Road Safety – Road Maintenance Strategies

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No maintenance … no safety problems …
The costs of accidents …

In average 2 times more than the costs of road maintenance
- on roads with heavy traffic (motorways ..) 5 times - even
10 times times - more than the costs of road maintenance

Road maintenance has a great effect to road safety. In practice a good strategy is a combination, a balance between safety, environment, costs…

It is worth to concentrate, direct attention towards right maintenance works.
Relation between Costs and effects of Maintenance

Effect of road maintenance

Costs of maintenance

Effect of road maintenance

Change of effect when changing maintenance

Quality of maintenance, road condition
Road Safety and winter time

Frictions / Relative stopping distances

- Dry pavement (asphalt): 0.7 … 0.8 / 1.0
- Wet pavement: 0.5 … 0.7 / 1.25
  - Sandy ice: 0.2 … 0.3 / 3.0
  - Dry ice: 0.1 … 0.3 / 3.75
- Wet ice: 0.05 … 0.1 / 7.5
All types of accidents increase in winter condition.
On road with snow risk is 2 times bigger than on bare, dry road but 10 … 30 times bigger if bad road condition (snow or/and ice) occurs unexpectedly, without warning and if the winter condition occurs seldom (f.e. southern and northern Finland).

About accidents in winter:
- Head-on collisions have bad consequences (side slip)
- Off-road accidents have milder consequences (lower speed, smooth road sides)
- Early and late winter and holydays with peaks in traffic are risk time
- Risk is especially high when the road condition changes rapidly
- Especially amount of bus and truck accidents increases in winter time
- For pedestrians icy pavement is a challenge (is even worth to buy studded shoes for elder people)
Safety and Winter Maintenance

- De-icing and snow removal (maintenance classes and quality requirements)
- Most effective on roads with heavy traffic
- Timing is important, e.g. preventive salting
- Good stand-by in early and late winter and during Christmas, New Year, Easter and schools’ winter vacation season
- Road weather stations and weather observations
- Attention also towards pedestrian and bicycle ways
- Real-time route forecast and warning service (Radio, mobile, e.g. Finnish VARO-service for professionals drivers; alerts road user mobile phone of accidents, road maintenance works, sudden changes in weather and road surface conditions)
Case from Finland
Winter Maintenance classes on main roads

1S = Bare. Friction min. day 0,30, night 0,28, under -6° C 0,25, (cycle time 2 h). Snow max. 4 cm (2,5 h, slush 2 h). Even surface.

1 = Mostly bare. Friction min. day 0,28, under -4° C and night 0,25 (cycle time 2 h). Snow max. 4 cm (4 h, slush 3 h). Evenness requirement 1 cm.

1b = Friction min. day 0,25, at night as needed (salting 3 h, sanding 4 h). Snow max. 4 cm, at night 8 cm (cycle time 3 h). Evenness 1,5 cm.

II = Friction according to traffic demands. Snow max. 8 cm, at night 10 cm (cycle time 4h). Evenness 3 cm.
Attention also towards pedestrian and bicycle ways

Pedestrian and bicycle paths are in 2 classes K1 and K2

- **Sanding** according to traffic by 05 am/06 am
- **Maximum snow** depth 3 cm (8 cm at night), cycle time 3 h/4 h
- **Evenness requirement** 2 cm, cycle time 12 h

- **Good timing** prevents traffic from the roads
- **Sufficient friction** for safety
- **No snow barriers**, they prevent biking and use of baby carriages
- Maintenance **must be completed** by 05 or 06
- Plowed or evened surface must be **roughened**
- In spring **slushy packed snow** should be removed to facilitate biking
- Packed snow bordering the road should be kept level enough to **prevent the traffic from moving onto the road**
Communicating road conditions improves safety and traffic flow

- Weather and other data from Road weather stations (fixed stations)
- Road cameras placed at strategic points
- Meteorological institutes
- Friction measurement (vehicle equipment)
- Road masters’ own observations
- Road users’ phone service; driver can report any problems
Road Weather Stations in Finland

More than 300.

Mostly in coastal areas, in sensitive points.
Safety and Road Pavements

- **Study in Finland;**
  - Even 4 mm water on the pavement is dangerous even driving with new tires → repaving when ruts more than 12 mm

- **Sweden;**
  - Friction during rain may go under 0,3 when a rut is more than 13 mm (60 km/h) or more than 4 mm (120 km/h)

- **UK;**
  - Accidents in rainy condition decreased 75 % after roughening pavement friction from 0,35 to 0,5 … 0,6
Safety and Road Sides

Mowing and brush cutting
- Chalmer, Sweden;
  - Accident density increases when a sight distance shortens
- Brush cuttings avoid animal accidents
- Especially in front of road signs and intersections
- Also on low-volume roads

Soften roadsides (more flexible, brake-away columns)

Median barriers
Safety and Road Signs; That isn’t all you can see!

90% of information comes through eye.
In dark eye is able to register 5% of normal.
The need of light doubles every 13 year.
Road signs in good condition improve traffic safety.

- Warning of curve: 20% reduction in accidents
  - Right-of-way sign: 20% reduction in accidents and 20% reduction in fatalities
- Mandatory stop sign: 40% reduction in accidents, 80% reduction in fatalities
In 5% of accidents there are something wrong in road markings.

One benefit way to improve safety is to maintain road markings and road signs.
Other Benefits of good Road Maintenance Strategy

For every 1 EUR not used in road maintenance you need to use 4 EUR on road repair.

OECD: for every 1 EUR not used in bridge preventive maintenance road authority need to use 5 EUR

+ road users’ extra costs 2 … 3 EUR
Road Maintenance Strategy

• Great capital invested in road network. Wise to take care of that.
• Preventive maintenance may improve safety and save money.
• Optimal road management is to minimize maintenance costs + road users’ transport costs
We need Innovations and Cost savings

Improved productivity through innovations

- Annual Change of Productivity of the Branch 1980-2001 (%)
- Re-Engineering and Innovation Competence Index (Mean Value)
- Best Organization Index of the Branch

Sources:
www.bearingpoint.com
BearingPoint, Jukka Vilhoenvs
Road Maintenance Policy in Finland

Currently 84 maintenance areas.
One contract covers 500 … 2 000 km of roads
Competition in price and quality
Each contract includes
  Winter maintenance
  Maintenance of the traffic environment
  Maintenance of gravel roads
  Maintenance of structures and facilities
  Minor investments
  Customer satisfaction bonus
Contracts last for 3, 5 or 7 years
[6 main contractors (a state-owned enterprise + 5 private)]

The price level has decreased in every round since 2001.
This year 13 contracts in competition, the bids were 14 % (30 MEUR) less than cost estimates
Bonuses are paid to area contractors for good maintenance and customer service.
The more positive assessments the contract receives the better bonus. Bonus requires min. 3 positive factors
Bonus is 0.4 … 1.6 % annual costs of the contract
The grade for customer satisfaction is determined by satisfaction survey.
Bonus system does not penalize for lower customer service. If failures, sanctions are a separate concern.
Maintenance of roads 100 % submitted to open competition
Long-term agreements, area based contracts
Contractors use their innovations to meet the quality requirements
Contractors have responsibility for the quality control
Contract model enables innovations from which all parties benefit
Purchaser (FINRA) monitors the functionality of the contractor’s quality system and randomly the quality and processes
Contractors understand the client’s vision, goals and ethics and produces excellent customer services
Excellent customer service is rewarded by bonuses
Meet You in the 27th Winter Road Congress 2008
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Turku, Finland

* Congress (English-Swedish-Finnish) * Exhibition * Demonstrations
* Programme for students * Social Programme

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