Schweizerische Eidgenossenschaft
Confédération suisse
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Safety recommendation no. 140

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Safety deficit	On 22 March 2017 at 13:57 two mid-train carriages of a Eurocity train derailed when departing from Lucerne station, so that when the train came to rest one of the carriages was leaning at an angle against an overhead line support. Seven train passengers sustained minor injuries. There was considerable damage to the infrastructure and the carriages. Lucerne station had to be closed to all normal-gauge rail traffic for four days for the infrastructure repairs. The derailment of a Eurocity train on 22 March 2017 at a set of points at Lucerne was due to the wheel flange mounting the top surface of the switch rail. The interaction of different factors resulted in the wheel flange tip running on the top edge of the switch rail at a critical area: The wear shape of the wheel flange resulted in the wheel flange tip moving closer to the switch rail tip. Since the gap at the switch rail was greater than the known values, the switch rail tip was also near to the critical area at the wheel flange tip. The absence of a lubricant film between the wheel flange face and the rail flank led to an increase of friction coefficient, and together with an increased lateral force caused by the fault at the transverse springs of the first bogie to derail, an increased wheel lift occurred while the bogie was travelling. All these factors contributed to the wheel flange tip becoming positioned in such a way that the wheel could rise up on to the top of the switch rail. In addition, the wheel flange tip was somewhat flatter due to rolling, which made rising up on to the switch rail without any counterforce easier. Measurements and various simulations showed that the friction between the wheel flange face and rail flank can reach values of up to 0.6. This results in significant lifting of the wheel when travelling through a curve, which in turn can – and did – lead to a critical condition for derailment in track geometries which impose high dynamic stresses, as exist in some tracks across points in Switzerland. The practice of lubricating the rail flanks via the wheel flange lubrication of traction units or power cars does not ensure lubrication in critical track geometries. The technical specifications for interoperability (TSI) treats the high-stress track geometries in the Swiss rail network as of secondary importance. Trains are therefore increasingly less able to make an adequate contribution to lubricating the rail flank. To date it is assumed that trains must also be operated as derailment-proof under dry conditions. A friction coefficient of 0.4 is generally assumed. Various investigations of derailments in Switzerland and other countries have shown, however, that under dry conditions without lubrication of the rail flank or wheel flange this coefficient can be exceeded until a derailment-critical situation arises.

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	The Federal Office of Transport (FOT) should examine measures and specifications to ensure that lubrication of the rail flank is ensured at all times in areas with high dynamic stress track geometries.
Addressees	Bundesamt für Verkehr
Stage of the implementation	It is technically and practically impossible to guarantee lubrication of the rail flank on the infrastructure at all times (i.e. for every wheel on all axles on all vehicles in every operating condition and in all weather conditions). The FOT does not believe that Safety Recommendation No 140 meets the purpose (it does not reduce the risk of a wheel lifting at the switch tip), nor that it is feasible. The measures resulting from Safety Recommendation No 139 ensure that the wheel lifting at the switch tip (the main cause of derailment resulting from infrastructure) can be ruled out with a high degree of probability, irrespective of the switch geometry. Additional lubrication measures on the infrastructure are not necessary.
Investigation report concerning the safety recommendation	Vorbericht Médias Medien Schlussbericht Media

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