

# **TYRE-RELATED RISKS IN FATAL ROAD ACCIDENTS IN FINLAND**



TYRE SPECIALISTS OF FINLAND

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# INTRODUCTION TO ANALYSIS OF TYRE-RELATED RISKS

According to the Summer Tyre Survey carried out by Tyre Specialists of Finland in 1997–2005, motorists give more thought to the condition of their tyres than before. The development is deemed to have a positive impact on road safety. Progress stems from the effective, regularly conducted Tyre Check and tyre pressure campaigns held under the European Road Safety Charter as part of the European Commission's Road Safety Action Programme.

Finland has an internationally unique investigation system set up to look into the causes of road accidents and to promote road safety. Special Road Accident Investigation Teams investigate all fatal road and cross-country traffic accidents. The investigation material is stored in a database maintained by the Finnish Motor Insurers' Centre. Information for the analysis of tyre-related risks is obtained from this database. *Additional information is provided in Appendix 1.*

## **Focus on road accidents in 2000s**

Fatal motor vehicle accidents caused by passenger cars and vans are examined in this risk analysis. During the period 2000–2005 there were a total of 1,292 accidents; of these 198 were incidents relating to the tyres of the party responsible for the accident. A total

of 248 people died in tyre-related accidents and 73 were severely injured.

Tyre-related defects are filed as risk factors in accident investigations only when they are considered to have affected the course of events. All tyre-related risks of cars and vans in the 2000s have been background risks deemed to have been contributory factors behind the accident, accounting for the immediate risk. *See term definitions in Appendix 2.*

## **How to get tyre risks under control?**

There is a clear need for risk analysis regarding tyres, as it has already been some ten years since the last tyre survey based on accident statistics was carried out. The aim is to provide fresh facts, stimulate broad discussion and generate new initiatives to bring tyre-related risks under control. The target groups for the publication are decision-makers influencing road safety issues, professionals in the tyre sector and automobile journalists.

We have received perspectives on the content of the publication from specialists in road safety and in the tyre industry. Grateful acknowledgement is given to the Finnish Motor Insurers' Centre in particular for preparing the necessary statistical material.

# TYRES AS PART OF ROAD SAFETY

Tyres are the most significant risk factor affecting driving properties in fatal car and van accidents. A tyre-related risk of some kind or another has been involved in approximately 15 per cent of accidents investigated in the 2000s, which is a slightly lower figure than in the 1990s. During this decade there have been, on average, 33 tyre-related accidents annually (*Figure 1*).

**A tyre-related risk is involved in every seventh fatal crash.**

## Heightened risks in demanding conditions

The significance of tyres is emphasised in difficult road conditions, which shows in the risk assessments conducted by the investigation teams. Three out of four tyre-related accidents occur in snowy, icy or wet road conditions although, more often than not, accidents caused by cars and vans occur in dry summer or winter road conditions (*Figure 2*).

Tyres are deemed to have contributed to the accident in as many as 38 per cent of fatal collisions occurring in snowy or icy conditions (*Figure 3*). In wet conditions, some kind of tyre-related risk has been involved in 9 per cent of incidents in the 2000s, while in

the 1990s the proportion was almost 15 per cent. Tyre-related accidents in other road conditions have remained at previous levels.

## Three categories of tyre-related risks

Tyre-related risks observed in accident investigations are associated in over 90 per cent of incidents with poor tyres, unsuitable tyres or incorrect tyre pressure (*Figure 4*). Major risk factors are addressed in the following pages as a separate issue. Further enlightenment on how to bring risks under control is also obtained from the most recently conducted wet condition tests.

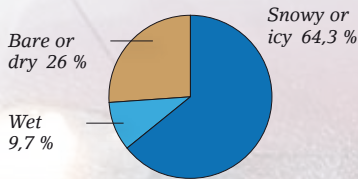
Other risk factors account for approximately 8 per cent of tyre-related risks in the 2000s, which is slightly higher than in the 1990s. Other tyre-related risks are so unique and varying in type that they will not be addressed in any greater detail here. Such risks include, for example, incorrect direction of tyre rotation, wheel bolts that are too short and the wrong type of rims.

**Three out of four tyre-related accidents occur in demanding road conditions.**

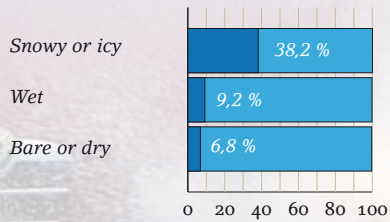
**FIGURE 1. Tyre-related accident trends.**

Tyre-related accidents:	1991-99	2000-05
- total (number)	345	198
- annually (average)	38,3/year	33,0/year
- proportion of all (%)	16,9 %	15,3 %

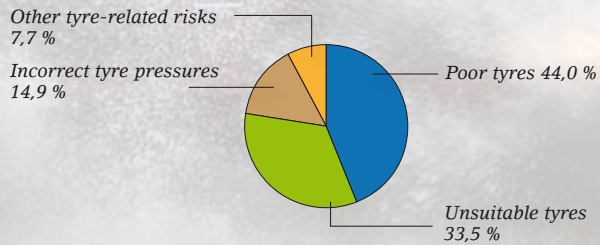
**FIGURE 2. Tyre-related accidents by type of road conditions in 2000s.**



**FIGURE 3. Proportion of tyre-related accidents by type of road conditions in 2000s.**



**FIGURE 4. Commonest tyre-related risks in 2000s.**



## Tyre-related risk factors:

# POOR TYRES

Studded tyres in poor condition or worn tyres are the commonest tyre-related risks found in cars and vans. The former risks are more often than not associated with wear and the number of studs on the tyres, and the latter with the tread depths of either summer or winter tyres. Previously, the problem of worn tyres was concentrated in summer tyres, but in the 2000s it has been considered a risk factor equally often in both summer and winter tyres.

Summer tyre wear has typically been deemed a tyre-related risk only when the tread depth of the most worn tyre has been less than 1.6 mm. In the case of winter tyres, on the other hand, worn tyres mainly mean tyres with a tread depth of 3–5 mm, which can still be legally used.

### Clear differences in wet condition tests

Tyre performance weakens significantly with wear, especially in demanding road conditions. In the wet condition test carried out by Test World in

2005–2006, summer tyre performance appears to fail dramatically well before reaching the minimum tread depth required by law.

In order to avoid aquaplaning in water less than a centimetre deep motorists should, if driving on poor tyres, drive 30 km/h slower than on tyres in a good condition (*Figure 6*). In wet braking, the speed of a car with poor tyres is still 40 km/h in a spot where a car with good tyres would stop (*Figure 7*).

### Safety actions and proposals

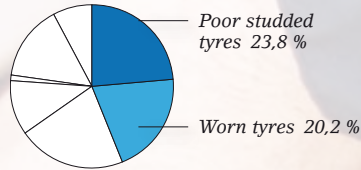
Since autumn 1997, motorists have been made effectively aware of the condition of their tyres by means of so-called “tyre raids”. In less than ten years the proportion of cars with poor tyres on Finnish roads has declined by more than 10 percentage points (*Figure 8*). Despite the improvement in tyre condition, worn tyres pose an accident risk as frequently as in the 1990s.

During the 2000s the investigation teams have made 85 improvement proposals relating to tyre safety. The majority of these concern education. Information letters urged emphasis to be placed on the importance of tyre condition, especially in extreme conditions. Proposals were also made to improve the monitoring of tyre condition and develop systems to detect tyre wear, for example (*Figure 16*).

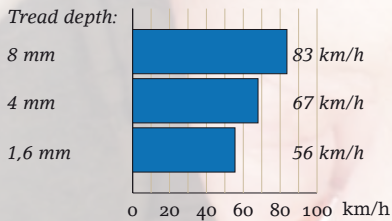
#### *Recommendations for tread depths*

- at least 4 mm for summer tyres
- at least 5 mm for winter tyres

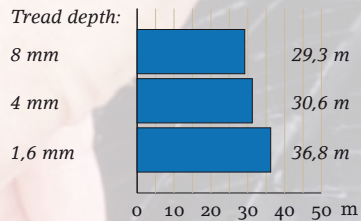
**FIGURE 5. Proportion of poor tyres in all tyre-related risks.**



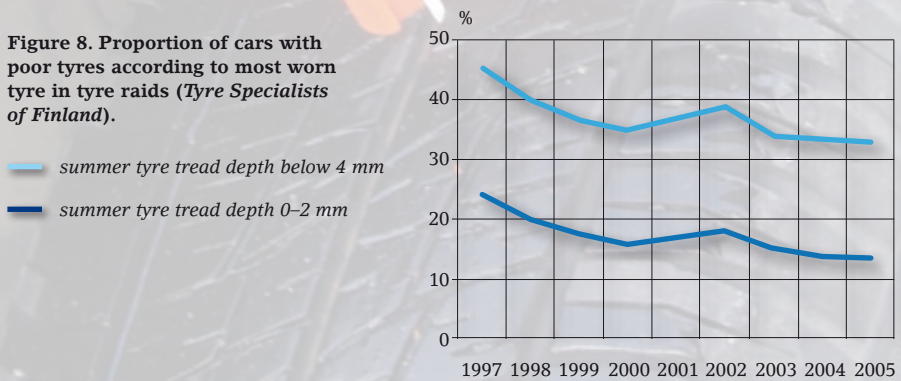
**FIGURE 6. Aquaplaning speeds with summer tyres of varying condition (Test World Oy, 2005).**



**FIGURE 7. Braking distances on wet asphalt with summer tyres of varying condition (Test World Oy, 2005).**



**Figure 8. Proportion of cars with poor tyres according to most worn tyre in tyre raids (Tyre Specialists of Finland).**



**Tyre-related risk factors:****UNSUITABLE TYRES**

Tyres that are unsuitable for the prevailing road conditions, tyres of disparate properties or tyres inappropriate for the vehicle represent approximately one third of all tyre-related risks. Tyres that are unsuitable for the prevailing conditions are typically studless winter tyres or summer tyres used in snowy or icy winter conditions. The use of winter tyres in wet conditions has never been considered a risk factor.

Tyres of disparate properties generally mean mixed summer and winter tyres. Also included are cases in which there are both new and worn tyres on the same vehicle. Tyres inappropriate for the vehicle usually refer to rims and tyres that are too big for the vehicle. Risks relating to unsuitable tyres have declined slightly compared with the previous decade.

**Shortcomings in anticipating road conditions**

During the 2000s, there have been only two fatal collisions caused by driving on summer tyres in the period when winter tyres are compulsory in December, January and February, while as many as ten similar accidents have occurred in October and November. It seems, then, that the first icy conditions of autumn always come as a surprise to motorists.

According to the wet condition tests carried out by Test World winter tyres cannot with safety be used to the end of their life, even during the summer. A half-worn winter tyre seemed to be as poor in wet conditions as a totally worn-out summer tyre (*Figures 10 and 11*). Motorists are presumably unaware of the risks, as every tenth motorist caught in the tyre raid in September 2006 was driving on winter tyres.

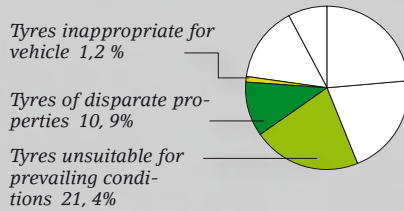
**Safety actions and proposals**

The first slippery days usually arrive as early as October, at which point tyre mounting service points become backlogged and many motorists continue driving on summer tyres or change over to old winter tyres. In all probability motorists in Finland would be more prepared for winter conditions if studs were sanctioned more clearly already at the beginning of October, as is the case in Sweden.

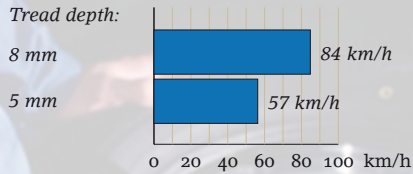
In the 2000s, the investigation teams have come up with a total of 62 safety proposals relating to unsuitable tyres. One investigation report recommended developing information for motorists on road conditions and winter traffic risks. The report also urged the relevant groups to reduce asphalt wear arising from studded tyres by means of product development (*Figure 16*).



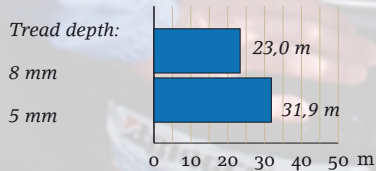
**FIGURE 9. Proportion of unsuitable tyres in all tyre-related risks in all tyre-related risks.**



**FIGURE 10. Aquaplaning speeds on new summer tyres and half-worn winter tyres (Test World Oy, 2006).**



**FIGURE 11. Braking distances on wet asphalt on new summer tyres and half-worn winter tyres (Test World Oy, 2006).**



**Tyre-related risk factors:****INCORRECT TYRE PRESSURES**

Excessively low or disparate tyre pressures represent some 15 per cent of all risk-related risks. Risks relating to tyre pressures are not emphasised in demanding driving conditions in the same way as risks relating to poor or unsuitable tyres. Nearly half of tyre pressure related risks arise in dry summer or winter conditions.

In accident statistics incorrect tyre pressures are involved when there is a pressure deficit of more than 20 per cent in one or more tyres. Risks relating to incorrect tyre pressures have declined slightly compared with the previous decade.

**Impact on safety, economy and environment**

Tyre pressures carry considerable significance in terms of safety, economy and the environment. According to the Michelin survey, one in five Finns drive on tyres with a pressure deficiency of at least 0.5 bar (*Figure 13*). Driving on under-pressurised tyres makes the car harder to control in extreme conditions, vehicle pull increases and the tyres can get a blow-out.

Low tyre pressures increase fuel consumption by 3–6 per cent and shorten the tyre's service life by 25–50 per cent. By employing the correct tyre pressures the average motorist can save at least EUR 10 per month in

Low tyre pressures increase motoring costs by as much as EUR 100 million a year.

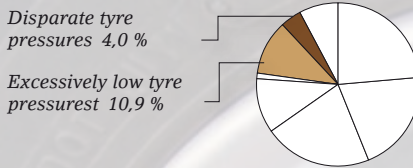
tyre and fuel costs. Applying the same formula, Finnish motorists would save as much as EUR 100 million annually by using correct tyre pressures (*Figure 14*).

**Safety actions and proposals**

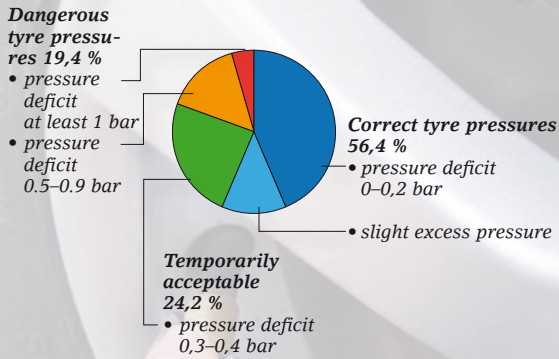
Tyre pressures should be checked at least once a month in accordance with the recommendations of the tyre or vehicle manufacturer. Operators in the tyre business have drawn particular attention to tyre pressures both in their own information efforts and in joint campaigns. Regular checking of tyre pressures will be made easier, faster and more reliable for motorists in the future.

During the 2000s the investigation teams have put forward a total of 26 safety proposals relating to tyre pressures. The investigation reports generally urged that attention be drawn to the significance of tyre pressure through education and information. Development of systems indicating tyre air pressure for passenger cars was also encouraged (*Figure 16*).

**FIGURE 12. Proportion of incorrect tyre pressures in all tyre-related risks.**



**FIGURE 13. Passenger car tyre pressures according to tyre with least pressure (Michelin Nordic, 2006).**



**FIGURE 14. Example calculation of the impact of under-pressurised tyres on motoring costs (Tyre Specialists of Finland).**

Annual costs:	Correct tyre pressures	Pressure deficit 0.5-1 bar
Fuels	EUR 2,000	EUR +60-120
Summer and winter tyres	EUR 200	EUR +70-200

*Estimation basis:*

- annual number of kilometres driven 18,000 km
- tyre service life 4 motoring periods (with correct pressures)

# KEY CONSIDERATIONS AND CHALLENGES

Tyres are the most significant risk factor affecting the driving properties of cars and vans in accident statistics recorded in Finland in the 2000s. The role of tyres is highlighted in demanding and rapidly changing road conditions. A tyre-related risk is involved in two out of five fatal collisions occurring in snowy or icy conditions, for example. Tyre-related risks are usually associated with poor tyres, unsuitable tyres or incorrect tyre pressure.

Tyre safety seems to have improved slightly compared with the 1990s. The proportion of tyre-related accidents has decreased from just under 17 per cent to the current 15 per cent. Tyre-related accidents have declined especially in wet conditions. On average there have been 33 fatal collisions a year in which tyres were deemed to have contributed to the accident (*Figure 15*).

## **Individual responsibility needed**

According to the risk accumulation model used in accident investigation, accidents always involve a number of risks relating to human behaviour, the vehicle or the traffic environment. A human factor of some kind is present as a direct or background risk in 99 per cent of fatal collisions. Seemingly unforeseeable factors which everyone

can nevertheless affect with the right attitude are involved in many of these accidents.

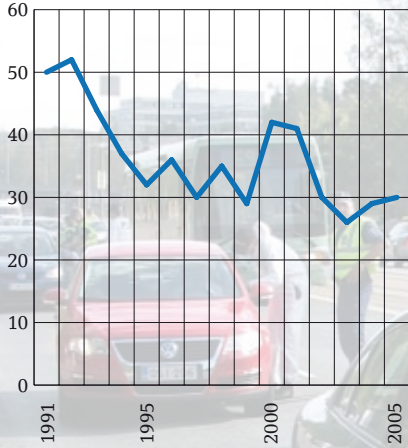
During the 2000s, the road accident investigation teams have made 186 safety proposals relating to tyre risks which fall into the categories of education and information, traffic enforcement, equipment development and equipment requirements (*Figure 16*). Safety proposals will continue to be screened and refined even more effectively based on the study carried out by the University of Turku.

## **Working for road safety together**

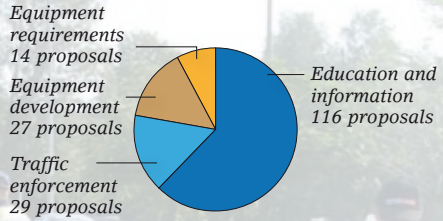
According to the long-term vision for road safety, the road traffic system must be designed so that no one needs to die or be seriously injured on the roads. The national road safety programme for 2006–2010 sets the target of reducing annual traffic fatalities to fewer than 100 by the year 2025; this would be one quarter of the present figure (*Figure 17*).

Developers and users of the road traffic system must co-operate and take their share of the responsibility to achieve the target. Safety measures cost an estimated EUR 2.8 million per fatality prevented, which is more or less equal to the theoretical price of one traffic fatality.

**FIGURE 15. Trends in number of tyre-related accidents.**



**FIGURE 16. Distribution of safety proposals concerning tyre-related risks in 2000s.**



**FIGURE 17. Trends in number of fatal collisions and traffic deaths (Liikenneturva, Central Organization for Traffic Safety in Finland)**

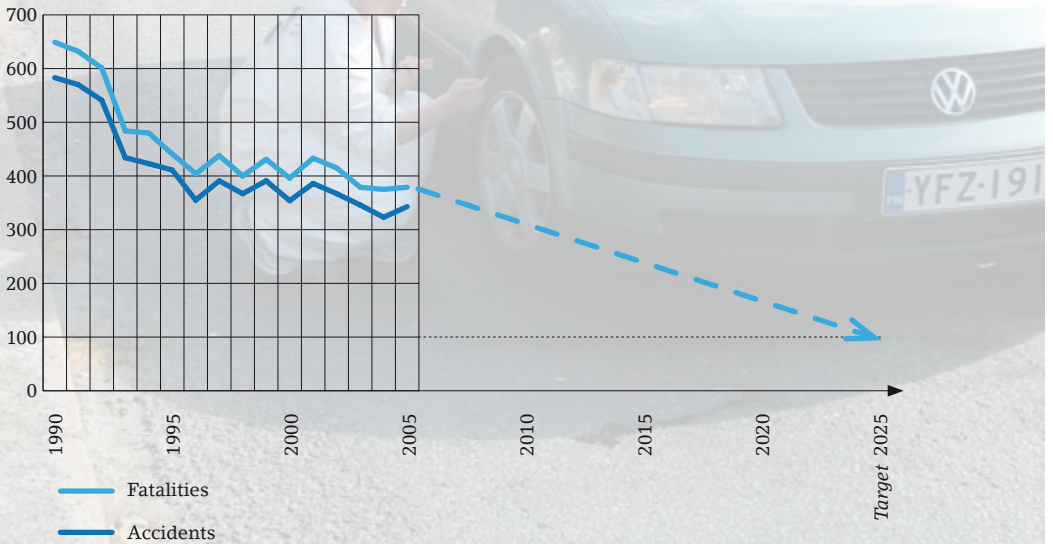


Photo: Juha Siltala/Rengasinkki

## Appendix 1:

# ROAD ACCIDENT INVESTIGATION IN FINLAND

The road accident investigation teams began their work on a voluntary basis at the end of the 1960s. From the outset, the aim was to generate data for the promotion of road traffic safety through investigating road accidents in collaboration with experts from different fields. Nowadays, the investigation teams investigate all fatal road and cross-country traffic accidents as well as other separately specified accidents.

### **From voluntary to statutory in 2001**

The activities of the road accident investigation teams have been statutory since 2001 (Act on the Investigation of Road and Cross-country Traffic Accidents, 19.1.2001/24). The Ministry of Transport and Communications appoints a road accident investigation delegation to steer the activities. The practical work of the investigation teams is handled by the Finnish Motor Insurers' Centre, or more precisely, by its road safety unit.

The delegation appoints members to 20 regional investigation teams, which comprise experts from special-

ist areas: police, vehicle technology, traffic technology, medicine and behavioural sciences. A railway expert is used in rail accidents and other experts are utilised on a case-by-case basis. The investigation teams have a total of some 260 members.

### **Investigations to promote road safety**

Accident investigations examine the course of events leading to a road accident, risk factors, consequences and conditions in order to be able to ascertain the causes and prevent similar incidents from occurring in the future. Based on the investigation the necessary proposals on safety enhancement measures are made.

After the final meeting of the team, the report and other material is compiled into a final investigation report. The material is filed and stored in an accident database on the basis of which the Finnish Motor Insurers' Centre prepares various annual reports. The investigation reports and database are available for use by the authorities and researchers.

**Appendix 2:**

# KEY TERMS AND DEFINITIONS

**Motor vehicle accident**

A collision or single accident involving the death of at least one person in a motor vehicle.

**Tyre-related accident**

A motor vehicle accident caused by a passenger car or van in which the background risk relating to the tyres is deemed to have contributed to the accident.

**Party responsible for the accident**

The driver in a single accident or the party in a collision who is deemed to have contributed to causing the accident more significantly than the other party involved.

**Immediate risk factor**

A risk factor deemed to have actively contributed to causing the accident. For example, the driver's error of judgement, a tyre blow-out or unexpected slippery conditions.

**Background risk**

A risk factor deemed to have been a contributory factor behind the acci-

dent, accounting for the immediate risk. For example, speeding, incorrect tyre pressures or the condition of the road.

**Vehicle risks**

Vehicle risks are associated with driving properties, visibility of the vehicle and visibility from the vehicle, and risks connected with collision safety. Risks associated with driving properties are grouped into steering and control, drive system and gear changing, tyres, acceleration, braking, sensitivity to rollover, and suspension and shock absorbers.

**Tyre-related risks**

Risk factors related to tyres are background risks by nature. The most typical risks are poor studded tyres, worn tyres, tyres that are unsuitable for the prevailing conditions, tyres of disparate properties and low or disparate tyre pressures.

Additional information:  
[www.liikennevakuutuskeskus.fi](http://www.liikennevakuutuskeskus.fi)



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