

User-centred Redesign of Dutch Traffic Control Simulation Interface

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Every day, over a million people travel across the Netherlands by train, all using the dense and complex train network spanning over 7.114 kilometres. To ensure the safety and efficiency of train traffic, Signalers will manage the train traffic 24/7 from twelve different traffic control posts in the Netherlands (Jepsen et al, 2023). To prepare future Signalers for this critical safety job, they have to go through a nine-month training program, where they are trained with a simulation system that will mimic real-life train scenarios. The simulation system is operated through one system screen by the Signaler Trainer, who will send train scenarios to the student's system screens. The system that the students see is also the system that is used in the workfield of traffic control posts. Since the trainers have to continuously monitor the rail traffic map, what their four students are doing, making phone calls with the simulation posts of the students, and setting train scenario cases to practice. The trainer's attention must constantly be focused on monitoring the system and simulation, reducing the time of providing personal attention and support to their students.

The design process started with a complex speed course of the simulation system's functionalities. Within a week, a basic understanding of the simulation system was acquired.

In the analysis following that, observations of the simulation system were conducted. In the first part, observations during training sessions were conducted to see how the Signaler Trainer interacted with both the simulation system and their students. The second part of the observations consisted of analysing all the screens showcased inside the simulation system, since knowledge about all the system functionalities was quite superficial at that point, it allowed for analysis from a design perspective point of view. This wider understanding led to the ability to conduct interviews with Signaler Trainers about the current working of the simulation system itself. Next, a function architecture of the system could be created in which the system was broken down into its functions and how they were connected. Based on the observations and interviews, a new architecture was created. This function architecture became the blueprint for the redesign and evolved further through feedback sessions. Together with the desk research about interface design in the world of UX and UI, eight problem cluster categories were written down to guide the process of design. These problem clusters were the highest pain points within the system.

The ideation phase started with revising the interface, since one of the main challenges of the system was an outdated interface aesthetic. Since the trainers indicated that they found it hard to compare low-fidelity sketches to the current system interface, high-fidelity sketches were provided. The interface layout was also revised, since the goal of the redesign is to guide the attention of the trainers as much as possible. With a different colour per tab, eight quick iterations of the layout could be created. The icons were also a major pain point, indicated by all the simulation interface users. All the icons were ambiguous, even with their supporting option text. So all the icons were revised and simplified. The last general element that had to be ideated upon was the placement of interactive elements in every tab. In every tab, the user has to go from a table to a search bar, to the table again, and then press a button. Within four ideas, the placement of these interactive elements was explored. In these ideas, the eye movements and head movements were analysed.

The next step was testing the ideation together with both trainers and people without simulation knowledge, to get both a perspective on the functionalities and visuals. From the structure testing it appeared that the alternating rows in the first idea greatly improved the readability. From the second idea, the information layout and use of colour on the left side was preferred, whereas the information layout from idea three on the right side was preferred. The trainers indicated from the layouts that the train and infra tab should be placed next to each other. The buffer should be long and vertical, whereas the attention screen, 'Visu', and notification should be long and horizontal. During the icon testing, it appeared that some options look so much like each other, that they were hard to differentiate between them. People were also turning icons upside down, giving them a completely different meaning. All these feedback points were implemented in the problem clusters,

This resulted in eight advice directions, resulting from problem clusters, and argues why the redesign is needed, where the current simulation is both visually and textually compared with the redesign for the next generation interface. This advice is aimed to create a more intuitive and ergonomic interface for the trainer, so they can invest their time directly into the success of their students, instead of putting their time into the simulation system.

To ensure feasibility, a technical design document has been created. This document states per interface feature what the guidelines are, so the developers will know exactly how to build the next generation interface.

References

Jepsen, E., Van Scherpenzeel, D., Harchaoui, N., & Nefkens, K. (2023, 8 februari). *Welkomst handboek stagiairs*. ProRail. Geraadpleegd op 22 juni 2025, van <https://prorailbv-my.sharepoint.com/my?FolderCTID=0x0120009046898114260C438D5E2628FFF2AFE1&id=%2Fpersonal%2Fkim%5Fholtman%5Fka%5Fprorail%5Fnl%2FDocuments%2FBureaublad%2FProRail%2FHandboek%20stagiairs%20ProRail%20%28140223%29%2Epdf&parent=%2Fpersonal%2Fkim%5Fholtman%5Fka%5Fprorail%5Fnl%2FDocuments%2FBureaublad%2FProRail>