Schwihag

Track and Switch Technology

Innovation in Rail Fastening Systems Components and Application

Alberto Pérez Ortolá

Urbana, Illinois. June 2016

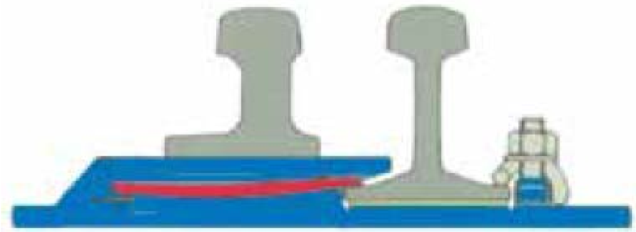
0. Index

1. Introduction

Schwihag AG (Switzerland). HQ

- Engineering&Design, Laboratory
- Production:
    - Turnout components
    - Machining
    - Spring clips for IBSR

60 employees.



1. Introduction

Schwihag Gmbh (Germany). Factory

- Production of Skl tension clamps
- Machining
- Assembly of hollow sleepers
- Plastic injection moulding

80 employees

1. Introduction

Schwihag UK

- Machining of steel components
- Molybdenum coating
- Approx. 30 employees

Joint Venture Schwihag Progress Rail Services (before Amsted RPS)

- Rail Fastening Systems for Heavy Haul
- Over 2 Million fastening systems supplied

0. Index

2.1 General characteristics of Skl type fastening system on a concrete sleeper

- Pre-assembly
- Exchangeability
- Protection against tilting (2nd stiffness)
- Different rail sections. Same sleeper
- Height & Gauge adjustment
- Integrated electrical insulation
- No track maintenance required

2. Skl SL 1

2.2 Evolution of the Skl tension clamp

Tension clamp comparison table:

<table>
<tr><th>Type of Skl</th><th>Weight [kg]</th><th>Peak-to-peak Amplitude [mm]</th><th>Clamping force* [kN]</th><th>Application</th></tr>
<tr><td>Skl 1</td><td>0.471</td><td>1.4</td><td>8.6</td><td rowspan="3">Concrete ties (ballasted track)</td></tr>
<tr><td>Skl 14</td><td>0.492</td><td>2</td><td>9.1</td></tr>
<tr><td>Skl 21</td><td>0.601</td><td>2.5</td><td>10.3</td></tr>
<tr><td>Skl 15</td><td>0.845</td><td>3</td><td>10.9</td><td>Slab track</td></tr>
</table>

*Theoretical clamping force after 10th load application [kN]

2.2 Evolution of the Skl tension clamp

Tension clamp comparison table:

Type of Skl	Weight [kg]	Peak-to-peak Amplitude [mm]	Clamping force* [kN]	Application
Skl 1	0.471	1.4	8.6	Concrete ties (ballasted track)
Skl 14	0.492	2	9.1	
Skl 21	0.601	2.5	10.3	
Skl 15	0.845	3	10.9	Slab track
Skl SL 1	0.631	3.5	12.9	Ballasted track + slab track

*Theoretical clamping force after 10th load application [kN]

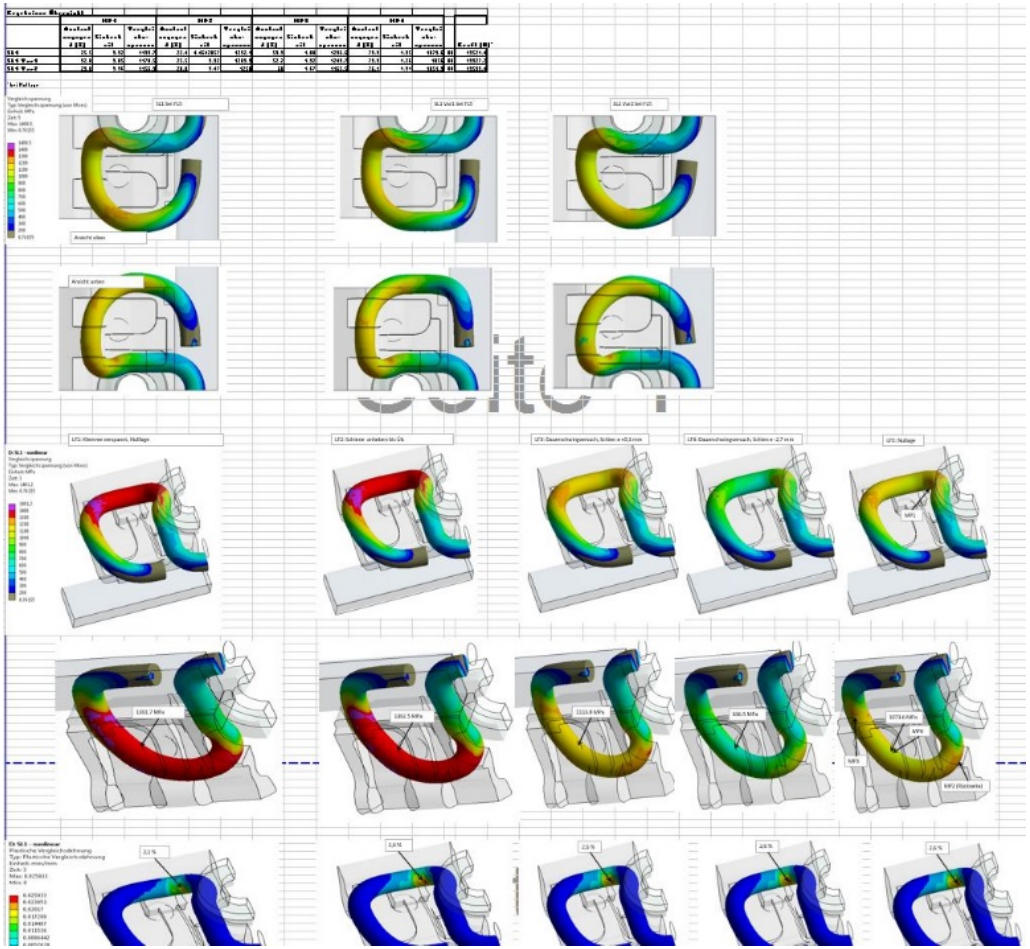
2.3 Design and production of the SL 1

Computer simulation

- FEM
- FEA-based fatigue analysis

Fatigue

- Failure under a repeated load which never reaches a level sufficient to cause failure in one single application
- Can be thought of initiation and growth of a crack



2.3 Design and production of the SL 1

Amount of load cycles necessary to induce failure due to fatigue?

→Load cycles to initiate a crack + Load cycles to propagate that crack

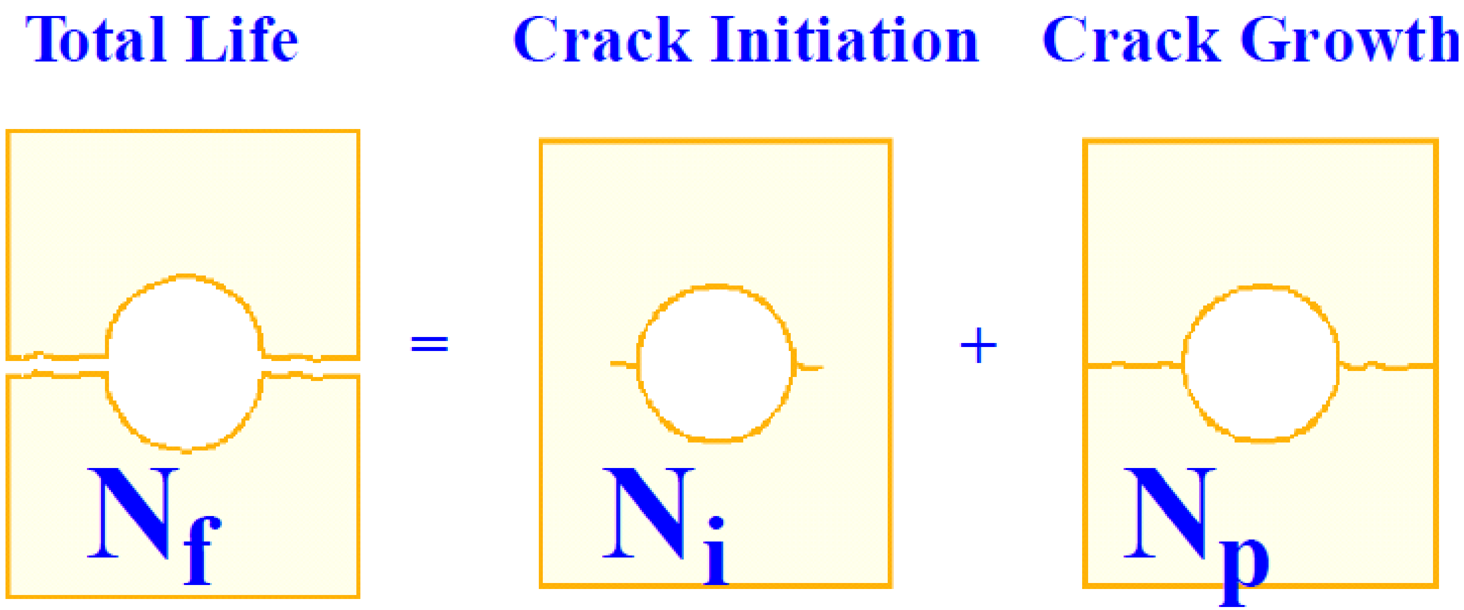


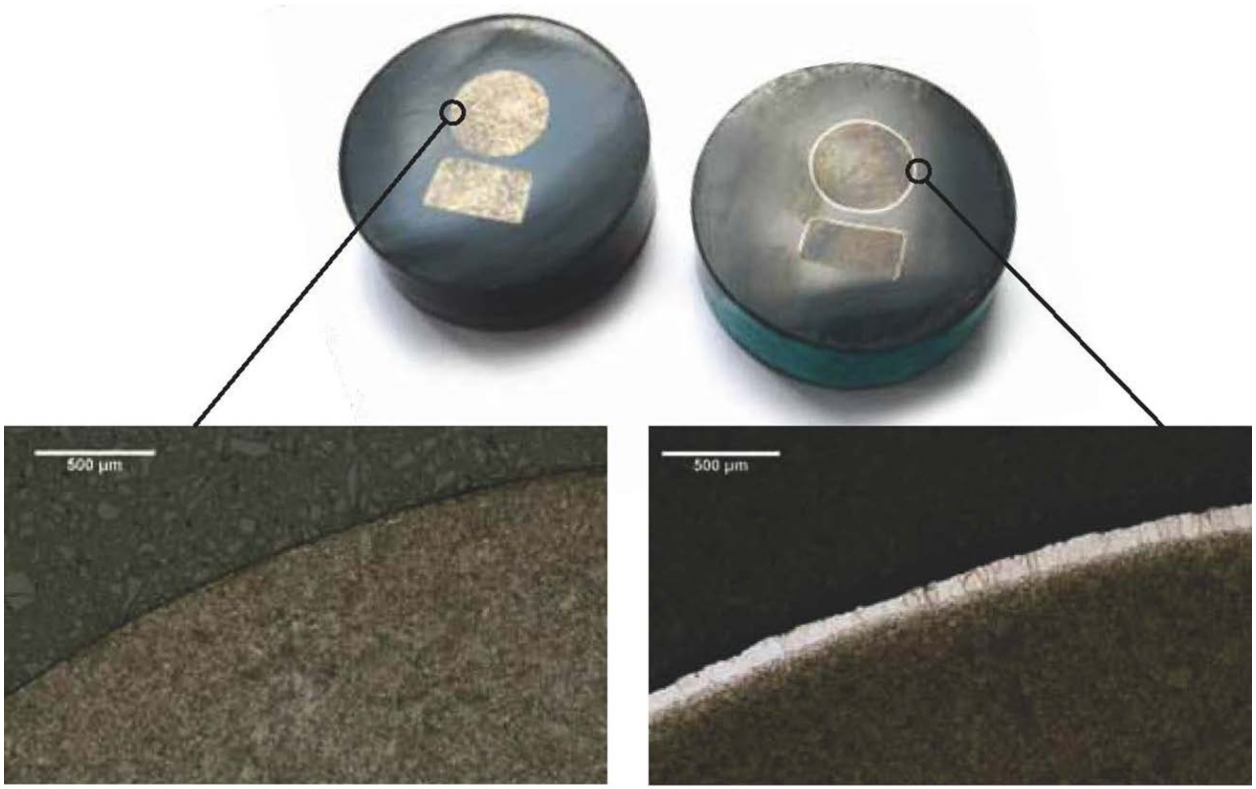
Figure 1. Life Prediction Methods

Source «Finite Element Based Fatigue Analysis». Authors Dr NWM Bishop, MSC Frimley and Alan Caserio

2.3 Design and production of the SL 1

- New heat treatment process. No decarburization

No surface decarburization, free of incipient cracks



All-round surface decarburization with formation of incipient cracks

Nirotec coating for corrosion protection

Photo 3: NiroTec® coating after 480 h

Photo 4: KTL coating after 480h

- Special electro-chemical treatment of the surface
- High resistance against UV-radiation, mechanical impacts, chemical attacks, Temperatures, etc.
- Tested under different environmental conditions (TU Dresden) against other coatings
- Pictures depict clamps after 480h of NSS testing + previous bombardment

➢ Plastic dowel Sdue S3

- Complete new design of the dowel (FEM)
- Tightening Torque:
  - 230-250 Nm (normal)
  - 300 Nm (machine not well calibrated)
  - 900 Nm (Safety Factor of 3 approx.)
- Traditional causes of failure:
  - Failure of the internal thread
  - Breaking of the dowel (into two or more parts)
  - Disconnection from sleeper (failure of external thread)

→ Redesign of internal and external thread
→ Walls of dowel made thicker (more material)
→ Better distribution of stresses in the concrete

- **Plastic dowel Sdue S3**

Behaviour of dowel when failure occurs

Source: Test report of Technical University of Dresden (TUD)

0. Index

- **1**. Introduction
- 2. Skl SL1
  - General characteristics of an Skl tension clamp
  - Evolution of the Skl
  - Design and production of the SL1
- **3. Milestone projects**
  - **Heavy Haul (US)**
  - **High Speed (Spain)**
  - **Bridges (Germany)**

3. Milestone projects

➢ ME 26 Rail fastening system

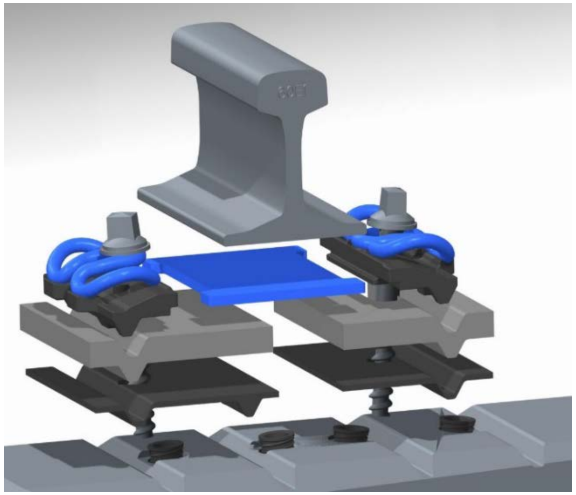
>1 Mio concrete ties

W SL2 900	Value
Stat. Stiffness [kN/mm]	300
Clamping force [kN]	24.5
Creep resistance [kN]	20.02
Electrical insulation [kΩ]	7.1

3. Milestone projects

➢ **High speed slab track (Spain)**

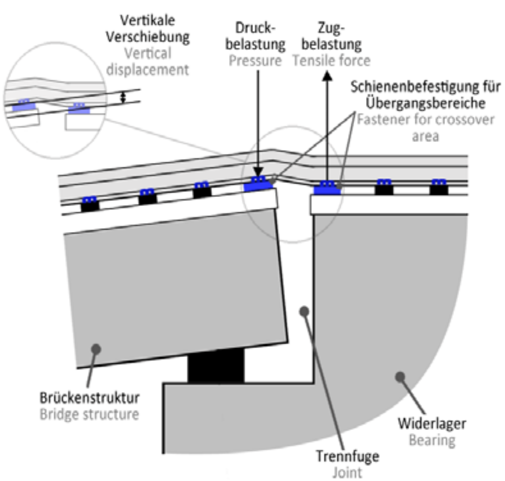
>200.000 fastening systems supplied

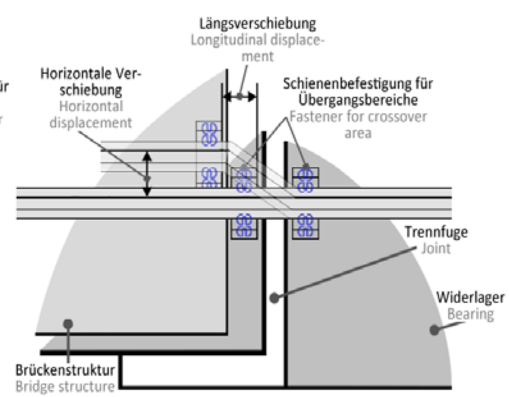


W SL 1T 1000PV	Value
Dyn. Stiffness [kN/mm]	48.2
Clamping force [kN]	19.92
Creep resistance [kN]	16.97
Electrical insulation [kΩ]	32.71

3. Milestone projects

➢ **Special fastening system for bridges (Germany)**





>5000 Fastening systems supplied

BSP FF-B-1	Value
Dyn. Stiffness [kN/mm]	42.2
Clamping force [kN]	26.9
Creep resistance [kN]	8.1
Electrical insulation [kΩ]	11.9

Thank you for your attention!

Schwihag AG - Gleis- und Weichentechnik

Lebernstrasse 23 ■ P.O. Box 152 ■ CH - 8274 Tägerwilen, Switzerland