AHEC Europe
Unit 20.1,
20-22 Vestry St
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americanhardwood.org

PRESS RELEASE
SEPTEMBER 2013

ENDLESS STAIR OPENS AT TATE MODERN

Endless Stair, a towering structure of 15 Escher-like interlocking staircases made from American tulipwood CLT, is now open to the public on the lawn in front of Tate Modern as part of the London Design Festival 2013. Designed by de Rijke Marsh Morgan Architects (dRMM) and engineered by Arup, Endless Stair is both a sculpture and research project advancing the knowledge of timber technology and sustainability. Endless Stair will be open to the public daily from 13th September – 10th October between 9am and dusk. This elegant sculpture will provide visitors the opportunity to enjoy stunning views of the River Thames and Tate Modern. The landmark project is a highlight for this year's festival and is sure to be one of London's most captivating destinations for the duration of its opening.

Endless Stair is made up of a series of timber flights, some veering to the right some to the left, providing many ways to explore the installation, which ultimately leads to the top flight that acts as a dramatic viewing platform.

The latest in a series of collaborations between the London Design Festival and the American Hardwood Export Council, Endless Stair pioneers the use of hardwood for cross-laminated timber (CLT). Cross-laminated timber is typically made from softwood, yet this project demonstrates the real potential for using tulipwood, an abundant, relatively inexpensive and structurally impressive American hardwood.

Professor Alex de Rijke, Director of dRMM said, "Endless Stair is a temporary sculpture designed to be endlessly reconfigured." A key objective for dRMM was to make the elements as environmentally friendly as possible, with each flight of stairs built from standard elements creating as little waste as possible in construction, and with the ability to re-use and relocate the design either in part, or as a whole. These laudable aspirations are backed up by hard figures, utilising AHEC's ISO-conformant life-cycle assessment (LCA) prepared by PE International, leaders in the field of LCA. This is the latest piece of work in AHEC's on-going mission to demonstrate the real sustainable credentials of American hardwoods.

David Venables, European Director of American Hardwood Export Council, sponsors of the project comments, "This project has everything we could wish for; great inspirational design, a serious structural challenge for the engineers, a pioneering use of one of our most intriguing timbers, and the first ever scientifically based environmental profile for a timber structure. Then add the winning combination of the London Design Festival as a platform and Tate Modern as a venue and you can see why I am grinning from ear to ear."

Genesis of the design

Faced with the challenge from the American Hardwood Export Council to produce a sculptural installation using slender tulipwood CLT panels, Alex de Rijke of dRMM settled quickly on an idea involving stairs; "On stairs people interact, they pass each other, they are always interesting places with spatial and social potential. We thought a staircase would be a good vehicle for exploring structure, space and making a sculpture. Stairs are sculpture's gift to architecture."

An early decision was to design and manufacture the steps and the balustrades on one side from identical elements of CLT, equivalent in size. These are stacked up with a spacer element between them, creating the flights which, as a result of the stacking process, then veer either to the right or to the left, depending on the position of the balustrade.

The structural importance of the tulipwood CLT is showcased through the project's design. The CLT that makes up the tread and balustrade panels is built up from three equal layers and is 60mm thick in total. The use of other timbers would doubtless have increased the size of individual elements and arguably not led to such an elegant solution. Arup's timber specialist,

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Andrew Lawrence comments, “The idea that we can now create huge wooden CLT panels from small trees is very exciting. Tulipwood CLT offers the potential to combine the advantages of CLT with the strength and appearance of tulipwood. It’s a great addition to the pallet of wood based materials.”

The installation has been designed to be interactive and people will be encouraged to climb the stairs. The sculpture therefore is safe to use, while not compromising the overall aesthetics of the design.

About CLT

Cross-laminated timber (CLT) is an engineered timber product that is used increasingly to build the walls and floors of buildings. CLT is of a ‘sandwich’ construction, normally with an odd number of layers. On each successive layer the fibres of the timbers run in opposing perpendicular directions, so that if you could look through the CLT from above you would see a grid of fibres. It is orthotropic – that is, it has different properties in three directions. This is important because timber is strong along the directions of the fibres, and less so in the cross direction. Building up this structure results in a panel that has equal strength in all directions. It also gives it dimensional stability. Modern offsite manufacturing methods mean that CLT panels can be made in a factory and then delivered to site for assembly in a fast and accurate manner, cutting down on the time needed for construction.

What is tulipwood?

One of the most abundant hardwoods in American forests, tulipwood is, like all American hardwoods, grown sustainably. Its botanic name is Liriodendron tulipifera and it derives its name from its distinctive tulip-shaped flowers. Its structural strength is well understood, since it is one of a number of species on which Arup and the Building Research Establishment (BRE) carried out tests several years ago. It is an anomalous material in that although it has the same bending strength as oak, it has a similar density to a typical softwood.

Structural concept

Despite the complex sculptural form, the structural concept for the stair is relatively simple. The flights tend to act as arching elements with loads transferred via both the stiff balustrade elements and through the treads themselves down to ground. The overall structure is stable when the flights are all joined together to form the overall sculptural form.

The solid balustrades look like solid timber beams, but in fact they are a series of CLT panels glued together. Tensile and compressive stresses in the beam have to be passed from panel to panel in rolling shear. The rolling shear stiffness therefore determines the bending stiffness of the beam. If the balustrades had been made of softwood rather than hardwood CLT, they would have had less than half the strength or stiffness. The stair would have been a lot more flexible and it might have been necessary to have a much greater overlap between panels or deeper elements.

Analysis and testing

Arup had to identify the appropriate engineering design criteria to assess the performance of Endless Stair. Helen Groat, Senior Engineer at Arup, led the team who undertook extensive computer modelling to design this intricate structure. Nüssli manufactured a test flight to compare its performance against the computer model.

Similarly, the complexity of the design meant that the overall vibration behaviour could not be easily predicted through analysis. The completed stair was tested, in situ, before the formal opening in order to measure its performance.

Adrian Campbell, Project Director at Arup comments, “The scale of complexity on the engineering design has been one of the most challenging yet rewarding aspects of this project. The intricate level of detail is phenomenal and Endless Stair beautifully illustrates the intimate relationship between architecture and engineering design”.

Making Endless Stair

Leading timber distribution company, Imola Legno, based in north Italy, made the tulipwood CLT from random widths and lengths of tulipwood lumber donated by 8 AHEC member companies. The team built up the three layers of 20mm timber to create panels that were

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60mm thick. The panels utilise some of the lowest grades of tulipwood, which helps define its visual character as well as being a significant cost saving

Swiss company Nüssli fabricated the flights and other elements, using a combination of glue and steel fixings. Nüssli delivered these to the site outside Tate Modern, erecting the structure in 10 days.

Sustainability
American hardwoods grow sustainably in forests that regenerate naturally. The American Hardwood Export Council has invested in detailed life-cycle analysis of its timbers, collecting data and measuring the environmental impacts from harvesting timber from the forest to the sawmill and drying processes in America through to delivery at the factory gate. This work was carried out by sustainability consultants PE International, and independently verified by an expert critical review panel. The report demonstrates that accessing wood fibre from non-local forest resources is not significantly detrimental to the environment and the impact is easily out weighed by wood's ability to act as a carbon store. The results of this LCA study can be accessed at www.americanhardwood.org

Lighting
Seam Design has provided the lighting scheme for Endless Stair, working with LED luminaires supplied by Lumenpulse, a mix of linear grazers and spotlights. The dynamic scheme cycles between warm and cool colour temperatures of white light and also responds to the presence of people.

Management
Endless Stair will be open during daylight hours and there will be security present to ensure that the installation does not become overcrowded. At night, Endless Stair will be closed off with custom-designed enclosures to prevent people accessing the stairs, however, will still be visible to the public.

The technical legacy
Working from first principles, through testing, research and analysis to design this prototype, the project team envisage Endless Stair will bring many lasting benefits. The ultimate aspiration is that this material is eventually brought into mainstream building construction. The American Hardwood Export Council has produced a technical design publication, written by Ruth Slavid, to tell the story of Endless Stair. Copies will be available free of charge from 30th September. To order a free copy please email europe@americanhardwood.org or visit www.americanhardwood.org

-ENDS-

Endless Stair will be open to the public from 13 September – 10 October, located on the riverside of Tate Modern, Bankside, SE1 9TG
Opening Hours:
13 September - 10 October
Monday – Sunday 9am-dusk

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Credits:
Client: London Design Festival
Design: dRMM Architects – timber studio, ARUP Engineering Structures, Material and Fire Specialists
Sponsor: American Hardwood Export Council (AHEC)
Contractor: Nüssli
CLT production: Imola Legno
Lighting Designer: SEAM

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Lighting: Lumenpulse

Hosted by: Tate Modern

American tulipwood kindly donated by:
Allegheny Wood - www.alleghenywood.com
Blue Ridge Lumber - www.blueridgelumber.com
J&J - jjlog@aol.com
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Notes for Editors:

About American Hardwood Export Council
The American Hardwood Export Council (AHEC) is the leading international trade association for the U.S. hardwood industry, representing the committed exporters among U.S. hardwood companies and all the major U.S. hardwood product trade associations. AHEC concentrates its efforts on providing architects, specifiers, designers and end-users with technical information on the range of species, products and sources of supply.

AHEC produces a full range of technical publications which are available free of charge by visiting www.americanhardwood.org

About Arup
Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. From 90 offices in 35 countries our 11,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

About dRMM
dRMM is a London-based studio of architects and designers, founded in 1995 by Alex de Rijke, Philip Marsh and Sadie Morgan. The practice takes pride in carrying out work that is innovative, high quality and socially useful. We have a track record of creating extraordinary architecture within the standard constraints of the construction industry. Our radical projects are led by site, client needs, concept and construction, rather than formulaic or style-based decisions.

Since 2000 dRMM has pioneered the use of, and applications for, engineered timber as a relevant material for 21st century architecture.

To set-up an interview with the project architect, receive further information and pictures, please contact Ann Dingli on +44 20 7803 0777 or press@drmm.co.uk

About Imola Legno
Imola Legno is Italy's leading timber distribution company with a great passion for wood and for its enormous versatility. The company offers customised semi-finished products suitable for different industries. Imola Legno is aware of its environmental responsibility towards the world's forest resources and therefore is committed to deliver only products that are legally sourced.

About London Design Festival, 14 – 22 September 2013
The London Design Festival was conceived by Sir John Sorrell and Ben Evans. Building on London's existing design activity, their concept was to create an annual event that would promote the city's creativity, drawing in the country's greatest thinkers, practitioners, retailers and educators to a deliver an unmissable celebration of design. First staged in 2003, the London Design Festival is now one of the world's most important annual design events. The Festival programme is made up of over 300 events and exhibitions staged by hundreds of partner organisations across the design spectrum and from around the world.

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The London Design Festival works closely with, and receives financial support directly from, the Mayor's Office – having transferred support from the London Development Agency. The Festival also receives support from Arts Council England, as a National Portfolio Organisation 2012-15.

About Nüssli

Nüssli is a leading, globally operating supplier of structures for events, trade fairs, exhibitions and in other applications in which temporary space is required. The combination of long-standing expertise, in-depth know-how and an international network ensures the focused, cost-efficient delivery of every Nüssli project. Nüssli's success is driven by its reliability and commitment to excel. The company delivers individually tailored, integrated solutions whose hallmarks are high quality and quick turnaround time – from concept to final implementation.

Key products include grandstands, modular stadiums, trade fair stands and pavilions. Nüssli can also provide the entire infrastructure for individual events. The company's wide-ranging products and services, combined with in-house planning and production capabilities, make Nüssli unmatched as a solutions provider to the worldwide events industry.