

A High-Speed Overhead Conductor Bar System?  
**The Furrer+Frey CR4.**  
What else?

# Overhead Conductor Rail Furrer+Frey CR4

## For over 30 years

It was more than 30 years ago that Furrer+Frey AG seized on the idea of an overhead conductor rail as an alternative to the conventional contact line. Since then, the overhead conductor rail has been subject to continuous enhancement from the very first prototype to today's Furrer+Frey® system for high-speed applications. All the experience and knowledge we have gained from projects carried out during this time has been directly invested in developing the overhead conductor rail still further. The outcome has been a technically mature product, appreciated and acknowledged by customers in more than 30 countries and with a total length of over 2,000 km now installed in tunnels and loading facilities, on lift bridges and in maintenance halls.

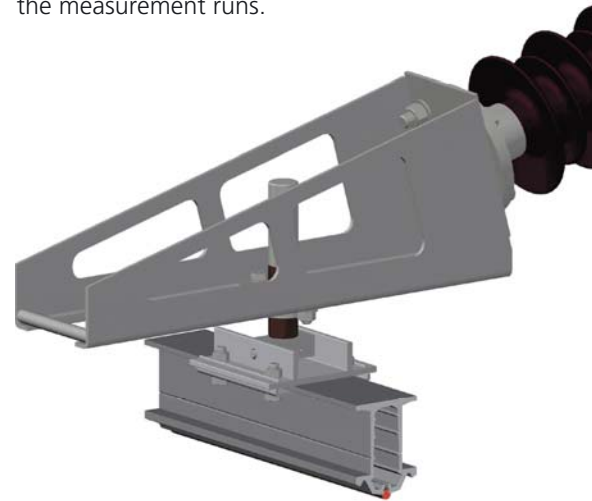
## Innovations

As early as 1988, 140 km/h was achieved on a test section. The overhead conductor rail was then equipped with sprung supports whose vibration-damping characteristics reduced contact force peaks. In addition, a new conductor rail profile was designed with raised notches which engage with the grooves in the fishplates. This improves positional accuracy at the joints between two conductor rail profiles. The first overhead conductor rail system for trains scheduled to run at 200 km/h which included these technical innovations was taken into use in 2004. The next milestone, the TSI compliant design of the 250 km/h overhead conductor rail with its components, was achieved in 2012!

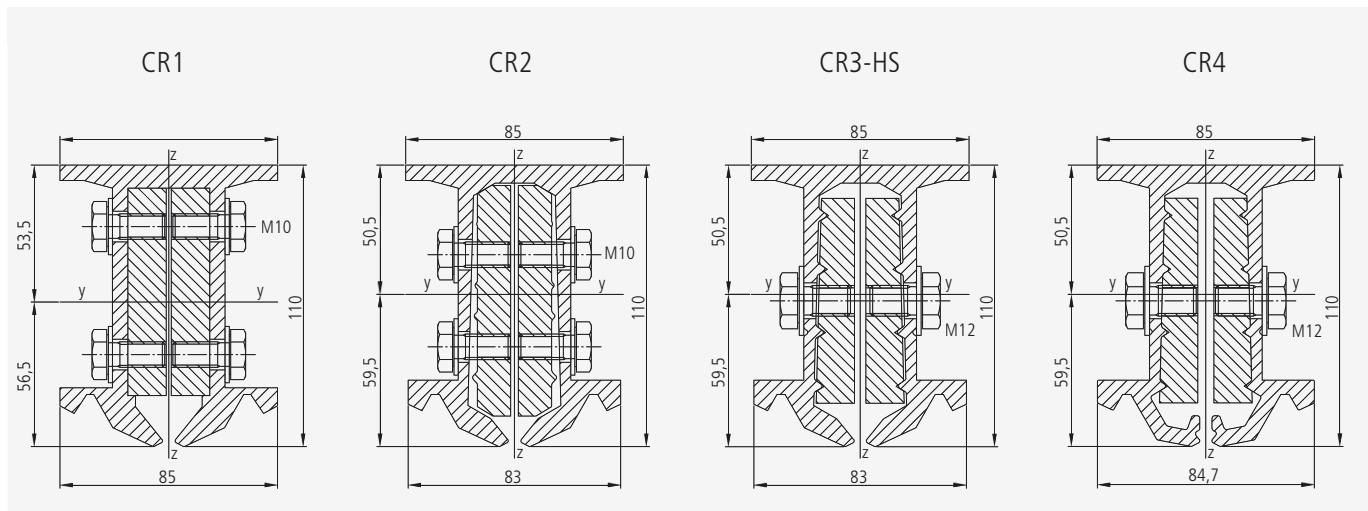
The relevant measurement runs took place on 4 March 2012 in the Sittenberg Tunnel on the section between Amstetten and St. Pölten in Austria.

## World Record

Thanks to the open-mindedness to innovation displayed by Austrian Federal Railways, part of the conductor rail already installed in the Sittenberg Tunnel was fitted with improved support structures and thus returned to accept even greater speeds. Measurement runs of up to 275 km/h with Deutsche Bahn's ICE-S measuring train have demonstrated that the Furrer+Frey® overhead conductor rail system can be used without restriction by trains travelling at 250 km/h while still adhering to the limits set out in EN 50367. During the measurement runs, a speed of 302 km/h was actually achieved. A world record! The TSI diagram below illustrates the contact force values recorded during the measurement runs.



Interlocking joint for conductor rail.



Conductor rail profile generations from our beginnings up to today.

## Measurements

The diagram below shows the measurement readings recorded during the second measuring run. The area to the left of the red dividing line shows the contact force pattern in the track section equipped with the original overhead conductor rail design, and the area to the right of the dividing line shows the section with the improved overhead conductor rail with its more uniform zigzag pattern and revised support structure suspension.



Hinged conductor rail cantilever with new height adjustment mechanism and floating rail clamp.

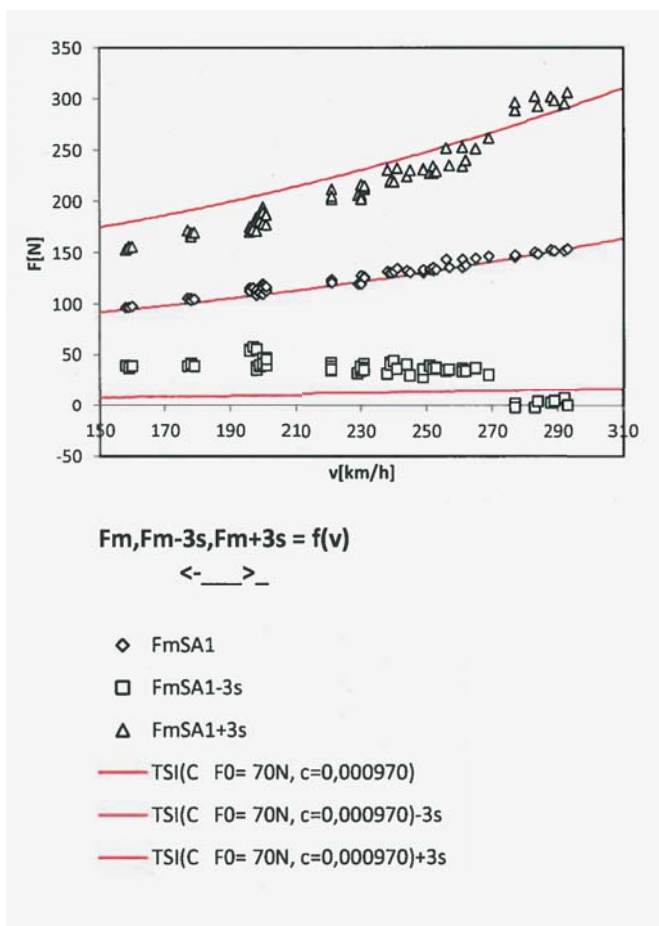
## Confirmations

In spring 2015, both DB Systems Engineering and the ÖBB checked and confirmed the positive measurement run results.

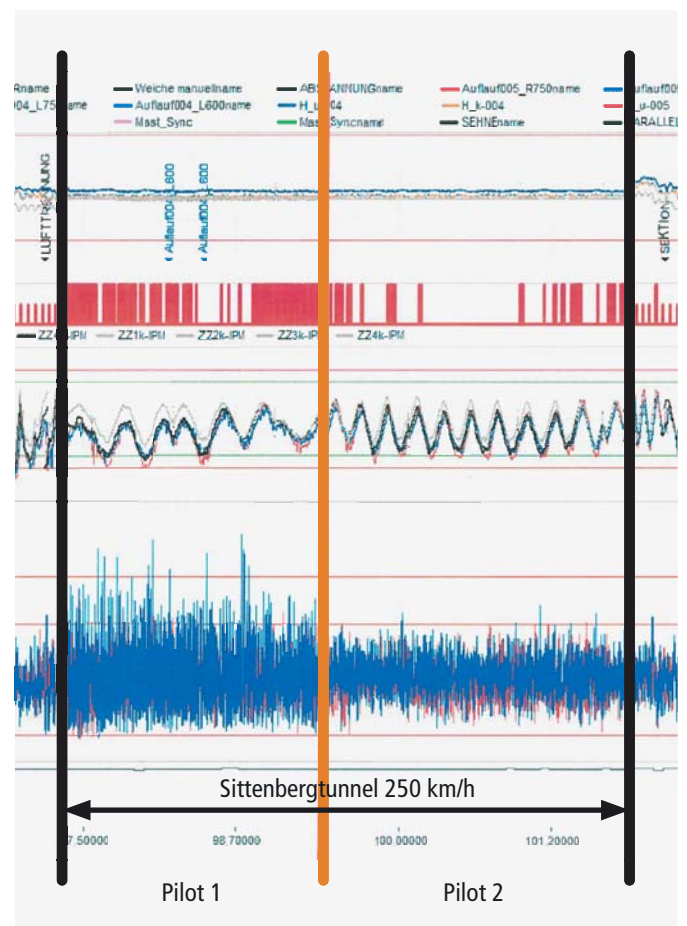
The current CR4 profile conductor rail will be used on all ongoing and future conductor rail projects. This fourth generation profile represents the result of developments over the last 30 years and embodies all the knowledge and experience we have gained about conductor rail construction over that time.

## Certificates

After extensive operational testing, compliance of the Furrer+Frey® CR4 overhead conductor rail system with the current TSI-ENE has been certified by Eisenbahn Cert in Berlin. The CR4 system has received type approval for 250 km/h from the Swiss Federal Office for Transport (FOT) and from the Austrian Federal Ministry for Transport, Innovation and Technology.



TSI diagram for the section from km 101.9 to km 99.3 in the Sittenberg Tunnel.

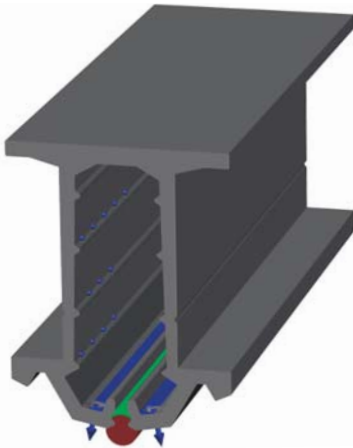


Measurement data from the second measuring run in the Sittenberg Tunnel.

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## The CR4 Profile

One innovation of the Furrer+Frey CR4 profile are the bulges on the upper rim of the clamping slot. This allows grease to be introduced into the profile gap instead of into the contact wire grooves, making it easier to insert the contact wire. Equally, it keeps any condensation which may form in the interior of the profile away from the copper-aluminium contact point. The condensation is collected at the outer sides of the bulges and is discharged through holes drilled through the underside of the conductor rail profile. These holes also help to ventilate the profile interior.



Condensation discharge on the underside of the profile.



Grease introduced into the profile gap.



Profile with contact wire inserted without excessive grease residues.

## The Future

Furrer+Frey's development work recently received fresh recognition. Based on the certificates cited above and on our many years of experience, Alp Transit Gotthard has decided to have the Furrer+Frey® overhead conductor rail installed in both the 15 km long Ceneri base tunnel bores.



## So it's obvious

You need a high-speed overhead conductor rail?  
Then install Furrer+Frey's CR4 – what else?

We are grateful to our development partners, Austrian Federal Railways, Infrastructure Division, and to our partner in Vienna, HC-Electric, for their ongoing support as part of this project.

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