Tree Root Protection Using Cellweb TRP®

Fact Sheet 5: Cellweb TRP® and Road Salt Pollution

Introduction

Road salt is applied to roads and pavements to help manage ice and snow and maintain safe access. It is commonly referred to as "gritting" and has been used in increasing quantities since the late 1940's. Although it provides safety benefits and minimises disruption to travel, the adverse impact that road salt can have on trees in some situations is well known (Transportation Research Board 1991 and Forest Research 2011). Road salt is the most commonly used de-icing chemical in the UK. It is crushed rock salt and the main component is sodium chloride. Both sodium and chloride ions can be harmful to some trees if there are excessive quantities in the soil.

The amount of salt applied to roads has reduced over recent years. This is due to generally milder winters (although severe winters can still occur as in 2010/2011) and better management of where and when gritting is carried out.

Salt damage occurs to trees through contamination of the soil around roots or by salt spray. Salt spray is much more likely on roads with fast moving traffic such as motorways and trunk roads. It is likely to be less of a problem where vehicles are moving at low speeds. These low speed areas are where the majority of Cellweb TRP® is installed. Damage to trees occurs most frequently where large volumes of salt are used to de-ice the roads and pavements (Forest Research 2011).

Where the Cellweb TRP® system is used below a permeable surface rainfall will carry the sodium chloride into soil around the roots. The same will happen on traditional impermeable surfaces if the water is allowed to flow off the edge of pavement, for example into a swale. Permeable surfaces (and swales) will not remove sodium or chloride ions from surface water runoff (SPU, 2009). Neither will any other form of sustainable drainage system (swales, etc). However, the difference is that permeable surfaces and the Cellweb TRP® system do not concentrate the polluted water around tree roots. This dissolved pollution is therefore spread out over a wider surface so the load of sodium and chloride ions per m² of soil is reduced. This effect reduces the risk of salt damaging trees.

For example assume that salt is applied to a 10m by 10m area (100m²) at the rate of 20/gm² and this is washed off an impermeable area towards a tree root zone that has 1m² of exposed soil (1m by 1m). The load of salt being washed into the tree root zone will be 2000g/m². If th same area is constructed using permeabl pavement the salt load into the soil belov the pavement is only 20g/m² (Figure 1).

There is also evidence that permeable paving systems have the capacity to store and then distribute the chloride load over a longer time period than would be observed on a standard, impermeable asphalt pavement, therefore reducing acute levels at trees (Houle 2006).

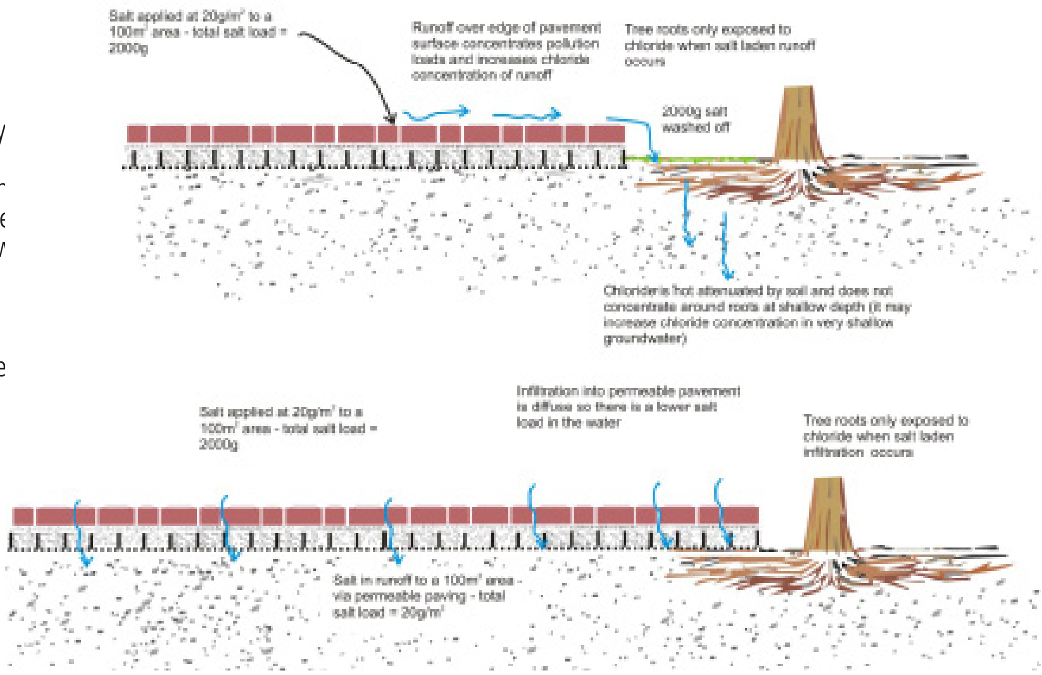

Figure 1: Use of permeable paving over Cellweb TRP® to reduce salt load to trees

Behaviour of Chloride in the Ground

Sodium chloride in runoff is a dissolved contaminant and is not removed by filtration or absorption in the pavement or soil. It does not accumulate in sediments or soils around infiltration systems (Datry 2003) and will pass straight through the vadose zone to the groundwater table (Pitt 1994). Having said that a study in Pennsylvania, USA (where there is frequent salting of pavements in winter) found that the level of chloride in infiltrating groundwater reduces rapidly when salt is not applied. The study concluded that it should not pose a risk to groundwater because of dilution.

Therefore chloride will not accumulate in soil around trees and shallow roots will only be exposed to chlorides during runoff events. The less frequently salt is applied the lower the exposure of trees to chloride.

Trees generally take up less water in winter and therefore if exposed to only a few instances of chloride contaminated water the effects may be minimal, for example in a small car park in the south of the UK. Greater exposure may be expected in a large supermarket car park in a more northerly location such as Scotland where salt treatment may be more frequent. In such instances the salt tolerance of the trees being protected should be considered (Table 1).

GEOSYNTHETICS

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Icing on Permeable Surfaces

The nature of permeable surfaces means that hoar frosts occur more frequently on permeable surfaces but ice layers are thinner (CIRIA 2002). Snow also settles earlier and stays longer. More frequent hoar frost has also been observed in trial areas of various types of surface constructed as part of a Highways Agency research project. However because surfaces are well drained and generally do not have standing water more recent experience indicates that ice forms less frequently on the surface (Houle 2006).

Pervious concrete has been found to reduce the occurrence of freezing puddles and black ice. Melting snow and ice infiltrates straight down into the pavement facilitating faster melting which will reduce the number of salt applications required (Gunderson, 2008).

De-icing on Permeable Surfaces

Permeable surfacing and tree root protection is used in many cases where surfaces will have much lower levels of salt application than the main road network (e.g. car parks, courtyards, tertiary roads). A study in New Hampshire, USA, found that overall less salt was used on permeable surfaces. When compared to salt application on traditional pavements there was a 75% reduction in annual use on a porous asphalt car park (Houle 2006).

TABLE 1 - TOLERANCE OF COMMON TREE SPECIES TO SALT (FOREST RESEARCH 2011)

Tolerance	Species
Tolerant	Alnus Glutinosa
Tolerant	Elaeagnus Angustifolia
Tolerant	Gleditsia Triacanthos
Tolerant	Pinus Nigra (all varieties/subspecies)
Tolerant	Picea Pungens
Tolerant	Quercus Robur
Tolerant	Robinia Pseudoacacia
Tolerant	Salix Alba
Tolerant	Ulmus Glabra

Tolerance	Species
Intermediate	Acer Campestris
Intermediate	Alnus Incana
Intermediate	Crataegus Monogyna
Intermediate	Carpinus Betulus
Intermediate	Fagus Sylvatica
Intermediate	Fraxinus Excelsior
Intermediate	Picea Abies
Intermediate	Pinus Contorta
Intermediate	Pseudotsuga Menziesii
Intermediate	Sorbus Aucuparia
Intermediate	Thuja Occidentalis

Tolerance	Species
Sensitive	Acer Pseudoplatanus
Sensitive	Aesculus Species
Sensitive	Betula Pubescens
Sensitive	Cornus Species
Sensitive	Corylus Species
Sensitive	Larix Decidua
Sensitive	Platanus X Hispanica
Sensitive	Prunus Avium
Sensitive	Tilia Cordata
Sensitive	Tilia Platyphyllos

Conclusion

Although permeable surfaces and the Cellweb TRP® tree root protection system do not prevent chloride and sodium ions reaching the soil around trees the evidence indicates that they will reduce the load of chloride that tree roots are exposed to. This is due to less frequent applications of salt and the fact that water infiltration from the pavement is diffuse and does not concentrate the chloride load.

References

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