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Tree Roots and Underground Pipes

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Summary

Instances of pipes being broken by the growth of roots are rare but blockage of damaged pipes is not uncommon. No sure way of preventing roots entering damaged pipes is known at present, so repair of the defect is the only certain remedy. Modern materials and joints should prevent most problems in the future.

Introduction

1. Tree root systems extend to exploit water and nutrients in the soil. Where moisture in the soil is plentiful, but provided the soil is not waterlogged, fine much-branched roots develop to absorb the moisture (Dobson, 1995). Roots are very sensitive to the soil environment, especially to compaction, aeration, mineral nutrients and water supply. Development of a root system may be influenced by both impenetrable layers and the activity of other tree roots in the soil. Disturbing soil may improve the supply of water and air and make it easier for roots to grow through an area.

2. Roots increase in diameter, but not in an ordered fashion as occurs in the stem and branches of a tree. What stimulates roots to increase in diameter is not fully understood, but they grow rapidly in diameter near the trunk. Beyond this zone a root may grow for many metres without either branching or a change in diameter. The same root may grow through a very narrow gap and the distal section can thicken to the same diameter as on the proximal side of the constriction(MacLeod and Cram, 1996). The very fine roots are often very short-lived and do not increase in diameter.

Underground services

3. Underground services are laid in trenches cut through the soil and then backfilled. The construction of a service will depend upon its age; for example between the wars, clay packed joints and cement seals were used; these are now beginning to break up because they are susceptible to drying out. More recently flexible joints have been developed, which are simpler to use, giving an effective water-tight seal which is not affected by drying.

4. If a pipe is cooler than the surrounding soil, moisture will condense around it creating conditions conducive to root growth. When pipes are excavated, a mass of fine roots may be found forming a sheath round the pipe, and this may lead engineers to blame tree roots for causing direct damage to the service.

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Damage to services

5. Displacement of underground services has been reported and could be the result of diameter growth of roots or slight movement of the roots in reaction to sway of the trunk and branches. Such damage, however, appears to be rare and probably only occurs when services have been laid across existing tree roots. Continuous, non-jointed pipes should be relatively unaffected by such displacements caused by root growth. Where jointed pipes are used, typically clay or concrete, modern jointing details provide a flexible, resilient seal that can accommodate some movement without damage or leaking occurring. Exceptionally, in the unlikely event of large movements occurring, damage to the pipe itself could ensue or possible backfall and silting problems could develop in gravity sewers. Where a root develops alongside or above a service, increase in the root's diameter should not exert sufficient pressure against the pipe and surrounding soil to cause damage (MacLeod and Cram, 1996). **Roots do not break pipes or force their way into pipes** to gain access to water and nutrients.

6. Apart from the problems associated with clay or mortar packing, why do pipes and their joints fail? On highly shrinkable clay soils tree roots may contribute to soil drying (Biddle, 1992), and where as a result a clay shrinks pipes may then move. But more important are the design and quality of the pipe materials, the standards of workmanship and supervision during construction of the pipeline. In addition, later excavations adjacent to the line of the service can result in slumping of soil and distortion of the pipe. All of these could cause cracks in pipes or weakening of joints.

7. If moisture escapes from a water-carrying underground pipe, a moisture gradient will develop in the soil. Tree roots in the vicinity of the pipe may flourish in the moist soil and penetrate the pipe at the seepage point. Roots will then proliferate within the pipe; eventually they may create a blockage. This is probably the most dramatic and troublesome form of tree root damage to a pipe - particularly if the pipe is carrying foul water. However, roots are most unlikely to grow into a pipe that is leaking under pressure (e.g. a water main).

Prevention and repair of damage

8. Blocked sewers may be cleared mechanically using rods or cutters. Removal of trees may appear an obvious treatment but is only a short or medium term expedient and is likely to have an adverse effect on the local environment. Roots of other trees, shrubs and even herbaceous plants exploiting the moist conditions around the damaged pipe may enter the pipe and produce further blockage. Similarly, mechanical or chemical root pruning to sever roots growing towards a pipe will not effect a long-term solution because roots will regrow.

9. An alternative would be to use a chemical to kill roots in the pipe. Some soil sterilants are used in America as a foam grout, but the products are not approved under the Food and Environment Protection Act 1985 for use in Britain. Inorganic metal salts, the efficacy of which has not been tested in Britain, have also been used in the United States but as some metal salts become absorbed onto organic matter they may have reduced effectiveness in killing roots in sewers. Furthermore, Water Authorities in Britain are loathe to accept sudden or prolonged increases in chemicals in effluent which could adversely affect the sewage treatment process.

10. Sealing rings containing a toxin or hormone growth substance have been suggested. However, their effectiveness is questionable because the rings would have to release the chemical in sufficient quantity to affect roots as they develop throughout the life of the pipe. Current construction techniques - both long lengths of unjointed pipes and non shrinking but flexible sealing rings should reduce the incidence of blockage by roots.

11. Barriers impenetrable to roots or simply to deflect them may be appropriate. However, specifications must be prepared to reflect the circumstances of each situation (Marshall et al., in press).

12. In the absence of mechanical or chemical techniques for permanently restricting the spread of tree roots, damaged pipes must be repaired. This will be facilitated by the increasing use of TV cameras to survey cleaned pipes for defects and regrowth of roots. A defect in the pipe can then be excavated and repaired so that tree roots will not be able to penetrate the pipeline. An alternative to excavation might be to line the damaged section of pipe or to use a pipebursting technique. However, it must be remembered that in shrinkable clay soils repair of a leaking pipe may lead to soil shrinkage and damage to built structures (see Biddle, 1992).

Conclusion

13 Physical damage to underground services as a result of direct root activity appears to be rare. Blockage of defective underground pipes by roots is relatively common and although chemical and mechanical means can remove a blockage, the only satisfactory long-term treatment is to repair the pipe. Removal of trees should not be regarded as a solution to the problem because the roots of other trees, shrubs and herbaceous plants could penetrate the defective pipe and cause a further blockage.

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