

# TracFeed<sup>®</sup> CATMOS<sup>®</sup>

The Validated Simulation Program



# TracFeed® CATMOS®

The validated simulation program for dynamic interaction between an overhead contact line and pantograph

**A service from Rail Power Systems for your overhead contact line installation**

## **The European Standard EN 50318:2018**

The TracFeed® CATMOS® simulation program has been validated based on the following standard (English title):

EN 50318, Railway applications – Current collection systems – Validation of simulation of the dynamic interaction between pantograph and overhead contact line.

This draft European Standard has been prepared under a mandate given to CENELEC by the European Commission and supports the Interoperability Directive 2008/57/EC. In this context, we explicitly refer to the Technical Specification for Interoperability relating to the energy subsystem (TSI Energy) of rail systems in the European Union. The Technical Specification for Interoperability relating to the energy subsystem was published in the Official Journal of the European Union L 356/179 (2014-12-12).

For the awarding of the EC design examination certificate for interoperable constituents of overhead contact line pursuant to TSI Energy according to module CH or CH1, there must be proof of observance of the criteria for the dynamic interaction between overhead contact line and pantograph (TSI Energy, chapter 6.1.4.1). As a result, a simulation program is required which is validated pursuant to EN 50318:2018.

## **Inspection Body TSI**

Rail Power System GmbH acts as a Type B inspection body according to EN ISO/IEC 17020. This body works as an external body for the German Notified Body Eisenbahn-CERT and is certified by the same organisation. It performs its inspections according to EU directives 2016/797/EU and 2023/1694/EU, whose technical specifications for interoperability applies, among other things, to the interaction between overhead contact lines and pantographs.

## **Performance features**

The optimisation and development of the running characteristics of overhead contact line systems using empirical measurements is very complex, time consuming and limits the number of variations. The results of such studies are also technically and economically unreliable due to the large number of environmental variables (e.g. wind and rain) and the inability to reproduce the effects of these variables.

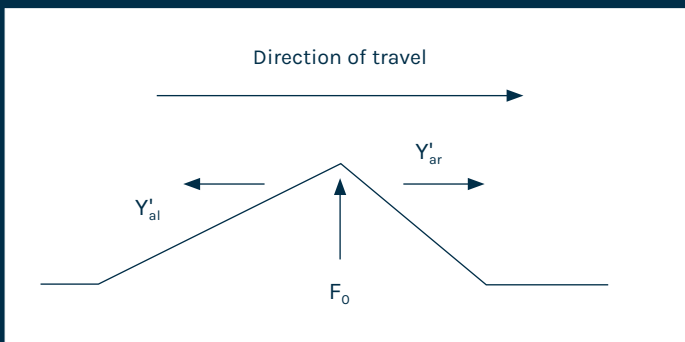
With the TracFeed® CATMOS® simulation program, a large number of variations can be studied and optimised without excessive time and cost expenditure. TracFeed® CATMOS® also allows very complex overhead contact line system designs to be studied for up to eight pantographs per train. The key performance features are as follows:

- Simulation of up to ten tension lengths with different tension forces for the catenary and contact wire
- Cross-catenary spans with cross-over rod and transverse stay cables
- Catenaries with stitch wires at supporting points and additional auxiliary catenary wire
- Eight different pantographs per train
- Pantograph models with up to eight degrees of freedom

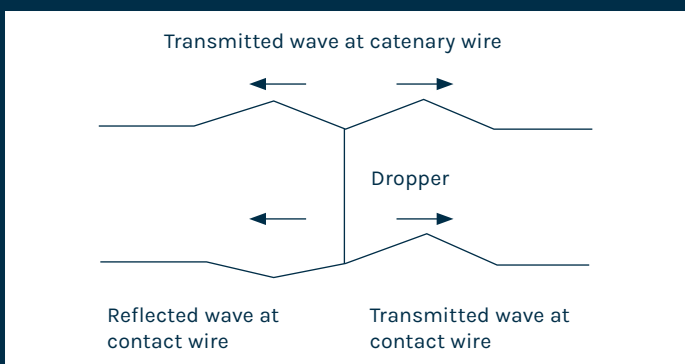
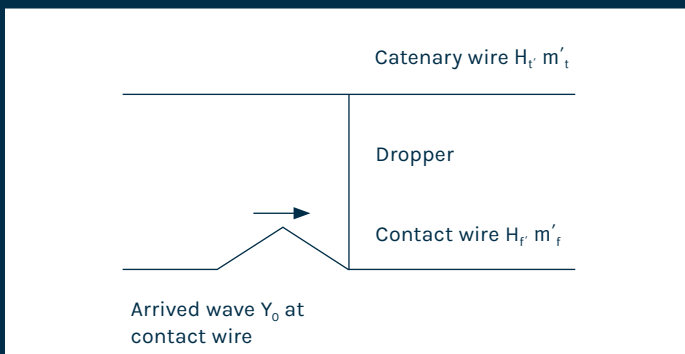
# Mathematical base

For the simulation of current collection of the overhead system it is necessary to create a mathematical model for the overhead contact line system and the pantographs.

As a result of the upward force of the pantograph, waves are created in the overhead contact line system. The d'Alembert method is used to determine wave travel.



By using this method, excellent simulation results are obtained, in which non-linear characteristics of the catenary, such as buckling of the droppers, is taken into account.



To determine the characteristics of the pantographs, 10 different simulation models are available. These simulation models are made up of discrete masses, springs and dampers. The masses are connected to each other by means of the springs and dampers. Pantographs with up to eight degrees of freedom can be simulated, with the rotational motion of the contact strip caused by the stagger of the contact wire taken into account for these models.

## Analysis options

Using TracFeed® CATMOS® simulation techniques, quite extensive evaluation studies can be carried out. Evaluation options include:

- Statistical evaluation of the contact force
- Graphic display of the assembly state, the contact force and the movements of the pantograph
- Graphic display of the movement of selected points on the catenary
- Location and duration of arcing for each contact strip of a pantograph

## Application of the simulation program

TracFeed® CATMOS® simulation techniques can be used for the following applications:

- Optimisation/simulation of existing overhead contact line systems
- Development of new overhead contact line systems
- Development/optimisation of special design and modifications to fixed installations
- Study/determination of assembly tolerances
- Increased speed on existing systems by using new pantographs
- Operation with multiple consecutive pantographs
- Development/optimisation of pantographs

# Credentials



Ankara-Konya, Turkey



RPS installation vehicles for the overhead contact line in the Gotthard Base Tunnel (GBT)



Dynamic acceptance run for the overhead contact line in the GBT at 275 km/h



Installation of the overhead contact line in the Gotthard Base Tunnel (GBT)

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The specifications set out in this document apply to conventional applications. They do not represent performance limits.

This means that divergent specifications may be attained in specific applications. The contractually agreed specifications alone shall apply. We reserve the right to effect technical modifications.

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