



<b>Reference</b>	<i>FP13</i>
<b>Project Title</b>	How We Roll
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<b>Project Manager</b>	<i>My Weidel</i>
<b>Project Duration</b>	2022-03-10 - 2022-12-31



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## Summary

The purpose of this project was to build a prototype of a new type of bicycle simulator. It consists of a versatile construction with potential for many functions, based on bike rollers. The goal was to keep a realistic bicycling experience.



## TITLE

### 1. Background

When trying to study bicycling in simulators the bicycling experience is often compromised by complicated technical solutions. By using simulators that do not resemble the real experience we cannot be sure to get a representative behavior in bicycle studies. We wanted to take a step back from engineering and take an innovative approach to building a cycling simulator which puts the realistic cycling experience in focus.

### 2. Project set up

#### 2.3 Purpose

To make sure that cyclist behavior can be studied without exposing participants to danger, to make events replicable and to test scenarios that cannot easily be implemented in the real world, we needed a bicycle simulator. Since there were no bicycle simulators that offered a realistic cycling experience the purpose was to build a prototype.

#### 2.4 Objectives

The goal was to build a prototype of a simulator made for bicycling that offered an experience as similar to real bicycling as possible. We also wanted a simulator that could be useful in many different studies. It had to be movable, safe, adjustable for different bikes and people, and possible to use in different set ups and contexts. We also wanted to investigate whether it should be used with a simulated world on a screen or whether it was possible to simulate the world in virtual reality (VR).

#### 2.5 Project period

The period for the pre-study was 2022-03-10 - 2022-12-31.

#### 2.6 Partners

VTI as project leader  
Trivector  
If

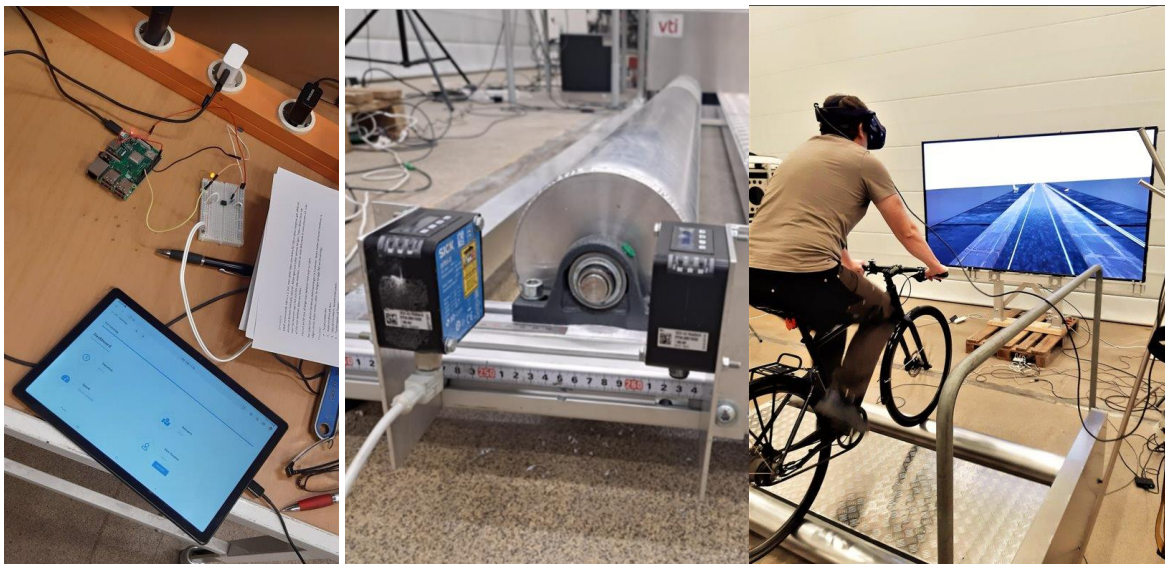


### 3. Method and activities



The prototype is based on a frame with three rolls, the front and middle one are connected by a chain. This is similar to the free rollers that are used in training and for warm-up by competing cyclists. It is driven by the wheels of the bicycle so acceleration and deceleration come from the pedaling of the cyclist. This is different to treadmill solutions, where the speed is externally driven.

The development was made in house at VTI. The workshop took it from the draft to finalized prototype. They sketched, sawed, welded, soldered, tested and added more features along the way. Such as sensors for measuring speed and position.



After this, a small validation comparing cycling on the roller and on a road was conducted. Simulation on screen and VR was also tried. At a presentation of the project in December 2022 visitors had the chance of trying cycling on the roller while using VR.



## 4. Results and Deliverables



The prototype was finished in December 2022. All objectives were reached. Some issues that need further development were encountered. While biking, especially fast, the chain used to drive the rolls makes a lot of noise that can be disturbing and disrupt the feeling of realism. The safety harness used to keep the person riding the bicycle safe and more relaxed is now installed in the room where the simulator is standing. To make the simulator more movable the safety harness would need to be integrated in the structure of the simulator.

## 5. Conclusions, Lessons Learnt and Next Steps

The less technical approach to build a simulator has proven to be successful.

In the continued development of the bicycle simulator prototype fans will be added to simulate wind. An engine will be built in to make it easier to start rolling on the bicycle and to simulate uphill and downhill slopes. Building a more adaptable safety solution is also planned in the next steps.

The virtual world is planned to be developed, we aim to introduce curves and terrain features and see how to make the experience even more realistic. Adding the possibility to see the handlebar and hands is expected to make the bicycling feel more familiar.

## 6. Dissemination and Publications

No publications have been done yet. If we get more funding two articles will be published in a follow-up project. One about validation and one about co-simulation.

The results were presented for external persons at an event at VTI 8<sup>th</sup> of december.



## 7. Acknowledgement

The great project group with Katja Kircher, Arne Johansson and Lennart Ochel. Carl and Hampus from Lund University for helping us with trying VR (during their vacation).

Our SAFER partners Trivector and If. VTI and SAFER for funding.

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