Safety recommendation no. 177

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Safety deficit	At around 09:50 on 6 March 2021, a driving pinion on a seven-car Adler rack-and-adhesion multiple unit of the Zentralbahn railway company broke on the line between Brünig-Hasliberg and Giswil. On railways with rack-and-adhesion systems, disengagement when entering or exiting the rack rail system cannot be ruled out. The bar used by Zentralbahn is capable of handling disengagement when entering the rack rail system, as it was designed for this purpose (Suspension, Figure 41). On the other hand, with the bar design used (which limits vertical travel of the bar close to the bolt), unsprung head impacts can occur when exiting the rack rail system (Appendix 7, Figures 55–58). These generate significant dynamic forces due to the very high accelerations, particularly at an exit speed of 30km/h. The distance between the driving pinion and brake pinion on Adler and Fink multiple units is smaller than the length of the bar. This means that there are two pinions on the bar at the same time, which the normal codes of practice advise against (D RTRs 29700, No 6.2.2.1). The simultaneous passage of several pinions across the bar can interfere with meshing in the event of a braking manoeuvre or sluggish brake pinion.
Safety recommendation	The STSB recommends that the Federal Office of Transport (FOT) review and, if necessary, adapt the concept for the bars Zentralbahn currently uses so that: • … unsprung head-to-head strikes cannot occur when exiting the rack rail system; • … there are never two pinions on a bar at the same time.
Addressees	Bundesamt für Verkehr
Stage of the implementation	Not implemented. The FOT states that the design of the bar has already been optimised. The wear issue is not considered the primary cause of the pinion breakage. Adjusting the running gear of the affected fleets was deemed disproportionate because the manufacturer and the transport company were able to demonstrate through the measures taken that the cause of the breakage could be addressed by other means. Although the wording of the recommendation focuses on the infrastructure, it nonetheless contradicts the principle, outlined in IP-RailO Ad Art. 47, IP 47.1 (first line), that vehicles must be adjusted to the superstructure. The existing traction transition constructions have proven themselves over many years. The problem addressed in the second bullet point is caused by the incorrect design of the bogies, meaning a solution should be found on the vehicle itself. Due to the inherent complexity and the experience-based nature of pinion technology development, it must

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	be assumed that adjusting the bars (i.e. shortening the track entry phase) would cause new problems.
Investigation report concerning the safety recommendation	Schlussbericht Vorbericht

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