

Stand-Up Rail



Bioengineering Year II Design Project



Small image showing a cyclist in a standing position. Credit: gdingweek/madafigital.com

Standing Position

The cyclist gets out of the saddle and uses his body weight to pedal. The arms are almost vertical above the handlebars.

The Stand-Up Rail is a device that can be attached to a track bicycle's handlebars to enable paralympic cyclists with upper limb disability to perform a powerful standing start.

What?

Why?

In track cycling a strong, powerful start is key to race performance. For an athlete to achieve this, heavy pushing is required from both legs whilst assuming a standing position at the beginning of the race. This upsets the cyclist's balance; they shift their weight forward and grasp the outer pursuit bars of their handlebars to help - the **standing position**. As the bicycle picks up speed, balance has been achieved and the cyclist transitions their arms inwards and places them near the center of their handlebars to reduce air drag - the **aerodynamic position**.

This transition from one posture to another is crucial: milliseconds gained or lost during acceleration may pay off several laps down the line. Furthermore, starting in a standing position uses different muscle groups for the initial push, conserving stamina. The inability to perform a standing start can make it or break it in cycling, where records are split by the millisecond.

Many paralympic cyclists with an upper limb disability (category C5), particularly above elbow amputees, are unable to maintain a standing position at the beginning of the race. The primary reason behind this is usually the prosthetic attachments; the vast majority of such attachments are fixed, i.e. the cyclist's prosthetic attaches to the handlebars in one spot. This is done for simplicity and stability. This attachment is then usually in the position the cyclist assumes for the majority of the race - the aerodynamic position. However, this forces the cyclists into an unbalanced state in their standing position - to the extent that many C5 paralympic cyclists give up trying to do a standing start at all.

Our project aims to change this.



Small image showing a cyclist in an aerodynamic position. Credit: jordanbutterworth/paralympics.org.uk

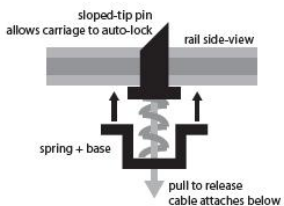
Aerodynamic Position

Pressed against the bike, the athlete hunches his shoulders to minimize front surface area and reduce drag. His arms are brought in front of him.



Control

The locking mechanism is controlled by a simple brake lever. The athlete presses down on the lever with their able hand to release the carriage from either locked position.



- 1 The carriage, with the prosthetic attached, starts locked in the standing position. The cyclist can put his weight on it.
- 2 The cyclist disengages the locking pin with his able hand by pressing the brake lever.
- 3 The cyclist transitions to the aerodynamic position by sliding the carriage which is then locked in place by another slanted pin.

How?



Rail

A thin, aluminum rail that houses the locks and provides a linear path for the carriage. It is capped by end blocks that prevent the carriage travelling further than it should.



Lock

A spring-loaded pin that retracts when the carriage rides over it, or when a brake lever is pulled.



Carriage

A block that provides smooth, non-powered, yet gradual movement along the rail from one lock position to another. Due to its shape, it cannot rotate nor fall off the rail. A prosthesis can be attached to a socket mounted at the top of the carriage.

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