

Study on

Coach Safety in the Case of a Fire

status quo



Agenda



- History
- Statistics
- Used Data
- Findings
- Conclusions

History

- 1990s Experts meeting and working group on bus safety at BASt
- 2003 Study on bus emergency exit systems by University of Trier
- 2004 Study on burning behavior of coach interior materials by DEKRA

- UN-Regulations 107 and 118



Statistics

- ▶ 1990s Experts meeting and working group on bus safety at BASt
- ▶ 2003 Study on bus emergency exit systems by University of Trier
- ▶ 2004 Study on burning behavior of coach interior materials by DEKRA
- ▶ 2014 BAM study on coach fire safety

- ▶ 2000s Several studies by SP/RISE

- ▶ UN-Regulations 107 and 118



➤ No comprehensive statistical data about bus fires

➤ Data from projections



0.5 to 1.0% of all registered busses



1.0 to 2.0% of all registered busses



> 0.76% of all registered busses (> 1.42% in another study)



1.0 to 1.4% of all registered busses

➤ Inhomogeneous distribution

➤ High share -> Fire is a topic!

Used data

- 125 newspaper articles from several countries (2010 to 2020)
- Well documented single incidents
- 307 DEKRA damage investigation reports (incl. some fire investigations) 2011+



Findings - Articles

Country	Number
Germany	77
USA	21
UK	8
Switzerland	4
Netherlands	4
Austria	3
Spain	2
Canada	2
Italy	2
Danemark	1
Sweden	1

Origin of Fire	Number
Engine Compartement	76
Fuel tank /-system	2
Tire, Wheel, Axle	9
Electric System	4
Heater	1
Post Collision	4
Unknown	29

Drive Mode	Number
Driving	106
Stopped, Engine running	16
Parked	2
Unknown	1

Case	Slightly Injured	Severely injured	Killed	Passengers
1	0	3	0	38
2	1	0	0	7
3	69	0	0	70
4	4	0	0	43
5	7	0	0	67
6	0	4	1	6
7	0	21	1	unknown
8	1	0	0	46
9	5	10	0	56
10	0	0	2	2
11	0	0	18	48
12	5	0	0	min. 16
13	0	10	16	min. 55
14	2	0	0	54
15	10	0	0	50

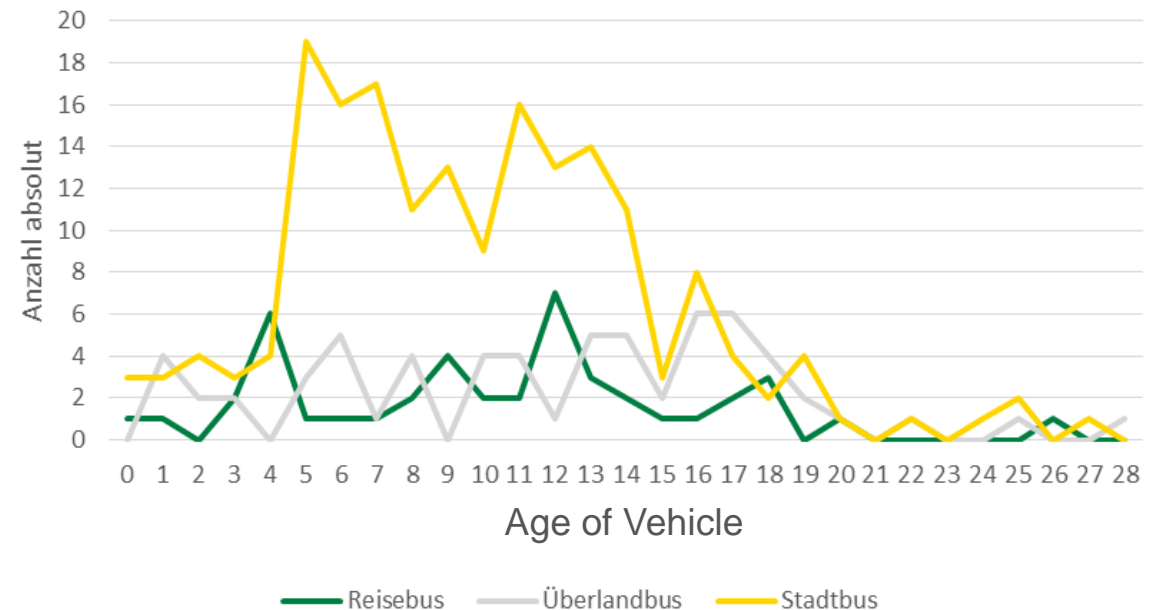
All cases with killed occupants were post-collision fires

Findings – DEKRA Damage Reports



	Coach	Regional Bus	City Bus	Total
Engine Compartment	35	43	138	216
Technic	3	3	2	8
Luggage Compartment	5	0	0	5
Driver Rest Area	0	0	0	0
Occupant Compartment	5	6	18	29

Most busses were driving (235)



Findings – DEKRA Damage Reports

- 11 coaches with fire detection system, 6 of them incl. extinguishing system
 - Three detections
- 15 regional busses with fds, 2 fes
 - Four detections
- 37 city busses with fds, 10 fes
 - 17 detections



Overall Findings

- Large number of fire incidents
- Average damage very high
- Only little number of personal damage incidents
- Minor injuries due to extinguishing attempts and rescue of personal belongings
- Severe consequences most often in post-collision fires
- Fuel as primarily ignited substance
- Elderly people and people handicapped in walking at highest risk
- Drivers at high risk

- Approaches for incident reduction (personal injury)
 - Accident prevention
 - Fuel tank protection (separation of potential ignition sources)
 - Regular inspections of tire/wheel/brake
 - Bus driver education in emergency acting and fire extinguishing
 - Improved passenger information

- Optimized Evacuation
 - Passenger information about usage of emergency door opening
 - Research about better marking of emergency windows
 - Research about usage of the front window for evacuation
 - No reliable triggering for automatic openings
 - Most fires start outside the passenger compartment. Automated opening of doors or braking of glass may increase the risk for the passengers
 - Braking glass may indicate a more dangerous escape way

- Optimized Evacuation
 - Fast implementation of the upcoming requirements for roof exit markings, retrofitting of already registered busses
 - Research for automated opening of roof hatches using local smoke detectors
 - Limit for smoke and toxicity emission of interior materials
 - The driver can usually not support in post-collision incidents

Ready for your questiones