



Available and possible risk reducing and consequence-reducing measures in bus transport

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The aims of the study are to provide:

- 1) An **overview of the traffic safety situation** and historical accident statistics for bus transport in Norway and Europe.
- 2) Description of the **necessary safety management systems and safety culture features** required to improve traffic safety in bus transport.
- 3) Overview of **measures to reduce the occurrence of accidents**, including estimated effectiveness of these measures where possible.
- 4) Overview of potential **measures to reduce the consequences of accidents**, including estimated effectiveness of these measures where possible.

The study is commissioned by **Public Transport Norway**.

Shall give decision-makers and procurers a basis for setting good and relevant requirements for increased traffic safety.

Point of departure from my own research on drivers at work in general:

- Drivers at work in general are involved in **36%** of fatal accidents.
- **Increased focus** on organizational safety management can lead to increased traffic safety (e.g. 20%-60% reduction).
- Several measures can be implemented for drivers at work, because of **the employment relationship**.
- But organisations with drivers at work **do relatively little**.
- Bus companies are an exception, but they too can improve.

Point of departure from my own research –problem and solution (?):

- Main problem: there is **no legal requirement** for systematic safety management and safety culture in the road sector.
- In contrast to **companies in other transport sectors** (air, rail, maritime), which have such requirements.
- ISO:39001 cannot be introduced as a national requirement, because it would conflict with the EU's **requirements for equal conditions for competition**.
- Solution: **a third party requires**, such as transport buyers.

The largest transit authority in Norway (Ruter) indicates the possibilities. The situation in 2019:

- **2019:** Strong focus on the fact that Ruter has no formal responsibility for traffic safety. Concern about “becoming responsible” if you interfere too much in what the bus operators are supposed to do.
- "Assumes that the bus companies follow Norwegian law".
- "The Road Traffic Act is a good enough road safety requirement; we don't need to demand more”.
- **Seminar 2020**, e.g. on the 2017 Nafstad accident: "Everyone" agrees that requirements for collision protection must go through the EU. That way we can get a national requirement introduced. It will take time....

Development after 2020:

- Ruter takes a more **holistic role** to contribute to increased traffic safety for the bus operators.
- Ruter sets requirements for the introduction of a safety management system (**ISO:39001**) and systematic work with a safety culture.
- Ruter works to establish a **system for learning** from incidents, "a learning culture" across bus operators, through the analysis of incidents
- Ruter makes requirements for **collision protection** for drivers
- The requirement for collision protection became **Norwegian law** October 1. 2023

Summing up the background:

- **Great development** in Ruter in recent years regarding setting requirements for road safety and taking "responsibility" for road safety and **driving the industry forward in a way that raises the standard**, beyond official requirements.
- This work has also involved trade unions, employers' associations, the Accident Investigation Board, bus operators etc.
- This development is unique, and it should be a **good example** for other industries, given the starting point (third parties must make demands) and not least for other public transport buyers.

Accidents and injuries in bus transport:

- **EU data:** between 2010 and 2019, the number of fatalities in crashes involving buses have decreased by 34%.
- **High proportion of vulnerable road users (37%),** especially pedestrians (29%) in bus accidents,
- Norwegian data: bus drivers' risk of personal injury accidents has declined. The same applies to bus passengers.
- Bus drivers have about the same risk of injury as car drivers, but a higher risk of injury than bus passengers. (drivers: prob. cons.)
- Between **80-85% of all passenger injuries** result from events onboard and when going on/off the bus (not traffic accidents).

Methods:

Three methods: 1) Analyzes of accidents and incidents and exposure figures, 2) literature study and 3) interviews.

The results of several studies of a measure are summarized:

	Measure studied on buses?	Does the measure reduce accidents / injuries?	Target group of road users	How uncertain is the effect?	Is the measure in conflict with other measures?	Is the measure relevant?
Qualitative assessment	Yes / No	Yes, a reduction of A-B percent / No	Persons within bus / Other road users	High / Medium / Low	Yes, in which case which measures / No	Yes / No / Maybe
Quantitative assessment	0: No / 1: No, but in other relevant cases / 2: Yes	0: No / 1: Yes, most likely / 2: Yes, small effect / 3: Yes, large effect	Driver / Vulnerable road users / <u>Other road users</u> / Passengers / All	1: High / 2: Medium / 3: Low	-1: Yes / 0: No / +1: No, and other benefits (<u>e.g.</u> reduced omissions)	0: No / 1: Yes, maybe / 2: Yes, to some extent / 3: Yes, to a large extent

We rate all measures based on the scoring system in the table:

Table 4.3. Assessment of effects of fleet management systems.

Measure	Measure studied on buses?	Does the measure reduce accidents / injuries?	Target group of road users	How uncertain is the effect?	Is the measure in conflict with other measures?	Is the measure relevant?
Fleet management systems	Yes	Yes, up to 20% fewer traffic accidents	Drivers, but also passengers	Low to medium	No, it can also lead to reduced fuel consumption and emissions	Yes, particularly injuries inside the bus resulting from hard braking
11,5	2	3		2,5	+1	3

The measures are divided into the following categories:

- 1) Organisational measures (3)
- 2) Measures addressing onboard passenger safety (5)
- 3) Crashworthiness and driver protection (2)
- 4) Crash protection for vulnerable road users (2)
- 5) Driver assistance systems – mandatory systems (9)
- 6) Driver assistance systems – optional systems (9)
- 7) Other measures (3).

Thirty-three specific measures are reviewed.

Point of departure for our conclusions:

- Many of the measures that we rate **are already legally required** in bus transport and are thus implemented in companies.
- **We rate them nevertheless**, to provide an overview of efficiency and relevance.
- It is, however, of more relevance to provide recommendations based on **efficient and relevant measures that are not legally required** (yet), and which thus are not fully implemented.
- When it comes to such measures, **some companies might have them, but not all**, as the measures are not mandatory.

Recommended measures that are not required (yet):

- Based on that, **we recommend that the following measures are made mandatory in bus transport:**
 - 1) Fleet management systems,
 - 2) Safety culture measures,
 - 3) Safety management systems,
 - 4) Crash protection for bus drivers.
- These measures are **not legally required** in bus transport, although they are highly effective for preventing accidents.
- Safety culture measures and Safety management systems are **required in other transport sectors**, with a high safety level (e.g. aviation, rail, maritime sector).

Required measures that are not fully implemented:

- Other measures are already required, but not fully implemented in practice.
- Given their efficiency, a relevant step would be to find measures aiming to increase their implementation.
- This applies e.g. to measures to increase seat belt use among passengers in class 3 and 2 buses.

Limitations and issues for future research:

- It should be mentioned that our rating and assessment is **conservative and biased**, as we rate existing and “older” measures higher.
- We compensate for this by **highlighting measures which seem promising**, but for which there is little relevant research, or current versions of the technology is not fully developed yet, indicating a need for further research.
- This applies e.g. to:
 - Geofence speed limiter,
 - Warning systems for VRUs and emergency braking,
 - Run over guards and pedestrian airbags,
 - Measures to prevent fall accidents on-board buses,
 - Measures to secure wheelchairs and baby buggies