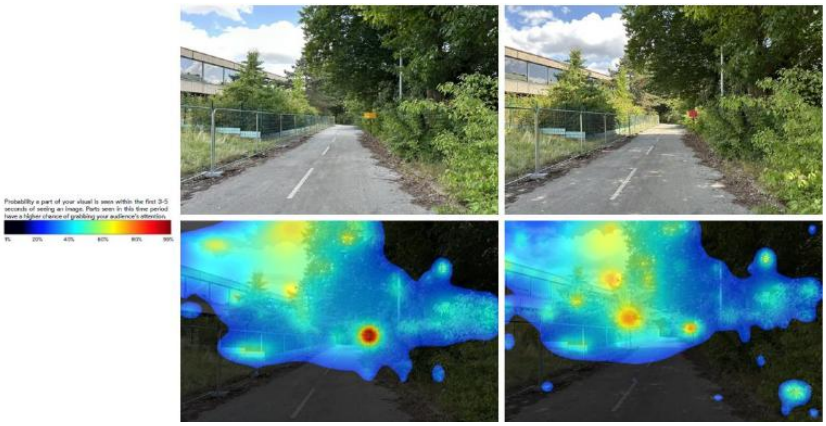

Figure 9 Luminance contrast test, left: yellow and right: pink

Pink signs were originally first used at Schiphol which uses their own sign system, the municipality of Amsterdam piloted the usage of it for cyclists, Utrecht followed soon after, as well as Den Haag, but retired the usage of it soon after. Tilburg also adopted the usage of it, reasoning that they were the city of pink, so it fit the core theme of the city. Is it wise to prioritize safety above aesthetics?

This is my starting point, I wanted to figure out why yellow was chosen in the first place, then if there are psychological effects behind the reasoning, and if epilepsy or other illnesses are involved with the reasoning.

Yellow for temporary traffic signs was chosen during the convention of road signs and signals in 1968 in Vienna (United Nations, 1968), which is the standard that Europe mostly uses, apart from some exceptions related to their respective environment.

The reasoning behind this was that yellow stands out the most on average in every environment or weather condition. Additionally, Fluorescent Red, Blue, and Yellow activate attention networks for humans, most traffic signs use one of these colors. Elliot (2015) So, there is psychological reasoning behind the usage of yellow. Meanwhile pink doesn't have that.

Another reason is that using only pink creates confusion on a first encounter, because of the lack of feedforward described in the frogger framework. How is one supposed to know what the color of a sign means without being informed prior? Symbols have a clearer feedforward than just a color, as well as creating redundancy for traffic signs is important for accessibility.

Figure 10 Article from the Haagse Tijden about the confusion for who the pink sign is meant. (De Haagse Tijden, 2023)

My advice on the feasibility of pink signs was clearly negative; I presented these findings at a workgroup meeting and the workgroup agreed with my conclusion. A stakeholder from the pedestrians' bond said that people with a mental disability prefer having simplicity over creating clarity for whom a sign is meant, which means that the benefit of using pink signs isn't

that inclusive.

During the meeting in which I presented this, it was decided collectively that the best way to transfer these decisions to municipalities was through a fact sheet. So, I synthesized all my work and the prior into easy-to-read bullet points and met up with a visual graphic designer that works for CROW. We decided on how and what to deliver this information and it is currently being made.

Figure 11 Presenting my work on the pink signs

5.3 Interviewing stakeholders

During my internship my internship coach took me along for company visits, during which I got the option to go back at a later moment and interview someone from that company. This fits with one of my goals so I took this opportunity. I was honestly pretty nervous about the whole thing; I lack the confidence of being proactive and taking that step.

I did my interview with someone who works at Versluys. Versluys is a company that places the traffic signs and barriers so that there is a safe workspace for construction companies to do their maintenance. I talked to one of the drawing experts.

Drawing in this context is for designing how the signs are placed on the map, how it affects the traffic, and this gets validated by a municipality (within the city), province (regional roads) or someone from Rijkswaterstaat (highways) based on what road you are working on.

Figure 12 Example of drawings in CROW (96B App, n.d.)

This drawing must comply with what is written in the guidelines from the CROW. Figure 13 is an example of how this is drawn in the CROW guidelines.

What I found interesting is that it's a sort of puzzle solving, with how you implement these drawings. In bigger maintenance operations you need to combine multiple of these drawings on the map, making sure that the traffic keeps flowing well. (Figure 14)

I also spoke to him about his thoughts on the CROW and compared to what my internship coach thought and saw the difference. I may be naïve in this field, so testing my findings against someone who knows more about it was insightful. It helped me understand the situation of what I'm dealing with.

Figure 13 Drawing made by stakeholder

Figure 15 Foil printer used for printing on traffic signs

5.4 Innovation & Automation

My assignment within the Innovation & Automation workgroup presented a core question. How do we incentivize innovation within the guidelines? From the knowledge and things, I learned speaking to my internship coach, the sector is conservative and doesn't want change for the better that much. My internship coach wants to break through this conservatism and come with new ideas, which is part of the reason that I was at CROW. The core problem is that safety is the highest priority and it should be, but if one wants to try out a new innovation it will get denied when they submit their proposal to a governing body. This is due to the innovation not being in the guidelines yet. And for some the guidelines are seen as the holy bible. The problem was that the current guidelines lacked a chapter about innovation.

Another part of this workgroup was discussing how and what the CROW guidelines should be published as they go forward. There is a wish from the sector to move the guidelines digitally and keep revising as things come up. This creates a more flexible environment to add new innovations as well.

Analysis

To understand why innovation was stalling, I utilized business analysis models, specifically a Stakeholder Onion Map and a SWOT analysis (Figure 15 & 16). As well as reading comments made by workgroup members. One thing that I struggled with was understanding the bias every

stakeholder might have. As an independent organization I shouldn't let that cloud my judgement.

Another was defining the term innovation itself, what does it even mean to innovate and are there different kinds of innovation. I defined two key types of innovation namely transformative innovation and iterative innovation. Iterative isn't something that is out of the ordinary and continues improving an already existing product. While transformative innovation is something unpredictable and harder to write guidelines for, because you can't really know how to define it and place it.

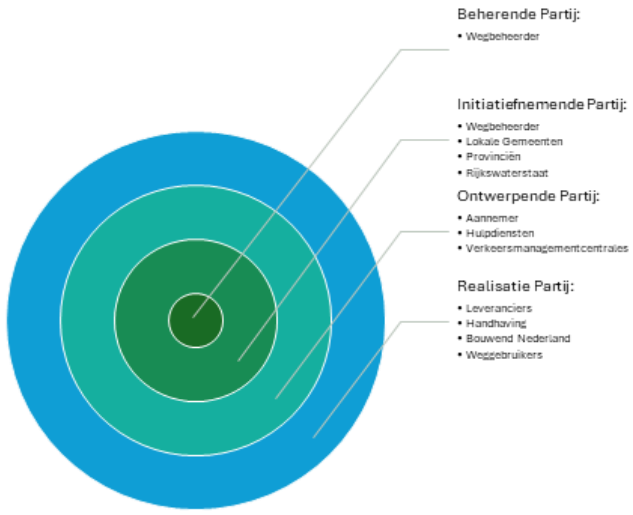

Figure 16 Stakeholder Union Map made

Figure 17 SWOT analysis conducted

The analysis revealed an economic barrier which is holding up innovation. The current process awards contracts to the lowest bidder. Since traditional labor is cheaper than a new innovation at the start, there is no financial incentive to innovate. If the lowest price wins, there's no margin for R&D. If a contractor invests €2 million in a machine, they lose the contract because they are no longer the cheapest option.

The Solution: To solve this situation, I drafted a strategic document proposing a couple of different ideas to get the gears turning. This proposal contains a sort of standardized checklist for innovations, which describes the path from new innovation to addition in the guidelines. I adapted the double diamond process and combined it with CROW's personal process to create this graphic. (Design Council, n.d.) The double diamond seemed fitting considering the topic of innovation, which has a lot of iterations.

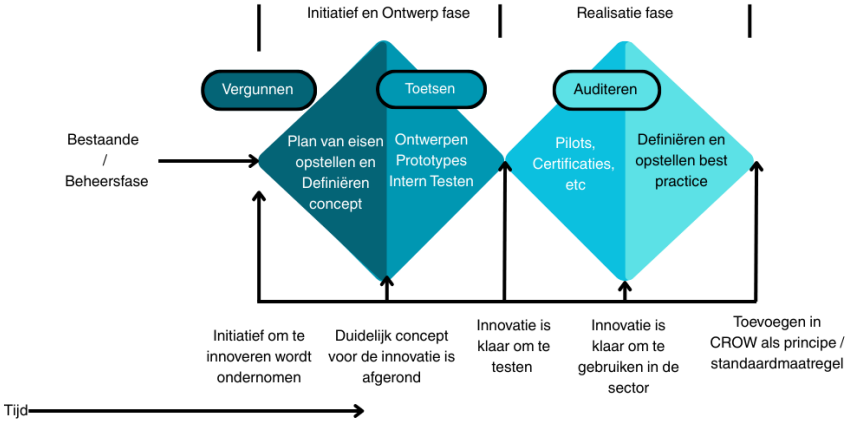

Figure 18 My developed process

Then in another document I drafted ideas on how a checklist would work and what would be necessary. I took inspiration from Singapore's Regulatory Sandbox, which is for autonomous vehicles. However, I could find similarities over defining both as transformative innovation.

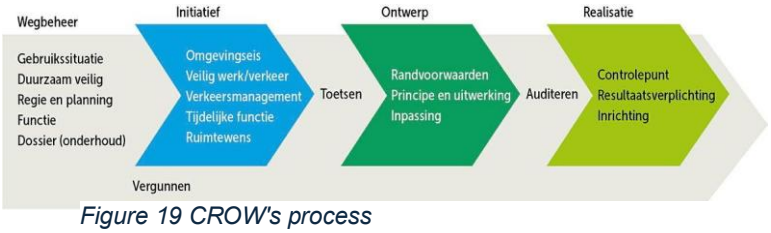

Figure 19 CROW's process

During the initial meeting, one of the stakeholders referenced an investment fund in London for innovation. Here, in every contract a tiny bit of the money would go to an innovation fund to overcome the economic gap. This incentivizes innovation and crosses the gap of the lowest price wins. Taking inspiration from this seemed like a no brainer. I worked out different implementations of this fund:

- One where a collaboration between all parties involved
- The fund would act as a separate entity keeping some information about the innovation hidden from the competition. The commercial stakeholders preferred the latter idea, and this is where we currently are.

I synthesized all of their problems and wishes into design constraints:

Main objective:

To establish a generic process that creates scope so that it can be applied regardless of the assignment or client.

- This process includes a checklist for assessing innovation.
- This assessment is carried out by an independent party.
- Points are awarded for innovation in the tender.
- This may mean that the chosen party is not always the cheapest.
- Being the cheapest in the current system often means that there is no margin left for R&D.

Sub-objectives:

Innovation fund to subsidize innovations:

- It is also carried out by the same independent party.
    - Consists of several experts from different fields to ensure an impartial decision.
- Money is allocated to this fund by setting aside a percentage of the tender.

This is where we currently are, and the good news is that I am continuing participating in this workgroup after my internship. The meetings are only once every 6 weeks, and it gives me valuable learning experience. I have visited multiple companies during my internship and doing this is good professional development.

5.5 Side content

I did smaller reports on the side looking into the prospect of autonomous vehicles, verifying a concern from a stakeholder from a different workgroup sent to me by my internship coach, making notes for a meeting and summarizing it. This required me to research the National Budget (Miljoenennota) and see the funding available for infrastructure. Which is something that I didn't expect I'd be doing beforehand. Conducting an open-ended interview with the stakeholder also fits this category. However, I think this was a big development for myself that I dedicated a section to it.

Another one of my key learnings came from a workgroup meeting for innovation where no one had read the document, and the only conversation was on the process I made. The visual part is part that gets attention, which is something I'll bring for future endeavors. Writing is still a strong skill for me.

Chapter 6: Conclusion on progress

6.1 Evaluation of PDP Goals

The overarching goal for this internship was to improve expertise areas that were previously underdeveloped, specifically U&S and B&E. I knew going into my internship that I wasn't going to apply T&R much, but it helped with understanding terminology and approaching things in a different way. For the pink signs and how it interacts with humans is applying and extending on what I learned in Aesthetics of Interaction, the same goes for applying models from Design Innovation Methods. And I extended my expertise, being in the environment and understanding biases is something that I want to attribute to B&E. While I iterated through a co-creation process with the innovation workgroup, by writing something first and implementing and discussing the feedback. Additionally implementing a design process with the process of CROW is applying the knowledge I gained from design research processes.

Figure 20 Site visit at Vermeulen Groep

Figure 21 Art made by sign printer at Vermeulen

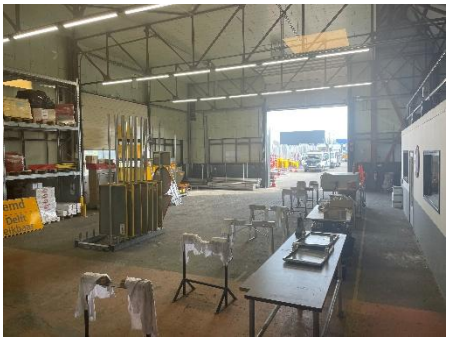

Figure 22 Site visit at Versluys

- **Goal 1: User Research & Proactivity**

    This goal presented the biggest step that I've made, because in the past I have struggled with social hesitation and not being as proactive in reaching as I'd like to be. Overcoming "social hesitation" in approaching stakeholders was a critical

hurdle. In CBLP3 and design <> research were the first steps I took, but they were not that huge, and I wanted to overcome this hesitation. While I needed a nudge from my internship coach to initiate contact, the subsequent site visit and open-ended interview were a breakthrough for me. This entire internship made it clear that people are welcoming to help young blood and partially overcoming my fears. While progress was made, I want to be proactive next time and do this for my FBP.

- **Goal 2: Infrastructure Solutions**

  Through the analysis of pink road signs and innovation processes, I learned to account for stakeholder biases and incentives. While I didn't design anything the solution, I did motivate from my personal expertise with Industrial Design. On top of the earlier reasons given. I learned to balance efficient work with my playful style for the future.

- **Goal 3: Cross-Functional Collaboration**

  Participating in the workgroups allowed me to develop essential soft skills, including reporting and professional correspondence . More importantly, it helped me define my role within a larger project, understanding "when enough is enough" regarding perfectionism .

My PDP really helped develop my soft skills in presenting, note taking, and planning meetings. General skills that a work life needs to have. I still want to be better at storytelling, because I believe that enhances most communication skills. Presenting would improve by a lot, writing would improve and it would fit with my playful style. And also learning how to know when enough is enough in speaking. What is necessary to converse my thought process, because at times this doesn't go well.

6.2 Updated Professional Identity:

I am naturally a playful thinker, my ideas form around what would be funny or exciting to do. I dislike boring ideas where I can't challenge myself enough. This can form the spark for my groupmates to engage and come to creative solutions. I find fulfilment in challenging myself and seeing the tangible value of my work.

Figure 23 Example of Kintsugi

I consider myself to be a generalist fuelled by curiosity and can find something interesting in any expertise area, and it's an archetype that I keep striving to guide my growth as a designer. It helps with understanding different perspectives in groups and also wanting to understand them.

I am a perfectionist which I have struggled with in the past, I shifted my mindset of wanting to be perfect, to seeing the beauty of imperfection and recognizing that to grow. There is a term for this in Japanese: Wabi-sabi or as an object form: Kintsugi. Like Kintsugi, I view my mistakes not as failures, but as an opportunity to grow and mend them together into something greater.

One particular hurdle, I aim to overcome social hesitation in approaching outside stakeholders by using my thirst for knowledge as the catalyst to reach out. It's a lacking aspect of my toolbox currently.

6.3 Vision

This internship affirmed my affinity towards social design. I am personally satisfied that there will be something published that will have an impact on society, even though it's small. While my vision is still more technology focused for the moment, I'm not sure if it will continue to be that way. I still struggle with writing because it needs to be a coherent narrative in my mind, and combining new interests with old ones gets more difficult.

Updated vision

Mental wellbeing finds itself in the littlest of things, a morning walk, freshly brewed coffee, meditation and so many other things. My generation faces a mental health crisis due to a variety of factors (Cashin, 2024).

While visiting New York, I went to Central Park which was a remarkable experience. There were no cars, and it has become an area of peace and leisure in the middle of the loudest cities in the world. Everyone should be able to have their own "Central Park in the middle of their NYC".

To create wellbeing in society, I design on two scales of design: Social and Interaction design. Interaction design can be seen as creating peace and leisure on a personal scale, Social design structures this peace on a collective scale.

I view technology as the tool to build these moments of peace. While currently rife with dark patterns that hijack attention. Design is being used to manipulate or invoke the emotions of users and by large society. My vision is to design technology around calm computing or public spaces that optimize health for the public.

6.4 FBP

I am excited to start on my FBP, I'm looking for ways to combine the development in U&S, and my making skills in T&R & M,D&C. I want to do my FBP in ARTIFICE, because AI is a controversial topic and there are plenty of big problems to look at from a designer's perspective.

The particular topics are AI in education, AI & environmental impact and GPTNL which is homegrown model from the Netherlands by TNO. Implementing that into an FBP is pretty cool to me, because it wants to be an ethical usage of technology.

I want to develop a hi-fi prototype for my FBP, using laser cutting. In general, it improves the look and feel of a design, and I haven't done it before, so I see it as a challenge. And as mentioned before, interviewing and reaching out to relevant stakeholders is an additional goal.

Chapter 7: Reflection

Communication towards the university could have gone better, I met up with my coach twice during the internship. One at the start and one in the middle, and now at the end as well. I appreciated the help and information that was given during those meetings and have shared them as well within my internship.

I was self sufficient during my internship for assignments where I could just sit behind a desk and type away, and the weekly meetings with my internship coach helped me understand a complex topic in a short amount of time. Getting used to the process took me some time, but overall I think I improved in a focused way because of CROW, and approached developing in my own way.

What I appreciated at my internship is that I was treated as a full workgroup member. It drives me to do more, and it gave me the courage to speak up more and give my opinion. I'm satisfied with my internship with the combination of learning new knowledge and applying old ones that I got from my time at ID.

In the future I'd like to implement my vision on sustainability more, but so far this has been a work in progress of finding words. As well as moving away from concentrating on the internet the entire time, I do think working on digitalization legislation and fighting for consumer rights is a good place to end up. It is a bit narrow for what I want it to be.

The development since starting ID is funny to look at, my PI&V is a lot less blurry but still far from a clear story. From starting ID because designing cars seemed cool, to designing interactions, to wanting to do interactions while having an impact on society. And the last one fits a nice niche in my mind.

I want to finish my bachelor's degree with a bang and show everyone what I can do my best. I need to set up a smaller scope but go into depth. Being by myself restricts the amount of work I can possibly do, so at least I want the core to be great.

Acknowledgements

Gemini 3 pro was used in this document to generate the executive summary, based on what I have written in the rest of the document. And I afterwards cleaned up and fixed the mistakes.

I want to thank Hanneke for her guidance, advice and helping me take steps. I was given help when needed and integrated me into the process as a core stakeholder.

Then I want to thank Matthijs for helping me get into this system of CROW. He just graduated from the TU Delft and his guidance helped me.

I want Kevin for his tips and links to research and more ID related projects within Temporary Road work.

I want Arjan for his time and openness for letting me conduct the interview, it was very insightful.

Appendices

See zip file submitted with report

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> “Prompt: How would you summarize this text into an executive summary while keeping the writing style the same?”

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