I, Ross Battoclette, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
Tradition: Its Impact on Architecture in Developing Worlds

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Tradition:

Its Impact on Architecture in Developing Worlds

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Figure 1: Image of NCA Site in Matagalpa, Nicaragua
Abstract

In a developing world, if traditions are too strong, can architecture be created or implemented? Throughout this paper, public interest design will be used in conjunction with humanitarian design. They both are used to explain the same idea. Humanitarian design is becoming an outdated term and is often thought of as architecture designed for those in need. Where as public interest design is human focused with the participation of all who are involved or impacted by the design.

In developing worlds, there are communities of people that are too remote to have quick access to simple necessities such as water, education, and healthcare. When humanitarian aid is implemented it is sometimes only for a short amount of time to help solve an issue. Buildings that are used are sometimes only temporary structures that provide little meaning to the community surrounding them; it is not a place that the community can call their own. Temporary aid is not a solution for long-term change.

This thesis presents a master plan design for a school in Matagalpa, Nicaragua, that focuses on specific needs of the site and its users. It then presents a building design that balances the specific site conditions, environmental factors, needs of the school and relationship to existing buildings. By working closely with a school in Nicaragua, it is my hope to present a design that arrives at a set of possibilities, which provides an understanding of the traditions and its impact on architecture in Nicaragua.
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The topic for this thesis comes from my own life thoughts and experiences. I grew up in the church as a Christian my entire life; I went to a Christian Liberal Arts College for undergrad. Religion has played a large role in my life and continues to do so. I remember during my teenage years, my parents would donate their money and time to organizations such as the Salvation Army and continue to do so. They showed me and taught me what it means to live in this world and how there are people in it that need help.

Why a developing world? A few years ago my church started short mission trips to Kenya to help local organizations there. My mother and sister were some of the people that got to experience that. That was a big impact for me even though I never got to go experience it. The reason for that is because of the stories that they told when they returned and the pictures they shared. It broke my heart to see people living in such poverty that I decided I wanted to try and understand how I might be able to make an impact through architecture.

In developing worlds, there are communities of people that are too remote to have quick access to simple necessities such as water, education, and healthcare. When Humanitarian aid is implemented it is sometimes only for a short amount of time to help solve an issue. Buildings that are used are sometimes only temporary structures that provide little meaning to the community surrounding them; it is not a place that the community can call their own. Temporary aid is not a solution for long-term change.

Small Scale, Big Change: New Architecture of Social Engagement talks about eleven firms that have constructed buildings in developing worlds. The author Andres Lepik introduces the idea that it is the architect’s role to participate and engage in humanitarian design. The projects
that are described each focus on how the active participation of community that surrounds the building helps to add value to it. It is important to understand that successful humanitarian design cannot be done through a prototype design that is implemented around the world. It is through the community and the specific location that the building must be designed for; otherwise, it does not provide meaning or will not be successful.¹ Paul Polak, author of *Out of Poverty*, stresses the value of ownership and community involvement in humanitarian aid. The one myth about aid that most people misunderstand is that it is not possible to fix or eradicate a problem by simply donating.² The way that progress is most successful is when the community of “people have to invest their own time and money.”³

This allows for aid to be successful and create ownership, because it is driven by the users needs, which adds more value to the end result.

*New Directions in Sustainable Design* by Adrian Parr and Michael Zaretsky brings together multiple thoughts about sustainable design and makes sense of it. It describes how sustainability needs to focus on how we design now can and will affect future generations. Therefore, we must design in a sustainable way that allows for potential growth, social development, and economic progress.⁴ It develops a coherent theoretical framework for how theories of sustainability might engage with the growing practice of design. With any building designed in a developing country, it is important that sustainability is thought deeply about. This text helps equip someone with the thoughts of where sustainable design is going.

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2 Paul Polak, *Out of Poverty: what works when traditional approaches fail* (Barrett-Koehler, 2008), 34
3 ibid. 39
and new ways that it can be approached.\textsuperscript{5}

Sustainability is an important aspect to public interest design, and there are many ways that it is defined. In \textit{New Directions in Sustainable Design} by Adrian Parr and Michael Zaretsky chapter seventeen is an interview with Christof Jantzen, who is an architect that has focused most of his career on sustainable design. Christof Jantzen talks about the definition of sustainable design and how it has many interpretations. The more common definition that is becoming misused within architecture is defined as “a way to meet the needs of the present without compromising the ability of future generations to meet their own needs.”\textsuperscript{6} It has also been extended to include social development and economic progress. Christof Jantzen then gives a more politically correct definition of sustainability. Sustainability is “handling natural resources in a more economical and responsible manner” as well as “learn to live and work with our environment in such a manner where, despite future demographic developments, we can reduce the risk of shortages.”\textsuperscript{7} The problem is how to create an architecturally sustainable design that creates permanent and lasting effects to the people it will serve?

Developing countries do not have quick access to essential needs of living and most do not benefit from good architecture. This is because most designers only design for the richest ten percent of the population. Paul Polak, author of \textit{Out of Poverty}, writes about designing for the other ninety percent. “The problem is that 90 percent of the world’s designers spend all of their time working on solutions to the problems of the richest 10 percent of the world’s customers. A revolution in design is needed to reverse this silly

\textsuperscript{5} ibid
\textsuperscript{6} ibid
\textsuperscript{7} ibid
ratio and reach the other 90 percent." People in developing countries are “ready to make any reasonable compromise in quality for the sake of affordability, but nothing is available in the marketplace to meet their needs.” For example, someone would buy a lesser quality product that might last a few months, versus the more expensive product that would last years. Paul Polak gives an example of when he was selling Chinese versus British-made lug wrenches to donkey cart operators in Somalia. He assumed that the more expensive, better quality British made wrench would sell better, but ended up not selling even one. “[Paul] realized a donkey cart operator could generate enough income in one month to buy ten British-made lug wrenches, but if he didn’t have the money to buy a lug wrench to fix today’s flat tire, he would earn nothing and might end up losing his donkey cart.” This shows that affordability is valued over quality. So how can we make architecture affordable? Through expandability, it can be possible to achieve quality and affordability. If someone can pay for a product that is expandable, they can get what they can afford that day and when they generate income from that initial purchase, then they can expand further. There are some designers that are making contributions designing for poor customers, but this area continues to be greatly ignored. Paul Polak then goes on to ask about designing for poor customers and is it “much more difficult than designing for the rich? I don’t think so.”

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8 Paul Polak, *Out of Poverty: what works when traditional approaches fail* (Barrett-Koehler, 2008), 64
9 ibid
10 ibid 65
11 ibid 64
Public interest design is a growing field within architecture. There are many organizations and firms designing and constructing buildings that benefit people in developing countries. One of the most well published and talked about texts about humanitarian design is *Design Like You Give a Damn* by Architecture for Humanity. Authors Kate Stohr and Cameron Sinclair engage with what it means to implement humanitarian design. They also make it clear that humanitarian design cannot be done successfully if someone is in it for the fame or taking pity on people. It is important that the reasons for designing in a developing country are rooted in dignity and optimism to help people to live better lives.\(^\text{12}\)

There is nothing to gain financially from public interest design; therefore, financial stability for an organization can be difficult. It is hard for organizations to be able to develop a design for a health center in a developing country if they do not have donations or funding to actually do it. For example, on January 1, 2015 Architecture for Humanity, whose has been around since 1999 and has been involved in thousands of projects, filed for bankruptcy and closed down. The reason for this is that funding was becoming difficult for them, like most charitable organizations. “Our leadership worked to overcome the funding gaps to the best of their ability, but the deficit combined with budget overruns and an overall decrease in donations finally became an insurmountable situation.”\(^\text{13}\)

Architecture for Humanity has helped millions of people across the world and the lack of funding is what shuts the organization down. This does not mean


that all of their work should be disregarded; it should be studied because of the impacts that it has made and the lives that it changed. Without the proper financial support, is it possible to be able to sustain public interest design?
Figure 2: Image of Roche Health Center in Tanzania
A precedent that has been successful and continues to make an impact in public interest design is The Roche Health center in Tanzania. This project is with the foundation Village Life Outreach, and is under the direction of Professor Michael Zaretsky in collaboration with students and other faculty at the University of Cincinnati. The reason that this health center project started was because Village Life Outreach began sending doctors to Tanzania every year, but there was never a permanent health center for the region that they were going to. The challenge for the project was how to provide clean water, education and health care to local villages that otherwise do not have quick access to those necessities.

This project has been successful in its design, function and local involvement. The design strategies that were created have been very successful. It was designed using passive design strategies for ventilation and shading. There was also a need for water during the dry season. During the dry season, it is hard to have a reliable water source. Therefore, during the rainy season, it is important that water is collected. That site related condition drove the design and the form of the building. Large roofs and large gutters were design to collect and store as much water as possible.
Another example of an architecture firm that has been doing work in the public interest realm is the MASS Design Group, based out of Boston, Massachusetts. The work that they do “seeks to provide infrastructure, buildings, and the human and physical systems necessary for growth, dignity, and well-being.” In all of their projects they strive to incorporate local materials and local labor. One of their projects Butaro Hospital in Rwanda is an example of a project that responds well to its site, materiality, and tradition. The hospital was constructed using locally harvested volcanic rock and a new construction method, which increased local knowledge and created jobs. What made this project successful was that it was not only sensitive to cultural conditions, but also improved on traditional building methods. They understood how buildings were constructed and improved upon those methods.

Another project by MASS Design Group is the Umubano Primary School in Rwanda. The design of the building layouts for this school “takes direct inspiration from the neighborhood and the region; due to the hilly landscape, people travel across switchbacks on terraced agricultural land – and the school’s traversing walkways and outdoor classrooms mirror this context.” The use of local materials, such as brick and papyrus reeds, were used to cut down on transportation costs. They were also cautious to limit the need to import materials that are more often then not, contextually inappropriate. By being mindful of those things, then the project can succeed in doing things such as encouraging local economic growth and incorporating local expertise into the project.


Figure 3: Image of Butaro Hospital by MASS Design Group in Rwanda

Figure 4: Image of Umubano Primary School by MASS Design Group in Rwanda
How Tradition Impacts Architecture

The key points that are relevant in all humanitarian design projects are that they are rooted in dignity and optimism to help people to live better lives. They are done with strong input and thought about the community that the building is being designed for. They are also involved the site and location, thinking about sustainable design and how this building can remain and be useful for years to come. Can architecture be created in a developing world, where traditions are strong? Can it be done without imposing western ideas, which inevitably will fail?

In Nicaragua, there are a lot of NGO’s that are driven to make a change in the country. There are two organizations in particular that focus their mission on women in prostitution and taking women from La Chureca (city dump) and help them rebuild their lives. La Chureca is the largest garbage dump in Central America, where 16 tons of trashed produced by over 2 million people is dropped off everyday.16 It was once 4.5 square miles of farmland on Lake Managua, which is now home to hundreds of families and wild animals.17 “After an earthquake destroyed 80 percent of Managua in 1972, La Chureca became a dumping ground for rubble—and a home to the 1,800 people who now make their living sorting trash”.18

The first organization is called House of Hope, which brings women from the city dump and puts them into a home that has slightly better conditions then they were living in. For example, the kitchen is still outside made out of two cinder blocks with a metal grate on top that spans between the two blocks. House of Hope relates to the women and their traditions and builds upon that. The other organization is called Villa Esperanza (Hope Village), which also brings women in from the

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17 ibid
18 ibid
Figure 5: Image of Villa Esperanza

Figure 6: Image of House of Hope

Figure 7: Image of La Chureca (the city dump)
city dump, except that the women are taken out of poverty and put into a resort like facility.

The reason for the sharp contrast between the two organizations is how each one perceives helping those in prostitution. Villa Esperanza clearly has a heavy North American influence, because of the resort like facilities. While House of Hope understands the local culture, values and traditions and knows that is the best way to heal. The most successful organization out of the two is House of Hope. Villa Esperanza does not respect the local context and seem inappropriately placed. To take someone that is in the lowest level of poverty and put them in a nice clean resort like facility makes the women feel out of place. How can one expect to give someone something that they might never have in their life and once they graduate from the program take it away and expect them to succeed? This misconception can only be explained by not understanding traditions and local cultures.

This explanation has a direct correlation to architecture in Nicaragua. An architect has no right to show up in a country and demand that the way someone is building is wrong and the architect is the only one who knows how to fix the problem. Often this can do a lot of damage and set back a community of people. There must be a time of investigation that takes place to understand local traditions and design construction processes in the country.

Often is the case in Nicaragua that good, thought-out design is the last thing considered. Nicaragua is “function over form, cheapness over function, tradition over cheapness and then job security often wins over tradition.”\(^{19}\) The way that buildings are constructed is based on tradition and local knowledge of how to build. Since tradition has such a strong hold on the building construction

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\(^{19}\) Interview with Dave S., Involved with NCA for 10 years
Figure 8: Diagram of the design and construction process in Nicaragua
in Nicaragua, it makes it difficult to construct a building that follows a specific design. From my visit to Nicaragua, it was possible to narrow down the design and construction process into two paths. The first path is that when a design is given to a contractor to build it, they often do not fully understand it need or function. The contractor will try to build it anyways but will often not be used for the purpose it was designed for. Alternatively, it was built because of a lack of communication and understanding of its need. The other path that is often found in the design and construction process in Nicaragua is that the contractor does not know how to build it. Since they do not know how to build it they will not build the design at all. What they will build instead is a building that they know how to build based on traditions and how they know how to build something. The issue at the end of these two paths is that once it is built there is no money to tear down and rebuild it correctly. The contractor is most likely breaking even on their costs and cannot afford to rebuild it. Therefore as the architect, is it possible to create a design when traditions are so strong?

A school in Nicaragua has been building campuses that push this tradition of the way buildings are built. Nicaragua Christian Academy is an evangelical, non-denominational, non-profit preschool, elementary, and secondary educational institution with three campuses in Nicaragua. The organization started in 1991 as a school for missionary children to get a quality Christian education in Nicaragua. It soon became clear that there was a great need for a quality education, for not only the children of missionaries, but also the local children in Nicaragua. There are three NCA campuses in Nicaragua, two in Managua and one in Matagalpa. Currently, the schools serve over 900 students and desire to expand throughout Nicaragua.
There is a need at the Matagalpa campus to develop a master plan that focuses on the long-term use of the site and how each building relates to each other. This has not been as successful at their other campuses. Buildings were built as needed without a long-term plan and not as much thought was put into why they were built where they were. At NCA Matagalpa, there has been more focus on building placements and relationships to each other and the site. Eric Loftsgard is the designer behind the existing campuses and has been influential in trying to push local building traditions. Eric has been living and working in Nicaragua for over 17 years, and before that he was a custom home builder and contractor in the United States. Often he proposes a design that local builders have a hard time understanding why he wants it a certain way. He does not propose the use of a new material; only new ways to use contextually appropriate materials that benefit the function of the building. NCA Matagalpa currently serves students from pre-school to 8th grade, with growth every year. There is a need to expand within the next 2 - 3 years to accommodate class levels up to the 11th grade. Currently there is a single section of every grade level, and a desire to double this in the coming years. Each section has a max student allowance of 25 students to achieve a desired student to teacher ratio. Other needs for NCA Matagalpa are spaces for administration, dining, and recreation.
Figure 9: Map of the country of Nicaragua and the location of Matagalpa

Figure 10: Map of the city of Matagalpa and its department

Figure 11: Map of NCA Matagalpa showing its relationship to the city and the surrounding density
The location of the site is in the country of Nicaragua in the city of Matagalpa. The city of Matagalpa has a population of about 150,643 and is roughly 3,291 mi$^2$ in size. The site is located 5km to the southwest of downtown Matagalpa. The site is roughly 450,000 sf and is relatively steep, with about a 30-meter change in elevation from the southeast corner to the northwest corner, with the lowest point being the Rio Grande Matagalpa. The site is bound on the north, east and west sides by a 4-5 meter tall concrete wall. The wall is for the security of the students and prevents unwelcome visitors on the site. The southern boundary has a metal fence that allows water to pass through it when the river floods. About ten percent of the site cannot have a permanent structure built on it, due to the flood plane that occurs from the river. Therefore, other programmatic activities, such as recreational fields have been proposed or built in those parts of the site.

Matagalpa is a tropical climate that is more than 700 meters above seas level. A tropical climate is a non-arid climate in which all twelve months have mean temperatures of at least 64°F. On average, Matagalpa receives between 47 to 75 inches of rain per year. Residents of Matagalpa often described the weather as an eternal spring.

The master plan for the site will show the relationship of new buildings to existing buildings on the site. The existing buildings were built in response to the topography, but do not function well in relation to each other. Other design goals have deal with the tectonics and spatial relations of the interior of the building to the exterior. The interior of the building should be designed in a way that makes the space functional. In addition, the tectonics of the exterior will help

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Figure 12: Map of NCA Matagalpa vehicular, pedestrian circulation and topography

Figure 13: Selection of images from around the existing site of NCA Matagalpa
Figure 14: Map of the proposed masterplan of NCA Matagalpa

1. Existing House
2. Administrative Offices
3. Preschool (under construction)
4. Existing Primary Classrooms
5. Existing Cafeteria
6. Cafeteria Expansion
7. Existing Covered Gym
8. Storage & Offices
9. Full Size Covered Gym
10. Theater
11. Music Classrooms
12. Secondary Classrooms
13. Vocational Building
14. Outdoor Gym
15. Storage & Restrooms
16. Soccer Field
to create the interior spatial arrangements. There should be a consistent fluidity that is brought from the exterior into the interior.

The site conditions and the needs of the schools influence the design. The environment and characteristics of it drive the function, and form of the building. Passive design strategies are important because there is no way to heat, cool or ventilate buildings efficiently or reliably in Matagalpa, Nicaragua. Passive design strategies help to drive the sustainability of the building. They create a building that lasts for a long time with little maintenance required to keep the building functioning.

The site has challenges, not only because of the topography but also because of the environmental factors, passive design strategies, site conditions and materials that must be thought about. These factors are diagrammed to provide the opportunity to understand them in figures 15 - 20. First, there are passive design strategies. There are four main strategies that are critical to creating a successful building in this environment: shading, indirect sunlight, water collection and natural ventilation.

Each one of these strategies correlates with the climate conditions and sustainable ideas. Shading is needed for solar radiation, which causes heat gains. This happens in two ways. First, radiation enters directly through openings and is absorbed by internal surfaces. Secondly, radiation is absorbed by the external building surfaces and then transferred to internal surfaces. The roof design, ventilation and vegetation on the site all impact this factor. Another strategy is indirect sunlight, which is important to help reduce the need for electricity to be used. It also creates a positive interior environment for learning. Water collection is important to reduce the need to drill more wells or rely on city water that is not
Figure 15: Diagram of climate conditions, dry to wet months, temperature and wind direction

Figure 16: Diagrams of the passive design strategies

Figure 17: Diagrams of environmental factors

Figure 18: Diagrams of the specific site conditions
Figure 19: Images of the primary design materials. Left to right: quarry stone/concrete, red brick, covintec, and steel

Figure 20: Diagram showing the process and use of the primary design materials
safe for consumption. This issue with collecting water is that Nicaraguans often see rainwater as being dirty. Therefore, it is often not done even though this could help offset water consumption during the dry season. The infrastructure to collect rainwater could be constructed within a project, so that once collecting water becomes important, then everything would be set up. Lastly, because the relative humidity is often between 65%-85% natural ventilation is important to keep a constant flow of air. By placing a low window on one side of the building and a high window on the other side, it can help to create a natural draft that pulls air through the building. Aligning windows on one side of the building to the other can help to create cross ventilation. Adding a clerestory, which allows hot air to escape, which would create airflow that helps to reduce the heat that can be generated from the roof. In addition, the orientation of the building to the direction of the wind, location of vegetation and the location of other buildings all affect the ventilation of a building.

Next are four environmental factors, which are earthquakes, landslides, and flooding and high winds/uplift. Using proper building construction that prevents structural failure from earthquakes and high winds are important in Nicaragua. Even though this site is located farther inland, it is still subject to hurricane weather. This site is also steep, which means when it rains a lot there is a chance for landslides to occur. With there being a major river that runs past the southern portion of this site, flooding is another factor.

Next are the four site conditions, which are the sun path, slope, water plane, and wind direction. These four factors are important to help decide building locations, building orientation, and airflow across the site.

Lastly, the materials that are used are
important to understand local construction and building types. Most buildings in Nicaragua use four main materials. They are red-fired brick, stone, concrete and steel. Wood is not a good material in this climate, and if used only lasts months before it becomes destroyed by humidity and termites. Wood is expensive and hard to get enough of because the good hardwood that is found in the country is often exported for its value. These main materials are used because they are what buildings are traditionally built with and to use other materials outside of what can be found locally would be contextually inappropriate. For example if someone from North America decided to use a material that was only made in North America and was then imported into Nicaragua, it would make it a contextually inappropriate material. The contractors in Nicaragua would not know how to build with this new material and often would require someone with experience working with that material. This affects the local skilled laborers and the economy of Nicaragua as well. Once traditional materials are no longer used and the skills of a Nicaraguan contractor are no longer needed then it has a ripple effect across the entire community and economy.

Some materials that are used have a strong tradition behind them, that it can often be hard to explain to a Nicaraguan contractor why not to use it for certain structures. For example, there is a local quarry stone, called piedra de cantera, which is commonly used for foundations and infill of walls. Each block is roughly 14” x 14” x 6”, weigh between 100lbs to 130lbs, and only costs $0.20. This material is often used as a foundation walls because of its low costs. There is also a traditional belief that because the stone comes from the ground, that it is the only material that can touch the ground in a building. Obviously, this material is extremely heavy and
creates dangerous structures. In comparison to another material that can be used instead, which are CMU blocks. While much lighter and efficient for building structures, costs around $2.00 a block, and requires a greater skill to build.

The way that steel is built in a building in Nicaragua is completely custom. A contractor will order the specific steel that is needed and it will arrive on site in stock lengths. Then a welder will come to the site and will assemble and weld all the pieces to the structure to create the desired structure. This is something that is not found in North American construction because all metal fabrication is done off site and the cost to bring a welder to the job site is not cost effective.

Another material that is starting to become more common in Nicaragua is called Covintec. This is a panel system much like what can be found in North America, which is called a Structural Insulated Panel. Covintec is made up of a foam core with metal supports running every 2” that is placed on rebar that has been pored into the foundation. Then a couple millimeter thick coating of plaster is then applied to finish it off. These panels are structural and even capable of acting as a floor slab on a second level. These panels costs about the same as building a wall out of brick and concrete. The only downside is that it requires a certain skill set to be able to work with this material that is often hard to find.

The design of these buildings for NCA Matagalpa will only reflect that of the tradition and contextually appropriate materials that can be found locally. It will push the way that the common materials are being used and thought about in the design. For example, brick could be placed in interesting ways to create opens that allow for natural ventilation. Instead of plastering over the brick it can be exposed to reflect the pureness of the material. Since steel
Figure 21: Diagram of building relationships and points of interest
is already custom and built on site, it is possible for the roof and other design features to be designed in a manner that positively impacts the function and efficiency of a building.

The organization of the proposed buildings has a direct relationship to the existing buildings as well as the topography of the site. The proposed buildings sit on a relatively flat portion of the site as the buildings slowly rotate and cascade down the landscape. The building orientations are a direct response to the movement of the sun as well as views out and wind direction. The use of extended roof overhangs and covered spaces provides a unique relationship between interior and exterior spaces. The proposed buildings relate to the existing buildings in their form and materiality to maintain the overall aesthetics. However, by presenting the possibilities of different roof configurations, clerestory’s for ventilation and large covered spaces helps to distinguish the primary from the secondary school buildings.
Figure 22: Images of Plan, elevations and section of design
Figure 23: Image of interior rendering of a classroom

Figure 24: Image of exterior rendering between the two primary buildings looking northwest
Conclusion

The research presented in this thesis provides the opportunity to explore the ideas about public interest design and question the impact that tradition has on architecture. It is important that all public interest design be stand alone projects that analyze their specific factors. It is through engaging with each individual site and cultures that will create successful projects. Yes, it is possible for architecture to be created when traditions are strong. But only if there is a complete understanding of what those traditions are and how to use them to benefit the design.
Figure 25: Image of Author and Eric Loftsgard at NCA International Campus engaging in conversation about architecture in Nicaragua.
Bibliography


