



## Safety recommendation no. 178

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<b>Number of the final report</b>	2021030602
<b>Safety deficit</b>	<p>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.</p> <p>On railways with rack-and-adhesion systems, disengagement when entering or exiting the rack rail system cannot be ruled out. The driving pinions and the tangential springs of the Adler and Fink multiple units are dimensioned for optimum meshing conditions, taking into account their current dimensions and safety margins. In the event of a disengagement on the bar, high dynamic forces are reached for which the current design of the adjustable driving pinions on the Adler and Fink multiple units was not intended or calculated. D RTRs 29700, Rack Railway Systems Engineering, stipulates the following regarding the dimensioning of a driving pinion: The tooth thickness or the tooth root strength is based on the maximum tooth load and the operational load as well as the relevant normal codes of practice and the regulations of the Railways Ordinance. The driving pinions are safety-critical components and one of the most important elements of a rack railway. A safety factor for the dimensioning of the driving pinion is not defined in the IP-RailO.</p>
<b>Safety recommendation</b>	The STSB recommends that the Federal Office of Transport (FOT) define a safety factor for the dimensioning of driving pinions in the implementing provisions to the Railways Ordinance (IP-RailO).
<b>Addressees</b>	Bundesamt für Verkehr
<b>Stage of the implementation</b>	Partially implemented. The FOT confirms that the manufacturer was able to prove using FEM calculations that the pinion is appropriately dimensioned. Adjusting the pinions in the affected fleets would therefore be disproportionate. Future authorisation requests will continue to require proof using FEM calculations. There are no plans to specify a safety factor in the IP-RailO, as this would impose unnecessary restrictions on the dimensioning process.
<b>Investigation report concerning the safety recommendation</b>	<a href="#">Schlussbericht</a> <a href="#">Vorbericht</a>