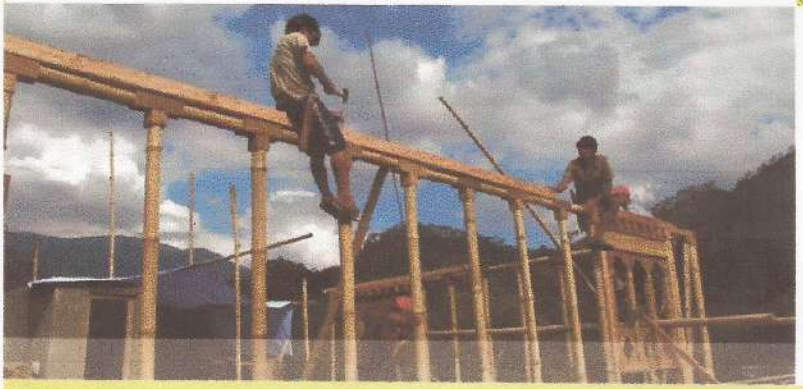
UK RESEARCH GROUP MEETING



BAMBOO CONSTRUCTION FOR INCLUSIVE & GREEN DEVELOPMENT

VENUE: KNOX SHAW CONFERENCE ROOM, SIDNEY SUSSEX COLLEGE, CAMBRIDGE

Agenda

3rd OCTOBER, 2013

ORGANISER: INTERNATIONAL NETWORK FOR BAMBOO AND RATTAN

HOST: CAMBRIDGE UNIVERSITY

PARTICIPATING RESEARCH GROUPS:

INBAR

BATH UNIVERSITY

CAMBRIDGE UNIVERSITY

UNIVERSITY OF CAMBRIDGE

COVENTRY UNIVERSITY

THE TIMBER RESEARCH AND DEVELOPMENT ASSOCIATION

UNIVERSITY COLLEGE LONDON

TIME	ITEM	SPEAKERS
01:55-02:15pm	Past and Present of Bahareque Architeture in the Coffee Cultural Landscape of Colombia	Jose F. Muñoz R. National University of Colombia
Discussion Sessions		
02:15-03:15pm	Strengths of UK Research Groups, Industry on Bamboo Construction and Potential Linkages to the global South	Andrew Bennett, INBAR (Moderator)
03:15-03:30pm	Drinks Break	
03:30-04:30pm	Priority Research and Geographical Areas for Collaborative Actions	Andrew Bennett, INBAR (Moderator)
04:30-05:00pm	Workshop Conclusions	Oliver Frith, INBAR

End

TIME	ITEM	SPEAKERS
09:30-10:00am	Registration	
10:00-10:25am	Overview of Bamboo Sector & INBAR's New Strategy	Oliver Frith, INBAR
Research Theme 1: Structural Bamboo Culms & Technology Transfer		
10:25-10:45am	Grading Bamboo Culms and low-cost Urban Housing in the Philippines	David Trujillo, Coventry University
10:45-11:05am	Structural Grading of Culms in Mexico, an International Collaboration Project	Rodolfo Lorenzo, University College Londo
11:05-11:25am	Recent Research on Structural Bamboo in Colombia	Juan F. Correal Daza University of Los Andes
11:25-11:35am	Tea Break	
Research Theme 2: Bamboo Structural Composites and Thermal Performance		
11:35-11:55am	Developing Green Building Materials and Building Codes for Structural Bamboo Products	Michael Ramage, Cambridge University
11:55-12:15am	Mechanical Characterization of Thermo-hydro-mechanically Modified Structural Guadua Panels for Construction	Hector F. Archila Santos, Bath University
12:15-12:35pm	Thermal Characteristics of Moso Bamboo along the Radial Direction	Puxi Huang, Bath University
12:35-01:35pm	Lunch Break	
Research Theme 3: Bamboo Construction Case Studies		
01:35-01:55pm	TRADA Experiences on Bamboo Construction	Lionel Jayanetti, TRADA

UNIVERSITY OF CAMBRIDGE
Department of Architecture

Michael H. Ramage
University Senior Lecturer
Architectural Engineering

Addressed to:
Professor Jose Fernando Muñoz Robledo
Universidad Nacional de Colombia
Cra 27 # 64-60 Manizales
Caldas - Colombia

9 August 2013

Dear Prof Muñoz,

We would like to invite you to our Bamboo Meeting entitled "Bamboo – a renewable and sustainable material for construction" held at the University of Cambridge on the 2nd to the 3rd of October. In the afternoon of the 2nd we intend to meet with representatives from various universities based in Europe, Asia and Latin America, together with companies and global organisation INBAR, represented by Mr Oliver Frith coming from the head office in China. On the 3rd, INBAR shall host a full day session for all their partners in the UK and will provide an excellent Bamboo networking opportunity.

Sincerely,

Michael H. Ramage
University Senior Lecturer in Architectural Engineering
Fellow, Tutor and Director of Studies, Sidney Sussex College

INTERNATIONAL MEETING: "Bamboo a renewable and sustainable material for construction"

University of Cambridge – England – 10 / 2013

TOPIC:

PAST AND PRESENT OF BAHAREQUE ARCHITECTURES IN THE COFFEE CULTURAL LANDSCAPE OF COLOMBIA.

JOSE F. MUÑOZ R.

Architect MA. - Associate Professor:

Universidad Nacional de Colombia - Manizales

Master of Architecture: Washington University. St. Louis MO. USA. (Fulbright Scholarship & Assistant Professor)

Member of Research Groups: Urban & Architecture Heritage – Habitat and Technology

PRESENTATION

This paper presents the heritage BAHAREQUE building systems (Wood and Bamboo Guadua structures) and their techno cultural developments, which characterizes the past and present architectures of the now called Coffee Cultural Landscape of Colombia, declared by UNESCO - 2011 as world heritage.

BAHAREQUES: Wood & Bamboo Guadua structural frameworks covered with a skin of different materials such as: Clay – Wood board – Metal – Cemented mortars.

SITE

COFFEE CULTURAL LANDSCAPE OF COLOMBIA

States of:

Caldas – Risaralda Quindío – Valle

Central Western Andes

World Heritage
UNESCO 2011

www. mapadecolombia.com

RESEARCH BACKGROUND

Universidad Nacional de Colombia – Manizales

FOREC
FONDO PARA LA RECONSTRUCCIÓN DEL EJE CAFETERO

AIS
ASOCIACIÓN COLOMBIANA DE INGENIERÍA SÍSMICA

Bahareque: Timber & Bamboo Guadua Heritage Architectures

1- CLAY BAHAREQUE

2- WOOD BOARD BAHAREQUE

3- METAL BAHAREQUE

4- CEMENTED BAHAREQUE

Characterization of BAHAREQUE Building Systems Heritage in the Coffee Cultural Landscape of Colombia.
MUÑOZ R. JF. 2002.

Base of Decree 052 / 2002 – Earthquake Resistant Code for Contemporary Cemented Bahareque – NSR/2010 – Chapter E

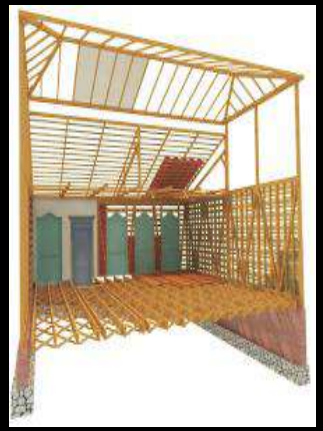


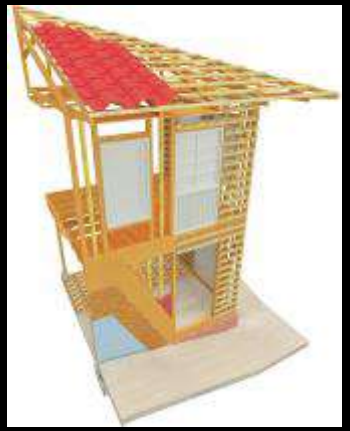

Photography: SARA MUÑOZ U


COFFEE CULTURAL LANDSCAPE OF COLOMBIA

AGUADAS – CALDAS

Paradigmatic Example of Bahareque Heritage Town






CLAY & CEMENTED BAHAREQUE

BUILDING SYSTEMS AND SUB-SYSTEMS of the Historical Republican Downtown of Manizales

135 - 3D Buildings Models.


CEMENTED BAHAREQUE

3D MODELS MADE BY ARCHITECTURE GRADUATION STUDENTS

CEMENTED BAHAREQUE: DECREE 052 – 2002 / Colombia

Earthquake Resistant Code for **Contemporary Cemented Bahareque** NSR/2010 – Chapter E

TECHNOLOGICAL MODEL

- Earthquake resistant foundations.
- Structural continuity: anchors between foundations - structural bahareque frameworks – floors – roofs.
- Bahareque (timber & bamboo - Guadua) structural frameworks.
- Cemented bahareque for structural walls: sand and cement mortars over metal netting.
- Lighter roofs with anchors.

Structural Wood & Bamboo Guadua Frameworks with Diagonals.

Architectural & technological design grid: 90 X 90 centimeters.



Photography: JOSE F. MUÑOZ R.



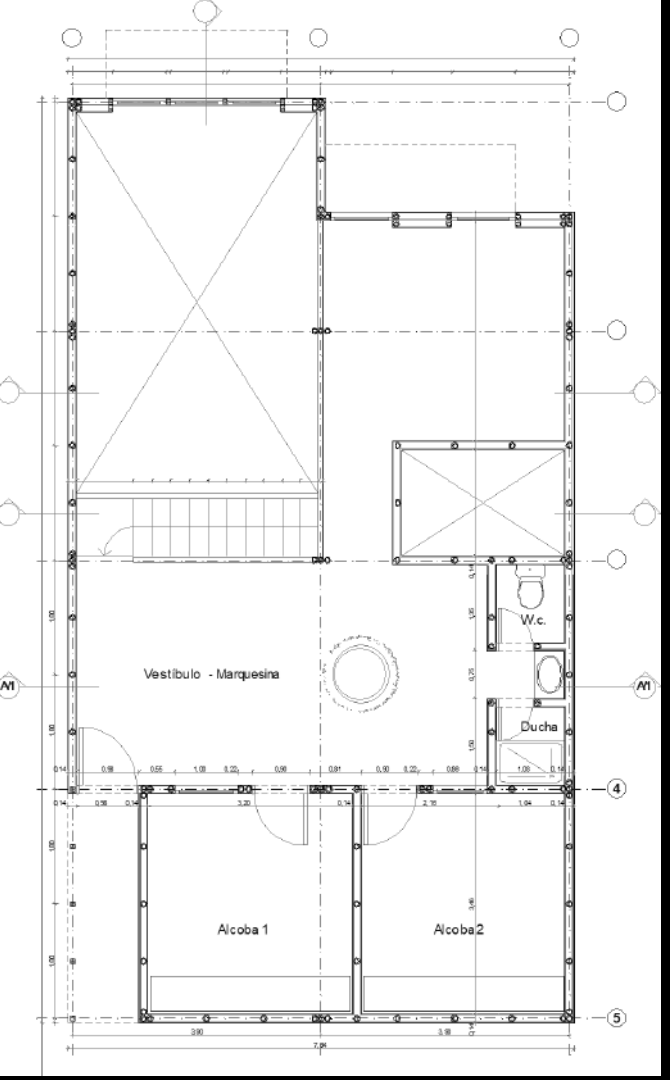

SANTANDER HOUSE

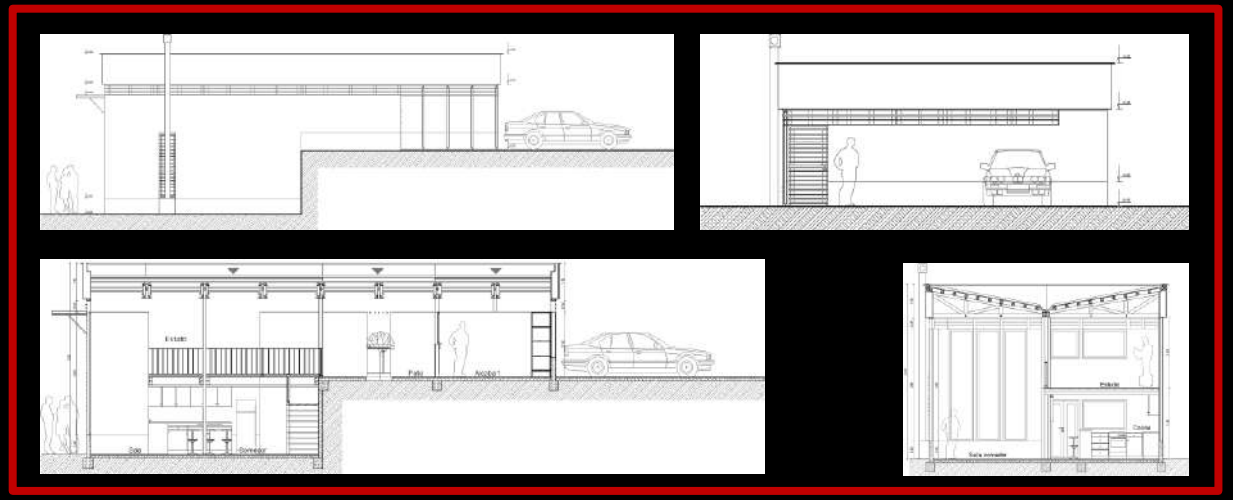
APPLIED CEMENTED BAHAREQUE CODE

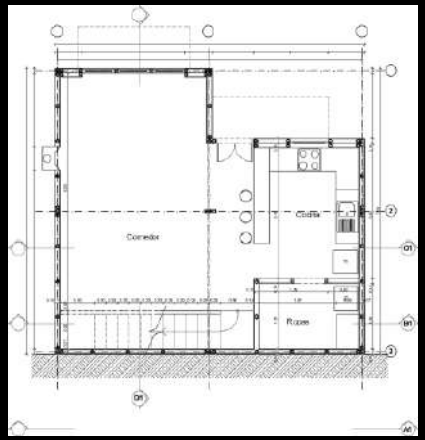
Decree 052 / 2002

Bajo Tablazo, Manizales

Design: **Architect MA. MUÑOZ R.** JF. 2004







Design 2004:

Architect MA. MUÑOZ R. JF.

Design goal:

CONTEMPORARY

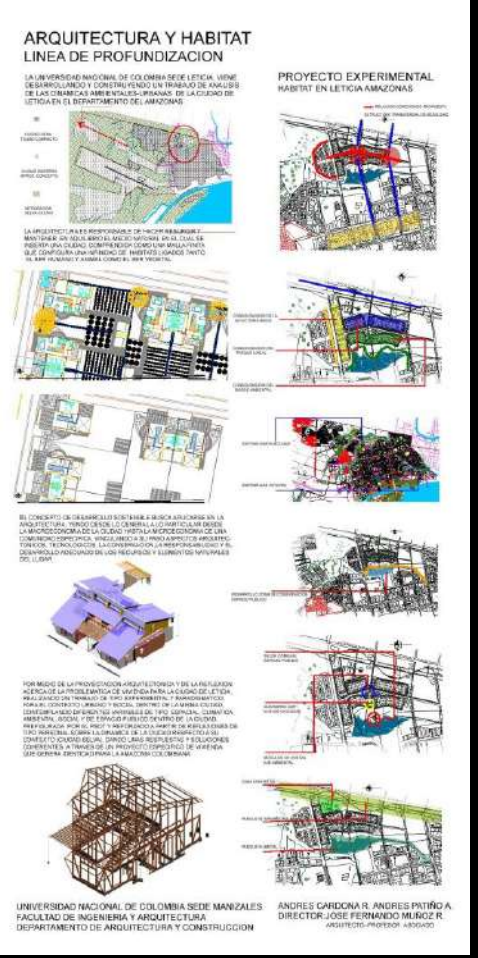
Vs

NEO-VERNACULAR ARCHITECTURE

AREA: 120 mt2

TOTAL COST: US$ 30.000 – (6 / 2005)

COST mt2: US$ 250



Rur- Urban Community
Leticia - Amazon

DEEPING **LINE OF ARCHITECTURE AND HABITAT (5th year).**

MULTIPLE ACADEMIC PROJECTS ARROUND COLOMBIA (MORE THAN 50) SOME OF THEM WITH NATIONAL AND INTERNATIONAL RECOGNITION. Theoretically Supported By The Master In Habitat.

Indigenous Community- "Embera Chami"- Risaralda - Caldas

Pacific Ocean Community - Buenaventura - Valle

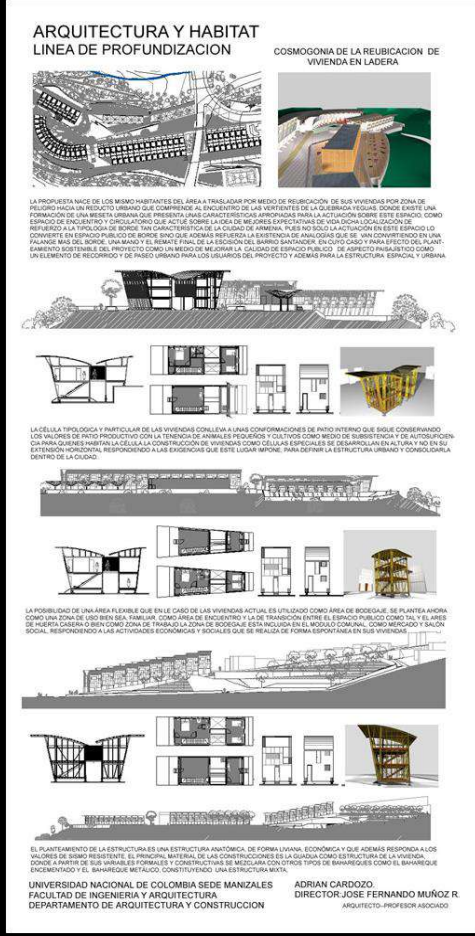
ACADEMIC PROPOSALS: 2000 - 2008

GRADUATION PROJECTS - PROFESSOR ARCHITECT MA. **MUÑOZ R. JF.**

UNIVERSIDAD NACIONAL DE COLOMBIA

SUSTAINABLE HABITAT FOR POPULAR HUMAN SETTLEMENTS

IN-SITU URBAN RENOVATION “EL CLIFF” - SAN ANDRES ISLAND



ACADEMIC PROPOSALS: 2000 - 2008

GRADUATION PROJECTS - PROFESSOR ARCHITECT MA. **MUÑOZ R. JF.**

UNIVERSIDAD NACIONAL DE COLOMBIA

COMMUNITY RE-LOCATION
POST- EARTHQUAKE 1999
ARMENIA - QUINDIO

NATIONAL UNIVERSITY OF COLOMBIA MANIZALES BRANCH – ARCHITECTURE AND URBANISM SCHOOL.

INTER SEMESTER ARCHITECTURE WORKSHOP 2013: July 9 – August 9

TOPIC: SUBURBAN SUSTAINABLE HOUSING AT THE ANDEAN TROPIC.

DURATION: FIVE WEEKS – FULL TIME: 180 HOURS – 18 STUDENTS – 9 PROJECTS.

The architecture intersemestral workshop (Summer Studio) appeals to a pre-studied Andean tropical scenario in the suburban area of Santagueda Town Center, Municipality of Palestina, Caldas State, Colombia, with the aim of developing some innovative architecture and technological design exercises of sustainable.

It deconstructs the modernist paradigm of "The house: a machine for living", aiming to innovate on a contemporary and humanist concept: of "the house, a place to inhabit in an Andean tropical context generating a contemporary site architecture.

For this particular exercise, unlike the multiple previously developed academic projects in the field of popular habitat; it focuses on three types of suburban sustainable houses for temporary or permanent uses, out of the many family types recognized by the contemporary sociology of Colombia.

1- The nucleated house: as a suburban housing solution, for temporary or permanent uses, for different nuclear or individual families.

2- The extensive house: as a temporary or even permanent housing solution for different extensive families, where today they get grouped to share a recreational and sustainable suburban habitat.

3- The bi-family house: where two different nucleated families inhabit permanent or temporary separated units, sharing facilities and recreational services in a suburban habitat looking for a context of sustainability.

THE CONTEMPORARY CEMENTED BAHAREQUE TECHNOLOGY: SUSTAINABLE, INNOVATIVE AND GLOBAL.

JOSE FERNANDO MUÑOZ ROBLEDO- Architect MA – Associate Professor

The contemporary Cemented Bahareque architectures (Decree 052/2002 – NSR/10) are typically constructed from renewable local materials based on structural frames made out of wood and bamboo guadua, and must correspond to a contemporary technological re-interpretation as a complement of the heritage Bahareque architectures, a constructive technical tradition of the ancestral architectures that identify the Coffee Cultural Landscape of Colombia.

For the purposes of allowing an architectural and technological innovation and adaptation of global materials, in this prospective exercise the metric modulation of 90 X 90 centimeters of the architectures governed by Decree 052/ 2002 corresponding to Contemporary Cemented Bahareque; the projects are developed as academic exercises based on a "spatial grid for architectural - technological design" of 40,6 X 40,6 centimeters, corresponding to 16 X 16 inches according to the American measurement system which prevails in almost all building materials factories in the world developing their products based on international standards.

The architectural and technological proposals are oriented toward a contemporary architecture related to the Andean tropical acting site and identify by its structural and constructive lightness, by bioclimatic solutions for the rain and solar protection, by natural ventilation and also related with the natural and anthropic landscape, and also by the low energy consumption; without appealing to historicist or neo-vernacular aesthetic solutions.

They are also oriented to new proposals for the solution of metal joints with dry wall screws and bolts; computer - designed for each particular case, which could be cut and folded, still in situ, with last generation laser cutters, as a future research line resulting from this recent academic exercises, supplementary to Decree 052/ 2002 of the NSR/10..




CONTEMPORARY SUBURBAN SUSTAINABLE HOUSING AT THE ANDEAN TROPIC: SANTAGUEDA – CALDAS: Altitude 1000 meters

Contemporary Cemented Bahareque Technology: SIG

Sustainable, Innovative and Global.

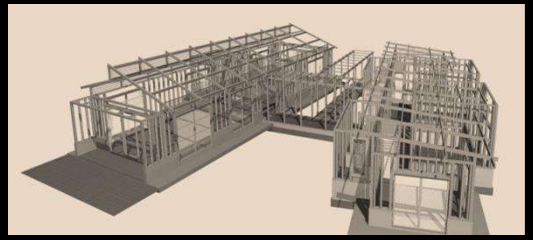
Spatial grid for architectural & technological design: 40,6 X 40,6 centimeters or 16 X 16 inches

ACADEMIC PROPOSALS: INTER-SEMESTER 2013

SUMMER STUDIO - PROFESSOR ARCHITECT MA. **MUÑOZ R. JF.**

UNIVERSIDAD NACIONAL DE COLOMBIA



CONTEMPORARY SUBURBAN SUSTAINABLE HOUSING AT THE ANDEAN TROPIC: SANTAGUEDA – CALDAS: Altitude 1000 meters

Contemporary Cemented Bahareque Technology: SIG

Sustainable, Innovative and Global.

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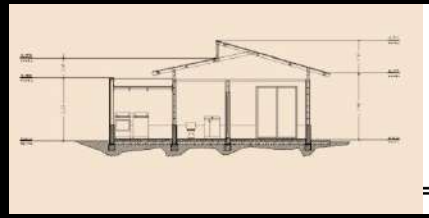
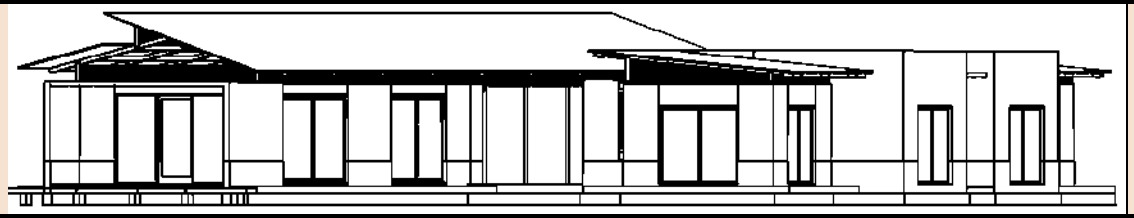
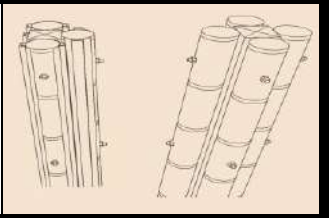
ACADEMIC PROPOSALS: INTER-SEMESTER 2013

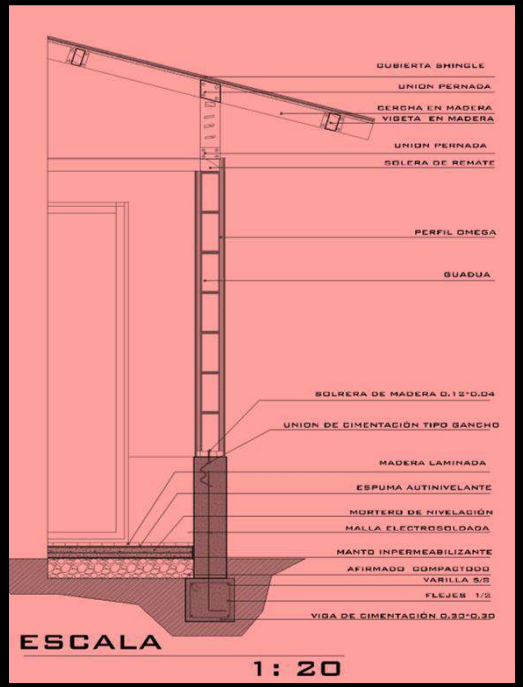
SUMMER STUDIO - PROFESSOR ARCHITECT MA. **MUÑOZ R. JF.**

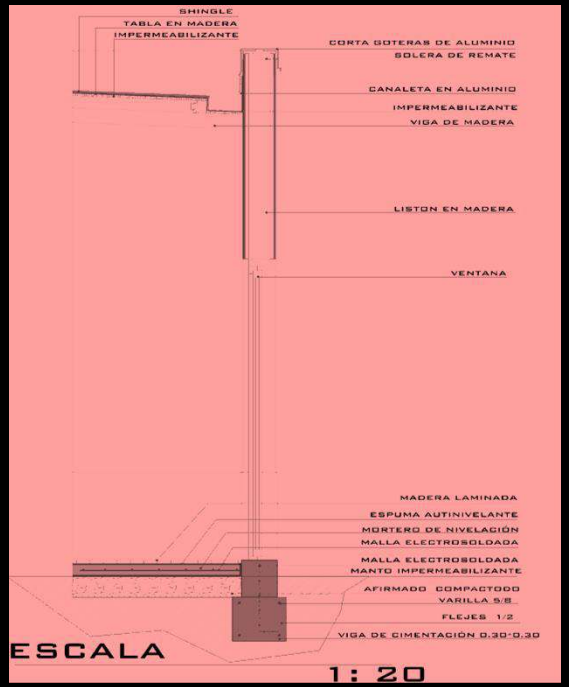
UNIVERSIDAD NACIONAL DE COLOMBIA

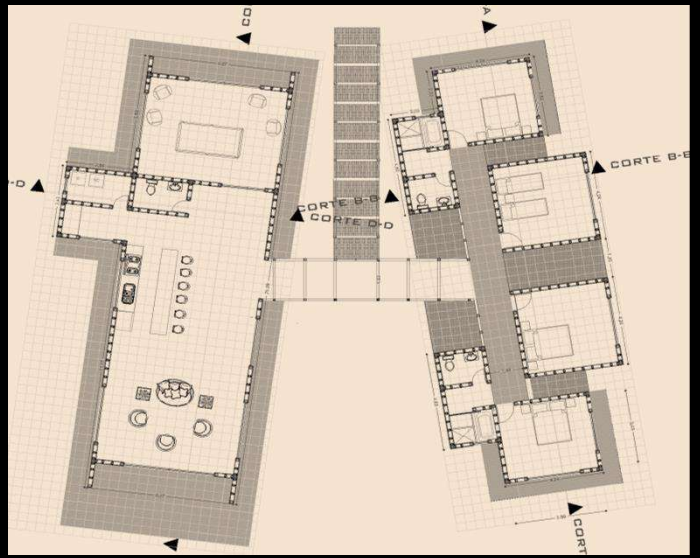







CUBIERTA SHINGLE
UNION PERNADA
CERCHA EN MADERA
VIGETA EN MADERA
UNION PERNADA
SOLERA DE REMATE
PERFIL OMEGA
GUADUA
SOLRERA DE MADERA 0.12*0.04
UNION DE CIMENTACIÓN TIPO GANCHO
MADERA LAMINADA
ESPUMA AUTINIVELANTE
MORTERO DE NIVELACIÓN
MALLA ELECTROSOLDADA
MANTO IMPERMEABILIZANTE
AFIRMADO COMPACTODO
VARILLA 5/8
FLEJES 1/2
VIGA DE CIMENTACIÓN 0.30*0.30
ESCALA
1: 20


SHINGLE
TABLA EN MADERA
IMPERMEABILIZANTE
CORTA GOTERAS DE ALUMINIO
SOLERA DE REMATE
CANALETA EN ALUMINIO
IMPERMEABILIZANTE
VIGA DE MADERA
LISTON EN MADERA
VENTANA
MADERA LAMINADA
ESPUMA AUTINIVELANTE
MORTERO DE NIVELACIÓN
MALLA ELECTROSOLDADA
MALLA ELECTROSOLDADA
MANTO IMPERMEABILIZANTE
AFIRMADO COMPACTODO
VARILLA 5/8
FLEJES 1/2
VIGA DE CIMENTACIÓN 0.30*0.30
ESCALA
1: 20


CORTE B-B
CORTE D-D
CORTE B-B

CONTEMPORARY SUBURBAN SUSTAINABLE HOUSING AT THE ANDEAN TROPIC: SANTAGUEDA – CALDAS: Altitude 1000 meters

Contemporary Cemented Bahareque Technology: SIG

Sustainable, Innovative and Global.

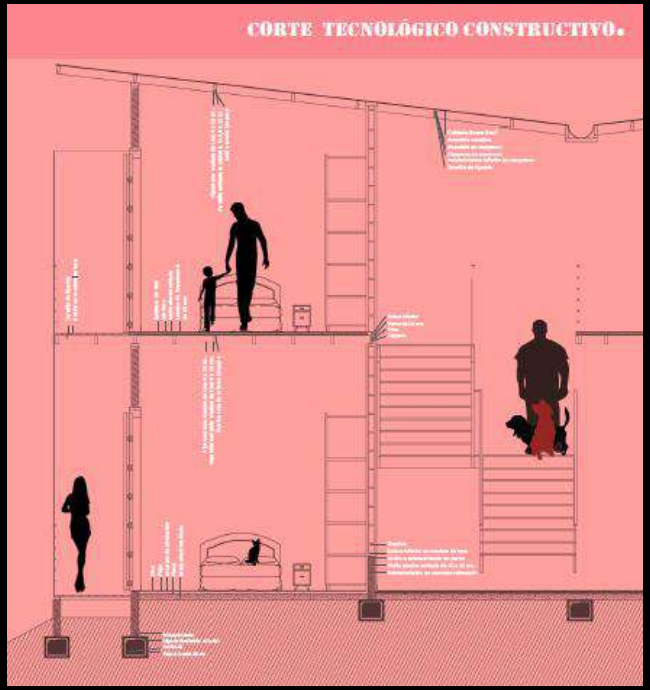
Spatial grid for architectural & technological design: 40,6 X 40,6 centimeters or 16 X 16 inches

ACADEMIC PROPOSALS: INTER-SEMESTER 2013

SUMMER STUDIO - PROFESSOR ARCHITECT MA. **MUÑOZ R. JF.**

UNIVERSIDAD NACIONAL DE COLOMBIA


Estructura muros


CORTE TECNOLÓGICO CONSTRUCTIVO.

TV8

UNIVERSIDAD NACIONAL de COLOMBIA Sede Manizales

ESCUELA DE ARQUITECTURA Y URBANISMO

VERTICAL WORKSHOP SUSTAINABLE ART- CHITECTURES 1sth semester 2014

Director: José Fernando Muñoz Robledo
Arquitecto – MA – Profesor Asociado
Correo electrónico institucional: jfmunozr@unal.edu.co

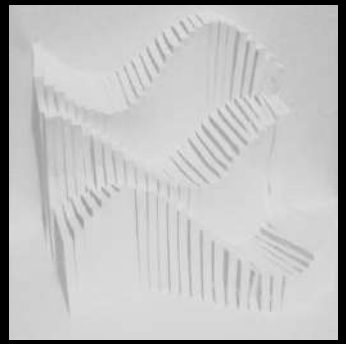
Kengo Kuma

PRESENTATION

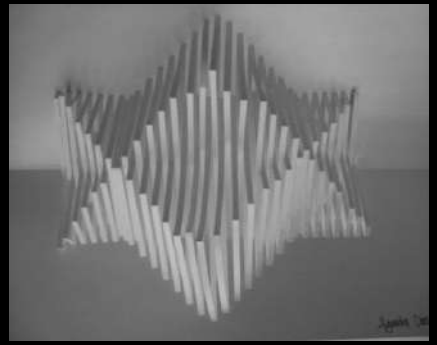
The workshop of sustainable art - chitectures looks for developing some “architectural – sculptural” inquiry of re-interpretation, compositional inspiration and functional adaptation, based on KIRIGAMI exercises: the art of paper cutting and folding, as well as including conceptual issues from paradigmatic referents taken out of worldwide architects, applied in a series of small scale architectural artifacts designed on search for new aesthetic, not pre-conceived, which are also enriched with new concepts of technological solutions under the “kinetic art”, based on mobile devises or components.

Its sustainability is specifically targeted towards the use of renewable natural or processed materials such as wood and bamboo - guadua; its low energy consumption as bioclimatic architectures being consistent with the environmental and natural conditions of the site, the use of natural alternative energy; besides re-interpreting and supplementing the architectural and technological contemporary aesthetic of the traditional culture of wood and bamboo - guadua architectures called “bahareques”, which identify the today called Coffee Cultural Landscape of Colombia - Heritage Site -UNESCO 2011.

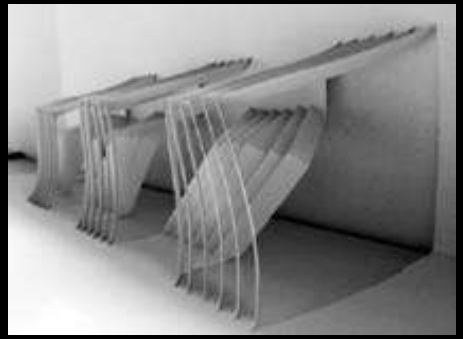
KIRIGAMIS EXERCISES



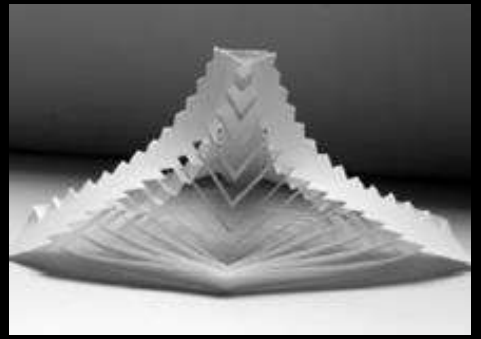
Luisa Fernanda Viedma



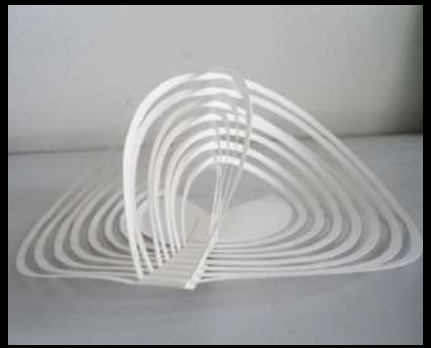
Aejandra Osorio



Wanda Matta



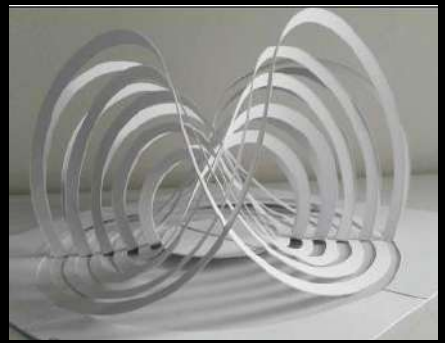
Yuli Henao



Laura Cardona

Linda S. Narvaez

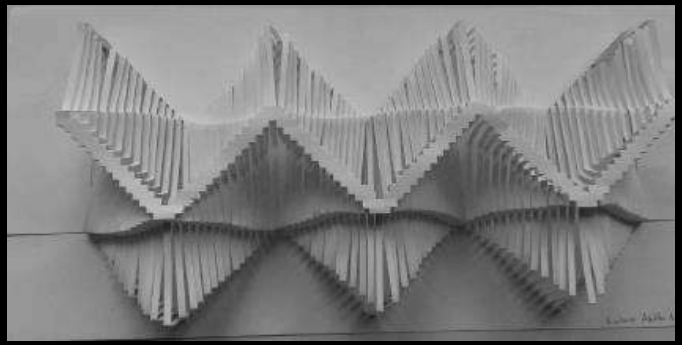
Jacobo Gomez



Valetina Correa

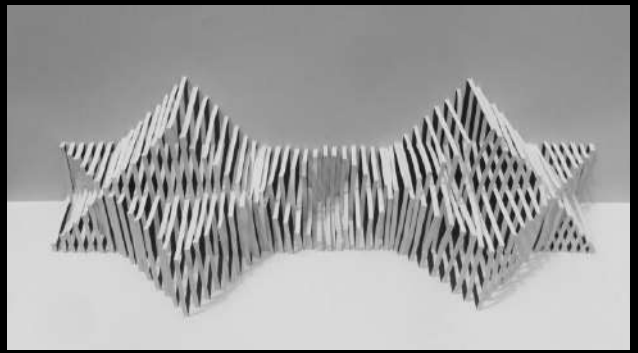
KIRIGAMIS EXERCISES

Pamela Londoño – Yeison Velasquez



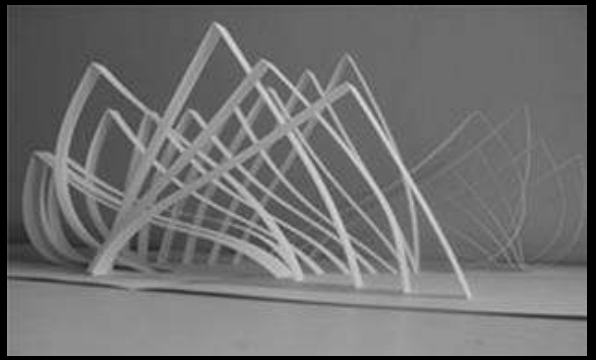
Gustavo Arango

Laura Chica



Jessica Garcia

Angela Montoya



Mateo Quintero

REFERENTS

KENGO KUMA

MARCELO VILLEGAS

HABITAT SIN FRONTERAS

SIMON VELEZ

CHRISTO

JOSE CRUZ

REFERENTS

ANNA HERINGER

IBUKU

VO TRONG NGHIA ARCHITECTS

FREI OTTO

SIMON HOSIE

HERMANN KAUFFMANN

SHIGERU BAN




CENTRO COMUNITARIO/ SANTA ROSA DE CABAL

Community Center/ Santa Rosa de Cabal

Pamela Londoño Peralta + Yeison Velasquez Toro

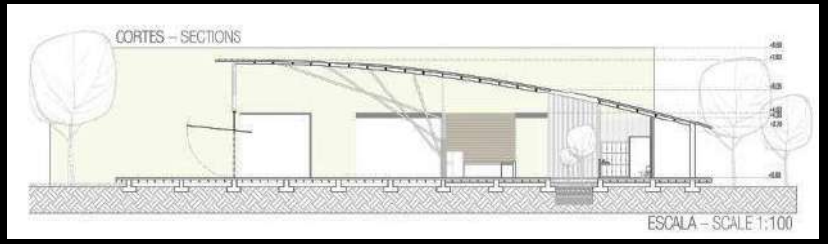
VIDEO 1

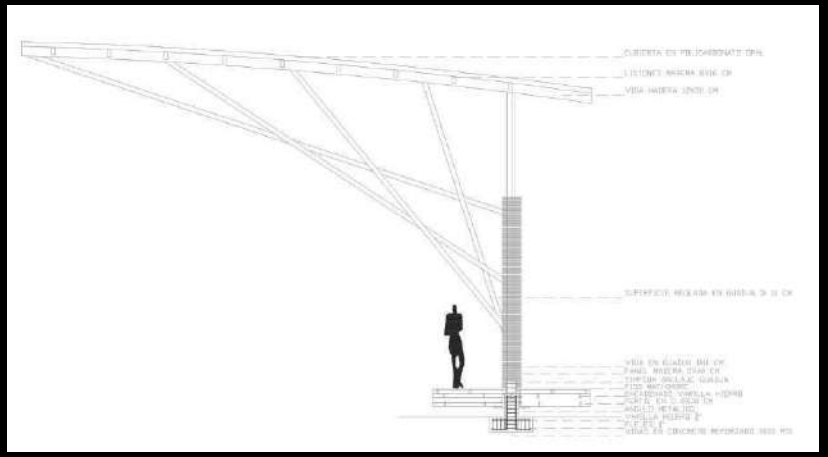
Coventry University

INTERNATIONAL RESEARCH GROUP MEETING

Structural & Architectural Applications of Bamboo

UNIVERSIDAD NACIONAL DE COLOMBIA


CORTES – SECTIONS
ESCALA – SCALE 1:100



RE SIGNIFICACIÓN DEL “MORRO” DEL BARRIO LA ISLA

Redefinition of “MORRO” - ¨La Isla¨ neighborhood

VIDEO 2

CENTRO COMUNITARIO

Community center

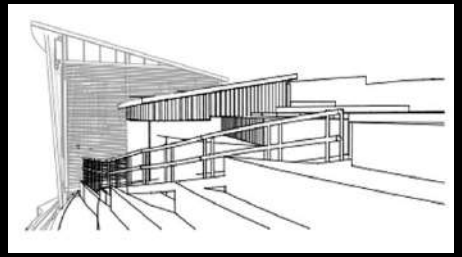
Sergio Alejandro Cárdenas + Valentina Gómez Gallego

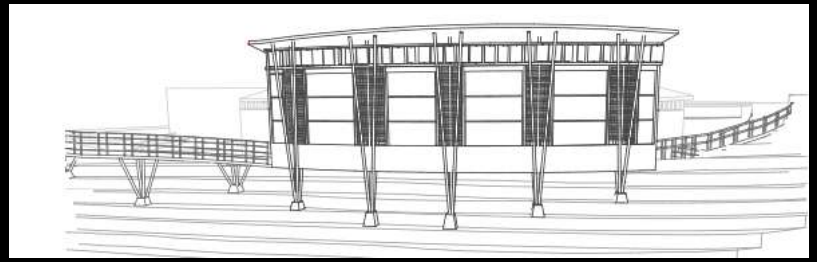
Coventry University

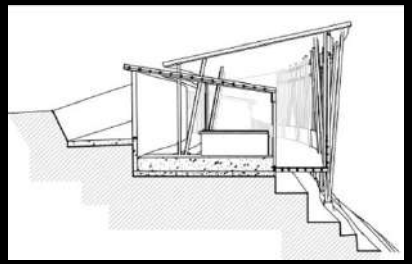
INTERNATIONAL RESEARCH GROUP MEETING

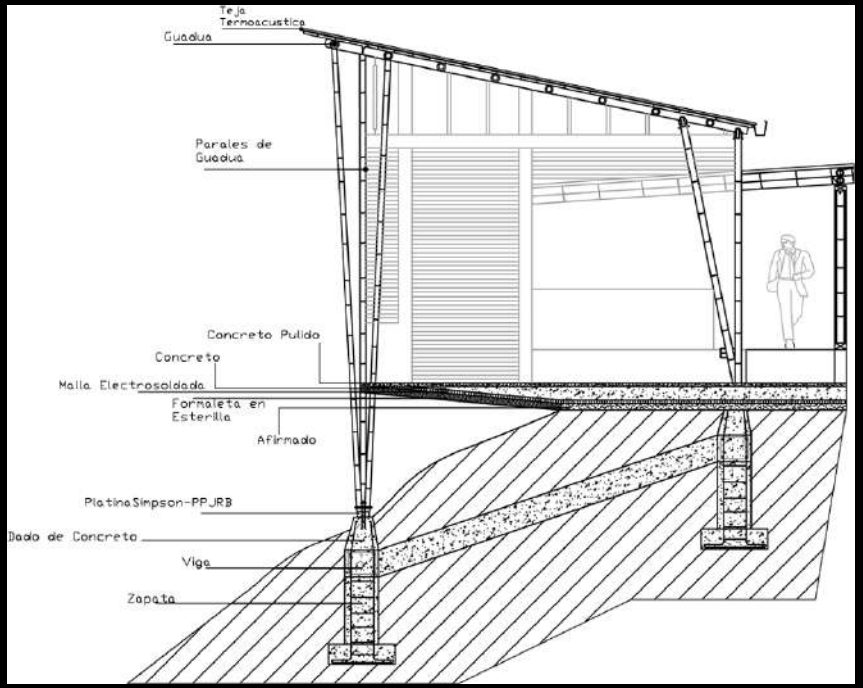
Structural & Architectural Applications of Bamboo

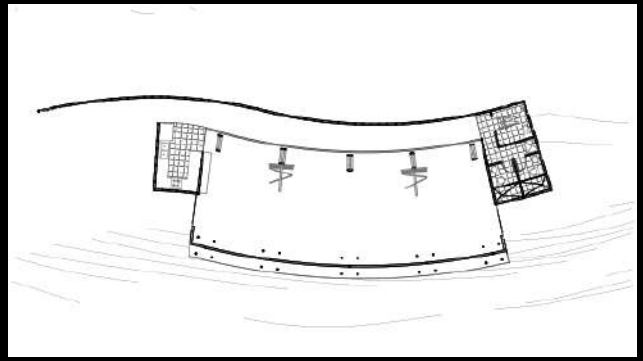
UNIVERSIDAD NACIONAL DE COLOMBIA

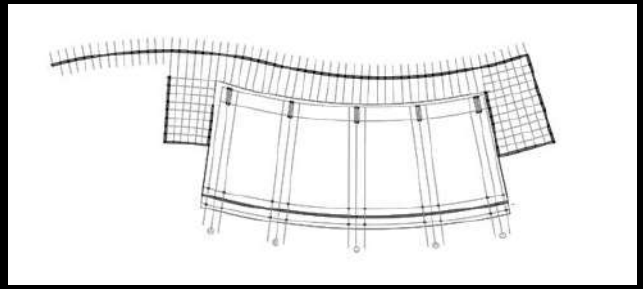







Teja Termoacustica
Guadua
Parales de Guadua
Concreto Pulido
Concreto
Malla Electrosoldada
Formaleta en Esterilla
Afirmado
Platina Simpson-PPJRB
Dado de Concreto
Viga
Zapata

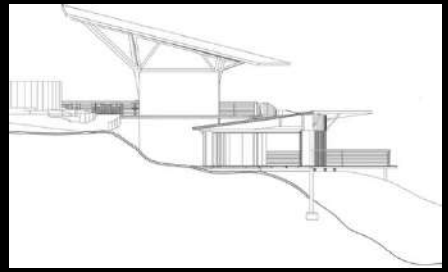


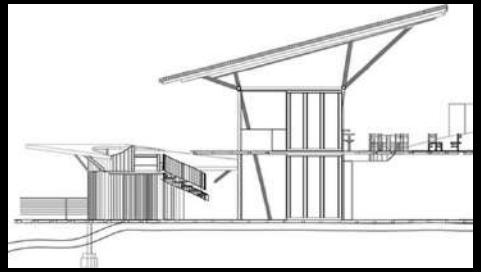


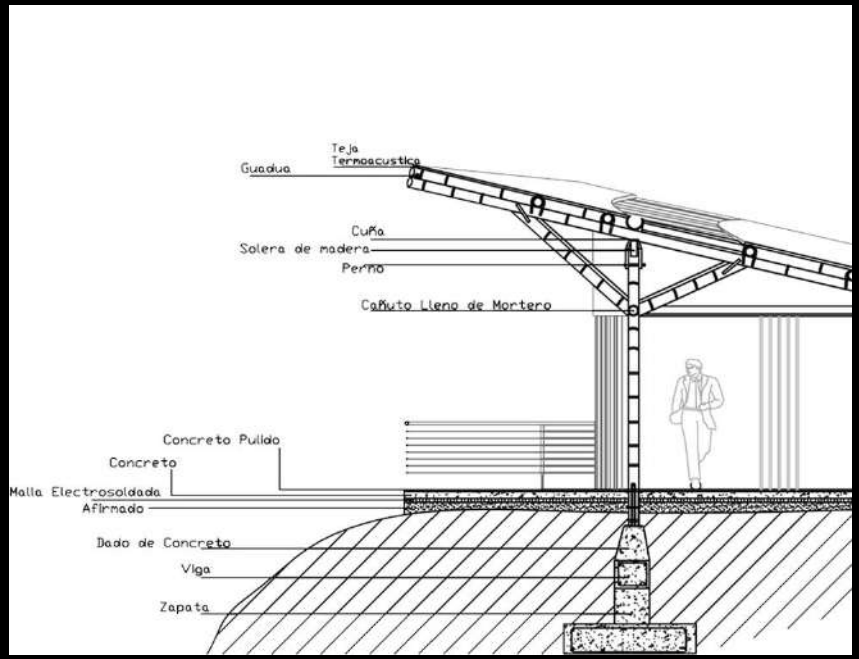
CENTRO JUVENIL

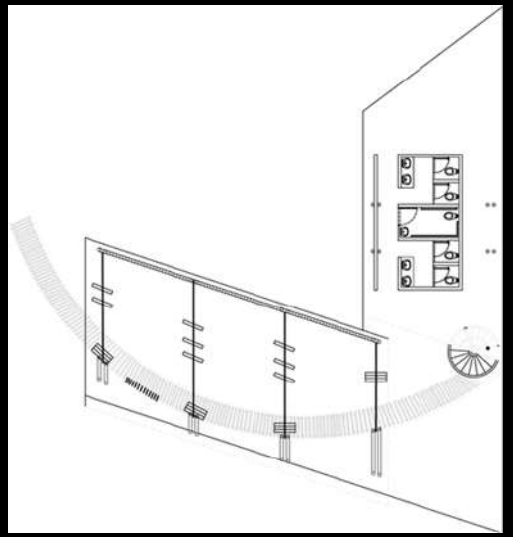
Youth center

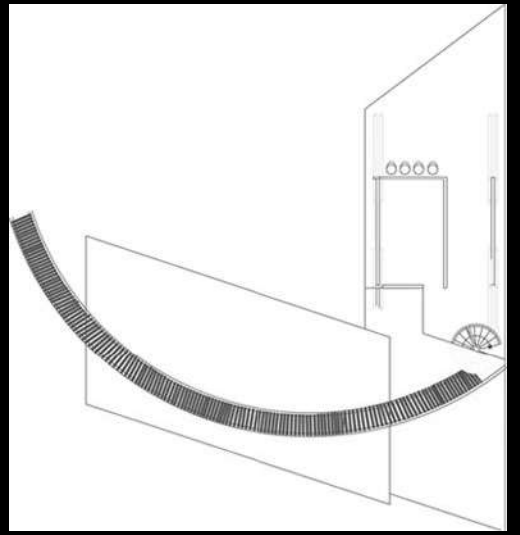
Jessica Tatiana Gutiérrez + Paola Vargas Camacho

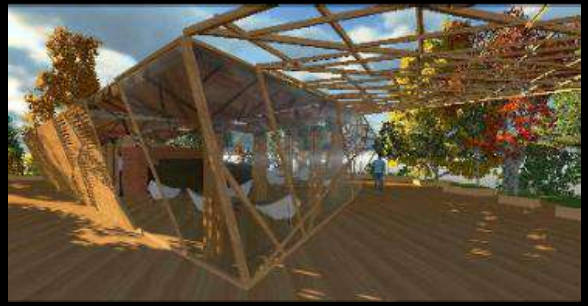


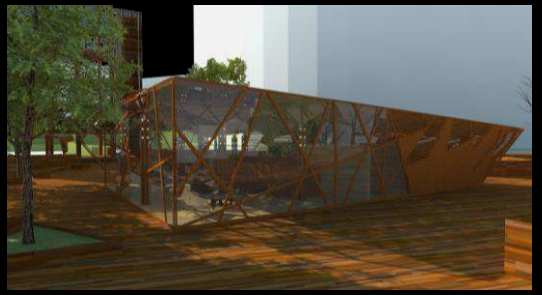



Teja
Termoacustica
Guadua
Cuña
Solera de madera
Perno
Cañuto Lleno de Mortero
Concreto Pulido
Concreto
Malla Electrosoldada
Afirmado
Dado de Concreto
Viga
Zapata





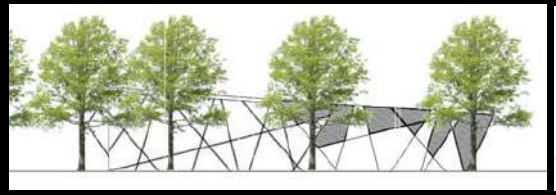


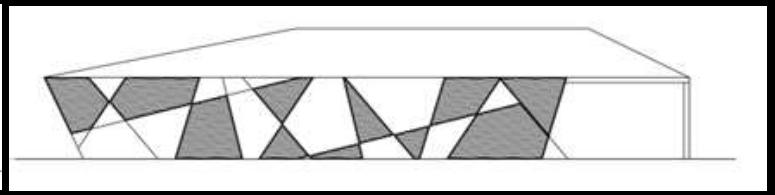


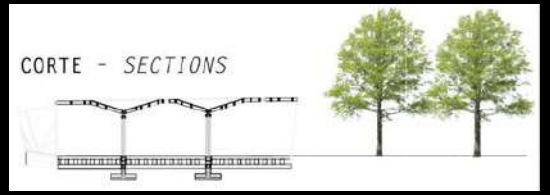
CAFÉ BAR LADERA SAN JOSÉ

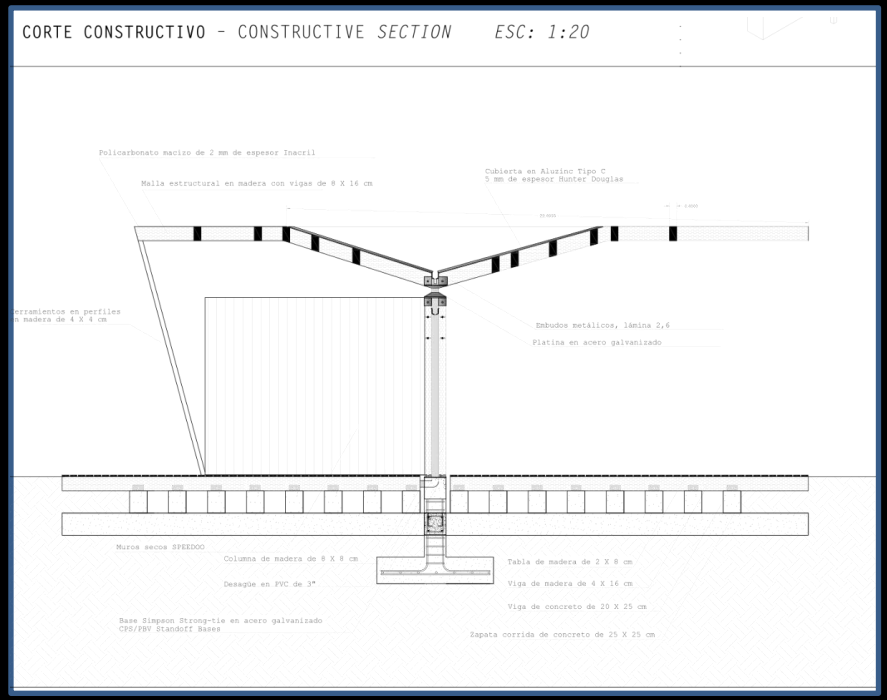
San Jose hillside bar/ coffee shop

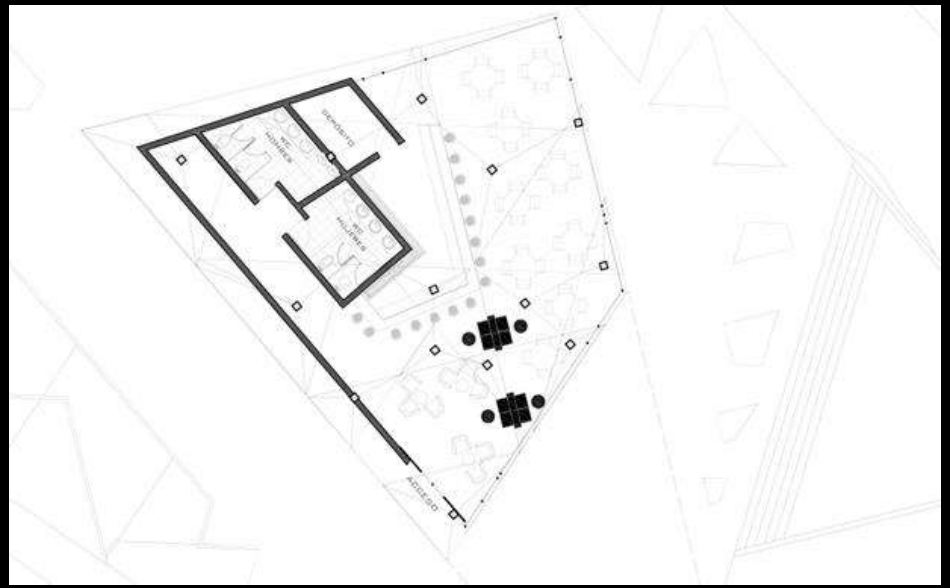
Valentina Correa + Gustavo Arango






CORTE - SECTIONS

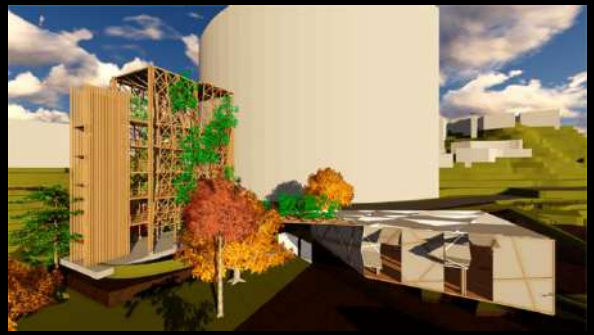

CORTE CONSTRUCTIVO - CONSTRUCTIVE SECTION ESC: 1:20
Policarbonato macizo de 2 mm de espesor Inacril
Malla estructural en madera con vigas de 8 X 16 cm
Cubierta en Aluzinc Tipo C
5 mm de espesor Hunter Douglas
Embudos metálicos, lámina 2,6
Platina en acero galvanizado
Muros secos SPEEDDO
Columna de madera de 8 X 8 cm
Desagüe en PVC de 3"
Base Simpson Strong-tie en acero galvanizado
CPS/PBV Standoff Bases
Tabla de madera de 2 X 8 cm
Viga de madera de 4 X 16 cm
Viga de concreto de 20 X 25 cm
Zapata corrida de concreto de 25 X 25 cm



TORRE MIRADOR LADERA SAN JOSÉ

Lookout Tower -Slope San Jose - Manizales

Laura María Chica Uribe + Cristian Mateo Quintero Girón



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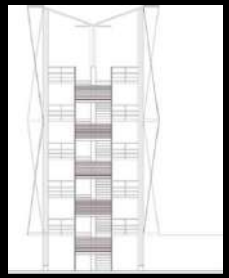
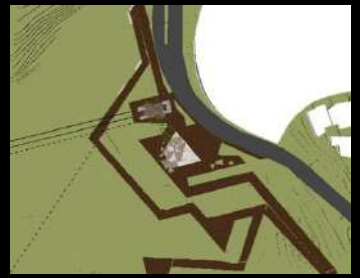
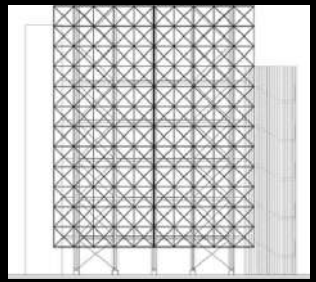
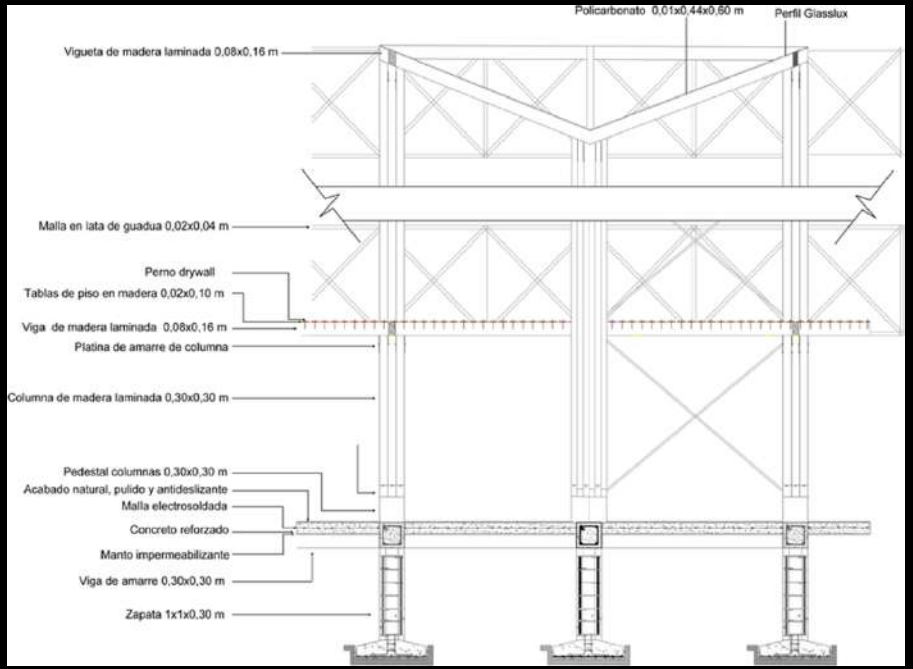
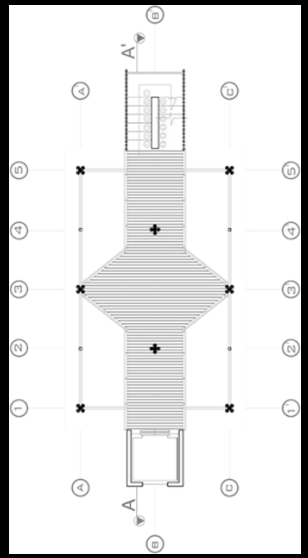
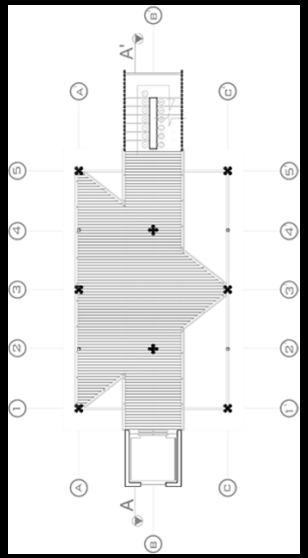


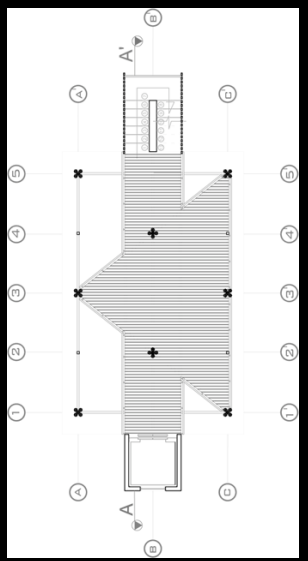





Policarbonato 0,01x0,44x0,60 m
Perfil Glasslux
Vigueta de madera laminada 0,08x0,16 m
Malla en lata de guadua 0,02x0,04 m
Perno drywall
Tablas de piso en madera 0,02x0,10 m
Viga de madera laminada 0,08x0,16 m
Platina de amarre de columna
Columna de madera laminada 0,30x0,30 m
Pedestal columnas 0,30x0,30 m
Acabado natural, pulido y antideslizante
Malla electrosoldada
Concreto reforzado
Manto impermeabilizante
Viga de amarre 0,30x0,30 m
Zapata 1x1x0,30 m











ALBERGUE TEMPORAL DE EMERGENCIA

Temporary Emergency Shelter

Daniel Marin Gonzales + Luisa Fernanda Viedma García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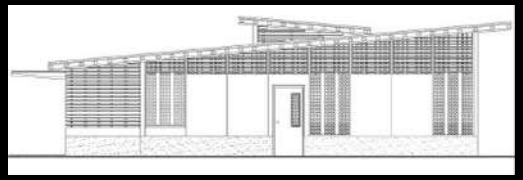
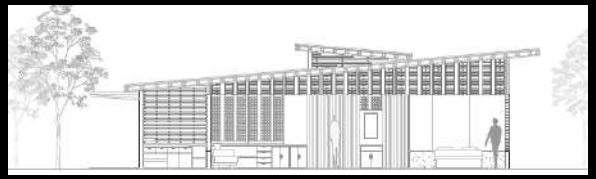
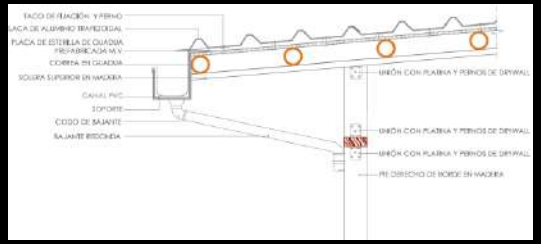
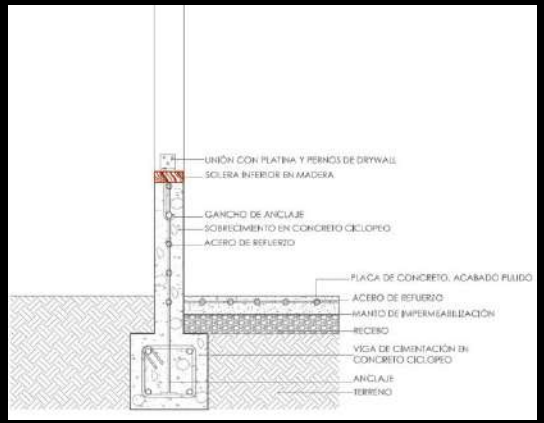
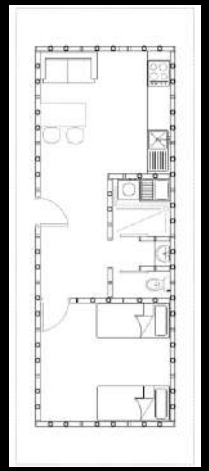


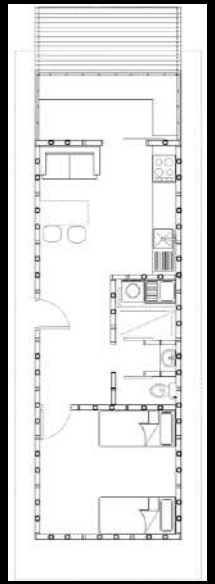




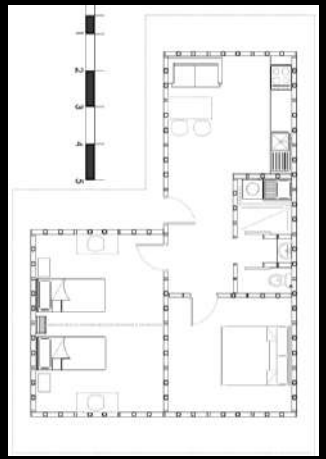




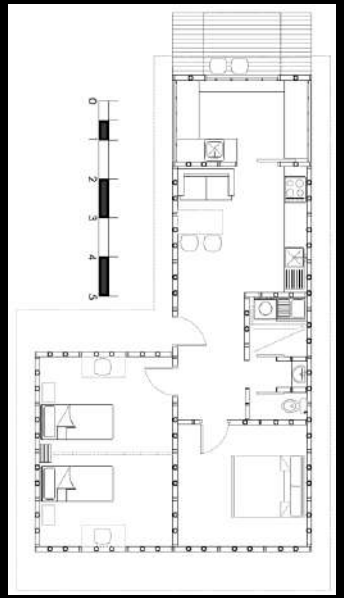
MODELO ESTANDAR / STANDARD MODEL



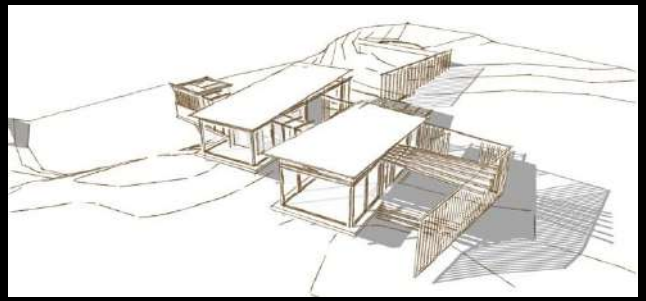
MODELO ESTANDAR / STANDARD MODEL
VIVIENDA PRODUCTIVA / PRODUCTIVE HOUSING



MODELO PROGRESIVO 1 / PROGRESSIVE MODEL 1



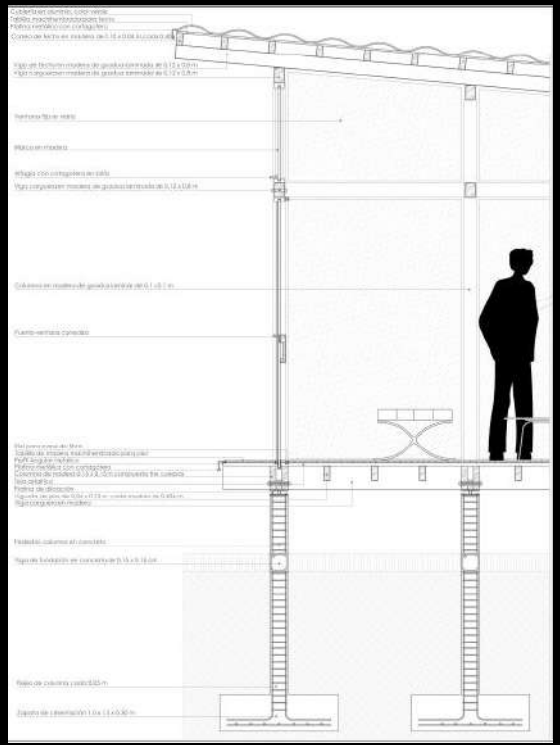
MODELO PROGRESIVO 1 / PROGRESSIVE MODEL 1
VIVIENDA PRODUCTIVA / PRODUCTIVE HOUSING



CASA EL ENCENILLO

El Encenillo Permacultural House

Estefania Marin Murillo+ Alejandra Osorio González



EDIFICIO MULTIFUNCIONAL PARA PERMACULTURA

Permaculture Multifunctional building

Linda Stephania Narváez Villota + Laura Cardona González

Coventry University

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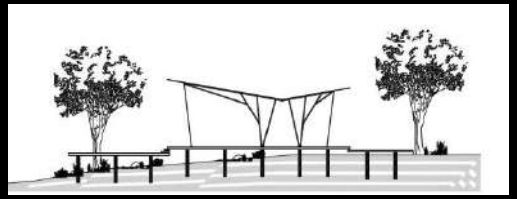
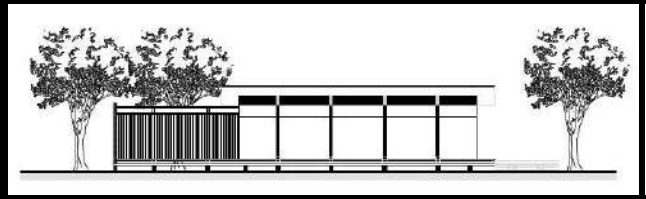
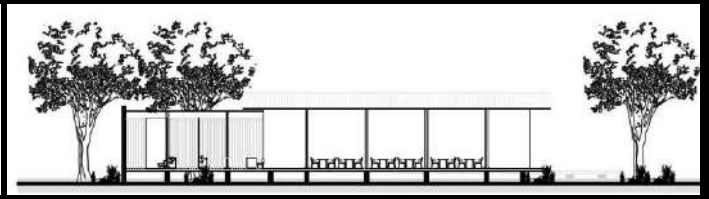
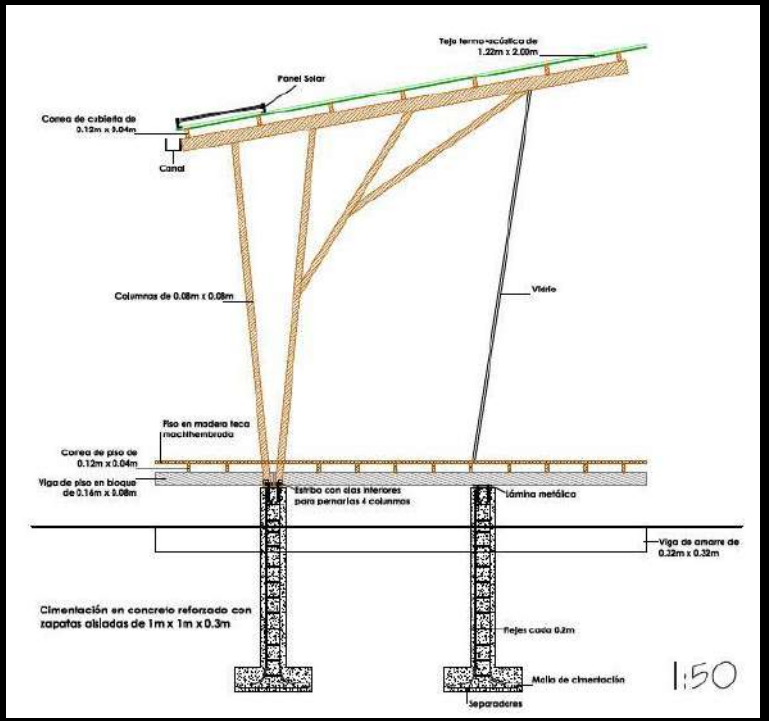
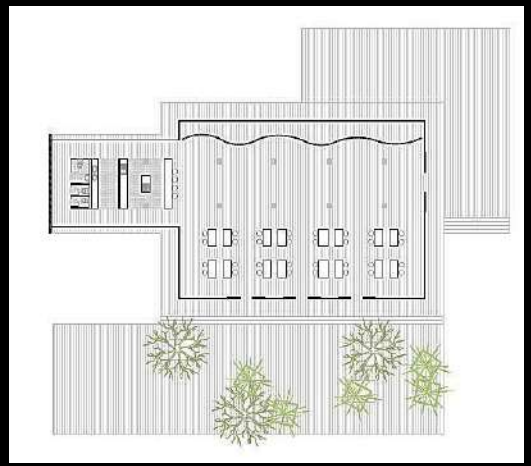
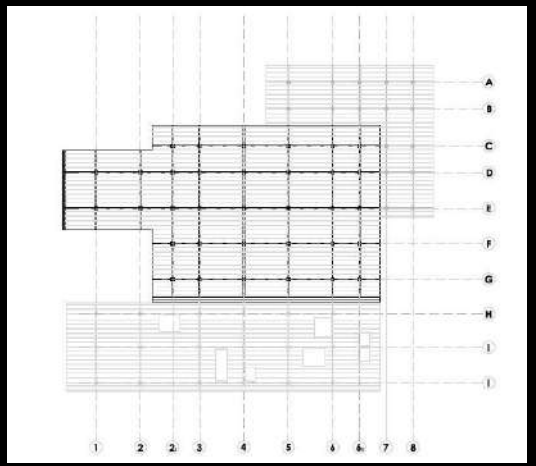







Teja termoacústica de
1.22m x 2.00m
Panel Solar
Correa de cubierta de
0.12m x 0.04m
Canal
Columnas de 0.08m x 0.08m
Vitrifo
Piso en madera teca
machihembrada
Correa de piso de
0.12m x 0.04m
Viga de piso en bloque
de 0.14m x 0.08m
Estribo con alas interiores
para pernarias 4 columnas
Lámina metálica
Viga de amarre de
0.32m x 0.32m
Cimentación en concreto reforzado con
zapatas aisladas de 1m x 1m x 0.3m
Pilejes cuota 0.2m
Malla de cimentación
Separaderes
1:50




A
B
C
D
E
F
G
H
I
J
1
2
2.
3
4
5
6
6.
7
8




CABAÑA TURISTICA EL ENCENILLO

Touristic Cottage The Encenillo

Wanda Xiomara Matta + Yuli Paulina Henao

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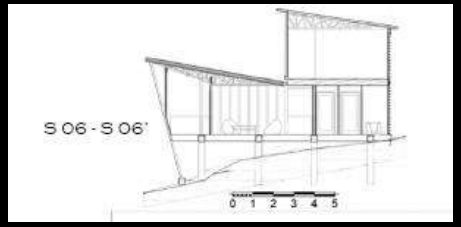
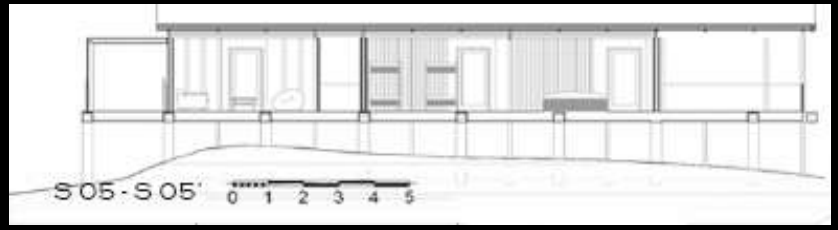
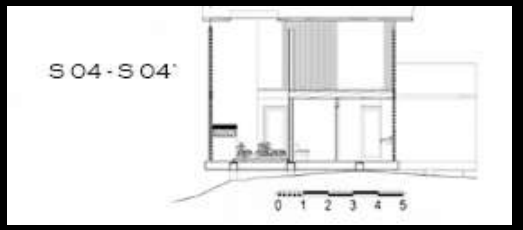
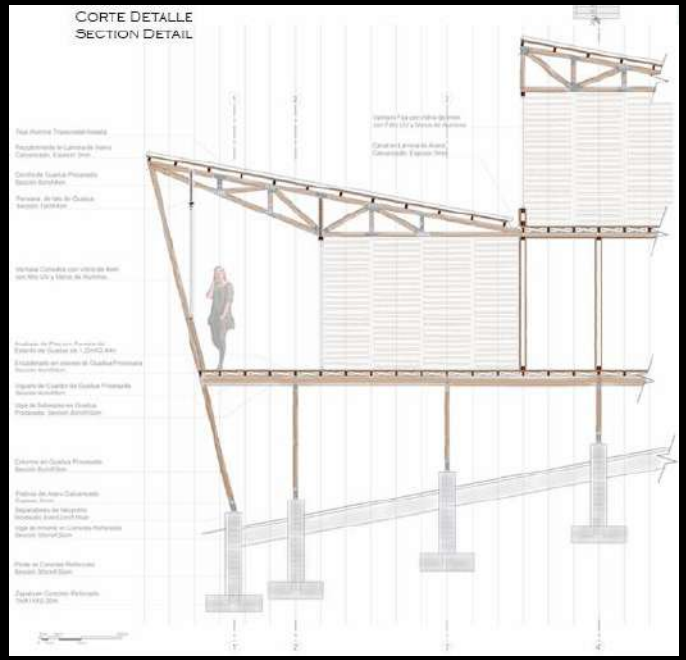
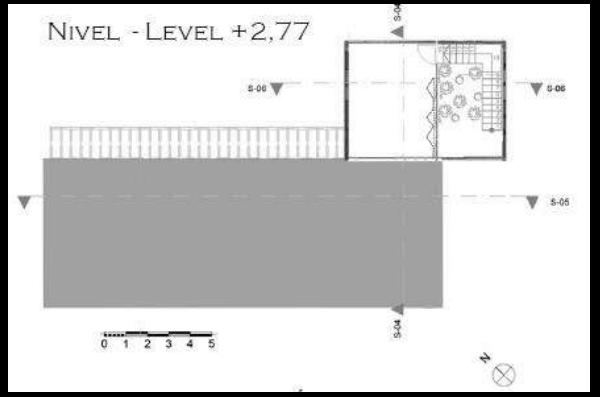

S 06 - S 06'
0 1 2 3 4 5


S 05 - S 05'
0 1 2 3 4 5


S 04 - S 04'
0 1 2 3 4 5


CORTE DETALLE
SECTION DETAIL


PLANTAS – FLOOR PLANS
NIVEL - LEVEL 0,00
S-00
S-05
S-04
N
0 1 2 3 4 5


NIVEL - LEVEL +2,77
S-06
S-05
S-04
N
0 1 2 3 4 5




CENTRO COMUNITARIO ¨LA AURORA¨

¨La Aurora¨ Community Center

Juan Jacobo Gómez + Lizzeth Cerón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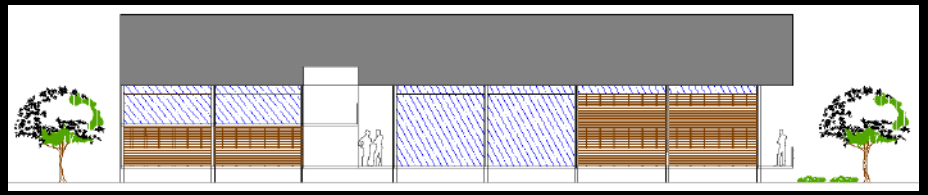
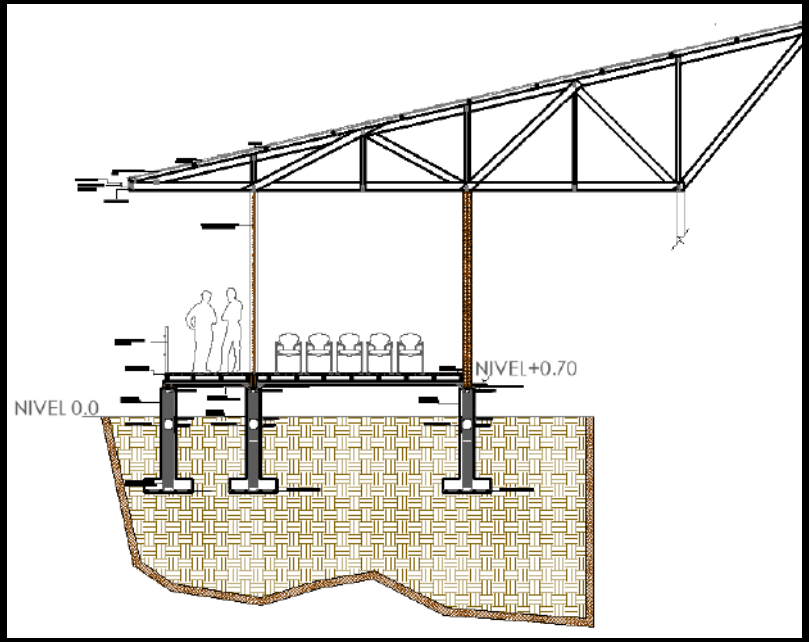
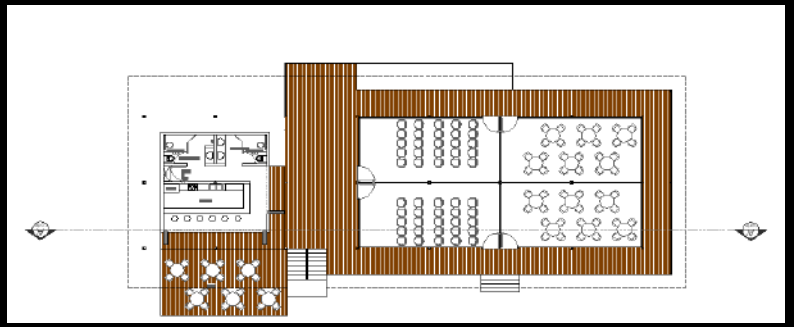
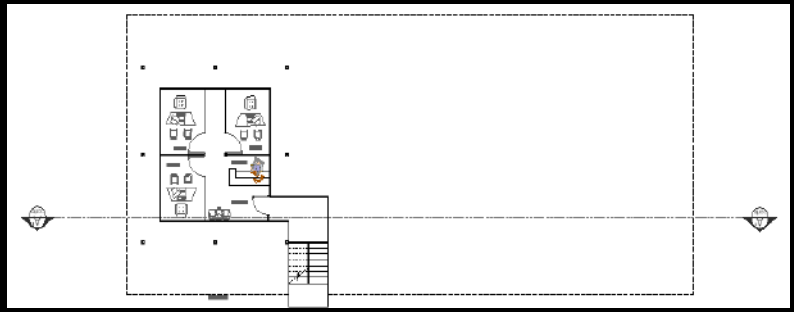
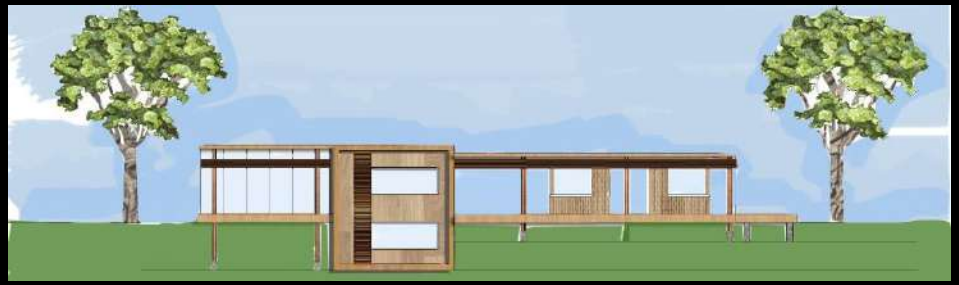
Cafeteria
Salon Multiple




NIVEL+0.70
NIVEL 0.0



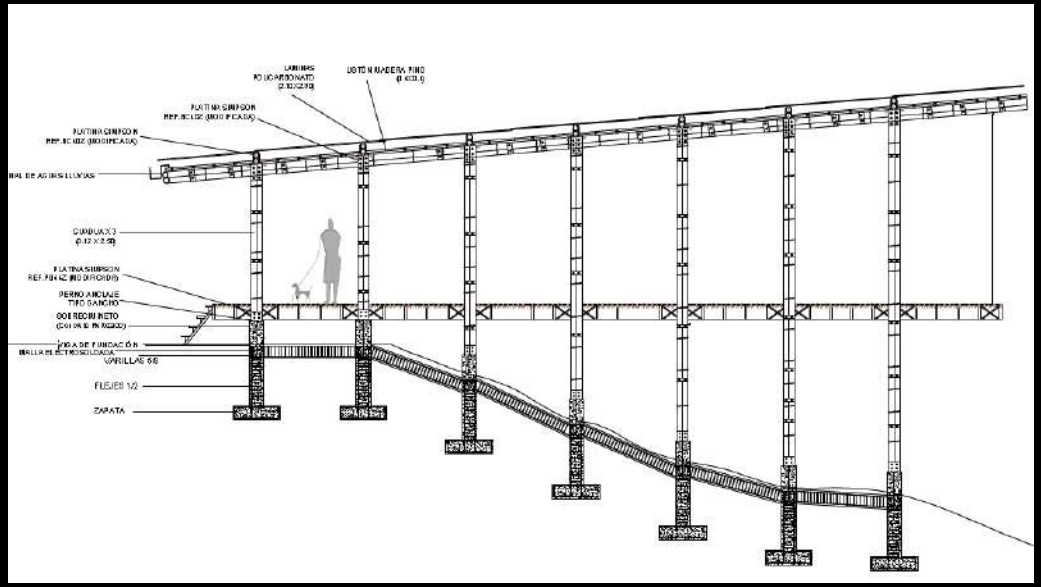


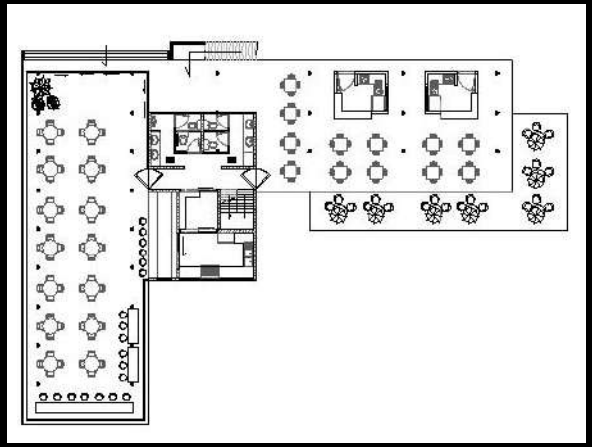


CAFÉ MIRADOR PUEBLO RICO

Look Out Coffee Shop

Yesenia Vanegas Mejia + Jessica Garcia Grajales


LAMINAS
POLICARBONATO
LISTON MADERA PINO
PLATINA SIMPSON
PLATINA SIMPSON
GUADUA X 3
PLATINA SIMPSON
PERNO ANCLAJE
TIRO SANCHO
VIGA DE FUNDACIÓN
VARILLAS 5/8
FLEJES 1/2
ZAPATA



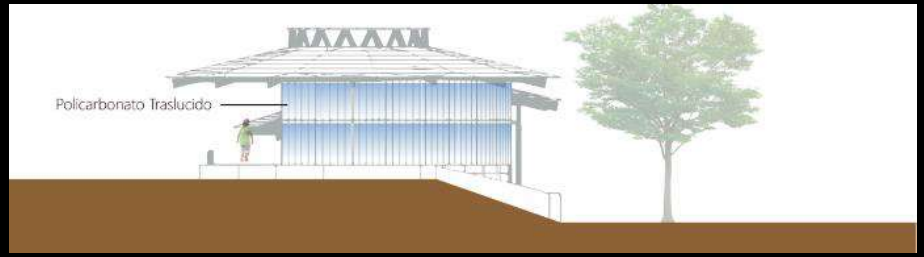


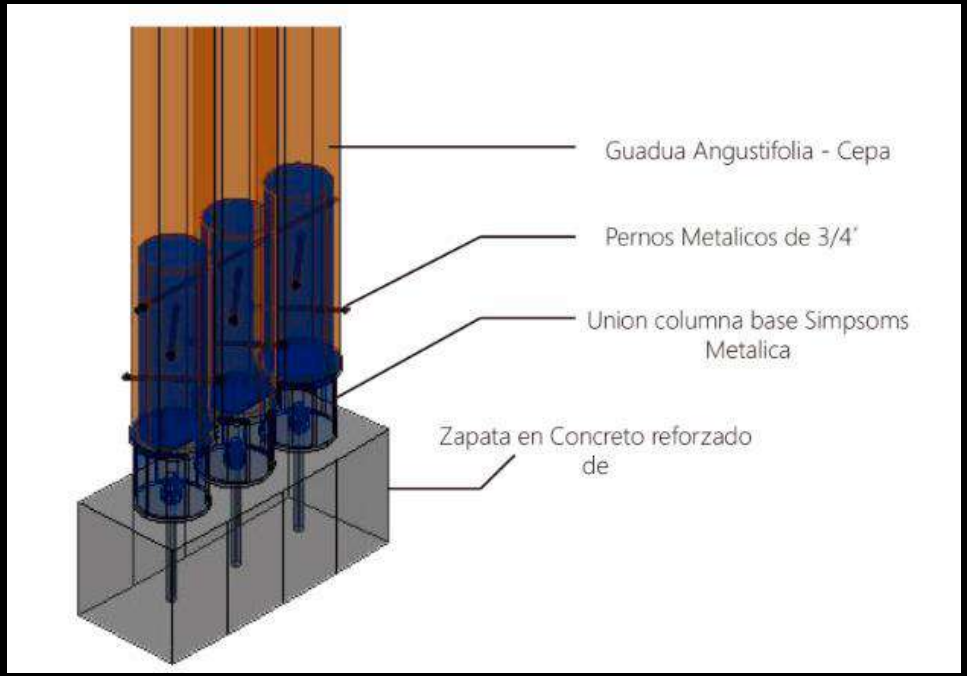

CENTRO COMUNAL Y JARDIN INFANTIL MATEGUADUA

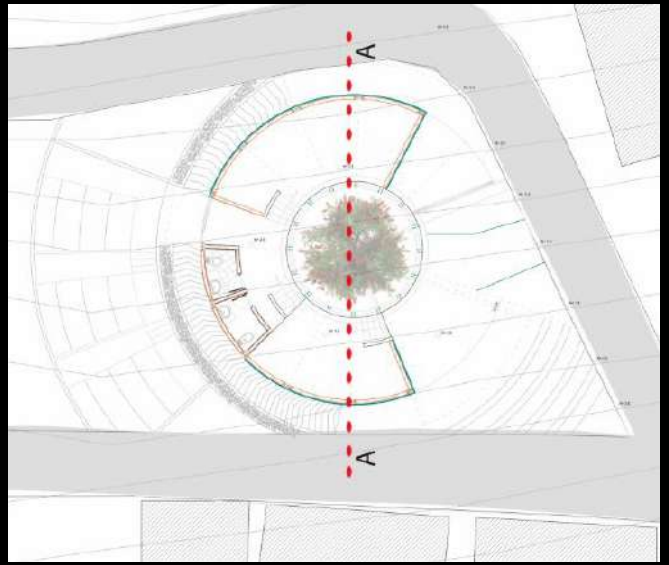
Mateguadua Communal Center And Kindergarten

Maria Camila Jaramillo + Luis EduardoOsorio


Coventry University
INTERNATIONAL RESEARCH GROUP MEETING
Structural & Architectural Applications of Bamboo
UNIVERSIDAD NACIONAL DE COLOMBIA


Policarbonato Traslucido


Guadua Angustifolia - Cepa
Pernos Metalicos de 3/4'
Union columna base Simpsoms Metalica
Zapata en Concreto reforzado de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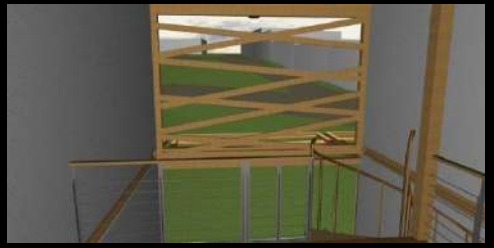
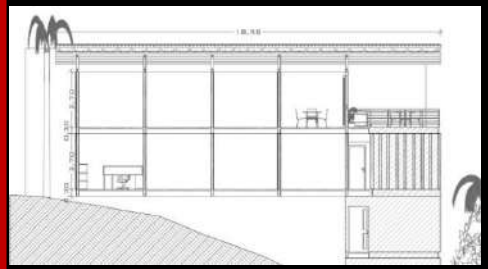


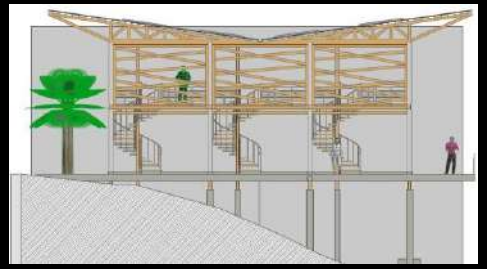

CAFÉ COMERCIAL TURÍSTICO RISARALDA

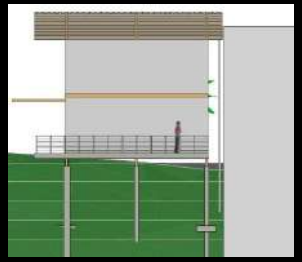
Tourist Trade Coffee Shop

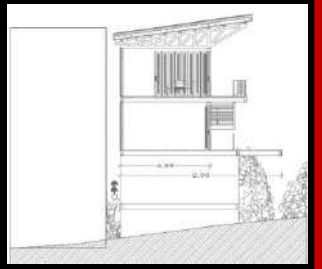
Juan Sebastian Orozco Villa

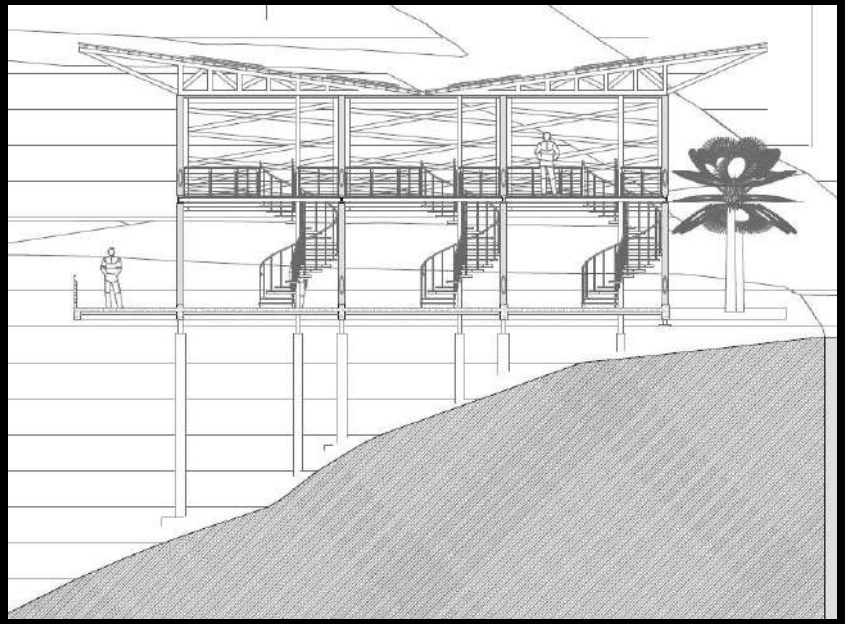

Coventry University
INTERNATIONAL RESEARCH GROUP MEETING
Structural & Architectural Applications of Bamboo
UNIVERSIDAD NACIONAL DE COLOMBIA

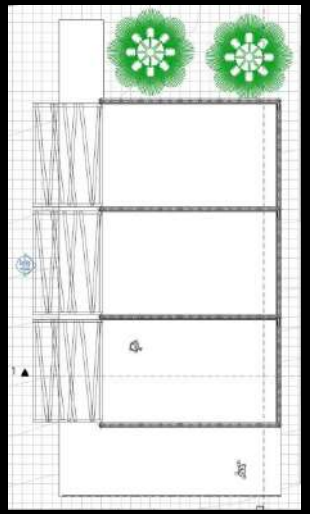


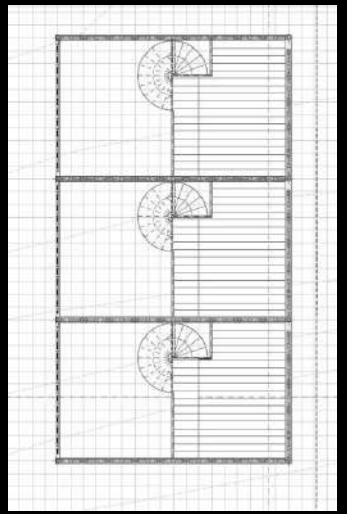


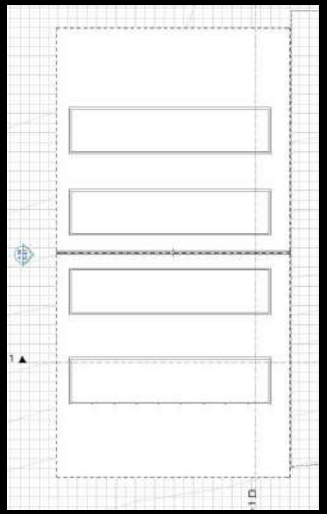


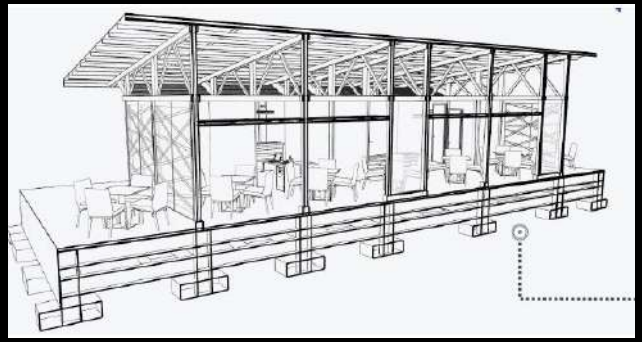


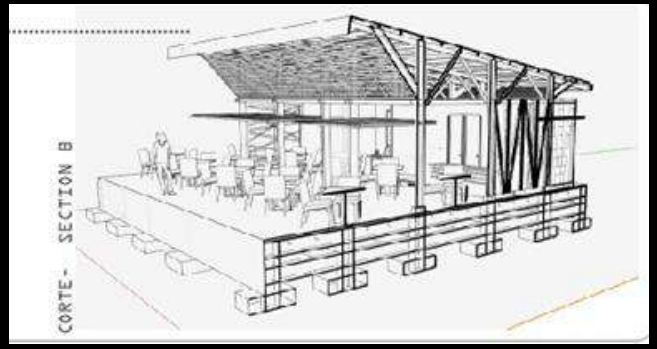








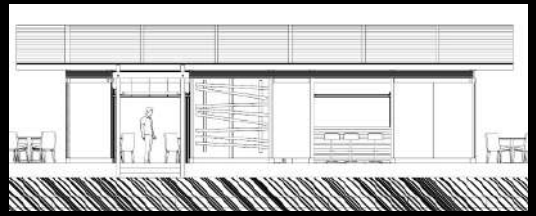


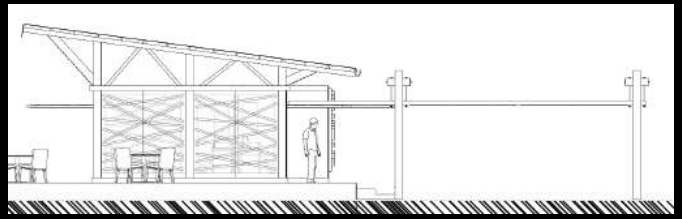


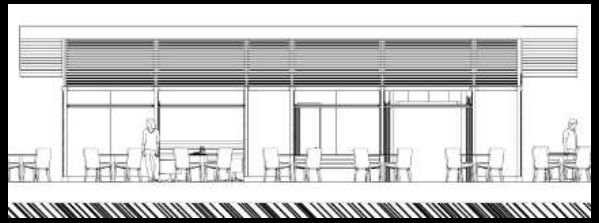
CAFÉ COMERCIAL TURÍSTICO RISARALDA

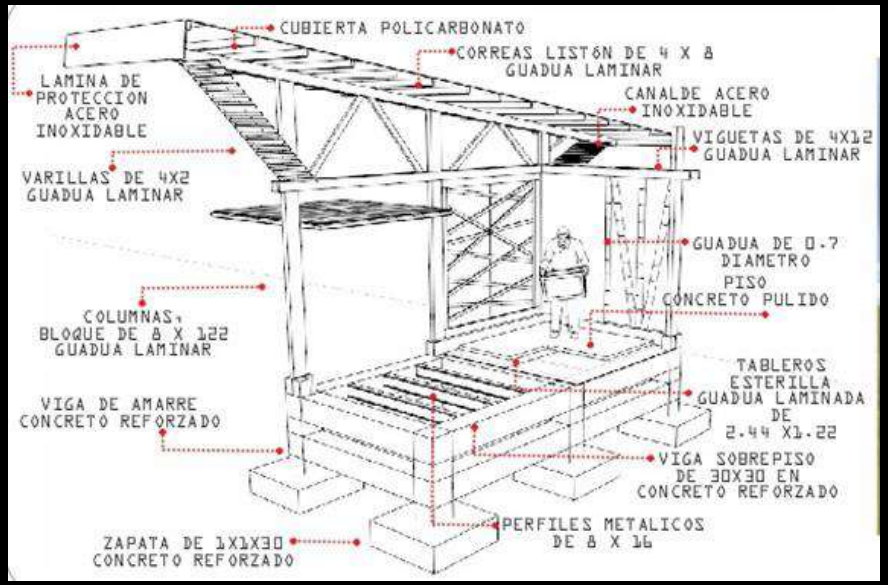
Tourist Trade Coffee Shop

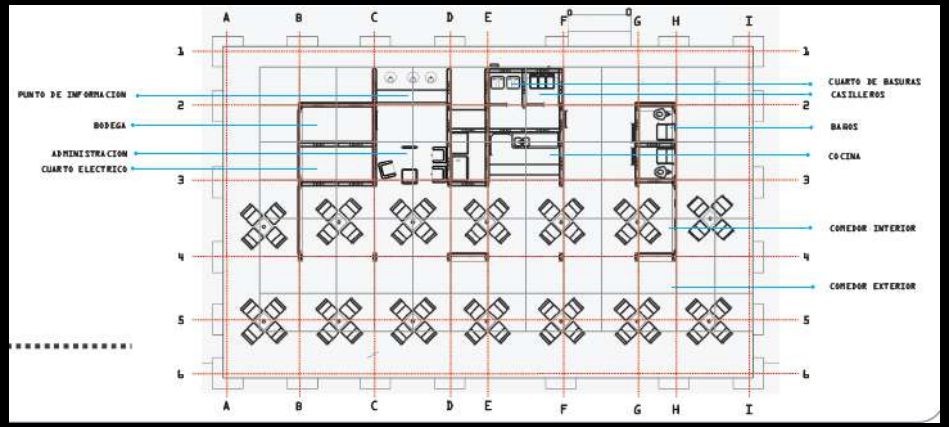
Angela Viviana Montoya








CUBIERTA POLICARBONATO
CORREAS LISTÓN DE 4 X 8
GUADUA LAMINAR
LAMINA DE
PROTECCION
ACERO
INOXIDABLE
CANALDE ACERO
INOXIDABLE
VIGUETAS DE 4X12
GUADUA LAMINAR
VARILLAS DE 4X2
GUADUA LAMINAR
GUADUA DE 0.7
DIAMETRO
PISO
CONCRETO PULIDO
COLUMNAS,
BLOQUE DE 8 X 122
GUADUA LAMINAR
TABLEROS
ESTERILLA
GUADUA LAMINADA
DE
2.44 X1.22
VIGA DE AMARRE
CONCRETO REFORZADO
VIGA SOBREPISO
DE 30X30 EN
CONCRETO REFORZADO
PERFILES METALICOS
DE 8 X 16
ZAPATA DE 1X1X30
CONCRETO REFORZADO


A
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PUNTO DE INFORMACION
BODEGA
ADMINISTRACION
CUARTO ELECTRICO
CUARTO DE BASURAS
CASILLEROS
BAÑOS
COCINA
COMEDOR INTERIOR
COMEDOR EXTERIOR

Draft Summary Report

Research Group Meeting:
Bamboo Construction for Inclusive and Green Development
Sidney Sussex College, University of Cambridge, Oct. 3rd 2013

Background

The meeting in Cambridge brought together participants from 11 institutions from the UK (6), Colombia (2), Canada (1), and the USA (1) that are currently working on structural bamboo in either a research and/or development-based context. This highlights a growing trend in interest towards bamboo as a construction material in both the global south and north. However, at present, coordination of efforts between different research groups has been fairly weak, thereby increasing the risk of inefficient allocation of limited resources and duplication of efforts. Therefore, this meeting was convened with the main aims of 1) identifying synergies and better ways of networking; 2) defining key areas for future collaboration; and 3) discussing best approaches to secure funds for future work. The meeting was also used as a forum for discussing how INBAR should interact with its various stakeholders and member countries to channel and support bamboo and rattan sector development. The summary and recommendations below will be used as a reference by INBAR's senior management during the drafting of the next strategy document for the years 2015-30.

Summary of Discussion and Proposed Recommendations from Participants

1. Improving networks & existing synergies

Networks

- ***Establish annual meetings*** - to share results of researchers & practitioners working on structural bamboo (these would likely be UK-based for the time-being)
- ***Coventry University*** has offered to host a meeting in 2014
- Funds permitted, ***extend meetings*** to researchers across EU, US and INBAR members
- ***INBAR plans to attend the UN Habitat - World Urban Forum 7 in Medellín, Colombia – April 5-11, 2014***. INBAR will apply for a networking event on value chains for bamboo construction at the forum and will advertise on our website if successful
- ***Improve Interactivity of INBAR website:*** Establish a portal or exchange system on the INBAR website that gives a dynamic list of paper titles/abstracts on bamboo and rattan. A world map showing the location of INBAR and partner projects was also suggested
- ***Online forum for dialogues –*** INBAR's Google bamboo housing group forum has been unsuccessful as a forum for sharing information. Participants use LinkedIn professional groups with more effect. INBAR may rebrand its online forum directly through our website

Existing synergies

- Both UBC and Bath are working on ***thermo-hydro-mechanically modified bamboo panels*** – Katherine Semple from UBC will visit Bath in October to present UBC's work.

The University of Los Andes is also working on laminated panel products and has conducted fire tests. All three groups are working with Guadua.

- Cambridge will investigate the ***environmental performance of engineered bamboo structural products***, with particular focus on thermal performance. Bath is conducting research on the thermal characteristics of Moso bamboo as well.
- ***TRADA has access to fire testing and other lab facilities in the UK*** – it would be worth assessing products from Bath, UBC, Los Andes and other groups. TRADA is well positioned to take new products to industry and scale them out.
- Coventry University and INBAR have started a project on ***strength grading of bamboo culms*** in October 2013. The project will classify both ***Guadua & D.asper*** (a South Asian sympodial bamboo, which is grown commercially in Ecuador) – a final ***INBAR technical report will be published by October 2016***. This work could be highly applicable to the enhancement of existing building codes for round pole bamboo in INBAR member countries, such as NSR-10 in Colombia
- UCL is working on a ***value chain project in Mexico*** covering cultivation, resource management and development of building systems for bamboo with *Bambuver* – INBAR experiences in Ecuador & Peru may be relevant (Alvaro Cabrera, LAC Regional Coordinator – acabrera@inbar.int)
- Prof. Munoz's work on ***cultural landscapes and Bahareque*** with the National University of Colombia is well aligned with work Cambridge is doing on echo housing with the Techo Foundation. INBAR also works with Techo in Ecuador and Peru – potential scope to develop small pilot and demonstration projects together?
- UCL and MIT are both working on ***characterization of bamboo at the micro-scale***. MIT have been working with Moso and Guadua bamboo, while UCL are committed to conduct work during their new project (see above).
- UCL has a MoU with ***Chongqing University*** in China. Cambridge also has strong links with the Department of Architecture at Chongqing. INBAR, with our Headquarters in Beijing, would be interested to see if it is possible to develop exchange programmes.

2. Future priority areas for collaboration

During the workshop discussions two general priority areas for collaboration where defined around the issues of 1) knowledge generation (i.e. as a new material there are still a number of critical gaps in our knowledge); and 2) catering to demand (i.e. making sure the research is applicable and relevant to end users)

<u>Knowledge generation</u>

- ***Standardization and codes:*** most participants felt this was where researchers could add real value. However, it was noted that following traditional industrialization approaches for construction materials for bamboo has the potential to stifle innovation and must be approached carefully. The idea of INBAR establishing a technical committee for bamboo and rattan standards, with a broad pool of experts, was broadly supported. Some participants suggested that the INBAR committee should have a mechanism for

individual associate memberships, based on a fee basis. In particular, standards related to developing *quality control*, thereby ensuring companies develop proper *process flows and sampling methods,* were deemed particularly important. On round pole bamboo building code development, it was suggested that focus should be given to countries with existing capacity, such as Colombia, Ecuador, India and Peru, to ensure they develop first-class codes, which can serve as an example for others. For engineered bamboo, it was acknowledge that the development of codes would take a longer period – but a first step is to develop building guidelines (i.e. a practical design manual).

- ***Life Cycle Analysis and Environmental Performance Data:*** Bamboo's marketability is deeply interlinked with its perceived green qualities – understanding environmental performance of the material (incl. across different climatic regions) is therefore critical. This is also increasingly relevant in the context of climate market finance – with the UNFCCC accords recently allowing for durable wood products to be included in national carbon inventories. Therefore, Methodologies are urgently needed to demonstrate the environmental impact of durable bamboo construction and furnishing products.

Demand side

- ***Overcoming stigma - demonstration and piloting of design:*** For round pole bamboo there is often a stigma associated to living in this type of housing. Communities aspire to live in houses made of 'real materials', such as concrete and steel. It was suggested that more work is needed to *develop prototypes and re-educate communities* – as well *Governments*, and the *private sector*, which do not have the knowledge or capacity to build with bamboo. INBAR's work in Ecuador & Peru on elevated housing was critically assessed, with some participants raising the fear that communities may use the foundations, but rebuild the house. Utilization of bamboo rather than 'showing it off' should be considered given the social context. More work on building higher-raise structures (3-4 storey buildings) should be explored as well. The need to *link this work to developers and clients*, with the ability to *scale up*, is vital. However, in our attempts to defeat stigma we must be careful to *stay within the limits of our knowledge*. High profile failures would be highly damaging for the sector – the timber industry was classed as being 'conservative and unwilling to take on products with lots of claims against them'.
- ***Developing products that take advantage of bamboo's intrinsic properties:*** Bamboo is often seen as a direct substitute for timber, but has some very different inherent properties. While it was agreed that engineered bamboo products should have less stigma and demand side problems than round pole bamboo, further work to develop new products, which fully take advantage of bamboo's unique physical and mechanical properties is needed.

3. Securing future funding

- ***Participants must report to INBAR*** if any successful collaboration with good ***outputs,*** significant ***outcomes***, and hopefully ***impacts*** evolve from this workshop. This is vital for justifying investments & developing a compelling narrative for donors
- ***Broad multi-partner, multi-country proposals*** are more likely to be successful in

funding applications in the current climate. As Andrew Bennett mentioned of one donor 'they *cannot afford to do small projects anymore*'. *At the same time**, partnerships should be natural and mutually beneficial***

- ***Harnessing University funding for exchange programmes*** could be a good way of building such natural partnerships – i.e. working together to demonstrate proof of concept before developing a big broad coalition project. For example, COLCIENCIAS in Colombia has funding available for exchanges incl. foreigners.
- ***There is a need to identify and target larger companies who are willing to take a risk on bamboo*** – the University of Los Andes is now talking to one of the biggest developers in Colombia about utilizing bamboo. Targeting bamboo-producing companies, which tend to be small to medium size enterprises with limited resources to invest outside of their core business may be less effective – unless research is directly supporting their business (e.g. student exchanges to factories, tech transfer…)
- ***INBAR should look into setting up an RSS feed for funding opportunities on bamboo –*** so that researchers are aware of opportunities well in advance of submission deadlines

Conclusions & Actions Arising from the Meeting

The participants generally considered that the meeting was useful with many people admitting it was the first time they had actually meet. It was agreed that further such meetings would be a good means of developing the network, increasing the share of information, and developing future collaborations. Based on this consensus, INBAR's global bamboo construction programme will aim to follow up on the recommendations made and attempt to organize a meeting at Coventry University next year.

Annex 1: List of Participants and Contact Details

Universidad de los Andes		
Juan F. Correal	Director	jcorreal@uniandes.edu.co
University of Bath		
Hector F. Archila Santos	PhD Candidate	H.F.Archila.Santos@bath.ac.uk
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University of British Columbia		
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Katherine Semple	Research Scientist	kate.semple@ubc.ca
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University of Cambridge		
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Bhavna Sharma	Post Doc	bs521@cam.ac.uk
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Coventry University		
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Agu Kirss	PhD Candidate	kirssa@coventry.ac.uk
International Network for Bamboo and Rattan		
Andrew Bennett	Board Member	
Oliver Frith	Programme Coordinator	obfrith@inbar.int
University College London		
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Massachusetts Institute of Technology		
Lorna Gibson	Professor	ljgibson@MIT.EDU
Patrick Dixon	PhD Candidate	pdixon7@MIT.EDU
Universidad Nacional de Colombia – Manizales		
JOSE F. MUÑOZ R.	Associate Professor	jfmunozr@unal.edu.co
Timber Research and Development Association		
Lionel Jayanetti	Head, TRADA International	ljayanetti@trada.co.uk

UNIVERSITY OF CAMBRIDGE
Department of Architecture

Michael H. Ramage
University Senior Lecturer
Architectural Engineering

Addressed to:
Professor Jose Fernando Muñoz Robledo
Universidad Nacional de Colombia
Cra 27 # 64-60 Manizales
Caldas - Colombia

3 October 2013

To whom it may concern,

We can confirm that Professor Jose Fernando Muñoz Robledo has attended the Bamboo Meeting entitled "Bamboo – a renewable and sustainable material for construction" held at the University of Cambridge on the 2nd to the 3rd of October.

Sincerely,

Michael H. Ramage
University Senior Lecturer in Architectural Engineering
Fellow, Tutor and Director of Studies, Sidney Sussex College

Bamboo Building Materials for Green Architecture:

Driving innovation based on tradition

Mr. Oliver Frith, Acting Director of Global Programme

8th Chinese Bamboo Culture Festival

Huangshan, Anhui Province, November 17th-19th 2014

INBAR

Contents

1. Bamboo as a cultural building material
2. Modernizing traditional – the example of Colombia
3. Standardizing and codifying bamboo modern construction
4. Concluding Remarks

INBAR

Global Important VERNACULAR BAMBOO ARHICTECTURE Heritage Sites

Bamboo architecture rooted in Millennia of Tradition

VS

Designed by architects

Vernacular Architecture

10%

90%

Wengding Village

Traditions under threat

PHOTO SOURCE: INTERNET

CHINA (GANLAN HOUSE)

EMERGENCY CONDITION

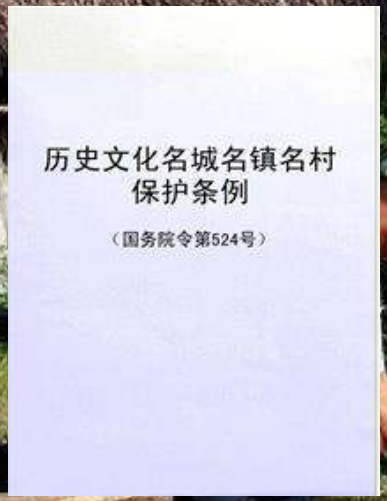
PUBLIC ATTENTION: ★★☆☆☆

MODERN TECNIQUE: ★☆☆☆☆

POLICY SUPPORT: ★★☆☆☆

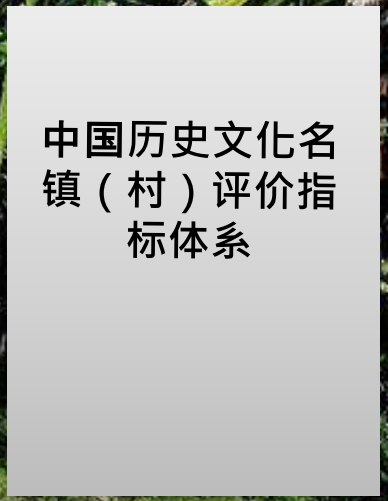
PHOTO SOURCE: INTERNET

《Protection Regulation of Chinese historical and cultural towns (villages)》

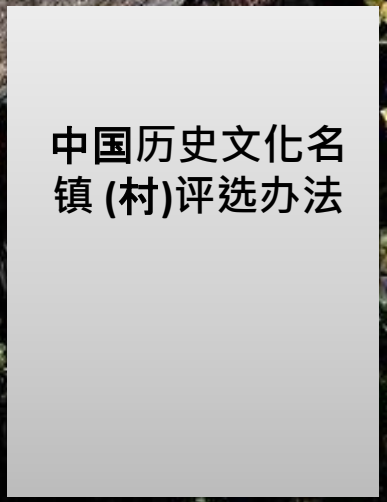


By State Council

《Election Method of Chinese historical and cultural towns (villages) 》



《Evaluation index system of Chinese historical and cultural towns (villages) 》



By State Cultural Relics Bureau &
Ministry of Housing and Urban-Rural Development

NOT FOR VERNACULAR ARCHITECTURE

Protection regulation, standard and policy
（PHOTO SOURCE: INTERNET）

COLOMBIA (BAHAREQUE)

GOOD CONDITION

PUBLIC ATTENTION: ★★★★★

MODERN TECNIQUE ★★★★★

POLICY SUPPORT: ★★★★★

COFFEE CULTURAL LANDSCAPE OF COLOMBIA WAS ON THE LIST OF INTANGIBLE CULTURE HERITAGE OF UNESCO IN 2011

MODERNISING THE TRADITIONAL: THE EXAMPLE OF COLOMBIA

PHOTO SOURCE: HTTP://VIAJEROSUSTENTABLE.COM/2012/02/24/EJE-CAFETERO

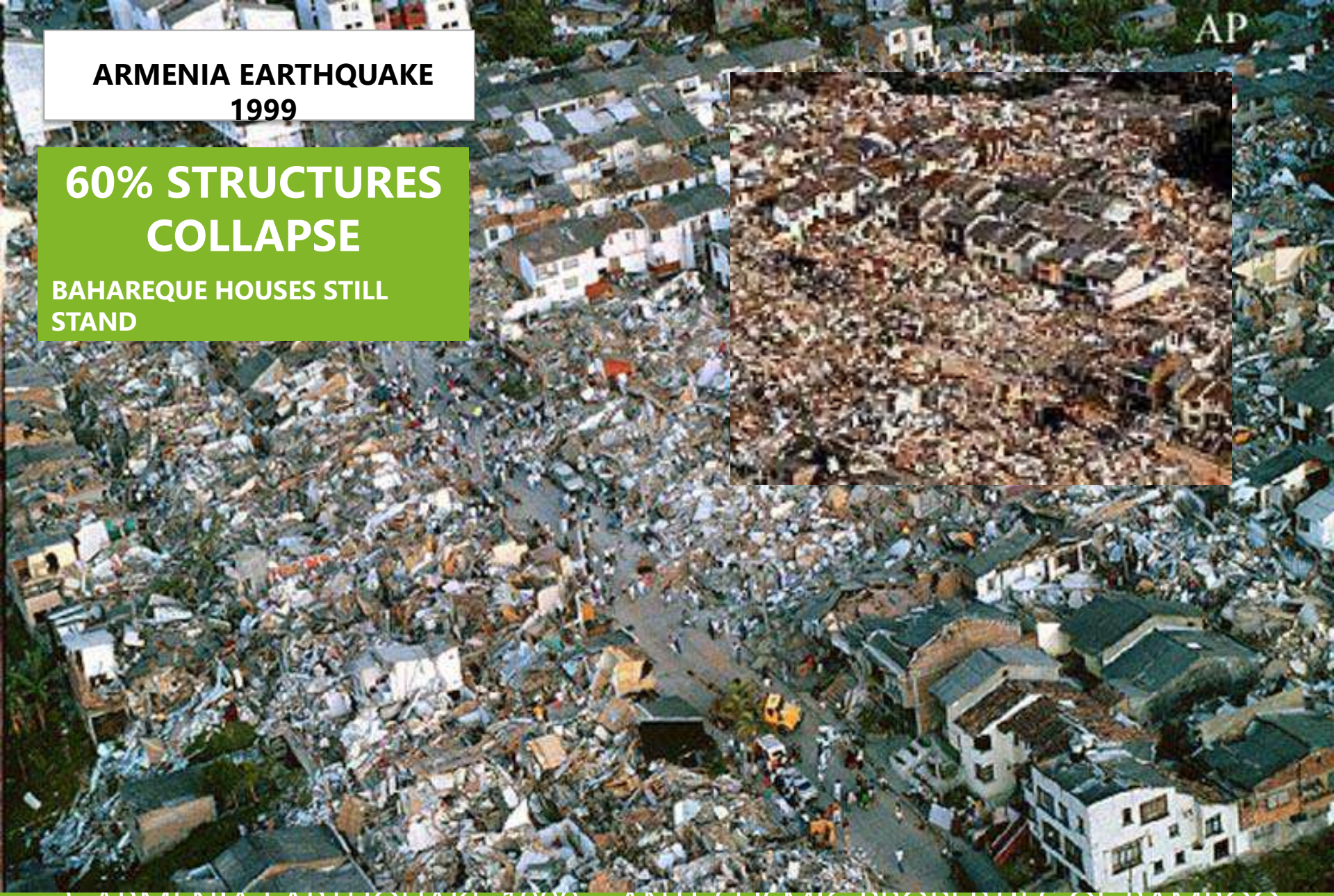





Altitude: 2170 meters

Photography: SARA MUÑOZ

COFFEE CULTURAL LANDSCAPE OF COLOMBIA - AGUADAS – CALDAS: Bahareque
(PHOTO SOURCE: INTERNET)



ARMENIA EARTHQUAKE 1999

60% STRUCTURES COLLAPSE

BAHAREQUE HOUSES STILL STAND

3. ARMENIA EARTHQUAKE 1999 – ANTI-SEISMIC PROPERTIES OF BAMBOO PROVEN

（PHOTO SOURCE: INTERNET）

Characterization of BAHAREQUE Building Systems Heritage in the Coffee Cultural Landscape of Colombia.
MUÑOZ R. JF. 2002.
Base of Decree 052 / 2002 – Earthquake Resistant Code for Contemporary Cemented Bahareque – NSR/2010 – Chapter E

1- CLAY BAHAREQUE

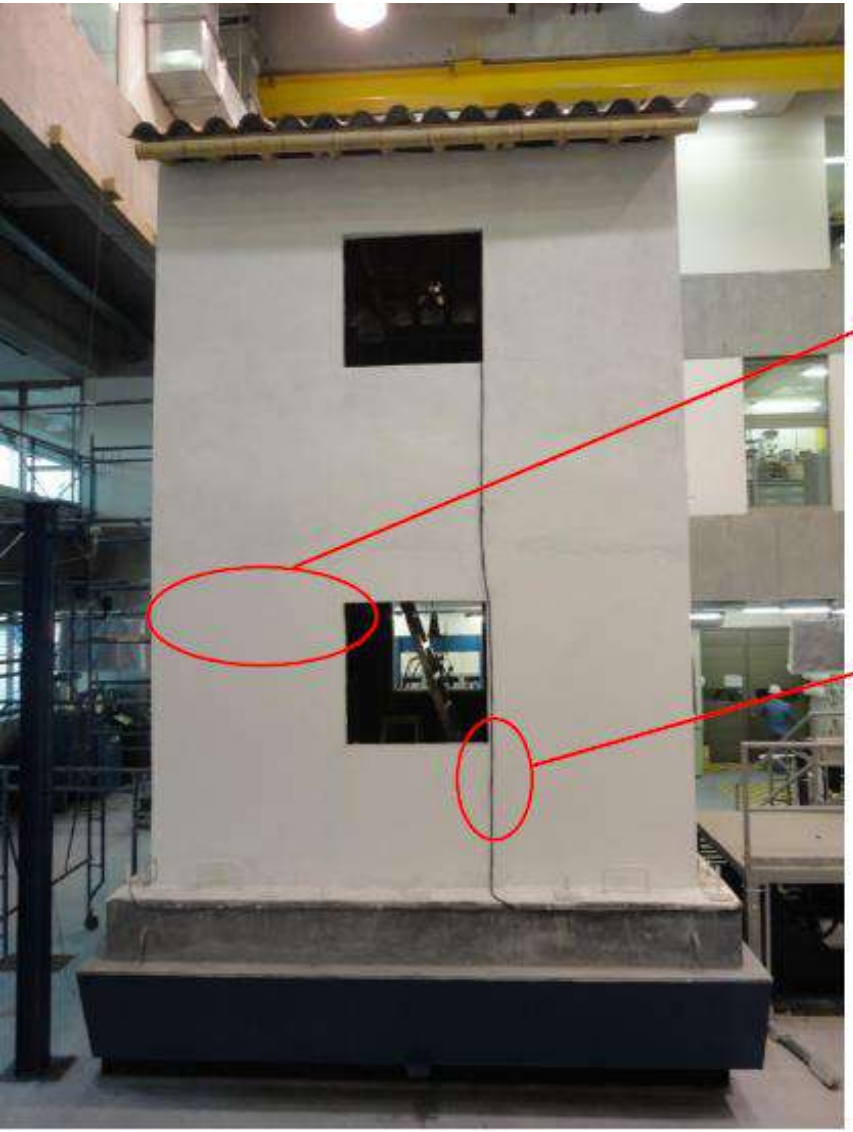
2- WOOD BOARD BAHAREQUE

3- METAL BAHAREQUE

4- CEMENTED BAHAREQUE

SCALE MODEL: SUBJECT TECHNOLOGY 3 - STUDENTS ESCUELA DE ARQUITECTURA Y URBANISMO
UNIVERSIDAD NACIONAL DE COLOMBIA – MANIZALES
SOURCE: PROFESSOR – ARCHITECT MA MUÑOZ. R. JF.

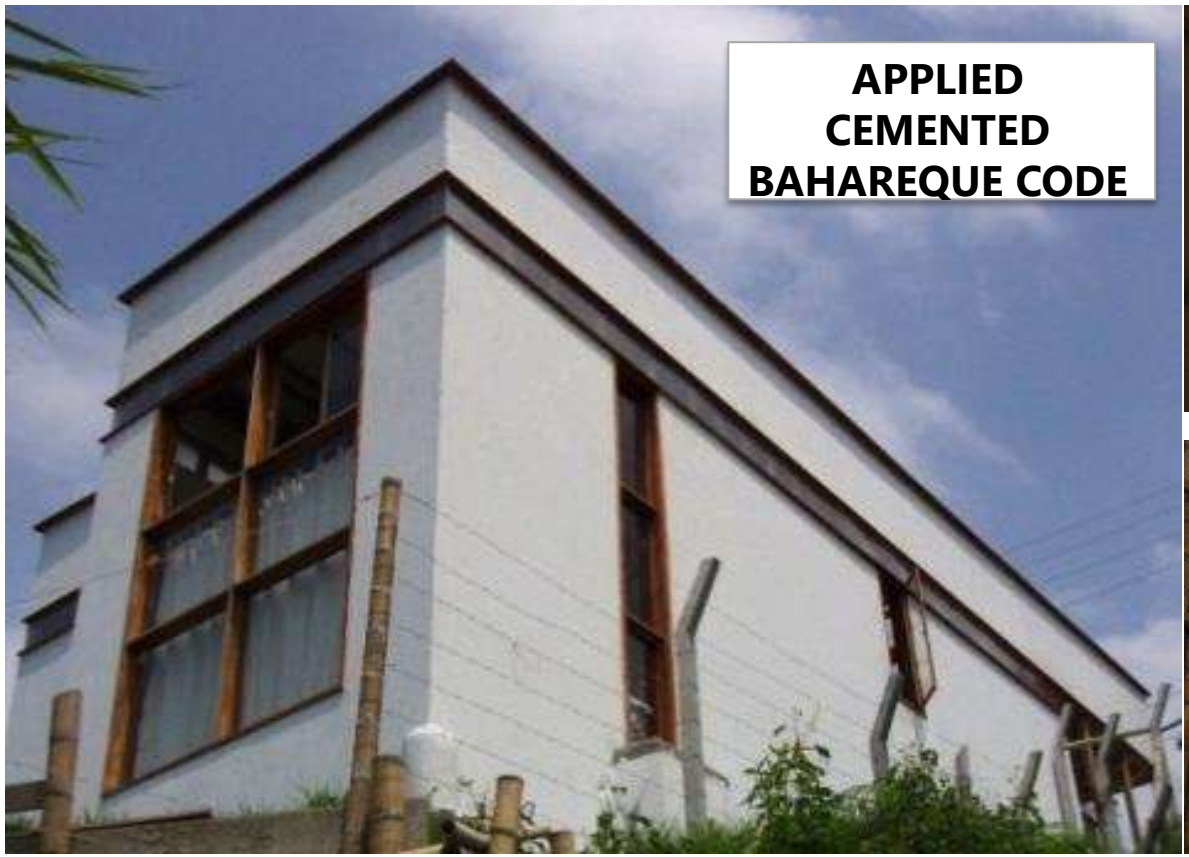
FULL SCALE SHAKE TABLE TEST: ROUND CULM



9 KOBE EARTHQUAKES & STILL STANDING

SOURCE: UNIVERSIDAD DE LOS ANDES

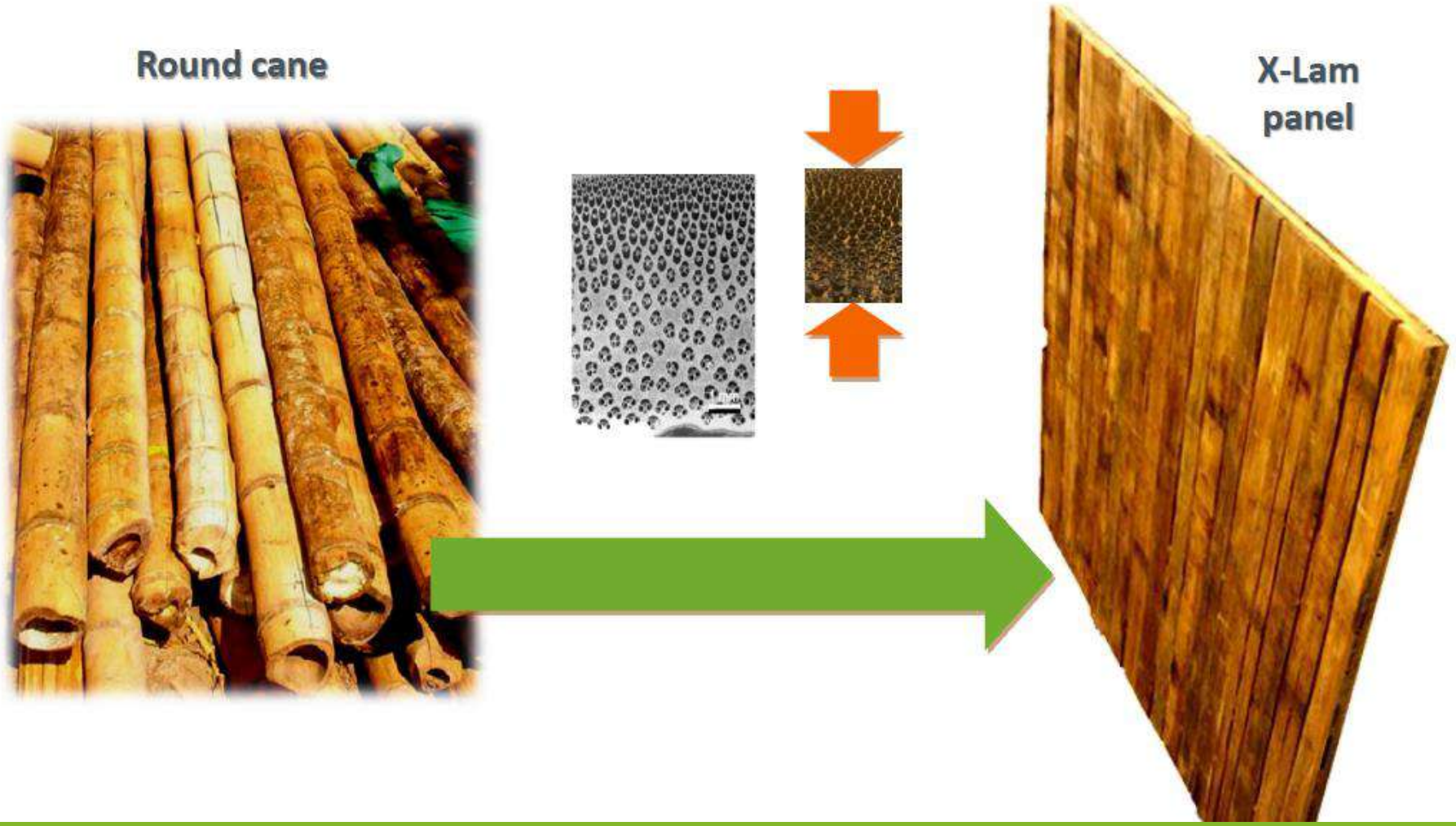
SOURCE: CEMENTED BAHAREQUE: DECREE 052-2002 & NSR-10 CHAPTER E 1 & 2 STOREY HOMES



APPLIED CEMENTED BAHAREQUE CODE

DESIGN: Architect MA. MUÑOZ R. JF. 2004
Photos: MUÑOZ R. JF.

Bamboo Panels – Modernizing Tradition

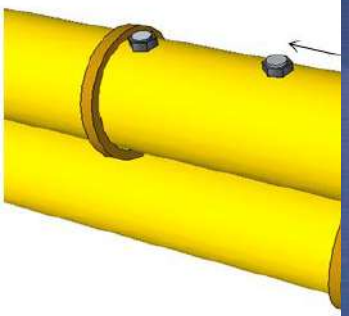


SOURCE: UNIVERSITY OF BATH

GLUED LAMINATED BAMBOO-SHEATHED WALLS CYCLIC TESTING

SOURCE: UNIVERSITY OF LOS ANDES

COLUMNS &



Ministerio de Vivienda, Ciudad y Territorio
Viceministerio de Vivienda y Desarrollo Territorial
Dirección del Sistema Habitacional
República de Colombia

Libertad y Orden

COMISIÓN ASESORA PERMANENTE PARA EL RÉGIMEN DE CONSTRUCCIONES SISMO RESISTENTES
(Creada por la Ley 400 de 1997)

Reglamento Colombiano de Construcción Sismo Resistente NSR-10

Tomo 4

- Título G - Estructuras de madera y estructuras de guadua
- Título H - Estudios geotécnicos
- Título I - Supervisión técnica
- Título J - Requisitos de protección contra incendios en edificaciones
- Título K - Requisitos complementarios

Incluye las modificaciones introducidas en los Decretos 2525 del 13 de julio de 2010, 092 del 17 de enero de 2011 y 340 del 13 de febrero de 2012

ais
Asociación Colombiana de Ingeniería Sísmica

MODERN ARCHITECTURE

DESIGN: SIMON HOSIE. 2007
PHOTO: JOSE F. MUÑOZ R.

INTERNATIONAL STANDARDISATION

SOURCE: ISO WEBSITE

SOURCE: COVENTRY UNIVERSITY

Concluding Remarks

1. Bamboo is already a mainstream building material – millions around the world live in vernacular bamboo housing
2. Engineering, architectural design, and technology has come a long way to making it a formal building material
3. For bamboo to become a building material for the 21st century technical, policy & social barriers still exist
4. But, with coordinated efforts, these can be overcome

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Thank You!

Find out more at:

www.inbar.int

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