Solutions

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How we cracked it 27

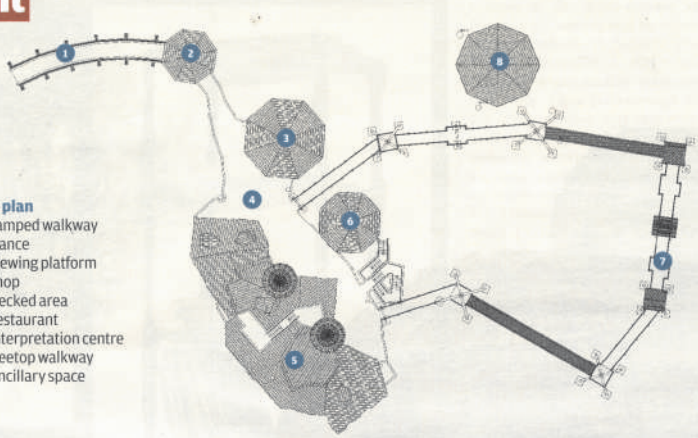
The challenge
To build a treehouse in an existing copse of mature lime trees

The solution
An innovative supporting structure and detailing that allowed the structure to move with the trees

Architect
Napper Architects

Site
Alnwick Garden, Northumberland

Project type
Treehouse



Site plan
1. Ramped walkway entrance
2. Viewing platform
3. Shop
4. Decked area
5. Restaurant
6. Interpretation centre
7. Treetop walkway
8. Ancillary space

Step 1 Tackling the site

The client, the Duchess of Northumberland, wanted to build a treehouse to add to the attractions at Alnwick Garden. The brief was for an archetypal treehouse out of a fairytale, with an organic feel that would blend in with the trees and the landscape.

The treehouse was to include a restaurant, shop and interpretation centre, set on an open decked area leading to a treetop walkway. Everything had to conform to building regulations, fire regulations and the Disability Discrimination Act.

The site was a stand of 30 or so mature lime trees close to the entrance of Alnwick Garden. The 550sq m wooden structure had to sit among the living trees without damaging the root systems underneath. But it was clear that the trees alone could not possibly carry the weight of the entire structure, and a supporting structure would be needed. After the contractor and tree surgeons surveyed the roots of the existing trees, we established a matrix of points on plan where it was feasible to set down piles for the supporting structure.

We required 14 12m-deep pile cap foundations carefully positioned away from any major tree root system. This method allowed us to preserve each and every lime tree during and after construction.

Step 2 Presenting the design

When we were novated across to principal contractor, Robert McAlpine, on a design-and-build contract, we were concerned that the original design might be compromised through value engineering.

We produced general cad arrangement plans, sections, elevations and details. But these seemed a bit sterile and didn't convey the natural, organic feel of the building forms, which aimed for a timeless structure. Different cladding types and timbers also helped to break down the scale of the design. To convey this approach, we produced hand-drawn coloured elevations and perspectives that illustrated to both client and contractor a warmer design intent (pictured above). This hand-drawn technique continued during the construction phase and was critical in order to re-educate the skilled carpenters into crafting intentionally "wonky" junctions and details. This process continued up to completion, and the final building is a testament to the quality of the craftsmen involved who genuinely loved the job.

Step 3 Designing the structures

The main building sits on a wooden "table top" made of yellow balau hardwood decking on top of Siberian larch glulam beams, chosen for their strength and span. These are supported by clusters of raking Douglas fir struts sitting on the randomly placed pile caps hidden beneath the woodland floor. The struts also complement the surrounding trees, giving the building a sense of "floating in the trees".

In addition to the main building, a 6.5m-diameter interpretation centre is supported entirely from a single lime tree 4.5m above ground level (pictured left). The splayed deck is supported by Douglas fir raking struts bolted into the trunk with stainless-steel pins. These connect with the tree at various angles and heights, as stripping away the bark for a ring of connections would have risked killing the tree.

Step 4 Detailing the treehouse

As a tree trunk thrusts through the apex of the conical roof of the interpretation centre (pictured right), we needed interesting threshold and weathering details. The weathering at the roof apex was eventually solved by cloaking the cedar-tiled roof with a rubber collar made from an old lorry inner tube.

Other trees grow up through the main restaurant structure with tolerance built in to allow the tree trunks to sway in high winds. In this part of the project, large-gauge hemp rope is coiled around the junction of deck and trunk allowing for movement. Any future lateral growth to the trunk will be resolved by cutting away the decking.

Also, the classroom was designed to sway in the wind with a tolerance of 20mm to allow for the twisting movement of the main trunk and floor base. A special steel plate with a piano hinge was made to bridge the gap between the moving classroom floor plate and the rigid deck.

Step 5 Conforming to standards

The first hurdle in conforming to building standards was to get wheelchair users on to the deck by ramping at no less than 1:20. We designed a DDA-compliant timber ramp that bridged the levels between the ground and treehouse. The deck and main restaurant floor structures were designed to support a maximum of 250 people at one time. Above the restaurant we built two round turrets containing WCs and a space for private hire. So that there were two fire escape routes from each space, the turrets had to be linked at high level. We took the link over the restaurant roof, offering a treetop experience with great views.

The fire strategy included a sprinkler system designed to keep the structure safe for long enough to evacuate the treehouse. We also specified timber struts of larger diameter than was needed to carry the structural load, so that the outer layers of the timber would be "sacrificed" in the event of a fire.

Building Control was also happy with the open log fire in the restaurant. Its position was dictated by the location of the insulated flue which discharged out above the canopies of the adjacent trees.

Dean Thody is an associate architect at Napper Architects, Newcastle.

Top left: The DDA-compliant timber ramp bridges the levels between the ground and the treehouse.