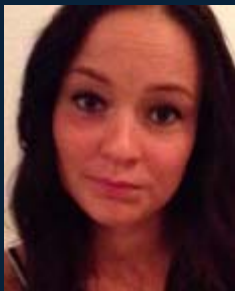


Speed changes in rural single-lane roundabouts converted for road trains



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Agenda

- Background
- Safety and speed
- Method
- Data
- Results
- Summary

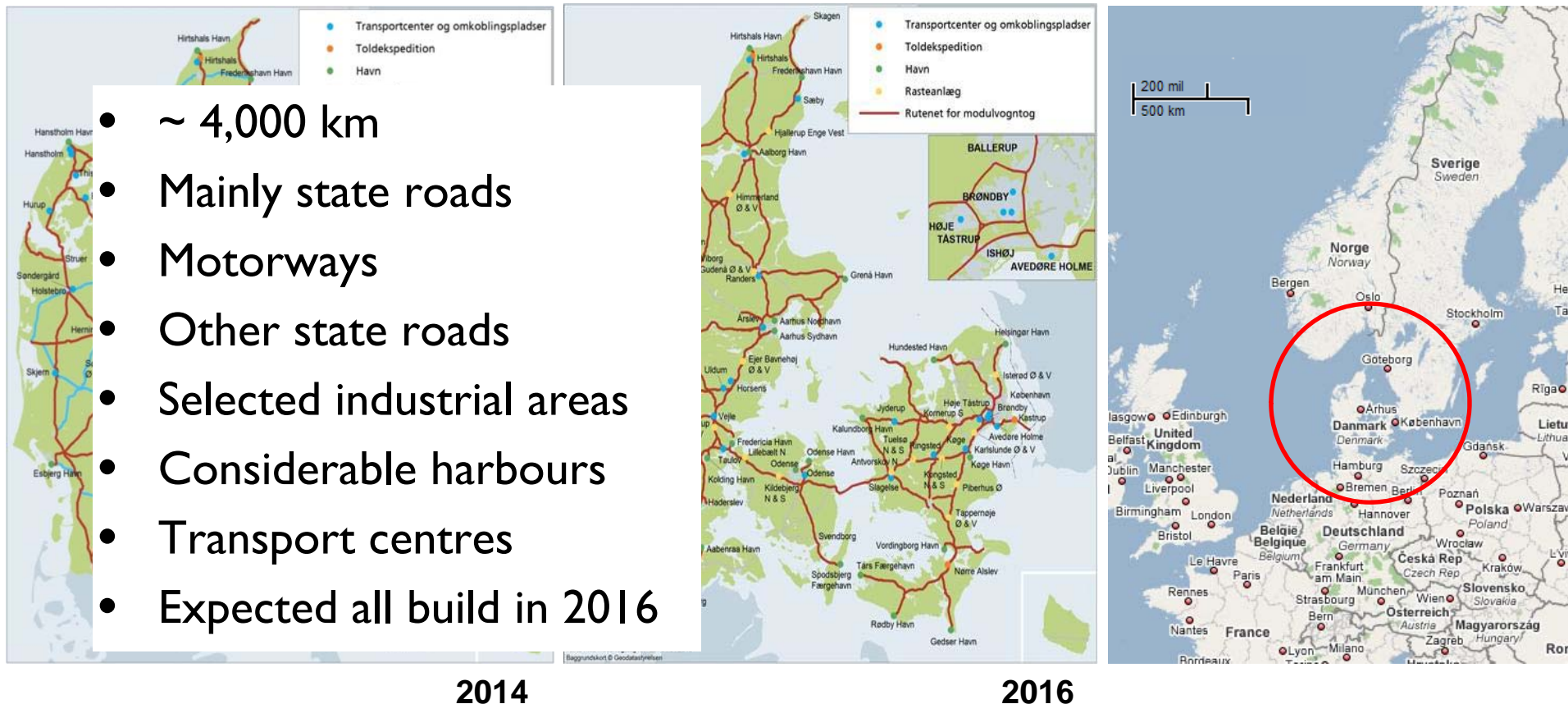
Background

Denmark and road trains

- It came late to Denmark
- Trail in 2008
- Prolonged several times. Now to 2030...
- Highly requested from Danish Transport and Logistics industry
- Swedish and Finnish schedule as role model



Where?



Why road trains?

- Up to three time more freight/vehicle
- Save money due to less drivers
- Environmental protection?
- Safety effects?
- Heavily requested



Outcome based on national reporting

- Direct effects:
 - Rebuild road network (Million € 17)
 - Additional operational costs (Million € 0.2)
 - No measurable extra attrition
 - Saved cost/km € 0.45
 - Reduced CO2 emission
 - Immeasurable effect on noise
- Indirect effects:
 - No. of recorded accidents has gone down
 - Accident frequency from 0.34 (2007) to 0.18 (2015)
 - No. of recorded accidents with road traffic fatalities reduced
 - Other road users feel insecure



Speed and risk

- Higher speed = higher risk
- Higher speed = more serious
- Higher kinetic energy = more damages

Power Model

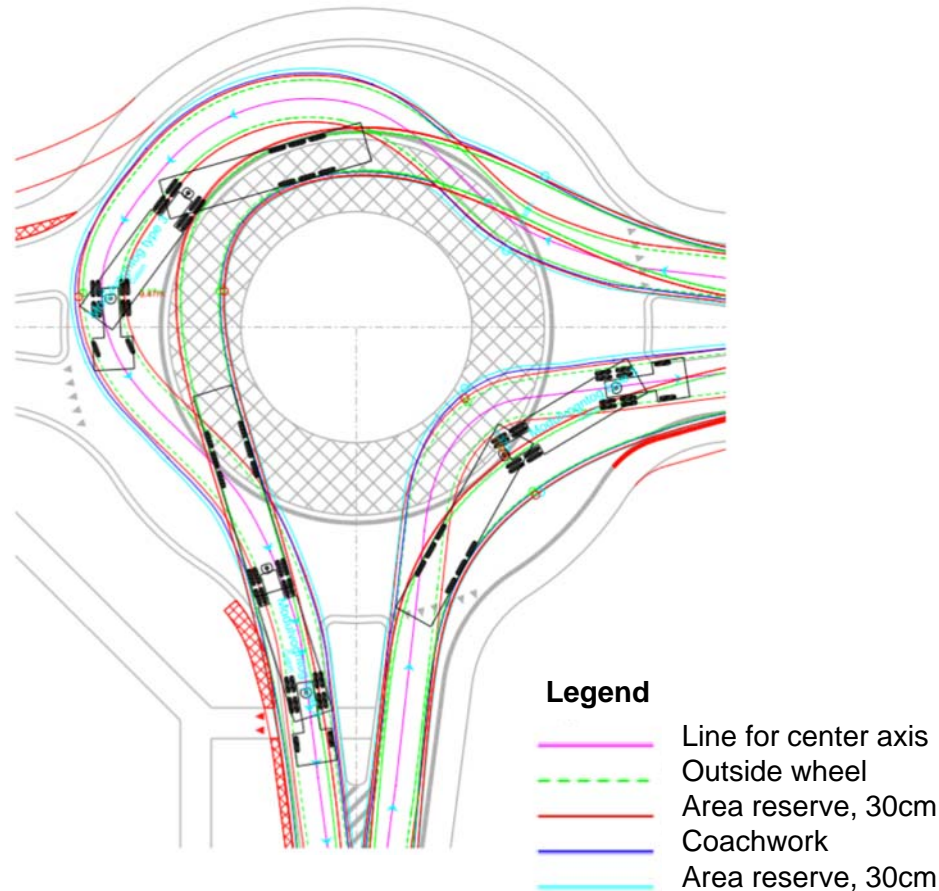


Problem statement

How is the speed of cars affected in roundabouts rebuilt for road trains?

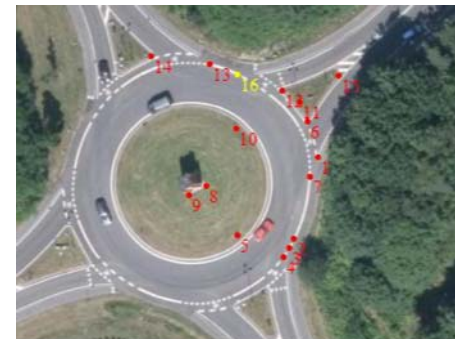
Methods I

- Literature review
- Analysis approach and method:
 - Before/after study
 - With/without study
- Traffic counts
- Speed-registration and -analyses
- All based on camera registrations



Methods II

- Traffic counts
- Speed registrations
- Camera registrations
- **Calibration with T-calibration**
- Calibration with T-analyst
- Auto detection of speeds with RUBA software



Methods III

- Traffic counts
- Speed registrations
- Camera registrations
- Calibration with T-calibration
- **Calibration with T-analyst**
- Auto detection of speeds with RUBA software



Methods IV

- Traffic counts
- Speed registrations
- Camera registrations
- Calibration with T-calibration
- Calibration with T-analyst
- **Auto detection of speeds with RUBA software**



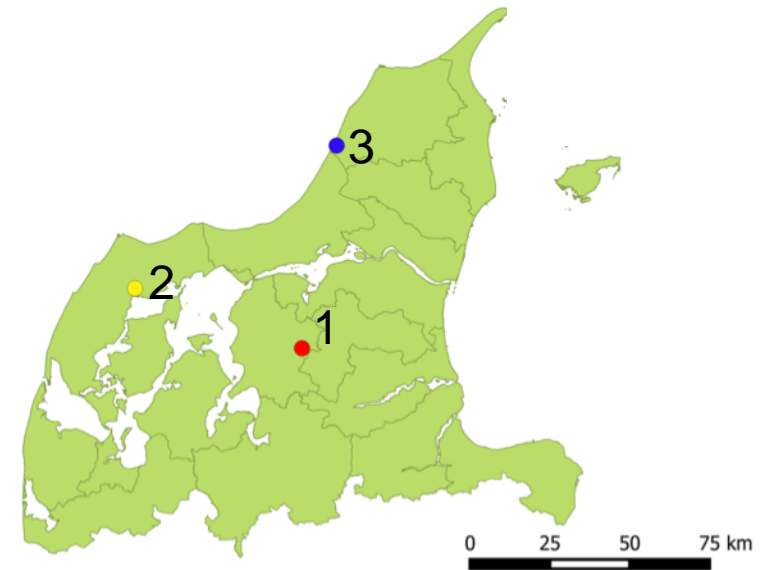
Data

Data collection

- Three selected locations
(roundabouts)
- A part of the road train road network
- Single-lane rural roundabouts
- Roughly identical geometrical design
- Roughly identical AADT and type

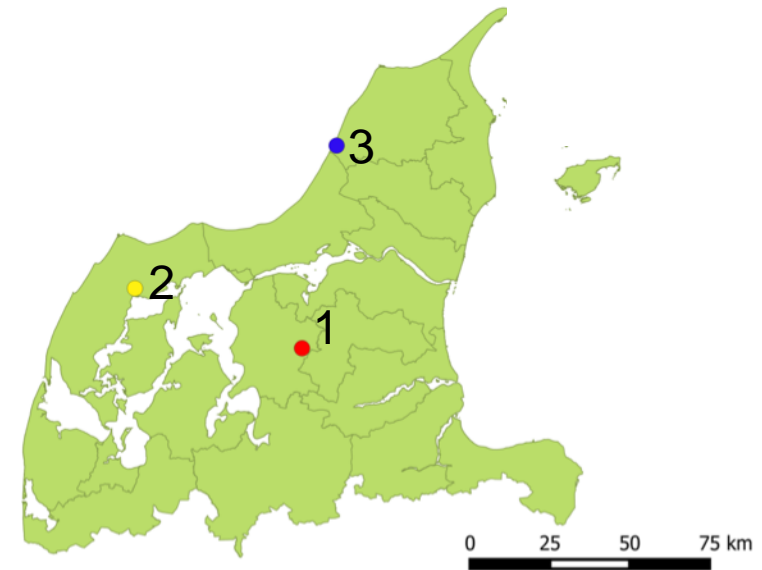
Selected locations

- North Denmark
- AADT 4-7.000
- Rural areas
- Considerable heavy traffic



Selected trips

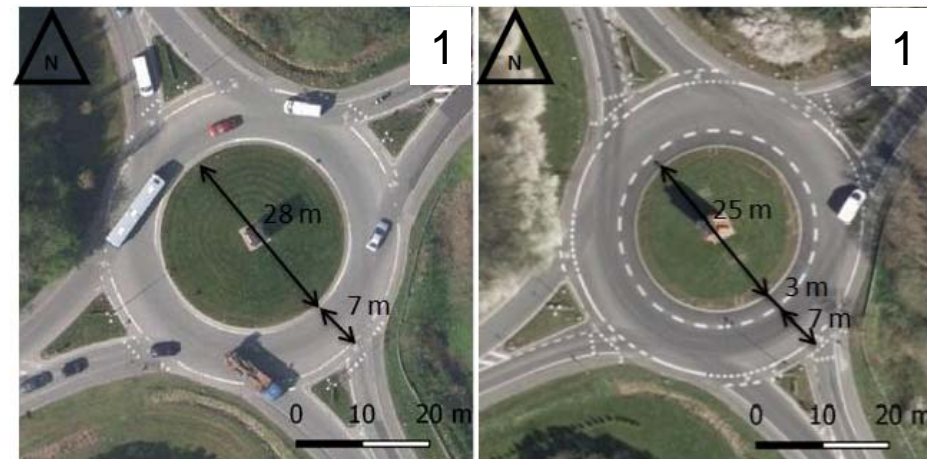
- Only cars
- Only under free-flow conditions
- Random distributed trips (weekday and time)
- For each registration period: 10 hours with 10 trips
- 4 * 100 trips in total



Design changes

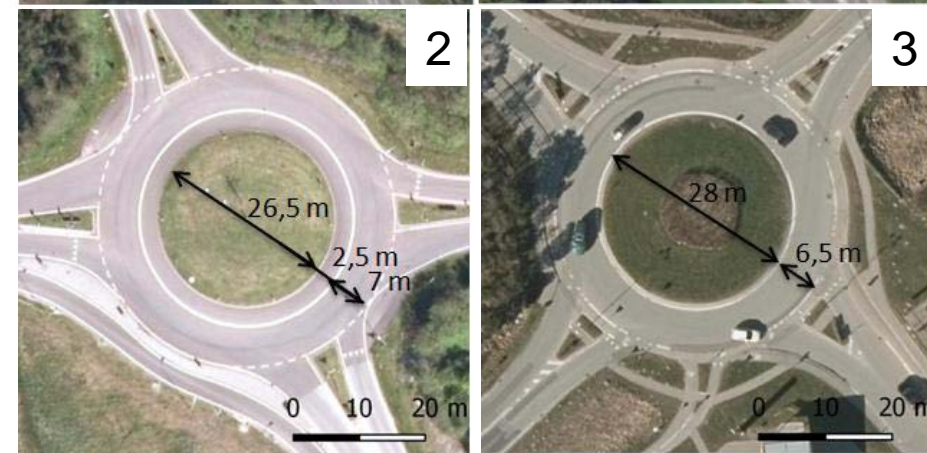
In one selected roundabout
(before/after) (1)

- **Reduced** central island
- **Added** a low profile mountable apron



Two other roundabouts:

- **With** a low profile mountable apron (2)
- **Without** a low profile mountable apron (3)



Results

Traffic counts

	Cars	Counted hours	Cars/hour
Location 1 (before)	36,736	119	309
Location 1 (after)	41,798	136	307
Location 2 (with)	13,632	40	341
Location 3 (without)	24,308	126	193

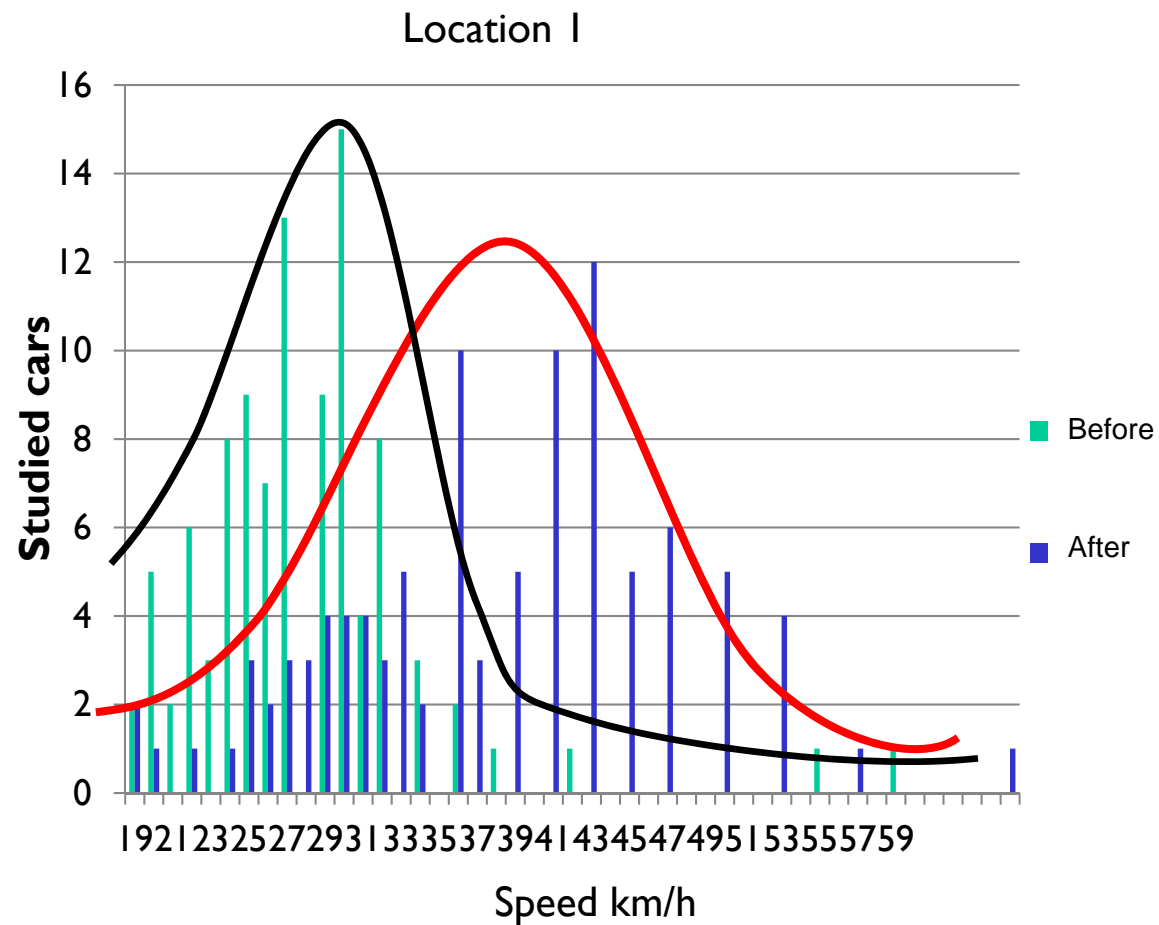
Speed analyses

	Overall mean speed
Location 1 (before)	27.9 km/h
Location 1 (after)	35.7 km/h
Location 2 (with)	32.8 km/h
Location 3 (without)	32.0 km/h

Statistical tests

		Statistically significantly difference			
Roundabout		Mean speed	Before	After	With
1	Before	27.9km/h			
1	After	35.7km/h	<0.05		
2	With	32.8km/h	<0.05	<0.05	
3	Without	32.0km/h	<0.05	<0.05	0.59

Speed distribution



Results

Summary

Effect from establishing a low profile mountable apron:

- The speed increases up to 8 km/h
- More speed variation
- All things being equal: an increased accident risk

Thank You 😊

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