

ASSESSMENT OF THE EFFECTIVENESS OF DIFFERENT SAFETY MEASURES AT TUNNEL LAY- BYS AND – PORTALS TO PROTECT OCCUPANTS IN PASSENGER CARS

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Motivation



No measure



Angular positioned concrete barrier



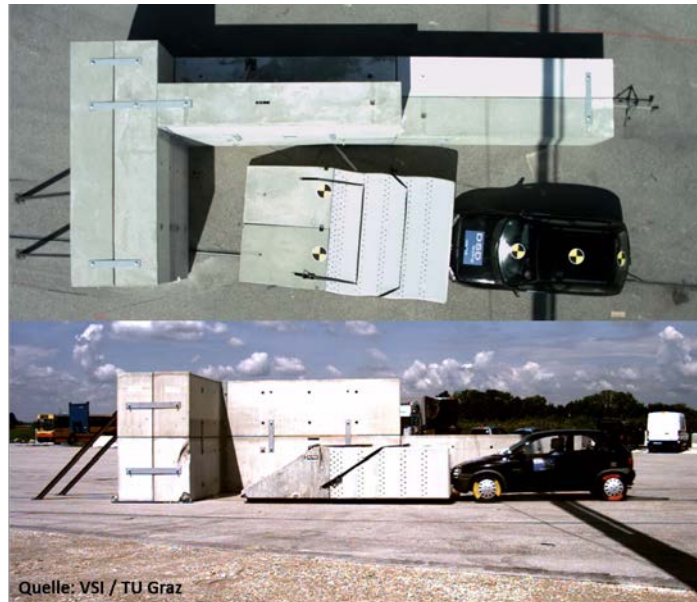
Crash cushion

What is the safety performance of these two measures?

Objective



- Angular positioned 4 m and 8 m concrete barrier



- Crash cushion
 - Alpina F1-50 not designed for this speed limit,
 - Alpina <prototype>

Method

- Test specifications
 - Vehicle: TB 11 with kerb mass of 825+/-40 kg
 - Impact speed 100 km/h
 - Vehicle trajectory simulating a run-off-road angle of 5°
- Data acquisition
 - Linear accelerometers in x-, y-, z-direction
 - Angular velocity sensor
- Assessment criteria
 - ASI (Acceleration Severity Index), limit: 1.4
 - THIV (Theoretical Head Impact Velocity), limit: 33 km/h for barriers and 44 km/h for crash cushions
 - Secondary impact and post crash kinematics
 - Test vehicle behavior
 - Test vehicle deformation

Concrete barrier 4 m























Concrete barrier 8 m



Crash cushion Alpina F1-50 and crash cushion Alpina <prototype>



Results

	Barrier 4 m		Barrier 8 m		Cushion F1-50		<Prototype>	
ASI (Limit: 1.4)	2.9		1.6		3.3		1.8	
THIV (Limit a): 33 km/h and b): 44 km/h)	53 ^a		30 ^a		74 ^b		57 ^b	
Secondary impact and post crash kinematics	Vehicle lift up and rotates		Vehicle lift up, no rotation		Moved backwards		Moved backwards	
Test vehicle behavior	Uncontrolled		Uncontrolled		Yawing		Yawing	
Test vehicle deformation	Intrusions		No Intrusions ^c		Intrusions		No intrusions	

a) and b): different limits for barriers and crash cushions

c): secondary impact

Conclusion

- Recommendations in the order of:
 - Alpina <prototype> (at the time when this crash cushion is fully developed)
 - 8 m concrete barrier
 - Alpina F1-50 (not designed for this speed limit)
 - 4 m concrete barrier (should nothing else be available, which can be used to protect vehicle occupants on crash impacts)

- Apart from the assessment criteria further parameters such as the on-site requirements (e.g. available space, bend radius, etc.), maintenance, operational conditions, etc. should be taken into consideration.

Outlook

- Vehicles used in EN 1317 are in general very old and lacking on sophisticated occupant protection devices
- Impact configurations are not always reflecting real accident configurations



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