

"Road Safety and Environmental Aspects of Winter Maintenance"

Presented (In PowerPoint) by Mr Jaak Liivaleht, Chief Specialist of the Planning Department of the Estonian Road Administration (approximately 20 minutes)

Traffic accidents in winter conditions (from November to March) are increasing: getting close to 40% of the traffic accidents with human casualties throughout the year.

Why are traffic accidents increasing in this period?:

There could be many reasons:

Winter service is not as good to ensure the safe traffic in every way in winter as well...

- the number of cars and traffic density is high also in winter conditions and the chances of possible conflict situations are big.

But it can be also assumed

- that the reason for an increase in traffic accidents is not objective conditions alone (weather, precipitation, condition of road covering), but also drivers' subjective attitude toward traffic safety.

In bad weather or road conditions drivers want to continue comfortable and fast ride and cannot make the right judgment in changed traffic conditions.

For several years Estonian Road Administration has carried out surveys in order to find out the opinion of road users on driving conditions during winter on state highways.

According to the performed customer survey, the driving conditions on main highways were rated as good, on secondary roads as sufficient, while the smaller roads were in much worse condition. The number of these drivers has increased who rate the efficacy of information distribution related to driving conditions in winter as good or as excellent. Important source of information is the traffic announcements on radio, but also the home page of Road Administration.

Traffic safety campaigns have been fruitful, the public awareness has been increased. Pedestrians are using more reflectors or flashlight when walking on highways. Most of the drivers are using correct winter tires. Wrong speed is the main cause of accidents in winter.

It is requested that the efficacy of the snow control would be improved on all highways and de-icing on smaller roads, that temporary traffic signs and markings would be used, also new information boards would be placed by the roads. It is requested that besides the salt also other nature and driver friendly materials would be used.

In countries with cold climate, snow clearing and de-icing of roads in winter is inevitable from the viewpoint of ensuring normal traffic conditions. In order to understand what would happen if there were no winter maintenance, consider the cases of unexpected snowfall or road icing in regions where such phenomena are uncommon and the required road maintenance solutions are therefore lacking. However, unexpected extensive snowfalls and road icing may cause significant problems in the North as well.

In the past, winter maintenance was often limited to mechanical snow clearing and occasional sanding. As motor transport evolved, such measures proved to be insufficient, and the importance of de-icing increased the most; chemistry-based methods (various salts) were introduced for performance of the treatment. At the same time, however, the negative impacts resulting from the use of chemicals – damage to green areas, increased vehicle corrosion, etc. – are becoming more and more problematic. Since it is impossible to stop using chemicals for de-icing (at least today), it is necessary to concentrate primarily on what chemicals should be used,

their optimal amounts and application methods, the negative impacts associated with their use, and possibilities for alleviation of the impacts.

The amounts and types of bulk material depend on the nature of winter.

The de-icing materials used in Estonia today can be divided into three groups:

- ✓ Pure chlorides, whether in granular form or as a solution,
- ✓ Mix of chlorides and sand or siftings,
- ✓ Sand and siftings.

When the developments that have taken place during the last years are considered, it is evident that the use of pure salts has increased, while the total amount of bulk materials used has continuously decreased (this is so in the Road Administration's system).

The amount of salt residues is of significant importance – salts that contain more residues causes more damage to roadside vegetation. Therefore, the environmental impact depends on the choices made by the undertaking.

Sand-salt: The use of sand-salt is expensive due to mixing costs and larger amount of bulk material required (compared to pure salt). Another negative quality is that the sand-salt mix corrodes vehicle bodies faster than pure salt (therefore, the influence of bulk materials on vehicles has reduced over the last twenty years), as well as that the sand is difficult to recover in spring. Nevertheless, sand-salt mix is irreplaceable in Estonian conditions, especially at low temperatures.

Causes of differences in the condition of roadside green areas As concerns roadside vegetation, no visible damage can be seen at some locations, while in some streets the pines are of red and brown colour in spring (although this is a result of complex pollution) and the maples start to lose leaves already at the end of summer. Accordingly, plant species included in roadside vegetation vary at different locations (some plant species withstand better an environment rich in chlorides), or the salts exert more influence on the vegetation. There are three influencing factors:

1. poor condition of road surface – salt is splashed from holes onto green areas.
2. vehicles travel too fast – the higher the speed, the higher and further into the green areas is the salt thrown from the street.
3. failure to observe instructions (e.g. thawing of snow by salt)

The sodium and chlorine contents differ by region because of several reasons – times of salt application, variations in salt amounts and snow volumes cleared. Differences arising from relief variations are very important as well. For example, salt concentration is higher in lower terrain areas and vice versa, which can be explained by flowing of rain water and thawed water.

Salt spreading exerts negative influence on the environment. Although this negative influence cannot be eliminated, it can be reduced. Considering the information provided above, it is possible to draw some conclusions that are stated in this section.

Environmental safety may only be ensured through co-operation of several parties – the owner of the road, the undertaking responsible for road maintenance and the general public. In order to minimize the negative influence exerted by salt spreading, the following must be available:

- road surface of good condition;
- storm water sewer;

- curbstones and slabs of curbstone;
- functioning public transport;
- machinery utilising modern technology;
- functioning laws and regulations;
- appropriate storage and regular removal of snow and washing of roadside soil and trees in spring;
- prevention principle.

Road surface condition Good technical condition of road surface is a precondition to efficient clearing works in winter. Thus the snow is being removed from roads and the ice melted with salt, but the salty thawed water is still splashed from holes onto roadside by passing vehicles.

Storm water sewer: The thawed water that has nowhere to flow is absorbed in the soil and may reach groundwater. Existence and adequate functioning of storm water sewer is a precondition to minimization of the influence exerted by salts on vegetation.

Curbstones and slabs of curbstone concentration of salt is the highest in the immediate vicinity of the road (1-2 metres from the road). If all streets had curbstones and slabs of curbstone (preferably slightly inclined towards the road), the movement of salts would be unidirectional.

Public transport is more environment-friendly: The more people decide in favour of public transport, the less we burden our roads. Therefore, the general public also has an important role upon ensuring of environmental safety - public transport is the most environmental-friendly solution.

High-quality machinery: The machines used for road maintenance are undergoing constant development. In the Road Administration's system, the machinery tends to be somewhat old, but the possibilities for dosage adjustment are still sufficient.

Legislation to be followed and supervision: Constant control over undertakings performing winter maintenance would ensure improved environment-friendliness of their operation. In case of the Road Administration (winter maintenance performed both by undertakings and regional road offices), a supervision system and the respective regulations already exist.

Snow loading and removal: Snow clearing- is divided into several activities, including loading and removal of snow. The equipment used on highways allows throwing the snow off the road and avoiding the need for removal, except occasional removal of snow at intersections.

Washing of soil and trees in spring Washing of soil and trees is beneficial due to the following reasons: washing of roadside surfaces accelerates salt transfer through soil, and washing of trees avoids salt diffusion through leaves or needles. However, washing of the roadside soil is useless if the water is thrown back from the road surface to the roadside by passing vehicles.

The prevention principle should be applied upon road winter maintenance, since it allows reduction of the salting-related and general environmental risks, while possibly being economically advantageous.

The prevention principle should be applied both in the case of road owners and undertakings responsible for road maintenance. If both parties were made responsible for the well-being of roadside vegetation, measures would be taken in order to minimize the negative influence.

Within the study the pollution level of heavy metals was determined along the Tallinn-Tartu highway. 120 samples were collected from 13 profiles perpendicular to the road.

The results obtained characterise the pollution level of Pb and Cd in the upper 5-cm layer of roadside soil of investigated road sections in the result of traffic. Concentration of Hg and Cr on some profiles was investigated as well.

The results show that in the upper 5-cm layer of roadside soil in the result of traffic the concentration of Pb has increased for almost 10 ppm. Withdrawing from road its concentration decreases and at 30–50 m from the road is close to the background concentration. More intense pollution of Pb is observed at the road curves and crossroads.

In comparison with the source information the traffic has doubled or increased even more the concentration of Cd in the uppermost 5-cm layer of roadside soil. At the distance of 30–50 m from the road the pollution was not in fact identified.

In all analysed samples the concentration of Pb and Cd is lower than the target value established in Estonia (concentration considered safe for the health).

All concentrations of Hg and Cr determined within the present study are lower than the average concentrations in the humus horizon of Estonian soils formed on tills, as well as average concentrations in Estonian sands. The concentrations of these elements remain within their prevailing concentrations.

Studies about environmental impacts of winter maintenance should be provided to find out the range of negative effects. According to analysis proper environmental mitigation measures should be investigated in future.

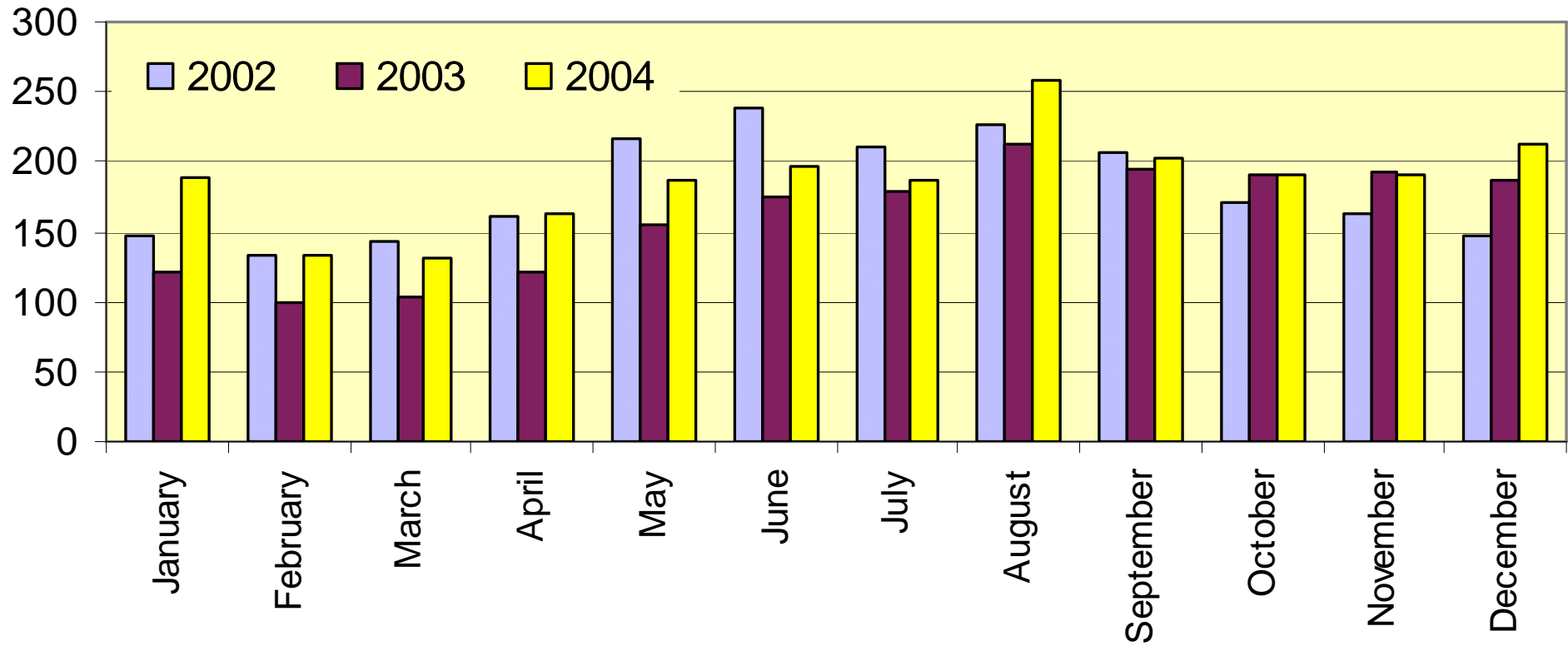


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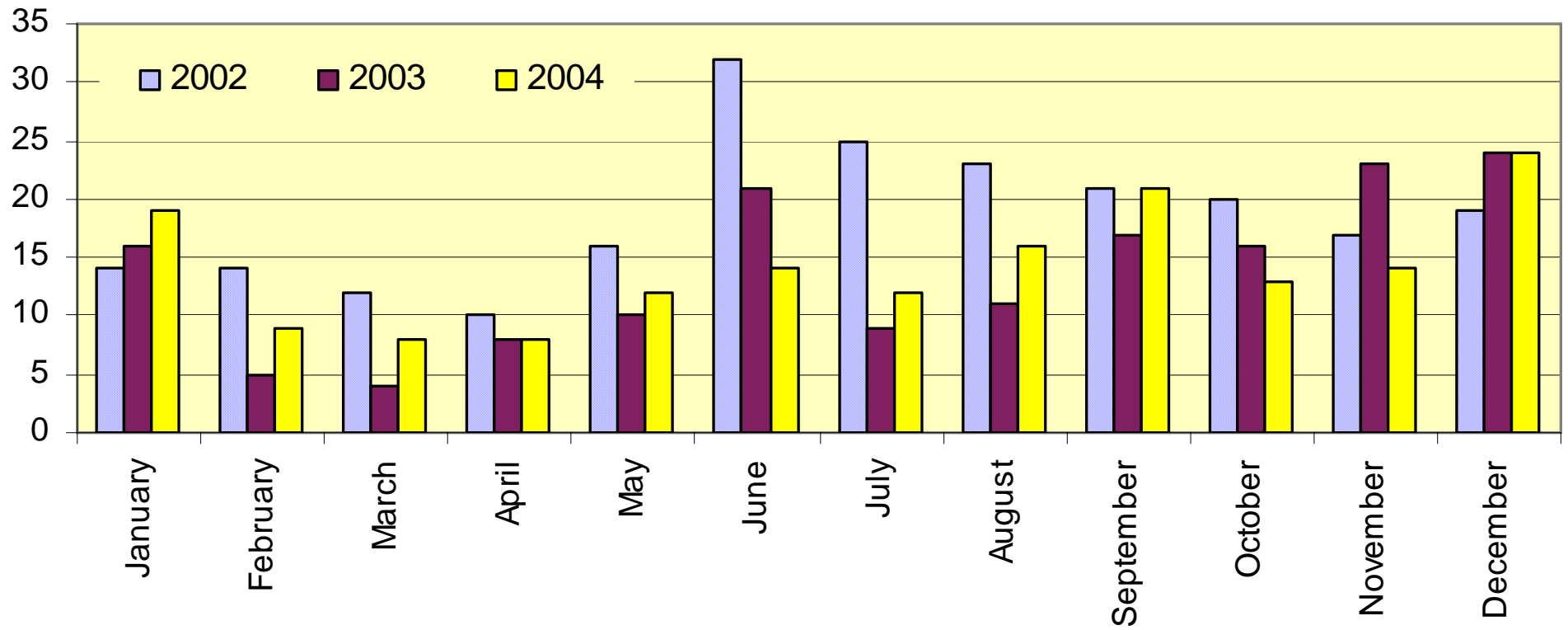
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Composed by Hendrik Puhkim

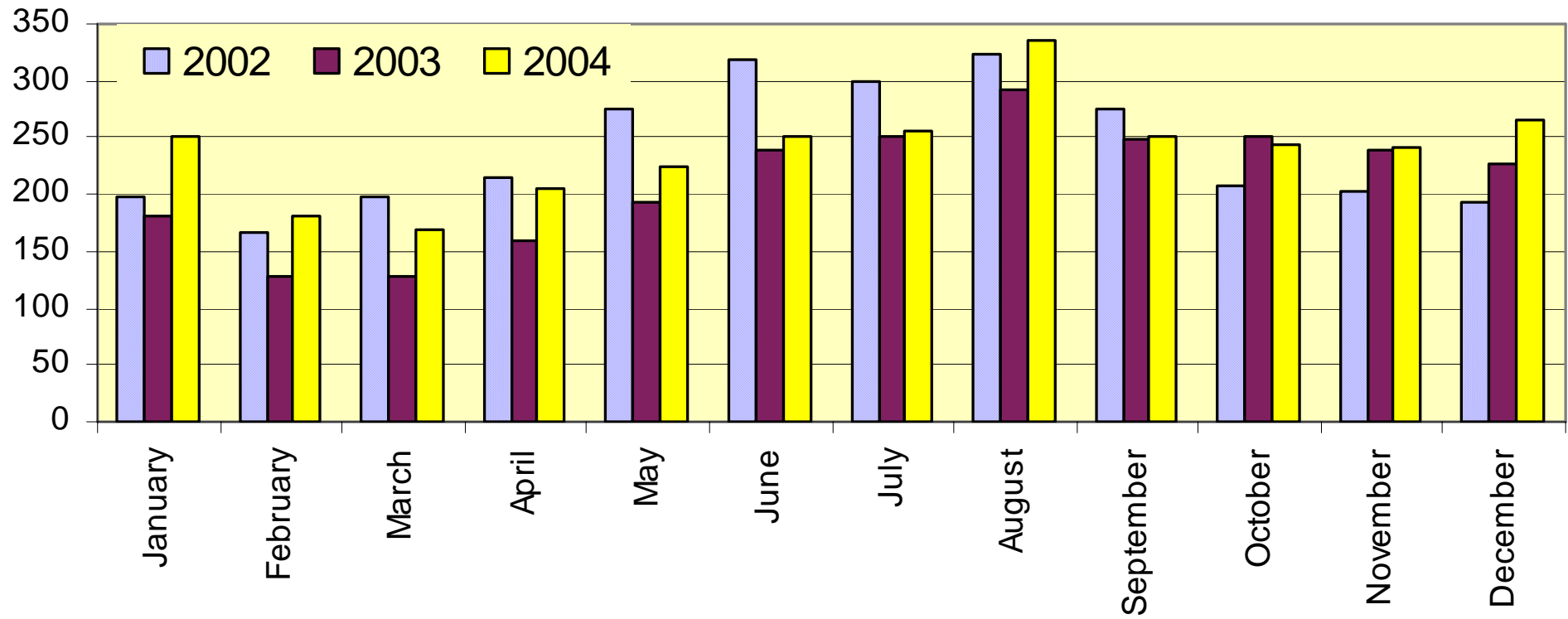
Number of Road Accidents with Personal Injury in Estonia



Number of Killed Person in Road Traffic Accidents



Number of Injured Person in Road Traffic Accidents



Traffic accidents in winter conditions

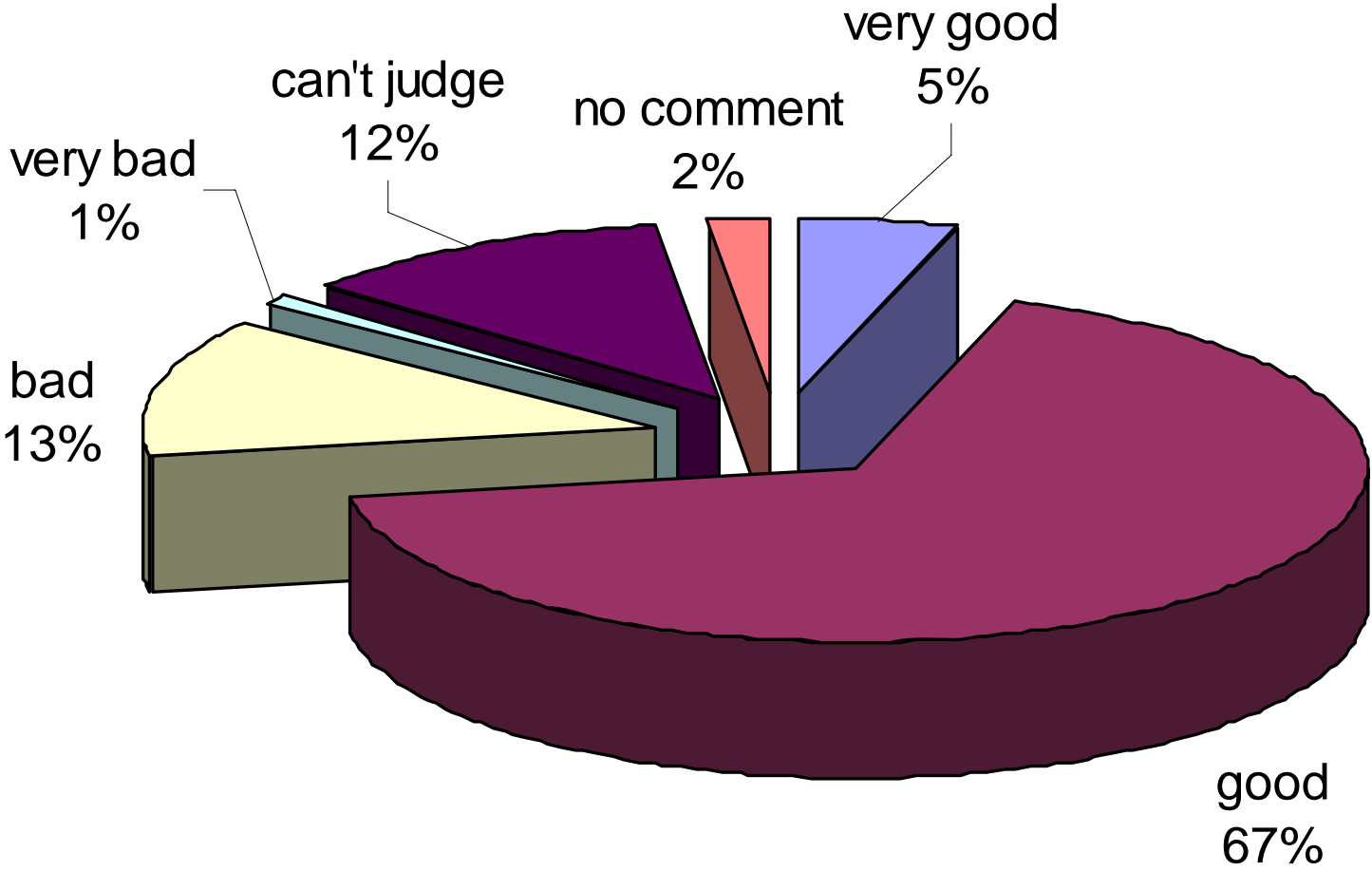
	Accidents 2164	Killed 223	Injured 2868	Accidents 1931	Killed 164	Injured 2539	Accidents 2243	Killed 170	Injured 2876	Accidents 1206	Killed 85	Injured 1566
	2002			2003			2004			2005		
Januar	147	14	198	122	16	180	189	19	250	175	19	201
Februar	134	14	197	99	5	129	134	9	182	118	7	167
March	143	12	197	103	4	129	131	8	170	136	10	177
November	163	17	202	192	23	238	191	14	242			
December	147	19	192	187	24	228	213	24	266			
SUM	734	76	986	703	72	904	858	74	1110	429	36	545
%%	33,9	34,1	34,4	36,4	43,9	35,6	38,3	43,5	38,6	35,6	42,4	34,8

	2002	2003	2004	2005 (Jan-Mar)
Number of Accidents by treated Road surface	31	46	53	44
%% of Number of accidents by Wintercondition	4,2	6,5	6,2	10,3
Driving with inadequate speed by the slippery road	111	114	200	64
%%	15,1	16,2	23,3	14,9

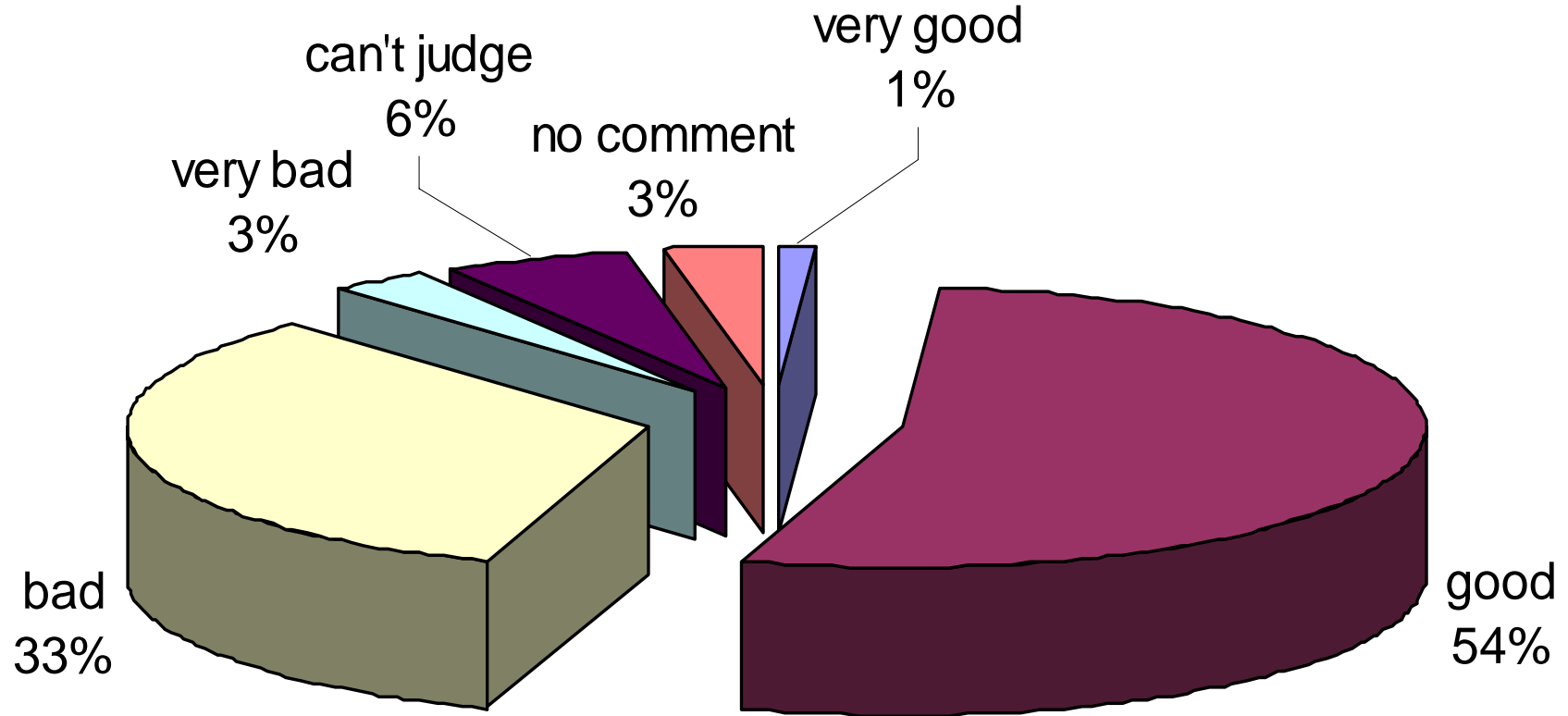
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- In bad weather or road conditions drivers want to continue comfortable and fast ride

- According to the performed customer survey, the driving conditions on main highways were rated as good, on secondary roads as sufficient, while the smaller roads were in much worse condition.

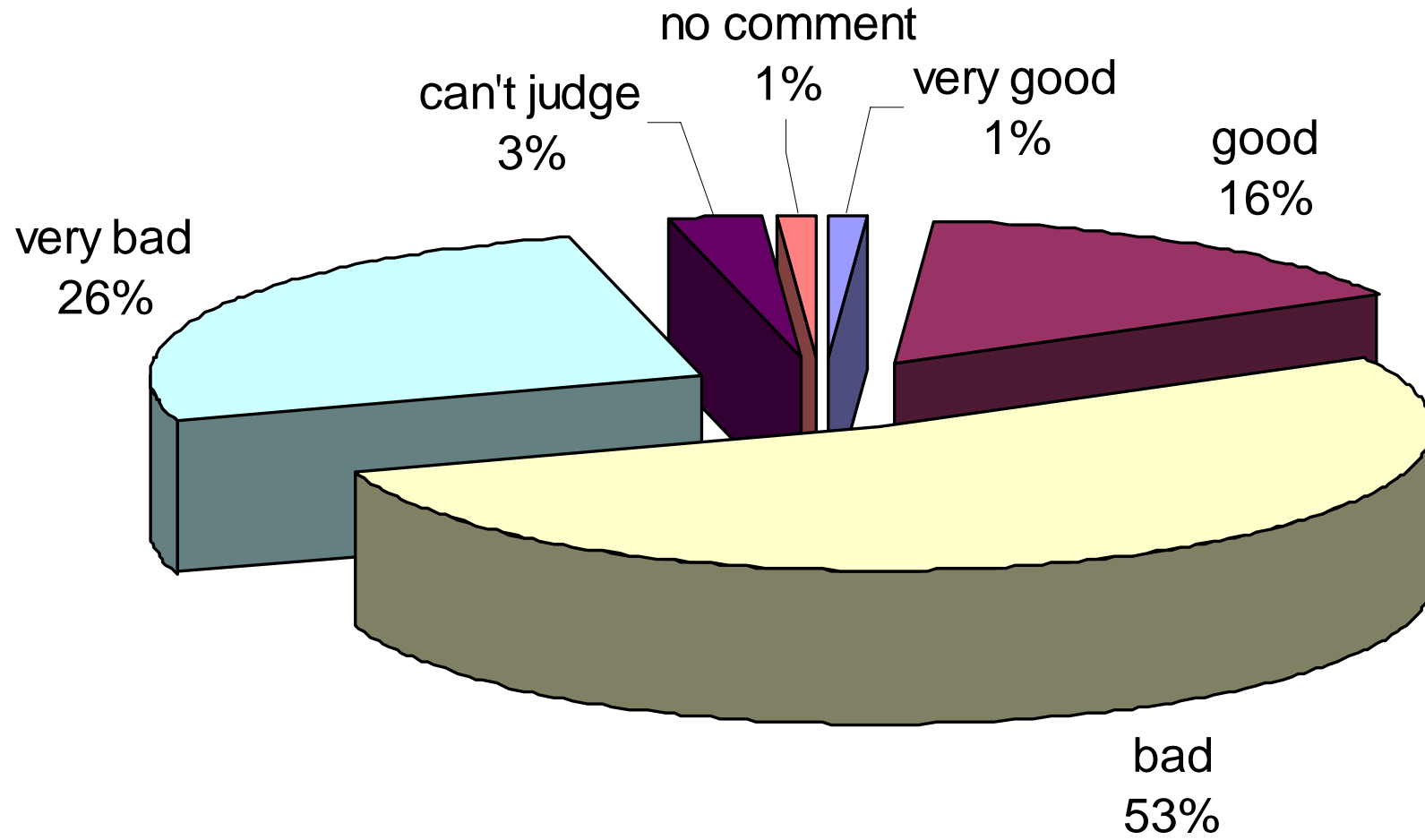
Tallinn-Narva, Tallinn-Tartu-Võru-Luhamaa ja Tallinn-Pärnu-Ikla highways 2005



Other bigger highways 2005

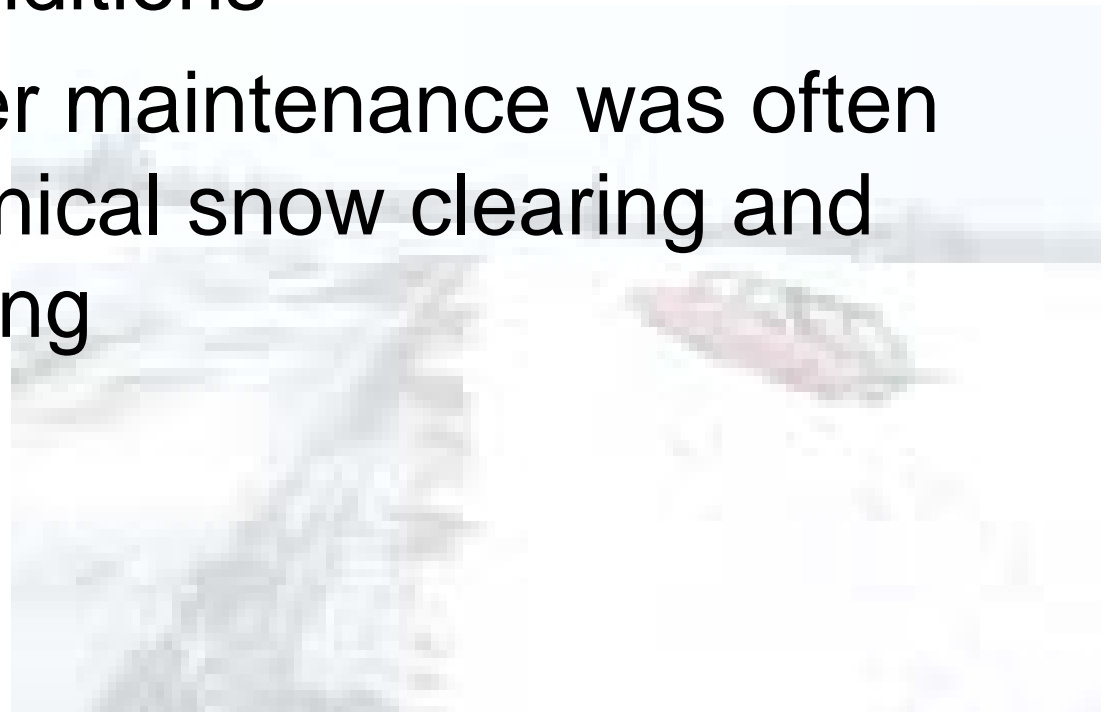


Other smaller roads 2005



- The number of these drivers has increased who rate the efficacy of information distribution related to driving conditions in winter as good or as excellent

- In countries with cold climate, snow clearing and de-icing of roads in winter is inevitable from the viewpoint of ensuring normal traffic conditions
- In the past, winter maintenance was often limited to mechanical snow clearing and occasional sanding

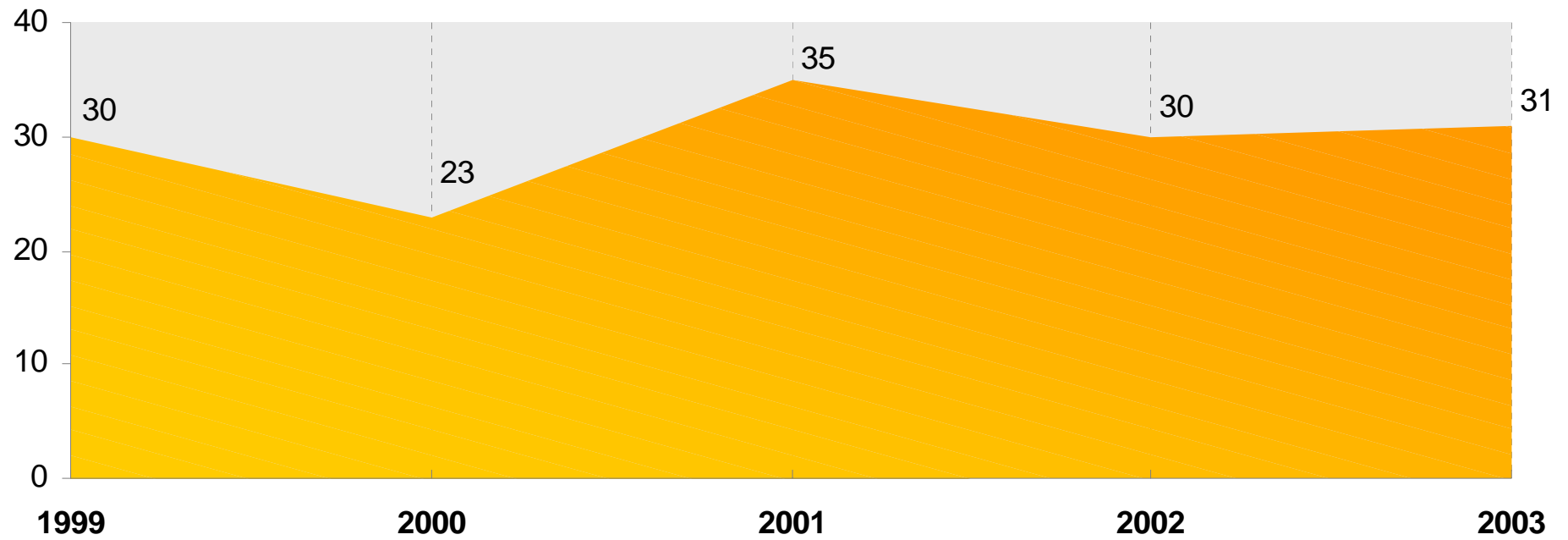


The de-icing materials used in Estonia today

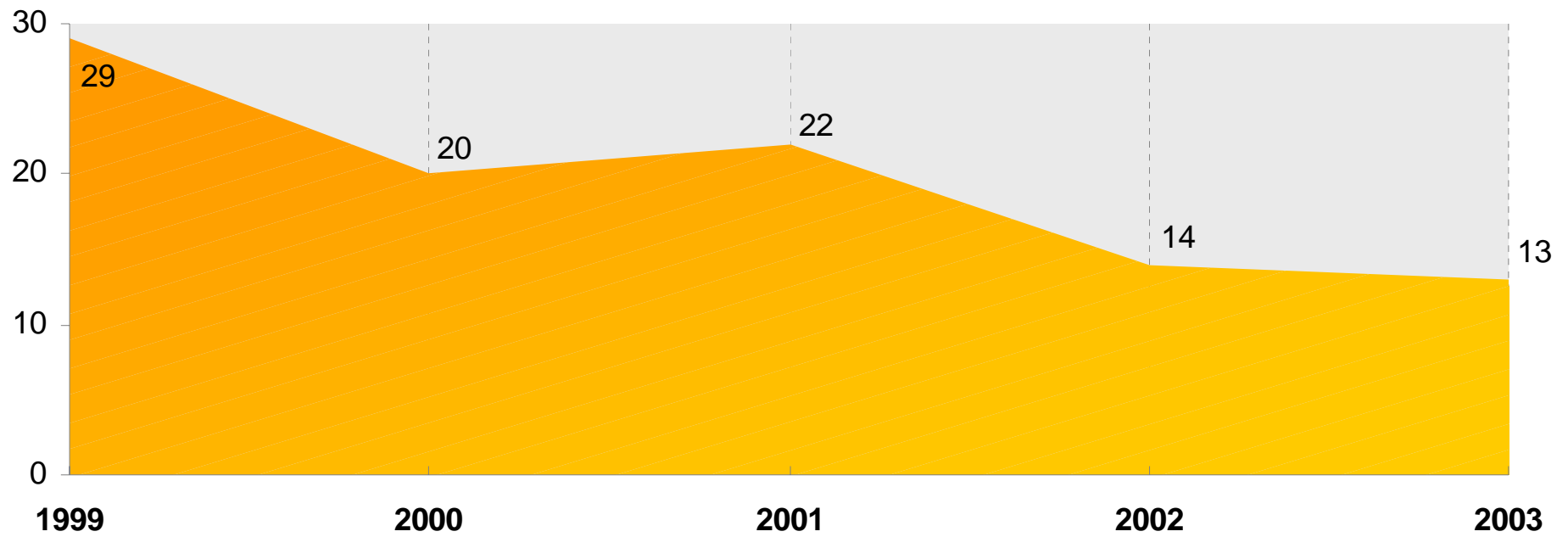
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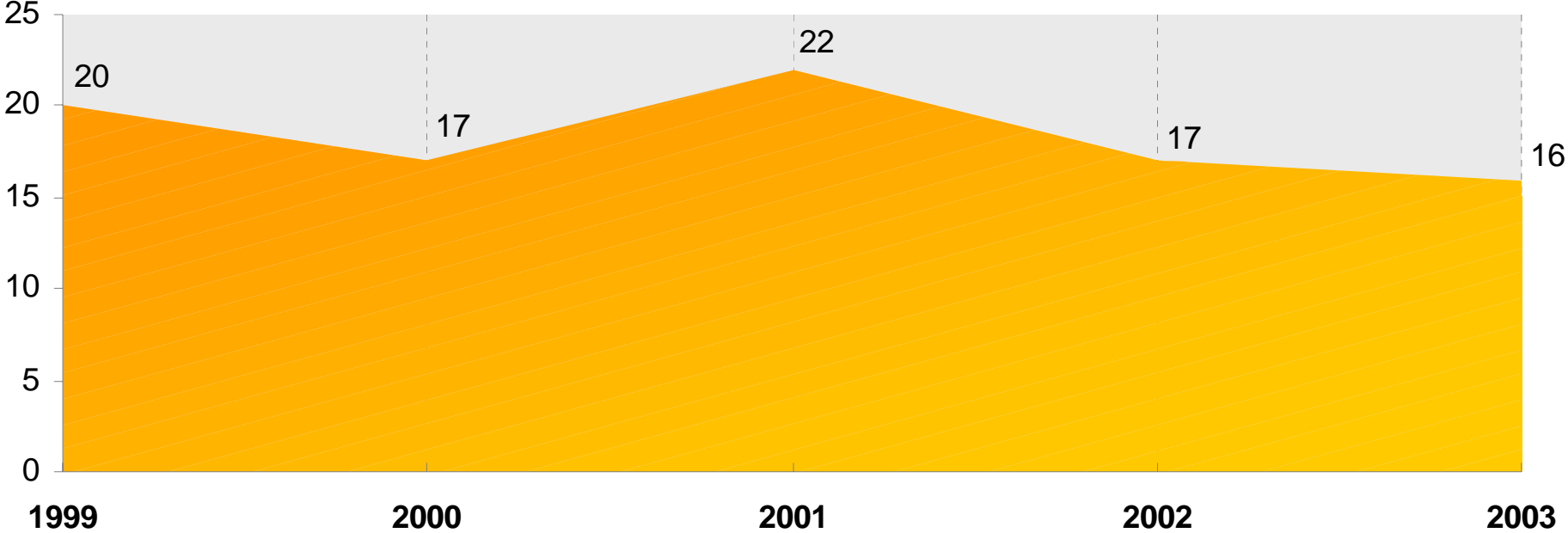
Use of chlorides



Use of sand mixed with salt

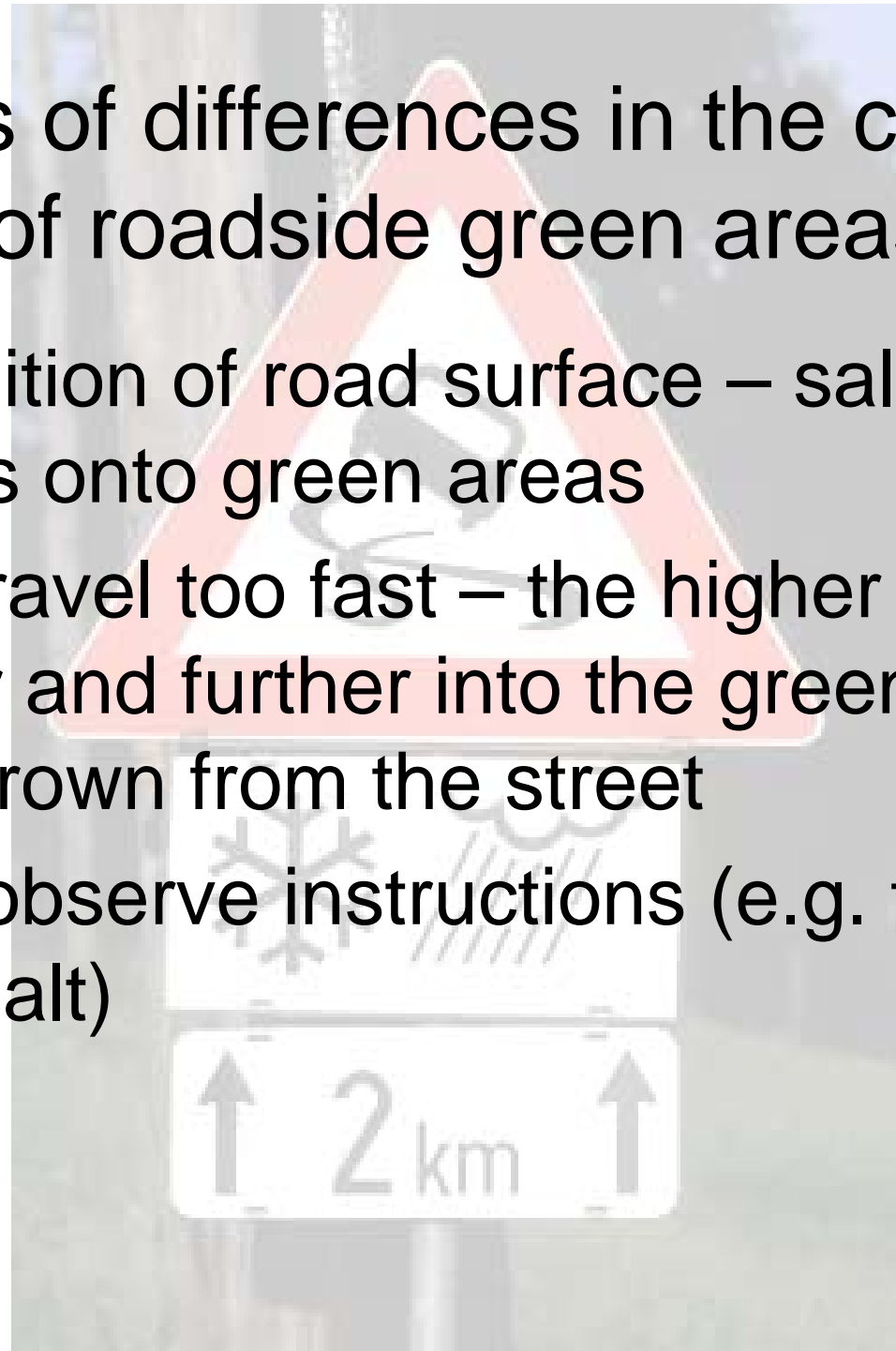


Other minerals



Causes of differences in the condition of roadside green areas

- poor condition of road surface – salt is splashed from holes onto green areas
- vehicles travel too fast – the higher the speed, the higher and further into the green areas is the salt thrown from the street
- failure to observe instructions (e.g. thawing of snow by salt)





Pine trees near the road are polluted, trees farther are green



Pine branch affected by salt

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Statements (1)

- Good technical condition of road surface is a precondition to efficient clearing works in winter
- The thawed water that has nowhere to flow is absorbed in the soil and may reach groundwater
- Concentration of salt is the highest in the immediate vicinity of the road (1-2 metres from the road)

Statements (2)

- The more people decide in favour of public transport, the less we burden our roads
- The machines used for road maintenance are undergoing constant development
- Constant control over undertakings performing winter maintenance would ensure improved environment-friendliness of their operation

Statements (3)

- Snow clearing- is divided into several activities, including loading and removal of snow
- Washing of soil and trees is beneficial due to the following reasons:
 - washing of roadside surfaces accelerates salt transfer through soil
 - washing of trees avoids salt diffusion through leaves or needles

Conclusion

Studies about environmental impacts of winter maintenance should be provided to find out the range of negative effects. According to analysis proper environmental mitigation measures should be investigated in future