

Safety Report

Mechatronic Project 478

Development of an Affordable Zwift Enabled Smart Bicycle Trainer

DC Eksteen

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Emergency contacts

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Fire brigade	-	887 1333	-
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Signatures

Project supervisor	Laboratory engineer	Laboratory manager
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The project does not involve vessels or pipes at pressure above 50 kPa

Overview

This final year project demonstrated the development of a smart bicycle trainer that can be controlled from virtual cycling exercise applications such as Zwift. The trainer has been manufactured and a torque characteristic and calibration test needs to be performed on the trainer and the brake. An existing master's student, Mr C Loedolff (21878439@sun.ac.za) has agreed that the his existing test setup in the Structures Laboratory may be used to perform the required tests.

General lab safety:

The following general lab safety instructions are applicable:

1. No after hours testing may be performed without the necessary permissions
2. An induction is required before testing may be undertaken.
3. Closed shoes must be worn at all times.
4. Loose clothing may not be worn.
5. Good housekeeping practices should be kept during testing.
6. No food or drink is permitted in the lab.
7. Safety report must be visible and accessible during testing.
8. If uncertain, ask for help - it will be willingly provided!

Fire Safety

There is no direct fire risk associated with the work to be performed as there is no use of highly flammable liquids/gases or explosive material. However, in the case of an emergency, the evacuation route for the laboratory can be found in Figure 1. To reduce the risk of serious injury or fatalities, all exits will remain unobstructed, and the use of earphone/headphones is prohibited while working in the laboratory so that warning and emergency alarms can be heard clearly.

Assembly Overview

The assembly of the frame will include fastening of mechanical equipment, connecting and insulating electrical wires as well as light processing of mechanical components (grinding, drilling and cutting). The assembly of an existing test frame will also be required, where components will need to be mounted together with fasteners. The mounting of an existing motor will be required, which includes fastening it to the existing frame.

Equipment that will be used in the lab during assembly are:

- Drill
- Screwdriver
- Spanners
- Wire Cutters
- Multi-tool
- Pliers
- Super Glue
- Clamps
- Ruler, measuring tape and vernier

Activity Based Risk Assessment

Table 1: Risk Severity Scores

Likelihood	Low	Impact	High
High	2	3	4
	1	2	3
Low	1	1	2

Table 2: Activity Based Risk Assessment of Assembly

Activity	Risk	Type	Severity	Mitigation
Entering the Lab	Hand Injury from door/gate	P	1	Pay attention when entering the lab.

Activity	Risk	Type	Severity	Mitigation
	Knocking equipment/tools over	E	2	Keep clear of objects when moving in lab
Walking around in the lab	Injury to falling or slipping	P	1	Be aware of surroundings and keep working area tidy
Test Rig Assembly	Dropping tools on feet/floor	P & E	1	Wear closed shoes at all times
Mounting Motor	Dropping the Motor	P & E	3	Ask for assistance
Handling Torque Transducer	Bumping or damaging equipment	E	2	Minimize the handling of transducer. Take care when handling
Clamping	Crushing limbs or damage to parts/equipment	P & E	2	Ensure body parts are clear when clamping. Use adequate clamping force.
Wiring	Short Circuits	E	3	Ensure cable insulation is in place and intact
	Injury during cutting	P	2	Keep fingers and hands clear of cutters and pliers
	Electrical shock	P	3	Ensure cable insulation is in place and wires are secured
Turing Off Equipment	Electrical shock	P	2	Ensure that all equipment wires are secure and insulated
Tidying workstation	Tripping	P	2	Be careful when tidying and keep space uncluttered

Activity	Risk	Type	Severity	Mitigation
	Cutting body parts	P	2	Beware of sharp edges and tools. Wear safety gloves
Leaving the lab	Theft	E	3	Ensure that all doors are locked and that all valuable equipment is stored away

Testing Overview

Testing will consist of running a servo motor that is attached to the trainer through a torque transducer. The motor will then be driven at various speeds and the torque reading will be collected. The motor will be mounted to an existing frame, and the trainer frame will attach to the existing setup with a custom built shaft.

Equipment that will be used in the lab during assembly are:

- Laptop
- Motor
- Multimeter
- Torque Transducer
- Test Rig
- Thermometer

Safety measures during testing:

The following safety measures will be adhered to during testing.

1. An emergency stop button will be implemented.
2. All rotating parts will be covered during operation of the test rig.

Activity Based Risk Assessment

Table 3: Activity Based Risk Assessment of Testing

Activity	Risk	Type	Severity	Mitigation
Starting the testing procedure	Electrical shock	P	3	Ensure that all equipment is in good order Ensure that insulation on wires are secure
Running the motor	Misalignment of shafts causing damage	E	4	Ensure that all alignment is correct before testing. Ensure Emergency stop is implemented and within reach
	Electrical shock	P	2	Ensure that all motor wires are insulated and secured
	Pinching or cutting	P	4	Stay clear of rotating components. Ensure that all rotating components are covered. Ensure that area around rig is clear before testing
Collecting test data	Electrical shorts / Over-voltage	E	2	Ensure compatibility between testing equipment and data acquisition devices
	Data loss	E	2	Regular saving and backing up of data on computer and server/cloud
Storing test rig	Theft	E	3	Ensure that all valuable equipment is stored away

Activity	Risk	Type	Severity	Mitigation
	Injury or damage to surroundings	P & E	2	Ensure that testing facilities are tidy and safe

Escape Route

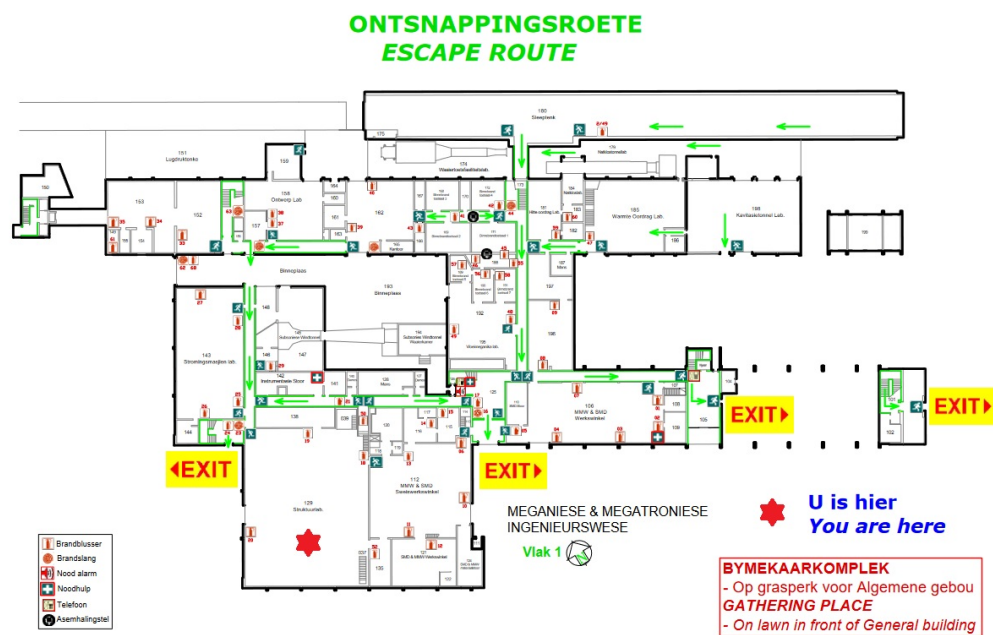


Figure 1: Structural Lab Escape Route