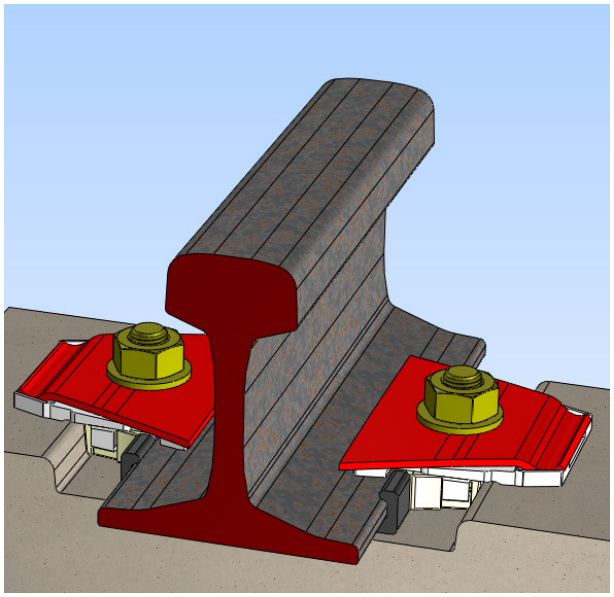
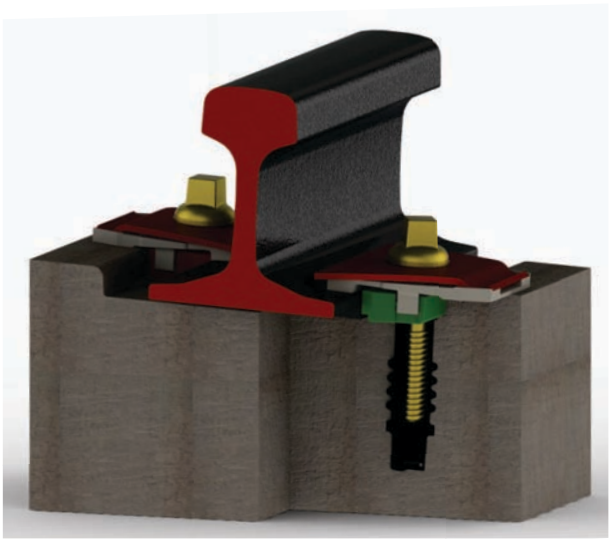
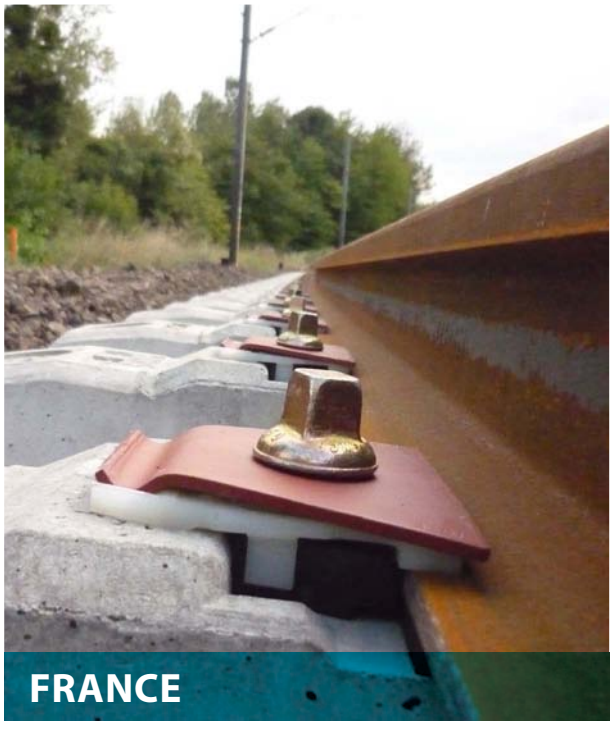
FOR BALLASTED AND SLAB TRACKS PANDROL PRESENTS:

NABLA EVOLUTION FASTENING SYSTEM





INSTALLATIONS



INSTALLATION

The Nabla Evolution Fastening System has been installed in France ("Plan Rail Auvergne") in order to sustain the track in the Massif Central. This contains many lines with tight curves (200m).

The system has also been largely used in tram applications, for ballasted track or slab track with concrete sleeper or plastic baseplate.

FEATURES AND BENEFITS

The Nabla Evolution Fastening System utilises the principal characteristic of the Nabla System that has been proven in installations for several decades. It enables simple installation and maintenance ease and has improved performance in tight radius curves as it maintains the track gauge and therefore increases significantly the life expectancy of the assembly components.

The Nabla Evolution Fastening System offers improved electrical insulation and lateral force absorption. The unique use of glass reinforced material in the lateral insulator also offers increased mechanical strength.

The Nabla Evolution Fastening System can be used in all types of track: concrete sleeper in ballasted track, slab track (tram version), concrete sleepers and plastic baseplate (Nabla Tram baseplate). It is also available for bridges with reduced or zero toe load.

- **Tightening by contact, for the consistency of the application force on the rail foot**
- **Lateral adjustment by 1.25mm increment**
- **Increase efficiency in tight curve in particular to maintain the rail gauge and limit rail movement**

TYPICAL PERFORMANCE RANGE

Clamping Force	20 kN
Creep Resistance EN 13146-1:2012	N/A
Electrical Resistance EN 13146-5:2012	>15 kΩ

TYPE OF SYSTEM

☐ Indirect ☑ Direct

SUITABLE FOR APPLICATION

☑ Tram ☑ LRT ☑ Metro
☑ Mixed ML ☑ HS ☐ HH

ADJUSTMENT

	Typical	Maximum
Lateral	+/- 7.5 mm	+/- 10 mm
Vertical	+/- 1 mm	-2/+3 mm

VIBRATION ISOLATION

Static Stiffness:

Tram	Except Tram
>40 mN/m	>60 mN/m

***** Assembly Stiffness EN 13146-9:2011

RECOMMENDATIONS FOR BALLASTED TRACK

NABLA EVOLUTION		OPERATING CONDITIONS					GENERAL SUITABILITY				
CEN / CAT	Typical Operation	Typical Rad	Min Rad	Typical Axle	Max Axle	Max Speed	Rail Pad Resilience				
		(m)	(m)	(kn)	(kn)	(kph)	Very Stiff	Stiff	Med	Soft	Very Soft
A	Industrial / Light Urban / Tram	80	40	100	130	100		✓	✓	✓	✓
B	Industrial / Light Urban / Metro	100	80	160	180	140		✓	✓		
C	Main Line Operation	400	150	225	260	250		✓	✓		
D	ML Large Curved (inc. High Speed)	800	400	180	260	250			✓	✓	✓
E	Passenger & Heavy Freight	150	150	300	350	200	✓	✓			
> E	Very Heavy Haul Freight	150	150	350	400	120					

For guidance only. All applications differ. Please consult Pandrol for recommendations specific to your project.