



Arboriculture Research Note

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De-ICING SALT DAMAGE TO TREES-THE CURRENT POSITION,

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Summary

During recent years the first quantitative data on the effects of de-icing salt on British trees have been produced. An investigation into the attitudes of Highway Authorities towards the storage and usage of salt has shown that improvements benefiting the environment have been made. However, further steps could be taken, particularly in respect to aspects and to the de-icing of pavements and other pedestrian areas.

Introduction

1. In the early 1980s it became clear to tree pathologists that salt applied to roads in winter was a serious cause of damage to urban trees in Britain (Gibbs & Burdekin, 1983). In 1989, the Department of the Environment commissioned a world wide review of the problem of de-icing salt damage to trees and shrubs; the results of which were published as Forestry Commission Bulletin 101 (Dobson, 1991). This note summarises the developments that have taken place since that time.

The 1991 Salt Damage Survey of Roadside Trees in London

2. In the summer of 1991 symptoms of de-icing damage were conspicuous in various parts of Britain; these were the consequence of heavy salt application during the relatively severe 1990/1991 winter. With funding from some of the Boroughs, a sample survey was conducted in London by Forestry Commission pathologists involving both main and side roads. Full results can be found in Gibbs & Palmer (1993). It was estimated that over 20,000 roadside trees in the capital were showing current salt damage. The most frequently damaged species was London plane (*Platanus x hispanica* (syn. *acerifolia*)); 39% of the main road and 30% of the side road trees being affected. Norway maple (*Acer platanoides*) was also frequently affected and other common species with a moderate incidence of damage included sycamore (*A.pseudoplatanus*) and the common and small-leaved limes (*Tilia* spp.) Cherries (*Prunus* spp.) were almost entirely unaffected.
3. The influence of site factors was examined by analysing separately the data from London plane and those of all the other species together. Damage incidence was higher on main roads than side roads but the most striking association was that between the incidence of damage, and, moreover, that if this operation could be conducted in some other way, much damage could be avoided.
4. A re-survey was conducted in late summer 1992 to determine the fate of the damaged trees. About 80% of them either recovered completely or only showed relatively small amounts of dieback. However it was estimated that some 2,500 trees had either been felled, or requires felling or major pruning. The direct costs for this work were calculated to amount to some £70,000 and costs in terms of lost amenity value were considered to exceed £2million.

Solving the De-Icing Salt Problem

5. In 1992 the Department of the Environment commissioned the Forestry Commission to establish whether High Authority attitudes to de-icing salt and tree damage had been influenced by the publication of Bulletin 101 (Dobson, 1991). During the early stages of the investigation it became clear that the impact of

various other documents also needed to be assessed. Attention was focused on the Audit Commission Report of 1988 "Improving Highway Maintenance", and several other sources of information were also of importance (see Appendix).

6. A report submitted to the Department of the Environment in February 1993 (Gibbs, 1993) and an article based on this report, and aimed at civil engineers, has recently been published (Gibbs, 1993b). The following paragraphs contain a brief digest of the main points.
7. Local Authority highway staff were invited, by means of a questionnaire and subsequent interview, to comment on their attitude to the storage and use of de-icing salt. Two-thirds of the authorities responded to the questionnaire, and of these 93% had read the Audit Commission Report and 45% had read Bulletin 101. These documents, together with the others listed in the Appendix, had evidently resulted in a substantially increased awareness of the environmental implications of using de-icing salt.
8. Salt stockpiles are increasingly being protected with temporary covers or y being kept in barns. However there is still much room for improvement. A systematic survey is needed to determine how much of the salt stock remains uncovered and how much is covered in different ways. There has also been a move to the provision of bins to replace salt piles ant roadside. Here again, however, more needs to be done as witnessed by serious damage to trees that occurred in various places during the last few years.
9. As far as application to roads is concerned, the view is firmly, and reasonably, held that salt will remain the principal de-icing material for the foreseeable future. From the questionnaires it is evident that there has been considerable progress in staff training and machine calibration to avoid over-application. Improvements in machinery, in weather forecasting, and through the rationalisation of de-icing routes have brought and will continue to bring about reduction in unnecessary salting and hence environmental benefit.
10. From the London survey described in paragraphs 2-4 above and other information it seems that the main problem is currently the de-icing after heavy snowfall on pavements and other urban pedestrian areas. Authorities sometimes use had-operated machines to apply a controlled salt dosage, and some have recently purchased new machines. But others involve excessive quantities of salt. It is clearly difficult to ensure that staff carrying out this, often infrequent, work are suitably trained in proper had-salting practice and the effects of over-application. The use of a training video would probably be helpful.
11. There is more interest in using alternative materials on footpaths than on roads. Urea is used in several authorities in specific locations and some have adapted street sweeping or street washing equipment to apply it. Also some authorities use chemicals such as ethylene glycol and calcium magnesium acetate (CMA). Mixtures of salt with sand or grit are used by some authorities with ratios ranging from 1:4 to 1:10. In some cases they are used for environmental reasons, in others, on grounds of cost. Those using the mixtures for environmental reasons are prepared to accept the extra work incurred in the subsequent clearance of the sand or grit.
12. Some of the damage results from applications made by the public using salt from roadside bins. Where bins are located near trees it might e worth stocking them with a material such as CMA, despite its considerable expense. Another sensible approach, already adopted by a number of authorities, would be to make much more use of salt/grit mixtures in the bins provided for public use. Some subsequent clearing of drains etc, would be inevitable but where trees are at risk the costs could readily be justified.

Conclusions

13. During recent years real progress has been made towards reducing the adverse environmental effects of de-icing salt. However, the storage of salt stocks at depots and at roadside requires further attention and the risk to trees posed by excessive manual salting of pavements and other pedestrian areas has not yet been reduced. At present there is no doubt that a winter with heavy snowfall and consequent use of salt would see the loss of many valuable trees nation wide.

Further Reading

Dobson, M.C. (1991). De-icing salt damage to trees and shrubs. *Forestry Commission Bulletin* **101**, HMSO. 64p

Gibbs, J.N. (1993a). De-icing salt and tree damage: the attitude of Highway Authorities. Unpublished report to the Department of The Environment under contract PECD/2/07. 15pp

Gibbs, J.N. (1993b). De-icing salt damage. *Surveyor* No 5262 Vol. 180, 14-15.

Gibbs, J.N. & Burdekin, D.A. (1983). De-icing salt and crown damage to London plane. *Arboricultural Journal* **6**, 227-237.

Gibbs, J.N. & Palmer, C.A. (in press). A survey of damage to roadside trees in London caused by the application of de-icing salt during the 1991/1991 winter. *Arboricultural Journal* (in press).

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Appendix: The Background Documents in order of publication

1. The 1987 Department of Transport 'Statement of Service and Code of Practice@. This document provides guidance on winter maintenance to DTp agents, both Local Authorities and contractors. Although principally concerned with the use of slat, there is a section on the storage and application of urea.*
2. The 1988 Audit Commission Report 'Improving Highway maintenance- 'A Management Handbook'. Part of this Report covers the storage and spreading of de-icing salt.
3. The 1991 Association of Metropolitan Authorities 'Winter Maintenance Supplement'. This document was produced by the AMA on behalf of themselves, The Association of County Authorities. Many of the recommendations impinge directly on the quantity of salt applied. Thus each Highway Authority is recommended to:
 - (a) Produce a winter maintenance plan and designate in it a hierarchy of carriageways and footways.
 - (b) Assess the de-icing priority of carriageways and footways on an annual basis.
 - (c) Examine the scope for improving its ice prediction systems.
 - (d) Check the calibration of all de-icing equipment at least annually. All spreaders should conform to certain standards and should be speed-related. Spreading patterns and widths should be selected for each route to avoid undue wastage.
 - (e) Consider the use of alternative materials to salt in appropriate locations.
 - (f) Review arrangements for the storage of salt.
4. The 1991 Forestry Commission Bulletin 101 'De-icing Salt Damage to Trees and Shrubs'. This represents the outcome of a DoE-funded research contract to evaluate the world wide literature on the subject. It separates damage due to salt spray from that due to leaching from uncovered salt piles, whether in a depot or at roadside. An outline of ice prediction systems is given. In a section on alternative methods of de-icing, reference is made to roadway heating systems, and the use of abrasives, salt-abrasives mixtures and other chemical de-icing agents.

* This has now been superseded by essentially similar information as contained in the 1992 Trunk Road Maintenance Manual, Volume 2: Routine and Winter Maintenance Code.