On the road

Tree inspection and management adjacent to the Welsh trunk road network

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This article shares some of the experiences gained over a 10-year period of involvement with the management of large-scale tree populations on and adjacent to the Welsh trunk road network (WTRN).[1]

In particular it examines:

- general survey and inspection considerations;
- the use of a desktop GIS (geographic information system) zoning methodology to assist with the assessment of risks from trees to neighbours on third-party boundaries; and
- the management of high value/prominent trees potentially in private ownership.

Our association with the Welsh Trunk Road Agents (WTRA) began in early 2006, shortly after the Welsh Government reduced the then eight existing agents down to three.[2]

We were asked to:

- train highway inspectors in arboricultural awareness ; and
- assist in delivering the tree inspection requirements set out in the Welsh Trunk Road Maintenance Manual (the required standards for highway maintenance, including trees).

To this end, we worked with our clients to develop a suitable inspection protocol. In general terms:

- a cyclic period of inspections by a qualified arboriculturist, to identify trees that present a reasonably foreseeable risk of harm, and to recommend and prioritise appropriate controls.

For trees on the front of verges with the highway within falling distance, this is achieved by foot patrol, with site data collected on hand-held mobile devices. In some instances we survey alongside other professionals (ecologists, geotechnical etc.) to manage resources efficiently.

A multi-discipline approach: working with ecology and geotechnical colleagues.

Drive-by surveys: we trialled these and found that they did not identify many serious defects which were subsequently easily found by foot survey. We concluded that they:

- may occasionally reveal an obvious safety issue; and
- can inform an overall strategy, such as preliminary assessments of roads for inspections, interim monitoring of the highway between professional inspections or after storm events.

Whilst there are some challenges in integrating trees into the same management system as other highway assets (barriers, signs etc.), fundamentally by doing so there is a documented and auditable system of inspection and maintenance in place.

Subsequent to these conceptual stages, site inspections need to be undertaken. By applying the agreed tree inspection protocols the organisation is endeavouring to do all that is reasonably practicable to fulfil its duty of care and manage the delicate balance between preserving tree benefits and controlling the risk of harm.

The real challenge is managing the actual realities of long roads, difficult access and high numbers of trees against wider industry norms – notably providing a close 360-degree inspection of individual trees as a default, regardless of reasonable and practicable considerations. It is the scale of the undertaking and the reality of site that challenge such norms, whilst acknowledging that most tree-related fatalities occur on the highway.

1. Please note: the terms 'trunk road' and 'network' reference the entire road estate, i.e. carriageways, verges, footpaths, vehicles and pedestrians. The front verge is the roadside boundary; the rear verge is that bordering third parties/private land.

2. Since 2012 there have been two: North and Mid Wales Trunk Road Agent and South Wales Trunk Road Agent.

The scale of the undertaking

The WTRN is 1,709km in length including single, dual and three-lane carriageways and motorways. As an example of scale and potential tree cover, a 70km road has two directions of travel, each having a front and rear edge. Features such as roundabouts and slip roads can add an additional 1km or 2km of verge. Consequently, a 70km road may present 250km of verges to survey. There are variables such as verge width and depth, but a conservative estimate suggests at least 1 million trees per 70km. To date we have undertaken three inspection cycles, totalling approximately 5,000km of verge and millions of trees.

General inspections

The initial difficulty is safely accessing sites to undertake surveys. Prior assessment is essential to identify suitable pedestrian access and egress and support vehicle parking points (for both safety and efficiency). This considered approach also helps to reduce the need for traffic management (lane closures, etc.) with the associated costs, disturbance and risks to road users and those facilitating the road works.

Unfortunately, not all highway trees are neatly aligned, waiting to be surveyed; there are large numbers of specimens landlocked within central reservations, roundabouts and concrete encasements of walls and bridges.

In some circumstances the floor of tree plots can be so dense with undergrowth that venturing inside is unreasonable, impracticable and sometimes impossible. Terrain can present further restrictions through uneven, steep or otherwise impassable ground. Often, after gaining access, the trees are virtually obscured by ivy, hedging and undergrowth.

Trees adjacent to third-party boundaries: zoning

The initial emphasis of the inspections understandably focused on trees at the front of verges. However, over time it became apparent that those at the rear of verges were increasingly becoming of concern in terms of risks (perceived and actual) to third parties, e.g. neighbours backing onto the trunk road. There were several related reasons for this:

- **Terrain and visibility:** sometimes it is not possible to see the third-party boundary from roadside, because of the terrain.
- **Adjacent development:** the arterial nature of the network attracts adjacent development, both commercial and residential.
- **Maturing tree stock:** initial landscaping planting obtaining a significant height and stature. This is increasingly the cause of complaint and in a few instances, after high wind events, trees have fallen into third-party property.
- **Maintenance/management regimes:** there are areas where by accident (lack of maintenance) and/or design (wildlife and ecology) dense areas of trees develop with poor form. In these circumstances there is greater potential for tree failures.

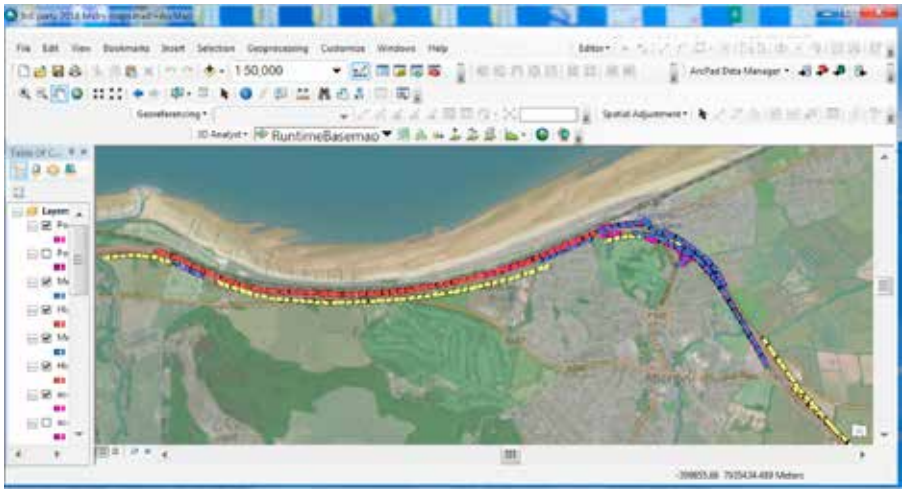
▲ *The difficulty of initial access*

▶ *The undertaking summed up in a single image: trees, motorway, railway and private residences.*

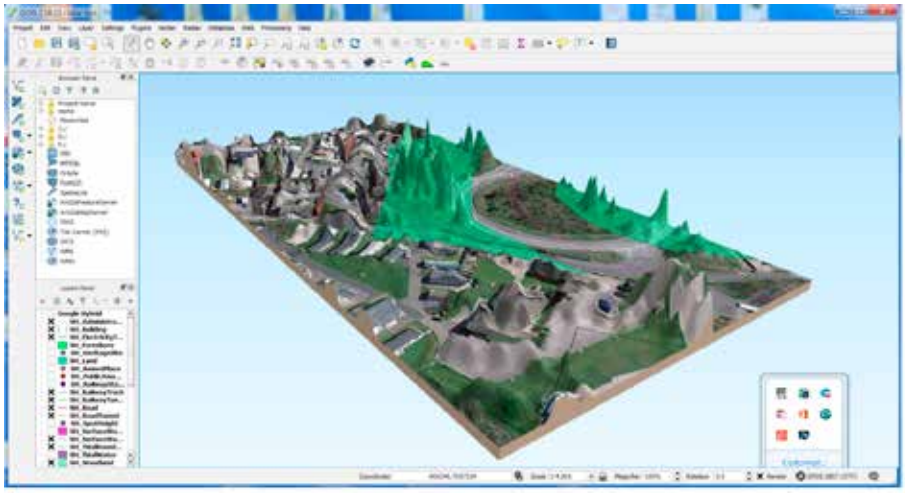
An insider's view: the reality of many sites is a reception of dense ivy and undergrowth.

Approach and method

Given the above circumstances, we suggested trialling a targeted approach to facilitating inspections on the third-party boundaries (piloted on the A55 Expressway). Given the size of the areas concerned and likely constraints, simply embarking upon a site inspection was considered to be a leap into the unknown, particularly in terms of time and associated costs. Also, where the front verge borders predominantly with the trunk road (and its users) the risks are known; however, the rear of verges often backs onto areas of unknown ownership, usage and occupancy. In these circumstances we considered that resources could be better focused by using an initial GIS-based desktop appraisal.



Zoning on desktop GIS.



Using 3D imaging with LIDAR to generate buffer zones.

We used our desktop GIS system (ArcGIS) to build a profile of the route consisting of base mapping of the road network overlaid with aerial imagery. This provided an overview of the nature and potential occupancy of land bordering the trunk road and also the location and extent of tree cover around the boundaries.

These insights informed a decision to assign the borders into one of three zones:

- **Zone 1:** bordering infrastructure such as railways, county roads (associated pavements and footpaths), buildings with likely high occupancy
- **Zone 2:** bordering minor roads, public footpaths, bridleways, waterways, cycleways etc.
- **Zone 3:** bordering open space, fields, brownfield sites etc.

Further analysis informed the location and extent of tree cover (as a percentage and distance) of each area. The zones were then exported as a 'layer' which could be used in the field on our (ArcPad) mobile devices to 'ground truth' (validate) the desktop findings. This desktop work initially used 2D plan views. Towards the end of the project period LIDAR (Light Detection and Ranging) data was made available to us, which facilitated the ability to derive the heights and spread of trees and project buffer zones of likely falling distances.

On site, zone 1 and zone 2 areas were initially targeted. Where accessible, trees were inspected. Where access was not possible or was restricted, we were able to specify appropriate action, e.g. removal of dense undergrowth to facilitate inspection, or remedial pruning to forestall existing and future issues.

Livestock boundaries

Zone 3 was not ignored, and it raised a unique consideration to transport safety. The tendency is to think of tree safety as the risks of trees causing direct damage and/or injury. However, many road boundaries are with farmland and livestock. The boundaries not only demarcate ownership, but also provide barriers to animal trespass onto the road network. Consequently, tree inspections also need to consider risks of trees falling through the boundary, potentially allowing livestock etc. onto the carriageway.

High value boundary trees and private ownership

A factor particularly associated with trees close to the rear boundary is establishing ownership. This is critical not just in terms of determining responsibility, but also in relation to the appropriate discharge of duties and powers.

Where trees are obviously within the trunk road, ownership and responsibilities can be clearly determined. However, trees outside of the network present several unique propositions, in particular, potentially

A considered and professional approach is required to manage the delicate balance between preserving tree benefits and controlling the risk of harm to road users.

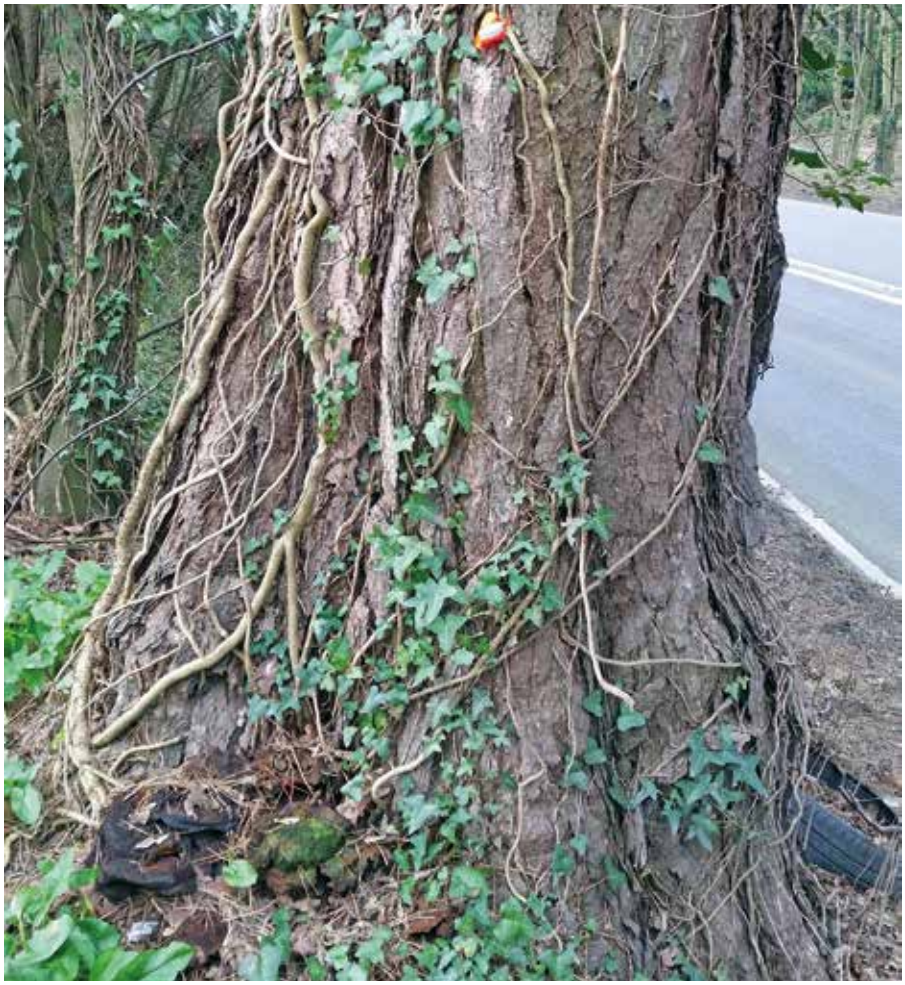
unintended consequences for prominent/ high value trees in private ownership.

There is no initial right of access to enter private land. Therefore, the tree inspection is limited to what can reasonably be determined from the trunk road. Where this reveals an obvious tree safety issue and control measure (e.g. a split limb above the road and its removal) the concerns can be presented to the owner with a reasonable expectation that (1) the hazard is abated and (2) the work has minimum impact upon the retained tree.

Issues may arise where symptoms are observed from roadside that indicate a hazard, but this (or the full implications) cannot be confirmed from the trunk road or initial inspection, e.g. the presence of fungal fruiting bodies. Obviously, the surveyor has a duty to note these findings, but when these are passed on to the tree owner there is little control over the subsequent actions taken, e.g. the competency of those providing further investigations, advice and tree work. Potentially, trees of high amenity value may either be removed or subjected to poor quality work standards.

In these situations, our experience is that, where potential issues are recorded, the first option is always to engage in dialogue with the tree owner or their agent. This presents the best chance of securing a professional arboricultural outcome. In some circumstances it may be necessary to follow the procedures outlined in Section 154 of the Highways Act, but this is a last resort, particularly as the process gives little scope to convey the need for considered works or professional standards etc.

The recent cause of a delay to our working day.



Prominent boundary tree with basal fungus: establishing ownership is critical in ensuring appropriate and measured follow-up action.

Summary

One of the key advantages for us is that our clients have in-house arboricultural and ecological expertise and recognise the value of trees and the 'green estate'. This facilitates a collaborative working approach and consequently we are able to talk a common language, to discuss and agree tree management issues.

For large-scale tree surveys where obtaining an initial overview on site by foot or vehicle is restricted, a desktop GIS appraisal can be a useful tool to inform the scope of a tree survey and target resources effectively. This is not a replacement for site inspections and any desktop information that is to be relied upon should be validated on site.

Any inspection and management system should be flexible and dynamic enough to identify and document where there are significant restrictions to meeting not only organisational expectations but also general good practice guidelines, for example, recording where restrictions prevent close inspection, together with an assessment of the most appropriate follow-up action. This could range from requesting access facilitation cutting through to removal of undergrowth and ivy to allow a close inspection if the situation warrants it.

In conjunction with the above, it is important to periodically test 'in house' protocols against changing industry attitude and opinion (e.g. towards inspection periods, inspector competency etc.) and be satisfied that they will stand up to potential external scrutiny.

Ultimately, there is no 'gold standard' for these surveys and it is only possible to do what is reasonable in the given circumstances with the resources available. Hopefully, this article will be of use to others facing similar situations, and perhaps give insight to those informing policy and practice, that the realities of site can be somewhat more challenging than is generally realised.

We welcome any comments via jezlawton@live.co.uk.

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