Content

4 Project Details

6 Summary of the Work and its Significance, Originality, and Rigor

13 Originality

20 Rigor

26 Significance

30 Dissemination and Evidence of Peer Review

32 Bibliography

34 Appendix
Typical column to roof joint detail for the Crest project
**Project Details**

**Designer:** Olivier Ottevaere  
**Practice:** Department of Architecture, the University of Hong Kong  
**Title:** Crest: a bamboo pavilion structure  
**Function:** open-air restaurant and recreation area on riverside  
**Location:** Anji County, Zhejiang Province, China  
**Client:** Lingfeng management committee of Anji County, Zhejiang Province, China  
**Practical Completion:** December 2017  
**Funding body:** Anji county government  
**Budget:** 70,000 RMB  
**Area/Size:** 150 sq. m.  
**Contractor:** Anji ZhuJing Bamboo Technology Co. LTD.
Project Details

Designer: Olivier Ottevaere
Practice: Department of Architecture, the University of Hong Kong
Title: Crest: a bamboo pavilion structure
Function: open-air restaurant and recreation area on riverside
Location: Anji County, Zhejiang Province, China
Client: Lingfeng management committee of Anji County, Zhejiang Province, China
Practical Completion: December 2017
Funding body: Anji county government
Budget: 70,000 RMB
Area/Size: 150 sq. m.
Contractor: Anji ZhuJing Bamboo Technology Co. LTD.

Crest project under construction in its context, Anji, Zhejiang Province, China
Summary of the Work and its Significance, Originality, and Rigor

Crest is a rest area and restaurant situated on a gentle slope along a riverbank in Anji county, Zhejiang Province. It was designed to test how effectively locally grown and produced materials such as bamboo could be used in contemporary architecture, using complex geometry and novel construction techniques, such as the way bamboo poles are jointed, in combination with highly skilled local craftsmanship. It was designed to test how local and imported building strategies could be combined to produce a new architectural expression of the vernacular.
Crest was submitted to represent the Department of Architecture of the University of Hong Kong in the 2017 National Universities Bamboo Design and Construction Competition, where it was selected as one of twenty final projects to be constructed. The competition was organized by the Chinese government to promote innovative and experimental green construction practices through an engagement with sustainable materials and local building techniques. The competition stipulated that all competition entries utilize bamboo as the major building material.

The design process also merged research and teaching practices through design. University of Hong Kong students were invited to participate in the
project, and gained hands-on building experiences by working closely on-site with a team of local craftsmen.

Crest is composed of three distinct parts, including a) a retaining wall and concrete foundation, which receives b) a bamboo structure, which in turn supports c) a pleated roof, covering a shaded area of around 150 square meters.

The project belongs to a larger body of practice research work that investigates how ruled-based construction practices can be applied to specific, rural contexts in China through different materials.

As ongoing experimentation from Crest, ruled-based prototypes were developed and built at a series of scales.
(from a wall to room size element) in an effort to explore how a range of different construction techniques might perform in relation to different sizes of structures. Prototypes include a curtain wall, mush-room, and roof shell. These techniques included formworks made of bamboo poles for concrete casting. An additional variable concerned the variety of materials to be used in the building’s construction, which included naturally grown bamboo, fabric, concrete, and wood.

The project received second prize at the 2017 National Bamboo Design and Construction competition, Anji, Zhejiang province. It has also been published online in various professional platforms and featured in national and local television programs throughout China.
Concrete foundation, bamboo structure and tensile roof membrane
Below: foundation and retaining wall under construction / Above: foundation with bamboo structure and tensile roof
Local craftsman at work on the Crest construction: each worker is highly skilled adopting a hands-on approach to building with bamboo onsite.
**Originality**

The work engages with a local, traditional and culturally significant material to conceive contemporary structures that present new ways of using the material. The aim is that the new bamboo project can challenge existing local craftsmanship and their know-how in building mainly vernacular types.

Crest also attempts to reinvigorate potential new ways of working with the rigid and irregular material of bamboo by utilizing existing craftsmanship and posing alternative construction procedures and structural logics to those local practices.

One of the aims of the competition is to
provoke experimentation with bamboo to test better economic models of building that not only benefit the local community but also be exported internationally.

Additional methods of formwork design and experimental bamboo structures were tested in relation to existing formwork methods. The new methods proved more adaptable and successful in building specific building elements such as columns, beams, walls and slabs (conventionally using rigid plywood sheets and timber).

The project makes use of flexible formwork made of fabric sheets and a series of bamboo poles capable of changing orientation to realize complex geometries with little building effort. It has the potential to be utilized in larger structures, not only in Zhejiang Province, but throughout China and other parts of the world.
provoke experimentation with bamboo to test better economic models of building that not only benefit the local community but also be exported internationally.

Additional methods of formwork design and experimental bamboo structures were tested in relation to existing formwork methods. The new methods proved more adaptable and successful in building specific building elements such as columns, beams, walls and slabs (conventionally using rigid plywood sheets and timber).

The project makes use of flexible formwork made of fabric sheets and a series of bamboo poles capable of changing orientation to realize complex geometries with little building effort. It has the potential to be utilized in larger structures, not only in Zhejiang Province, but throughout China and other parts of the world.

Mush-Room project, testing bamboo and fabric formwork for concrete casting
Formwork construction and concrete casting of a Mush-Room showing the responsiveness of the liquid concrete with its formwork: interaction between hard and soft materials.
Formwork construction and concrete casting of Mushroom Room showing the responsiveness of the liquid concrete with its formwork: interaction between hard and soft materials.
Concrete corrugations of Curtain Wall, testing the capacity for its formwork to be responsive to the liquid properties of concrete.
Dry formwork of Curtain Wall before concreting. The formwork uses cheap and local materials with the aim for knowledge transfer to local builders.
Rigor

The bamboo structure of Crest is organized into thirteen bays of trusses. Each changes in profile to support a roofscape that gradually evolves in relation to the topography of the site. At one end of the wall, the roof crest peaks at over 6 meters, echoing the mountainous silhouette in the background. Towards the other end, the roof channels downward to eventually merge and disappear with the landscape. This is both a visual and spatial effect that reflects the structure’s intimate sensitivity to the surrounding terrain.

The main social space below the roof is qualitatively demarcated by the articulation of its ceiling plane. In areas identified with more solar exposure,
Rigor

The bamboo structure of Crest is organized into thirteen bays of trusses. Each changes in profile to support a roofscape that gradually evolves in relation to the topography of the site. At one end of the wall, the roof crest peaks at over 6 meters, echoing the mountainous silhouette in the background. Towards the other end, the roof channels downward to eventually merge and disappear with the landscape. This is both a visual and spatial effect that reflects the structure’s intimate sensitivity to the surrounding terrain.

The main social space below the roof is qualitatively demarcated by the articulation of its ceiling plane. In areas identified with more solar exposure, bamboo poles are placed closer together to provide greater shading, whereas in zones with less direct sun exposure, the clearance between poles is increased. This design gesture not only offers a unique and differentiated material expression to the space but also creates a comfortable zone for leisure—one that is conducive to a range of social activities while remaining responsive to its environmental context.

A field of thirty-one differently sized columns, each made of bundles of bamboo poles that are each flaring upwards, split and bend in four different directions to delineate the specific yet irregular roof profiles. They are both structural and aesthetic elements that support the roof and provide a unique interior atmosphere.
Most of the project’s rigor stems from its structural complexity. A series of columns, each composed of different sizes and pole angles, create a single joint system. Each contributes to the overall structural integrity of the building despite the singular and uncertain structural integrity of each individual bamboo shaft.

Catalogue of thirteen changing structural bays for the Crest project.
Most of the project’s rigor stems from its structural complexity. A series of columns, each composed of different sizes and pole angles, create a single joint system. Each contributes to the overall structural integrity of the building despite the singular and uncertain structural integrity of each individual bamboo shaft.

Above: bottom view of field of 31 columns / below: typical construction drawing for one structural bay
Series of changing column-roof joints in Crest
Significance

In 2017, Crest received second prize in the National Universities Bamboo Design and Construction Competition. Through this recognition, we were able to develop additional joint systems, all of which rely upon the same structural integration of bamboo and fabric tested through the project's original three prototypes.

The research findings in these projects present new formwork techniques for concrete casting as well. These casting techniques are responsive to the concrete properties, reusable for other concreting applications and adaptive to other kinds of building elements and shapes. In addition, the implementation of these techniques is economical, in so far as they take advantage of a number of
In 2017, Crest received second prize in the National Universities Bamboo Design and Construction Competition. Through this recognition, we were able to develop additional joint systems, all of which rely upon the same structural integration of bamboo and fabric tested through the project's original three prototypes.

The research findings in these projects present new formwork techniques for concrete casting as well. These casting techniques are responsive to the concrete properties, reusable for other concreting applications and adaptive to other kinds of building elements and shapes. In addition, the implementation of these techniques is economical, in so far as they take advantage of a number of readily available local materials.

Following the completion of Crest, some of these tested prototypes have since been applied and integrated to larger scale architecture projects, including Bamboo Shells, a reception hall for a resort currently under construction in Zhangjiajie County, Hunan Province, China.

The prototypes’ transferability and robustness in being able to address architecture projects of larger scales underscores the project’s significance.

Another important aspect of these projects lies in their position within the intersection of research and teaching. Each research project is initiated and
carried out through intensive teaching workshops that explore hands-on experiments with materials and building techniques from an empirical and prototyping process all the way to an on-site design-built outcome. It’s an invaluable and unique opportunity for both teachers and students to develop new design methods through onsite testing.

Construction experience on site with students and local craftsmen
carried out through intensive teaching workshops that explore hands-on experiments with materials and building techniques from an empirical and prototyping process all the way to an on-site design-built outcome. It’s an invaluable and unique opportunity for both teachers and students to develop new design methods through onsite testing.

Scaled models testing spatial and tectonic aspects of the project, produced during the design process with students.
Dissemination and Evidence of Peer Review

Awards:
2nd prize, National Bamboo Design and Construction competition, Anji, Zheijiang Province, 2017

Lectures:
“Design through Prototyping,” Faculty of Architecture, Zhejiang University, Hangzhou, China, May 2018
“Concrete Approximations,” Practice Research seminar, Ho Chi Min City, RMIT Asia, October 2017
“Points, lines, surfaces and volumes,” Design-Make Festival, Turenscape Academy, Huangshan, Anhui Province, China, September 2018
Teaching:
Crest Studio, Summer Bamboo Workshop, Department of Architecture, The University of Hong Kong, Anji, Zhejiang Province, July 2017

Curtain Wall Studio, Design-Make Festival, Turenscape Academy, International workshop, Xixinanzhen County, Anhui Province, China, October 2017

Mush-Room Summer Elective Studio, Department of Architecture, The University of Hong Kong, Xia Mu Tang, Jianxi Province, July 2018
Bibliography

- “Grow your Own House: Simon Velez and Bamboo Architecture”, Kries, Mateo; Dethier, Jean; Steffens, Klaus, Weil am Rhein. Vitra Design Museum, 2000
Interior view of Crest taken during competition presentation to members of international jury
Appendix
Aerial view of Crest during opening day
Aerial view of Crest during final construction
Aerial view of Crest during final construction
Aerial view of Crest during final construction
The Department of Architecture educates students in an active culture of service, scholarship and invention. Uniquely situated at the crossroads of China and global influence, the Department takes the approach that design is best explored from a sophisticated understanding of both. With a multidisciplinary curriculum emphasizing technology, history and culture, students gain broad knowledge and skills in the management of the environmental, social, and aesthetic challenges of contemporary architectural practice. With opportunities for design workshops, international exchanges, and study travel, graduates of the Department of Architecture are well prepared for contribution to both international and local communities of architects and designers.