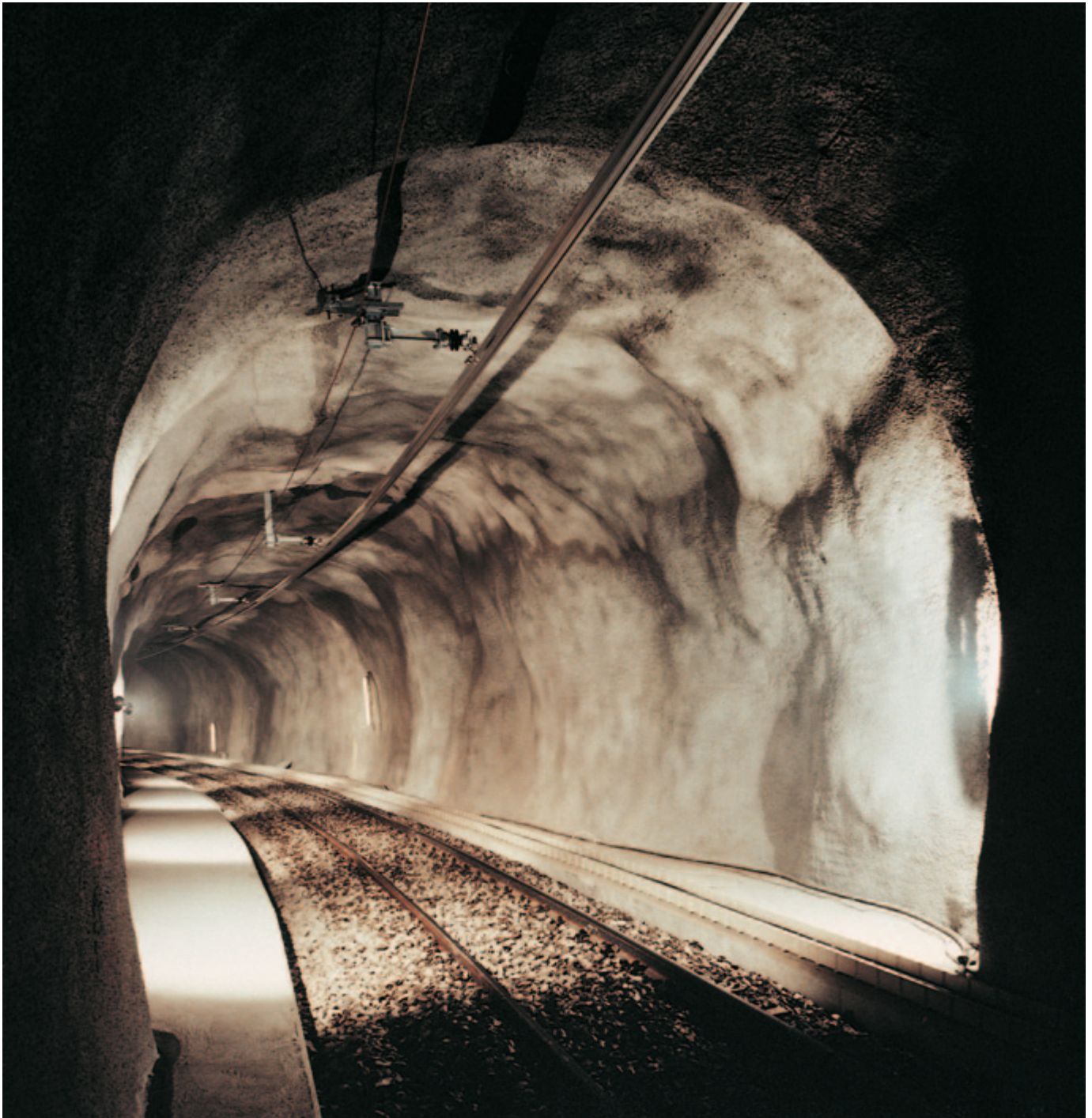




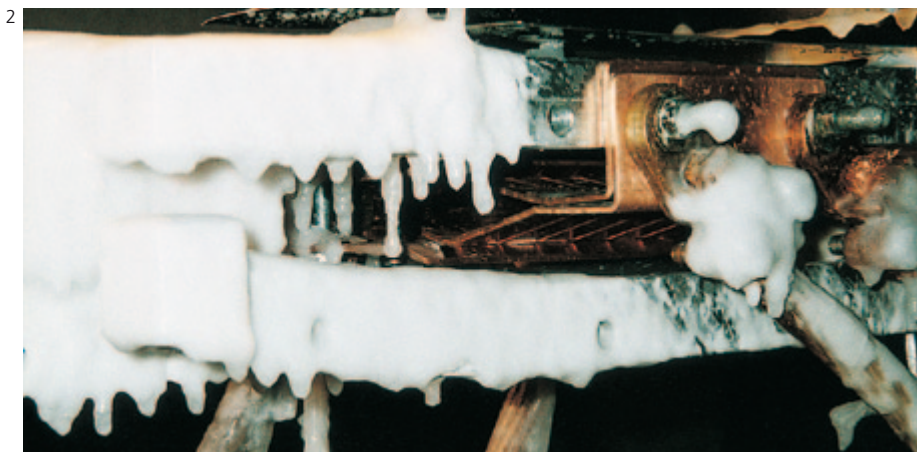
Overhead Conductor Rail Systems Furrer+Frey®

Furrer+Frey® Overhead Conductor Rail Systems OCRS

For many decades Furrer+Frey® has maintained very close relations with train operating companies. The diminution of infrastructure costs and the reliability and safety of rail operations have always been, and still are, important discussion topics. This was the spur for us, at the beginning of the 1980s, to develop an alternative to the conventional overhead contact line. And the outcome was the Furrer+Frey® overhead conductor rail system.



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The Furrer+Frey® overhead conductor rail system makes it possible to choose smaller tunnel cross-sections for new builds and allows the electrification of tunnels originally built for steam or diesel traction. The system's major advantage is its low overall height, plus the fact that there is no contact wire uplift even if operated with multiple pantographs. Our overhead conductor rail demonstrably offers high electrical cross-sections, so that additional feeders can be avoided. Moreover, this system's fire resistance is significantly greater than that of a catenary system. And, lastly, our experience of the system which is now installed on over 1 700 km of track has proven that the Furrer+Frey® overhead conductor rail system is extremely operationally reliable and requires little maintenance. This is true regardless of the operating voltage, from the 750 V urban rail systems to the 25 kV high-speed rail lines. — **[1]**

Electrical and mechanical testing, fire resistance tests and, finally, actual operational experience of the Furrer+Frey® overhead conductor rail system have demonstrated that the overhead conductor rail can perform reliably at speeds of up to 250 km/h. — **[2,3,4]**

The overhead conductor rail mainly bears only its own weight; there are no additional mechanical tensile forces. The overhead conductor rail can be directly combined with the contact wire, meaning that it can be integrated into existing overhead contact line systems.

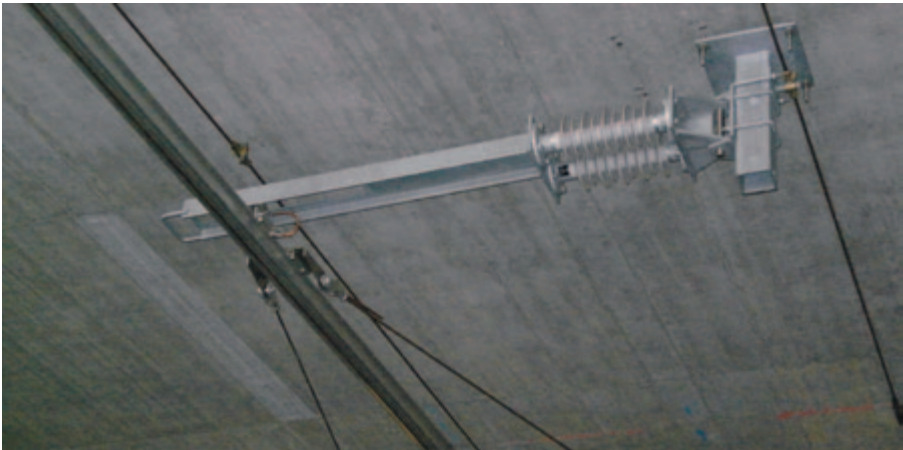
References



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The number of countries covered by our reference list is quite impressive. The systems we have already built and the experience we have gained as a result, provide both the foundation and the spur for us to constantly develop and improve the Furrer+Frey® overhead conductor rail system.

To date, more than 1700 km of Furrer+Frey® overhead conductor rail systems are in daily use in more than 20 countries throughout the world*: Australia, Taiwan, Thailand, South Korea, Hongkong, China, India, Turkey, Italy, Spain, France, Belgium, Germany, Austria, Croatia, Netherlands, Great Britain, Denmark, Sweden, Norway, Russia, USA, Ukraine, Algeria and, of course, in Switzerland.

* These are all systems which have been completed, not future projects

Examples of overhead conductor rail systems planned and executed by Furrer+Frey®:

Installation in Tunnels

- Olso Tunnel, Norway — [1]
- North-South Berlin, Germany — [2]
- Berlin International Airport, Germany — [3]
- Buschtunnel, Germany — [4]
- Tunnel Engelberg, Switzerland — [5]

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References



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Conductor rail on open track

Bourg-en-Bresse – Bellegarde

The conductor rail over open track connects two tunnels on short distance. The continuous conductor rail reduces the number of changeovers between catenary and conductor rail. — [1]

Copenhagen Mainstation

The team of architects that revitalized the building of the mainstation wanted to have an overhead contact line that adapts to the curved platforms. The conductor rail follows the curved track. — [2]

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Salzburg Mainstation

The team of architects that renovated the arched roof over the tracks looked for a new element for the overhead contact line and voted for overhead conductor rail. — [3]

Südtirolerplatz

Before the cut-in double track could be covered by a concrete roof the overhead conductor rail was installed at provisional supports. — [4]

After the roof was in place the supports for the conductor rail could be fixed at drop tubes. — [5]

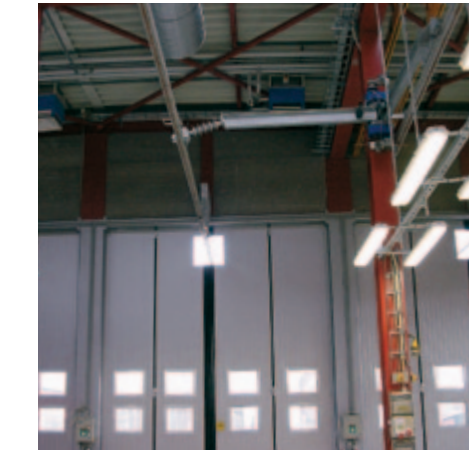
Westbahn

In view of the remodelling of Wien Mainstation the connecting Lainzer-tunnel was equipped with overhead conductor rail. — [6]

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References



7



Installation in depots and maintenance shops

- RHB liftable conductor rail, Switzerland — [1]
- Metallostroy St.Petersburg, Russia — [2]
- Rotated section insulator in Würzburg, Germany — [3]

Fixed conductor rail system

- Dresden Reick, Germany — [4]
- Helgoland depot, Denmark — [5]
- Bernmobil depot, Switzerland — [6]

8



Movable conductor rail systems

- Geneva, on track and retracted, Switzerland — [7, 8]
- Short moveable section, Krefeld, Germany — [9]
- Frankfurt Griesheim, Germany — [10, 11]

9



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11



References



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Equipping lift, bascule and swing bridges

- Lifting bridge in Sweden — **[1,2,3]**
- Swing bridge in France — **[4,5]**
- Swing bridge in the USA — **[6]**

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References



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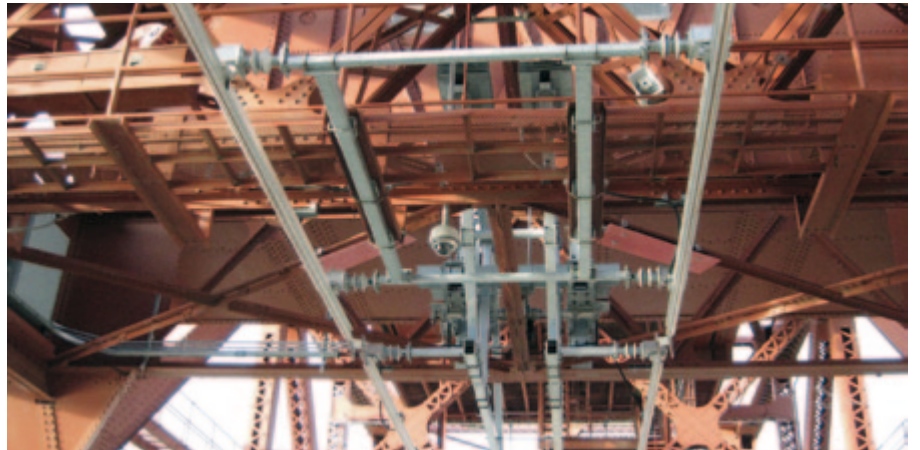
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Equipping lift, bascule and swing bridges

- Bascule bridge in Turkey — [1]
- Bascule bridge Boston-New Haven, USA — [2,3]
- Bascule bridge in Germany — [4]
- Bascule bridge in Sweden — [5]
- Bascule bridge in Portland, USA — [6,7]

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References



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Systems in loading terminals

- Loading terminal in Kiruna, Northern Sweden — [1]
- Loading terminal in Schynige Platte, Switzerland — [2]

Special applications for

Overbridge

- Sargans, Switzerland — [3]

Temporary structures

- Bruggmoos, Biel, Switzerland — [4]

Tunnel refurbishment

- Berghau Tunnel, Germany — [5]

Three-phase railways

- Jungfraubahn, Switzerland — [6]

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Components which make up a Furrer+Frey® OCRS



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The conductor rail profile

The box-shape profile has become more sophisticated as a result of experience gained over 25 years. We currently use the CR3-HS profile. An untensioned contact wire is clamped to the lower side of the profile by means of a special insertion device. Contact wires of between 100 and 161 mm² can be accommodated in the profile. A special anti-corrosion grease prevents ion exchange, thus permitting the use of copper contact wires. Thanks to the profile's large cross section, there is no need for auxiliary lines such as feeders and cables. The profiles are generally delivered in 11.90 metre lengths. — [1,2]

Interlocking joints

Conductor rail profiles are jointed by using pairs of interlocking joints. The patented groove and rib system between conductor rail profile and interlocking joint ensures that the joints are formed free of any kink and, at the same time, it ensures optimum current transfer due to the numerous single-point and continuous linear contacts between the profile section and the interlocking joints. This has allowed the number of screws at the joint to be reduced from 16 to 8. — [3]

Support structures

The overhead conductor rail replaces the catenary system in particular circumstances and/or because it is more reliable. There are at present many types of support structures available, all of which have proven their worth in practice and which have been granted appropriate approvals. Three examples are shown below:

- Hinged support structure, *Sittenberg* — [4]
- Sliding support structure, *Metro* — [5, 6]
- Minimum encumbrance support, *Axen tunnel* — [7]

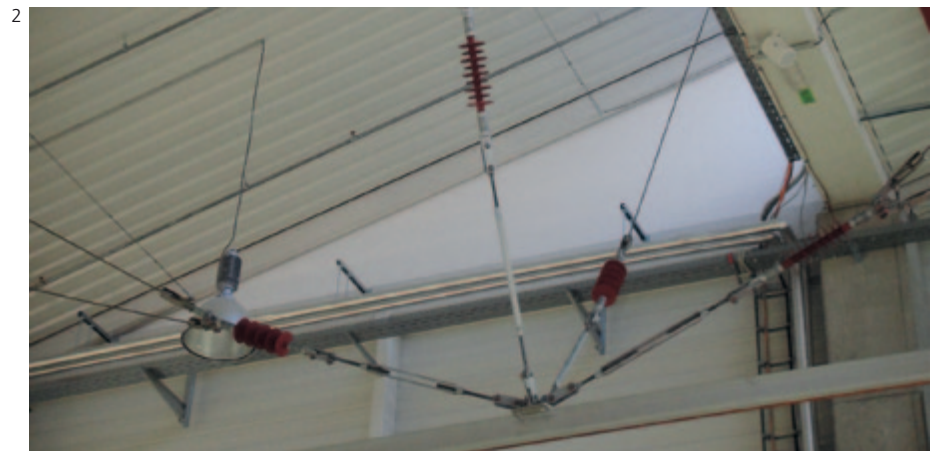
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Components



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Pendulum support structure

We achieve the fine adjustment of the height at which the overhead conductor rail system is positioned using patented swivel heads on the support structure. These swivel heads also contain spring stacks. Depending on train speeds and where the support structures are situated, these spring stacks are allocated to installed components such as expansion joints or section insulators. In this way, we can achieve the optimum dynamic behaviour between overhead conductor rail and pantograph. — [1]

Flying support structure — [2]

Transition bar

The overhead conductor rail system must provide a possibility to be integrated in an existing catenary systems. We have developed the transition bar in order to do this. The transition bar takes up and absorbs the vibrations from the contact wire of the catenary system and reinforces it with an increasing cross section onto the full profile of the overhead conductor rail. — [3]

Expansion element

Like in a catenary system, temperature changes also produce changes in the length of the overhead conductor rail. Changes to its length are compensated for by expansion elements cut into the axis of the conductor rail. These expansion joints allow the pantograph to run smoothly without mechanical or electrical interruption. — [4]

Fixed point anchor

The position of long conductor rail systems is determined by fixed point anchors between the expansion elements. These compensate for varying longitudinal forces in the overhead conductor rail caused by any inertia in the hinges of the support structure or the gliding elements. Long conductor rail sections fixed to pendulum support structures do not necessarily need fixed point anchors. The profile sections' own weight can provide sufficient stabilisation.

Anchoring the catenary system in tunnels or on external structures

The endpoint anchors take up the tensile forces of the contact wire as it passes into the overhead conductor rail. Once inside the ends of the conductor rail, the contact wire is installed without being subjected to tensile forces. — [5, 6]

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Components



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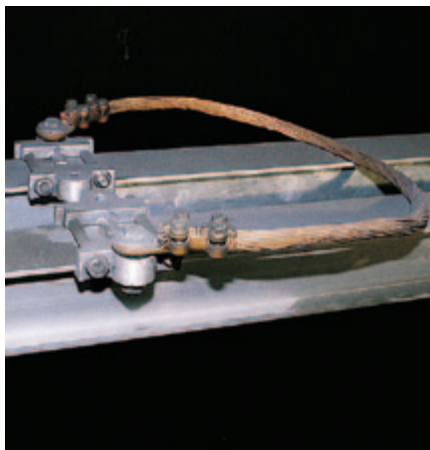


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Anchoring the catenary system in the maintenance workshop

In maintenance shops, the catenary system is normally anchored to the front of the building with a termination arrangement. In this arrangement, the contact wire is passed and anchored via a transition bar and the messenger wire is firmly terminated. Inside the maintenance shop, a fixed or moveable conductor rail is installed according to the local requirements. — [1, 2]

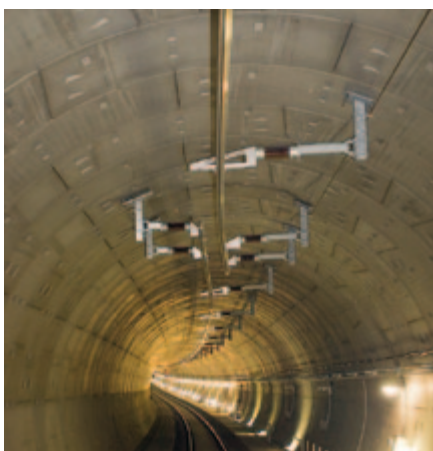
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Turnouts and crossovers

Where tracks branch off, the overhead conductor rail is run parallel to the conductor rail above the main track. In order to ensure the pantograph runs smoothly, the ends of the overhead conductor rails which branch off are bent up with a large radius. — [3, 4, 5]

7



Section insulators

Section insulators are designed either with parallel overlapping conductor rails or with „inline“ section insulators for the conductor rail. For speed > 140 km/h we use section insulators with special skids. — [6, 7, 8]

Phase separation

Phase separation is achieved in the same way using section insulators and/or parallel overlaps.

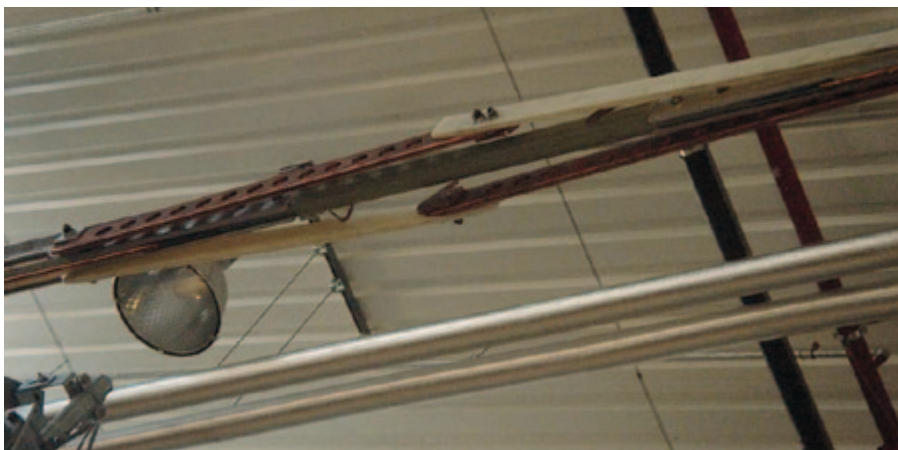
System separation points

We have special solutions and components for system separation points.

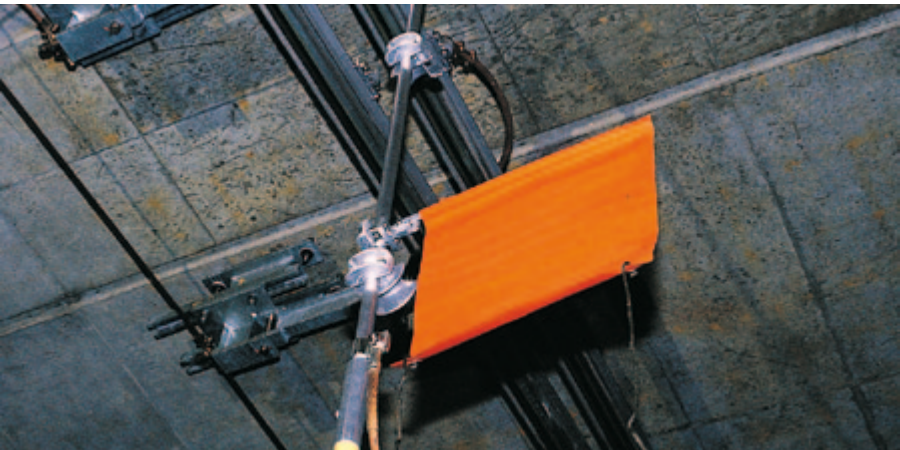
Electrical connections

Flexible copper cables act as electrical connectors where there are breaks in the conductor rail. We have developed current carrying clamps which complete the circuit for these circumstances. These clamps are also able to accept feeder cables. — [9]

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Components



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Earthing

Just like the contact line, the overhead conductor rail also needs to be earthed. Depending on the project and the design of the support structures, this can be done either on each support structure or by using special current carrying earthing clamps. These earthing clamps have also been tested for short circuit currents of 40 kA for 60 ms. — [1]

Protecting plastic cover

At particularly exposed, damp places the overhead conductor rail is protected against water by a plastic cover. Because of their open shape, the transition bars are always covered. In ramps the conductor rail is equipped with a water deflector. — [2,3]

Retractable overhead conductor rail

The many new multiple units have an increasing number of equipment items attached to the roof area. The contact line or the overhead conductor rail should not obstruct access to these equipment items for carrying out maintenance work. Maintenance shop cranes are installed in many places for lifting these items off the roof area. So as to allow work to be carried out without hindrance, we have developed the retractable conductor rail and, of course, the associated safety controls. We shall restrict ourselves here to the retractable conductor rail. Information about the controls can be found in our brochure: Railway safety control systems for depots. — [4]

Moveable bracket, slave

Whether it's short retractable sections or conductor rails of up to 250 metres long in maintenance shops, the overhead conductor rail system is always suspended from horizontally or vertically moveable cantilevers. In the case of slave cantilevers, only a pivot bearing is installed. — [5]

Moveable bracket, motorized

Depending on the length of the section of conductor rail to be moved, a number of moveable brackets are motorized and set in motion by a central operating unit or local operating panels. At the same time, we do not just monitor the movement of the conductor rail but we also ensure that the system is switched off and properly earthed before it is possible to access the roof working platforms or to start using tools. — [6]

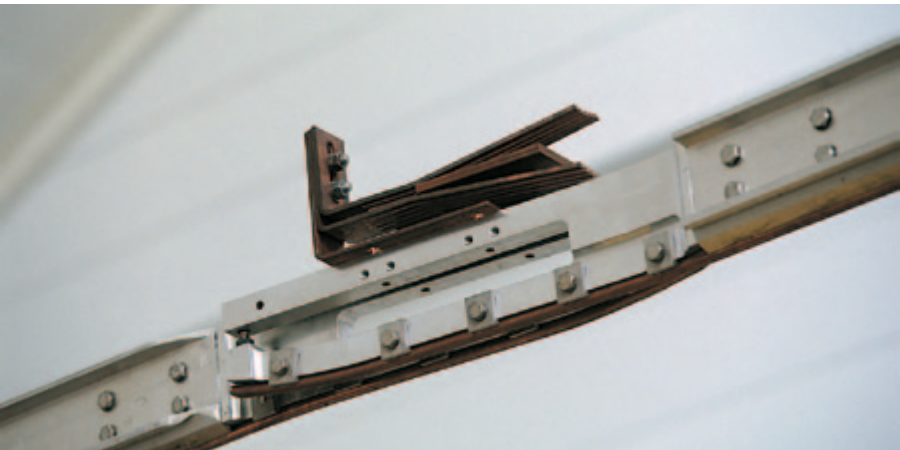
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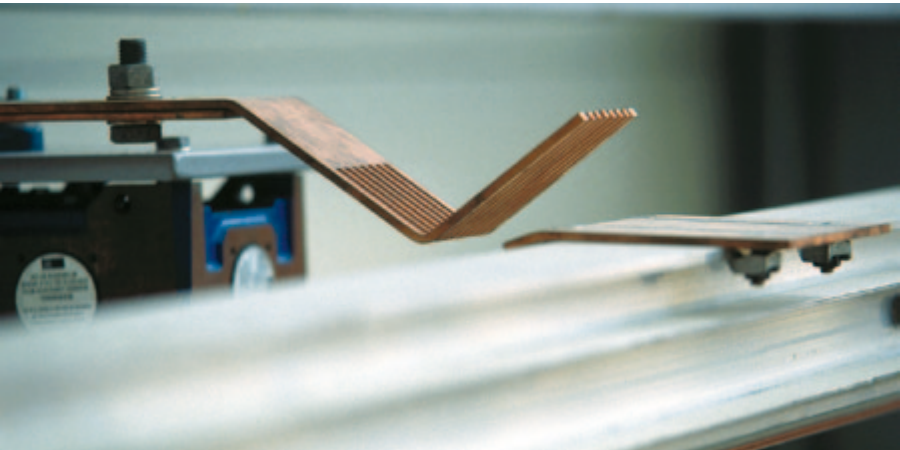
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Electrical contact

The product range includes electrical contacts depending on how the overhead conductor rail system and the conductor rails which then connect up are moved. — [1]

Forced earthing

As with the electrical contacts, several forced earthing methods are realized. — [2]

Power supply feed for pivotable overhead conductor rails

The power can be fed in via the cantilevers. The design varies depending on the project. — [3]

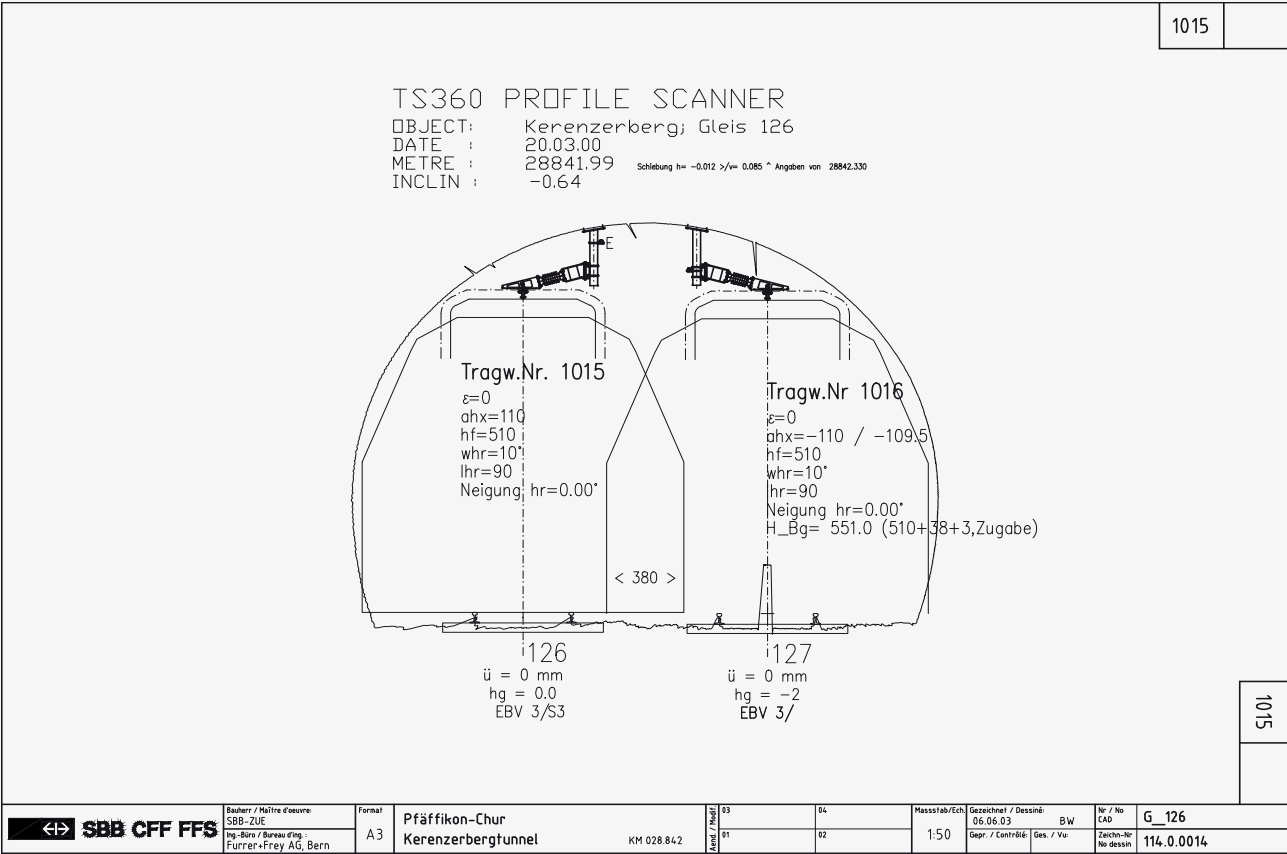
Control systems in depots and maintenance shops

Information about the controls can be found in our brochure: Railway safety control systems for depots. — [4, 5]

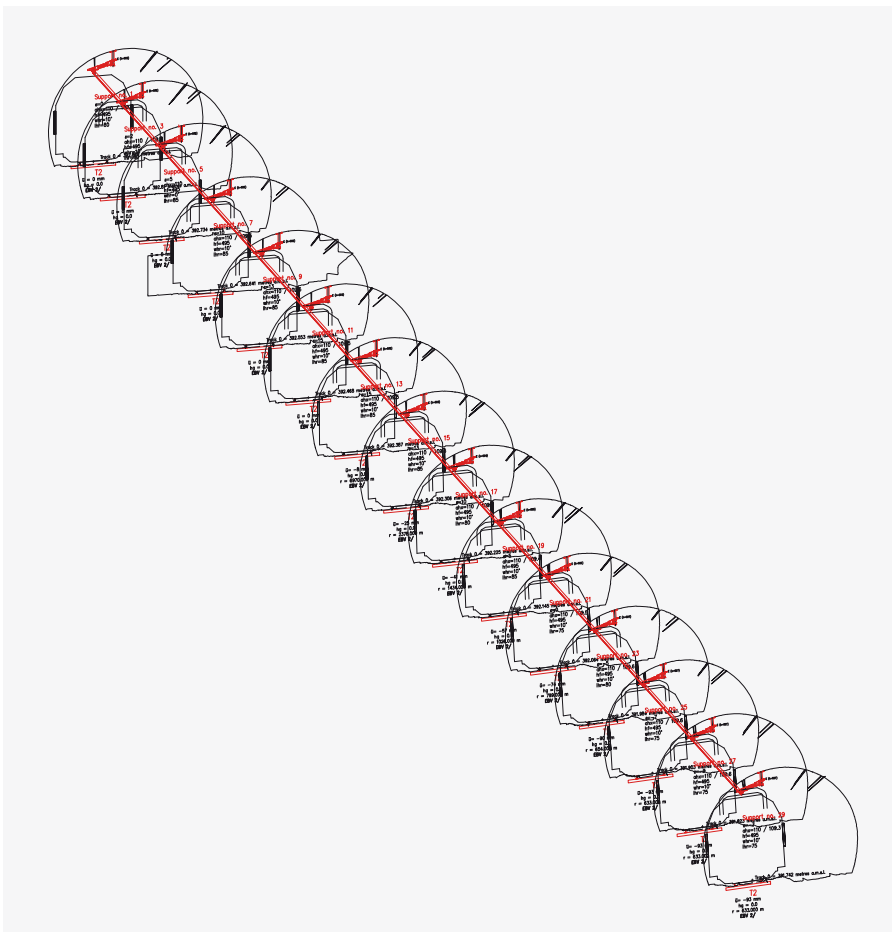
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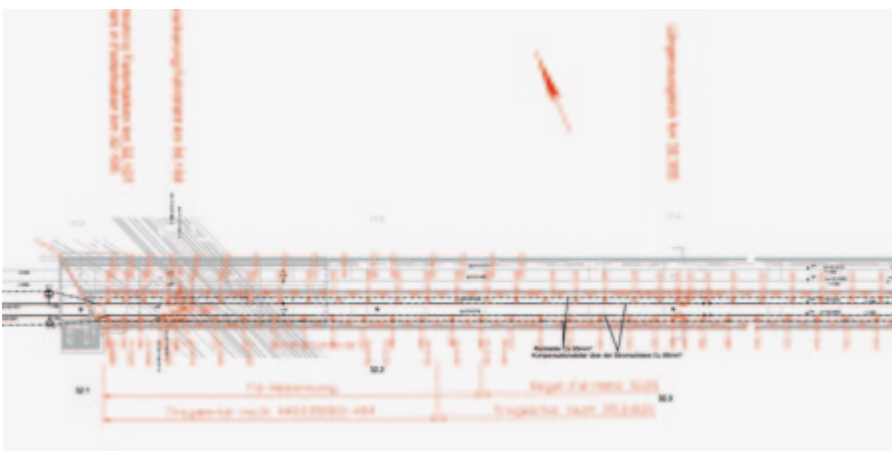


The overhead conductor rail system, as designed by us, permits a very large degree of planning freedom. Depending on train speeds, the distance between supports is 7 to 15 meters. Radii of down to 120 m can be managed without difficulty using standard elements. Below this figure, the conductor rails are pre-bent using a special process; this makes radii of 20 metres possible and this has already been achieved in practice.

Planning is assisted by our ELFF® planning tool which allows us to prove in the shortest possible time whether the overhead conductor rail system will fit into an existing tunnel, what contact wire height can be achieved and by how much the tunnel could be reduced in size if the overhead conductor rail system is employed.

According to the EN Standard 50122 no overhead contact line zone has to be considered, since it is assumed that the conductor rail is practically indestructible and will not fail in the event of short circuits. This results in considerable savings with regard to earthing measures.

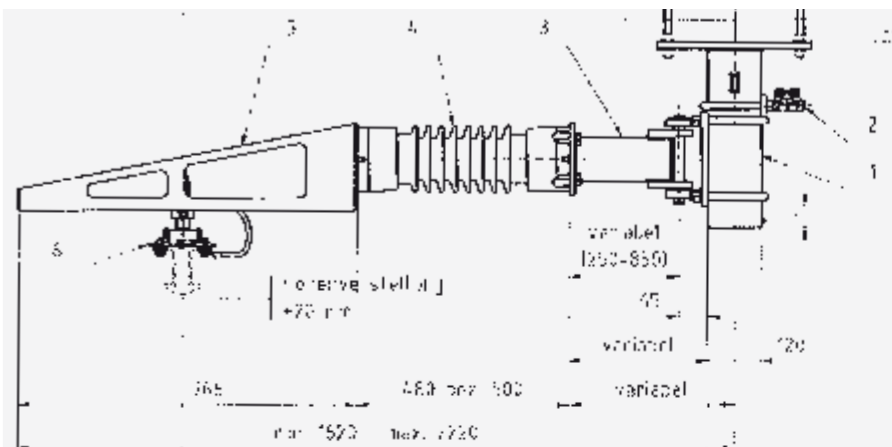
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With the experience we have built up over many years, we are able to rapidly produce preliminary project documents and quotations.

- Tunnel cross-section profile with overhead conductor rail system produced by ELFF® — [1,2,3]
- Tunnel tube with overhead conductor rail system produced by ELFF® — [4]
- Site location plan extract for an overhead conductor rail system — [5]
- Example of 15 kV support — [6]

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Assembly aids for the Furrer+Frey® OCRS



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Drilling equipment

A range of drilling equipment is available for undertaking drilling tasks in the tunnel roof vault. — [1,2]

Test device for set bolts

We do test the bolt setting but also the vault material around. — [3]

Lifting equipment for conductor rails

The conductor rail profile sections can be delivered ex works in special transportation racks. We have the appropriate lifting equipment for raising the conductor rail profile section up to the desired contact wire height. — [4]

Contact wire insertion vehicle

The contact wire insertion device is used to insert the contact wire into the profile of the overhead conductor rail. The spreader wheels open up the profile locally and the central height device lifts the contact wire up to the height of the clamping point. After the insertion device has passed by, the profile closes elastically and clamps the contact wire. Of course, in the event of undesirable burnouts following a short circuit, the contact wire insertion device can be used to replace parts of the contact wire or to replace it completely at the end of its life cycle. There is no need for any adjustments to be carried out after replacing the contact wire since the position of the overhead conductor rail system will not have changed. — [5]

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Greasing device

As long as there is no moisture between the aluminium profile and the copper wire, there is no risk of corrosion. We prevent this, first with venting holes in the profile so that no condensation can form inside the profile. Then, we completely fill the grooves in the contact wire with grease. The grease is applied in the same working process before the contact wire is inserted. We have developed special greasing devices for this task. For systems several kilometres long we use the speed-related grease dispensing system. Our small greasing system for short sections in maintenance shops works on the same principle. — [6]

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Homologations and approvals

Eisenbahn-Bundesamt		
22. MAJ 1996		
Kontak:		
Bezeichnung:		
Ort:		
Datum:		

Fa
Furrer + Frey AG
Ingenieurbüro für Fahrleitungsbau
Postfach 182

CH-3000 Bern 6

Bearbeitungskennzeichen

1221/11101/22AZ2/0011/54

Bei Zahlungen und im
Schriftverkehr
bitte immer angeben

Geschäftszeichen/Bearbeitung
22.12 Shz 41/9- Herr Syre

Tel. (02 28) 98 26- 223 **Fax. (02 28) 98 26- 229** **Datum 22.05.1996**

Zulassung für Stromschiene Bauart Furrer + Frey

Ihr Schreiben vom 19.09.94 - Fuj/mac/531

Anlage:

Zulassungsurkunde

Sehr geehrte Damen und Herren,

mit o.a. Schreiben beantragten Sie die Zulassung für die Stromschiene Bauart Furrer + Frey. Zugelassen werden soll die Ausführung dieses Systems mit Horizontaltragewerk und Stromschiene Typ II.

Dem Antrag waren folgende Unterlagen zur Prüfung und Genehmigung beigelegt:

- Zulassungsantrag an die DB AG,
- Versuchsberichte
 - 25/15 kV Isolator, elektrische Prüfung,
 - 25/15 kV Isolator, mechanische Prüfung,
 - Dilatation/Stoßlasche, elektrische Prüfung,

Hausanschrift:
Vorgebirgsstraße 45, 53119 Bonn
Tel.-Nr. (02 28) 98 26-0
Fax-Nr. (02 28) 98 26-1 99

Übereweisungen an Bundeskasse Bonn
Konto-Nr. 38 001 000 Landeszentralbank Bonn (BLZ 380 000 00)
Konto-Nr. 11 900-005 Postbank Köln (BLZ 370 100 00)

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<p align="center">Certificate of Acceptance</p>	
<p>1. Name of the project</p>	<p>2. Name of the client</p>
<p>3. Name of the contractor</p>	<p>4. Name of the project manager</p>
<p>5. Name of the project engineer</p>	<p>6. Name of the project supervisor</p>
<p>7. Name of the project controller</p>	<p>8. Name of the project administrator</p>
<p>9. Name of the project secretary</p>	<p>10. Name of the project clerk</p>
<p>11. Name of the project assistant</p>	<p>12. Name of the project intern</p>
<p>13. Name of the project trainee</p>	<p>14. Name of the project apprentice</p>
<p>15. Name of the project graduate</p>	<p>16. Name of the project professional</p>
<p>17. Name of the project senior professional</p>	<p>18. Name of the project senior manager</p>
<p>19. Name of the project senior executive</p>	<p>20. Name of the project senior advisor</p>
<p>21. Name of the project senior consultant</p>	<p>22. Name of the project senior analyst</p>
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Furrer + Frey
Seil- und Drahtfabrikationen

EC Declaration of Conformity for Interoperability Components

No. CH201100010355

Interoperability component: Overhead line D55, overhead conductor rail

Manufacturer: Furrer+Frey AG
Thurnstrasse 26
CH-3020 Berne 6

The interoperability component named above conforms to the following European legal regulations

- + Directive 96/44/EEC dated 23 July 1996 concerning the interoperability of the Trans-European high-speed rail system
- + Technical specification for the interoperability of the "Energy" sub-system of the Trans-European high-speed rail system (2000/294/EC)

Assessment: Design type inspection in acc. with Module H2

Assessed by: Notified Body, Interoperability
c/o Federal German Railway Office, EBC Eisenbahn CERT
Hermannstrasse 6
D-53175 Bonn

EC Design type test certification (Annex 1) – Certificate number:
EN500910/EN50910CE EN50099 – extension

Module H2 was employed for the purposes of conformity declaration

The complete design type test certification technical dossier (Annex 2) and the conditions of use are held by:

- + the notified body named above
- + Furrer+Frey AG, Ingenieurbüro und Fabrikationsbetrieb, CH-3020 Berne 6

Handwritten signature: 

Furrer+Frey AG
Dept. Ing. B, Furrer, CEO

Hochschule
Niederrhein
University of Applied Sciences

Steinbecker Seite 10
Verfahrensbereich Technik
Lehrveranstaltung im Studiengang
IMA Fach
Name: _____
Matrikelnummer: 000 _____

THEORETISCHE FRAGEN
zur Fachklausurprüfung
**zur Anmeldung im elektronischen Prüfungsanfragen-
Dienstleistungsportal**

1. Die folgende schriftliche Frage gilt für die Semester I (Lehrveranstaltung:

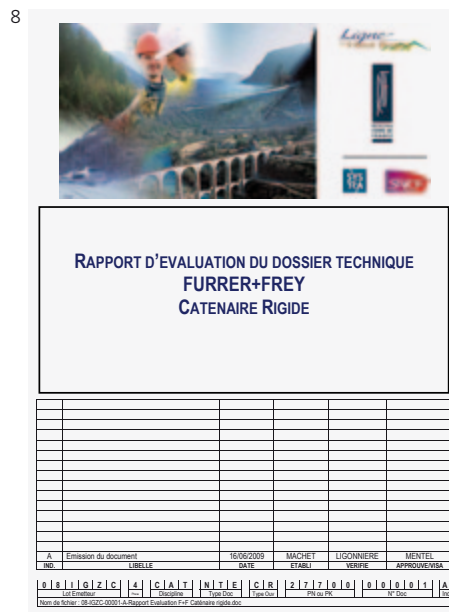
Festigkeits-FEM II
Festigkeitslehre I
Semester I
SS 2005 Seite 6

2. Die schriftliche Frage gilt für die Betriebsanwendungslehre (Statik und Festen der 20. SS 04):

- **Stromschienenbefestigungslehre:** "Stromschienenbefestigung Typ Festeis-III mit Stromeisenschienenprofil C3X-40 und Mittelverankerung Typ Last-IV Typ 1.

3. Folgende Übersichten und Tabellen legen die schriftliche Frage zugrunde:

- **Übersichten und Bezeichnungssymbole (20. SS 08 FEM-40 K04):**
 - 25.1.2005 B1-9 "Typschienenbefestigung",
 - 25.1.2005 "Stromschienenbefestigungsarten an "Hängestützen",
 - 25.1.2005 "Vollstangebau an "Hängestützen oder Gabelbau an Stromschienenbefestigungsarten",
 - 25.1.2005 "25.1.2005 "Vollstangebau für Last IV Typ 1-20 an "Stromschienenbefestigung",
 - 25.1.2005 "Schweißbau an "Stromschienenbefestigung",
 - 25.1.2005 "Verbinder (1997 an Stromschienenbefestigung",
 - 25.1.2005 "Verbinder 290W an "Stromschienenbefestigung",
 - 25.1.2005 "Tagesverankerungen an Stromschienenbefestigung",
 - 25.1.2005 "Vollstangebau Typ I",
 - 25.1.2005 "Vollstangebau Typ 2 (Stromschienenbefestigung)",
 - 25.1.2005 "Vollstangebau Typ 3 (einseitige Befestigung und Stromeisenstütze",
 - 25.1.2005 "Anschlußbezeichnungen für elektrische Verbindungen an Stromschienen",
 - 25.1.2005 "Vollstangebau Typ 4",
 - 25.1.2005 "Vollstangebau Typ 5",
 - 25.1.2005 "Vollstangebau Typ 6",
 - 25.1.2005 "Vollstangebau Typ 7",
 - 25.1.2005 "Vollstangebau Typ 8",
 - 25.1.2005 "Vollstangebau Typ 9",
 - 25.1.2005 "Vollstangebau Typ 10",
 - 25.1.2005 "Vollstangebau Typ 11",
 - 25.1.2005 "Vollstangebau Typ 12",
 - 25.1.2005 "Vollstangebau Typ 13",
 - 25.1.2005 "Vollstangebau Typ 14",
 - 25.1.2005 "Vollstangebau Typ 15",
 - 25.1.2005 "Vollstangebau Typ 16",
 - 25.1.2005 "Vollstangebau Typ 17",
 - 25.1.2005 "Vollstangebau Typ 18",
 - 25.1.2005 "Vollstangebau Typ 19",
 - 25.1.2005 "Vollstangebau Typ 20",
 - 25.1.2005 "Vollstangebau Typ 21",
 - 25.1.2005 "Vollstangebau Typ 22",
 - 25.1.2005 "Vollstangebau Typ 23",
 - 25.1.2005 "Vollstangebau Typ 24",
 - 25.1.2005 "Vollstangebau Typ 25",
 - 25.1.2005 "Vollstangebau Typ 26",
 - 25.1.2005 "Vollstangebau Typ 27",
 - 25.1.2005 "Vollstangebau Typ 28",
 - 25.1.2005 "Vollstangebau Typ 29",
 - 25.1.2005 "Vollstangebau Typ 30",
 - 25.1.2005 "Vollstangebau Typ 31",
 - 25.1.2005 "Vollstangebau Typ 32",
 - 25.1.2005 "Vollstangebau Typ 33",
 - 25.1.2005 "Vollstangebau Typ 34",
 - 25.1.2005 "Vollstangebau Typ 35",
 - 25.1.2005 "Vollstangebau Typ 36",
 - 25.1.2005 "Vollstangebau Typ 37",
 - 25.1.2005 "Vollstangebau Typ 38",
 - 25.1.2005 "Vollstangebau Typ 39",
 - 25.1.2005 "Vollstangebau Typ 40",
 - 25.1.2005 "Vollstangebau Typ 41",
 - 25.1.2005 "Vollstangebau Typ 42",
 - 25.1.2005 "Vollstangebau Typ 43",
 - 25.1.2005 "Vollstangebau Typ 44",
 - 25.1.2005 "Vollstangebau Typ 45",
 - 25.1.2005 "Vollstangebau Typ 46",
 - 25.1.2005 "Vollstangebau Typ 47",
 - 25.1.2005 "Vollstangebau Typ 48",
 - 25.1.2005 "Vollstangebau Typ 49",
 - 25.1.2005 "Vollstangebau Typ 50",
 - 25.1.2005 "Vollstangebau Typ 51",
 - 25.1.2005 "Vollstangebau Typ 52",
 - 25.1.2005 "Vollstangebau Typ 53",
 - 25.1.2005 "Vollstangebau Typ 54",
 - 25.1.2005 "Vollstangebau Typ 55",
 - 25.1.2005 "Vollstangebau Typ 56",
 - 25.1.2005 "Vollstangebau Typ 57",
 - 25.1.2005 "Vollstangebau Typ 58",
 - 25.1.2005 "Vollstangebau Typ 59",
 - 25.1.2005 "Vollstangebau Typ 60",
 - 25.1.2005 "Vollstangebau Typ 61",
 - 25.1.2005 "Vollstangebau Typ 62",
 - 25.1.2005 "Vollstangebau Typ 63",
 - 25.1.2005 "Vollstangebau Typ 64",
 - 25.1.2005 "Vollstangebau Typ 65",
 - 25.1.2005 "Vollstangebau Typ 66",
 - 25.1.2005 "Vollstangebau Typ 67",
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 - 25.1.2005 "Vollstangebau Typ 69",
 - 25.1.2005 "Vollstangebau Typ 70",
 - 25.1.2005 "Vollstangebau Typ 71",
 - 25.1.2005 "Vollstangebau Typ 72",
 - 25.1.2005 "Vollstangebau Typ 73",
 - 25.1.2005 "Vollstangebau Typ 74",
 - 25.1.2005 "Vollstangebau Typ 75",
 - 25.1.2005 "Vollstangebau Typ 76",
 - 25.1.2005 "Vollstangebau Typ 77",
 - 25.1.2005 "Vollstangebau Typ 78",
 - 25.1.2005 "Vollstangebau Typ 79",
 - 25.1.2005 "Vollstangebau Typ 80",
 - 25.1.2005 "Vollstangebau Typ 81",
 - 25.1.2005 "Vollstangebau Typ 82",
 - 25.1.2005 "Vollstangebau Typ 83",
 - 25.1.2005 "Vollstangebau Typ 84",
 - 25.1.2005 "Vollstangebau Typ 85",
 - 25.1.2005 "Vollstangebau Typ 86",
 - 25.1.2005 "Vollstangebau Typ 87",
 - 25.1.2005 "Vollstangebau Typ 88",
 - 25.1.2005 "Vollstangebau Typ 89",
 - 25.1.2005 "Vollstangebau Typ 90",
 - 25.1.2005 "Vollstangebau Typ 91",
 - 25.1.2005 "Vollstangebau Typ 92",
 - 25.1.2005 "Vollstangebau Typ 93",
 - 25.1.2005 "Vollstangebau Typ 94",
 - 25.1.2005 "Vollstangebau Typ 95",
 - 25.1.2005 "Vollstangebau Typ 96",
 - 25.1.2005 "Vollstangebau Typ 97",
 - 25.1.2005 "Vollstangebau Typ 98",
 - 25.1.2005 "Vollstangebau Typ 99",
 - 25.1.2005 "Vollstangebau Typ 100",
 - 25.1.2005 "Vollstangebau Typ 101",
 - 25.1.2005 "Vollstangebau Typ 102",
 - 25.1.2005 "Vollstangebau Typ 103",
 - 25.1.2005 "Vollstangebau Typ 104",
 - 25.1.2005 "Vollstangebau Typ 105",
 - 25.1.2005 "Vollstangebau Typ 106",
 - 25.1.2005 "Vollstangebau Typ 107",
 - 25.1.2005 "Vollstangebau Typ 108",
 - 25.1.2005 "Vollstangebau Typ 109",
 - 25.1.2005 "Vollstangebau Typ 110",
 - 25.1.2005 "Vollstangebau Typ 111",
 - 25.1.2005 "Vollstangebau Typ 112",
 - 25.1.2005 "Vollstangebau Typ 113",
 - 25.1.2005 "Vollstangebau Typ 114",
 - 25.1.2005 "Vollstangebau Typ 115",
 - 25.1.2005 "Vollstangebau Typ 116",
 - 25.1.2005 "Vollstangebau Typ 117",
 - 25.1.2005



Some cover sheets of all the current approvals held by Furrer+Frei® overhead conductor rail systems:

Germany

Zulassung Eisenbahn-Bundesamt für Stromschiene Bauart Furrer+Frei — **[1]**

Switzerland

Bundesamt für Verkehr, Typenzulassung für das Stromschienen-Fahrleitungssystem S-FL 250 — **[2]**

UK

Network Rail – Certificate of Acceptance for Conductor Beam Assembly — **[3]**



Europe

EBC Eisenbahn Cert_EC Design Examination TSI Certificate — **[4]**

EC Declaration of Conformity for Interoperability Components

Overhead line DSS, overhead conductor rail — **[5]**

DBAG

Technische Freigabe, Deckenstromschiene Typ Furrer+Frei — **[6]**

Austria

bmvi Oberste Eisenbahnbaubehörde erteilt der ÖBB Zulassung der DSS für 250 km/h uneingeschränkt — **[7]**

France

RFF_SNCF_Rapport d'évaluation du dossier technique Catenaire Rigide Furrer+Frei — **[8]**

South Korea

Korean National Railroad Product acceptance for Overhead conductor bar — **[9]**

Hongkong

Kowloon-Canton Railway Corp. — **[10]**

Furrer+Frey® Overhead Conductor Rail Systems OCRS

General technical data

Rated voltage	V DC	600 - 3000
	kV AC	11 - 25
Short circuit current	kA	40 during 60 ms
Continuous current across all components*	A	3500
Ambient temperature	°C	> - 30
Max. conductor temperature	°C	90
Distance between support structures	m	12
Max. train speed	km/h	250
Conductor rail cross-section	mm ²	2100
Conductor rail material		Aluminium alloy
Contact wire used	EN 50149	100 - 161 mm ²
Max. length between expansion elements	m	800
Weight of the conductor rail without contact wire	kg/m	approx. 6.1

*incl. across expansion elements



Your partner for the design, delivery and construction of overhead conductor rail systems.

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