Road traffic safety risks with articulated vehicles on low friction roads

IRU Commission for Road Safety
Borås, Sweden
September 9, 2015

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Outline

Voices are raised that artic´s create disproportionate risks:

→Icy upgrades often jammed.

→Loss-of-control crashes; jackknifing & trailer swing.

Our aim is to find out if that is true, and facilitate consensus.

If disproportionate, the objective is to identify feasible actions to efficiently reduce the risks.

Demonstrating examples of problems.

Existing knowledge.

Three complementary research approaches.

Invitation to open seminar at Nov 12th in Sweden.

Background / Problem

Trucks jamming long steep icy upgrades

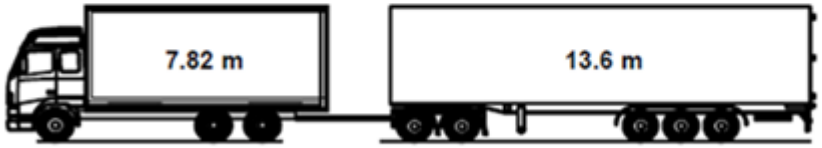
- → Annually, at the first snow, hundreds of Heavy Goods Vehicles fail to negotiate slippery uphill climbs in the EU Northern Periphery. The problem continues over the whole winter season; thousands of stops.
- → The result is increased risk for queue / rear-end accidents, as well as delayed transports and travel.
- → Articulated vehicles are perceived as heavily overrepresented cause.

Loss-of-control crashes

- → With booming number of artic´s on Nordic roads, the number of loss-of-control crashes is perceived booming as well.
- → Trending crash modes are both jackknifing and trailer swing on artic´s.

Are risks on slippery roads disproportionate:
-Articulated vehicles versus rigid trucks with trailers

Short tractor unit, high friction in the articulation joint



Efficient EMS vehicle with no friction in the joints

Research objective and aim:

- → Do artic´s exhibit disproportionate risks on slippery roads?
- → Normalizing risk to payload ton*km, as well as to vehicle*km.
- → If disproportionate risks associated with artic´s on low road friction; how can the risks be efficiently reduced?

Upgrade climbing performance
“Foreign truckers on Norwegian snow”

Video source: https://www.youtube.com/watch?v=YQ5XQmX9S0g

Recent knowledge on crash frequencies

An analysis of data from Sweden show the crash frequency per vehicle*km among 18.75 – 25.25 m long “Nordic vehicle combinations” is only 78 % of the crash frequency among 12.01 - 16.5 m long vehicles (the latter group is dominated by the artic´s).

“*Correlation between truck combination length and injury risk*”, Chalmers University.

Jackknifing
-A problem already on moist asphalt…

Video "*Amazing car driver avoids collision with oncoming lorry*" available at:
https://youtu.be/mRhqhSdAg6s?list=FLAlJP86wypaAT8FLV33nvkQ

Fatal “trailer swing” crash at Highway 50

The “forgotten” factor: High turntable/kingpin friction (1)

Sweden's largest mass-collision ever, at the E4 bridge in Tranarp.

Photo: SVT

Photo: P Thomson

High friction at the artic joint of the first vehicle to jackknife and crash.

The “forgotten” factor: High turntable/kingpin friction (2)

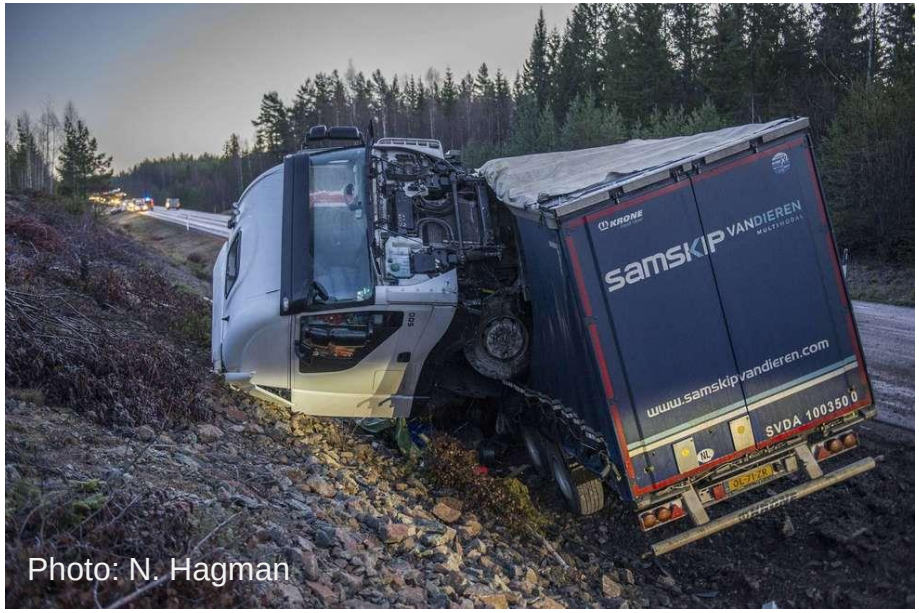


Photo: N. Hagman


Photo: J Granlund

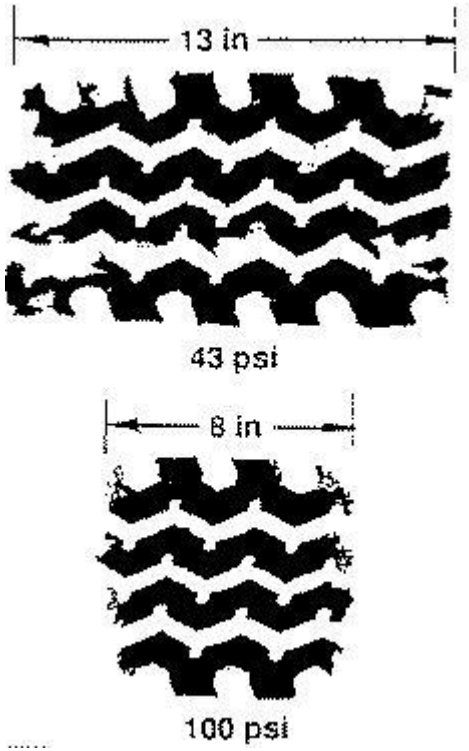
A “typical artic jackknife crash”:
Highway 68, artic jackknifed over the oncoming lane and ditched.

Only few minutes apart from the full seated school bus passed.

High friction at the rusty artic joint.

Existing knowledge: Influence of tire pressure

- → Most jackknifing incidences involve an empty or nearly empty trailer.
- → If the tire air pressure was right when the trailer was loaded, it is now **wrong** when it is empty.
- → The brakes only work if the tires have decent footprints on the road.



"*To jackknife or Not to jackknife – That is the Question*", by Bob Rutherford

<u>Comment:</u>

The serious problem with over-inflated tires on the unladed trailer is relevant for both artic´s and rigid combos.

However, it does not by itself explain ***disproportionate*** *risk for artic´s.*

Sample of instructions on hill climbing

"For semitrailer combinations it is especially important to make sure that the trailer pivots well so that inertia does not prevent the towing vehicle from turning properly."

"When operating vehicle combinations on slippery roads, you should load most of the cargo on the tractor unit and not on the trailer, because this will help reduce the risk of jack-knifing."

"If the vehicle has a bogie, you can ensure greater load on the drive axle by using bogie-lift/load transfer." *

From "*Trucker´s Guide to Driving in Norway*", presented by Donna Diesel:
http://www.vegvesen.no/_attachment/290611/binary/1026405

*Comment: Most tractor units on artic´s in the EU have no bogie to lift for increased traction, in contrast to typical Nordic long haul trucks.

Three complementary research approaches

1. Analyzing truck incident data, separating artic´s and rigid combos:

→ Official data on injured persons from the police.

→ Tow statistics from recovery trucks

→ “Crashes on the map” - data on compensation for repair by Sweden's dominant motor insurance company *Länsförsäkringar*.

2. Comparing handling and stability performance of artic´s versus rigid combos in computer simulations for driving on low friction surfaces.

→ The vehicle model is able to consider high friction in the articulated joint.

3. Comparing handling and stability performance of artic´s versus rigid combos at low road friction conditions, on the newly built Swedish *Asta Zero* test facility for driverless testing.

-How will this research be funded?

Open seminar at Nov 12th in Karlstad, Sweden

A Nordic language seminar on the topic will be held in Sweden.

Hosts of the open seminar are:

Invitation and program available at www.nvfnorden.org

Summary

Do artic´s create disproportionate risks:

→Jamming icy upgrades.

→Causing loss-of-control crashes, i.e. jackknifing.

We need to find out if that is true, in order to facilitate consensus on the overall problem.

If disproportionate, there is a need to identify feasible actions to implement, in order to efficiently reduce the risks.

Examples of problems.

Existing knowledge.

Three complementary research approaches.

Invitation to open seminar at Nov 12th in Sweden.