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## **STRAY CURRENTS ON DIRECT-CURRENT RAILWAYS IN SLOVENIA**

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**Abstract:** DC stray currents are currents, which do not flow through the designed conductors, but along the path of least resistance. These currents are very harmful to various metallic structures and lead to corrosion in the long term. The most significant source of DC stray currents in Slovenia can be found in the electrified railways, using the direct current system at 3000V. Not all the return current can flow back to the rectifier substation through the rails, but a high percentage of this current is dispersed in the earth, depending on conductive arteries. In some cases, this stray currents even cross a very winding railway line. The paper presents the derivation of the equation for calculating the stray currents on the basis of the telegraphic equation, from which the total conductivity of the railway (rails + road metal) is derived. All given calculations are completely satisfying for the analysis of the above-mentioned problems, and they confirm the fact that rectifier stations in direct current systems of electric traction should be located as close to each other as possible.

**Key words:** DC stray currents, electric traction, rails, rectifier stations, road metal, earthing electrode, locomotives.

### **INTRODUCTION**

DC stray currents in the earth cause damage to metal structures. The possible sources of these currents in the earth are the following installations:

1. DC operated railways, where rails are used as the return conductor,
2. earthed DC installations with the operated circuit, earthed in several points.

Such installations are:

- overhead trolleybus networks with one pole earthed in several points or with one pole more than once connected to the return conductor of the tram network (rails),
- DC networks and DC industrial installations,
- DC telecommunication networks,
- Installations for protection against corrosion.

Installations, buried in the earth which are imperilled by DC stray currents, are:

1. metal pipelines,
2. metal cisterns,
3. metal constructions and concrete reinforcement
4. armoured cables
5. earthings of power and telecommunication installations

Electrified railways, operating in DC system at 3000V, where the total current flows through the return conductor (rail), are at present the main source of DC stray currents in Slovenia.

Return currents amount up to 2400A, depending on the number of consumers (electric locomotives).

### **CALCULATION OF STRAY CURRENTS ON DC RAILWAYS AT 3000V**

In electric traction at 3000V, the traction vehicle receives its power supply from the rectifier substation through the

overhead contact system (contact line).  
The circuit is closed