



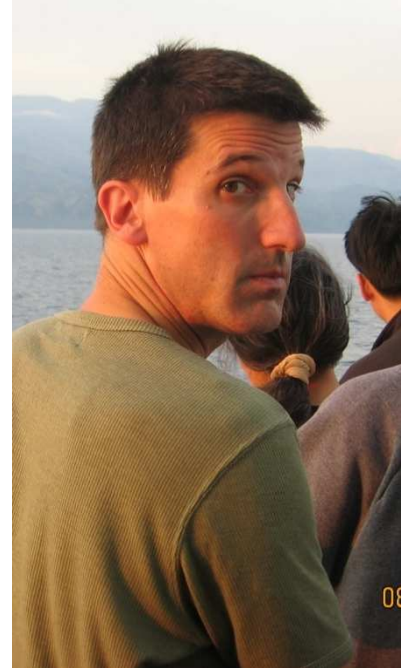
Design in the Developing World

Using Engineering and Architecture in Missions

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Gary MacPhee

Engineering Ministries International



**Everyone knows what they do,
some know how,
but very, very few know why.**

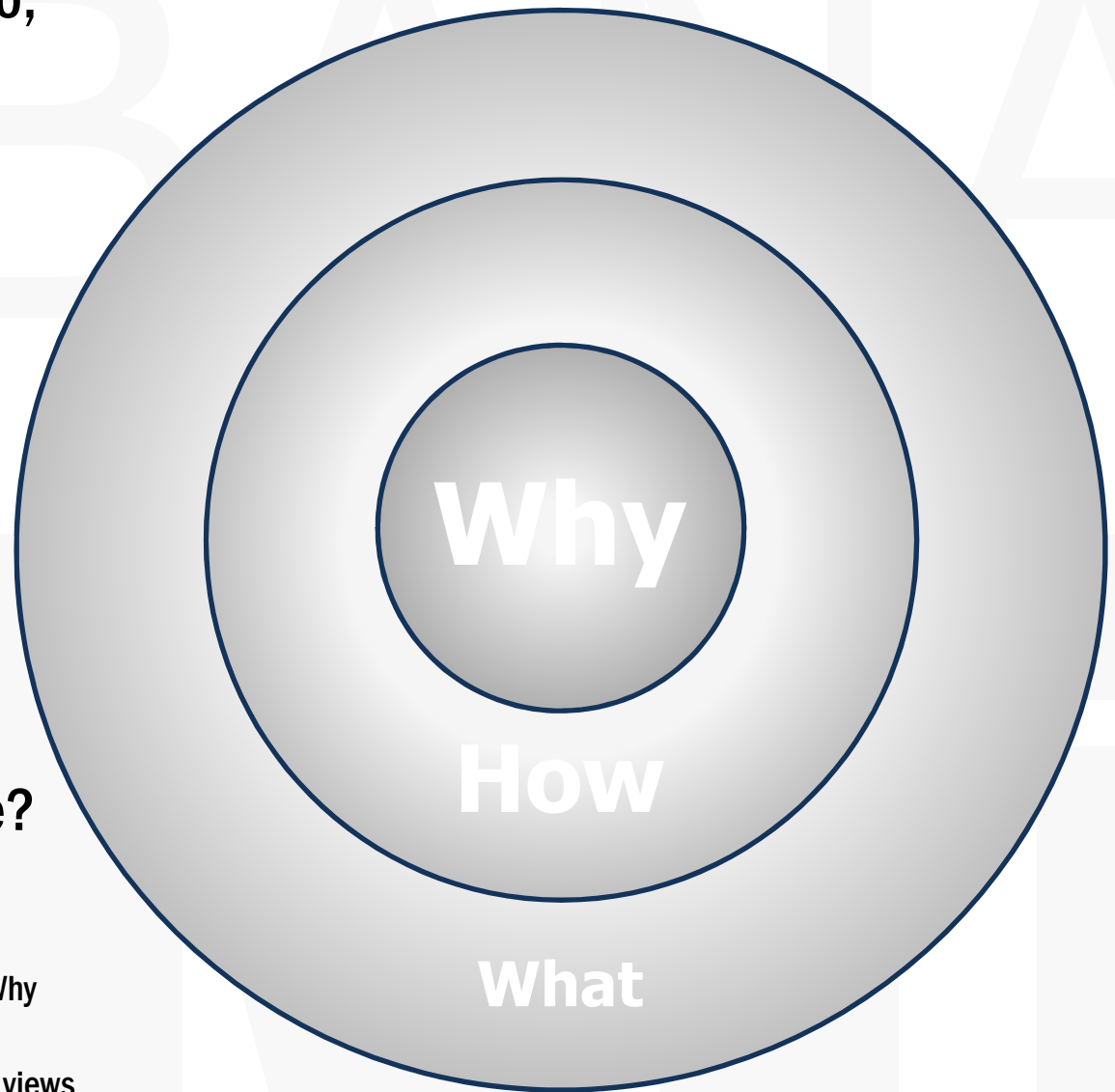
**What's your purpose,
cause, belief ?**

Why do you exist?

**Why do you get out of
the bed in the morning?**

And why should anyone care?

**Adapted from Simon Sinek, Author: Start With Why
How Great Leaders Inspire Action
third most viewed Ted Talk , over 20-1/2 million views**



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Spiritual Gifts
Heart • Passions
Abilities • Talents
Personality • DISC
Experiences • Story

Psalm 139:13-16
Ephesians 2:10

*SHAPE – from Purpose Driven Life, by Rick Warren



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Drivers • *Heart*
Experiences • *Story*
Skills • *Talents*
Interests • *Passions*
Gifts • *Spiritual*
Nature • *DISC*



Psalms 139:13-16

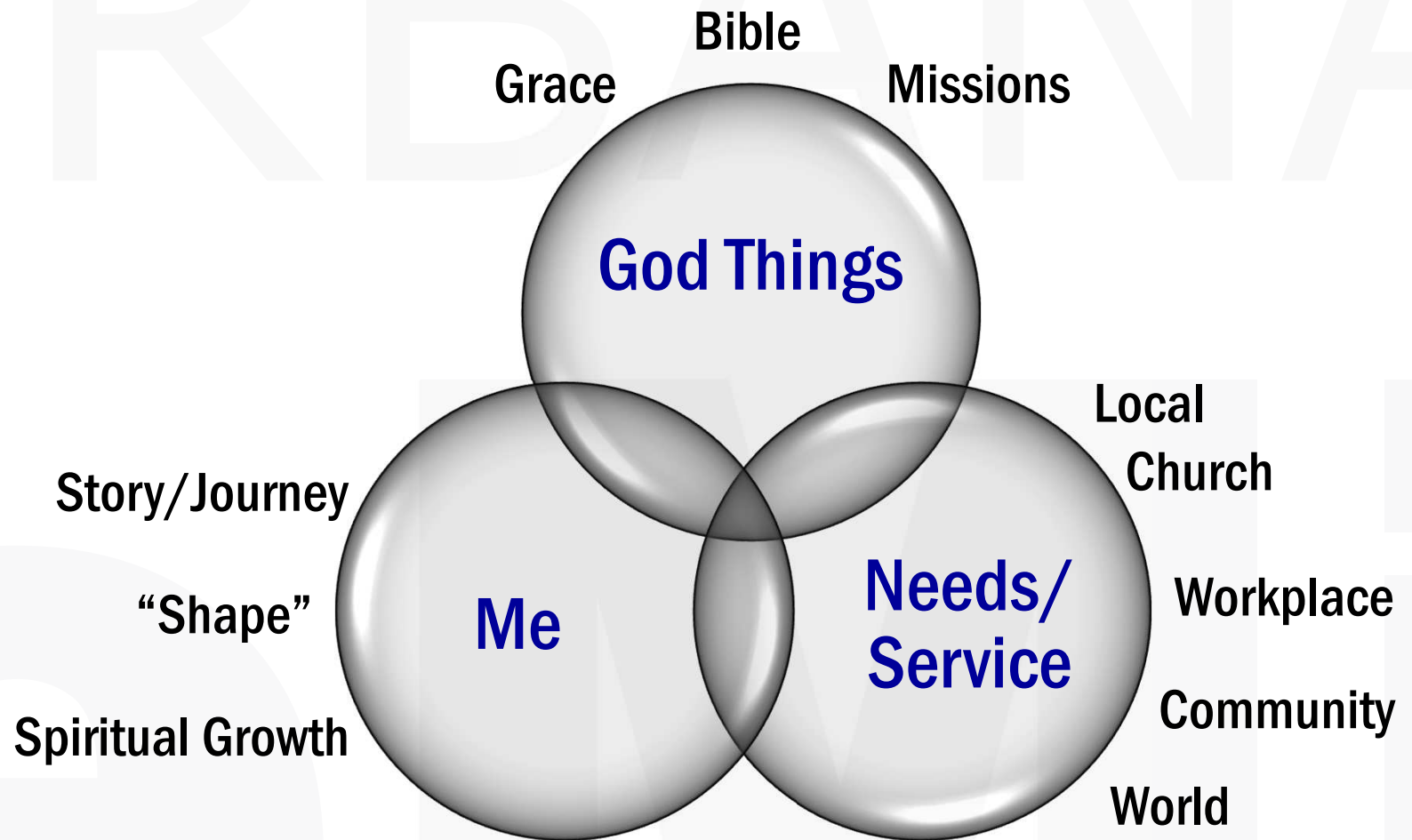
Ephesians 2:10



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The Sweet Spot



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The Sweet Spot? ...

“ This is who I was created to be!”

“Don’t ask yourself what the world needs. Ask yourself what makes you come alive and then go do that. Because what the world needs is people who have come alive.”

*- Howard Thurman, early 20th Century
African American Theologian*



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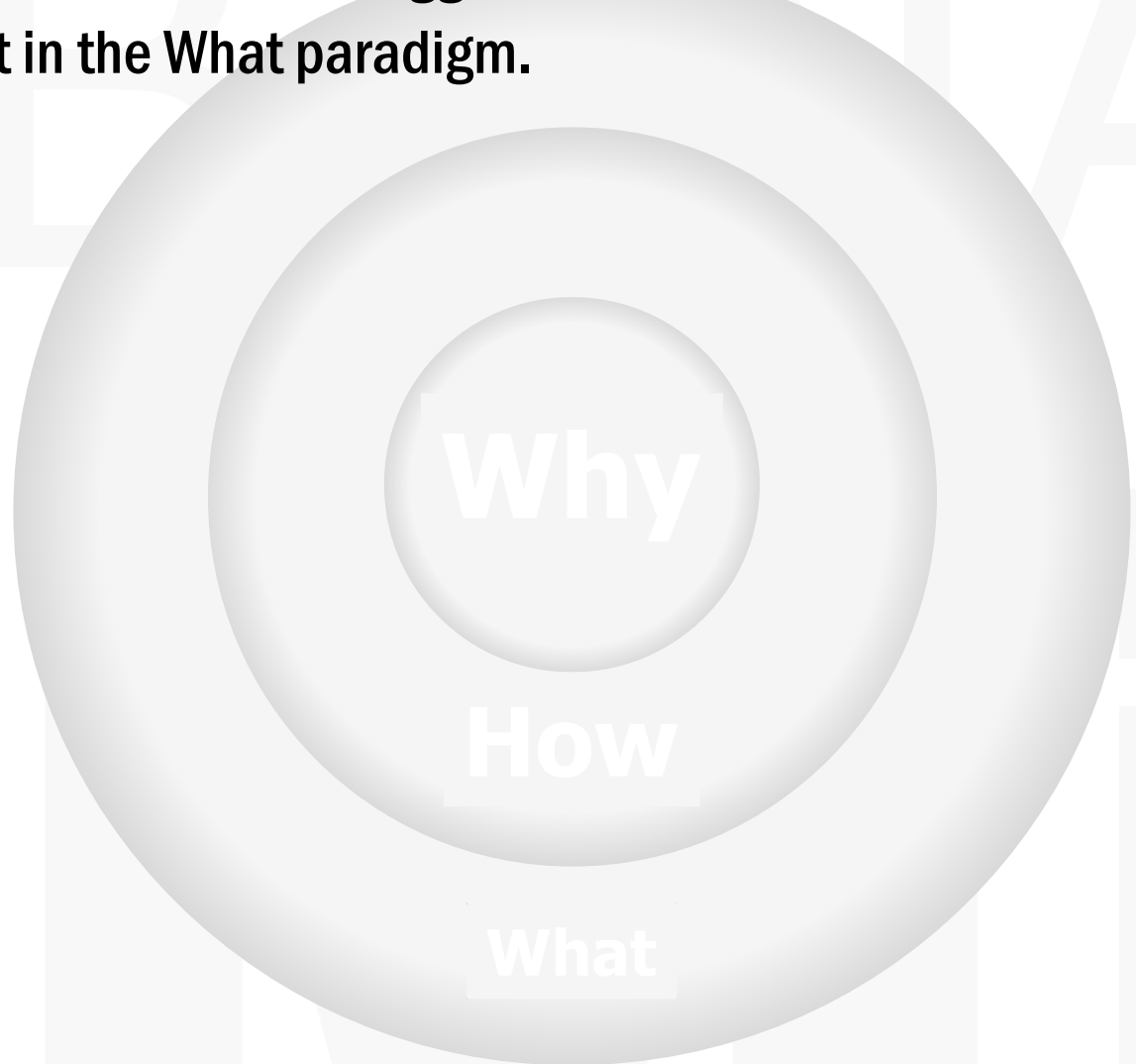
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Today in our culture we have a classic struggle between two sides
– and both seem caught in the What paradigm.

what we need to do is
START WITH WHY

So...

How did Jesus do this?



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START WITH WHY

How did Jesus do this?

Calling the disciples – Matt 4: 18-22

Woman at the well – John 4:7-42

Prayer and the Golden Rule – Matt 7:7-12

Rest for the Weary – Matt 11:25-29

Why

How

What



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So... Why did Jesus die?...

...and He died for all, so that they who live might no longer live for themselves, but for Him who died and rose again on their behalf.

II Cor 5:15 NASB

Why

How

What



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And there we find our mission:

Therefore we also have as our ambition, whether at home or absent, to be pleasing to Him. vs 9

Therefore if anyone is in Christ, he is a new creature; the old things passed away; behold, new things have come. ¹⁸ Now all these things are from God, who reconciled us to Himself through Christ and gave us the ministry of reconciliation, ¹⁹ namely, that God was in Christ reconciling the world to Himself, not counting their trespasses against them, and He has committed to us the word of reconciliation.

²⁰ Therefore, we are ambassadors for Christ, as though God were making an appeal through us; we beg you on behalf of Christ, be reconciled to God.

²¹ He made Him who knew no sin to be sin on our behalf, so that we might become the righteousness of God in Him. Vs 17-21



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Why? The Challenge

**“The righteous care about justice for the poor, but the wicked have no concern.
- Prov 29:7**

“You hear O Lord, the desire of the afflicted; you encourage them, and you listen to their cry, defending the fatherless and the oppressed, in order that man, who is of the earth, may terrify no more.” – Ps 10:17-18

**“Rescue the weak and needy; deliver them from the hand of the wicked” –
Ps 82:4**

**“True religion is this to look after widows and orphans in their distress” –
James 1:27**

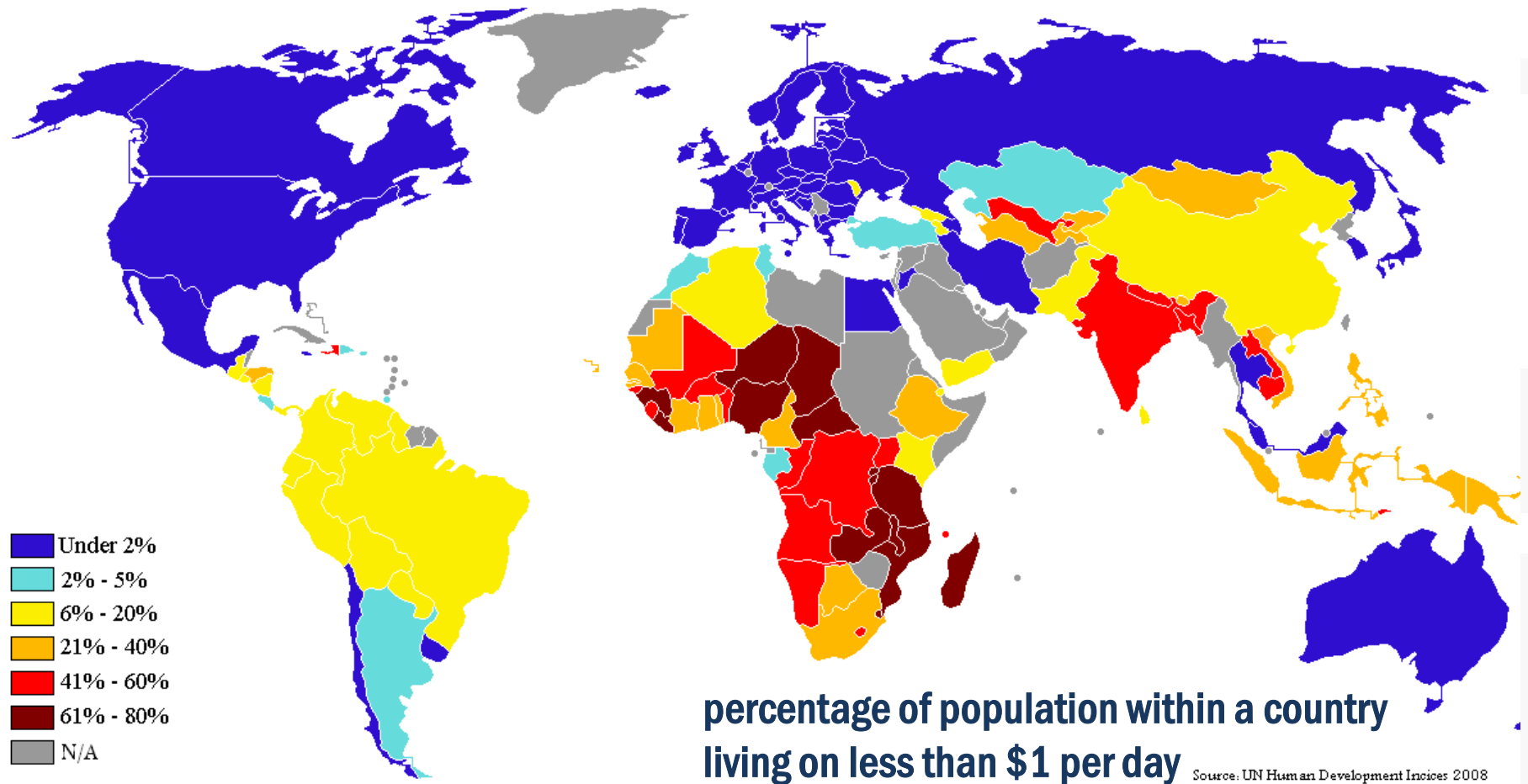
**“And if anyone gives even a cup of cold water to one of these little ones who is my disciple, truly I tell you, that person will certainly not lose their reward.” –
Matt 10:42**



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Why? The Challenge “designing a world of hope...”



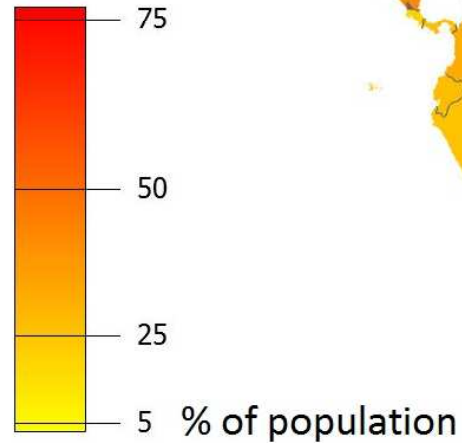
...for a world in need



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Poverty rate at
national poverty line



- A comparative map of poverty in countries in 2012, at national poverty line, according to the World Bank.



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Life on less than \$1.25 a day

The \$1.25 per person per day threshold for extreme poverty is a standard adopted by the World Bank and other international organizations to reflect the minimum consumption and income level needed to meet a person's basic needs. That means that people who fall under that poverty line—that's 1/6 of the world's population, or 1.4 billion people—lack the ability to fulfill basic needs, whether it means eating only one bowl of rice a day or forgoing health care when it's needed most.



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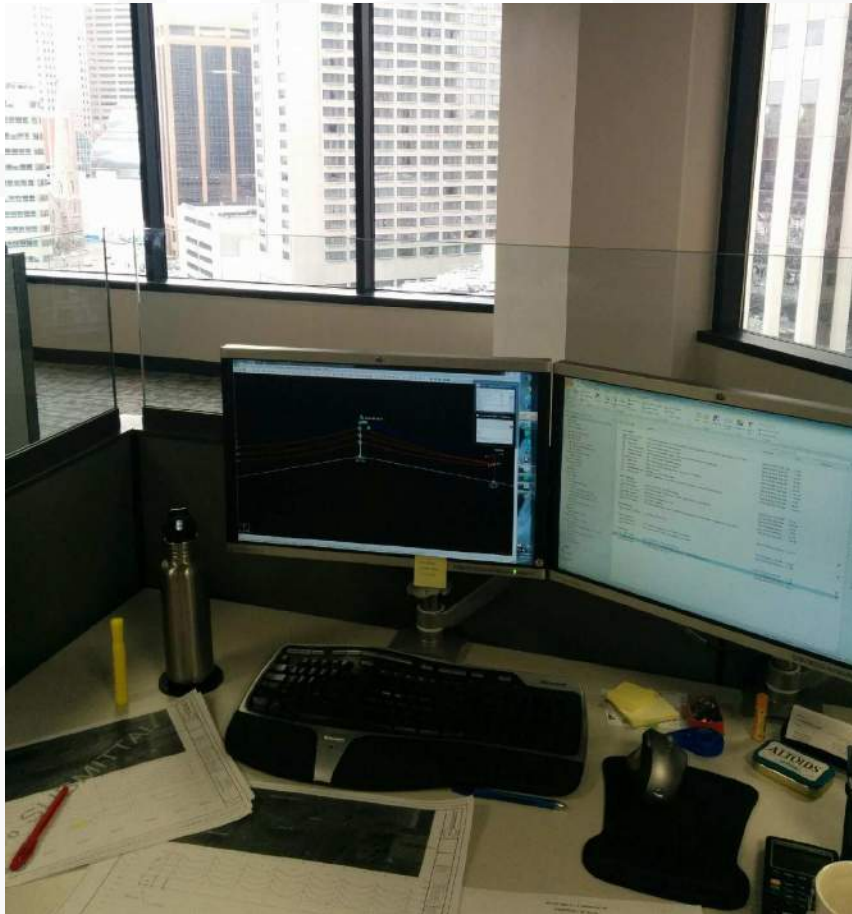
Our World
in Data

- Absolute poverty is defined as living with less than \$1.90 per day per person, measured by adjusting for price differences between countries ((PPP) adjustment with 2011 prices).



Licensed under CC-BY-SA by the author Max Roser.

Why? The Challenge



“The US produces some of the best engineering talent in the world. And engineers trained in the most in-demand fields can command among the highest salaries of all college graduates in the country.”

**High-Paying Engineering Jobs
Which Positions Take the Highest
Engineering Salaries?**

By John Rossheim, Monster Sr Contributing Writer

...and our conflict



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Why? The Conflict

Stephen Colbert, political satirist, writer, comedian, and host of The Colbert Report, a satirical news show, In response to a Bill O-Reilly comment , said...

“But if this is going to be a Christian nation that doesn’t help the poor, either we’ve got to pretend that Jesus was just as selfish as we are,

or we’ve got to acknowledge that he commanded us to love the poor and serve the needy without condition...



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**“...and then admit
that we just don’t
want to do it.”**

Stephen Colbert



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Why? The Calling

**“True religion is this to look
after widows and orphans
in their distress”
James 1:27**



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Why? The Calling

“If you spend yourselves on behalf of the hungry and satisfy the needs of the oppressed, then your light will rise in the darkness, and your night will become like the noonday...in a sun-scorched land. You will be like a well-watered garden, like a spring whose waters never fail. Your people will rebuild the ancient ruins and will raise up the age-old foundations; **you will be called Repairer of Broken Walls, Restorer of Streets with Dwellings.”**

Isaiah 58:10-12

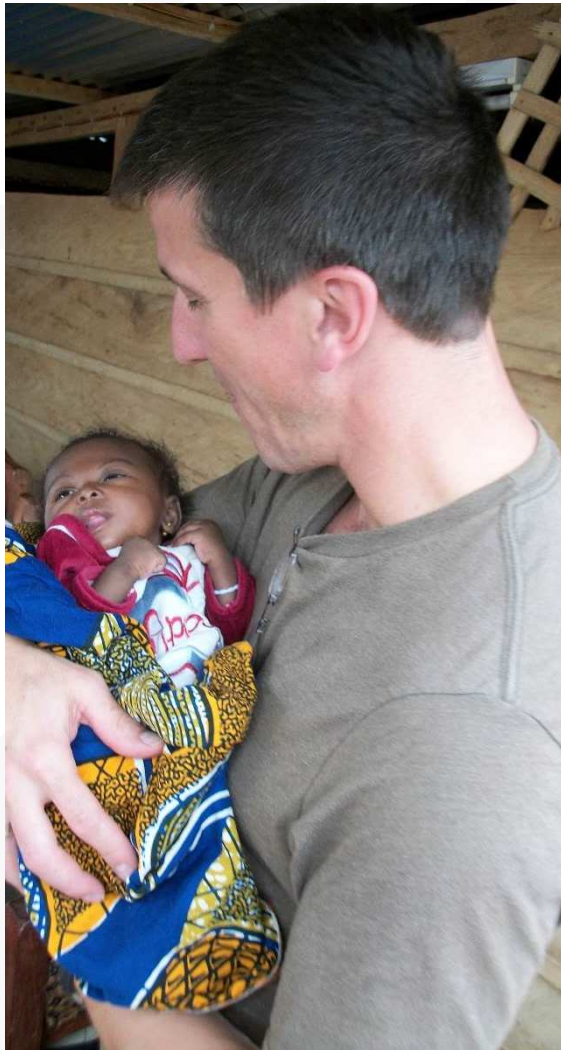


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Why? leads us to How and What?... a *Both/And* Model



What are we doing? and How are we doing it?

Should our focus be to help the poor, or
to share the gospel with them?

This has been a heated debate in the body of Christ.

E. Stanley Jones, British missionary to India...

“The Individual Gospel without the Social Gospel is like
a soul without a body;

The Social Gospel without the Individual Gospel is like
a body without a soul.

One is a corpse,

and the other a ghost.”

It's the substance of the Great Commission

AND the Great Commandment

*James 2:14-26, faith and works – *Integral Mission*



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**The design professions –
engineering,
architecture,
surveying,
construction
management -**

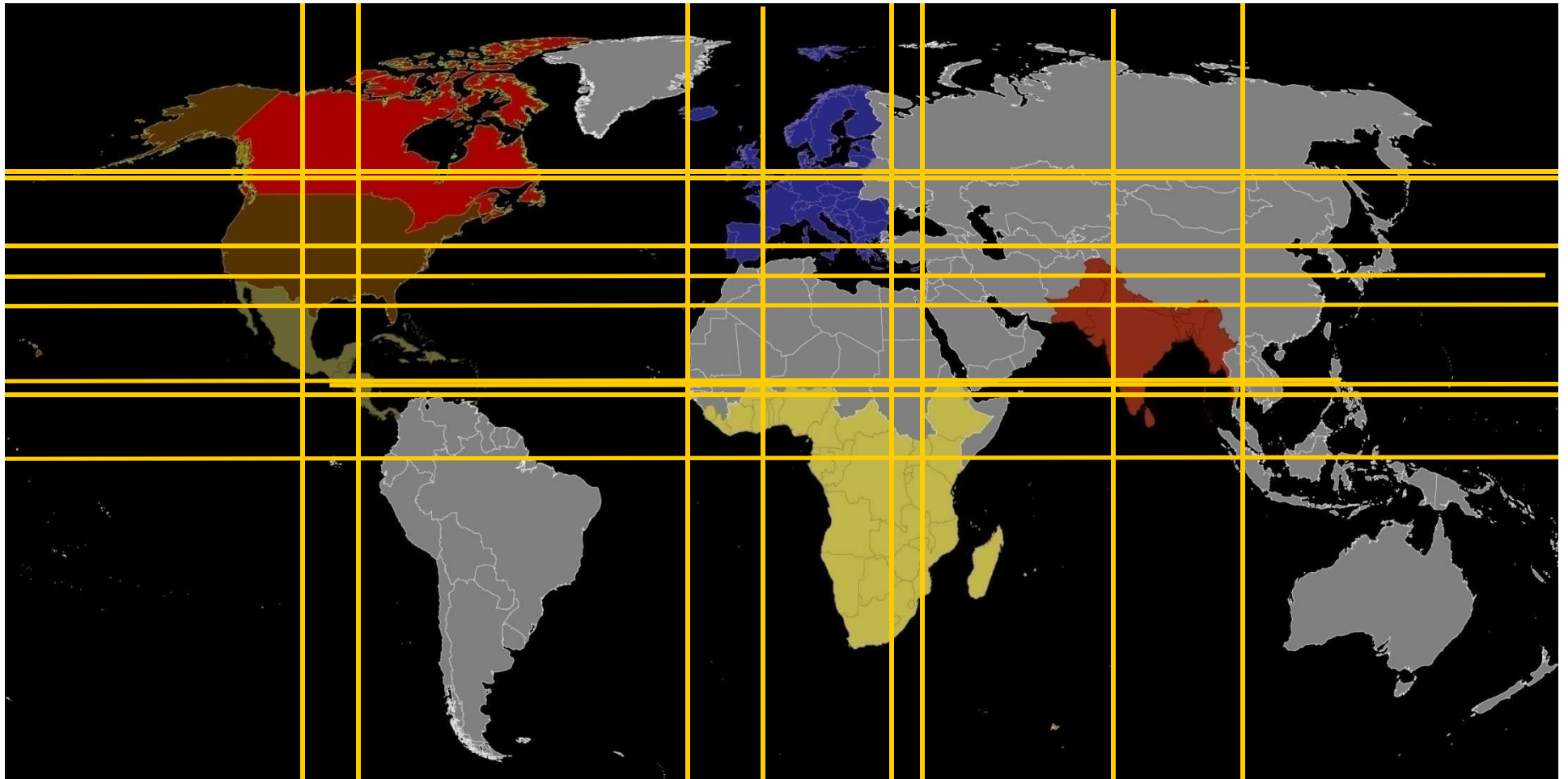


**will play a critical role in the
ongoing worldwide
missions movement,
especially as we grapple
with the challenge of
reaching the hardest,
closed places that still
remain.**



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eMi Growth Around the World

Organic & Strategic



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Strategic Growth continues



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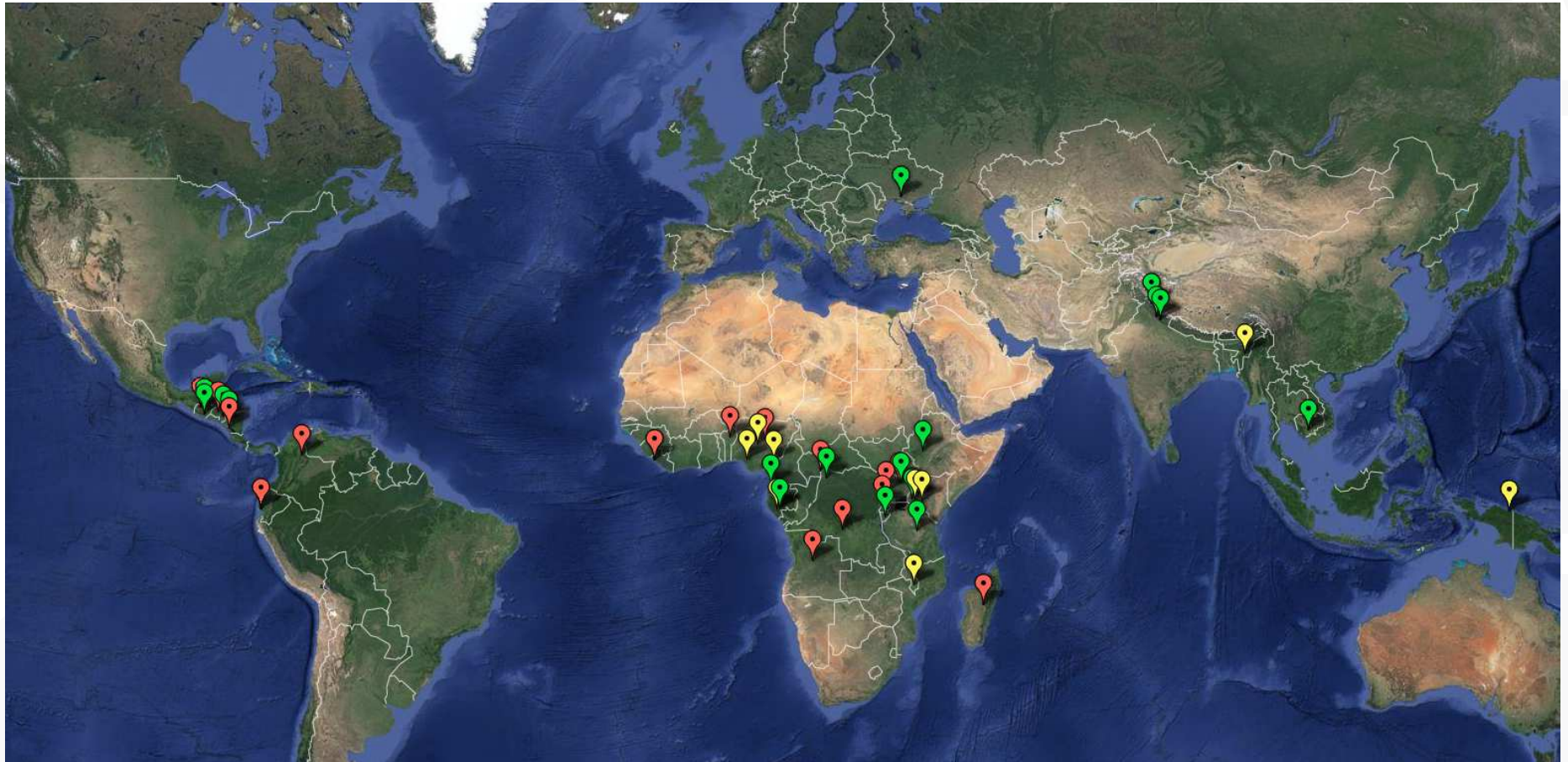
EMI's Current Projects – 2015



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2015 Projects



Why? leads us to How and What...

WHEN HELPING HURTS

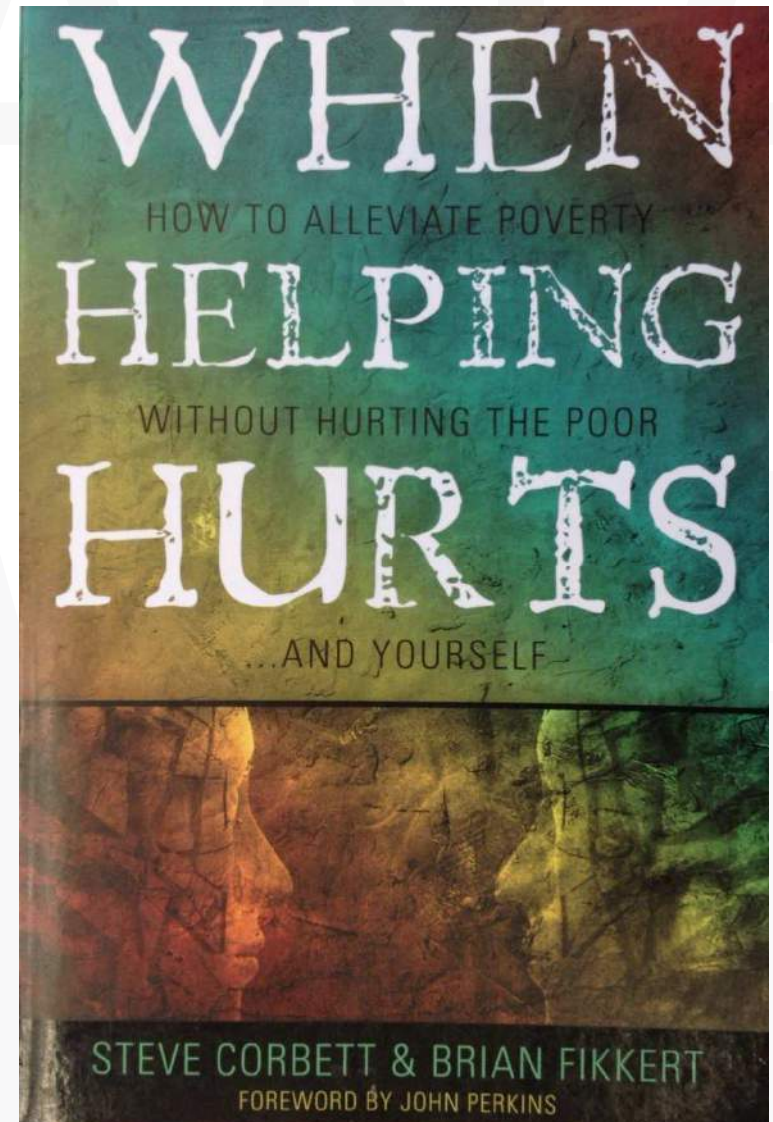
How To Alleviate Poverty Without Hurting the Poor... and Yourself

Foundational Concepts:

- Brokenness and Reconciliation
- Transforming good intentions into lasting change



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Our role as designers – the “silent” partner

General Principles:

True partnership
that recognizes
mutual need and
participatory
learning and action

Practical Strategies:

Short Term assistance
without doing long
term harm



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From Here...

Short Term Teams (Project Trips)
have traditionally been the way EMI
carries out its mission and vision



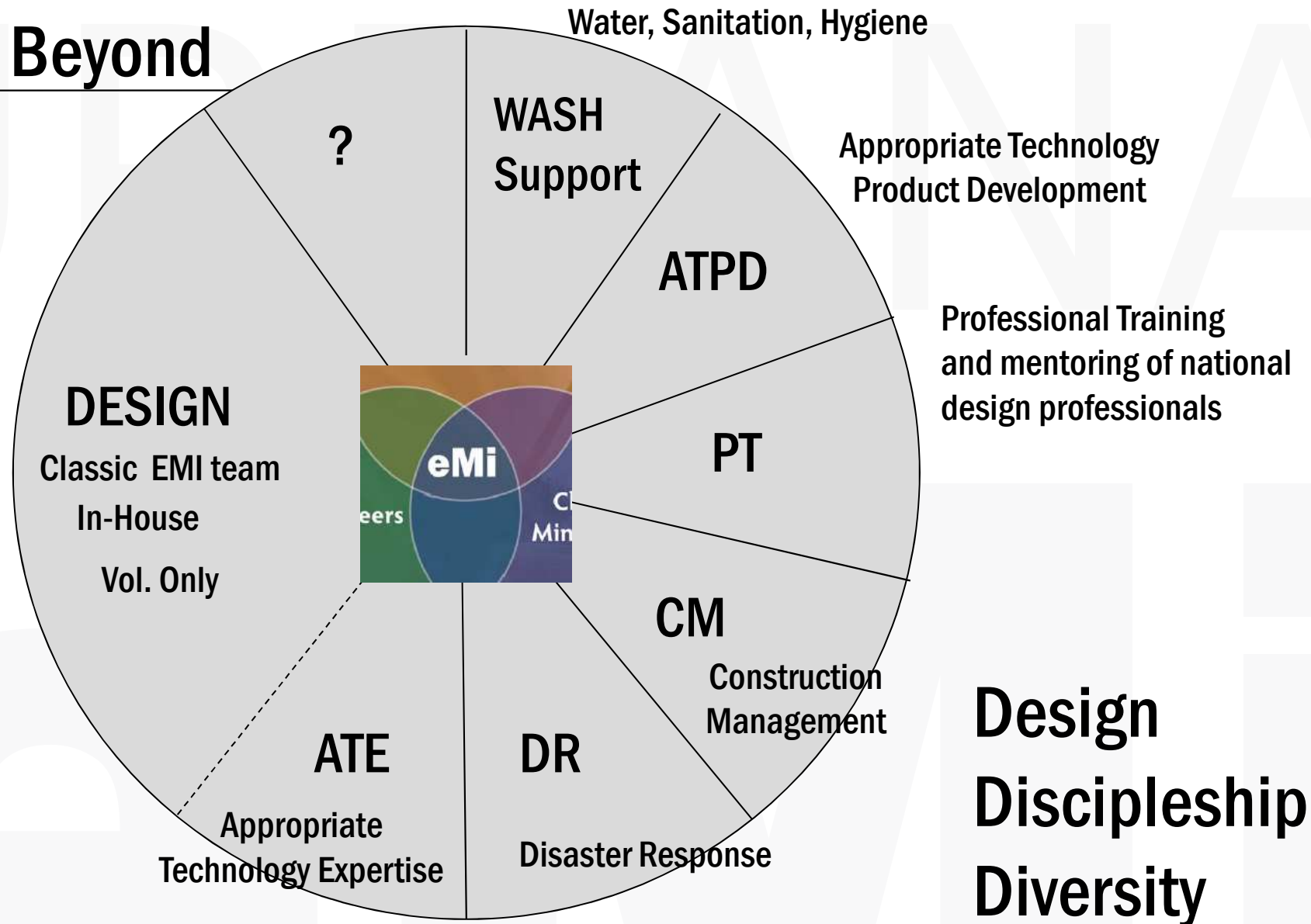
bringing together the
poor, the volunteers,
and the clients



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...and Beyond



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Design

Using engineering and architecture in development and relief projects to meet needs and open doors for the message of the Gospel.

Discipleship

Creating a deeper presence for demonstration and training through expats living and working among the nations, bringing integrity and transformation through relationship.

Diversity

Welcoming national design professionals to join in the calling to serve and reach their own people, mentoring and training in a relational way.



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Design
Discipleship
Diversity



Construction Management



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Design
Discipleship
Diversity



EMI's Disaster Response



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Appropriate Technology Expertise



Professional Training



Local Design Professionals

Design
Discipleship
Diversity



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How... the Practical Steps

Main Objective/Desire - To design with all the tools and expertise you have, but in a new, unfamiliar, and limiting environment

Nothing's the same once you've crossed an ocean.

Main Question - How do I apply what I know cross-culturally?

Main Goal - Train ourselves to observe and investigate the unique constraints of working in the developing world

Become aware of the direct impact of these constraints on the design development process



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Where do you begin?

designing a world of hope... *in faith*

Hold on Loosely!

- “Whatever you do, work at it with all your heart, as working for the Lord, not for men...” – Col 3:2
- Pray for the ministry partners, your own team, and those you serve! I Tim 2:1
- Of EMI design projects, approximately:
 - 25% - built exactly as designed
 - 25% - architecture followed but not details
 - 25% - significantly changed but still built
 - 25% - Not built – due to a variety of factors
- 75% did get built!
- What else did God do for His Kingdom in the hearts of men?



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Where do you begin?
designing a world of hope... *in faith, with hard work!*

Good Program = Good Design

Good program development means:

- Interpreting real needs
- Recognizing real constraints
- Proposing real solutions



We must learn to work within their reality!



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Good Program = Good Design

- **INPUT**

How to obtain reliable, accurate information

- **SOLUTION**

What is Appropriate design?

- **OUTPUT**

Ensuring your design is followed



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Good Program = Good Design... INPUT

1. Simple Language

- English is not 1st language
- Avoid “Tech Speak”

2. Don't Lead the Witness

- Open-ended questions
- What would you do?

3. Triangulate Answers

- Ask multiple questions
 - Ask multiple people
 - Overcomes language, cultural, technical barriers
- Example: African Nazarene University – Flood level

4. Assumptions must yield

- We must work within their reality!
- Example: inverse relationship of labor and materials



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Good Program = Good Design... INPUT

5. Far, Far Away

- Gather more info
 - Take extra photos
 - Ask that question 1 more time
 - Shoot extra topography
 - Dig that hole!
- Hard to get from Home
 - Client is busy
 - Client is non-technical
 - Language barrier



6. Write it Down

- You will forget
- Back pocket flip pad



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Good Program = Good Design... SOLUTION

Keys to Appropriate Design

1. Mutual Discovery

- Serve with humility
- Don't impose 'our' solutions
- Discover best answer together
- Learn from them and they will learn from you



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Good Program = Good Design... SOLUTION

Keys to Appropriate Design

2. Climbing the Ladder

- Only 1 or 2 rungs
 - Not First World design
- A little better
 - Safe
 - Functional
 - Reliable
- Uganda vs Peru

3. Baby Steps

- Improve 2 or 3 things
- KISS - Keep it simple,...
 - concrete mixers, standard column grid, space planning, environmental factors



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Good Program = Good Design... SOLUTION

Keys to Appropriate Design

4. Stay as long as you can

- “1 week in camp is like 1 year in church” –

Isam Ghattas

Manara Int'l, Jordan

- 1 day in country is like 1 month back home



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Ensuring your design is followed ... OUTPUT

1. Build Relationships

- Client and Builder
 - Master builder has high social status
- Don't depend on drawings
- Know Cultural Differences
- Drawings confirm conversation



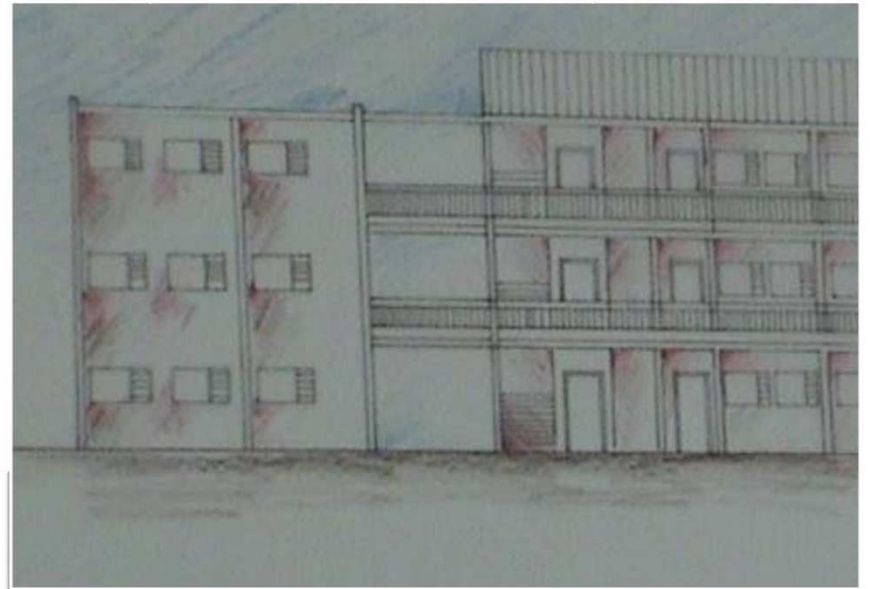
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Ensuring your design is followed... OUTPUT

2. Keep drawings Simple

- Pictures vs Text
 - Line weighting importance
- Highlight New Things
- No Abbreviations



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Ensuring your design is followed ... OUTPUT

3. Know the Level of Appropriate Design

- Schematic or Conceptual Design
- Good enough to build from
- Just detail the two or three new things
- Don't detail what they will do anyways



Faith Village – Prayer Oasis



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CASE STUDY - Flexibility in the Field

1. Communicated

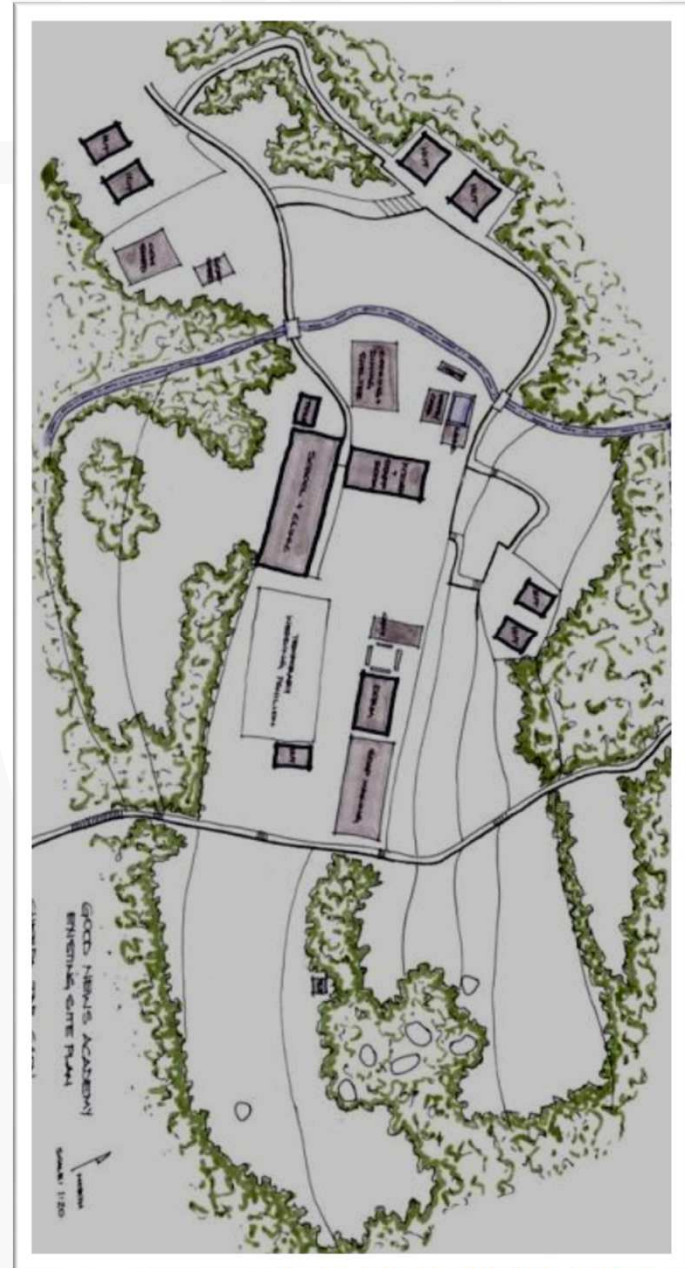
- Small Site – 0.5 acre
- Few Structures
- Ministry Contact Available
- Staying Near Site

2. Actual

- Large Site – 3.5 acre
- Many Existing Structures
- Ministry Contact Not Available
- Staying 1hr. from Site

3. Challenges

- No Electricity or water to aid design investigation



CASE STUDY – Realities in the Developing World



- **Design Goal:** Design a primary school in a remote village
- **Design Reality Parameters:**
 - No electricity
 - 3 hour drive to nearest town
 - Bad road conditions in rainy season
 - High cost and demand for materials
 - High temperatures during dry season



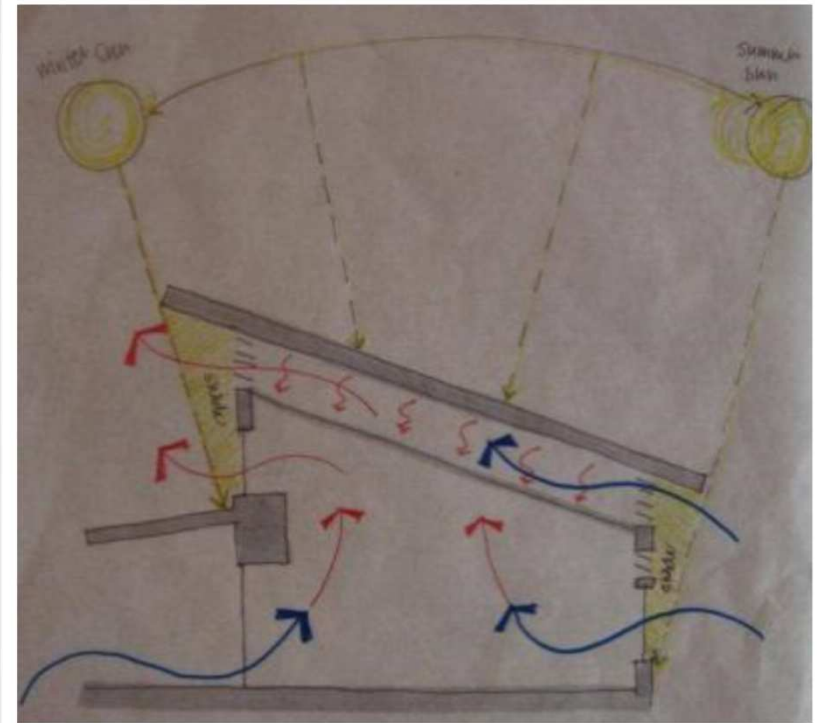
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CASE STUDY – Realities in the Developing World

Passive Environmental Design

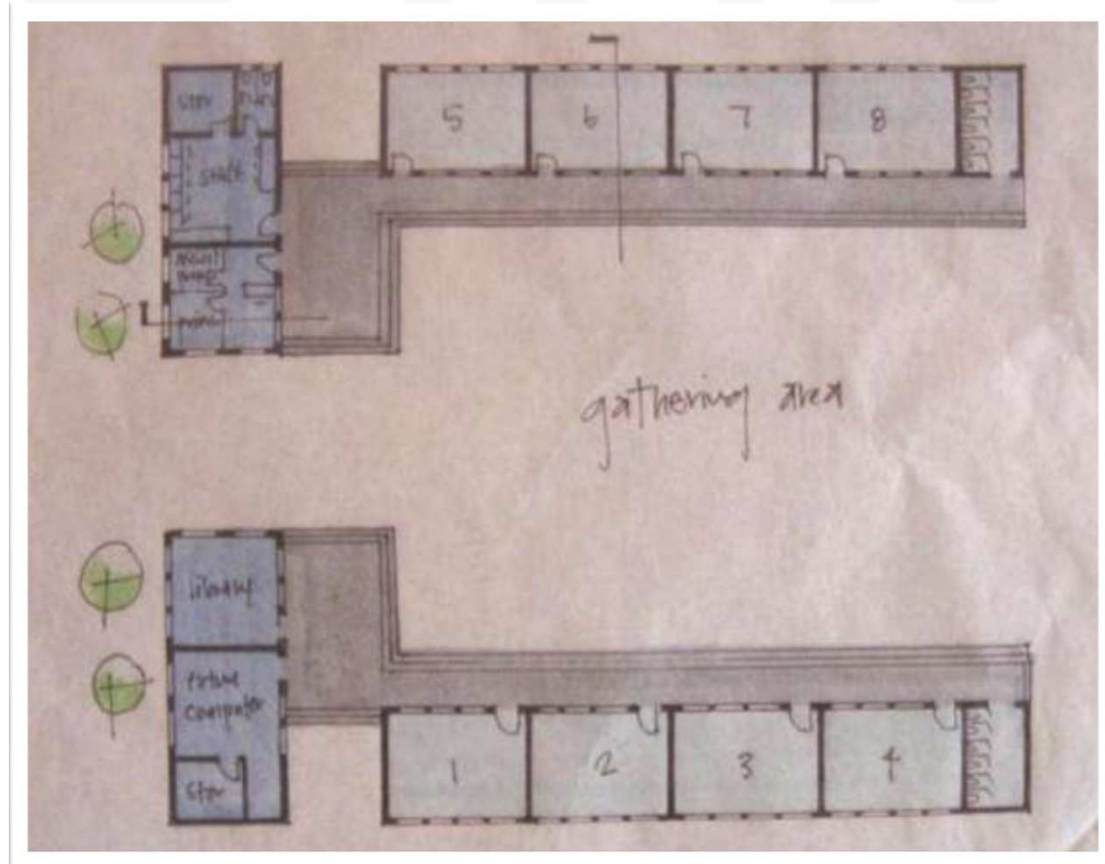
- East/West orientation will minimize direct sunlight
- Orienting building plans to capture prevailing southern breeze increases ventilation
- Gap between roof and ceiling - Traps and vents hot air
- Sloped ceiling encourages ventilation



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CASE STUDY – Realities in the Developing World



KISS...

- Simple layout and repetitive structure
- Can be built in smaller phases



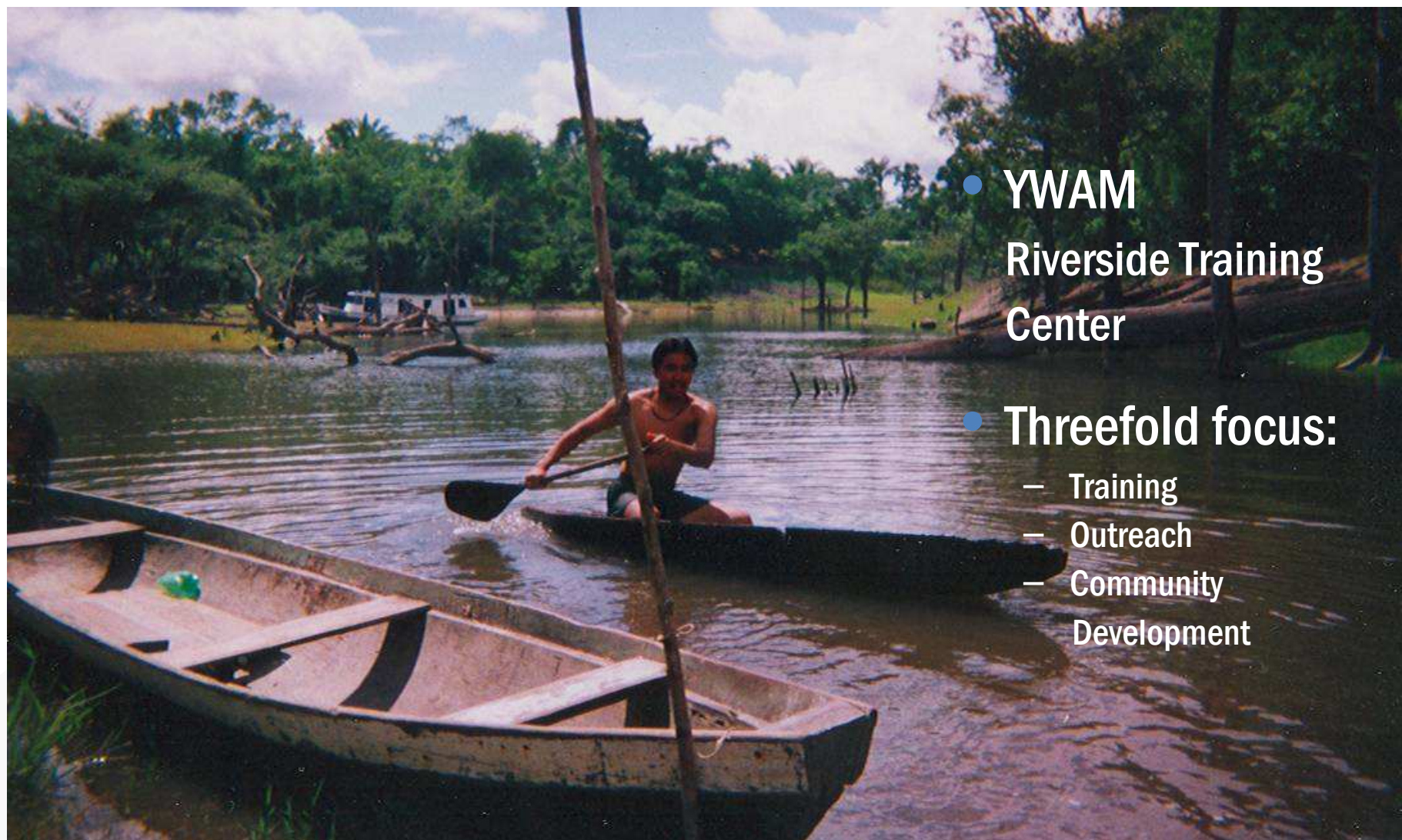
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CASE STUDY – Realities in the Developing World



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- YWAM
Riverside Training
Center
- Threefold focus:
 - Training
 - Outreach
 - Community
Development



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ACCESS How do I get there?



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MATERIALS I have to buy what?



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PROCESS

Go to the docks.

Catch the river boat.

Which one?

That one, over there.



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**Head for the project site...
24 hours on the water**



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Please return your seats to the upright position and fasten your...? Never mind.



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You have arrived!

Well, not quite...



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When we say the interior of the Amazon, we mean it!



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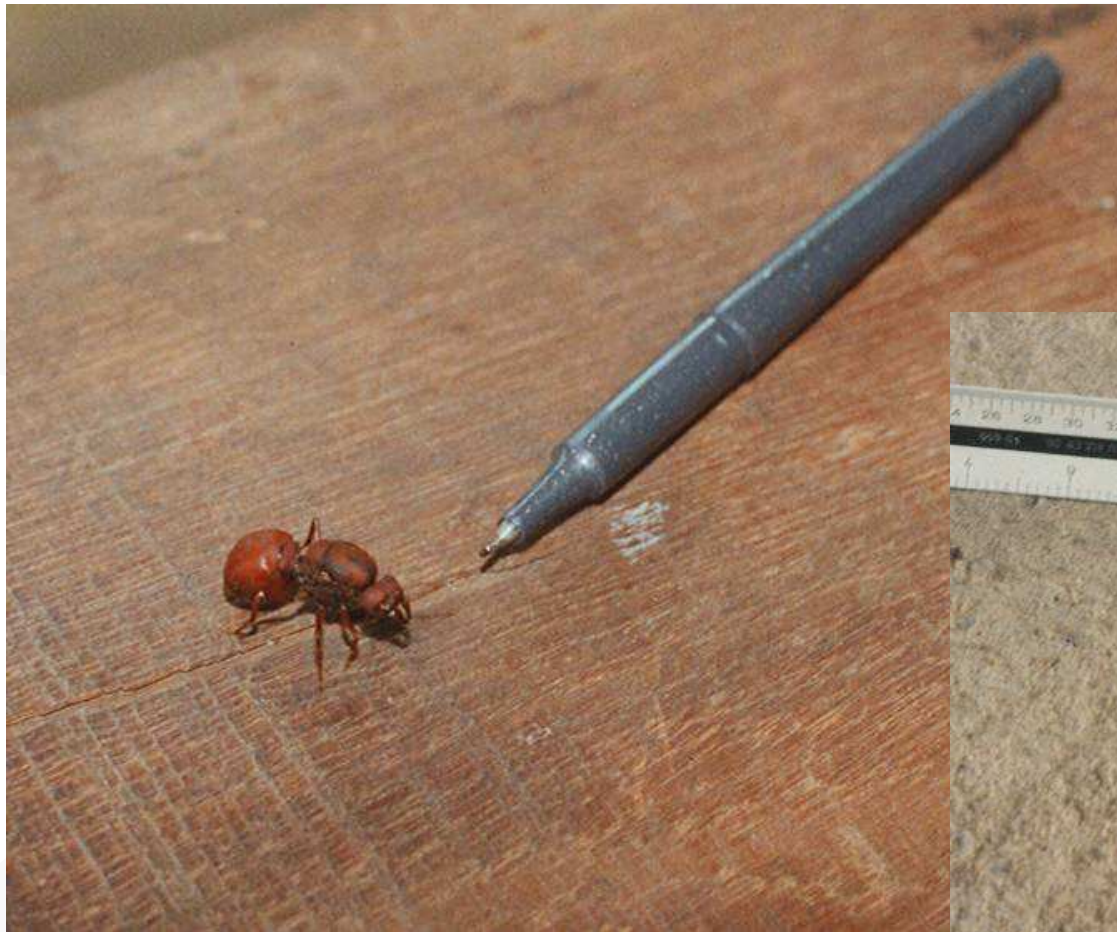


**Tropical location: hot, buggy, and humid
(if it's not raining, it's just plain wet!)**



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... and did we say it's buggy?



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The first structure erected

- observations - *"What's that I hear?"*
- lessons learned

A long, open, one-story wood structure with a clay tile roof and slab-on-grade foundation



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- Big concrete slab foundation
- Erosion around perimeter
- Wood plank siding moldy
- Termites in the wood columns
- Clay tile roofs – expensive

The first structure erected:

- observations
- lessons learned



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Openness is nice for ventilation and breezes in the oppressive humidity, but hard surfaces are required to protect from the wind-driven rains

The first structure erected:

- observations
- lessons learned



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A new well recently bored; water tower constructed.

New huts built for toilets /showers & a few huge seepage pits dug

Main Question – as the campus grows over the 100 acre site, how best do we distribute water and handle waste water?

Civil issues – water, waste water, soils

What's working? What's not working?



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Construction Materials and Design Practices:

- *Wood rots/gets infested with termites, so...*

- Don't use wood BUT...
- Wood is plentiful

- *Concrete/masonry is often the choice in the tropical world due to moisture and insect resistance, so...*

- Use concrete or masonry BUT...

Concrete is no where to be found (easily or cheaply)

- USE WOOD?!



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Paradoxes: What do we do with such conclusions?

- Difficult and expensive access or transportation, for people and materials
- Excessively high humidity and insects/termites.....
- Materials resistant to moisture/insects (concrete, steel/clay tile roofs) are not readily available at the site.....

Limit the use of materials or construction methods requiring transportation of people, equipment, materials

Limit the use of wood due to rot and infestation.

Limit the use of materials not readily available at the site

We can't limit everything, can we?



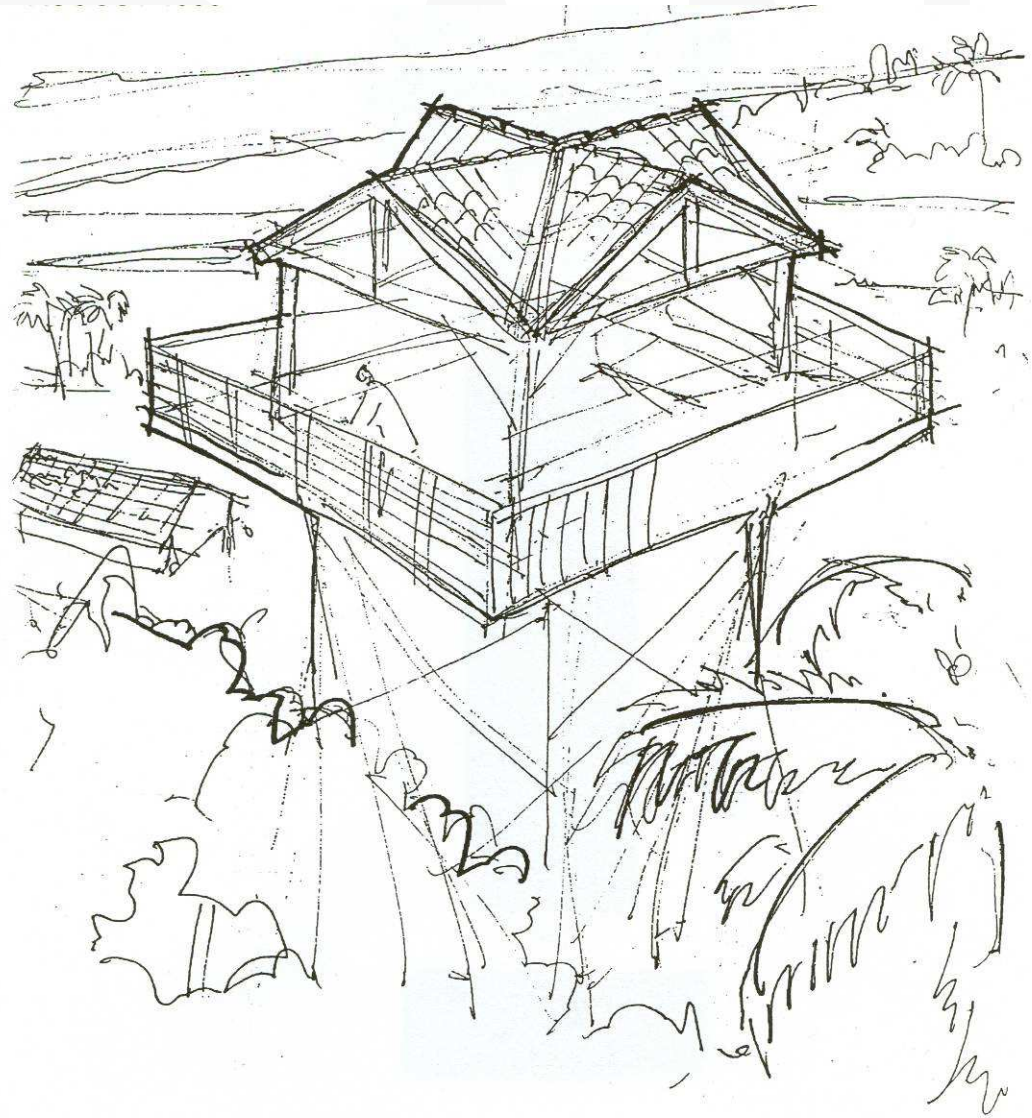
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The eMi Design

Compromise –

- Minimize weaknesses
- Maximize strengths

**You must use both,
AND limit both!**

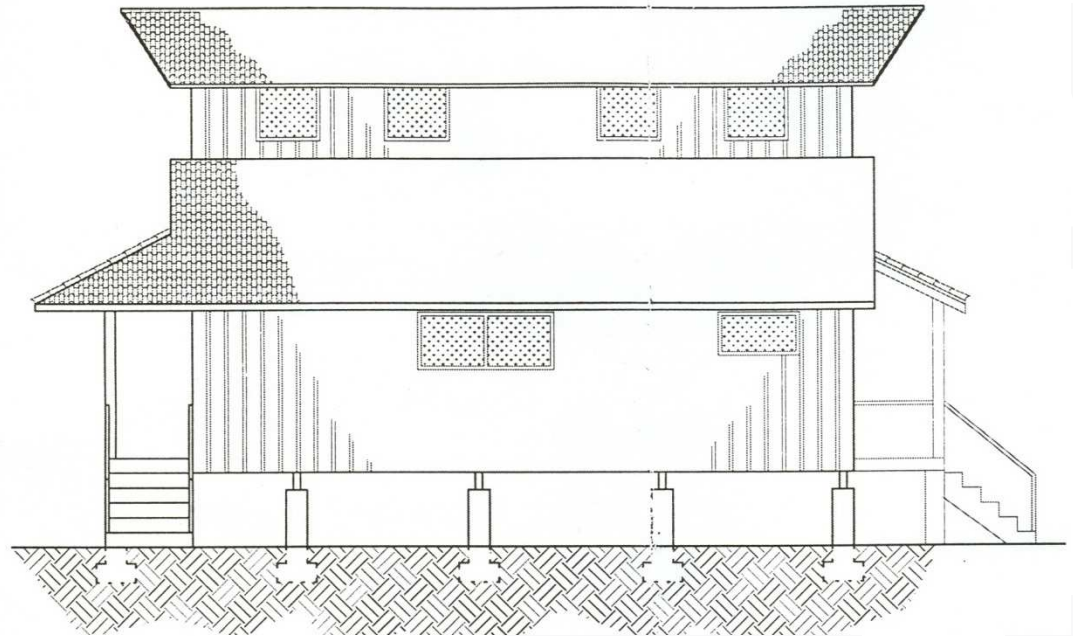
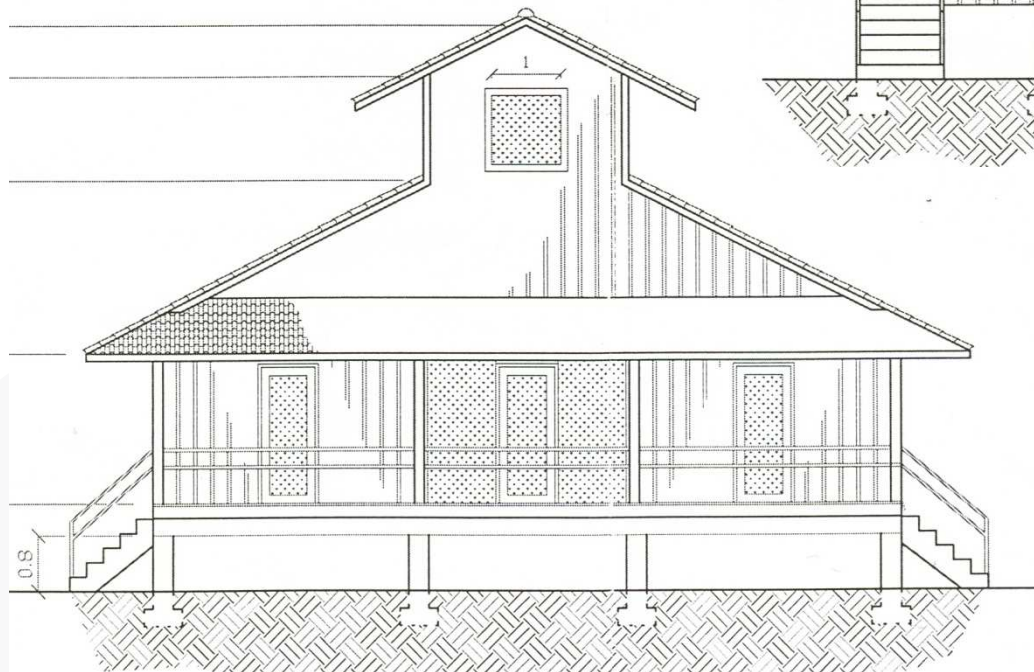


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Typical building design across the campus

- Smaller, individual buildings across the site



all site/civil work can be fit
in small areas between
buildings and trees/jungle

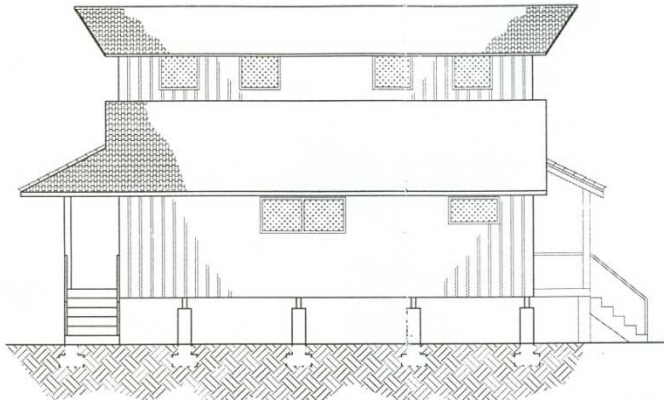
Wood framed, w/porches and
longer overhangs

Concrete pier foundations



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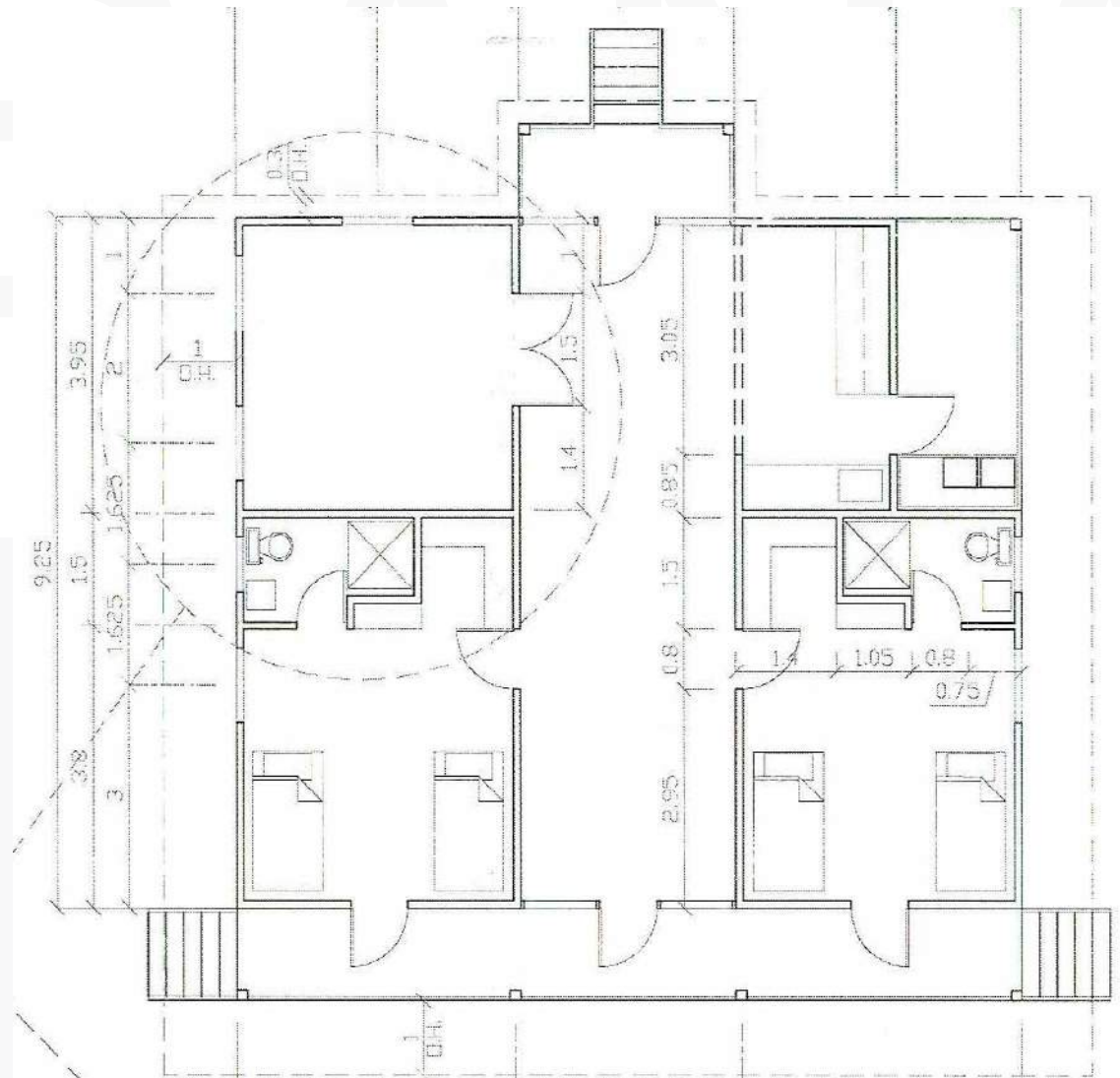
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**Either very open floor plans
(such as classrooms),**

or

**Well-ventilated individual
spaces, such as the
connecting breezeway
concept for the single staff
dorm**



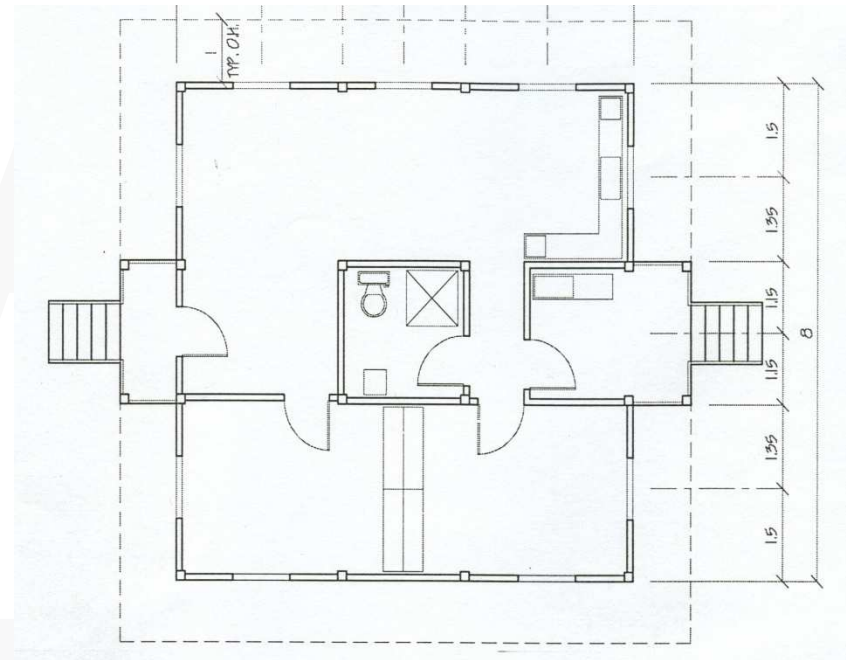
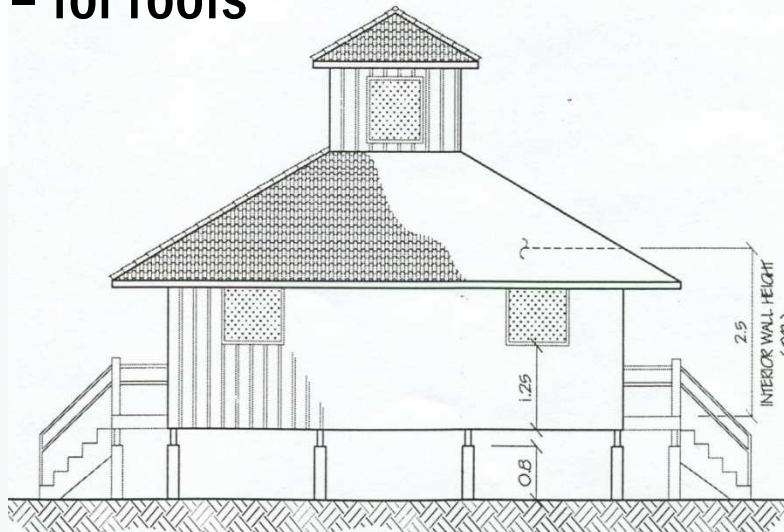
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Use wood – because of its endless supply and cheap labor to mill it.

Use concrete – in limited amounts - for concrete piers to raise the buildings off the ground.

Use clay tile - produced on their own site! – for roofs



minimizing the amounts of the expensive materials/methods and maximizing the amounts of cheap materials/methods still allows structures to be protected both above and below.



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Keys to Good Design and Development - Summary

The Right Understanding and Response -

- Compassion and Service

Mutual Discovery & Partnership (Helping Without Hurting)

- Real Listening and Questioning.
- Brainstorm together. Build Relationship.

Appropriate Design and Assistance

- Too much “helping” creates dependency and/or corruption opportunity
- Learn from them – and they will learn from you!

Some Teaching, Training, Supervision

- People like to learn, grow – find answers together!
- Real partnership

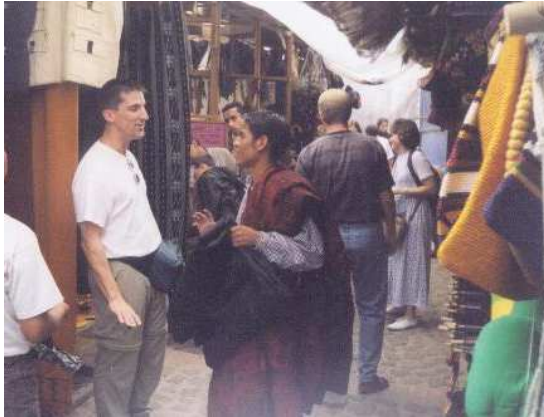
Keep it Simple

- for adoption & propagation - work in their reality!



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Design in the Developing World -
Start With WHY...
Change the World



URBANA

Questions?

eMi



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