9.1 Track technology

The track forms system from which four main components assume the necessary function for the final transport target: the rail, the sleepers, the ballast and the platform.

The rail is a steel bar in three parts; the rail trace is the upper face of the head, who permits the wheel rolling.

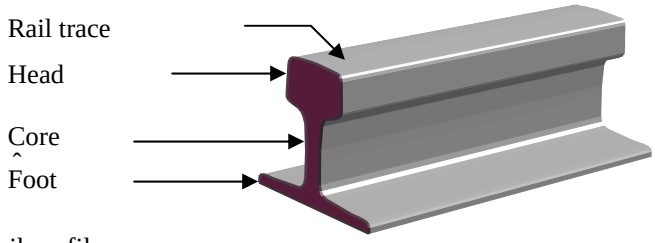

Fig. 9.2 Rail profil.

The sleepers not only guarantee the constant rail spacing, but also transmit at ballast the length rails constraints and their transversal, longitudinal or vertical forces. It exist a great number of rail fixing systems on the sleepers; the recent type fixings do not allow the longitudinal rail gliding.

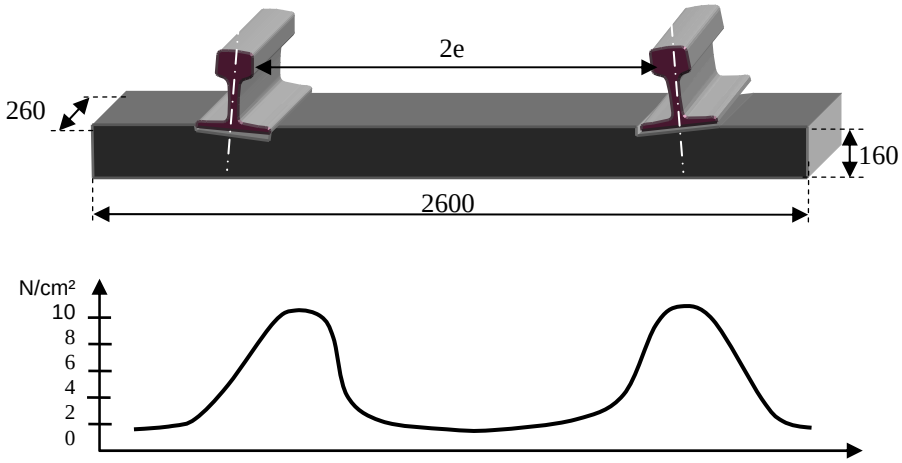

Fig. 9.6 Constraint distribution on a sleeper.

The platform fixes the trace and assures the flow of precipitations and the ballast hold the sleepers in all directions.

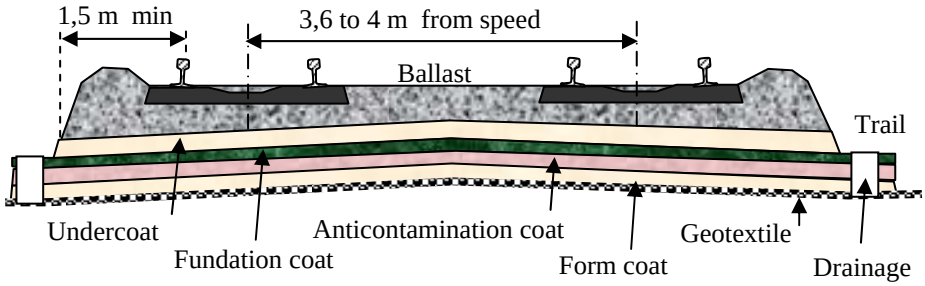

Fig. 9.10 Crossprofil of the track.

In curve, the track laying provides a superelevation in sort the composition of forces would be – if possible – perpendicular of the track plan by a circulation at the expected speed on this line. The superelevation is limited by the risk of switching inside the curve at the start

of a train stopped in the curve. By insufficient superelevation, the force moment on the body risk to induce the switching outside the curve. The body pendulation allows reaching a force perpendicular to the floor for passengers, accepting a light insufficient superelevation for vehicle on le rail. This allows a higher speed without passengers comfort reduction, without approaching derailment limits described in this section and the next one.

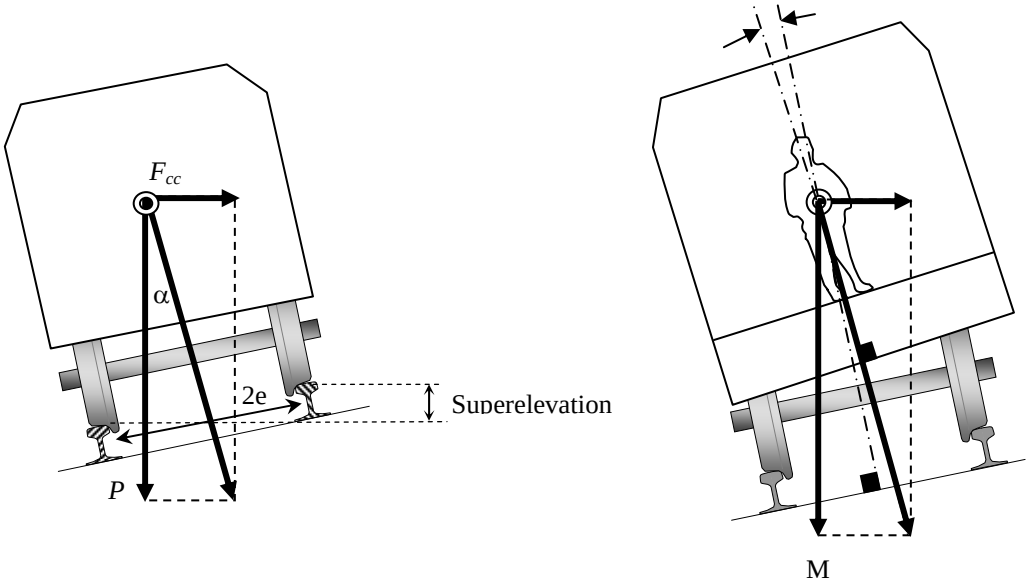

Fig. 9.16 Forces in curve and superelevation.

9.2 Circulations on rails

The dicon of the plan of wheel rolling band to the plan of rail trace guarantee the centering of the axle on the track in sort that the flange touch almost never the internal face of rail head. It assumes the function of a « automatic differential» which permit, in curve, the rolling of each wheel on a different diameter, corresponding to distinct way lengths.

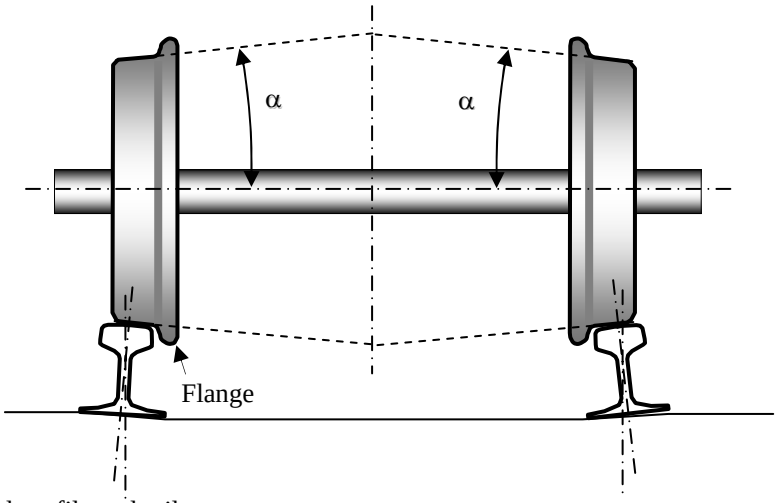

Fig. 9.24 Wheel profile and rails pose.

The speed on curve has to be limited to avoid that the force component induces the flange rise on the rail trace, ending on a derailment. In practice, the centrifugal force Y must not exceed 150 % of the weight Q.

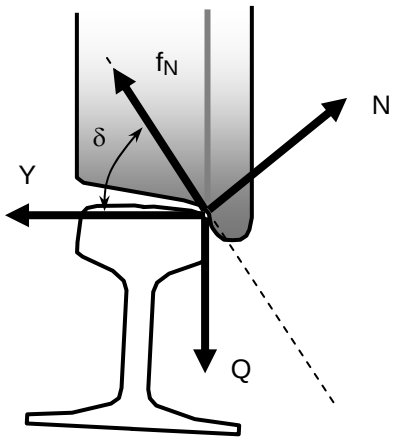

Fig. 9.30 Efforts at derailment**.**

In general, the axles are not aligned with the track curvature direction. Grouped on bogies, the axles form an angle with the radial direction, increasing the risk of flange rise on the head.

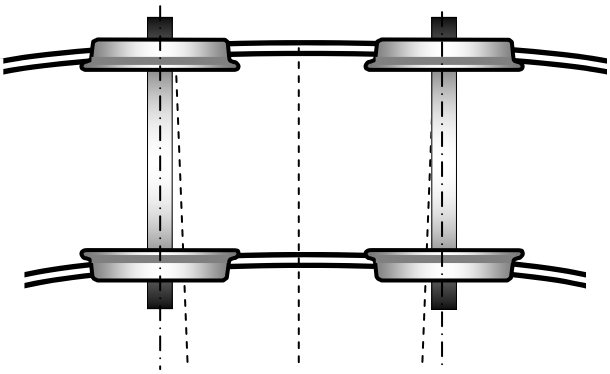

Fig. 9.31 Bogie in curve**.**

The Prud'homme limit has to be mention, exceeded if the centrifugal force Y cannot be contained by the sleeper pressure on the ballast.

The usury of wheel profiles compromises the good running of vehicles, on alignment and on curve and needs a regular reprofiling.

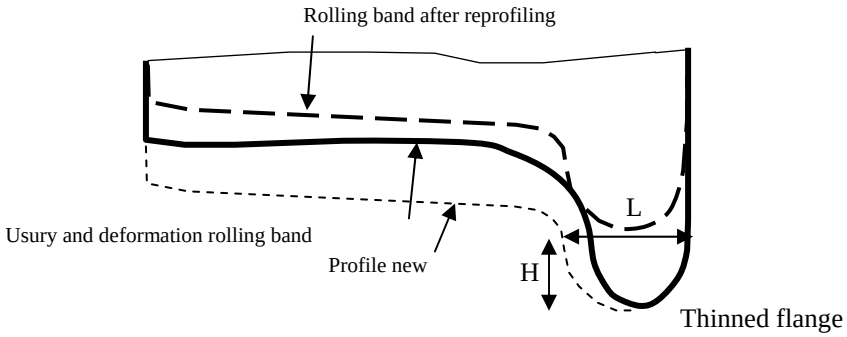

Figure 9.33 – Usury of wheel.

9.3 Switches

The principle of flange wheels, rolling on a pair of steel rails, induces the necessity of complex devices for route changes. The essential pieces are mobile blades, which guide the flanges, and the gaps necessary for the way, and are a missing for the other way. Passing the gap, the wheel « falls» and hits the next rail or the hearth's point.

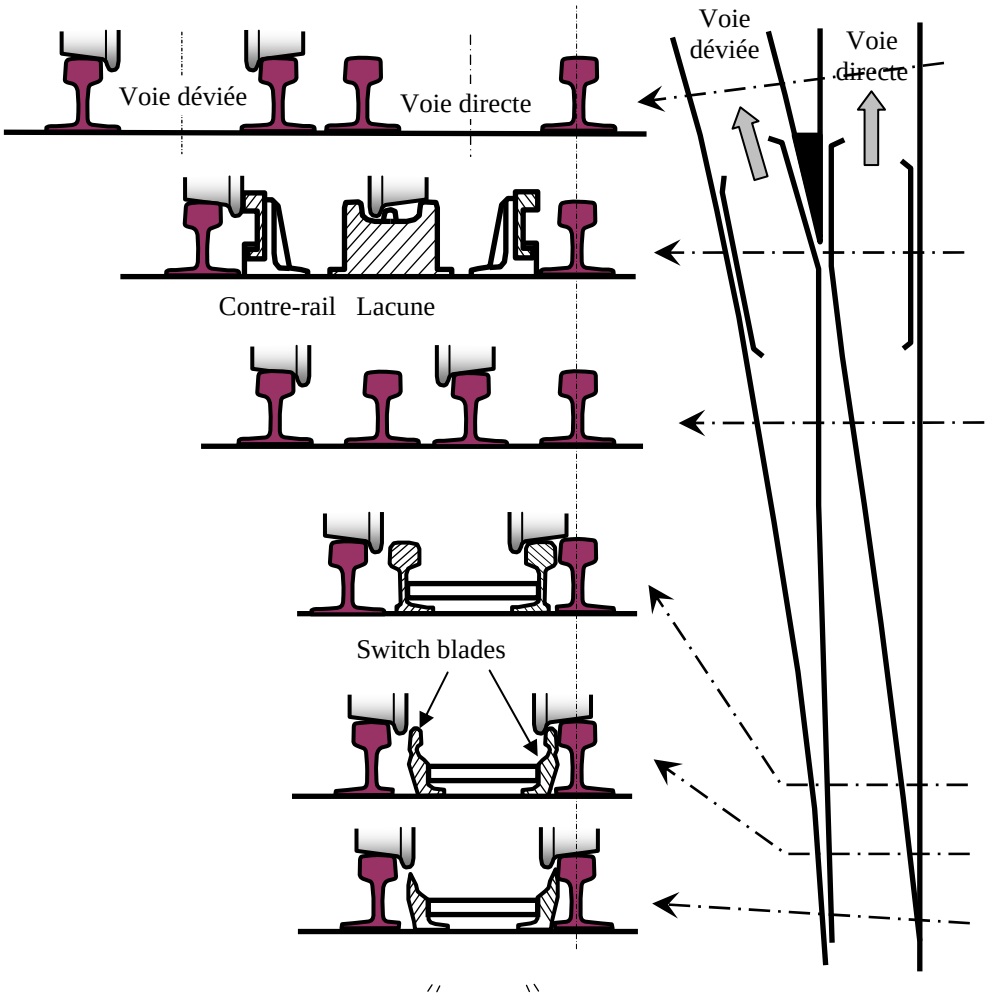

Fig. 9.37 Kinematics at switch passing.

9.4 Special tracks

As mentioned at section 5.9, the traction can be transmitted through a cogwheel on a rack. With one exception (Santos-Jundiai) the rack is installed high on track center to permit the passing of cogwheel above the rail trace at a switch.

9.5 Contactless tracks

They are very complicated systems of magnetic guiding and sustentation for « light», vehicles, incompatible with classical railway.

9.6 Gauge

The fixed obstacles along the track must let a free place greater than vehicle dimension, including a place for imprecisions of track installation and lateral movements in curves or due at vehicle suspensions.

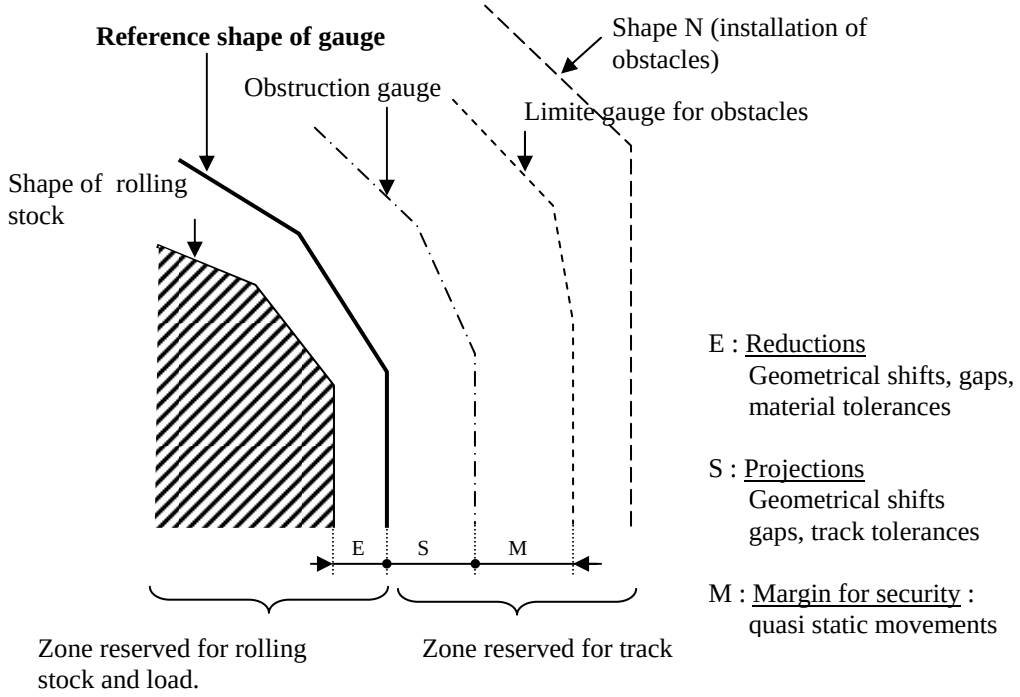

Fig. 9. 52 Marges de sécurité des gabarits

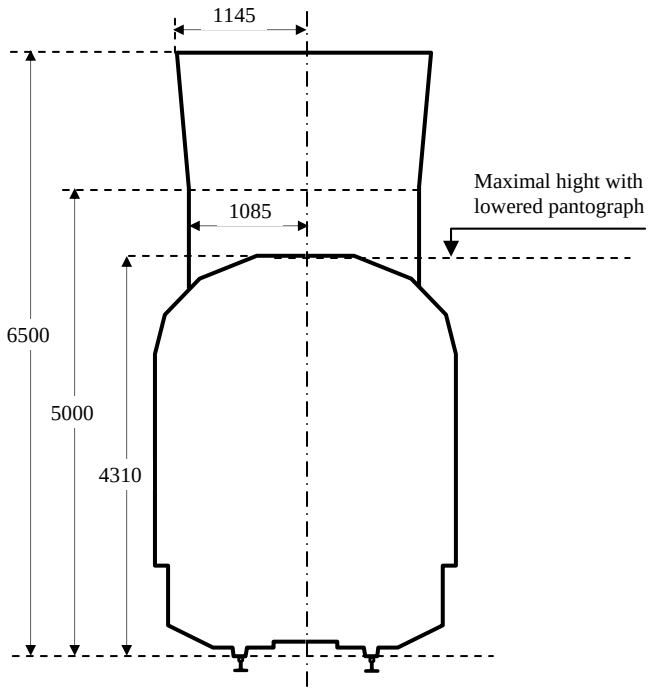

Fig. 9. 54 Example of gauge for electric vehicle (aerial line)