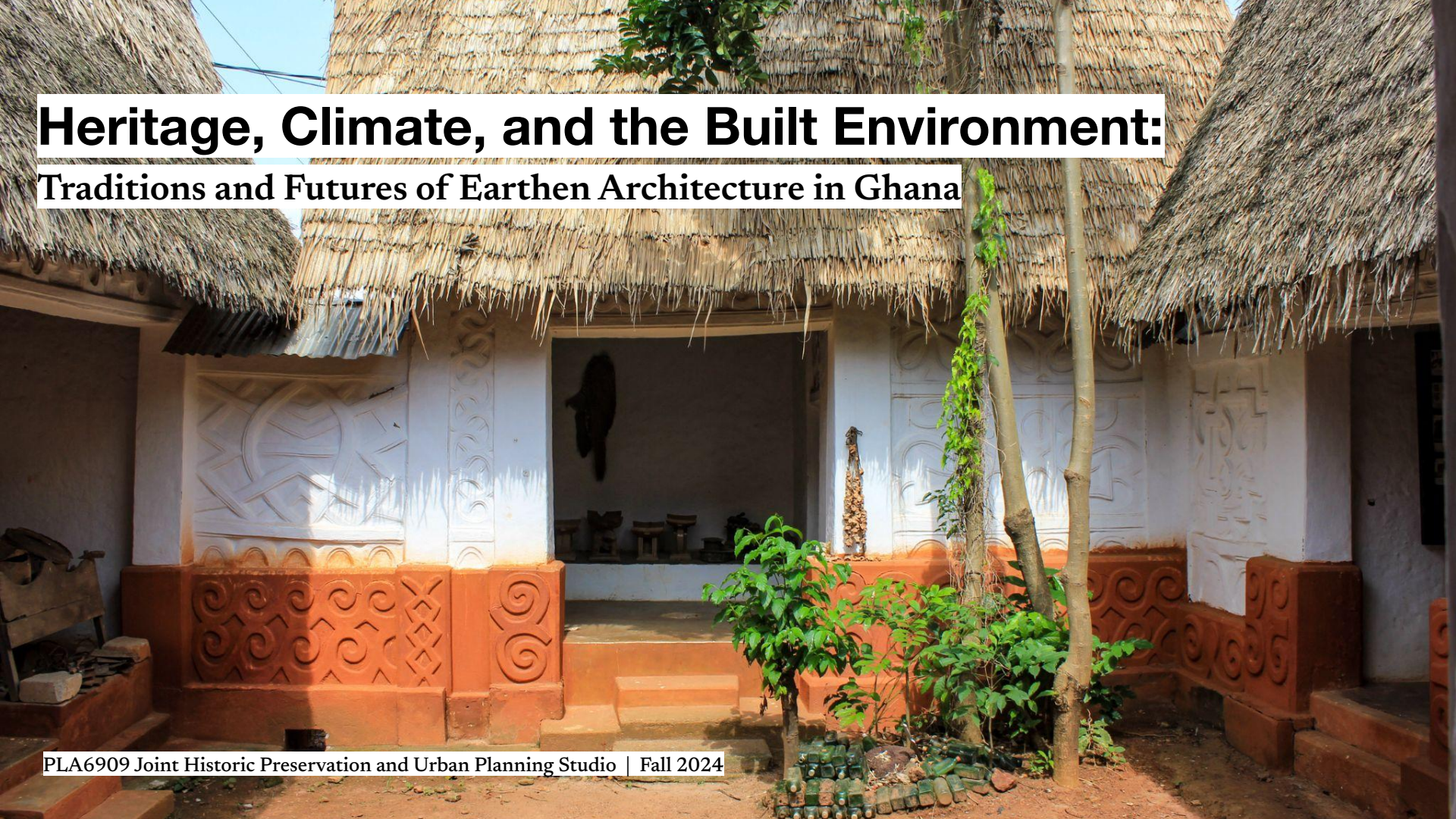

Heritage, Climate, and the Built Environment:

Traditions and Futures of Earthen Architecture in Ghana

PLA6909 Joint Historic Preservation and Urban Planning Studio | Fall 2024

Acknowledgments

Ghana Museums and Monuments Board

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Prof. Samuel Amos-Abanyie
Prof. S. O. Afram
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Dickson Harry
Dramani Abudulai
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Nyong Jacob Faal Kofi Nakpan
Pearl Owusua Berko

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Institutional Collaboration

Conservation of the Asante Traditional Buildings

Columbia University
IN THE CITY OF NEW YORK

COLUMBIA
GSAPP

Semester-long Studio

Sept - Dec
2023 & 2024

Week-long Workshop

October
2023 & 2024

Research Framing:
Connecting Earthen Heritage & New Construction

Context Inquiry 2023

Earthen architecture histories and heritage through the lens of social justice

Context Inquiry 2024

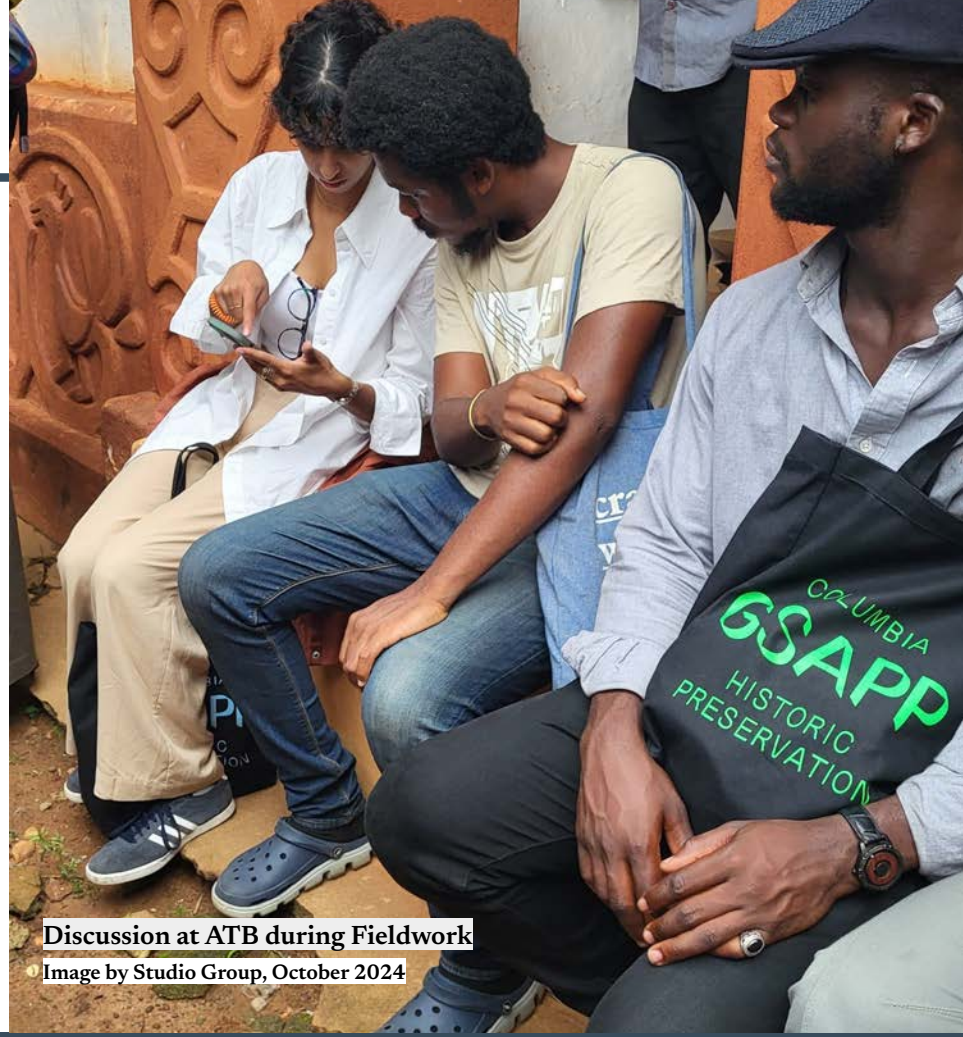
Continued use of architecture as a constructive culture and climate-response

Case Study

Asante Traditional Buildings & Communities
Earthen Architecture in Kumasi, Ghana

Case & Context Analysis

- Public Policy
- Education & Research
- Natural Resource Management
- Design and Planning Practice
- Construction Industry



Discussion at ATB during Fieldwork

Image by Studio Group, October 2024

Field Workshop

- Field Workshop
  - Building Survey
  - Community Survey
  - Interviews

Site visit to the Abetenim Arts Village

Image by Earthen Architecture Workshop, October 2024

Survey and Engagement Sites

Asenemaso | Tano Kwasi

Edwenase | Atua-Kosua Kwame

Ejisu-Besease | Tano Yaw

Adako Jachie | Kwasi Sima

Kentinkrono | Tano Kojo

Saaman | Saaman Kadwo

Abirem | Tno Subunu

Abetenim Arts Village

Mfensi Pottery Village

Kokrobitey Institute

Building Survey

Field Workshop

- **Building Survey**
- Community Survey
- Interviews

Team meeting before material survey

Image by Studio Group, October 2024

Community Survey

Field Workshop

- Building Survey
- **Community Survey**
- Interviews

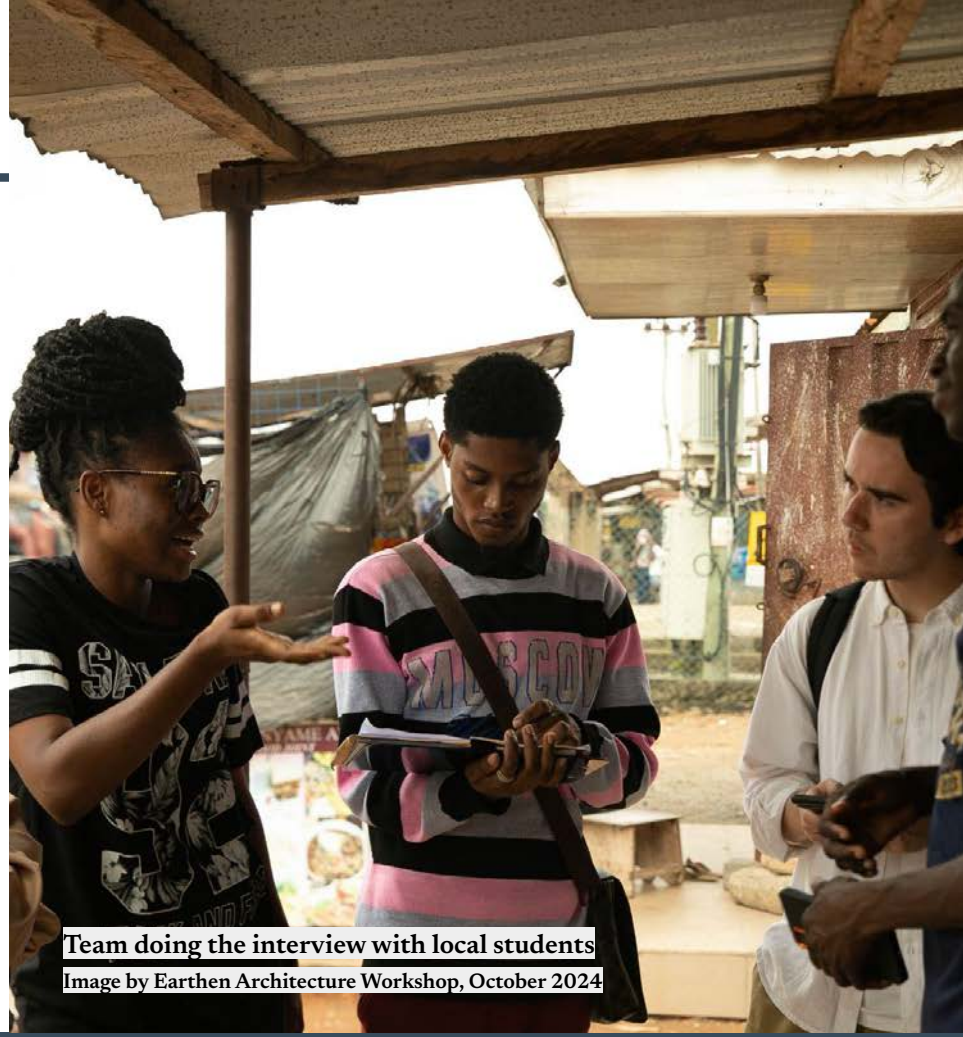
Team conducting the community survey

Image by Earthen Architecture Workshop, October 2024

Interviews

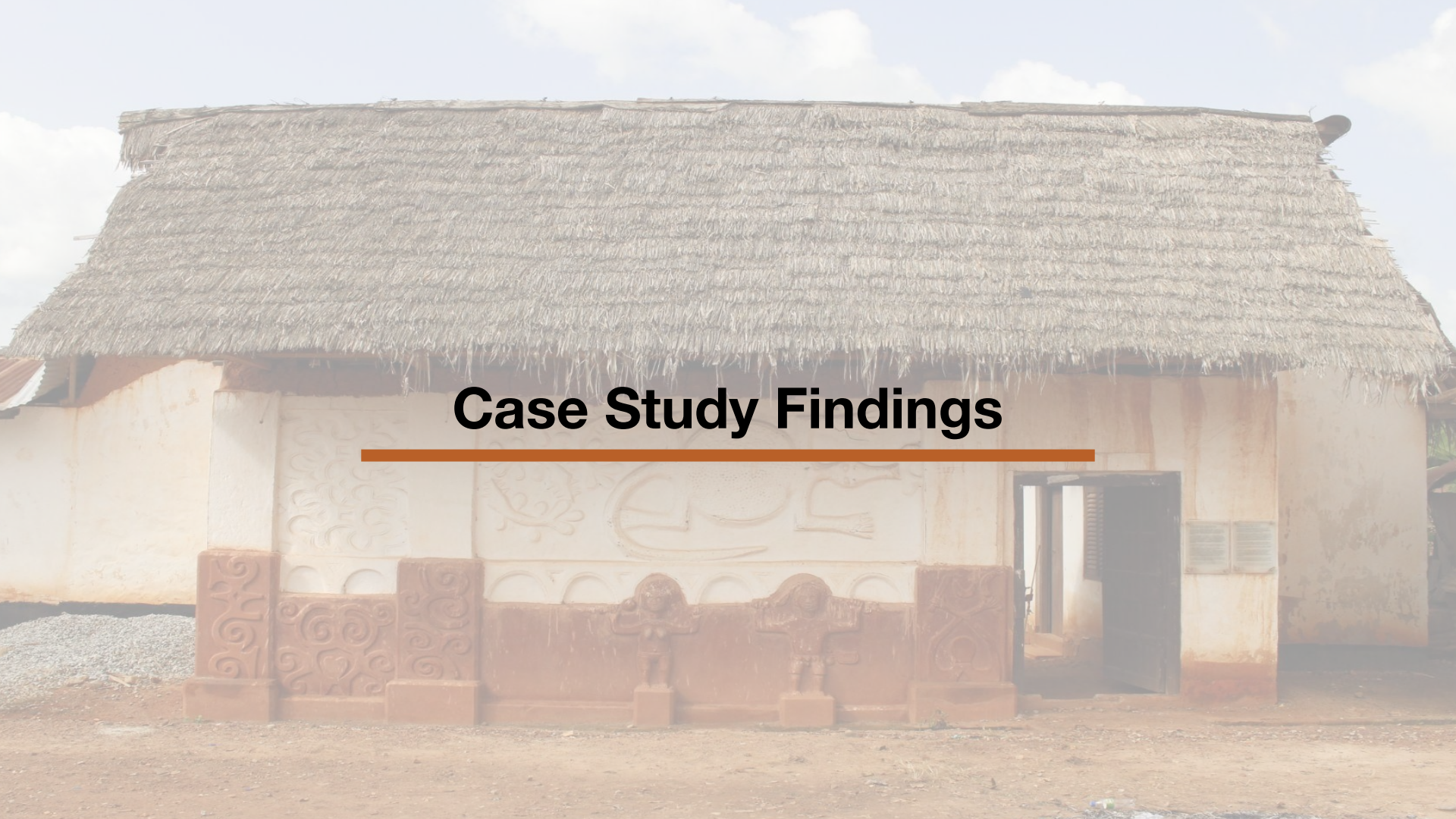
Field Workshop

- Building Survey
- Community Survey
- **Interviews**



Team doing the interview with local students

Image by Earthen Architecture Workshop, October 2024



Case Study Findings

Earthen Heritage

Field Visit

Image by Earthen Architecture Workshop, October 2024

Asante Traditional Buildings Surveyed in 2024

Abirem

Adako-Jachie

Asenemanso

Edwenase

Ejisu Besease

Kentinkrono

Saaman

Communities and ATBs visited during the 2024 Fieldwork

Images by Earthen Architecture Workshop, October 2024

Loss of Decorated Surfaces

Deteriorating Decorated Surfaces in Ejisu Besease Shrine (Left) and Kentinkrono Shrine (Right)

Image by Studio Group, October 2024

Integration of Traditional and Contemporary Materials

Edwenase | Thatch and Metal

Ejisu-Besease | Thatch and Metal

Adako-Jachie| Metal

Asenemanso | Metal

Abirem | Metal

Kentinkrono | Metal

Saaman | Metal

Varied Applications of Corrugated Metal Roofs in ATBs

Images by Studio Group, October 2024

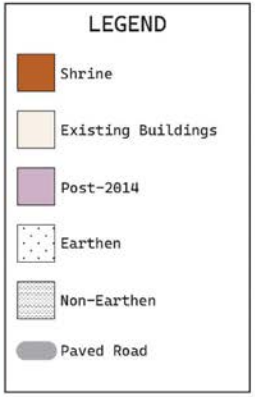
Continued Use of Earth

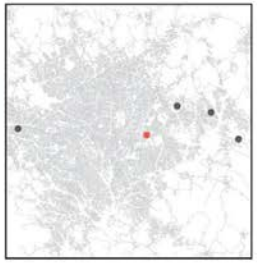
Identified the presence or absence of earthen materials in post-2014 buildings in ATB Communities

Field Visit

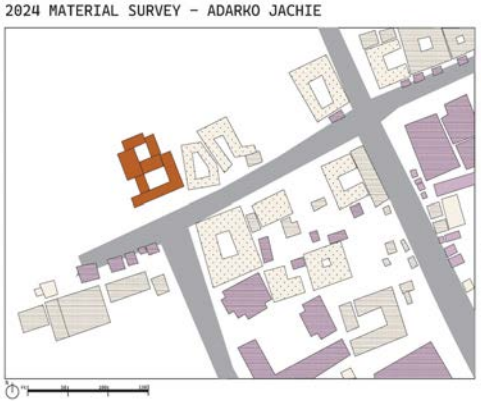
Image by Studio Group, October 2024

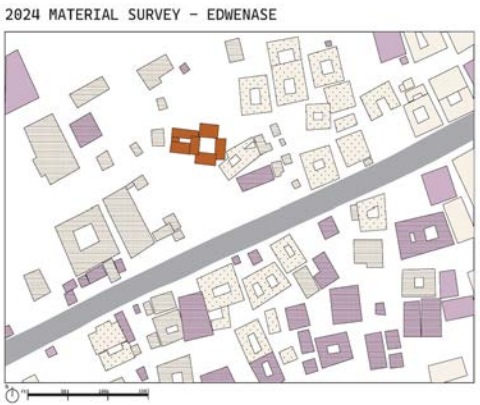
Characterizing New Construction

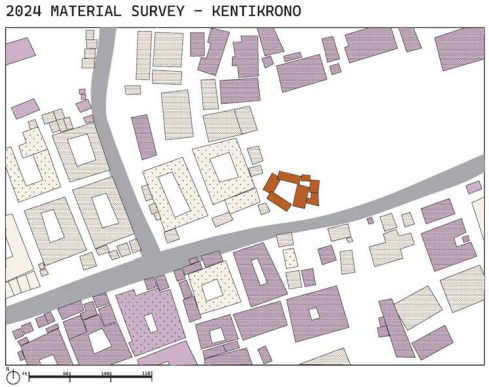


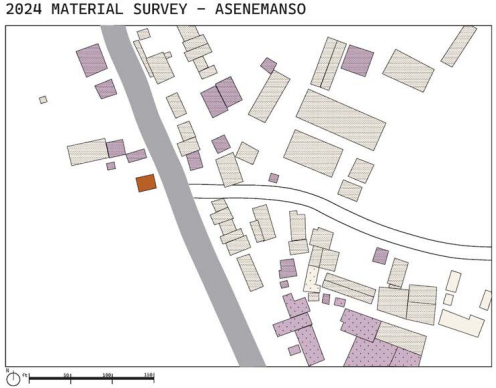


Maps by Charlotte Boulanger

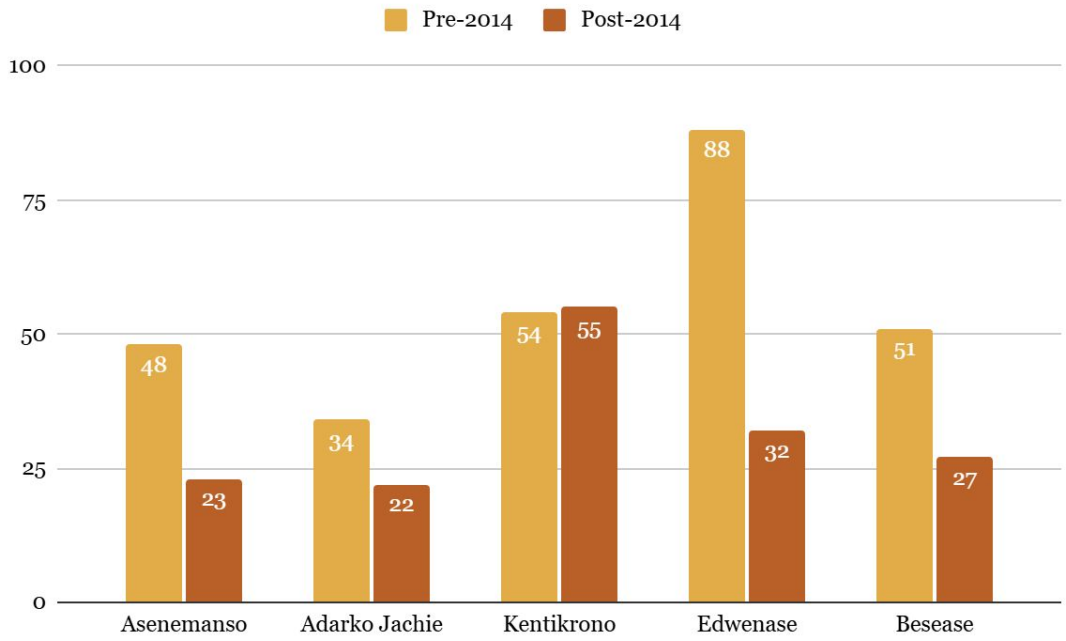








Expansion of the Built Environment

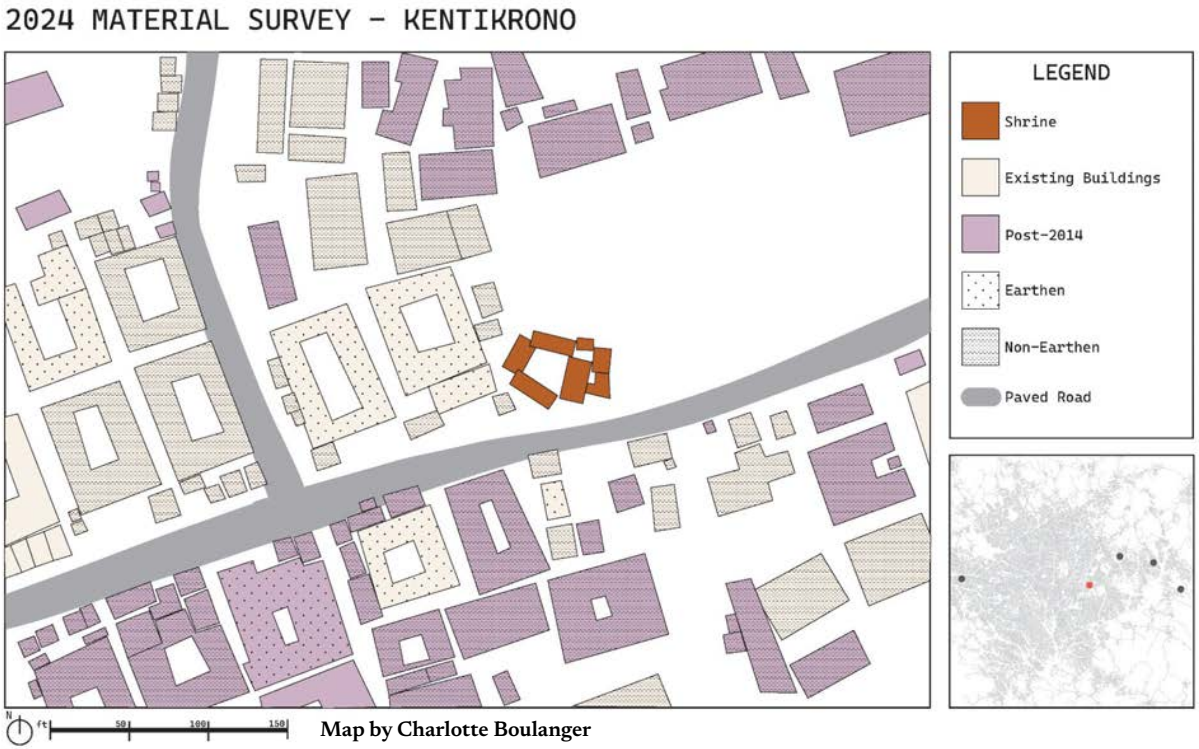


434 Buildings

275 Pre-2014

159 Post-2014

Rapid Urbanization Closer to Central Kumasi



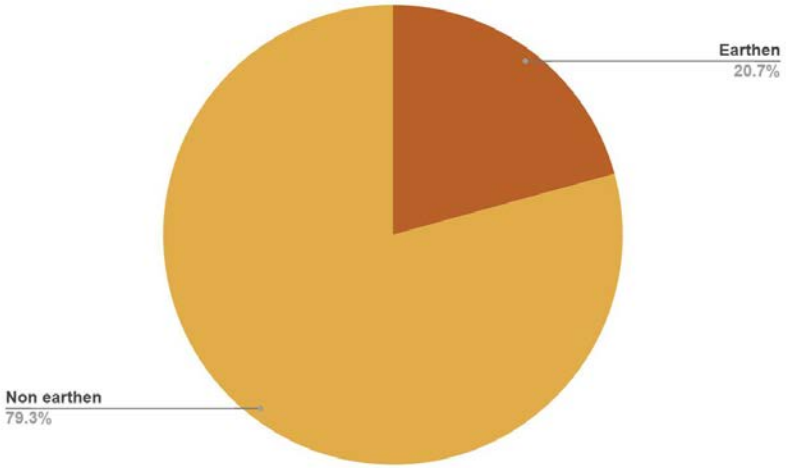
Map by Charlotte Boulanger

Kentinkrono Surroundings

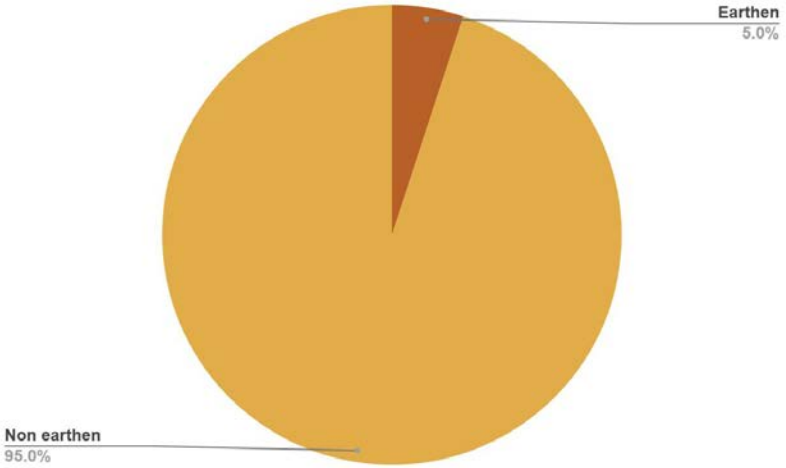
Image by Studio Group, October 2024

Use of Earthen Materials

Out of 159 post-2014 buildings surveyed, only 8 were earthen

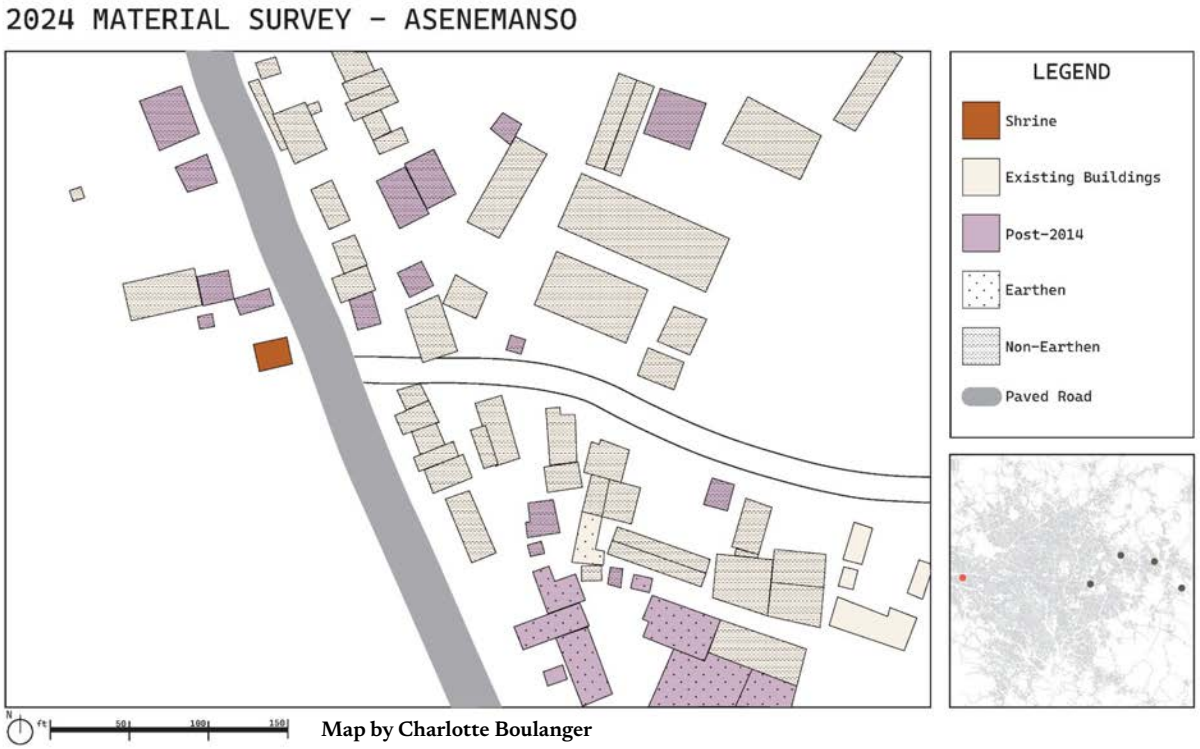


PRE-2014



POST-2014

New Earthen Construction Further from Central Kumasi



Map by Charlotte Boulanger

New Earthen Uses in Asenemanso

Image by Studio Group, October 2024

Perceptions of Earth

Community Perception Survey

Image by Earthen Architecture Workshop, October 2024

Key Themes from the Community Perception Survey

Familiarity with Earthen Buildings

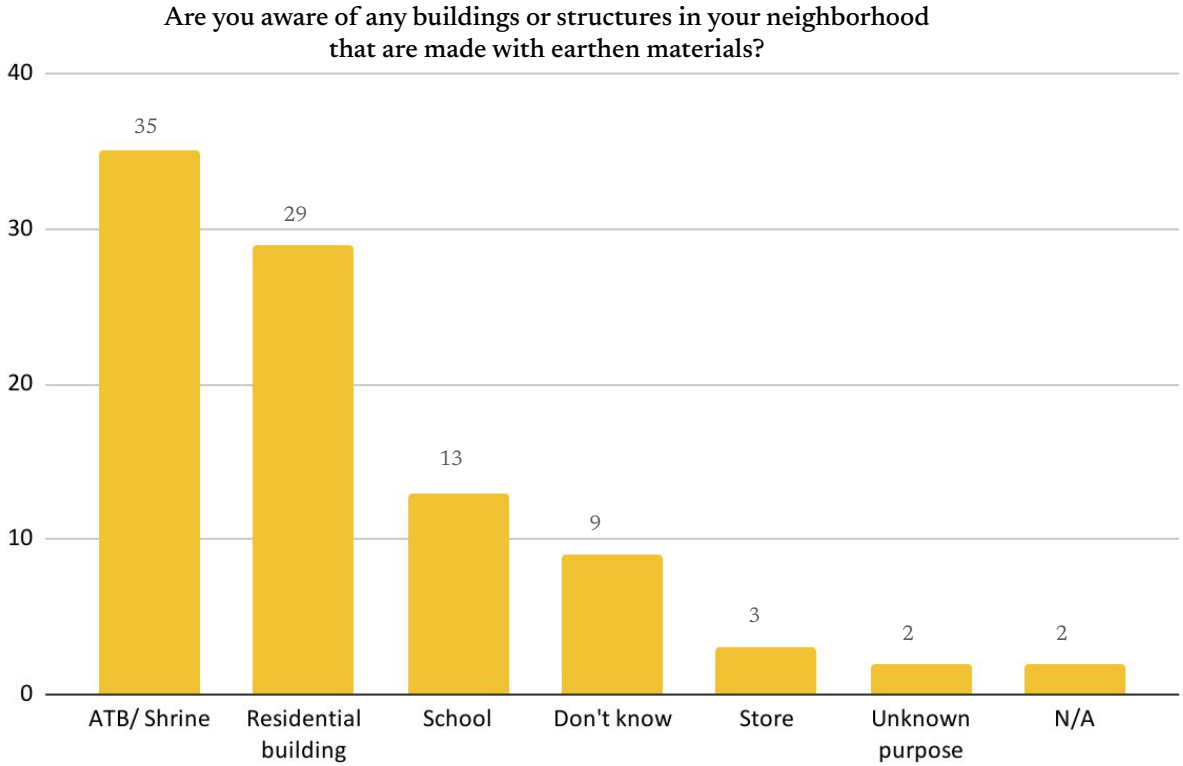
Family Tradition in Earthen Construction Knowledge Transfer

Preference for Modern Construction

Familiarity with Earthen Buildings

Signage of Tano Kojo Shrine in Kentinkrono Community

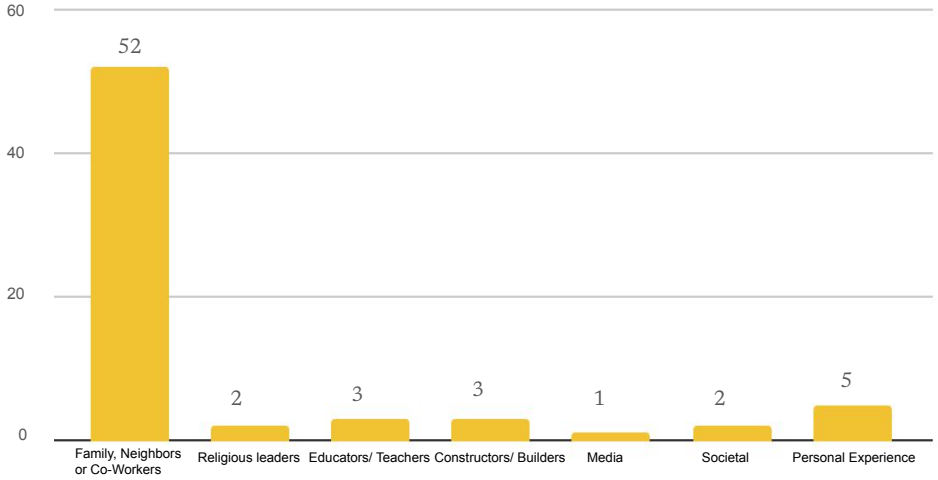
Image by Studio Group, October 2024



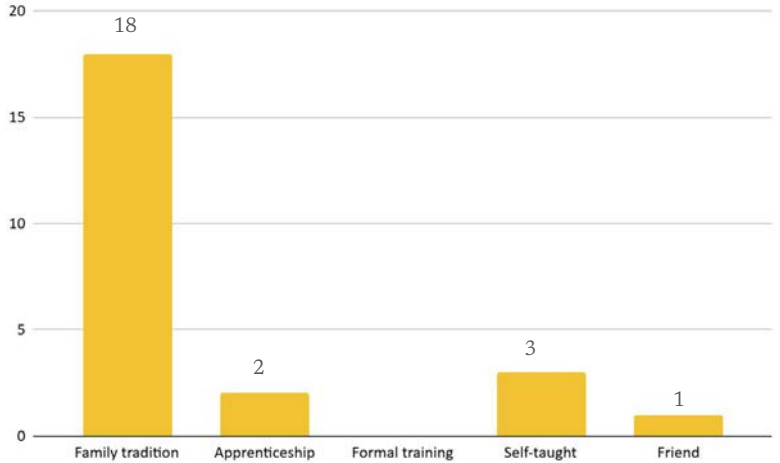
Note: N/A- 2 answers are referring to kitchen appliances/ utensils

Family Tradition in Earthen Construction Knowledge Transfer

Who has informed your views toward earthen construction?



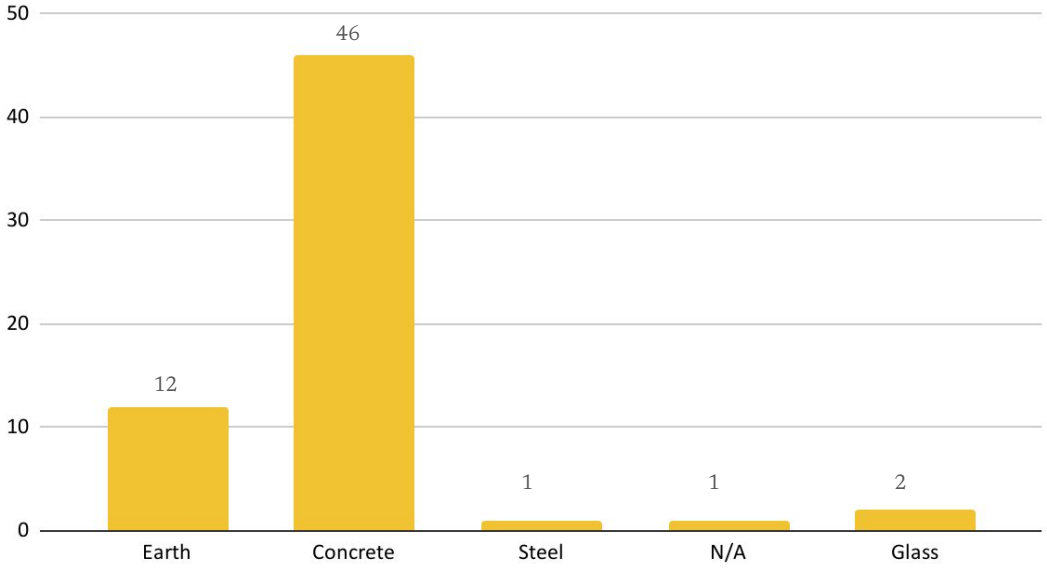
If you build and repair with earth, how did you learn the skills?



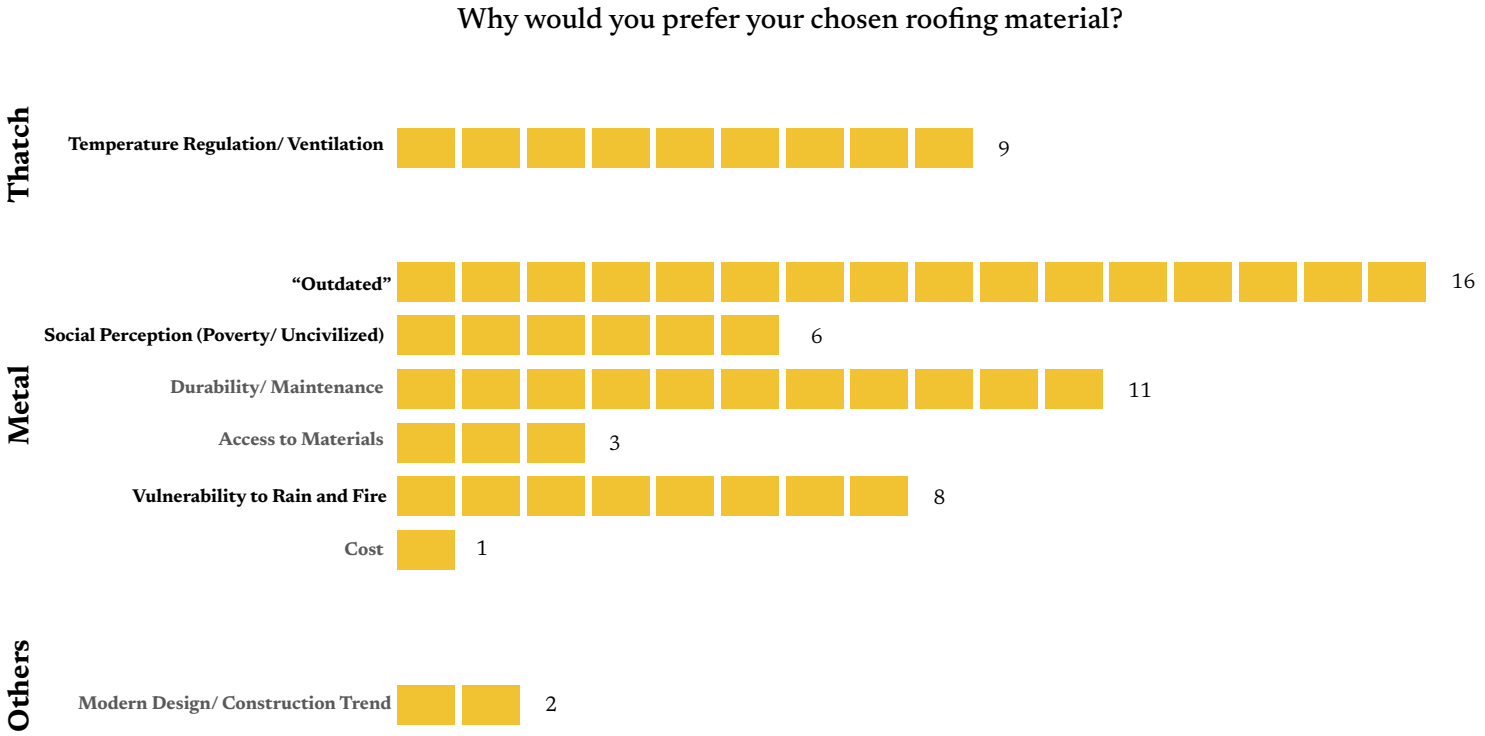
Concrete as the Preferred Construction Material

Use of Concrete in New Construction
Image by Studio Group, October 2024

In general, which material would you most prefer to build with?



Thatch Perceived as Less Modern and Less Durable



Preference for Modern over Traditional Construction Materials

Modernization	• Earthen seen as outdated • Loss of traditional knowledge • Shift to concrete
Comfort	• Cool temperature indoors • Better ventilation • More comfortable than modern buildings
Safety Concerns	• Fear of collapse • Vulnerable to pests • Weaker in heavy rain

“Though earthen materials offer comfort, societal changes and the perception of progress drive us to concrete.”

– Excerpt from the Community Perception Survey

Cement used as plaster

Image by Studio Group, October 2024

CRITICAL INTERSECTIONS

Critical Intersections

- Earth as a Constructive Culture
- Access to Earthen Materials
- Adaptations and Additives
- Construction and Indigenous Building Materials
- Carbon and Economic Implications
- Building Codes and Policy
- New Earthen Design and Construction
- Education and Research

Critical Intersection:
Earth as a Constructive Culture

Earthen blocks developed at the AAMUSTED lab
Image by Studio Group, October 2024

Intangible Cultural Heritage and Earthen Architecture

unesco
Intangible Cultural Heritage

Final report

Strengthening Capacities to Safeguard Intangible Cultural Heritage and Contribute to Sustainable Development in Ghana

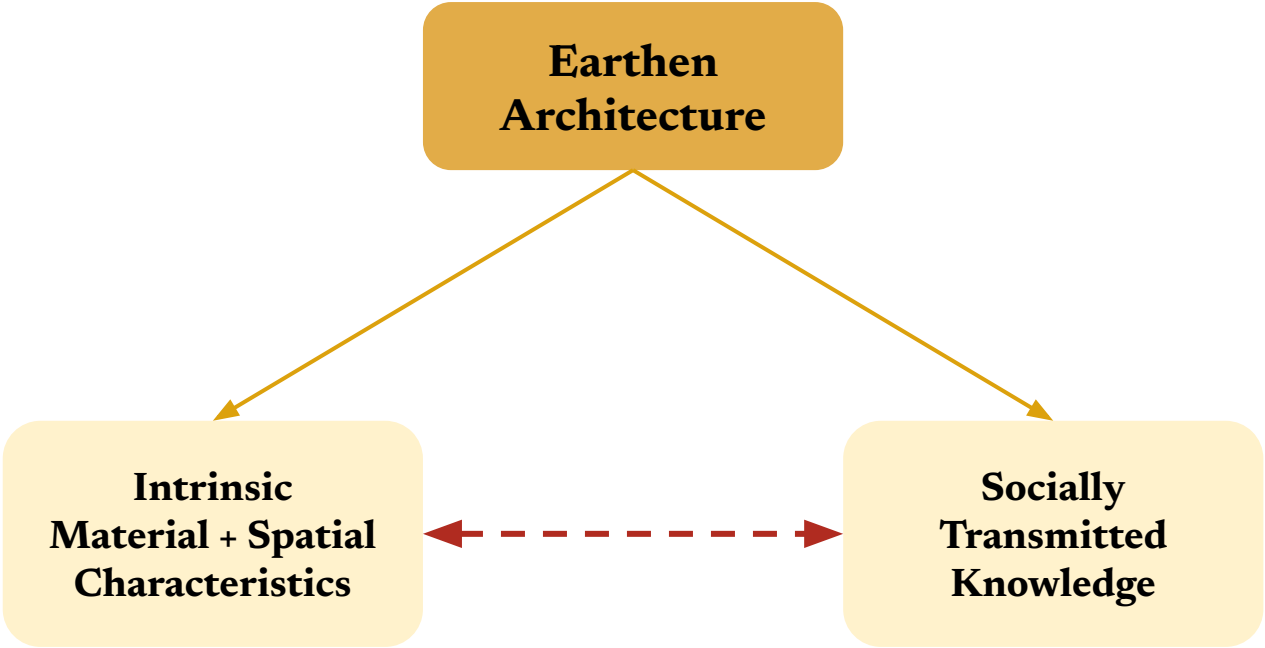
Geographical scope/benefitting country(ies)	Ghana
Type of funding	Earmarked voluntary contribution to the Intangible Cultural Heritage Fund received from France
Amount	US$ 135,575
Executing field office(s)	UNESCO Office in Accra
Reporting period	November 2021 – May 2024

REPORT ON THE UNESCO EARTH NETWORK WORKSHOP

Training workshop for the Asante Traditional Buildings; Exploring Connections between Intangible Cultural Heritage, Biodiversity, and World Heritage Sites (19TH – 23RD December, 2023)

DECEMBER 28, 2023
GHANA MUSEUMS AND MONUMNETS BOARD .REGIONAL OFFICE, KUMASI
POST OFFICE BOX 1262, KUMASI

Opportunities of Earth as a Constructive Culture



Critical Intersection:
Access to Earthen Materials

Visible timber framing of atakpamé walls and thatch roof at Edwanase Shrine
Image by Studio Group, October 2024

Conserving and maintaining access to the natural materials used in building are fundamental to the continued use of earth in future design and construction around Kumasi and Ghana.

Building with earth at Adako Jachie

Image by Studio Group, October 2024

Traditional Forms of Earthen Architecture Near ATBs

Tadan

Image by Daniela Martínez, 2023

Atakpamé

Image by Roberto E. Villasante, 2023

Use of Laterite in Earthen Construction

Lateritic soils surround the Adako Jachie shrine in Kumasi.

Image by Studio Group, October 2024

Bright red lateritic soil at Abetenim Arts Village.

Image by Studio Group, October 2024

Use of Clays in Earthen Construction

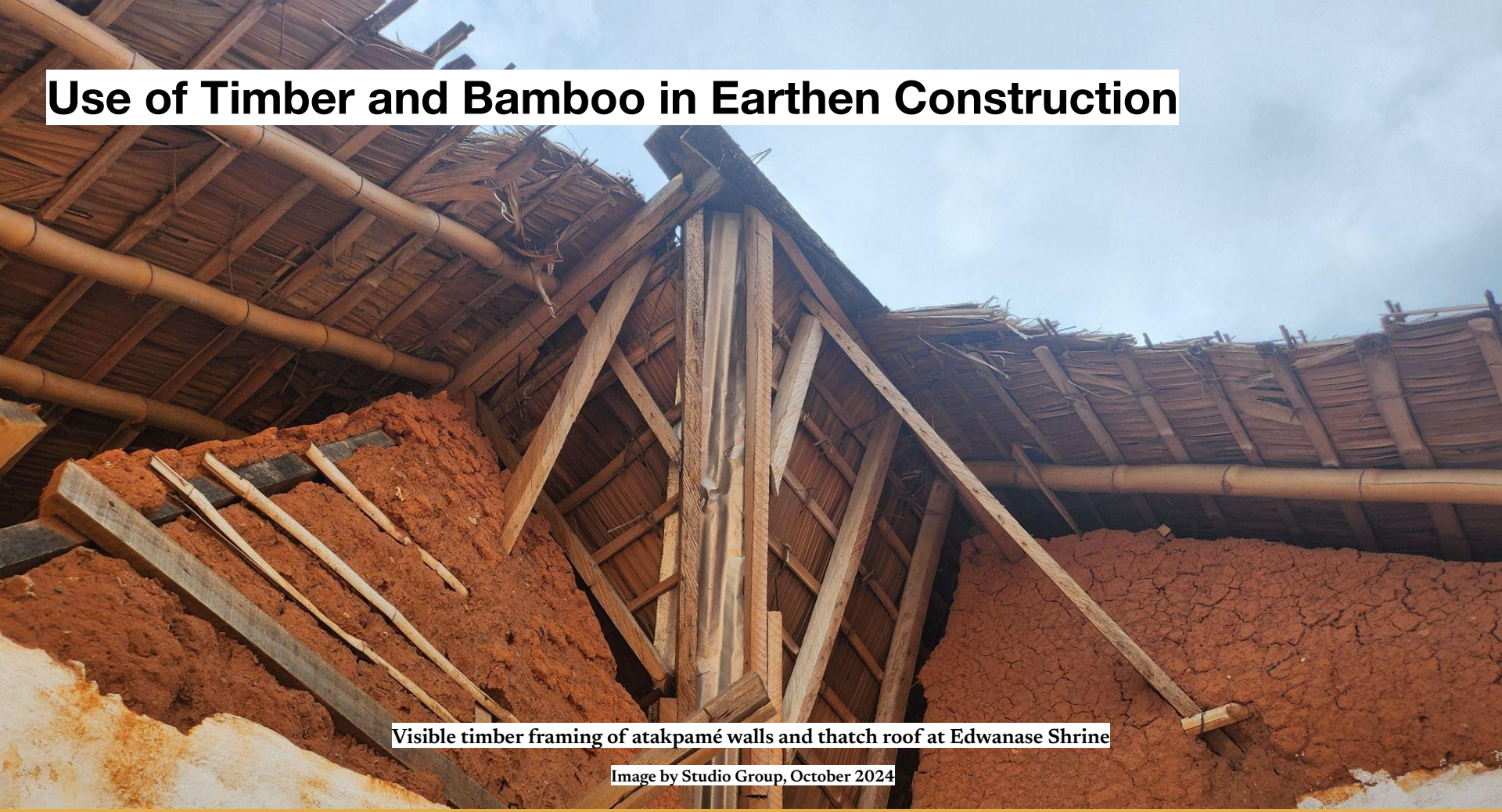
A self built tadan house

Image by Daniela Martínez, October 2023

A woman works makes clay bricks at the Mfensi Pottery Village

Image by Studio Group, October 2024

Use of Timber and Bamboo in Earthen Construction



Visible timber framing of atakpamé walls and thatch roof at Edwanase Shrine

Image by Studio Group, October 2024

Sourcing Timber and Bamboo for Framing

Timber logging and tree cover, Kumasi

Image by Studio Group, October 2024

Tano-Offin Forest Reserve, Ashanti Region

Image by Ellis Lomotey, Wikimedia Commons, 2018

Tano-Offin Forest Reserve, Ashanti Region

Image by Tinny Jnr, Wikimedia Commons, 2022

Use of Palm Thatch in Earthen Construction

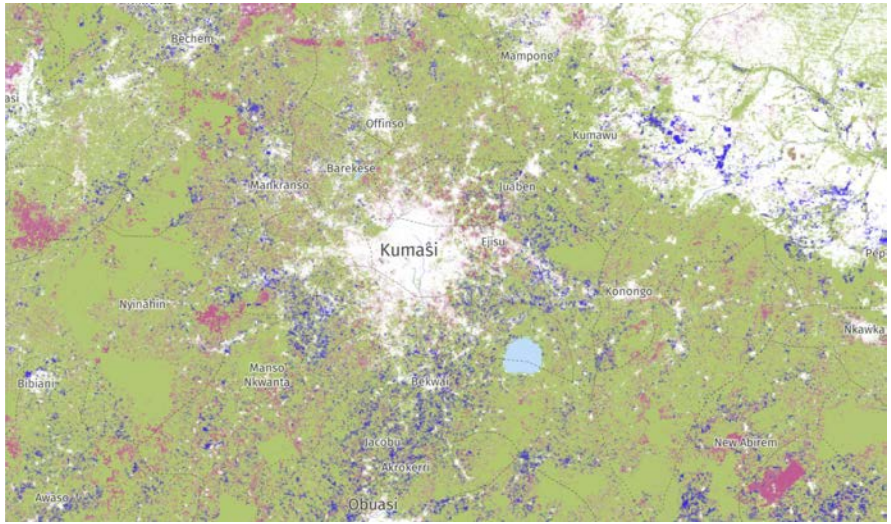
Raffia Palm thatch is found at the Edwenase Shrine.

Image by Studio Group, October 2024.

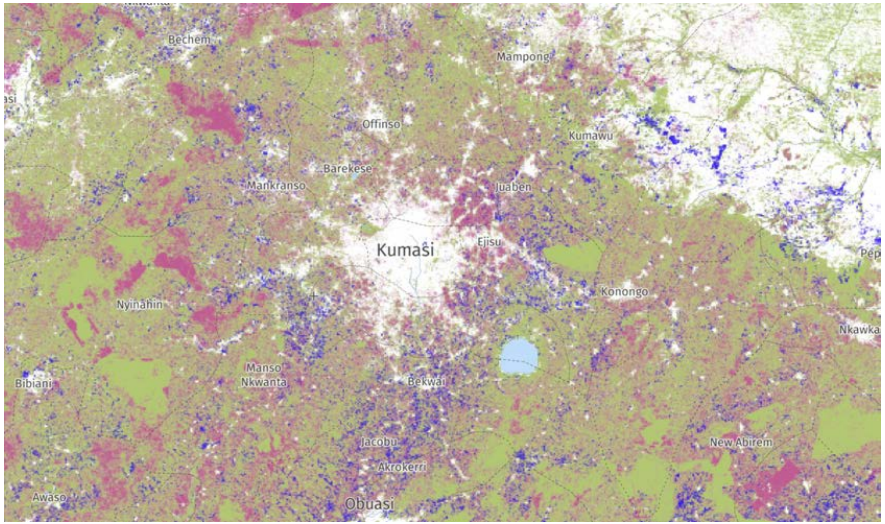
Demonstration thatch panel at Ejisu Besease.

Image by Studio Group, October 2024.

Deforestation Affecting Timber, Bamboo, and Palm Thatch



2015



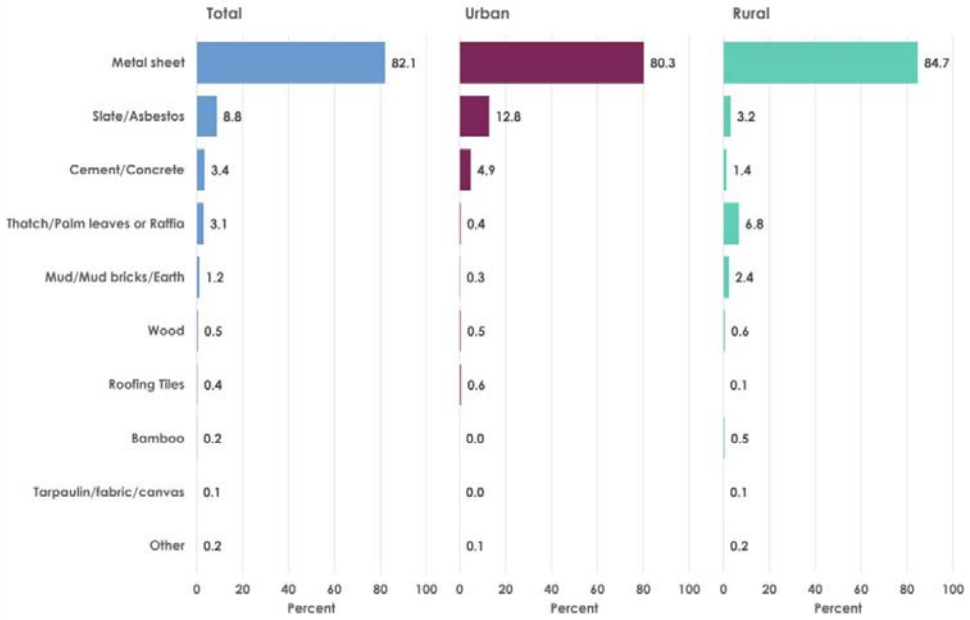
2024

- Tree Cover
- Tree Cover Loss
- Tree Cover Gain

Forest Map & Tree Cover Change, Kumasi Region

Images by Global Forest Watch, 2024

Prevalence of Metal Roofing in Ghana



Roofing Material for Dwelling Units by Type of Locality.

Ghana Statistical Service, 2022.

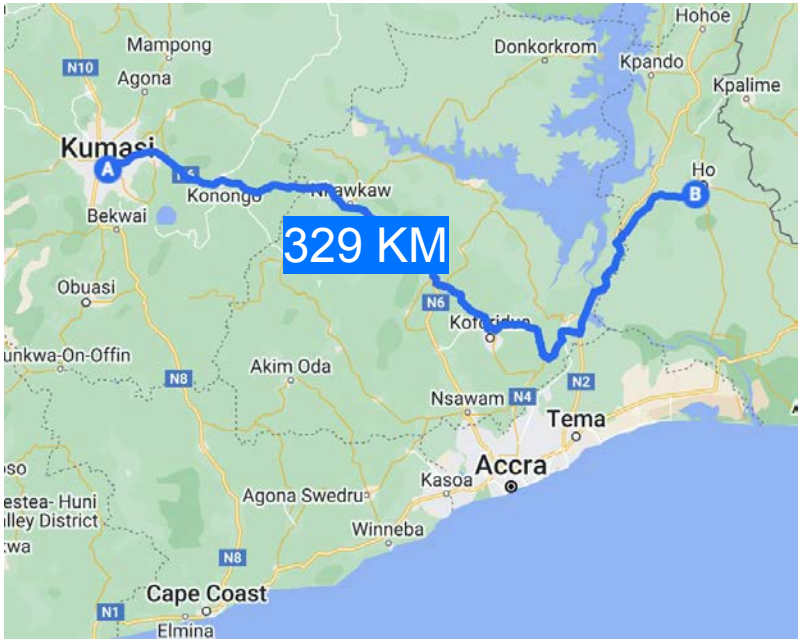
"Eight out of every 10 dwelling units have metal sheet as the main roofing material."

– Ghana Statistical Service, 2022

Access to Palm Thatch: Loss of Industry / Greater Travel Distance

A recently installed metal roof at Adako Jachie.

Image by Studio Group, October 2024



Map illustrating the distance between Kumasi and the Volta Region.

Map by Studio Group, 2024

Economic Impact of Thatch vs Metal Roofing

Cost and Maintenance

Thatch
Cost: 212.5 cedis/m²
Maintenance cycle: 2-3 years
Replacement: ~10 years

Metal Roofing
Cost: 620 cedis/m²
Maintenance Cycle: ~10-20 years
Replacement: ~40 years

Roof Cost / 40 Years

Thatch Roof
~8,000 Cedis

Metal Roof
2,800 Cedis

Critical Intersection:
Adaptations and Additives

Earthen Blocks at AMUUSTED lab
Image by Studio Group, October 2024

Types of Cement Adaptations and Additives

Cement used in Existing Earthen Buildings

Cement as render/ plaster, mortar, and stabilizer in new construction

Image by Studio Group, October 2024

Cement used in Existing Earthen Buildings








Images by Studio Group, October 2024

Cement used as Render/Plaster in New Construction








Images by Studio Group, October 2024

Cement used as Mortar








Images by Studio Group, October 2024

Cement used as Mixture of Soil/Clay




Cement additives at AMUUSTED lab
Image by Studio Group, October 2024

“Earth render is stabilized with low Portland cement mix (ratio 1:15)... minimal amount of cement to prevent corrosion and wear”

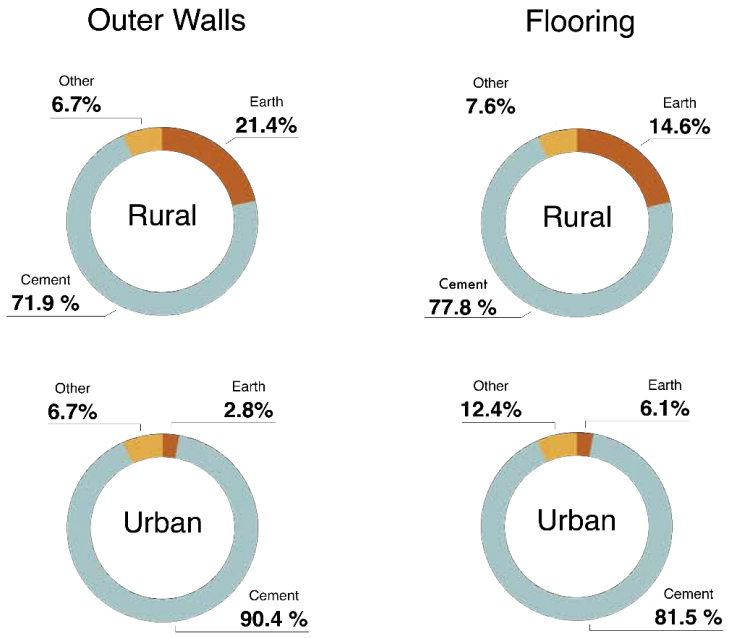
- Dr. Arc. Kwadwo Twumasi-Ampofo, BRRI Roundtable 2024

Critical Intersection:
Construction & IBMs

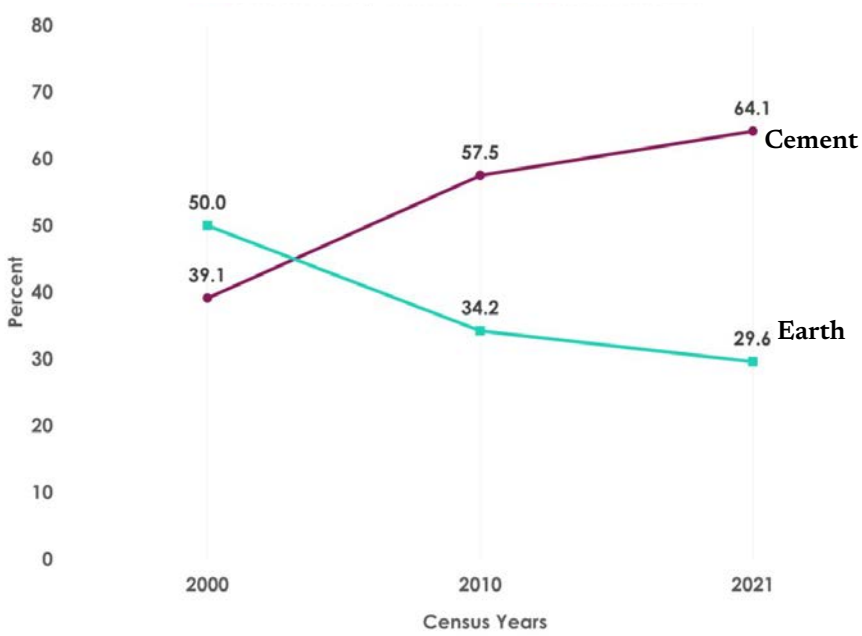
Construction at Abetenim Arts Village

Image by Studio Group, October 2024

Cement as a Primary Construction Material



Use of construction materials in Ghana
Image by 2023 Studio Group



Trend of the construction materials in Ghana from 2000-2021.
Source from Ghana 2021 Population and Housing Census Report, 2022

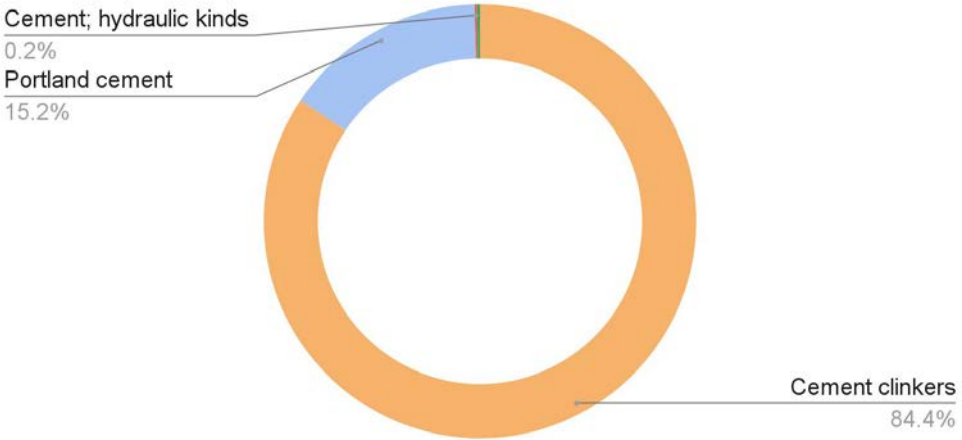
“Ghana began to produce cement domestically in **1967** when Ghana Cement Works (GHACEM) was established”

GhanaWeb 2024

Advertisements for sale of cement

Image by Studio Group, October 2024

Dependence on Cement Clinker Imports



$288 million

imported cement clinkers

Proportion of importation, including Portland cement, aluminous cement, slag cement, super sulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers.

Data source from Trend Economy, 2024

Critical Intersection:
Carbon & Economic Implications

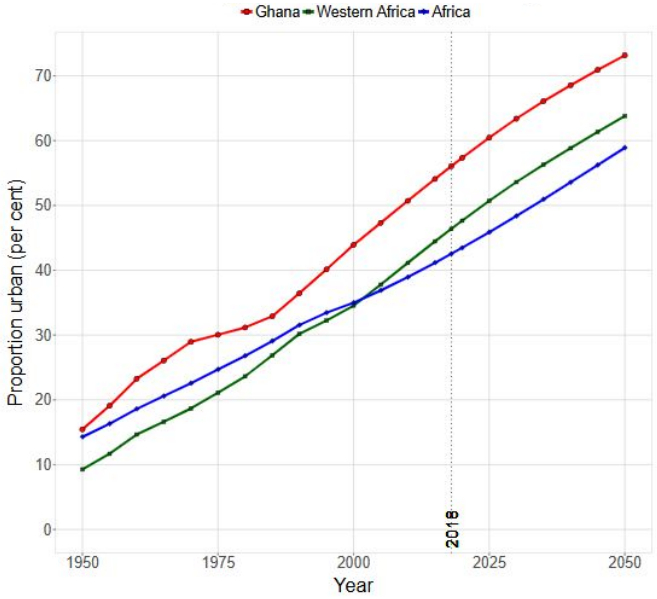
Mfensi Pottery Village

Image by Studio Group, October 2024

Growth of the Built Environment

80%

of construction projects are yet to be built in order to accommodate the growing population in Africa



Projected Urban Population Growth in Ghana

United Nations Department of Economic and Social Affairs, World Urbanization Prospects 2018

Low-Carbon Construction

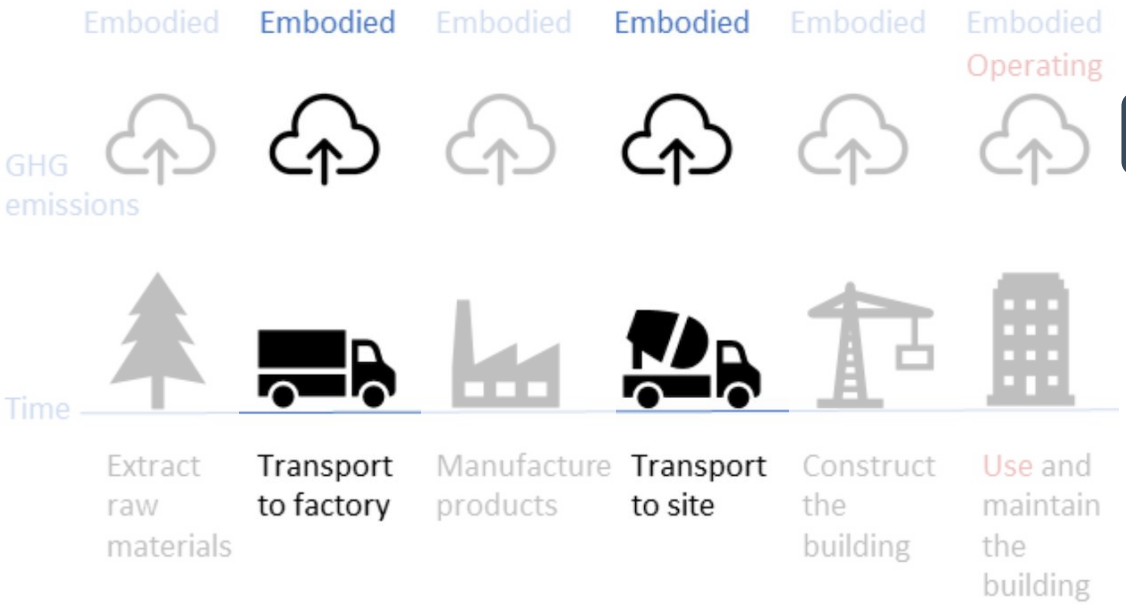
- The building sector currently accounts for nearly **40%** of global greenhouse gas emissions.

- Indigenous Building Materials like earth can become crucial in mitigating environmental impacts while still meeting the demands of an ever-growing urban population if sustainably managed.

Mfensi Pottery Village

Image by Studio Group, October 2024

Foreign Construction Materials Drive Embodied Carbon



Life Cycle of a Building

Image by C40 Knowledge Hub, 2024

Foreign Construction Materials (FCM)

Imported construction materials used in Ghanaian buildings

Corrugated Metal Roofing Importation

“Made in Japan” mark on the Roof of Kentinkrono Shrine, 2024

Image by Studio Group, October 2024

Kentinkrono Shrine, 2024

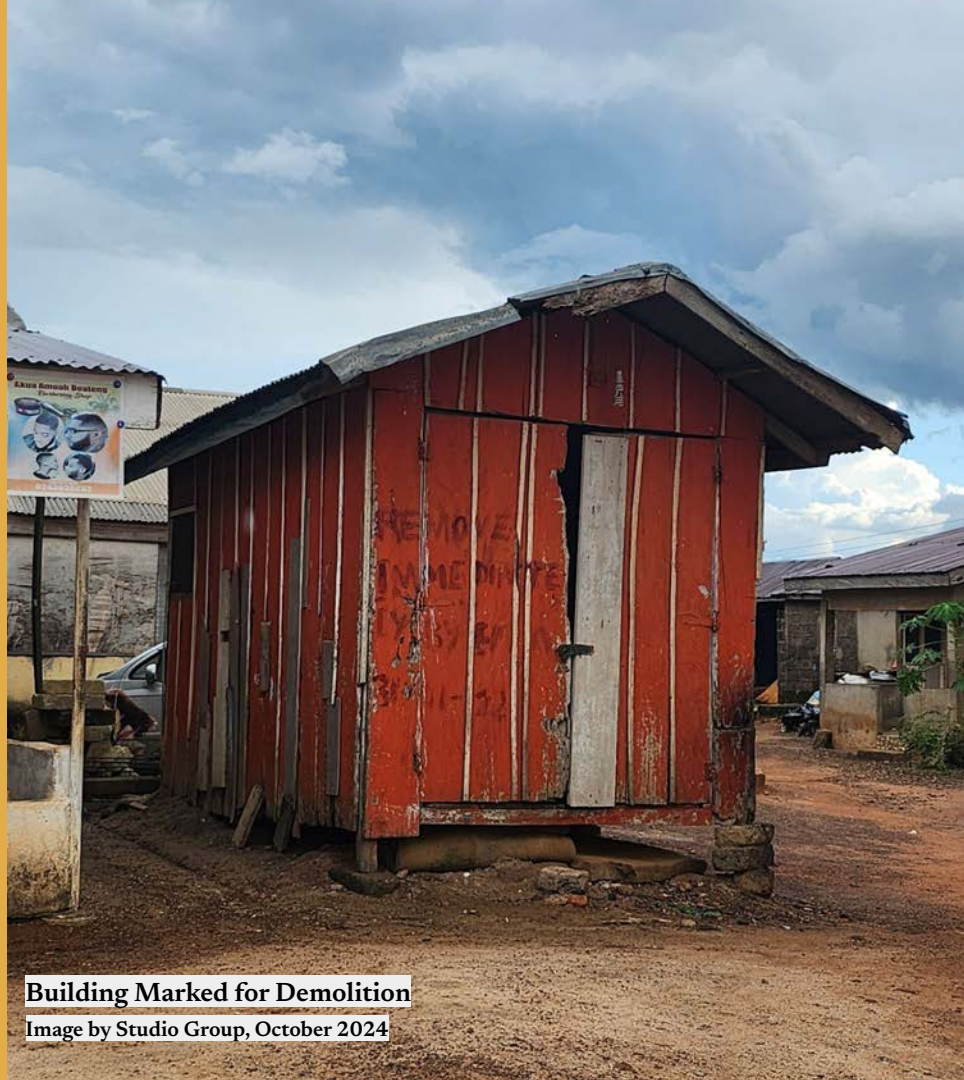
Image by Studio Group, October 2024

Economic and Environmental Implications

Environmental Gains	Economic Boost
Reduced transportation emissions contribute to a more sustainable building sector	Switching to Indigenous Building Materials will save **$80M annually**

Source: Building and Road Research Institute (BRRI) Projection, 2012

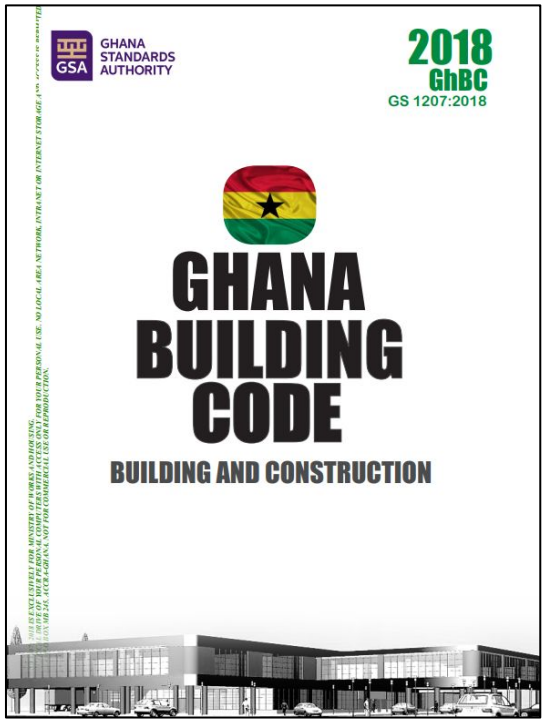
Critical Intersection:
Building Codes & Policy



Building Marked for Demolition

Image by Studio Group, October 2024

Ghana Building Code



Ghana Building Code
Ghana Standards Authority

Performance Based Code

22.9 - Empirical Design of Adobe Masonry

"Masonry shall be designed in accordance with the engineered design provisions of Clause 22.1.2"

18.6.2 - Presumptive Load-Bearing Capacity

"Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted."

Standards and Formalization

Building Marked for Demolition
Image by Studio Group, October 2024

45%

of Kumasi's population is estimated to live in self-built structures that are constructed outside of formal regulatory frameworks

Critical Intersection:
New Earthen Design & Construction

Compressed earth block wall, Kokrobitey Institute

Image by Studio Group, October 2024

Advancing earthen construction occurs through four key pathways:

Adapting traditional techniques

Tadan wall at Zero KM House, Butre
ISOPTERRA, 2023

Re-valorizing earthen aesthetics

Sandbox Complex, Accra
Adjaye Associates, 2020

Adapting traditional materials

Eco-Pavilion in Diamniadio, Senegal
Worofila, 2019

Community-engaged design

Tourism Center in Albreda-Juffureh, Gambia
CRA-Terre, 2015

Innovating traditional construction with contemporary methods

***Tadan* wall at Zero KM House**
ISOPTERRA, 2023

Eco-Pavilion by Worofila
Diamniadio, 2019

Re-valorizing traditional aesthetics

Sandbox Complex, concrete with earth render
Adjaye Associates, 2020

Nkron Residence, pigmented concrete
Adjaye Associates, 2013

Adapting traditional materials for contemporary use

Earth block wall, Edwanase community
Image by Studio Group, October 2024

Compressed earth block wall, Kokrobitey Institute
Image by Studio Group, October 2024

Disconnects between Professionals and Self-built Practices

CEB used in Kokrobitey Institute
Image by Studio Group, October 2024

Community-made Earth Blocks
Image by Daniela Martínez, 2023

Making clay bricks at Mfensi Pottery Village
Image by Studio Group, October 2024

Community engaged practice

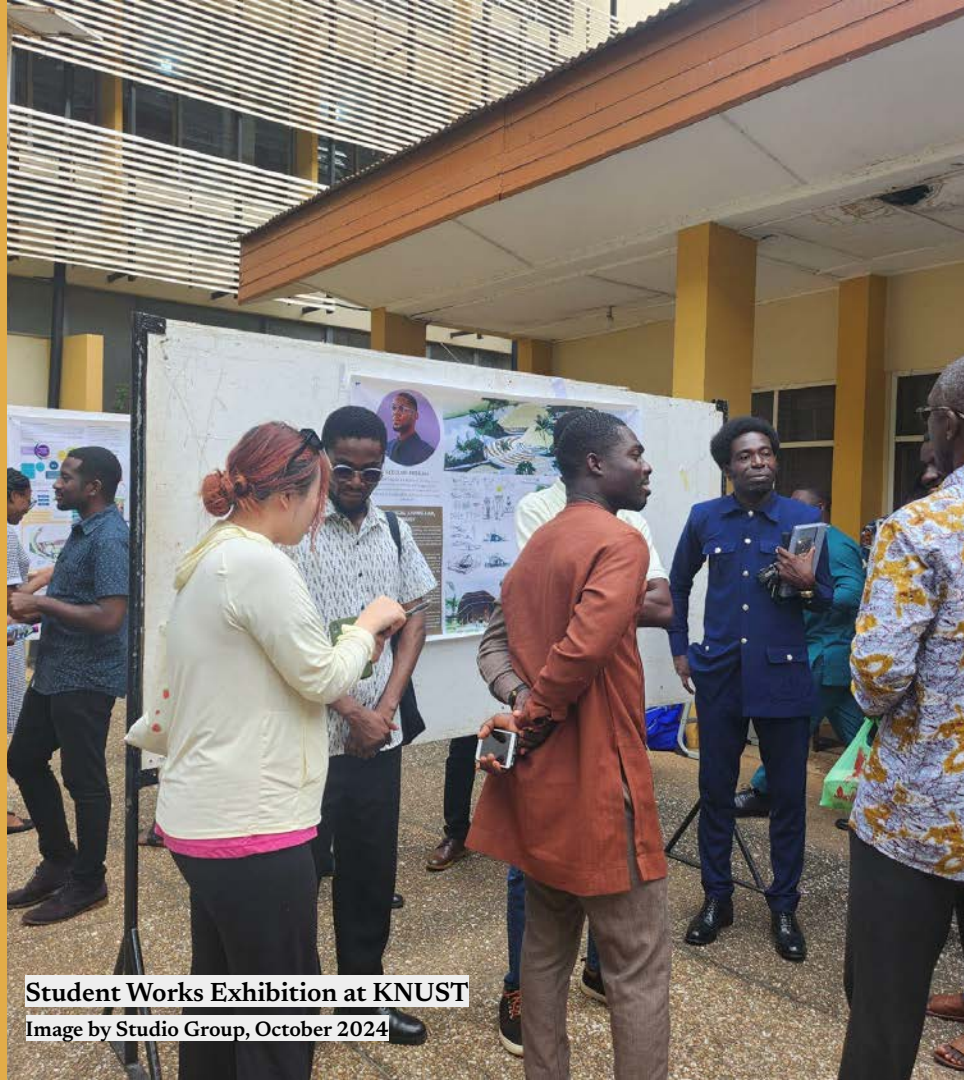
Rammed earth building at Abetenim Arts Village

Image by Studio Group, October 2024

Rammed earth buildings at Abetenim Arts Village

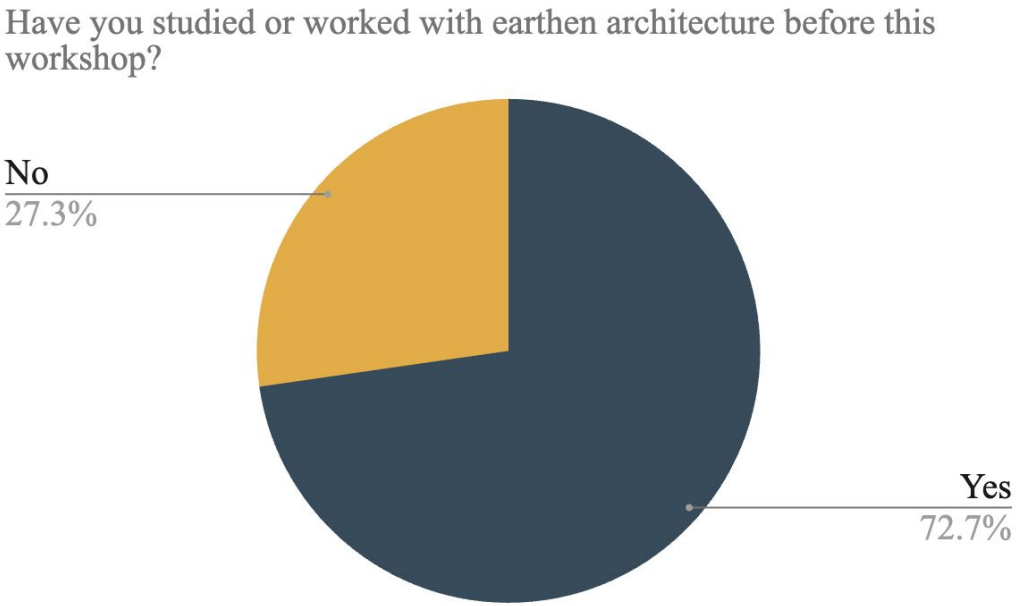
Image by Studio Group, October 2024

Critical Intersection:
Education & Research



Student Works Exhibition at KNUST
Image by Studio Group, October 2024

Limited focus on earthen architecture in education



Data from interviews with KNUST and AAMUSTED students

Graph by Studio Group, 2024

Limited focus on earthen architecture in education

Interview Question: How is earthen architecture taught in your curriculum?

"It's **something that is minor** ...often through an assignment project by a professor. Our introductory courses covered different types of buildings typologies, but not deeply."

"**It's not taught at all.** Students to infuse in their designs. Have to find out about it on their own. Do teach sustainable materials."

"Not taught, **self-study** and research...**Not a standardized curriculum feature**."

Quotes from interviews with KNUST and AAMUSTED students
Studio Group, 2024

Limited focus on earthen architecture in education

UNESCO Chair Earthen Architecture, partner universities and institutions

UNESCO Chair Earthen Architecture, 2024

Research on earthen architecture

Bricks produced in the CSIR-BRRI Bricks Factory
Image by BRRI

Earthen blocks developed at the AAMUSTED lab
Image by Studio Group, October 2024

Architects and practitioners filling the gap

Hive Earth
Hive Earth, 2024

KASA Konsultants
KASA Konsultants, 2021

Advancing Connections Between Earthen Heritage and New Construction

Advancing Connections

Charrette

Roundtable

Policy Recommendations

Charrette
Primary Objectives:

- Combine traditional and contemporary earthen construction techniques

- Serve local community and institutional needs of GMMB

Charrette Group Work

Image by Earthen Architecture Workshop, October 2024

Collaboration and Pin-Ups

Project Presentations

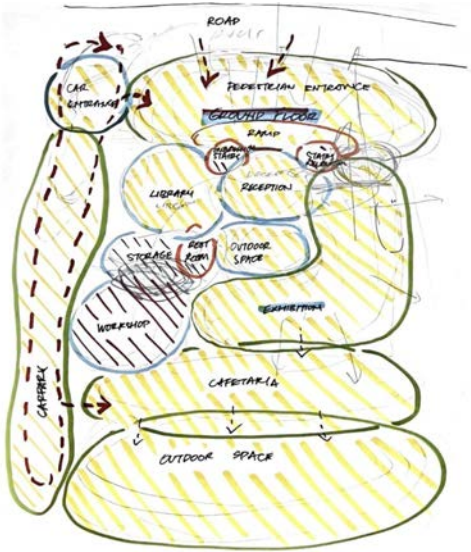
Image from Earthen Architecture Workshop, October 2024

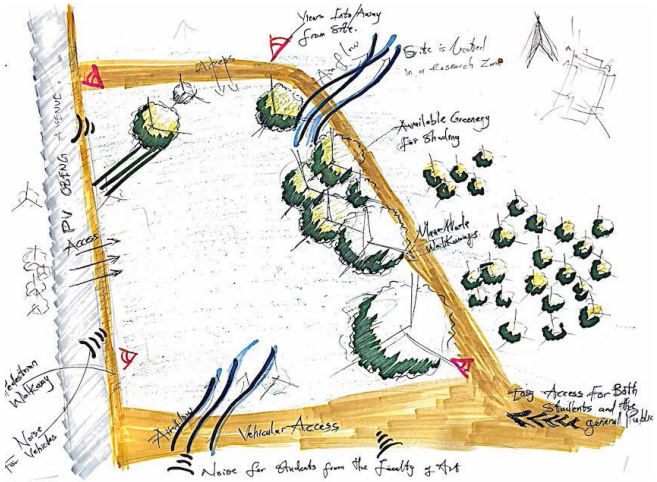
Site Selections

Adako Jachie ATB

GMMB Cultural Center

KNUST Campus

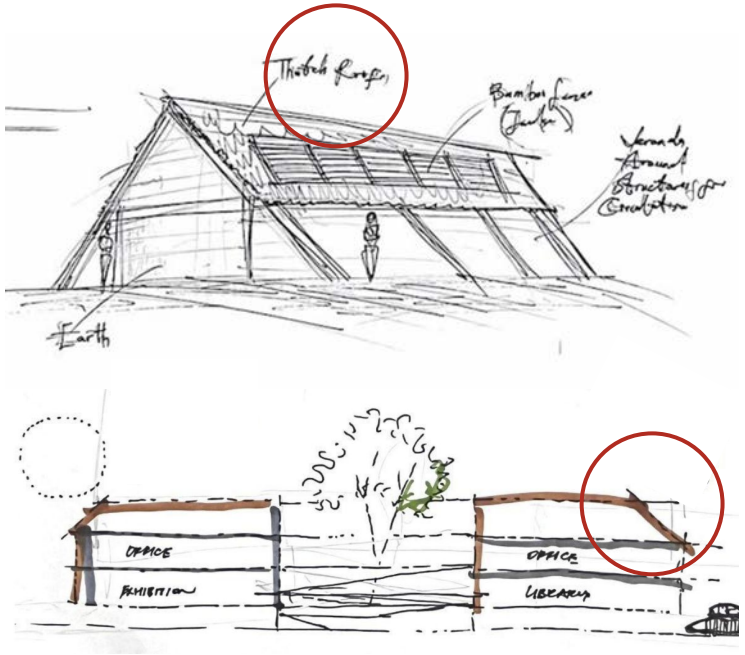


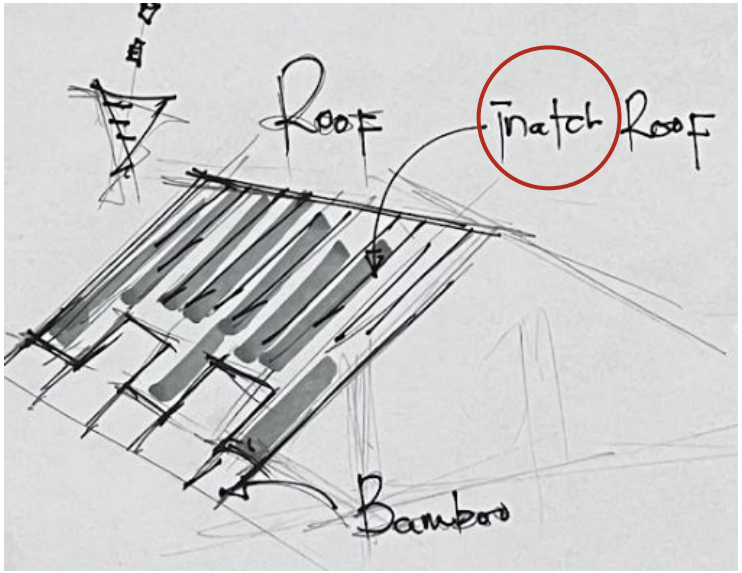


Sample Diagrams

Image from Earthen Architecture Workshop, October 2024

Materials, Design and Program Ideas





Building Sketches Including Three Thatched Roofs

Image from Earthen Architecture Workshop, October 2024

Advancing Connections

Charrette

Roundtable

Policy Recommendations

Background of Roundtable and Session Overview

Students listen in the audience of the roundtable.
Image by Earthen Architecture Workshop, October 2024

Session I Panelists: Left Desmond Opoku, Dr. Ampofo and Mr. Kwarayire.
Image by Earthen Architecture Workshop, October 2024

Roundtable 2024: Thematic Summary

Transfer of Knowledge

Indigenous Building Materials as Heritage

Negative Social Perception

Governmental Policy

Sustainability and Construction Technology

Urban Expansion and Deforestation

Potential for Replicability / Future Roundtables

Dr. Mantey speaks during his roundtable panel.
Image by Earthen Architecture Workshop, October 2024

Audience members listen during the roundtable sessions.
Image by Earthen Architecture Workshop, October 2024

Advancing Connections

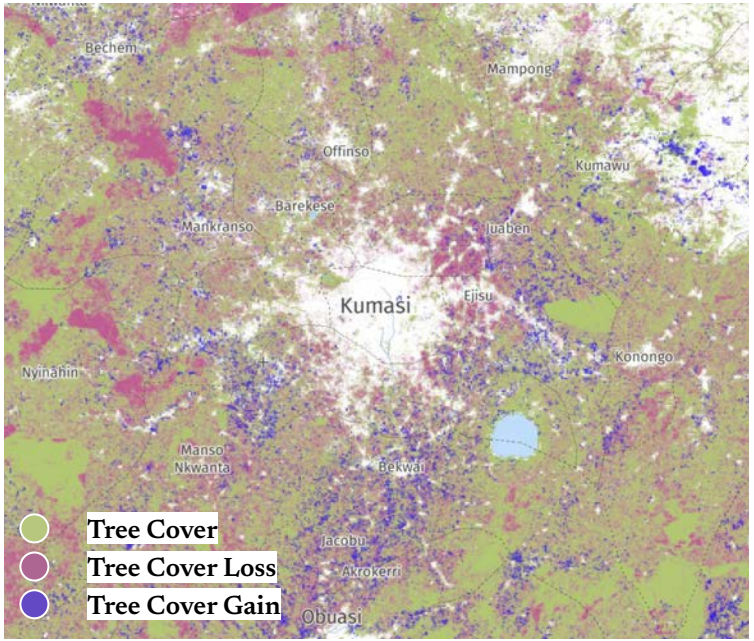
Charrette

Roundtable

Policy Recommendations

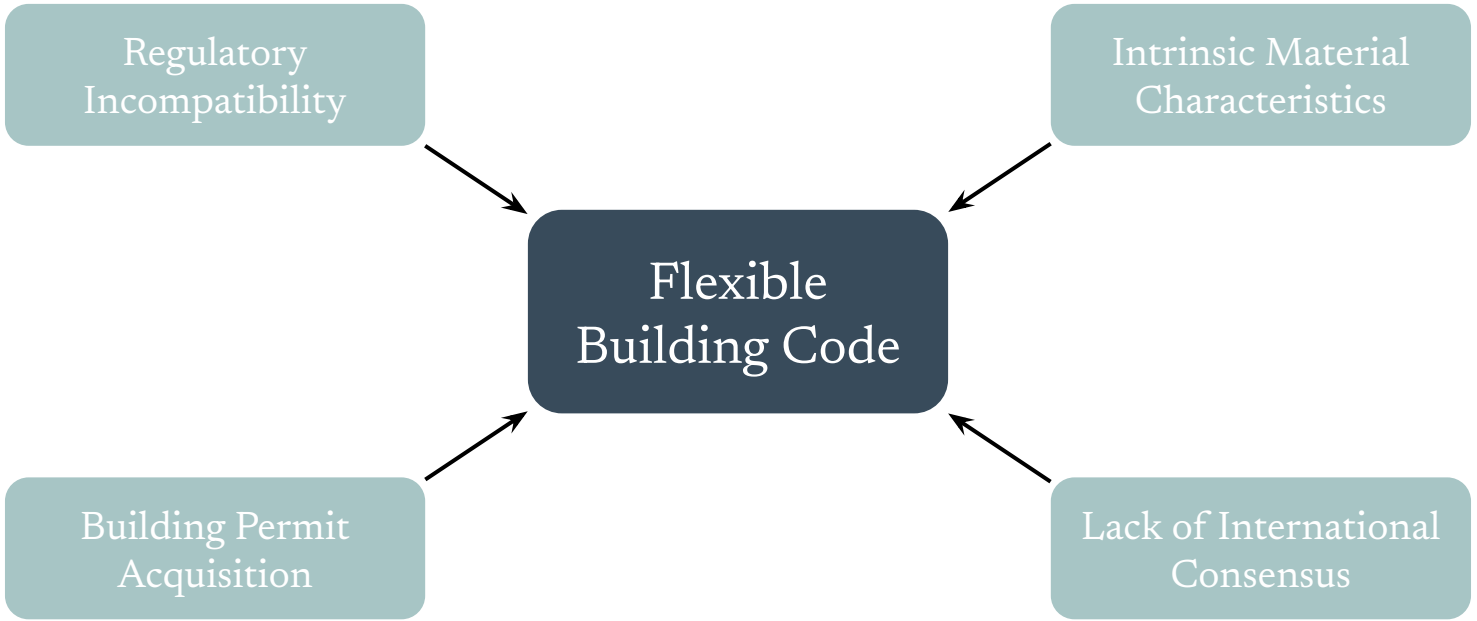
Sustainable Production of IBMs as Cultural Heritage

Forested area surrounding Adako Jachie
Image by Studio Group, October 2024



Forest Map & Tree Cover Change, Kumasi Region
Images by Global Forest Watch, 2024

Flexible Building Code to Facilitate use of IBMs in New Construction



Centering Indigenous Building Materials in Discussions of Embodied Carbon Assessment

IBMs at Adako Jachie, including traditional Sankofa symbol: looking to the past to inform the future

Image by Studio Group, 2024