Internally, the use of chestnut wood creates a sense of warmth and vibrancy

A chestnut coppice in Shorne Wood

External use of chestnut wood, including tree truck veranda struts.

The curved laminated frames spanning the roof show how chestnut can be used to create strong, lengthy construction materials. These frames are produced through a glue laminate process and can be designed on a case-by-case basis to meet the specific length and strength requirements of a building project.

At various points across the ground floor level, solid, unprocessed tree trunks have been inserted to provide an interactive aid that shows the trunk in its original form. The architects envisage the texture of the trunks will change over time as the bark from the trunks falls off, showing the difference between the unprocessed wood and the smooth trunk. In this way the building itself acts as a tool to educate visitors about chestnut wood and how it can be used within building projects.

Developing a new product: glue laminate chestnut

In the past, chestnut wood has not been widely used within construction, due to the tree providing a short plank length and being a fairly soft wood. Modern glue laminate technologies have enabled a new, more versatile product to be created by 'stitching together' chestnut planks, forming a building material of any width or length.

The Shorne Wood Visitor Centre incorporates glue laminate beams made from coppiced sweet chestnut sourced from local forests within Kent. Typically, coppiced chestnut trees grow to a height of approximately 15m. Most building frames require wooden struts that are longer than these and to produce chestnut beams of sufficient length for a variety of construction projects, a new manufacturing process was developed that takes varying lengths of chestnut wood and binds them together using adhesive. In this way, beams can be ordered to meet the height specifications of individual building projects.

The curved laminate beams had not previously been used in construction. The Building Research Establishment assessed the beams' structural strength and functionality under a range of British Standard load tests (Section 8, British Standard 5268: Part 2). Coppiced chestnut trees grow quickly, which results in a fairly soft wood compared to oak, which can take up to 100 years to mature.

Initial concerns that the beams were too supple proved unfounded, provided the wood used is taken from the chestnut tree trunk where it begins to straighten to grow upwards and the adhesive is used according to the manufacturers' recommendations. Following completion of a full range BRE Tests, the recommendation was to grade the chestnut beams as compliant with BS5756 (visual grade TH1).

Sustainable technologies

The Visitor Centre uses a range of cost effective sustainable technologies including:

- Greywater system: this Centre recycles the greywater from the existing water systems. Water is flushed into a tank set below ground level, where it is treated using special enzymes. Once the treatment process is complete, the now clean water is pumped from the tank back to the bathrooms where is it used to flush the toilet facilities.
- Wind turbine: at the Centre, electricity generated from a wind turbine will be used to run the kitchen and administrative facilities onsite. Being located in the carpark, the wind turbine is a highly visual part of the demonstration of onsite energy generation and use. The turbine shows how wind energy, a free and inexhaustible resource can provide a source of clean, non-polluting electricity; a single 750kW turbine can prevent the emission of 5000 tonnes of carbon dioxide; it would take approximately 500 acres of forest to absorb the equivalent amount.
- Solar panels: energy generating photovoltaic panels have been inserted into the Centre's rooflight spaces. These panels have a dual function, as they act to shade the Centre's main internal space during the hottest part of the day as well as generating electricity. The earth receives enough energy from the sun in 15 minutes to power humankind's current energy needs for a whole year. On average, Britain receives 2.5 kWh of energy landing on every square metre every day – enough energy to run a 100W light bulb all day and all night or heat the water for a bath.
- The use of on site materials: including timber and clay in the construction process and wood fuel was cost effective and helped to minimise traffic impacts

The Centre's solar panels (top left, centre) and wind turbine (right)

Sustainable technologies rejected

A wide range of sustainable technologies and materials were considered during the design process for the Visitor Centre. While the majority of the proposed designs and materials were used, not all could be included in the final build:

1. Cladding: the architects intended to construct the external walls in chestnut shingles, in keeping with the Centre's woodland theme. These were difficult to source and were not selected due to concerns over weather tightness.
2. Wind turbine: a larger wind turbine with greater electricity generating capacity was initially considered. In the end, a smaller turbine was chosen as it had less visual impact within the Area of Outstanding Natural Beauty. To compensate, solar panels were installed, which will help to educate visitors on renewable energy sources.
3. Greywater recycling – the architect considered using reedbeds instead of the Klargester to treat the Centre's greywater. However, on assessing the capacity of both systems, the Klargester proved to have a greater ability to accommodate the Centre's greywater throughput at peak visitor times.

Key lessons learned

The procurement of public buildings has a key role to play in promoting high standards of design and sustainability.

Incorporating sustainable technologies into any public building will conserve energy and running costs, reduce waste, recycle materials and can help to educate visitors about environmental issues. Some sustainable building techniques are easy to implement with little or no extra costs. Orienting a building to be south-facing can make use of natural sunlight/heat and thus save energy. Installing good insulation will reduce heat loss and lower electricity bills. The costs of more sophisticated technologies such as wind turbines can be recouped relatively quickly as they cost little to operate.

Using locally sourced chestnut coppice had a number of benefits including reducing traffic impacts, encouraging biodiversity and supporting a rural industry.

Consulting users/stakeholders early in the process can help to identify cost savings while still meeting operational requirements – for example, wind turbines can be less expensive to install than solar panels and have a quicker payback period but the location needs to be sensitively handled.

Ensuring the project team has the right mix of skills and abilities and communicates regularly is essential to the delivery of an innovative project. During the construction stage, the implementation team needs to feed back any issues encountered on site to the design team so that solutions can be devised that are practicable and in keeping with the original design.

The role of the quantity surveyor over the project is vital to ensure that the materials used are of the best quality and value and that the project remains within budget. The role of craftsmen on site is also critical to ensure that innovative materials are used sensitively and that the original architectural vision is achieved.

The more complex the building design and proposed useage the more time and resources are required to develop and implement it successfully and this needs to be reflected within the project plan to ensure that the scheme is delivered on time.

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CASE STUDY: Sustainable Construction

design excellence **IN NORTH KENT**

Shorne Park Visitor Centre

the architecture centre · KentDesign · Kent County Council · Department for Communities and Local Government · Thames Gateway

Prepared by Arup

Design Excellence North Kent

Design Excellence North Kent is a project, supported by the Department for Communities and Local Government, intended to promote high quality design. The project commissioned this case study as part of a series to share best practice, celebrate excellence and share lessons learnt.

The Shorne Wood Visitor Centre is located within the Shorne Wood Country Park, which is just off the A2 between Gravesend and Rochester. It forms part of the Shorne Wood Heritage Project, which aims to encourage residents in North Kent to take part in recreational activities in the countryside by enhancing interpretation and access provision.

One of the most visited open spaces in North Kent (more than180,000 visitors annually), the Shorne Country Park provides a range of leisure and recreational facilities for the area's growing population. It acts as a hub for other parks and woodland areas, all of which have considerable ecological, landscape and/or archaeological importance. Shorne Wood covers approximately 288 acres of ancient woodland. This includes heathland, an old clay extraction pit, meadows, wetlands with ponds and lakes rich with reeds, rush and willow.

Following a Heritage Lottery Fund grant, Kent County Council (KCC) was able to extend Shorne Wood Country Park. This included connecting Shorne to Cobham Park and promoting links to Randall Wood and Brewers Wood. The Country Park now encompasses approximately 360 acres and provides world class recreational and education facilities.

KCC recognised that re-developing the Park's visitor facilities provided an opportunity to educate visitors and school children about the Park's extraordinary biodiversity and local historical traditions. It was also keen to promote the centre as a working example of how modern technologies can save costs and lower carbon emissions while raising awareness of the importance of climate change. It was intended that the centre would become a flagship example of sustainable building technologies for other projects located in the Thames Gateway area to follow.

Being located within the Kent Downs Area of Outstanding Natural Beauty, high quality design was an essential criterion. Organisations supporting the Centre's development include:

- Department for Communities and Local Government
- South East England Development Agency (SEEDA)
- English Nature
- Forestry Commission
- Gravesham Borough Council
- Rail Link Countryside Initiative
- Kent Downs Area of Outstanding Natural Beauty Unit

The design brief

KCC held a competitive tender to find the winning design, based on the following objectives:

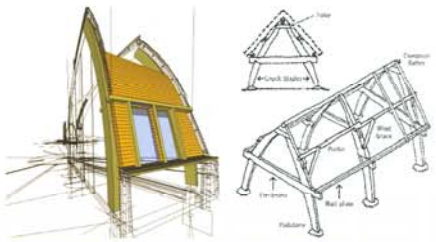
1. To design a multifunctional new building or an extension around the existing buildings that increases capacity anc improves the experience of people visiting and operating within it.
2. To provide an interpretative space, education facilities, including a classroom and welfare facilities, a café, toilet facilities and an administration/office space.
3. To ensure it is as environmentally friendly as possible, with sustainable constructional methods, materials, energy use, water and waste management, all aiming to minimise environmentzl 'footprint'.
4. To enable, within the design, opportunities for interpreting the building itself.
5. To create a secure, robust building in a public area.
6. To strongly consider the aesthetics of the building, balancing innovation, interest and surroundings.
7. To be sympathetic to the sensitivity of the location of the site with regard to the various designations placed upon it.

The Winning Design

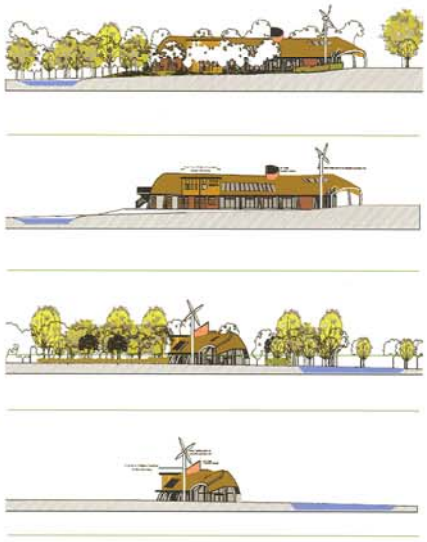
The Lee Evans Partnership was the architectural firm chosen, as their proposal responded best to the Council's brief and, in addition, included a wide range of sustainable technologies.

The winning design is inspired by its setting within a chestnut woodland and draws on its local heritage. Historically, this area was well known for boat building. Cruck housing is a customary form of housing in this area. The Centre's design reflects both these traditions by incorporating bent wood elements that resemble the hull of an upside down and timber cruck housing form. The Centre is constructed almost entirely from wooden materials and the architects worked with chestnut foresters in the area to source local materials, including larch, chestnut and oak. The design is so innovative that it encourages park visitors to interact with the Centre regardless of whether they enter the building or not.

The building's ground plan is shaped like a narrow 'S' and is clad with chestnut and punctuated with glazing. It has been designed to draw the visitor into the main site via a footbridge. Located at the building's eastern end, the interpretation centre forms the main part of this space, with the café, toilet and office facilities at the building's western end. This space is entered through a glazed eastern elevation. Two frames extend outside the main entrance providing a covered accessway.



Structural deck study – the Centre's form reflects traditional cruck housing



Building elevations – these show how the Visitor Centre will blend into the surrounding landscape

Above these facilities at first floor level, going via a spiral staircase or lift, are the classroom and welfare facilities. These facilities are housed beneath the span of curved chestnut beams, which overarch the building, providing structural support. Dormer window elements puncture the curving roof form.

Externally, at first floor level, a viewing deck runs along the northern and western building facades. This platform has been raised to canopy level to allow views over the tree tops and across the Shorne Country Park. An outdoor recreational area is provided at the southern end of the building and café users canaccess this during the summer months.

The exhibition space provides educational organisations, interest groups and schools with access to a wide variety of information regarding the park's heritage features, the building's sustainable and energy efficient technologies, and construction materials and methods.

The designers needed to consider peak visitor flows as well as the variety of activities which would occur at different times of the year such as school visits, community courses and recreational uses. The layout and design of the building make it possible to be open 364 days a year, an increase of 111 days over the number of days that the previous centre was open. It is anticipated that an extra 20% more visitors will be attracted to the centre.

Access

A range of non-vehicular access points and routes will be provided as part of the park enhancements, including linking with and contributing to regional green transport networks. Integration of these new access routes will encourage more sustainable forms of transport and will open up Shorne Wood to a much wider population.

The two previous satellite car parks were closed to allow these areas to be converted back to woodland and to improve traffic management, security and pedestrian safety. The main car park has been extended and now includes 17 spaces allocated for mobility-impaired users as well as bicycle parking stands. No entrance fee is proposed although a small charge for parking remains to encourage people to use more sustainable transport methods, such as public transport. There are regular train services from London to local stations at Meopham, Gravesend and Higham. These stations are served by local buses and taxis.

External use of chestnut wood, including tree trunk veranda struts

Chestnut as a building material

The Visitor Centre is constructed almost entirely of locally sourced chestnut from coppice woodland. Sweet chestnut coppice covers approximately 18,000 hectares in the south of England but only approximately 10% of this material is currently harvested for use. The use of chestnut in the design process means that the Centre itself will become a tool to educate visitors about the area's traditions of coppicing. It also demonstrates the possibilities for using this material more widely in the construction industry.

Coppicing is a traditional method of woodland management whereby tree stems are cut down to a low level. New tree shoots subsequently emerge, and after a number of years the coppiced tree is ready to be harvested again. Typically coppiced woodland is harvested in sections on rotation to ensure an annual harvest and regular income for the forester. This has the side-effect of increasing biodiversity within the forest, as light is allowed back to the woodland floor prompting the flowering of woodland flora, which in turn attracts additional local fauna. As coppicing is rotated, different areas of woodland contain trees of different heights. This allows different quantities of light to the forest floor, encouraging different ecosystems to emerge. Certain plant species thrive in coppiced woodland and if cutting ceases, the dense canopy that forms shades the woodland floor, causing these plants and the fauna that rely on them to die out.

The various elements of the building, such as the internal walls, structural supports and floorboards, incorporate different forms of chestnut, revealing the wood's various textural qualities and colours that will weather and change over time.

The curved building is externally clad with sweet chestnut. As the Centre is exposed to the elements, these chestnut panels will weather and turn silvery grey. Cedar shingles are used as roof cladding. These are the only building material sourced from outside the United Kingdom, being shipped from Canada.