



Vehicle Restraint Systems on German Rural Roads: Current Approaches and Established Solutions

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17.09.2026 | Ilja Jungfeld | BAST

Introduction

Some values....

At over **13,000 km**, Germany has the 4th-longest **motorway** network (= Автомагистрала (А)) in the world (after China, the USA and Spain).

The **extra-urban road network** (excluding local roads) covers around **175,000 km**. This includes approximately **39,000 km** of **federal roads** ($\approx$ I. клас) .

Alongside federal motorways and federal roads, **state and district roads** ($\approx$ II. & III. клас) , with a total length of approximately **91,000 km**, play an important role in connecting different areas.

In this context: rural roads = all roads outside towns and villages that are not motorways => more than 100,000 km

Introduction

typical situations on German rural roads

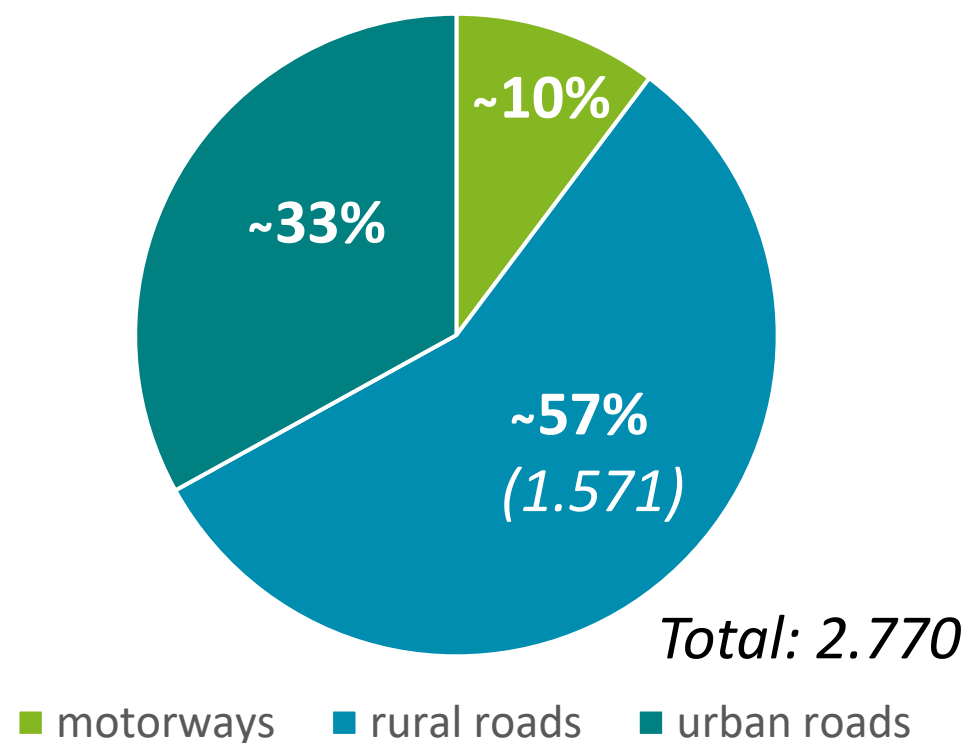


(source: BAST)

Introduction

Potential to improve road safety: why is the focus on rural roads?

Road traffic fatalities in Germany in 2024



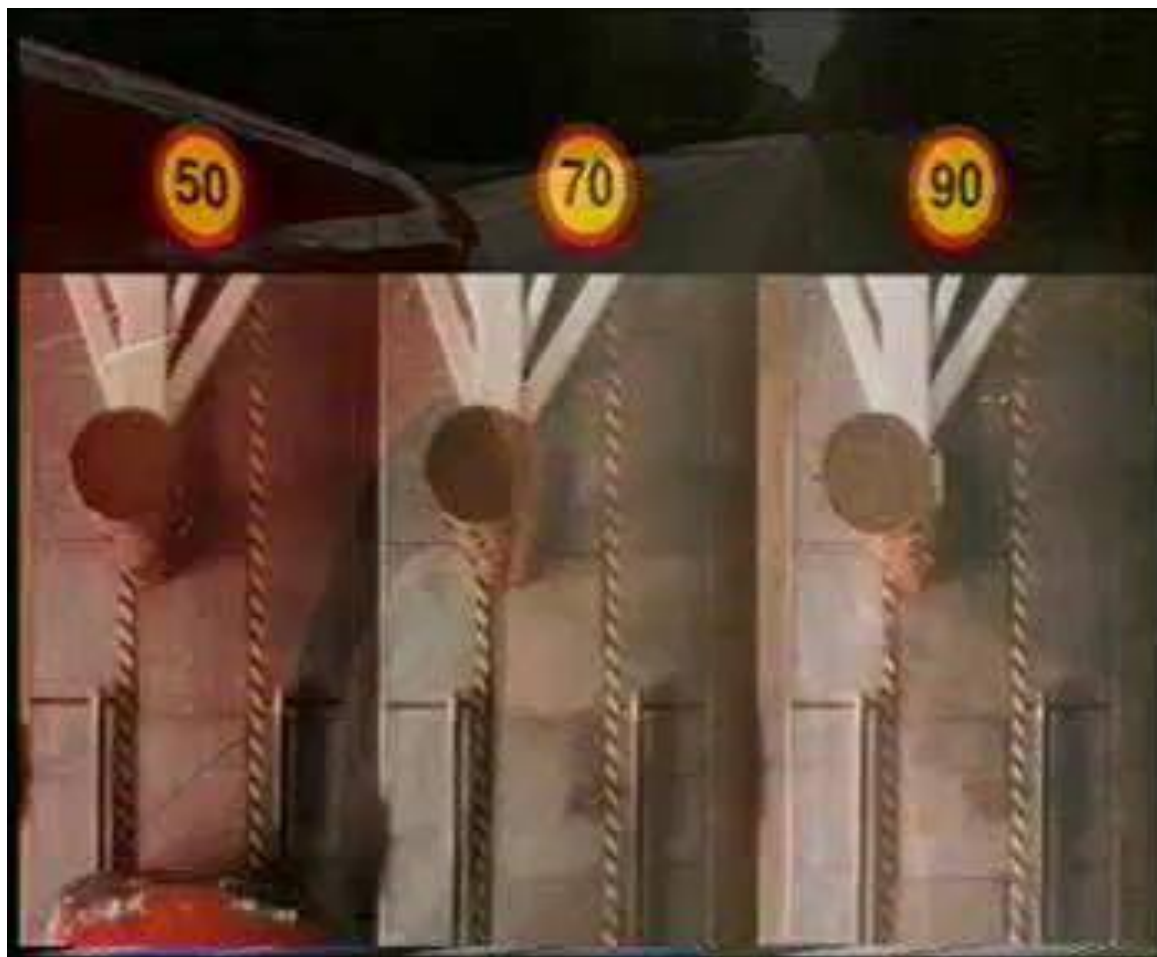
Accidents on rural roads tend to be particularly serious:
24 % of killed people in accidents on country roads died in collisions between a car and a tree (371 in 2024)



(source: BASt report “Unfallgeschehen auf Landstraßen 2024”)

Challenge: Collisions with trees and other objects

Consequences of a head-on collision with a pole-like obstacle



maximum speed limit
on German rural roads:



(source: Swedish National Road and Transport
Research Institute (VTI))

Challenge: Collisions with trees and other objects

Special solutions for the protection against collisions with trees and other objects



← **Guideline**
Examples →

Made by BAST & German NRAs
created 2017 / modified 2020



Challenge: Collisions with trees and other objects

Guidelines and Examples on protection against vehicles colliding with tree and other objects – *What's that? What's in?*

- Guidance on implementing safe and appropriate solutions
 - To be used once a decision has been made to install a protection
 - Relevant aspects when selecting and implementing a protection (with examples)
 - Not direct solutions, but examples to assist with the decision-making and selection processes
- Final decision still to be taken by the road authority

Examples for protection against collisions with trees

practical example 1: Description *(part 1)*

- Road width: approx. 7.0 m
- Maximum speed limit: 100 km/h
- Tree-lined avenue, trees with a trunk circumference of > 25 cm
- Distance between trees: approx. 30 m – 40 m



Examples for protection against collisions with trees

practical example 1: Description *(part 2)*

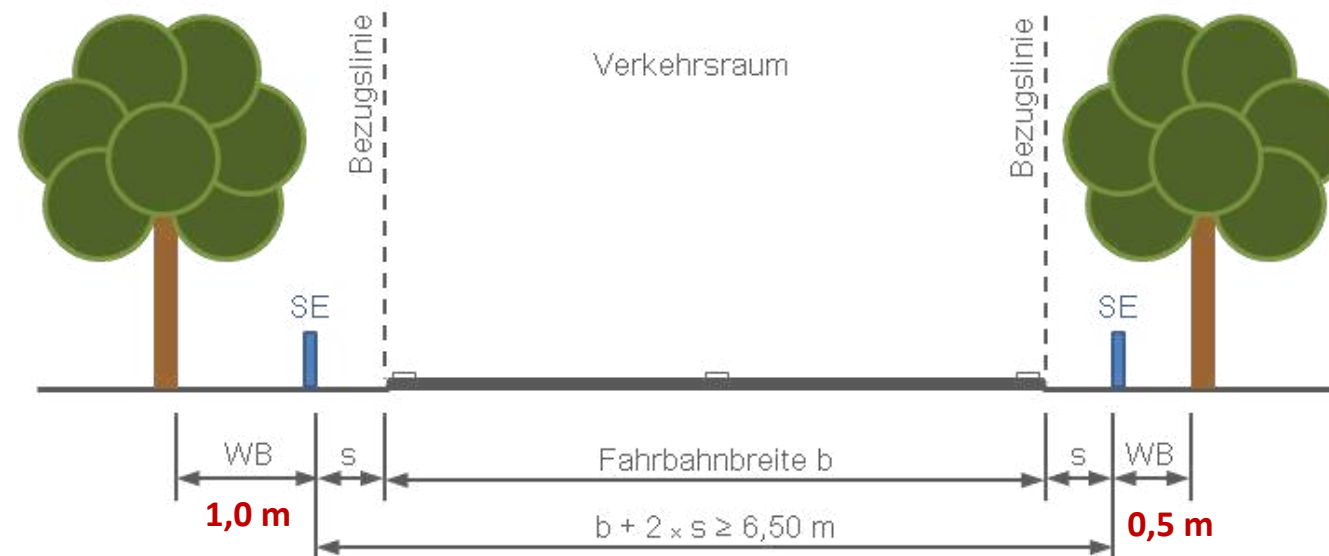
- Distance between trees and roadside barriers:
1.50 m on the left / 1.00 m on the right
- Partial roadside safety barriers in place
- Small wall as a protection barrier



Examples for protection against collisions with trees

practical example 1: thoughts on a potential solution based on the guidelines

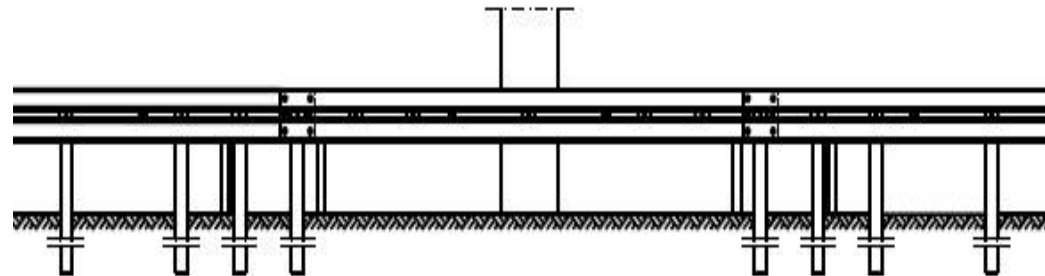
- Protection is needed on both sides (in Germany: containment level N2)
- What is the usable working width? (*= max. distance, needed by a safety barrier during a car impact*)



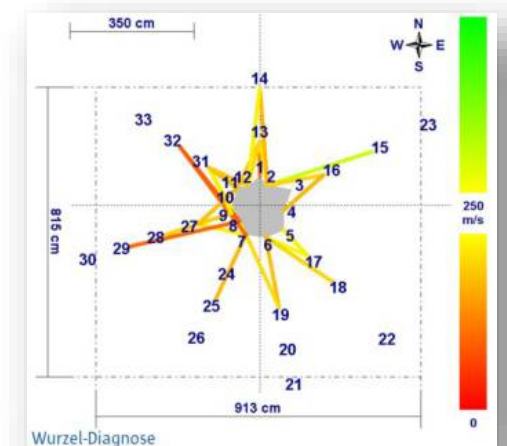
Examples for protection against collisions with trees

practical example 1: thoughts on a potential solution based on the guidelines

- Old trees => protection of tree roots needed
- choose a specific safety barrier (usable in front of trees) or with a wide post spacing



- Support from the nature conservation authority or other experts, e.g. with specific root-detection equipment



Examples for protection against collisions with trees

practical example 1: thoughts on a potential solution based on the guidelines

- Take existing objects and systems into account
- How to take field access routes into account?
- What is the best way to take the existing safety barrier into account?
- What is the best way to take this additional obstacle (small wall) into account?



Examples for protection against collisions with trees

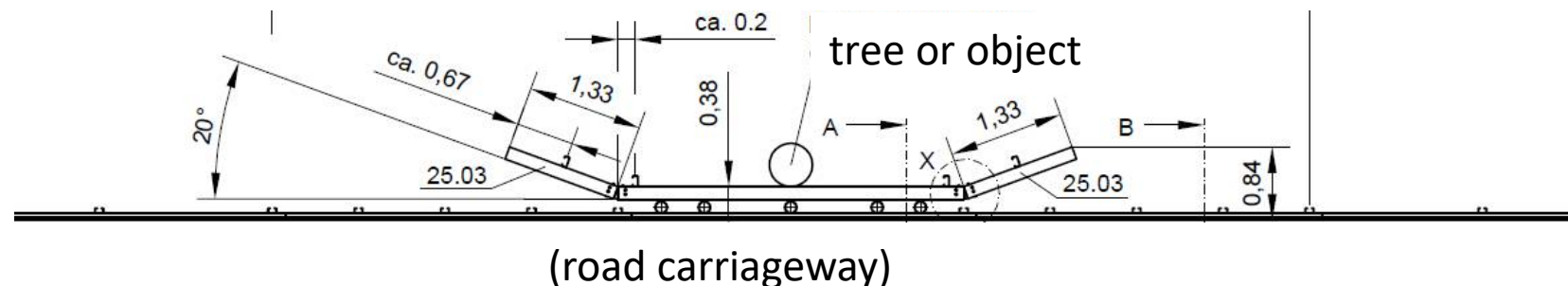
practical example 1: potential solution

- Safety barrier with integrated tree protection
- Performance data: N2 – W3 – B
- Trees within the working width are acceptable

Front-View:



Top-View:



Examples for protection against collisions with trees

practical example 1: potential solution

- Dismantling of existing safety barrier and use of a consistent new construction
- Re-routing of the field access route away from the bend



Examples for protection against collisions with trees

practical example 2: description

- The need for protection against collision with single trees



Examples for protection against collisions with trees

practical example 2: potential solutions

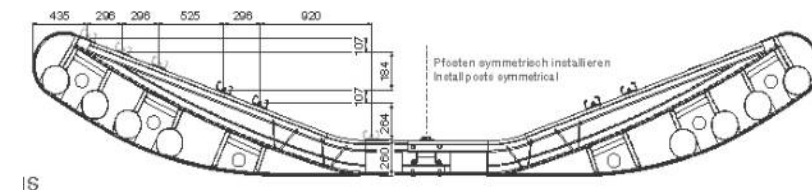
- Continuous protection from the entire group of trees or protection from a single tree with a specific safety barrier system



(Terminal + safety barrier)



(specify safety barrier system for single trees)



Some further German national standards and guidelines

regularly used in the field of vehicle restraint systems (extract)

Richtlinien für passiven Schutz an Straßen durch Fahrzeug-Rückhaltesysteme RPS 2009 (*general national planning standard for vrs*), Forschungsgesellschaft für Straßen- und Verkehrswesen, published by FGSV Verlag GmbH, Cologne 2009

Zusätzliche Technische Vertragsbedingungen und Richtlinien für Fahrzeug-Rückhaltesysteme ZTV FRS (*national construction standard for vrs*), Ausgabe 2013/ Fassung 2017, published by FGSV Verlag GmbH, Cologne 2018

Technische Lieferbedingungen für Stahlschutzplanken TL SP 99 (*national delivery standard for steel safety barriers*), published by FGSV Verlag GmbH, Cologne 1999

Technische Liefer- und Prüfbedingungen für Übergangskonstruktionen zur Verbindung von Schutzeinrichtungen TLP ÜK 2017 (*national test and delivery standard for transitions*), Regelwerk der Bundesanstalt für Straßen- und Verkehrswesen (BASt), Bergisch Gladbach 2017, published on www.bast.de

Some further German national standards and guidelines regularly used in the field of vehicle restraint systems (extract)

Einsatzempfehlungen für Fahrzeug-Rückhaltesysteme (*general guidelines for the use of vrs, additional to German national standard*), BASt 2020

Technische Kriterien für den Einsatz von Fahrzeug-Rückhaltesystemen in Deutschland **TK FRS** (*general technical criteria for the use of vrs, base for TÜL*), BASt 2019

Technische Übersichtsliste für Fahrzeug-Rückhaltesysteme in Deutschland **TÜL** (*technical overview list of vrs, non-binding*) BASt 2026

Leitfaden für Sonderlösungen zum Baum- und Objektschutz an Landstraßen (*guidelines vrs & trees/obstacles*), Regelwerk der BASt 2020

Sonderlösungen von Schutzeinrichtungen in Einmündungsbereichen (*guidelines vrs @ t-junctions*), BASt 2024

Sonderlösungen für kurze Schutzeinrichtungen (*guidelines short safety barriers*), BASt 2025

*There is still
a lot to do...*



Thank you!

I look forward to the joint discussion.

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