



XIII
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Québec 

SUSTAINABLE WINTER SERVICE FOR ROAD USERS

Bus accidents in winter time

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FINDING A BETTER WAY

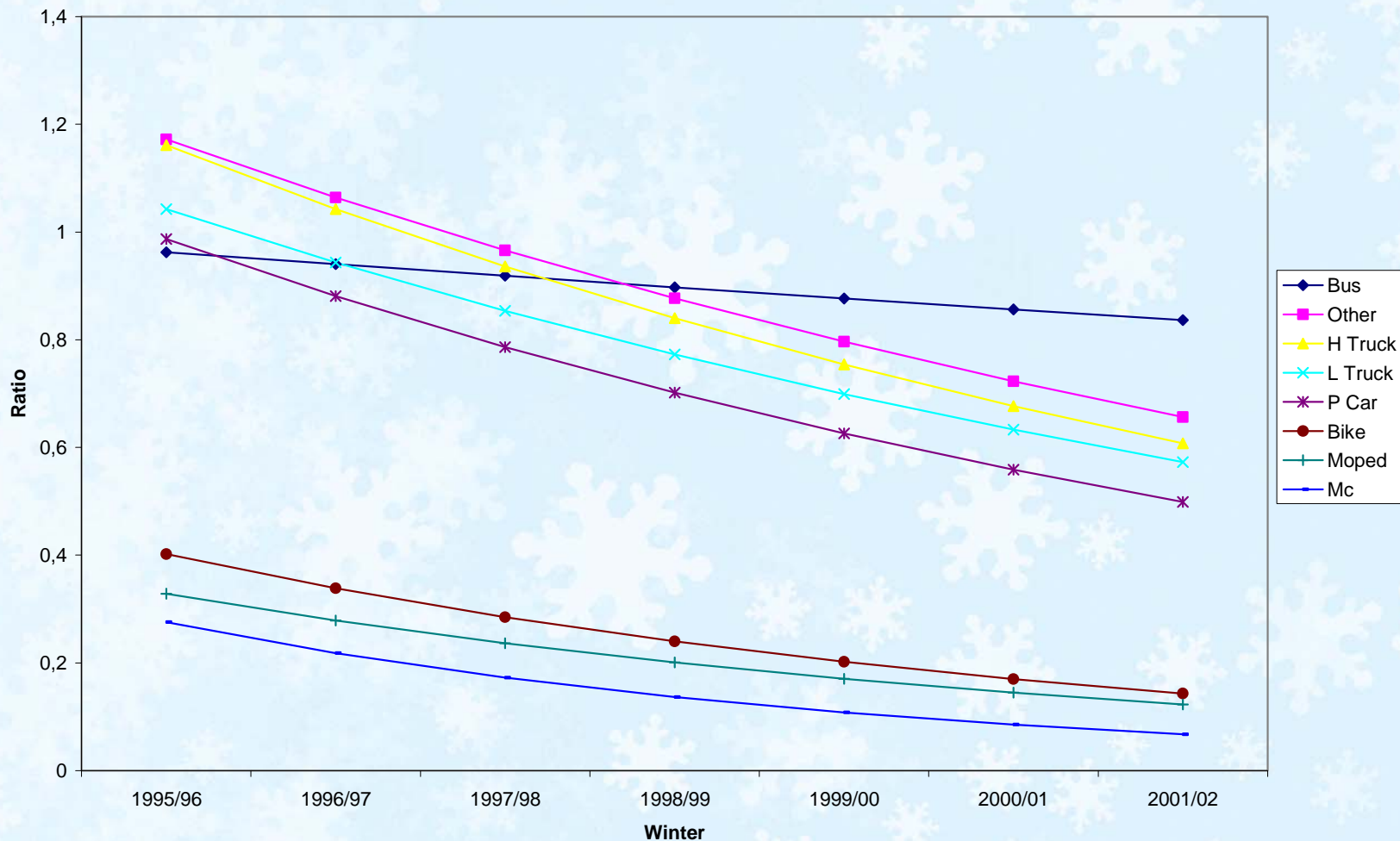
Overview

- Background – A problem with bus accidents winter time
- VTI study 2005 – 2008: several parts
- Focus groups
- Accident statistics
- Use of different tires
- Ice grip test of different tires
- Driving simulator study – Cross wind
- Conclusions

Background

- Accident statistics: Buses vs other vehicle types
Data from 7 winters in Sweden from 1995-2001 =>
- Number of accidents with personal injuries involving buses during winter time is increasing with 4% per year.
- The ratio (Accidents on snowy/icy roadways)/(Accidents on bare roadways) is however decreasing!

Buses show worse trend compared to other vehicles



Present VTI study

What is the problem with buses and winter roads?

Focus groups with Swedish and Norwegian bus drivers and bus mechanics =>

- Tim and winter. Should we have a winter tire regulation for buses? (as we have for passenger cars)
- Bad winter maintenance.
- Drivers feel that they lack further education and practical excercises with buses on slippery roads.

How important are the tires?

- What kind of tires are being used?

Steering axle /Drive axle	Winter 2005/2006	Winter 2006/2007
summer/summer	20.0	19.1
summer/winter	28.1	22.2
winter/winter	46.3	47.8
winter/summer	0.3	0.1
studded/studded	3.9	7.1
studded/other	1.4	3.6

From inquiries among bus companies during winter 2005/2006 and winter 2006/2007

How important are the tires?

- How large share of the estimated vehicle mileage is performed on icy/snowy roadways?

Steering axle /Drive axle	Bare roads	Ice or snow
summer/summer	74 %	26 %
summer/winter or studded	73 %	27 %
winter/winter	67 %	33 %
studded/other	47 %	53 %

From inquiries among bus companies during winter 2005/2006 and winter 2006/2007

How important are the tires?

- Police reported accidents with personal injuries during the two winters

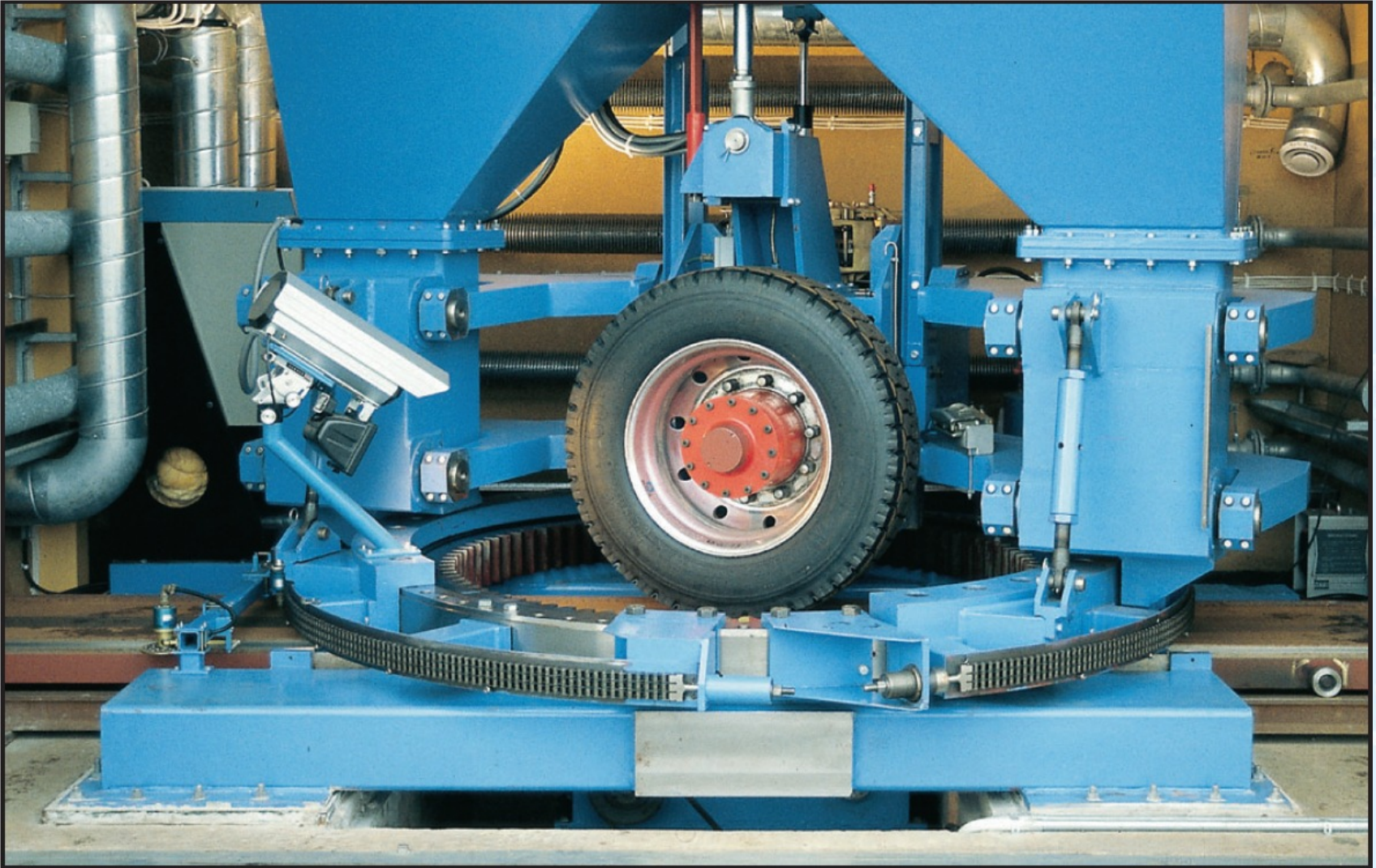
Steering axle /Drive axle	Bare roadway	Ice or snow
A (summer/summer)	35	14
B (summer/winter or studded)	46	13
C (winter/winter)	93	55
D (studded/other)	3	4

How important are the tires?

- Combining the previous data to calculate the relative accident risk on icy/snowy roadways versus bare roadways

Steering axle /Drive axle	Relative risk	Confidence interval (95%)
A (summer/summer)	1.15	(0.62; 2.14)
B (summer/winter or studded)	0.76	(0.41; 1.41)
C (winter/winter)	1.20	(0.86; 1.68)
D (studded/other)	1.17	(0.26; 5.23)

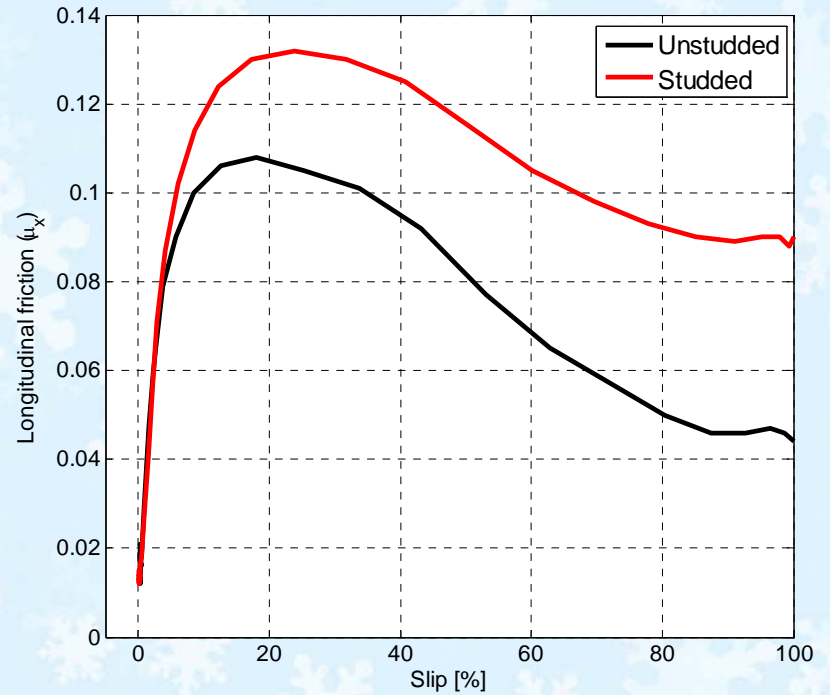
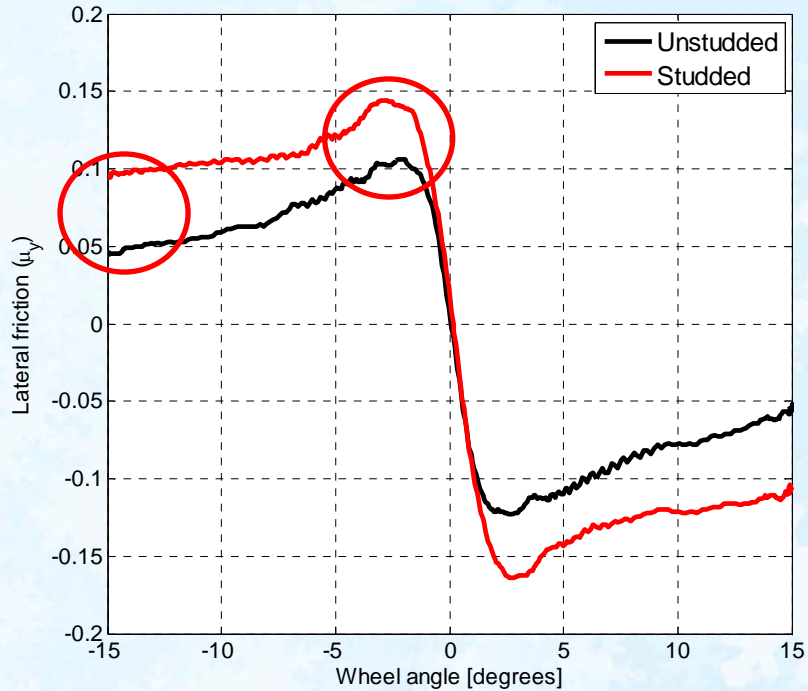
What about pure ice grip?



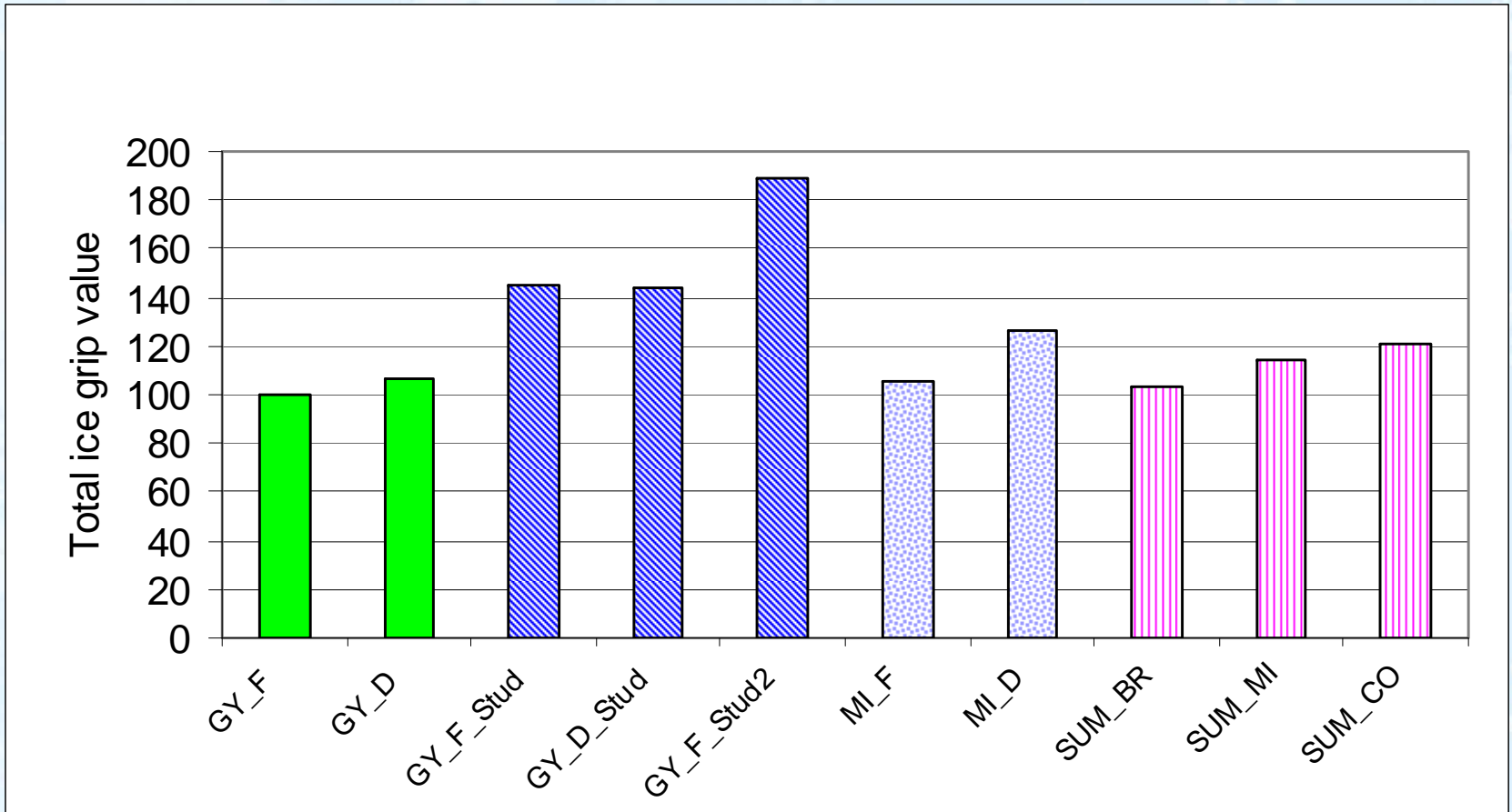
Measuring road grip on ice for many different bus tires

Short name	Name	Category	Placement
GY_F	Good Year Ultra Grip WTS 295/80-R22,5	Winter (can be equipped with studs)	Steering
GY_D	Good Year Ultra Grip WTD 295/80-R22,5	Winter (can be equipped with studs)	Drive
GY_F_Stud	Good Year Ultra Grip WTS 295/80-R22,5	Studded (120 studs)	Steering
GY_D_Stud	Good Year Ultra Grip WTD 295/80-R22,5	Studded (96 studs)	Drive
GY_F_Stud2	Good Year Ultra Grip WTS 295/80-R22,5	Studded (240 studs)	Steering
MI_F	Michelin X Pilote XFN 295/80-R22,5	Winter (can not be equipped with studs)	Steering
MI_D	Michelin XDN2 Grip 295/80-R22,5	Winter (can not be equipped with studs)	Drive
SUM_CO	Continental HSR Regional Traffic 295/80-R22,5	Summer	Steering
SUM_BR	Bridgestone R249 295/80-R22,5	Summer	Steering
SUM_MI	Michelin XZE2+ 295/80-R22,5	Summer	Steering

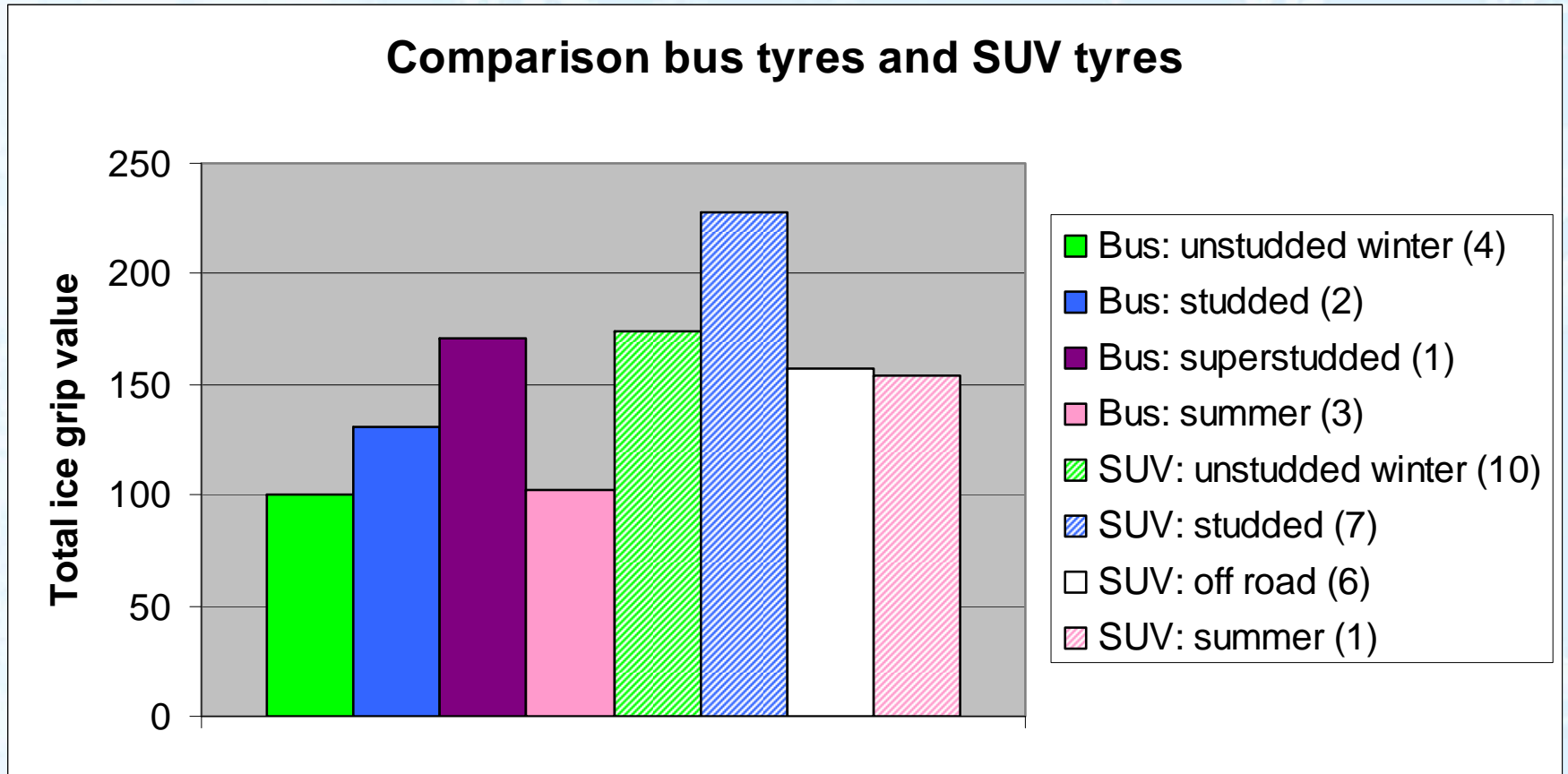
What friction properties are important?



Ice grip results



Comparing bus tires with passenger car (SUV) tires



Crosswind sensitivity

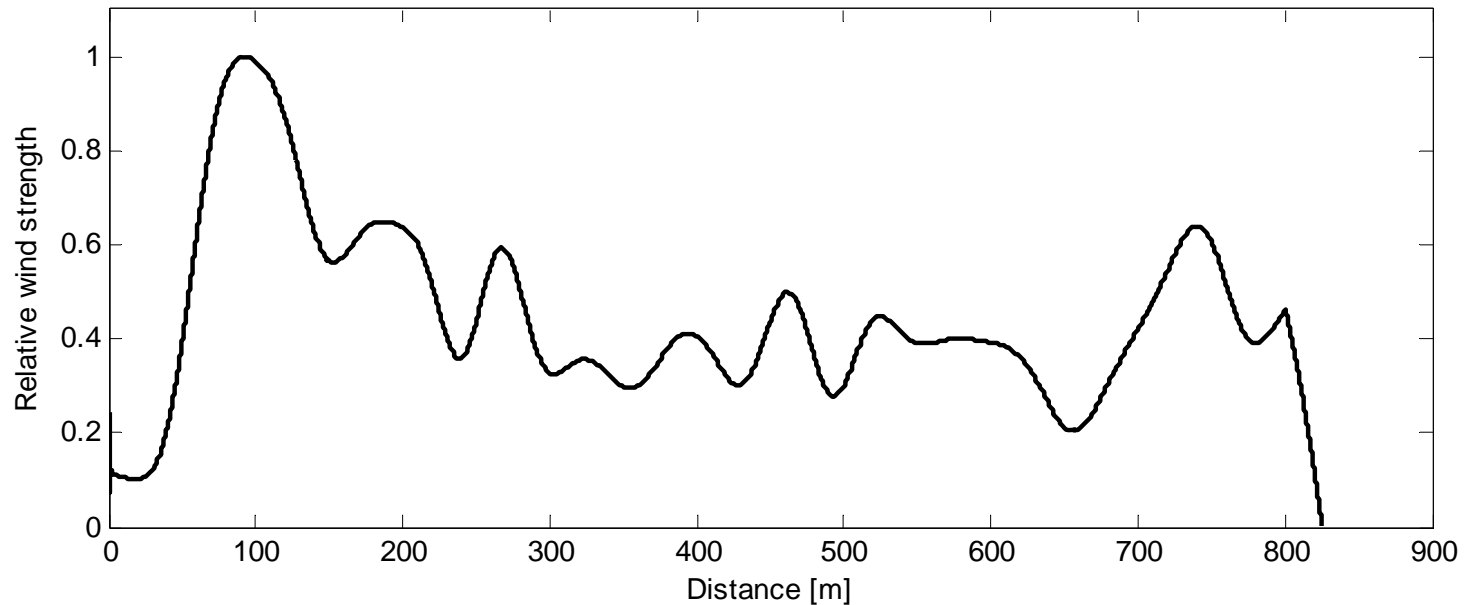


Using VTI:s moving base driving simulator



Bus drivers had to drive on straight, icy road

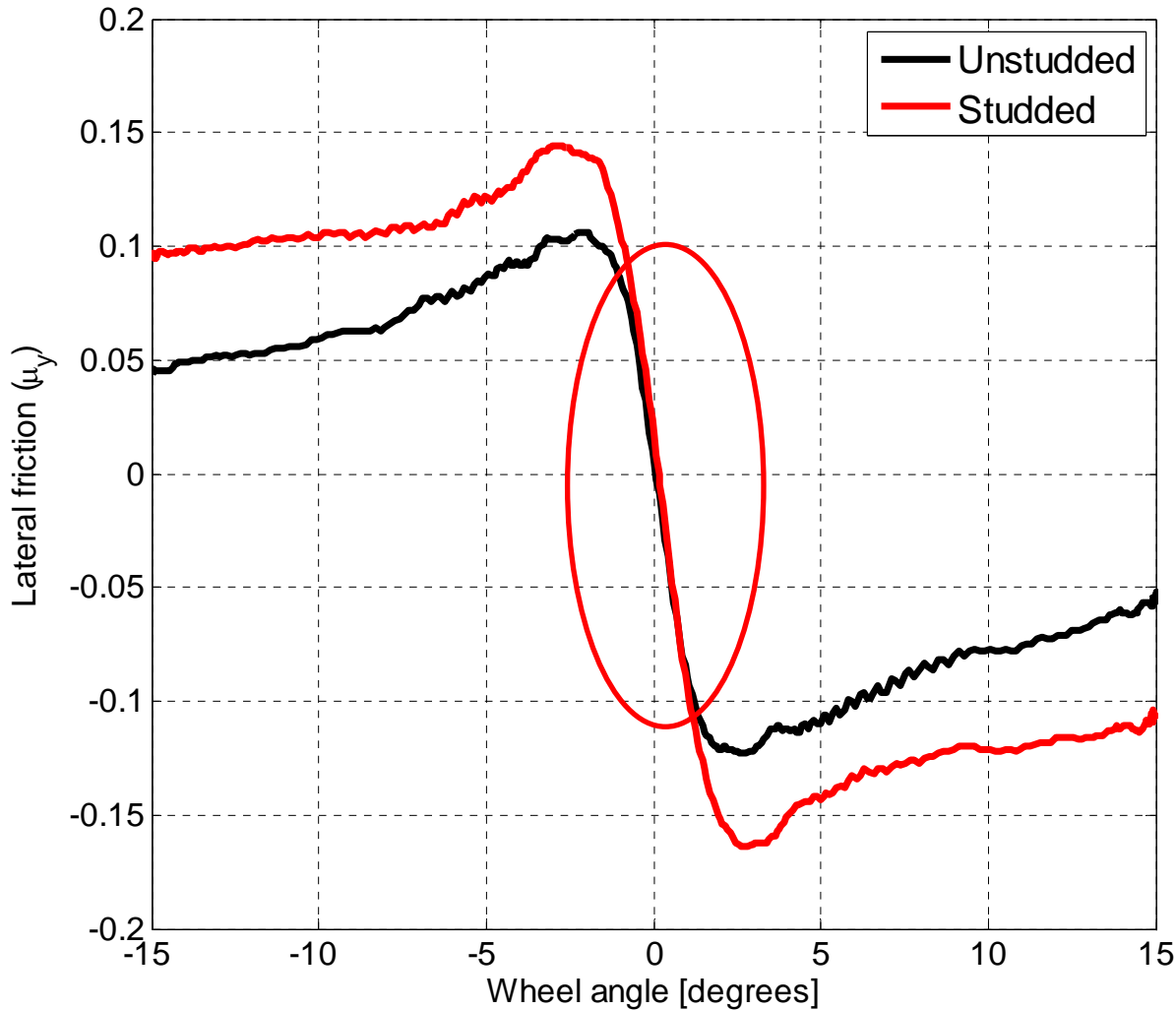
Introduce sudden wind gust,
that varies during 800m distance



Repeat with many different tire configurations!

Results

- No significant difference between studded and non-studded tires
- Studded tires performed better than non-studded tires
- If studded tires were used, simulation results would have been different
- All the data was felt to be very good and would be used for the simulation.



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Summarized conclusions

- Tire tests on smooth ice did not show any significant difference between summer tyres and non-studded winter tyres
- Driving simulator tests in conclusion with tire tests. It is difficult for bus drivers to in advance estimate the tire grip in an extreme situation.
- Accident statistics indicate that buses with summer tyres on the steering axle and winter tyres on the drive axle have the lowest estimated accident risk results (not statistically significant due the low number of accidents)

=> Not reasonable with winter tire regulation for buses for traffic safety reasons!

Thanks for the attention!

Funding:

the Swedish Road Administration
the Norwegian Public Roads Administration

References:

Traffic Safety of buses winter time, VTI report 618, 2008 (in Swedish)

Crosswind simulator study described in detail in upcoming special issue of Accident Analysis and Prevention, by M. Hjort and J. Jansson.