Designing affordable pre-school with the inclusion of disabled children in Mozambique

Master's Thesis

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Abstract

This paper highlights the need of the creation of a preschool designed for disabled and socially excluded children in an underdeveloped country, like Mozambique. Children with disabilities are often overlooked in humanitarian action and become even more marginalized as fewer resources are available in the midst of a crisis. Countries overlook them, because few of them collect data on children with disabilities and even when countries know about them, most don't know how to include them in their education systems. It begins by introducing the political history of the country and its impact on the architectural world, followed by an analysis on the affordability, the rapid urbanization and the population growth which shows the difficult life that they live in with the lack of money.

Xai-Xai district was chosen by the competition's organizers to build a pre-school because of a school teacher demanded it for her town children. The goal of this competition was to find the best techniques and ways to use local materials to build the school. Local, affordable, ecological and sustainable materials were chosen as a solution to a low-cost construction. Compressed Earth Blocks and Bamboo were explained, shown with drawings how to join and intersect them. How to make them strong enough to handle the climate, loads and make their duration longer.

Based on the previously mentioned materials, a design proposal was elaborated, with section wall details showing the people how to build them. The proposal is versatile, meaning it could be upgraded over time, even used for other buildings not only schools.

Keywords: affordable, pre-school, disabled children, compressed earth blocks, bamboo, local materials

Table of Contents

List of Figures

Part I
Introduction

Political Backgroung

Following the Independence War (1964 to 1974), the Civil War (1977 to 1992) created a cynicism between individuals and mistrust between one another. Such interactions were enticed by the Colonial Power (Portugal) to create a shift between the individuals in order to weaken the country internally. The implementation of assimilados (assimilated) was utilized in order to strengthen the shift between Mozambicans.

"The Republican Colonial Law in 1914 sought to clarify the interpretation of contradictory policies such as the "assimilation policy" and the policy of compulsory labour. As a result, Africans who had already been assimilated became "citizens" while Africans, the "Indigenous people" were obliged to work against their will, disguised in the form of contracted labour." The Colonial shift occurred followed Portugal's three major incidents: economic crisis recession after its participation in World War I, political crisis relation to the military coup following the fall of the Republican Party and the commencement of the Great Depression.

Samora Machel (1933-1986) - the heroic godlike fixture - first president of the Republic of Mozambique was the glue that united the nation

Figure 1: Historic Frelimo United Nations Photos.

through his profound soul-grabbing speeches and ability to be of-the-people and for-the-people due to his low-life birth and mannerisms. The man is a God, and lives through generation through his charisma and humble understanding of the "small man."

After his death, the country was broken in spirit and efficiency for the savior was eradicated by an unseen enem and the country was too young to stand for itself. The symbolism of the Civil War between FRELIMO (Frente de Libertacao de Mocambique or Mozambican Liberation Front) and RENAMO (Resistencia Nacional Mocambicana or Mozambican National Resistance) scarred the country in a form that cannot be taken back. The civil war was "long and scarring due to its symbolic and physical violence." (Funada-Classen, 2012)

Above all, the transformative structure of social awareness and interaction is ruled through feitico and its importance in society. Mozambicans are immensely superstitious, which means that it dictates the way they maneuver through obstacles and solutions.

Colonialism, was the reality of the most of the African continent through several centuries. The division of the land and its people left scars and collateral cultural manifestations that may still be felt today. The Portuguese rule left behind

Figure 2: Women soldiers at Samora Machel's funeral. Source: Bernard Bisson, Le Monde Diplomatique

many effects such as: Architecture, language and culinary finesse but - for example Rwanda - also birthed a divide and disrespect among the population. The impact of colonialism in Mozambique may still be felt today, with the tangible conflict between the two major parties: FRELIMO and RENAMO. Similar to the Rwanda's genocidal approach to European stimulus, the emergence of RENAMO dictated the annihilation of violent war - Independence War and struggle for national discovery - through the paradoxical initiation of ritualized violence.

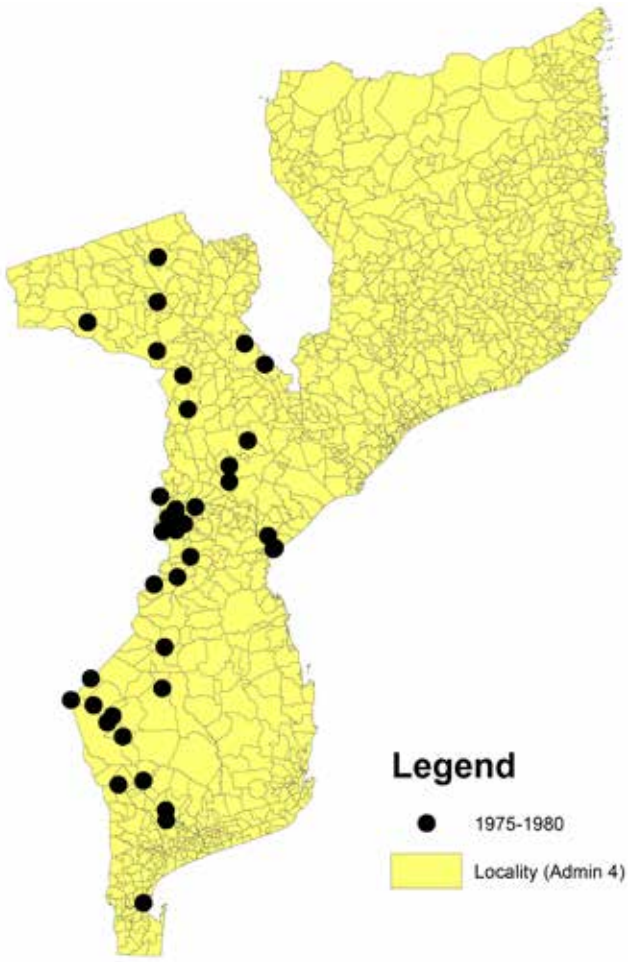
The emergence of the movement, sparked in Zambezia and Nampula (north of the country), became the resultant of a divided peoples whom were taught to hate due to their European oppressors creating vulnerable of mysticism through the embodiment of a charismatic man, Andre Matsangaissa.The rawest explanation between the main divide between RENAMO and FRELIMO would be their geographical dispersion. RENAMO supporters (as well as the birthplace of the party) resides in the north, whilst FRELIMO is mostly dominant in the south but engages supporters throughout the nation.

Mozambique - like many African countries - relies on the importance of the unknown or spiritual. Spiritual awareness in the country is embedded at a young age, allowing for a consensus belief of unexplained forces. Whether God or Allah is integrated in one's religious interpretation, the importance of the spiritual cannot be compared. Mozambique is made up of different ethnicities, religious and beliefs but their common denominator is: the realm of the unknown and the untouchables. The country is divided into ten provinces with Portuguese as the official language but many poorly documented Bantu group languages take places most of the population's first (or only) language. Amongst the various religious practiced in the country Christianity and Islam hold the highest following; but, with the practicing religion local practices are woven into prayer.

The governmental rule automatically moved back to FRELIMO (since the Civil War was won by them and they were also victorious in the War of Independence) and the major cities had many of their supporters which left little options for the militants than to remain north and rural. The shift in society and family relations for the soldiers became tricky. They carried possible spirits from their battles and had to be cleansed, but it also meant that their departure caused many enemies and dangers; aiding in the witchcraft dynamics in their home villages.

The integration of feitico - Portuguese for witchcraft - in the country's DNA, complicates interactions between people in everyday setting. Division of tribes existed prior to the invasion of Portugal, but the various tribes coexisted in a pacific and neighborly environment, where community was treasured through similar social structure and practices. The

Figure 3: Historic Frelimo United Nations Photos.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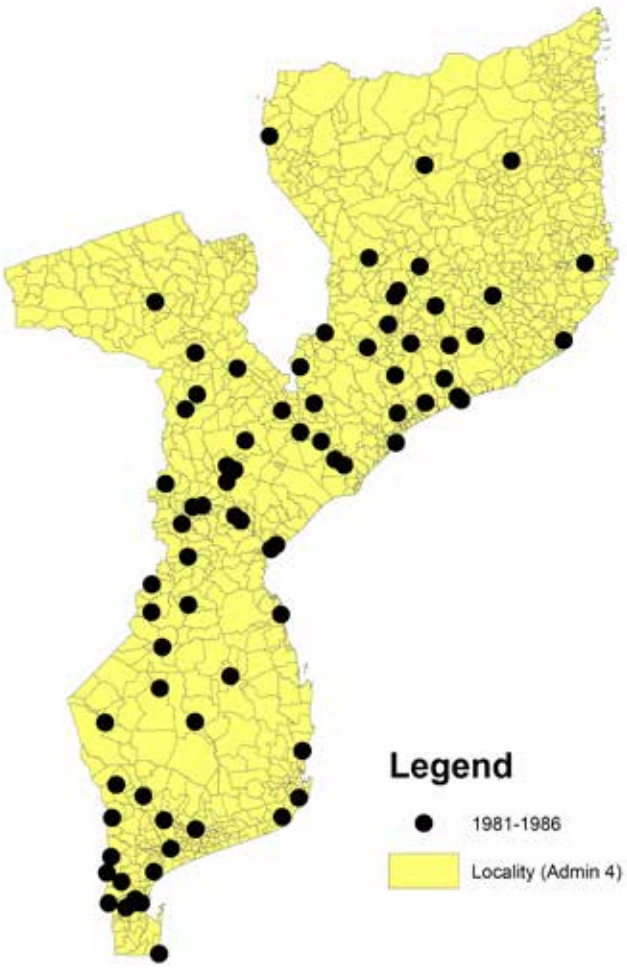
1975-1980
Locality (Admin 4)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1981-1986
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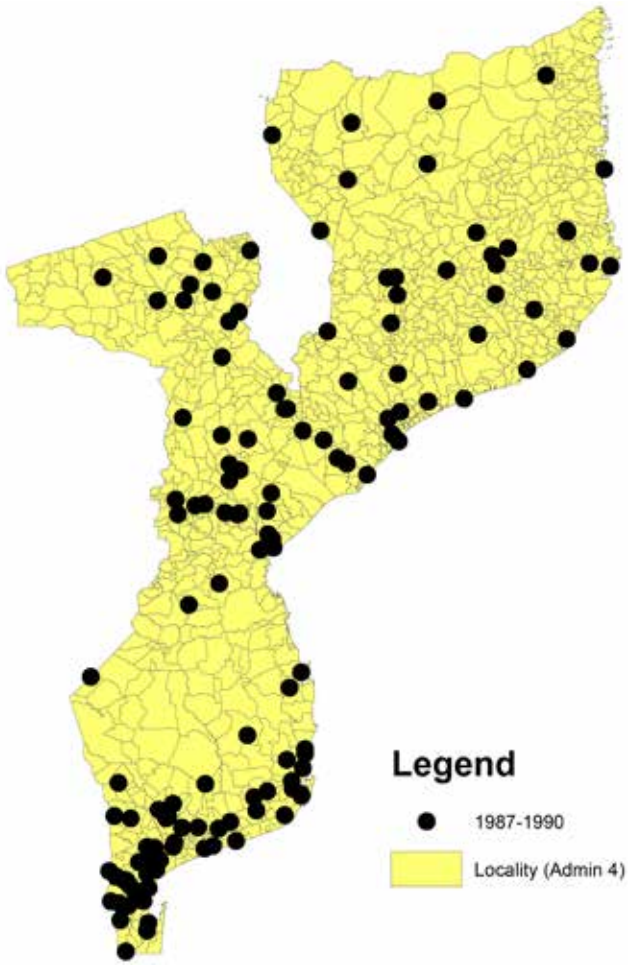
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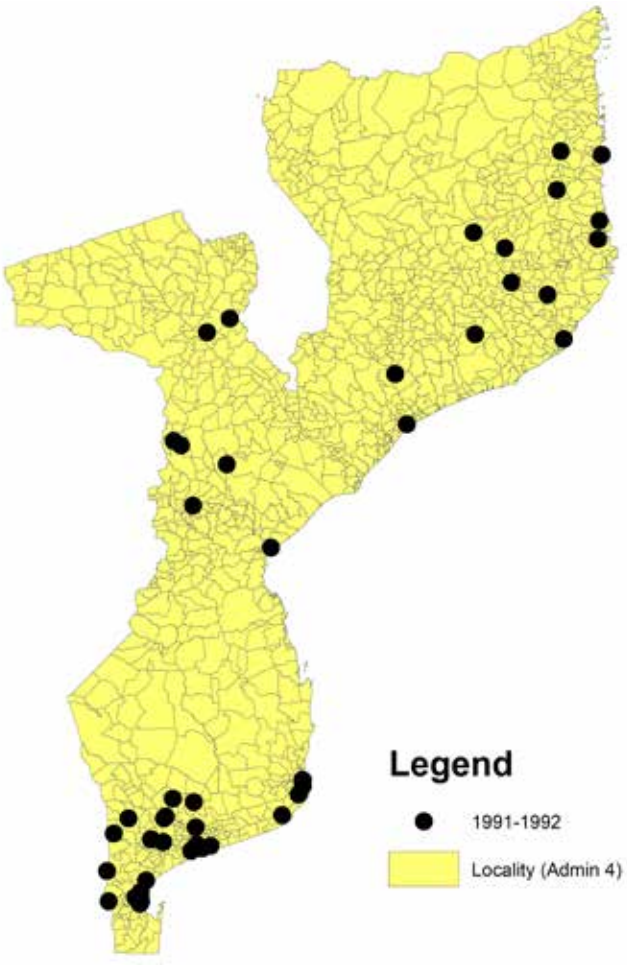
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1991-1992
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earliest inhabitants of present-day Mozambique consisted of hunter-gathered related to the Khoisan and were later joined by the Bantu (1000 BCE) migrating from the Congo basin through the Niger Delta in West Africa; possessing great skill in agriculture and iron-working. Many of the tribes - like the Yao - developed commercial networks throughout the country connecting the different crafts dominant to different "communities."

By the first millennium CE, traders from Arabia began to arrive through coastal settlements around: Sofala - the original Sofala eroded and overtaken by flooding - Angoche (Nampula Province), Querimba Islands (Indian Ocean near Pemba, Cabo Delgado) and Zambezi. Trading between the Arabs and locals existed for over a thousand years, adding to the history of Islam in Mozambique; therefore, imbedding itself as one of the largest and most influential religious in the country. In other words, the Muslims inhabiting Mozambique have been around since the settlement of the first tribes in the land. Like the "natives," the Muslims - from Arabic descent, mixed or converted - suffered severely during colonialism; which was a form of retaliation toward centuries of Muslim occupation. In the sense, when thinking about Mozambique it is inevitable to ignore the Muslim influence and population in the country.

Like the Arabic population in Mozambique, there is a large Indian population - Muslim and Hindu alike - that arrived from the Asian Portuguese colonies, during the colonial era. Though "in Mozambique, many Portuguese and Indians had personal relationships" there was a large oppressive rule in terms of religion. Therefore, in appearance the Indians were give more "privilege" compared to the Arabs and the Africans but still did not rule side-by-side with the Portuguese; but like the Portuguese harbored racism against the other races.

The social tension between the different races is intriguing; for, the exist within the same land-perimeters and due to the years of familiarity the cultures have become woven. In modern-day Mozambique, the cultural segregation between the different religious and races does not exist because the nation is one in terms of social interaction. The nature of suspicion encoded in the modern Mozambican society, the act of socialization falls (often) into guided by mistrust. However, Mozambicans still remain social and cheerful people; but the development of financial and global interventions aid in the cautious trust given between one another. Colonialism planted the seed; whilst the Civil War intensified it and the financial stabilization of the nation serves to fortify it.

The parties are linked with blind belief, mysticism, like RENAMO's Andre Matsangaissa and his claimed access to spiritual power, and familial bias. The parties are chosen as if selecting a tribe to follow until the extinction of an individual's family line. The connotations behind the in-

terpretation of an individual's political views are not taken lightly, and often lead to a sub-community of its own. The complexity of the subject creates a delicate relationship in the nation.

In Africa, architects are rarely sought after and are a rare commodity. In Mozambique, most of the "design" is developed from Civil Engineers, contractors or Portuguese architects - who have no sense of locality and cultural importance; therefore, many of the modern edifices fail to create a cohesive relationship between its location and historical influence, instead it follows a global trend creating impersonal and unsustainable design. "It is not important to have local architects, but it is important for architects to think locally" says Christian Benimana in his talk on 'Architecture thatserves the community'. Buildings are meant to be designed to respond to a community's needs and improve the lives of those touched by it.

It is important to understand that Architecture cannot stand alone when dealing with the enhancement of community. Psychology, sociology, anthropology and history are crucial in the complete awareness and comprehension of the design response. The human condition in modern-day Mozambique lacks the "sense of community" found in previous generations; where: social media, feitico (witchcraft) and political cult-like parties affect interaction between citizens.

Figure 4: Witchcraft, Strong Medicine. Source: Africandecisions

Architectural Backgroung

Mozambique is found on the East coast of Southern Africa with a population of around 30.8 million inhabitants living in an area of approximately 801.590 km². The capital and therefore the larger city in the country is Maputo, which was called Xilunguine in the precolonial period and named Lourenço Marques in the subsequent Portuguese colonial period, was structure by periods of economic, political and social deep adjustments which is reflected in the urban structure, form and morphology of the city. According to Jenkins, the most important periods of economic and political changes in the colonial period are five: the early mercantile period of city development, the subsequent early, middle and late colonial periods [Jenkins, 2009].

While according to Nunes, the recent post-Independence moment is characterized by different periods as the occupation of the city, the beginning of the environmental and urban deterioration of the city, the deterioration phase and the beginning of the recovery of the city and the real estate investments in central areas and speculation in per-central zones [Nunes, 2015].

The urban growth process of Maputo, called Lourenço Marques, in the colonial period was characterized by the centrifugal force of the port, the railway and the growing of economic activities in the region. In the Portuguese colonial times was established a hierarchical urban system centralizing urban facilities and services, while in the post-colonial period the economic crisis and the civil war triggered the creation of informal settlements in the periphery of the former colonial city.

Colonial Maputo

Xilunguine, Maputo before the commercial and trading period

Since the first century, there were human settlements located where the capital of Mozambique was established. These former settlements were integrated by communities settled temporally in this place to survive from fishing and hunting activities [Jenkins, 2009]. It was not until the 9th century when communities established permanently in the place to find possibilities to survive based on commercial activities related to interchange of goods with East Africa and even with the Persian Gulf.

The regional and inter-oceanic trade activities was the cause for the “discovery” in the 15th century of the place that today is called Maputo Bay, the Portugues navigator Lourenço Marques was the first European navigating the bay in 1544. From that moment, temporary settlements related to commercial and trading activities were established in the area by Dutch, British, Austrian and French, however the Portuguese were the ones who es-

tablished, in the last years of the 18th century, the first permanent settlement as the most important trading station in the area [Jenkins, 2009].

The Portuguese changed the economic, social and political structures of the indigenous settlements in the region while English people started the colonial process where today is South Africa. For this reason in the 19th century the Portuguese established agreements related to boundaries for the creation of the formal colony and the subsequent resistance from some of the indigenous communities in the North and South against the Portuguese domain.

From the end of the 16th century to the late 19th century the settlement was established in the North side of the bay as a safe place surrounded by fortified walls as a protection from attacks as a fortress with a more organic growth around the central square and inside the walls. For these reasons the first morphology of the settlement is a clear manifestation of the influence of the Portuguese domain in what today is Maputo and as the first piece of the subsequent urban mosaic.

While commercial activities evolved to the commerce of different kind of products the settlement started to grow and the Portuguese expand its domain in the area establishing a land control in 1858 as a way have more income for the Portuguese state increasing its power over local clans also involved in trading activities. In this period of time, was established what it can be called the first small town with an administrative control and military defense created by the Portuguese.

The beginning of the Portuguese colony and the establishment of the city

The discovery of gold in the

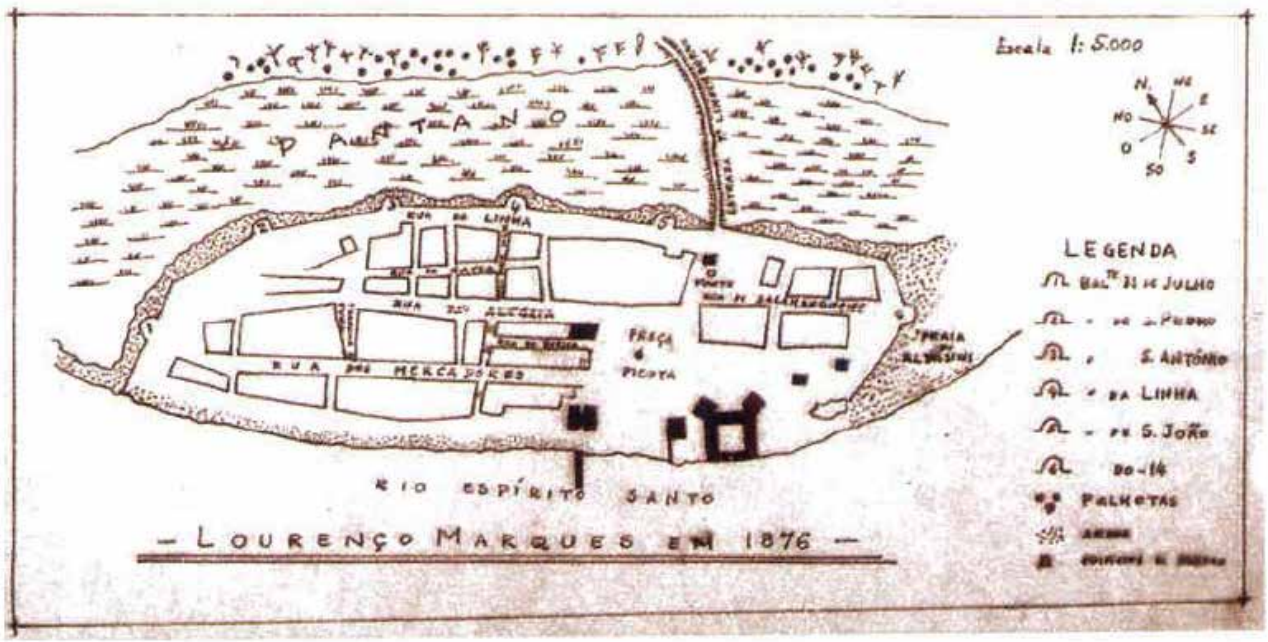


Figure 5: The initial permanent settlement and early 'city centre', 1876. Source: Jenkins, 2009

interior of the country was the fundamental reason to create a link to the port as the main element in the articulation of the commercial activities in the area. The construction of infrastructure was one of the first steps to extend the colony, started with the construction of roads and the plan of a railway to connect the port with the Transvaal area, which was completed in 1886.

The settlement started to grow and in 1876 was denominated as a town and officially as a city in 1887 when it became the main port connected-to the economic activities related to mining in the interior of the region. In that moment, the so called city started the expansion in the surrounding swamp areas and also in the higher land, again, when the infrastructure was built to give access from the city to the new urban area. The Portuguese colony created the land registry and the Ministry of Public Works developed the formal plan for the expansion of the city as an instrument to order the grow of the city around the central square and following the "grid-iron layout" [Jenkins, 2009].

The plan was implemented after ten years and completed in 1880. Now the small town became in a city called Lourenço Marques, in honor to the Portuguese navigator with the same name, which grew rapidly at the end of the 19th century. In that moment the colonial city was integrated by fundamental elements as a new church, a hospital, a cemetery and a formal dock for steamship traffic. The city grew from the central square to the swamp areas creating landfills for new residential areas as well as for the connection of the new railway to the port. The expansion of the city represented an important income for the Portuguese government, the land leasing and sale of the areas close to the new planned urban circumference which was the base for the emergence of new economic activities related to new investments and the development of the real estate speculation. By 1887, the Portuguese colony dominated the territory and the indigenous population organized in clans, strengthening the military presence in the region expanding its control to the Northern areas in the last decades of the 19th century.

The official power of the Portuguese colony was demonstrated with the establishment of the city of Lourenço Marques as the capital of the country in 1895. "The emerging capital city could boast a planned grid-iron network of roads and land registry for urban development and soon also had further key public buildings: the Municipal Market, main Post Office, Public Works, Tax Office, Customs House, Hospital, Police Station, Port Captaincy Building, National Press Building, main Railway Station, Law Courts etc. - and several other major commercial and private buildings (including banks, shops and the British Consulate)." [Jenkins, 2009].

However the areas outside the circumference were informal set-

tlements with a characteristic organic growth linked to the planned area characterized by the straight grid. In 1903 a new urban plan proposed the improvement of the railway and the new residential areas around the city, nevertheless the investment and new development was concentrated in the established central area of the city expanding the orthogonal pattern based urban fabric to existing roads. This new plan for the city was the key of the development of the city in the early period of colonial city development. The city started to experience issues related to erosion and drainage but the city center preserved the character of the social, cultural and political heart of the region and as the concentration of the "state-oriented economy" of the colony." [Jenkins, 2009].

The informal urban growth beyond the limits of the planned city was undeniable. For this reason the plan from 1940 faced the challenge to integrate formal and informal as a whole city, however the formal and informal, the legal and illegal were difficult to int grate because African people were not allowed to own land until 1961, denying possibilities to the new population attracted to the city looking for opportunities to work and improve its lifestyle.

The urban expansion and the state control in the colonial period

In 1940, the African population surpassed the Portuguese pop-

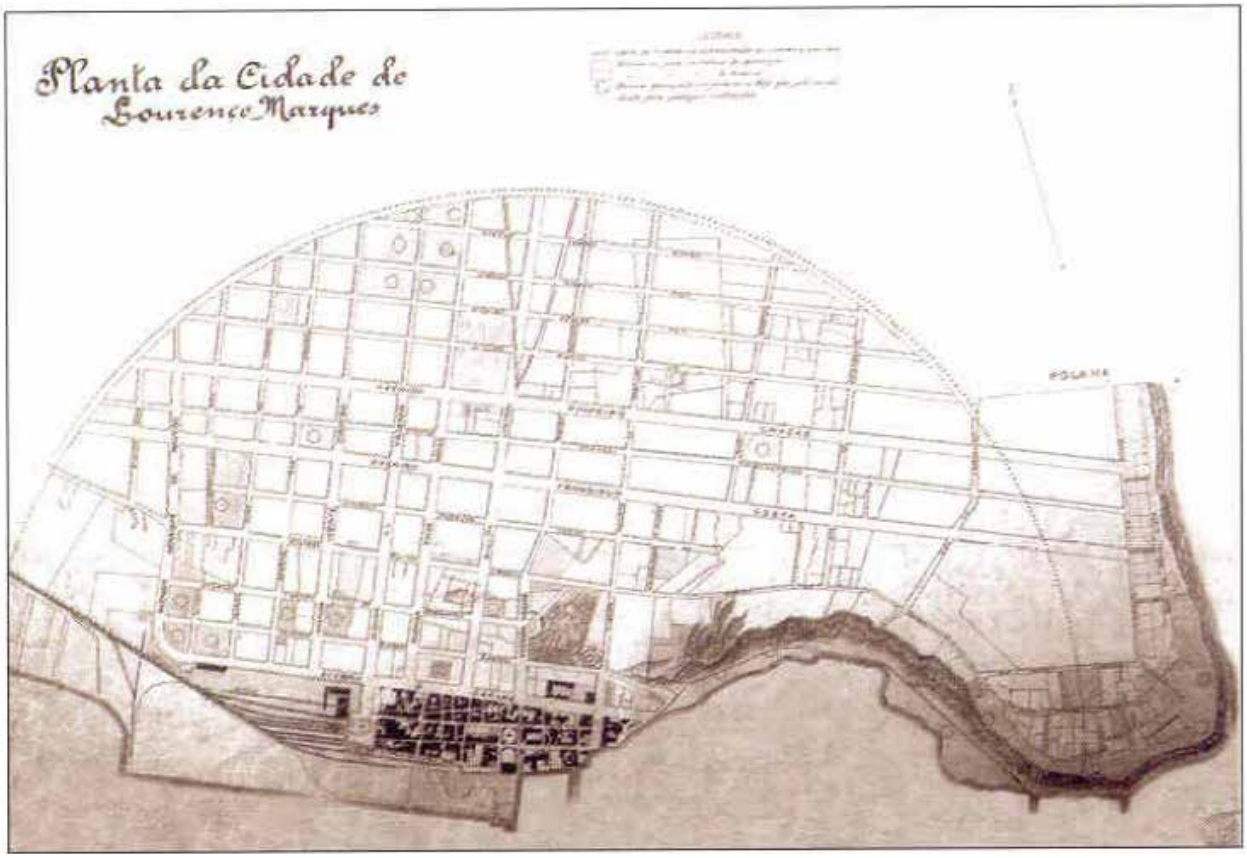


Figure 6: The 2 km radius layout, the initial permanent settlement and early 'city centre', 1876 (Source: Jenkins, 2009)

ulation. However, the African people were displaced to the outskirts of the city center where there were no services and facilities, while the high income population started to occupy the Northern areas beyond the informal settlements established around the city center, which was the point of confluence of new commercial and business activities.

The synergy between the two development forces in the city (formal and informal) was the main input for the formulation of the new urban plan, developed in 1940. In 1930 the population of the city grew over 20,600 inhabitants, in 1940 over 44,700, and in 1950 over 90,000 inhabitants [Jenkins, 2009].

In that moment the urban morphology reflected separation and the segregation in the colonial city, where Africans were confined to informal areas outside the city, Asians close to the commercial activities in the city center and even European population was divided by class and economic status. The densification of the city center started when the land became more expensive while the poorest people in the city continued with the occupation of the low areas without access to basic services and in high risk of being affected by flooding events, however the informal areas were increasingly consolidated as urban areas which was not taken in account in the new urban plan for the city in 1952 developed in Portugal by the Urban Planning Office for Overseas Territories considering

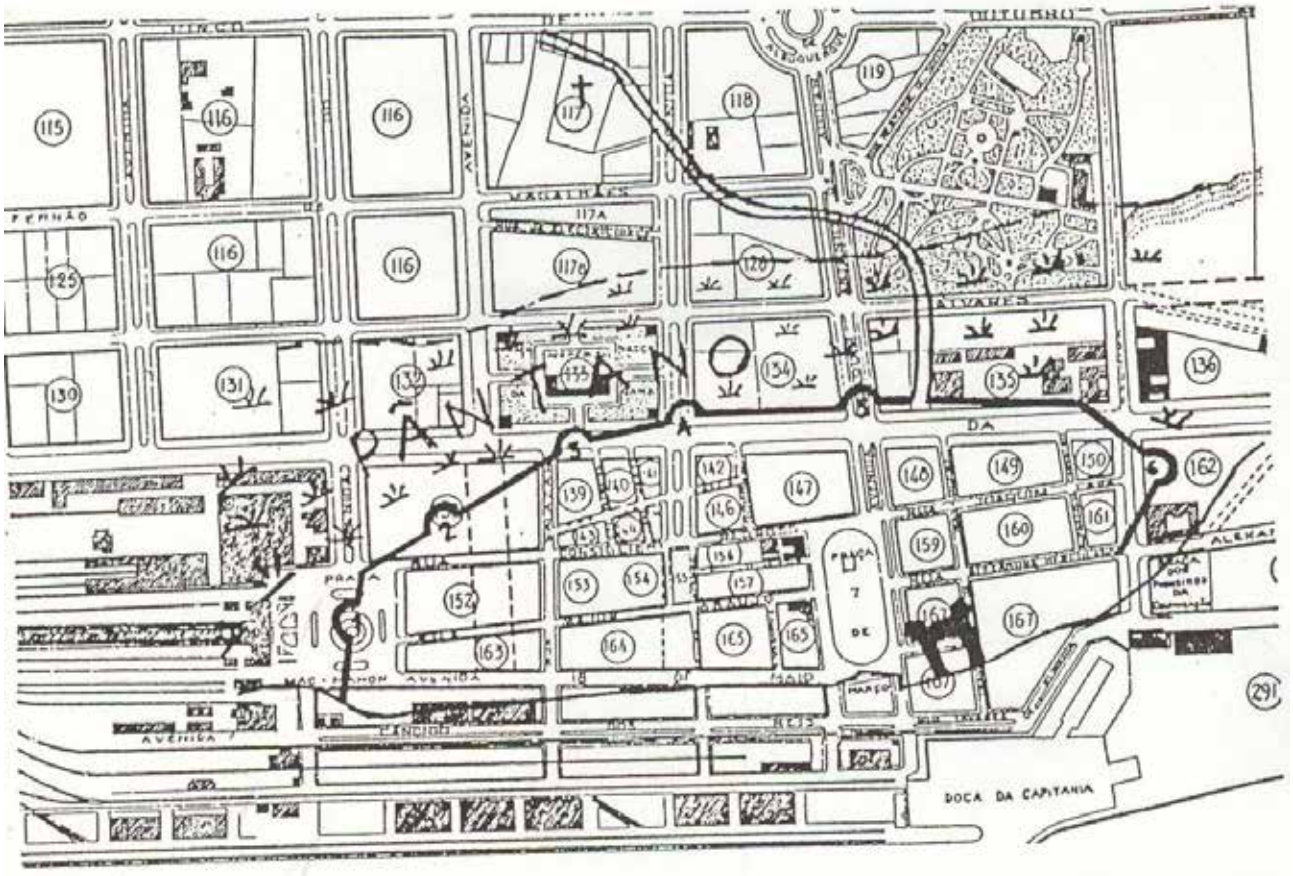


Figure 7: showing the relation between the original settlement and the new city centre. Source: Mendes, 1985

these areas as potential areas for urban expansion and envisioning new monumental civic buildings which were never built. This plan reflected the new European ideas about modernist generic urban development which was not according to the economic and political conditions of the context deriving in a land speculation over the new urban areas around the planned new axis connecting the city center to the coast.

THE END OF THE COLONIAL PERIOD AND THE PREDOMINANCE OF THE PRIVATE INVESTMENTS

In 1960, the implementation of the plan from 1950 was abandoned and it was created a local Urban Planning Office for the development of the new plan for the city which started to be conceived as a city-region integrating the new urban center in Matola where new large scale industries were established close to the new port.

In contrast to previous plans, the new plans were functional and related to land use, transport systems and new developments according to the context, which was the support of the new master plan developed by the Portuguese urban planning engineer Mariode Azevedo. The Azevedo plan was approved in 1972 and includes proposals to upgrade the informal settlements close to the city center. The areas for urban expansion were limited and the construction of high rise building in the city center started triggered by new investments coming from the private sector and the state.

"However, although this late colonial period of urban development was much more closely based on an improved understanding of the reality of the fast growing city, it - crucially - ignored the wider political context of the liberation wars.

By the time the 1972 urban plan was published major new investments in city expansion to the northeast (liberated when the Sommerschield concession dispute was resolved), such as the vast Bairro Kock including a new railway shunting yard with its associated industrial area and new upper income housing north of the existing formal city area, were being abandoned due to the prevailing political and economic climate in Portugal.

The April 1974 Carnation Revolution led to the abrupt decolonization of the country and handing over of power to the coordinated liberation front FRELIMO, with limited violence, but significant exodus of the settler population.

The city thus went through a period of stasis in its formal development, but concurrent peripheral development as many of its indigenous residents - often heads of households on their own - opted to bring their families in from rural areas to join them, rapidly expanding the 'caniço' and reoccupying areas which had recently been clear through relocation program for the 1970s formal urban development." [Jenkins, 2009].

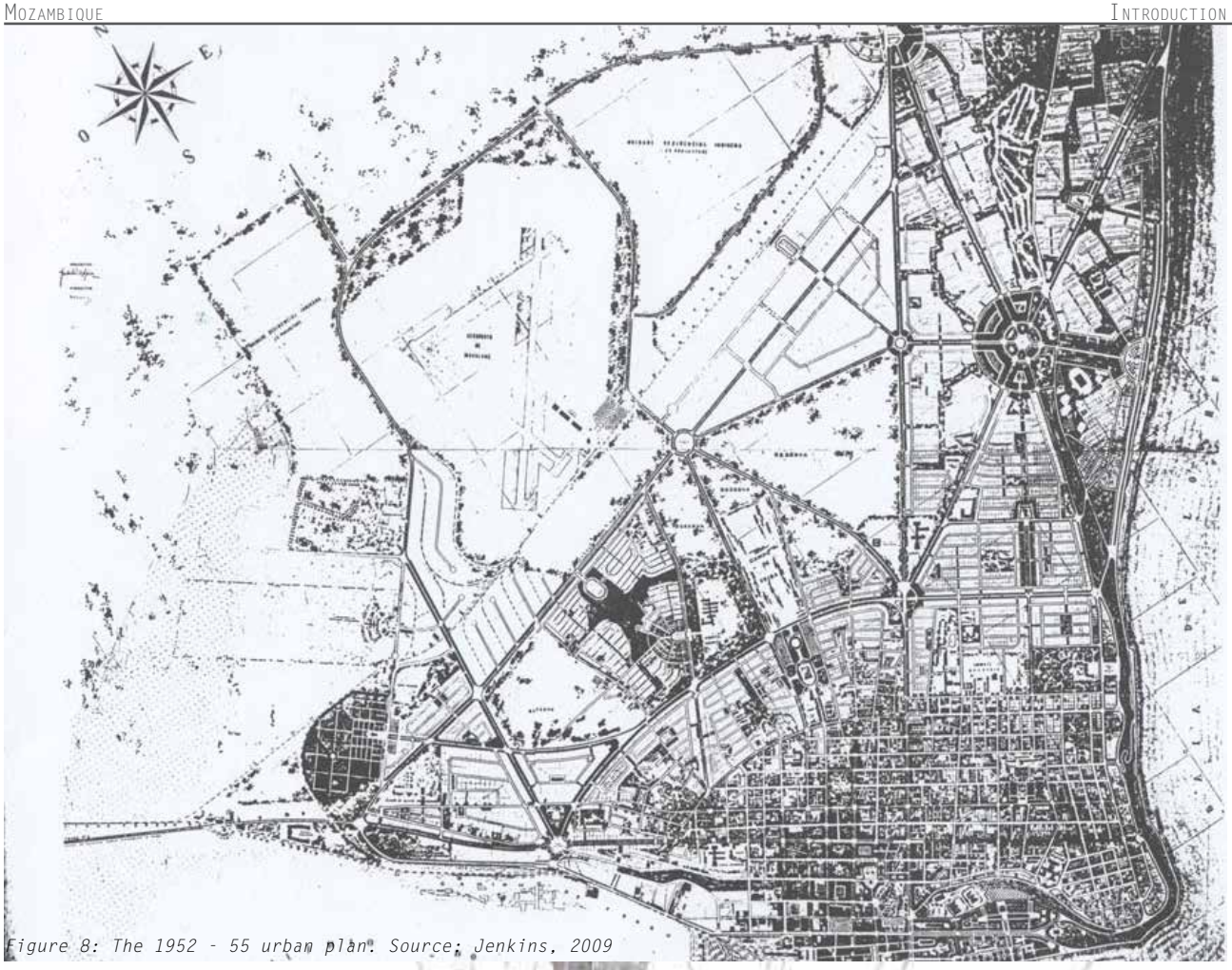


Figure 8: The 1952 - 55 urban plan. Source: Jenkins, 2009

Figure 9: The 1972 city plan. Source: Jenkins, 2009

Post-Colonial Maputo

Post-colonial period and the occupation of the city

After the independence the city was almost abandoned by the Portuguese and the area in the city center was available. The socialist-oriented new government nationalized the abandoned buildings which were occupied by local inhabitants and the new members of the government as a way to integrate the Mozambican population in the administrative structure of the new state. In 1980 the informal economic activities emerged as a response to the lack of jobs in the formal sector, in that moment the city almost stop the formal urban development and the informal urban development was increased, the population of the city grew rapidly in the peri-urban areas.

In the post-colonial Maputo the informal activities and development domain, "the trade markets, though conducted under supervision of the Directorate of Urban Services, was the largest sub-sector of the "informal" sector in Maputo, absorbing about 30 per cent of the "informal" workforce. It played a key role in the supply chain which ensured the survival of the townspeople." [Nunes, 2015].

In 1980 the City Council Urban Planning and Construction Department developed a structure plan for the city as an instrument to control and contain the informal urban expansion in the outskirts of the city. The plan was never approved and the city experienced an accelerated growth due to the civil war and the displacement of people from rural areas to the city, generating an intense densification process in the peripheries and the city center.

After the end of the civil war in 1992, the constitutional changes,

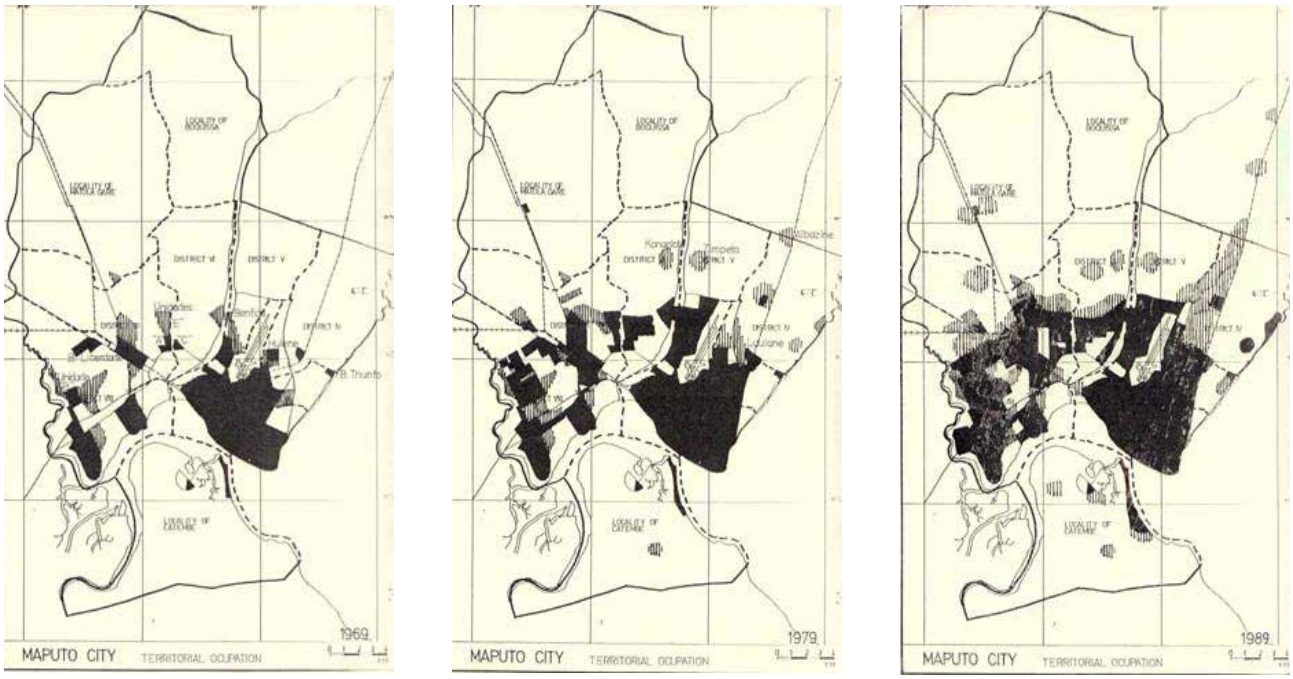


Figure 10: Land use in 1969, 1979 and 1989 showing rapid peri-urban expansion and densification. Source: Jenkins, 2009

the emergence of the neoliberal economy and the democracy changed radically the way the city was being developed in that moment.

ENVIRONMENTAL AND URBAN DETERIORATION OF THE CITY

The deterioration of the city was visible in the decreasing conditions of urban facilities and services as water supply, waste collection, sewage treatment system and drainage system, which combined with the increasing population in the informal areas contributed to the environmental deterioration of the area.

As it happened in the past, the economic, political and social transformations influence directly in the urban form of the city and reflected in the deterioration of the urban living conditions. The city continued growing demographically and physically without control, increasing the urban poverty and the rising of the new private housing market as a response to the needs of the new high income class, which started the development of the areas not suited for urbanization as wetlands, swamp and coastal areas.The crisis of the city after the socialist government demanded the improvement of the infrastructure and urban facilities in the existing and the new residential areas.

In 1990 the World Bank sponsored the development of the new Metropolitan Structure Plan for the urban expansion of the city, including the emerging urban areas in the Matola district and the surrounding areas in the Maputo province which integrated the so called Greater Maputo. This was the first step in the environmental recovery of the city and the densification of the colonial grid leading to the improvement of the existing formal urban areas and concentrated efforts to reduce the expansion in the peri-urban areas.

"Most recently a new structure plan has been produced for the Maputo city council by the university and one for Matola is being developed, to a great extent re-cycling and updating the 1999 metropolitan plan. These most recent plans, however, focus predominantly on projected land use and are not based on in-depth empirical studies of city and city-region functions such as transport and investment trends. However they may serve as the basis for application of the fairly recently approved planning law and urban land use regulations to permit more orderly urban land development. During this period the city center 'came back to life' with rapid intensification of commercial and cultural activities including informal retail. Many old tourist facilities have been re-developed and new ones built." [Jenkins, 2009].

REAL ESTATE INVESTMENTS AND SPECULATION IN THE PERIPHERY

Nowadays the urban planning instruments are addressing the urban expansion of the city focused in the improvement and development of infra-

structure, public services as water, electricity, sanitation, waste management and public transport system. The Structural Plan for the Metropolitan Area of Maputo envisioned the densification of the existing urban areas and the expansion towards the North.

"The city center of Maputo is definitely once again in transition, with strong international investment in the built environment which seems strangely de-linked from the world recession. In this the balance of power between the state and the market in determining urban form has swung once again to an extreme, and the state's presence is largely absent with virtually no planning and/or construction control. In fact the state at national level is a promoter of inward investment and facilitates this in the locality of the city, the new independent city council playing a minor role in both promotion and regulation. In this, the wider lower income population of the city, which came to occupy spaces in the central 'Baixa' in the proto-socialist initial post-Independence period (such as low-income residents in state rented properties that have not be bought out, informal vendors and homeless kids) are likely to be soon pressurized out. This – as in all previous manifestations of the city center – reflects the political, social and economic realities of the context, now with quite extreme forms of socioeconomic polarization, weak local political and governance structures and elite-focussed speculative development." [Jenkins, 2009].

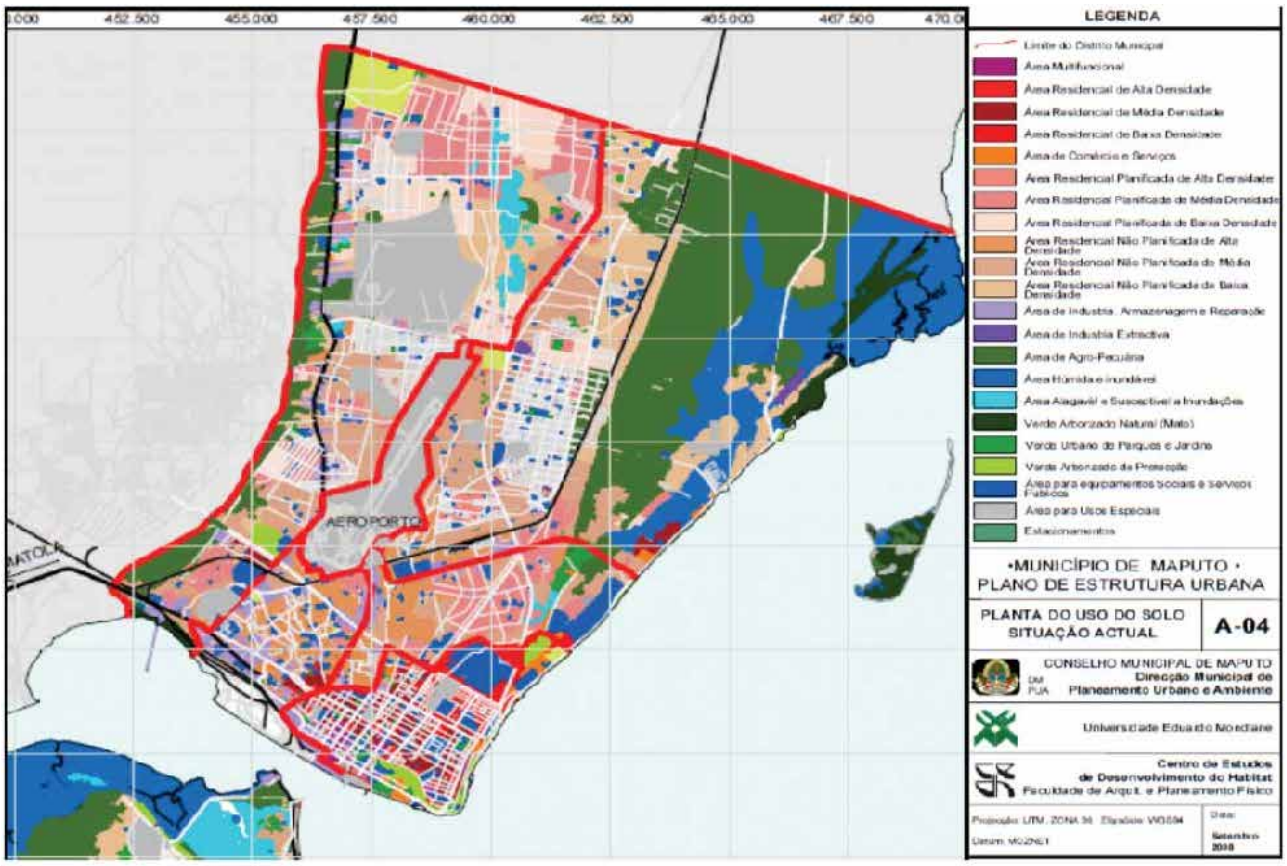


Figure 11: The Urban Structure Plan for Maputo Municipality - PEUMM (Source: Conselho Municipal de Maputo, 2008)

Gross Domestic Product

Mozambique is classified as a Sub-Saharan low income economy and is one of the poorest economies in the SADC region, despite having extensive natural resources. It is a "lower-middle-income country with a small-sized economy" making it the 128th largest economy by nominal Gross Domestic Product (GDP). The discovery of natural resources increased the country's social gap while witnessing large investment pouring in, but, after Felipe Nyusi took over presidency from Armando Emilio Guebuza, a hidden debt surfaced. "The 'Hidden debts' refer to loans of over 1.1 billion US dollars from European banks (Credit Suisse and BTV of Russia).

Mozambique was at an exponential growth; prior to Guebuza's intervention. Investment was abundant and the growth of the country was promising; in other words, the nation "went from being lauded by the IMF's Managing Director Christine Lagarde to being ravaged by a combination of excessive borrowing, plummeting commodity prices and delayed investments in massive natural gas files." The majority of the country that was already living in poverty is now living below the poverty line. The country's overall make-up is in bad state. Finance Minister Adriano Maleiane and President Felipe Nyusi are delaying payments until the country's financial stability is minimally restored through "profiting from offshore gas fields that were discovered by Anadarko Petroleum Corp. and Eni SpA at the start of the decade."

The government plays a large role in the success of a nation and its stability. In many African countries, corruption is immensly elevated; where the needs of the people are completely overlooked.

Figure 13: The Gross Domestic Product GPD in Mozambique. Source: Trading economics

AFFORDABILITY

Source https://www.cgidd.com/C-GIDD, 2019

The government is the largest local institutional investor in affordable housing in Mozambique. The government's main support for the housing market is the Fund for Housing Promotion (FFH), which is supervised by the Ministry of Public Works, Housing and Water Resources (MOPHRH). The FFH was created in 1995 and has a broad mandate to offer housing and construction finance, and to develop housing through public-private partnerships. FFH does not offer independent mortgage products. Its current business model is to build housing and sell it to targeted population groups through a 20-year payment program and fixed interest rates (old data from 2008 suggests these rates range between 5 percent and 10 percent).

Given the above factors, much housing construction is financed through short- and medium-term consumer loans (up to five years) of up to MT300 000 (US$ 4 839) at interest rates of 20 to 25 percent. This is still cheaper than the rates provided by micro-finance institutions. The value of housing construction loans is growing at approximately 10 to 15 percent a year. The banks do not control the application by the user of the funds and so no information is available on the volume of credit used for housing construction.

Demographic Data

Population

Analyzing the population growth of Mozambique, we can see that population growth is not a new trend. The population growth started earlier even before the civil war. The steep growth rate of Mozambique is above 2% and it's predicted to stay for at least the next 50 years. (World Population Review, 2020)

Mozambique 2020 population is estimated at 31,255,435 people at mid year according to UN data. The current population is 30,868,013 based on Worldmeter elaboration of the latest United Nations data, where 38.3% of this population is urban (11,978,439 people in 2020).

Mozambique population is equivalent to 0.4% of the total world population and it ranks number 46 in the list of countries (and dependencies) by population. The population density is 40 per Km2, calculated on a total land area of 786,380 Km2.

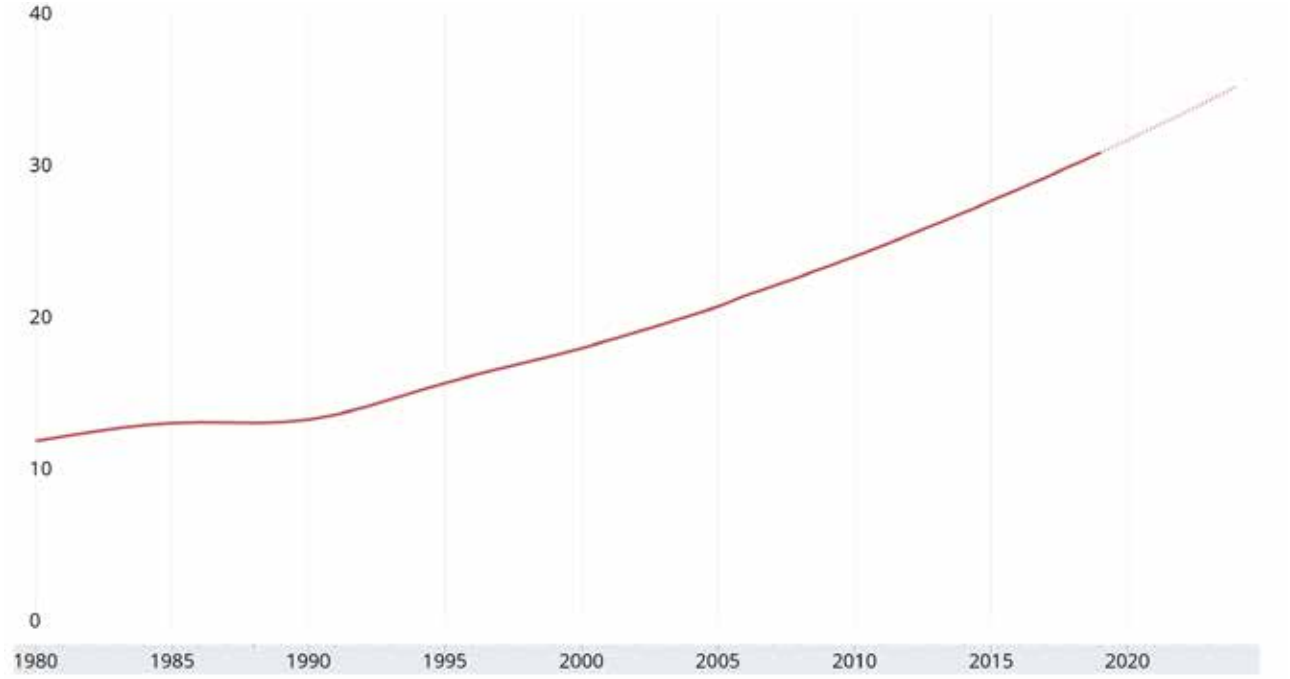


Figure 14: Mozambique Population. Source: Worldometers

Figure 15: Year population Growth Rate %. Source: Worldometers

Mozambique's rate of population growth, though high by world standards, is lower than that of most other African countries. The country's infant mortality rate is among the highest in the world, 44.9 per 1,000 live births. Moreover, average life expectancy is among the lowest in the world (62.13 years), but comparable to that of other southern African countries. As in most African countries, Mozambique's population is young - more than two fifths are under the age of 15 and two fourths under 25 - the median age is 17.6 years.

In 2020 the percentage of males in Mozambique is showing slightly less than the female percentage, with 48.6% for males and 51.4% for females. The population pyramid of 2020 is almost symmetrical with small differences. (Worldometer Mozambique Population, 2020)

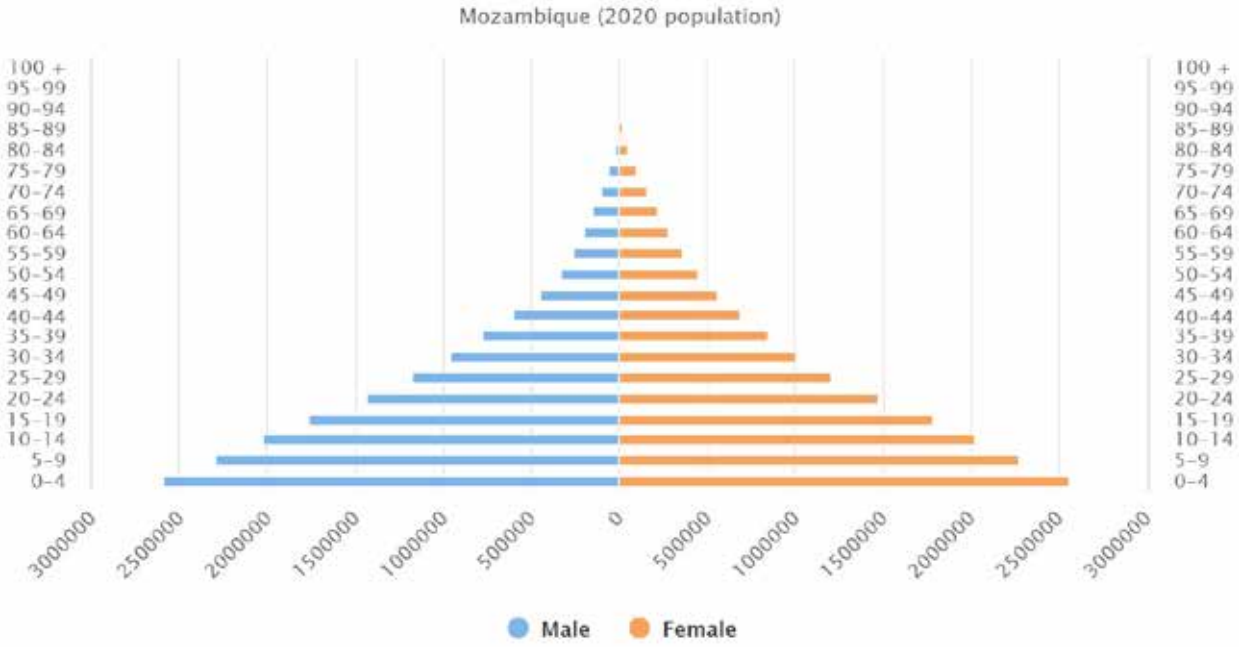


Figure 17: Female Male Age Structure. Source: Worldometers

Settlement Patterns

In Mozambique, the settlements usually are concentrated in the areas with the best soils and climate. In drier areas, the settlements are smaller and they usually plant crops to create a safer environment. And to reduce the danger of floods, drought or other natural disasters. (Encyclopaedia Britannica)

As for the historical changes of the settlement patterns, they were changing according to the circumstances. In the colonial period, the Portuguese tended to build denser communal settlements. Meanwhile, the farmers preferred to spread and scatter their settlements were harder to control, and to provide services to. In 1940

the African population surpassed the Portuguese population, and the African people were displaced to the outskirts of the city centre where there were no services and facilities. While the high-income population started to occupy the Northern areas beyond the informal settlements established around the city centre, Which was the point of confluence of new commercial and business activities.

After independence, more people moved towards urban areas. The government tried to reduce the population of an urban area by forcing people to go back to rural areas without any jobs. However, this attempt to reduce the population of urban areas was a failure, people went back to the city which they were removed from (Encyclopaedia Britannica).

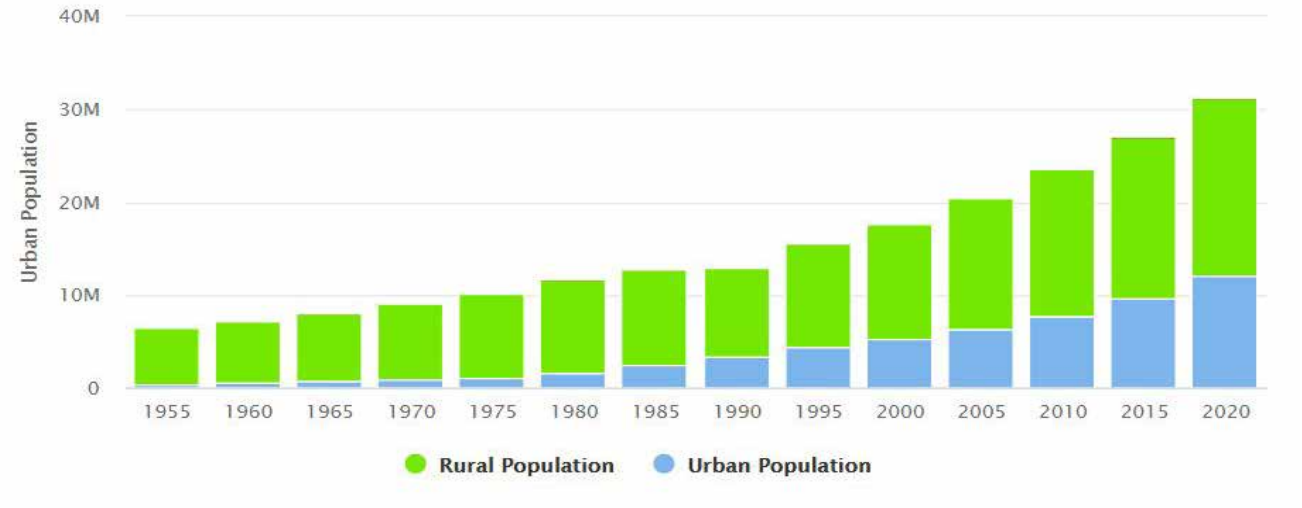


Figure 18: Mozambique Urban Population. Source: Worldometers

SLUMS

According to the Oxford dictionary, a slum is defined by "A squalid and overcrowded urban street or district inhabited by very poor people." As stated in Affordable land and housing in Africa (2011) "At household level, slum is defined by 5 different indicators, known as "shelter deprivation":

• Durability: A house is considered 'durable' if it is built on a non-hazardous location and has a structure that is permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold and humidity.

• Lack of water: A household is considered to have access to improved water supply if it has sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort.

• Overcrowding: A house is considered to provide a sufficient living area

for the household members if not more than three people share the same room.

• Lack of sanitation: A household is considered to have access to 'improved' sanitation if it has a private toilet or a public toilet shared by a maximum of two households.

• Secure tenure: is the right of all individuals and groups to effective protection by the state against forced evictions."

Housing that is characterized by one or more of the above shelter deprivations is defined by UNHABITAT as inadequate.

Such housing, which is in poor condition or situated in a very high density area, is catered at a cost that low-income households could most probably afford; but such settlements are never healthy or comfortable places to live.

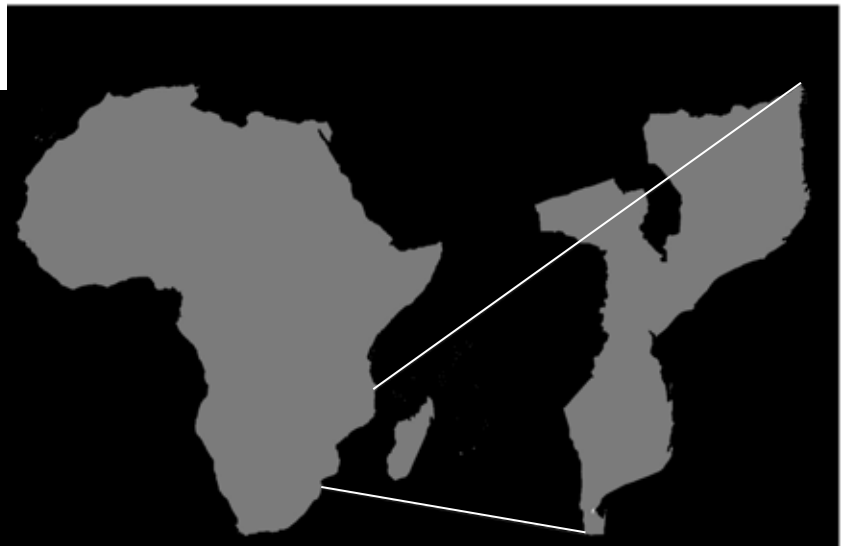
Population living in slums (% of urban population) in Mozambique was reported at 80.30 in 2014, according to the World Bank collection of development indicators, compiled from officially recognized sources. Its highest value over the past 24 years was 80.50 in 2009, while its lowest value was 75.60 in 1990.

Figure 19: Affordable housing in Maputo. Source: Vladimir Gintoff Archdaily

Part ii

Location/site analysis

Mozambique



- South-East Africa
- Capital City Maputo
- 786,380km² Land Area
- 31,172,530 Population
- Portuguese and a number of the Bantu languages
- Tropical to Subtropical climate with some semi-arid regions

- Urban 38.3%
- Rural 61.7%
- Female 51.4%
- Male 48.6%
- 0-14 44.1%
- 15-64 52.9%
- 65+ 3%
- Christians 56.1%
- Muslims 17.9%
- Others 26%

Population

- 0.39% of world population
- 40/km² population density
- 2.93% population growth rate
- 37.88/1000 birth rate(2017)
- 8.964/1000 death rate(2017)
- 17.6 years median age
- 70% live under poverty line
- 25.04% unemployment rate(2017)

Education

- 60.66% literacy rate 15+(2017)
- 70.91% literacy rate 15-24(2017)
- 65.49% literacy rate female 15-24(2017)
- 77.26% literacy rate male 15-24(2017)
- 78.36% labor force 15+(2019)
- 52.13% labor force female (2019)

Land use

- 786,380km² mainland area
- 2,739km² urban area(2010)
- 769,595km² rural area(2010)
- 63.5% agricultural land(2016)
- 21.59% terrestrial protected area(2018)

Health

- 2.2million HIV positive(2018)
- 12.6% HIV positive 15-49(2018)
- 54,000 HIV/AIDS related deaths(2018)
- 27.1% contraceptive prevalence 15-49(2015)

Services

- 27.43% access to electricity(2017)
- 49% access to clean water(2017)

Figure 20: Provinces and their capital city

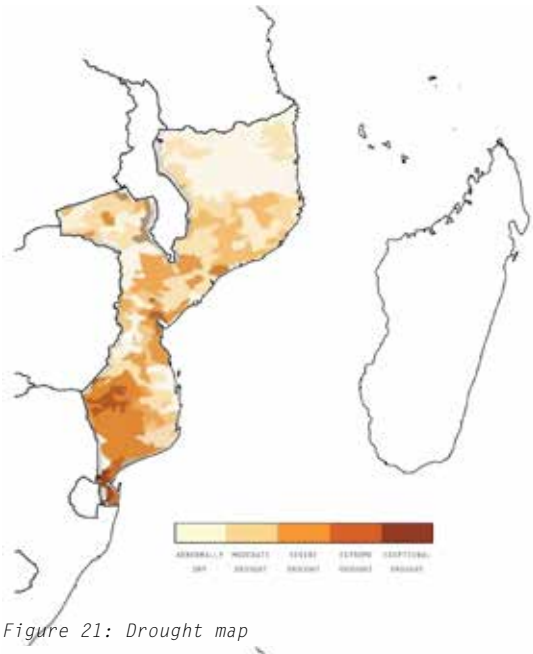


Figure 21: Drought map

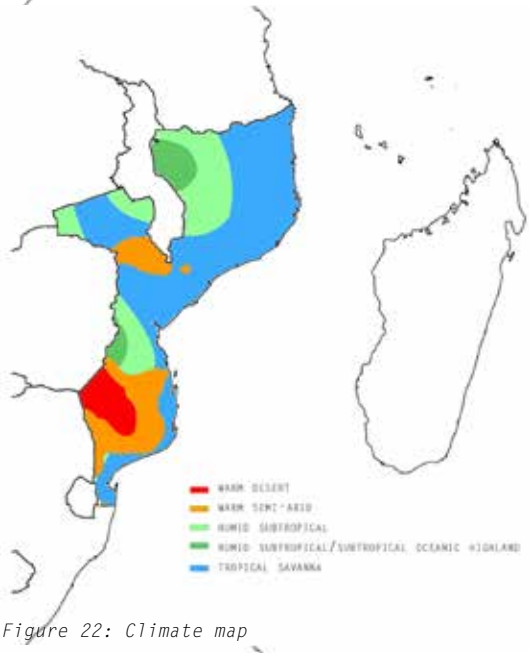


Figure 22: Climate map

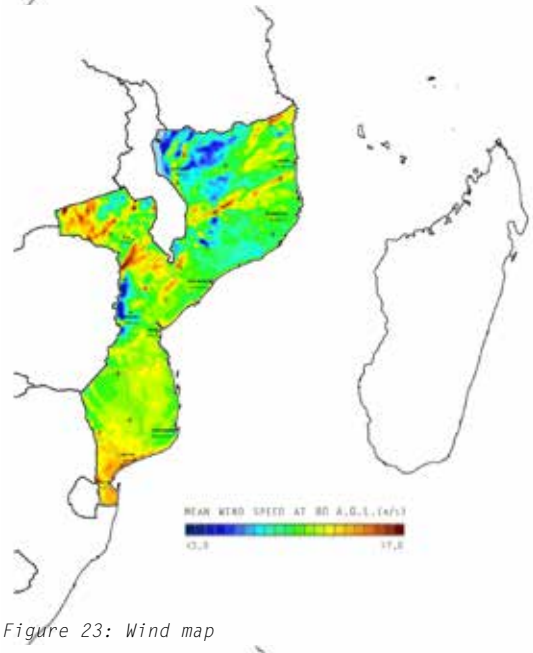


Figure 23: Wind map

Figure 24: Vegetation map

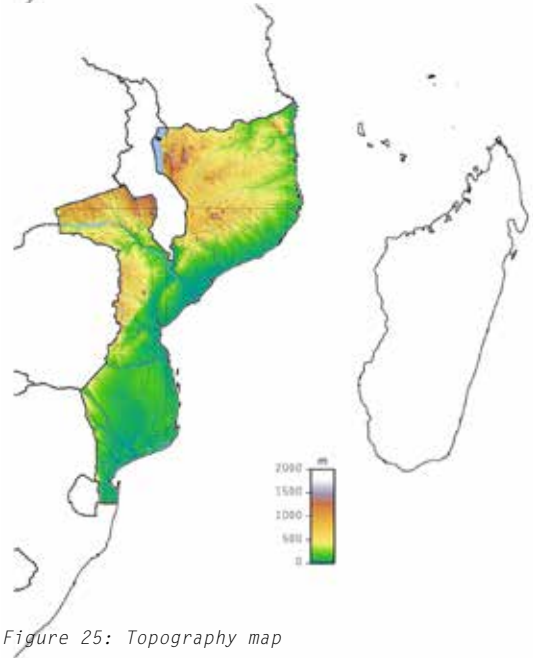


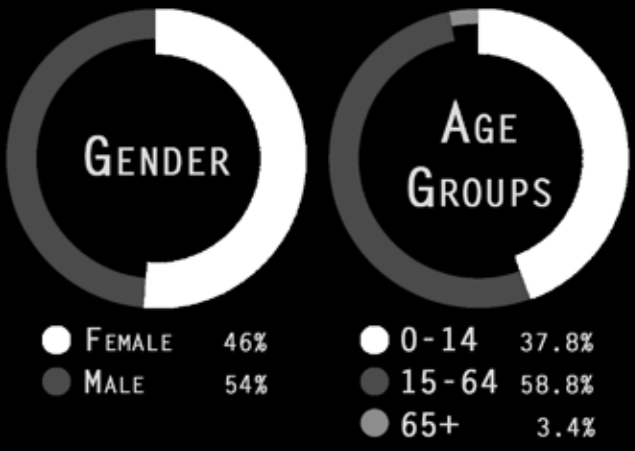
Figure 25: Topography map

Gaza Province

- Southern Mozambique
- Province Capital Xai-Xai
- 75,709km² Land Area
- 1,422,460 Population
- Points of interest: Bilene, Xai-Xai, Limpopo National Park
- Tropical to Subtropical climate with some semi-arid regions

Xai-Xai District

- Southern Gaza Province
- Formerly João Belo
- 1,908km² Land Area
- 127,366 Population
- Points of interest: Praia do Xai-Xai, Xai-Xai Eco Estate, Praia de Chongoene
- Tropical savanna



Xai-Xai District

Xai-Xai (pronounced 'shy-shy,' and known during colonial times as João Belo) is the capital of Gaza Province. It was developed in the early 20th century as a satellite port to Maputo, although its economic significance never approached that of the national capital. Running just south of Xai-Xai is the Limpopo River of Rudyard Kipling fame. It's Mozambique's second largest waterway, with a catchment area of more than 390,000 km2 and drains parts of Botswana, South Africa and Zimbabwe as it makes its way to the sea. Despite its size, water levels vary dramatically throughout the year, leaving some sections as just small streams during the dry winter months. The wetlands around Limpopo's lower reaches are rewarding birdwatching areas, and are most accessible near Zongoene.

The town is a market centre for cashew nuts, rice, corn (maize), cassava, and sorghum raised in the surrounding area, which is irrigated by the lower Limpopo irrigation project; dairy cattle also are raised.A light railway system runs inland and provides access to the port, which has declined in importance since the silting in of its harbour and because of competition from truck transport. Xai-Xai is connected to Maputo, the capital of Mozambique, by the major north-south road along the coast of the Mozambique Channel.

Xai-Xai District is a district of Gaza Province in south-western Mozambique. The administrative center of the district is Chongoene. The district is located in the south of the province, and borders with Chibuto District in the north, Manjacaze District in the east, Bilene Macia District in the southeast, and with Chókwè District in the west. In the south, it is bounded by the Indian Ocean. The area of the district is 1,908 square kilometres.

Figure 26: Location. Source: Competition Briefing

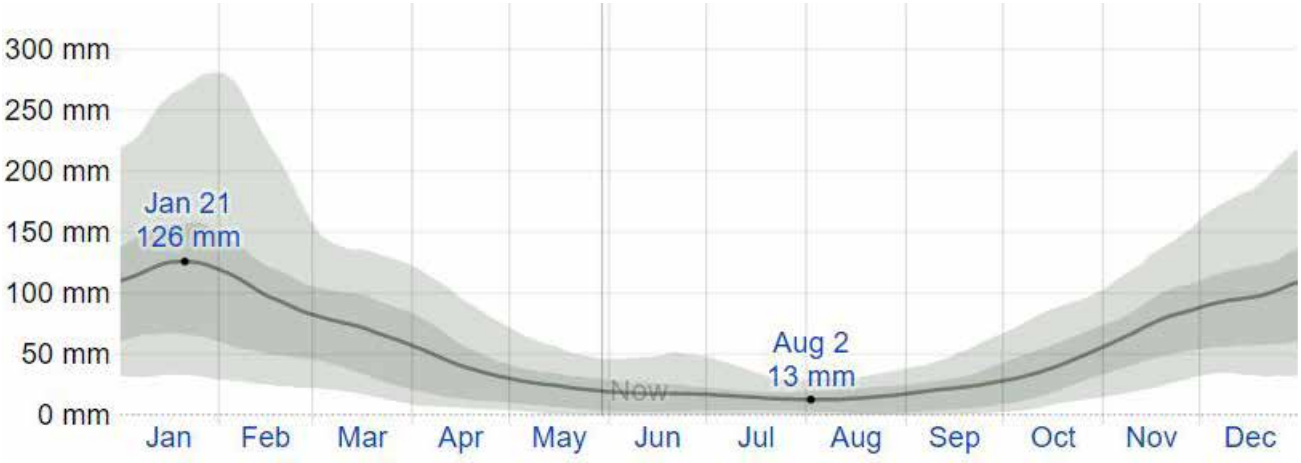
The school will be located in a plot between the cities of Xai-Xai and Chongoene, approximately 1 km away of the road that connects them.

Mozambique has a tropical to subtropical climate, with some semi-arid regions in the southwest of the country. The east consists of lowlands while the west is more mountainous. It has a coastline of 2,700 km. Average temperatures are highest along the coast as well as in the south of the country (20-26°C) and lower in high inland regions. There are seasonal temperature variations, with a

cool dry season from April to September (coolest months are June - August) and a hot humid season from October to March (warmest months are December - February).

Rainfall is highest in the north (1,000 mm/year) and lowest in the southeast (500 mm/year), but also varies according to topographic features - with most rainfall in higher areas and along the coast (800- 1,200 mm). The driest area of the country is the southern inland area, where some locations receive only 300 mm of rainfall per year.

Rainfall mainly occurs during the hot season, from November to April - with the majority falling between December and February. The north receives 150-300 mm of rainfall per month during this season, while the south receives 50-150 mm per month.



The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

The rainfall accumulated over a sliding 31-day period centered around each day of the year is shown in the figure above. Xai-Xai experiences extreme seasonal variation in monthly rainfall.

Throughout the year in Xai-Xai, the most rain falls during 31 days centered around January 21, with an average total accumulation of 126mm. The least rain falls around August 2, with an average total accumulation of 13mm.

The site has a rhomboidal shape. The long sides measure 82,58m and 76,96m, and the short ones 34,41m and 37,83m.

The principal road that connects the cities of Xai-Xai and Chongoene is 800m northwest of our plot. The access road of the school will come from the northeast and will be located on the side that measures 76,96m.

The topography study reveals that there's a slight sope in the plot. The highest point has an altitude of 63m while the lowest point registers and altitude of 60m.

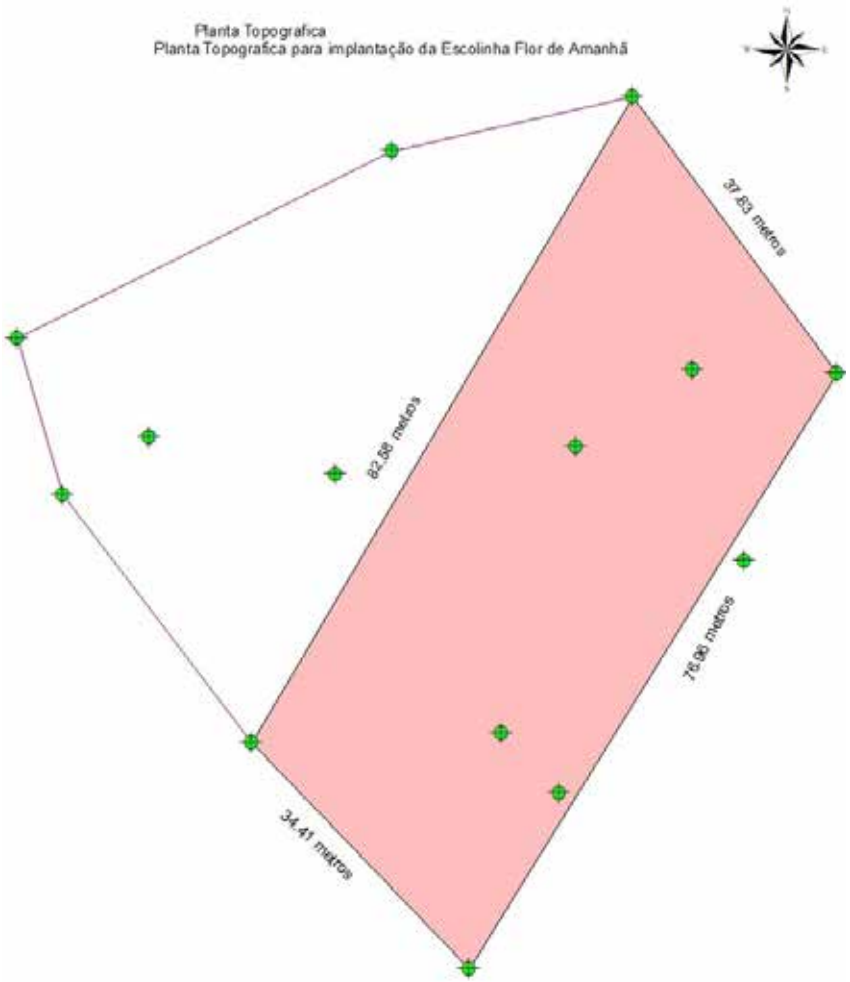


Figure 27: Plot Dimensions. Source: Competition Briefing

Figure 28: Plot Picture. Source: Competition Briefing

Figure 29: Plot Picture. Source: Competition Briefing

Politics History

Portuguese rule

Xai-Xai, formerly João Belo, developed in the early 1900s, under Portuguese rule, as a companion port to Lourenço Marques (currently Maputo), though its economic significance was never on par with Mozambique's largest city. Before independence from Portugal in 1975,
Xai-Xai was known as João Belo, in the Overseas Province of Mozambique. João Belo grew and developed under Portuguese rule as a port, agricultural and industrial centre (rice and cashew were harvested and processed), a provider of services, including a district hospital and banking, and an administrative centre. Tourism was also important with beaches and hotels. In 1970, the city had 63,949 inhabitants.

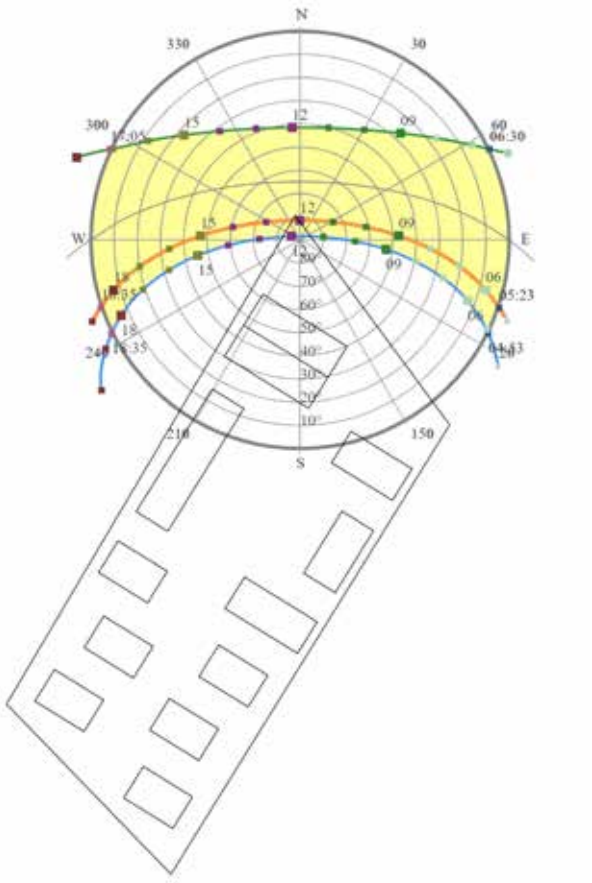
Post-independence from Portugal

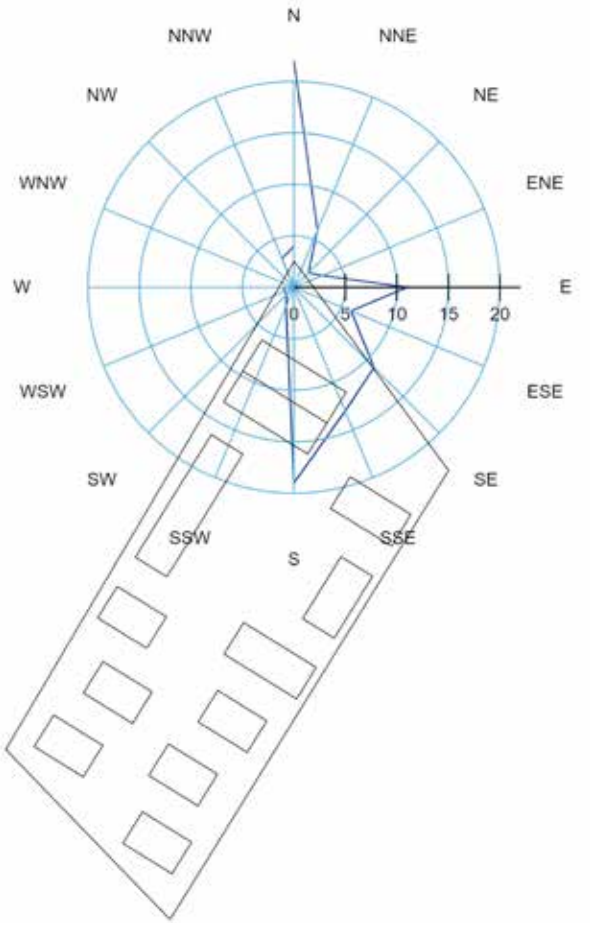
It was hit hard by the 2000 Limpopo floods, with some buildings 3 metres (10 ft) under water. However, shortly after the waters receded the town was opened for business again.

Infrastructure

3% of the households in the district have access to electricity.

There is a road network in the district which includes a stretch of the national road EN1, connecting Maputo and Inhambane, as well as secondary roads.





Part III

Including Children With Disabilities

Children With Disabilities

Early Childhood Care and Education is important; young girls and boys that attend quality early learning/preschool programmes are more likely to go to primary school on time. Their performance in school is better and have higher-skilled jobs in the future. Early Childhood Development refers to the rapid development across different domains - physical, socio-emotional and language, cognitive - that occurs amongst children under 8 years old. This development period is crucial and froms the basis of a child's future development into adulthood.

In Mozambique, one child out of five is not educated, an estimation of 1.2 million children do not attend school at all. Preschool is neither mandatory nor free to begin with. For those who go to school, study conditions are very different from the conditions of those in developed countries. The buildings, school equipment and facilities are in bad shape or even absent. Moreover, the classes have a majority of young boys because of the profusion of harassment and sexual violence in shcools toward girls.

In Mozambique, 14% of children between two and nine years old are disabled. They are often hidden away by their families and are vulnerable to discrimination as well as an increased risk of violence. These children need greater support from their families and better access to edu-

Figure 30: Childhood needs. Source: UNICEF

cation, which would enable them to attend school with their peers. But that can only happen if the necessary facilities, equipment and training are provided. Although there have been impresive steps forward in terms of school enrolment in the past years, only 40% of children who attend school complete their primary level of education. On average, they complete only 3.5 years of schooling. Lack of safe school spaces, early marriage and pregnancy are major reasons for children to not complete school. Around 40% of girls have given birth before they are 18 years old and half are already married.

Children with disabilities are often the most likely to not be in school for many reasons. Some because they are kept hidden home in communities where disability is stigmatized; some because their parents are unaware of the benefits that they will gain; some because the preschools are not adapted to be disability-inclusive and the educators do not have the skills to work with them.

Investing in Inclusion

Plan Mozambique's ECCE Programmes

Plan International Mozambique has made significant investments in Early Childhood Development (ECD) interventions that aim to support young children's growth, learning and development in a healthy and stimulating environment. These include support for expanded access to quality ECCE/preschools for children aged 3-5 years.

Plan's ECCE/preschool programmes focus on developing physical abilities; language, communication skills and cognitive skills (such as recognizing numbers and letters); socio-emotional skills; and the child's readiness to transition into primary school. Children attend the pre-school programme five days a week, from 8 - 11 am. The pre-school interventions are organized together with government institutions such as the Provincial Directorate of Gender, Child and Social Action and the Provincial Directorate of Education and Human Development.

Between 2015 and 2017, Plan International Mozambique worked together with communities supporting 106 preschools in rural Mozambique, with financial support from Plan International Finland. Plan International's aim was that these preschools should be community managed- and led and be inclusive, recognising that children with disabilities have the same rights to a healthy and stimulating environment for learning and development. Recognising that Plan International Mozambique had limited experience with regards to the inclusion of children with disabilities in ECCE, Plan entered into a partnership with Light for the World and Uhambo Foundation in late 2016, with the aim of piloting an approach to support community-based preschools to be disability-inclusive. The overall goal of this pilot was to increase the number of children with disabilities enrolled in ECCE centres that deliver quality early learning opportunities.

Inclusion Works - Case Stories

The preschools targeted in the past year demonstrated how actively working towards the inclusion of children with disabilities has made a difference to all community members. These are some examples of how carers of the preschools were able to adapt their teaching activities so that children with disabilities were able to participate more.

Figure 31: Helping her grandchild. Source: Plan International

Stella

Stella's impairment affects her ability to control her muscles which makes movement, speech and forming words difficult. The caretakers in the preschool, however, have found great ways of communicating with her by learning to understand the sounds that she makes and by using visual items or pictures when completing an activity. Stella takes part in all of the activities in her class: she points out numbers or shapes when her classmates say the name of the number or shape. Even though Stella cannot hold her balance to walk, she is able to pull herself up and balance by holding onto the wall - she does not let her impairment keep her out of any activities with the class. Stella's parents both attended training when the CBR worker offered it to them, and now have a better understanding of their child and encourage her to learn and move.

Figure 32: Stella interacting with a communication assistive tool. Source: Plan International

Didórcia

In 2017, Didórcia's mother enrolled her (5 years old) at the local preschool. Didórcia was the first child with a disability to attend. In the first 3 months, Didórcia's mother would carry her on her back for nearly a kilometer twice every morning to take her to and from the preschool. Parallel bars were built at the preschool using local materials that she could use to exercise: Didórcia's mother then asked for parallel bars to be built in their home as well, so that she could practice at home during the weekends. Didórcia tells, "I like going to school every day because I play, sing, dance and have lots of friends. As the carers play with me, I manage to stand up and walk on the parallel bars." The carer reported how Didórcia easily adapted to the centre's routine and was a cheerful young girl who will often amuse other children by singing and dancing. Her mother adds, "I am very happy with the development of my daughter. When she returns from the centre, she tells me everything she has learned. I see that this project has brought added value, since my daughter is very motivated to go to the centre and she even gets sad on the weekends when she cannot go." Didórcia now travels the 850 meters to the school independently every day, along with her neighbourhood friends.

Edilson

Edilson is 6 years old. He could not walk more than 3 steps when initially introduced to Cecilia, the CBR worker. Cecilia built a corner seat of wooden poles and parallel bars. She also built a set of parallel bars at the preschool. The other children at the preschool were so excited to use the parallel bars as play materials that Edilson understood they were fun, and was motivated to practice. After 2 months he was able to walk. Before, to go to school, he had to be accompanied by his twin brother. Now, he can go to the centre by himself.

Good Practices In Inclusion

According to the previous examples, it is necessary to work with the family, preschools, the community and others around the child in order to ensure that the children with disabilities are enrolled and included in the preschools. The aspects needed to include these children are:

1. Work directly with the parents/caregivers of children with disabilities
2. Address individual physical and medical needs of children with disabilities
3. Build the skills and confidence of carers
4. Equip and build a strong implementing team
5. Build evidence on what is happening and what (doesn't) work

The inclusion of children with disabilities is not a simple, linear process. As experienced in this pilot, it is a complex process that requires the participation of all key stakeholders in the community, but which brings great benefits for all those individuals involved. In line with this, the process of inclusion at these centres in Mozambique still has further to go in removing the remaining barriers to the participation of children with disabilities in ECCE/preschools. However, the success stories shared prove that in the case of this pilot, there is good progress to build on in the future, to ensure that all children realize their right to participate in learning activities in their communities.

Wooden outdoor parallel bars as walking aids to support walking. They are built at the home as well as at the centre, where it is as much fun for the other children.

The small plastic bottles are filled with sand and can be pulled down, to exercise arm muscles and coordination.

Part iv
Materials and Techniques

Echale a Tu Casa

According to government figures, Mexico has a housing deficit of approximately 9 million homes. The destruction caused by the earthquake of 2017 made an already dire situation worse. 300,000 homes were damaged and 100,000 collapsed after the earthquake of 2017. This means that 400,000 million people became homeless from one night to an another. Francesco Piazzesi, the founder and CEO of "Echale a tu Casa", worked on a solution to help those who are not eligible for any housing credit or support. He came up with a model that makes the community part of the solution.

Eco block is the key to his model. First, It is produced on site. "Echale a tu Casa" brings the equipment to the community, then train the community in order to produce the blocks by themselves; and get paid for the production. The model combines community organization, social inclusion, financial education, technical training and social franchising. The goal is to build around 1,500 new homes and enable 6,000 home improvements per year.

Technical Training

Integrates the community to the production of ecoblock and they earn a wage by doing this.

Family Financial

Fosters financial education and encourages saving habits.

Co-Design

Establishes the design of the communities according to their traditions and customs.

Social Workshop

Creates an atmosphere of social cohesion in the comunities, encouraging them to take part in the project.

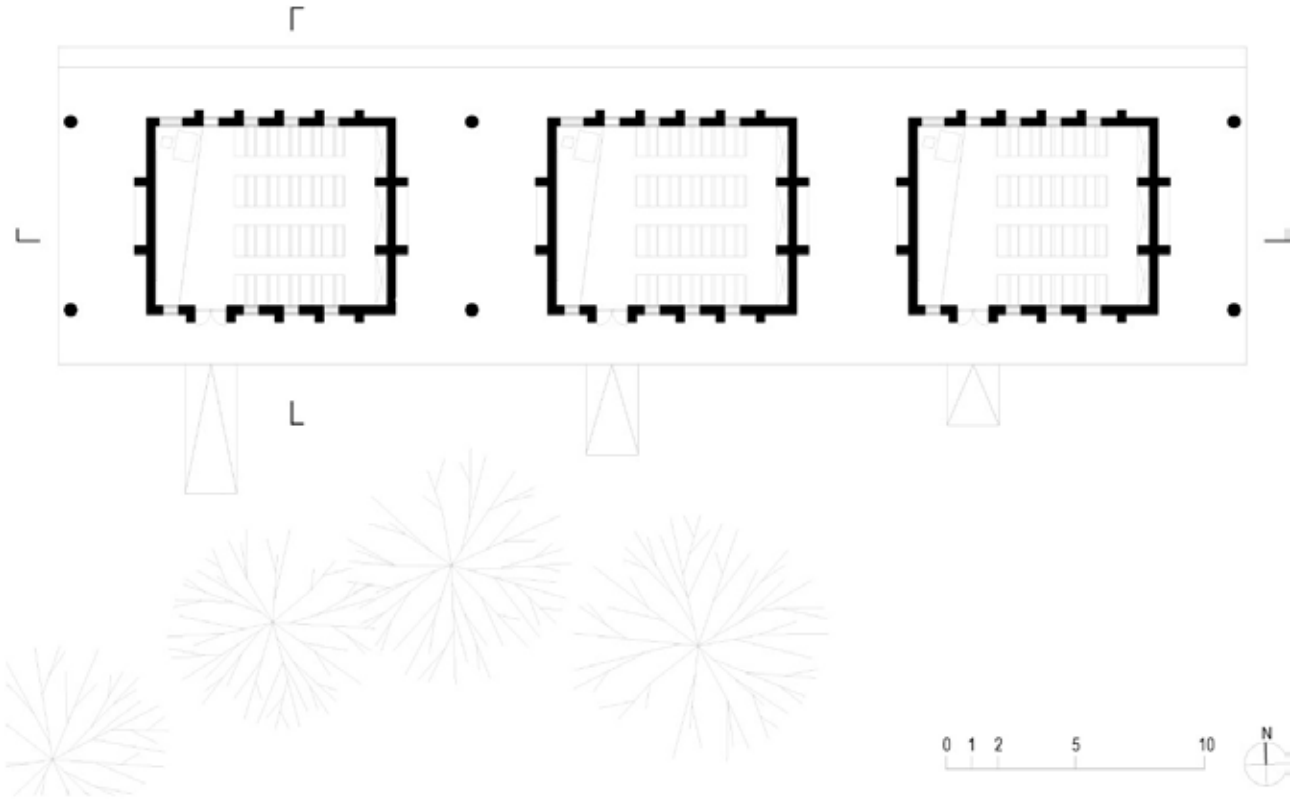
Kere Architecture - The first primary school in Gando

The internationally-acclaimed architect Francis Kéré garnered critical praise from the beginning of his architectural practice when awarded the prestigious Aga Khan Award for Architecture (2004) for his first-ever building - a school he designed, raised the funds for and realised in collaboration with the residents of his native Gando, Burkina Faso.

Kéré has gone on to become one of the most distinguished contemporary architects thanks to his pioneering of a communal approach to design and his commitment to sustainable materials as well as modes of construction. Inspired by a curiosity for the particularities of any given locality and its social tapestry, he has gathered a diverse, agile team at his Berlin-based Kéré Architecture office, to take on projects across four continents.

Working across continents from Africa to Europe, we strive to engage localities in our design and construction approach. Our philosophy of providing more with less fosters innovation and resourcefulness in our practice, using local materials, local knowledge, and local technologies to create holistic and sustainable design solutions. We believe that architecture can be a vehicle for collective expression and empowerment, which is why we work closely with local communities in all phases of design from planning to construction.

By supporting the educational, cultural, and civic needs of local communities with provocative and dignifying design, we will continue to raise awareness towards the sustainable and economic issues facing populations in rural Africa and beyond.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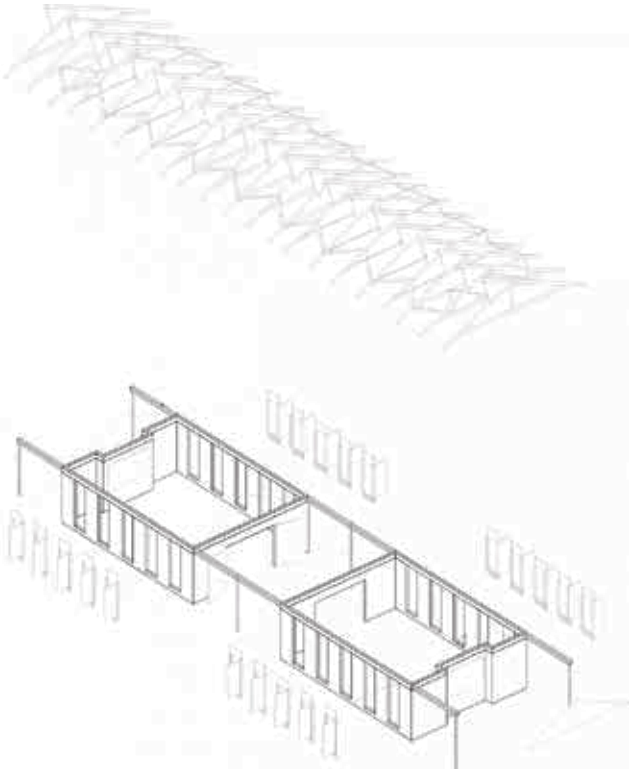
Low-Cost School Buildings - Arup & John McAslan

The designs have been adopted as a school model in Malawi, one of the world's least developed countries. At a cost of 25,000$ per building the designs use locally available materials to create flexible, zero-energy buildings to accommodate up to 170 children and space for community activities in a mixture of open-sheltered and enclosed spaces.

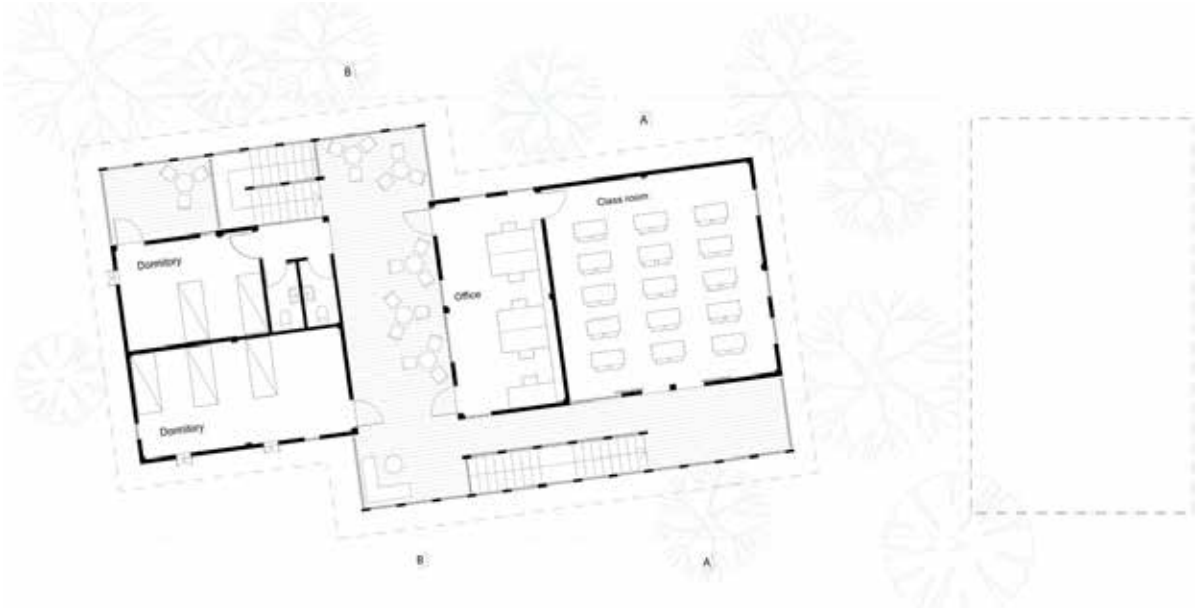
Arup delivered a sustainable, performance-based design that was very lean, robust, cheap and easy to build. The schools were built mainly with local construction techniques and materials, such as timber and stabilised soil blocks. They are also designed to run without electricity. They harness natural daylight and ventilation to create a comfortable learning environment, which is typically three degrees cooler than existing school buildings.

The flexible classroom blocks include three interconnected indoor spaces as well as two generous covered terraces. The outdoor areas create a sense of connection between the schools and the families they serve. This helps to encourage parents to send their children to school and establishes the new buildings as focal points of the community.

Simple brick spread foundations reduce the need for concrete. The walls are made of CEB. The roof is a simple timber truss that incorporate a roof light and shade. The result is a very lean but robustly designed structure that is cheap and easy to build.



Komitu Architects - Kouk Khleang Youth Center



Cambodia is one of the poorest countries in the world, but a recently completed Kouk Khleang youth center could help bring sustainable upward mobility to a community in Phnom Penh. Finnish design group Komitu Architects teamed up with Cambodian NGOs Cambodian Volunteers for Society (CVS) and Khmer Kampuchea Krom Human Rights and Development Organization (KKKHRDA) to design and build an ecologically and socially sustainable youth center that teaches computer skills, languages, and vocational skills to disadvantaged youth. The eco-friendly youth center was built using locally sourced bamboo, compressed earth bricks, and recycled plastic bottles.

Community workshops and input from local architecture students and professionals played an essential role in the design of the youth center, which celebrates both the local Cambodian culture and traditional building techniques. These community workshops, lectures, and site visits even inspired the local NGO UPDF to build a community center from bamboo and organize bamboo training workshops for a network of community builders throughout Cambodia.

The Phnom Penh youth center features a concrete frame for the main load bearing structure. That frame is filled with locally produced earth bricks; the carbon footprint of an earth brick is ten times smaller than conventional bricks per mass. Bamboo was used extensively throughout the project as supporting beams, columns, and as the main elements for the screens and well-ventilated terraces. The architects also developed an illustrated Khmer-language bamboo construction guide to help locals maintain the building and apply the bamboo building techniques to future projects. The building is elevated off the ground to prevent flooding and rainwater is harvested on site.

Bamboo

Bamboo

Bamboo is woody and fast growing grass, which occurs naturally on every major continent except Europe. There are almost 1,500 species of bamboo in the world, distributed across about 87 genera. About 14 million hectares of the earth surface is covered by bamboo forest. It is one of the oldest and most versatile building materials with many applications in the field of construction, particularly in developing countries. The main area of distribution are the tropics, in particular, South-East-Asia. It is also found in sub-Saharan Africa and mid-Atlantic United states, Argentina and Chile. Bamboo grow at sea level and can be found at altitudes of up to 3700m.

Bamboo is the regarded as the "Emperor" among the grasses and commonly called poor man's timber. It is extraordinary and unique plant that is sustainable, productive and fastest growing plant in the world. It belongs to family Poaceae and sub family Bambusoideae distributed in humid tropical, sub tropical and temperate region of the world. "The Green Gold" of the 21st century is available at much lower price compared to wood and is as strong as strongest wood. It has new applications as an alternative source of depleting and costly wood resources.

Bamboo as a Material

Bamboo is a versatile, strong, renewable and environmentally friendly material. It takes only three years to produce a mature fiber for use. Bamboo has been used since 3,500 BC and has more than 1,500 documented uses. It is capable of providing solutions for shelter, livelihood, and food security for regions where bamboo grows. They also provide ecological security by timber substitution and efficient carbon sinks.

However bamboo is subject to attack by fungi and insects and intreated bamboo have a life expectancy of

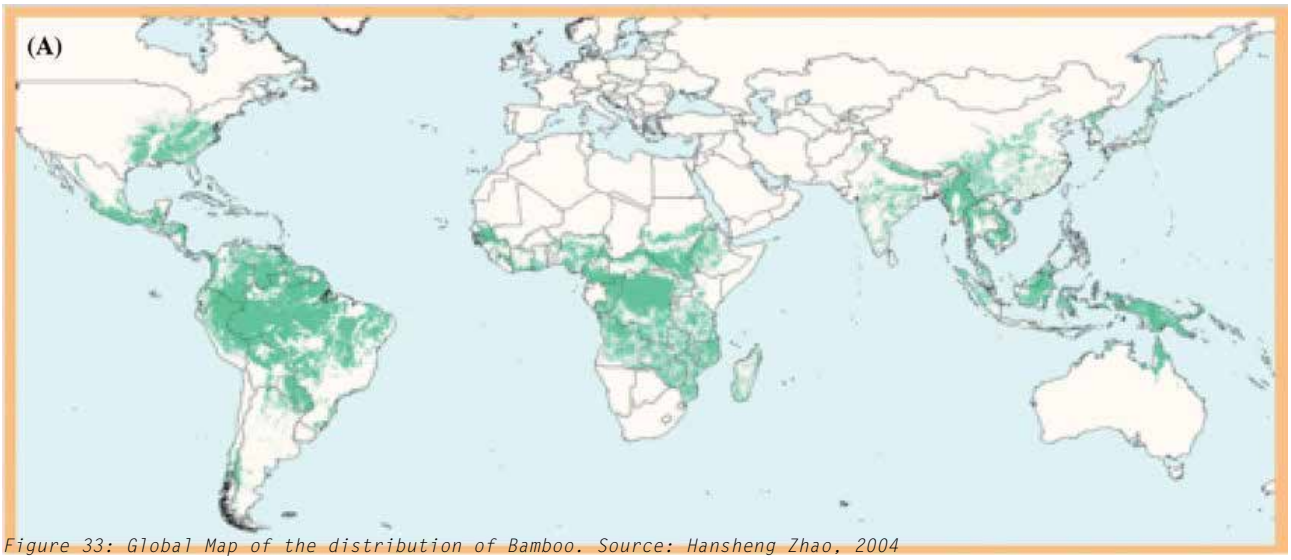


Figure 33: Global Map of the distribution of Bamboo. Source: Hansheng Zhao, 2004

not more that five years. The physical and mecahnical properties of bamboo are subjected to a greater variability determined by culm height, topography and climate under which the bamboo has grown. Fire presents a potential hazard in any form of construction, but the risk is especially high in bamboo buildings. The combination of bamboo and matting and the tendency of the internodes to burst cause rapid spread of fire. The risk is increased when the joint lashing is destroyed which can cause the building to collapse.

Harvesting Bamboo

It is important to follow good harvesting practices to ensure sustainable yields:

-Do not cut culms younger than three years

-Do not harvest in the rainy season

-Do not harvest from a flowering grove

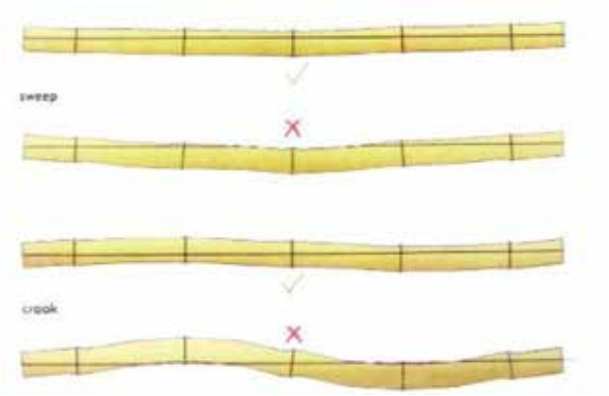
-Do not cut lower than the second node, or higher than 300mm above ground

-Remove branches, culm tips, and all harvest debris (waste material obstructs growth, encourages disease and makes later harvests more difficult)

-Retain leaves for mulch. Their 6% silica helps harden later culms.

-Leave a minimym of six mature culms uncut in each clump to sustain grow around the edge vitality and ensure a steady yield. As new culms grow around the edge a solution is to use the horse-shoe method by cutting a narrow path into the grove and harvest the mature culms from within.

Grading of Bamboo



The shape size and quality of bamboo can vary greatly even within a given species. The following grading rules will help in selecting the best material for construction.

Straightness - the bamboo culms should be as straight as possible. A line streched between the tip and butt ends should not fall outside of the culm.

Taper - or change in diameter over length should be kept to a minimum. A maximum taper of 10mm per meter is acceptable for lenghs up to 3 meters.

Nodes - nodes are the strong points in the culm and should be used to advantage especially at critical joints.

Splitting - it is a good practice to cut bamboo lengths longer than required to allow cutting away of split ends that can have a serious effect on the strength of the bamboo.

Insect/Fungal attack - bamboo culms that show signs of insect or fungi attack should be avoided.

Selection and Size of Bamboo

Only bamboos with at least three-year maturity shall be used in construction. Columns and roof members should be a minimum of 70-100mm in diameter at thin end of bamboo and walll thickness of bamboo not les than 10-12mm. The distance between nodes (internodes length) should not exceed 300-600mm.

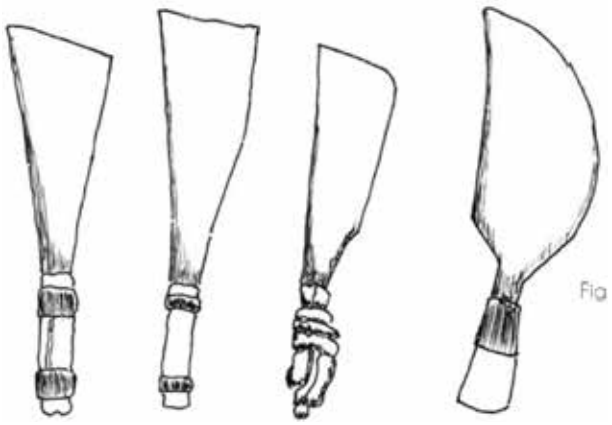


Figure 34: Traditional Tools (Dabiya)

Tools

Bamboo is generally used as it is in required length or in slit form. Traditionally this task is performed by only one tool. Though there are few carpentry tools that can be used for different purposes. Usually, below shown traditional tools are ysed by bamboo artisan for harvesting and construction.

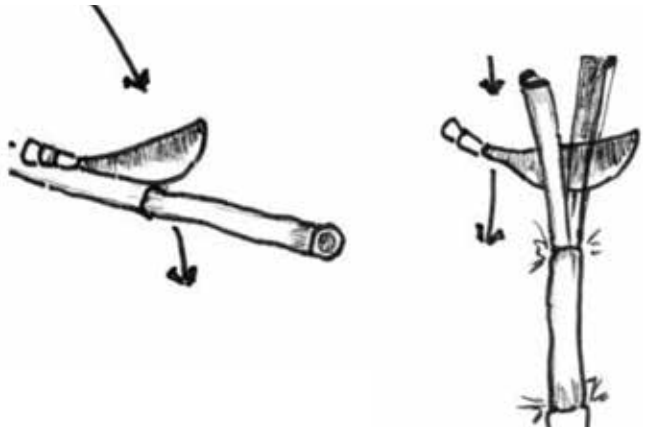


Figure 35: Bamboo Splitting

Joinery of Bamboo

Effective jointing is fundamental to the structural integrity of a framed construction. Furthermore, the suitability of a material for use in framing is largely dependent upon the ease with which joits can be formed.

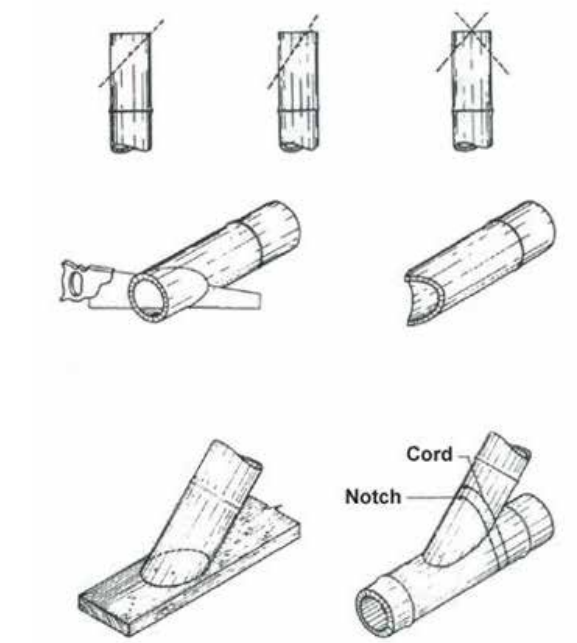


Figure 36: Bamboo Joints. Source: Guaduabamboo

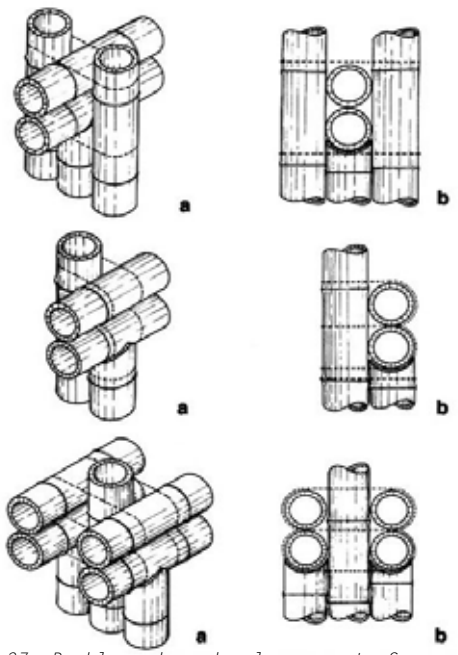


Figure 37: Double and quadruple support. Source: Guaduabamboo

Plugin connections:

Carpenterlike connections with mortise and tenon are seldom used in bamboo structures. On the other hand plugin elements like bolts or consoles you find very often.
This is a type of connection for greater diameters with a hardwood bolt and wedge. Five holes, the bolt and the wedge - a more extravagant connection. If the bolt is conical, the connection is save in all directions.

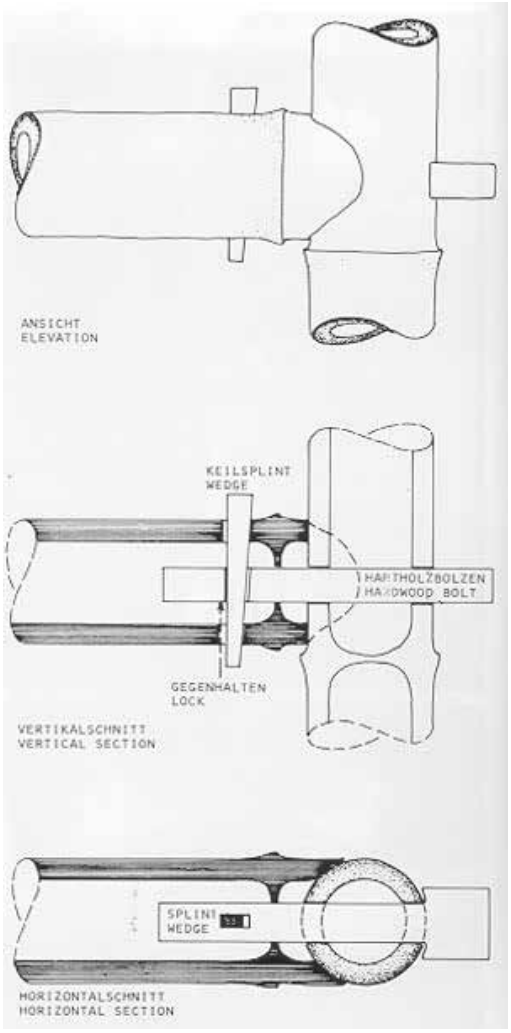


Figure 38: Bolt Structure. Source: bambus.rwth-aachen.de

Connection with inner plug:

Inner plug and a horizontal drill-hole to fix the connection with a lashing tie. If the lashing is tight and the plug fits quite good into the opening, both plug and lashing can do the power transition. But even if not, this connecting method can be very durable at less force. The inner plug prevents the beam from slipping down the post and the lashing is against unplugging.

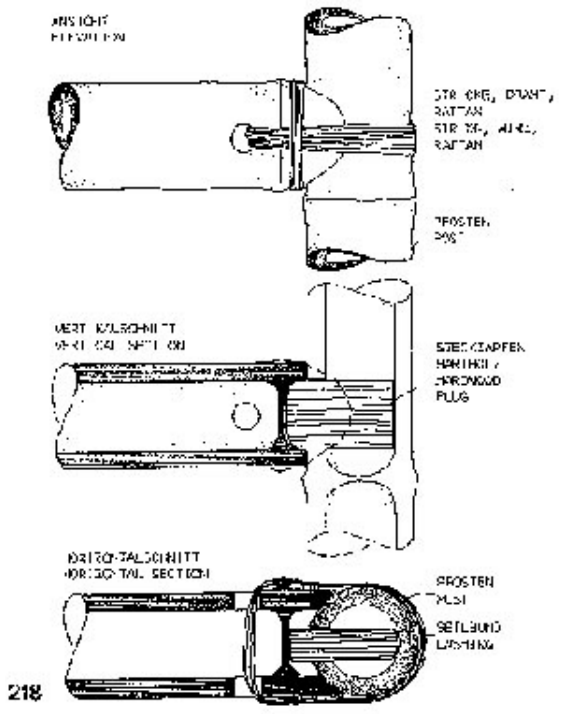


Figure 39: Connection with inner plug. Source: bambus.rwth-aachen.de

Interlocking connection with a wedge:

With the wedge driven into the opening, the strips of the horizontal beam are pressed into the hole and fix the beam. If the wedge shrinks, the beam can be easily pulled out of the opening. So additional arrangements like lashingor bolts are necessary for a save connection.

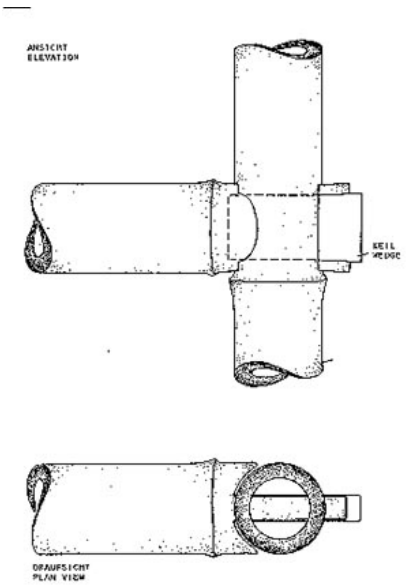


Figure 40: Interlocking connection with wedge. Source: bambus.rwth-aachen.de

Rope connection fixed with bolt:

The bolt keeps the connection in place even if the rope or cord lenghtens.

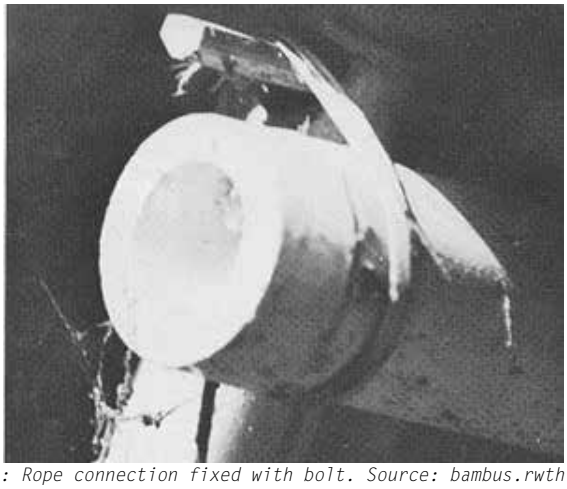


Figure 41: Rope connection fixed with bolt. Source: bambus.rwth-aachen.de

Connection with a steel tension clamp:

Leaving the low-tech sector, with the use of steel elements a lot more connections which produce great forces vertical to the cane axis. They can detroy the bamboo cane.

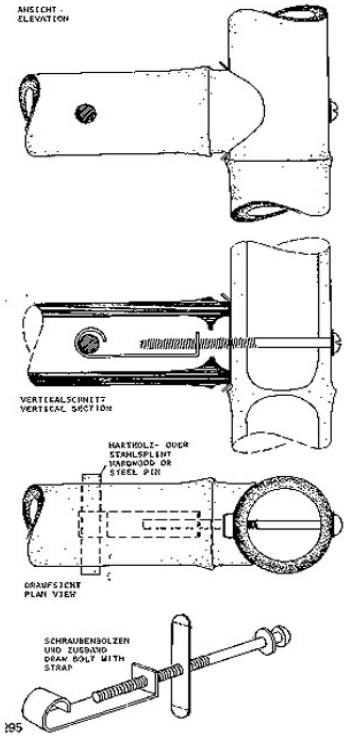
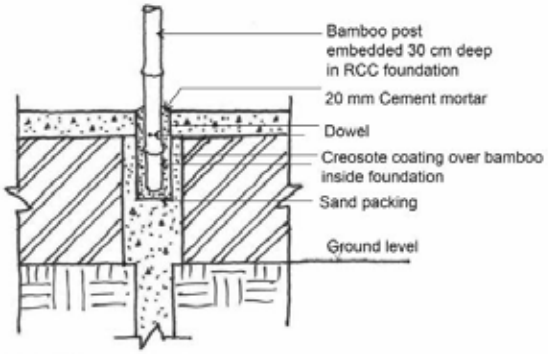


Figure 42: Connection with steel clamp. Source: bambus.rwth-aachen.de

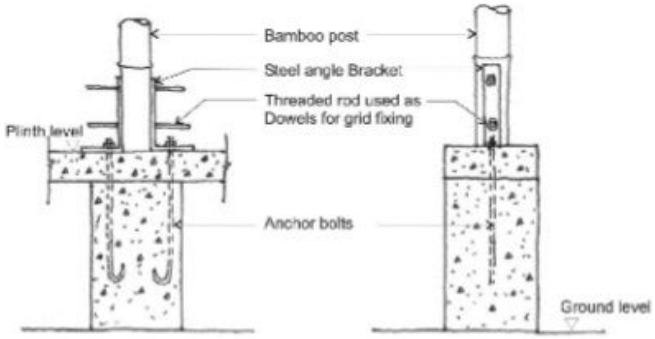
Foundation and Plinth

Bamboo is basically an above-ground material. Unless undergoing proper treatment it can last about 2-3 years underground.

To install bamboo post in foundation, a 300mm deep and 100mm diameter hole should be made in the plinth beam. Before inserting post, bamboo must undergo treatment at the bottom. Then the spaces between clum in the hole must be filled with sand.



Other possibility allows fixing bamboo and foundation with bolts and steel brackets and anchor bolts. At this point bolts should be embedded at appropriate place at the same time of casting plinth beam.

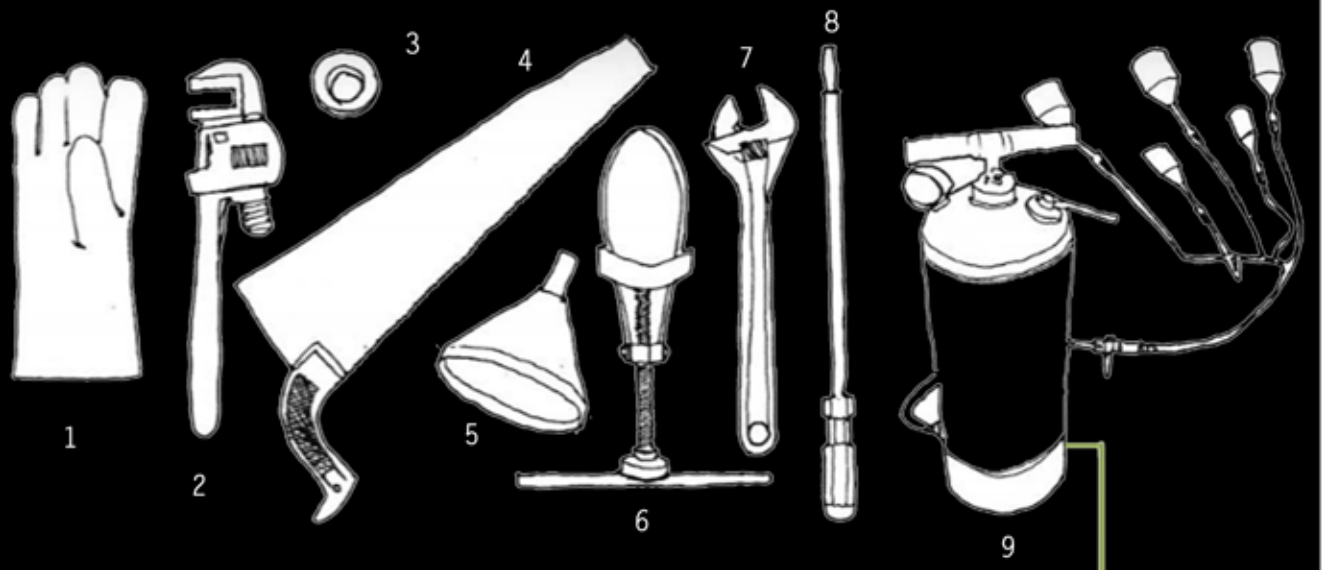


Bamboo treatment for longer life of shelter

Bamboo has a very little natural toxicity and therefore, is easily prone to fungi and insect attack. The objective of treatment is to remove the starch and other carbohydrates (soluble sugars) that attract fungi and insects and replace it with chemicals in the cells of the bamboo thereby increasing the life of the bamboo. Well treated bamboo has a life expectancy of 50 years without losing its structural properties. The efficiency of the chemical treatment is influenced by anatomical structure of the bamboo culm. There are no radial pathways in the culm tissue, like the ray celss in wood, and lateral cell-to-cell movement of preservatice depends on a slow diffusion process. Freshly cut culms are easier to treat due to the water -filled cells providing a continuous transportation channel. Both ends of the culms should be cut up to the next node in order to remove the blockage of vessels.

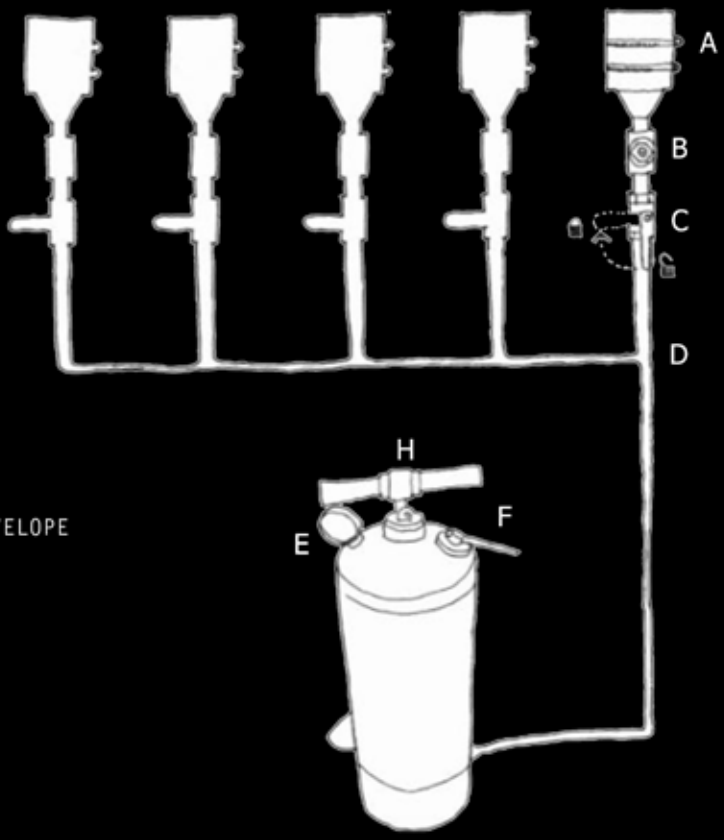
Whereas there are several indigenous treatment systems like limewash and smoking bamboo, chemical treatments are know to have longer effect against fungi and insects. The use of water as a solvent to carry the preservatives into the cells of the bamboo. Water-soluble salts are dissolved in water, on treatment the water evaporates leaving the salts incide the bamboo. The recommended salts are boric acid, borax and copper sulphate. Boron salts are effective against borers, termites and fungi (except soft rot fungi). High concentrations of salts have fire retardant properties as well. They are not toxic.

Necessary Tools Required For Bamboo Treatment



1. Rubber gloves
2. Adjustable wrench
3. Tape
4. Hardwood back saw
5. Funnel
6. Clamp
7. Adjustable spanner
8. Screwdriver
9. Hand operated pump

Hand Operated Pump Detail



A. Nozzle connection bamboo with envelope
B. Pressure regulator
C. Solution regulator
D. Hose pipe
E. Pressure gauge
F. Solution input
G. Solution outlet
H. Handle for pumping

Compressed earth blocks

CEB as building material

Compressed earth blocks are small masonry elements, parallelepiped in shape, but the common dimensions of which differ from those of hand-moulded earth blocks or of fired bricks and vary depending on the type of specially developed presses or moulds used.

Two main criteria must, however, be taken into account when determining a compressed earth block's dimensions, which should above all be suited to the great degree of flexibility in use which is one of the great qualities of this building material. These are:

- On the one hand the weight of the block, bearing in mind that they are solid blocks which are principally used in masonry
- On the other hand the work (or nominal) dimensions of length (l), width (w) and height (h) which will determine bonding patterns. For this reason, as a rule, compressed earth block production has mainly used dimensions consistent with a unit weight in the order of 6 to 8 kg and with the possibility of building walls 15, 30 or 45 cm thick.

The most common nominal dimensions in use today are 29.5 x 14 x 9 cm (l x w x h), which gives a material which is very easy to handle and very flexible in the way it can be used for many configurations of wall and roof building systems jack-arch flooring, vaults and domes) and of arched openings.

Figure 43: Compressed earth blocks. Source: earthecobricks

There are four main families of blocks

1. Solid blocks

These are mainly prismatic in shape. They fulfil very widely differing functions.

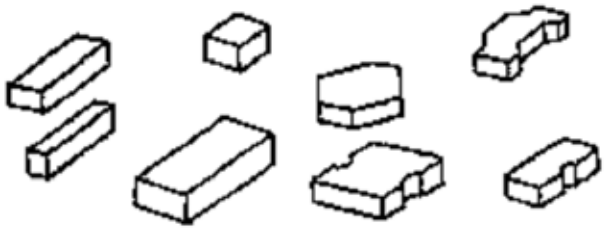


Figure 44: Solid blocks. Source: Manual of design and construction

2. Hollow blocks

Generally the voids of hollow blocks account for a total of 5 to 10%, and up to 30% using sophisticated techniques. Voids can improve the adherence of the mortar and reduce the weight of the block. Certain hollow blocks can be used to build ring-beams (lost formwork).

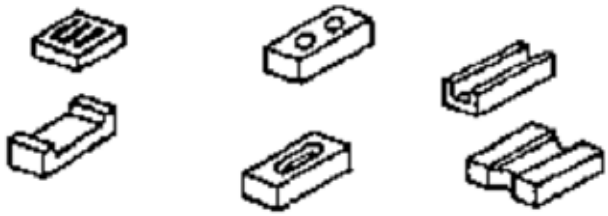


Figure 45: Hollow blocks. Source: Manual of design and construction

3. Perforated blocks

These are light but require fairly sophisticated moulds and greater compressive force. They are suitable for reinforced masonry (in earthquake areas).

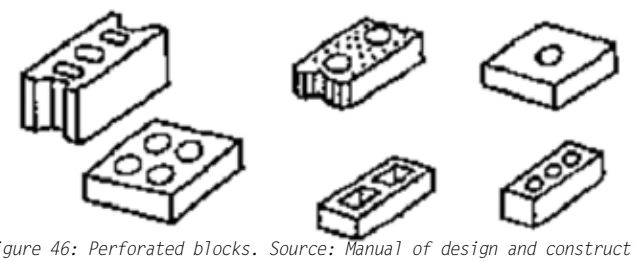


Figure 46: Perforated blocks. Source: Manual of design and construction

4. Interlocking blocks

These can be assembled without mortar, but they require sophisticated moulds and high compressive force. They are often used for non-loadbearing structures.

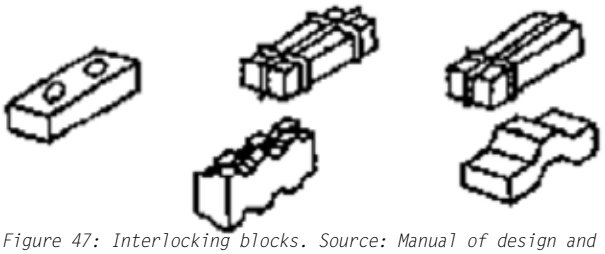


Figure 47: Interlocking blocks. Source: Manual of design and construction

Main Characteristics

Comparisons between the characteristics and performances of the compressed earth block and those of other classic masonry materials, should not be restricted solely to taking account of their compressive strength or differences in production costs. The issue is a more complex one and any comparison should rather be based on a wide register of parameters, including: the shape an dimensions of the material, its appearance (surface, texture, attractiveness,) as well as a full range of measures of performance, such as - indeed - dry and wet compressive strength, but also thermal insulation, apparent density, and durability. But over and above this, aspects linked to the production and use of the material highlight all the complexity of such comparisons by taking account of such factors as the nature of the soil deposits supplying the raw material, the means by which this raw material is processed into a building material, the energy involved in this processing, the nature of the

material when considered as a building component or element, and its state in the finished building, taking account of questions of durability and maintenance. This «intelligent», way of comparing materials with each other, over and above scientific considerations intended to compare materials in laboratory conditions, takes account of the architectural and practical application of materials in situ.

COMPARISON BETWEEN CEBs AND OTHER MASONRY MATERIALS

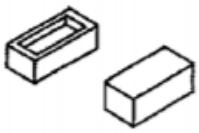
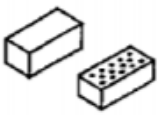
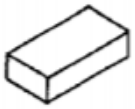
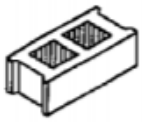
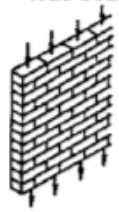
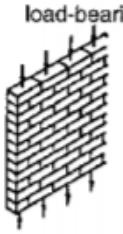
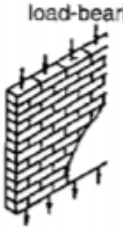
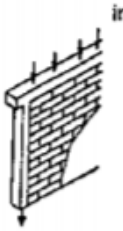
Characteristics	Unit	CEB	Fired bricks	Adobes	Concrete blocks
SHAPE AND SIZE					
Type					
l x w x h	cm	29.5 x 14 x 9	22 x 10.5 x 6.5	40 x 20 x 10	40 x 20 x 15
APPEARANCE - Surface - Visual aspect		smooth medium to good	rough to smooth good to excellent	irregular poor	rough average
PERFORMANCES - Wet compressive strength - Reversible thermal dilation - Thermal insulation - Density - Durability	Mpa % W/m°C kg/m³	1 to 4 0.02 to 0.2 0.81 to 1.04 1 700 to 2 200 low to very good	0.5 to 6 0 to 0.02 0.7 to 1.3 1 400 to 2 400 low to excellent	0 to 5 - 0.4 to 0.8 1 200 to 1 700 poor	0.7 to 5 0.02 to 0.05 1.0 to 1.7 1 700 to 2 200 low to very good
USE IN MASONRY		load-bearing  without render	load-bearing  without render	load-bearing  with render	infill  with render

Figure 48: Comparison between CEBs and other masonry materials. Source: Manual of design and construction

Masonry Principles

A compressed earth block masonry structure consists of small building elements placed one on top of the other following a particular bonding pattern and bound together with mortar.

The earth blocks therefore form a building system - whether it be a wall or a partition, a post or a pillar, an arch, a vault or a dome - which has compressive strength. This characteristic of compressive strength is indeed essential as, by contrast, masonry structures using small elements have very little tensile strength. The good strength and good stability of a masonry structure using small elements is dependent on the interaction of several factors:

- the quality of the block itself
- the quality of the masonry (i.e. the interaction between the block, the bonding pattern and the mortar)
- the form of the building system, which should be suited to the compres-

sive forces exerted
- the quality of detailing of the building system, notably ensuring good protection against water and humidity
- the quality of execution of the work.

CHOOSING A MACHINE

There are machines for making CEB's that works with or without electricity. The manual presses are more suitable for rural areas. It comes in several variations: you can make standard CEB's or ICEB's. These ICEB's also have different variations.

Although the machine is very heavy, it is important to fix the machine extra firmly to the ground, so it doesn't get lifted during the compression. The machine needs to be oiled every time 3-4 bricks are made, to prevent the soil from sticking to the metal. Make sure you don't use black oil, since it will leave visible stains on the bricks. When the work is finished, the machine needs to be cleaned carefully and placed inside.

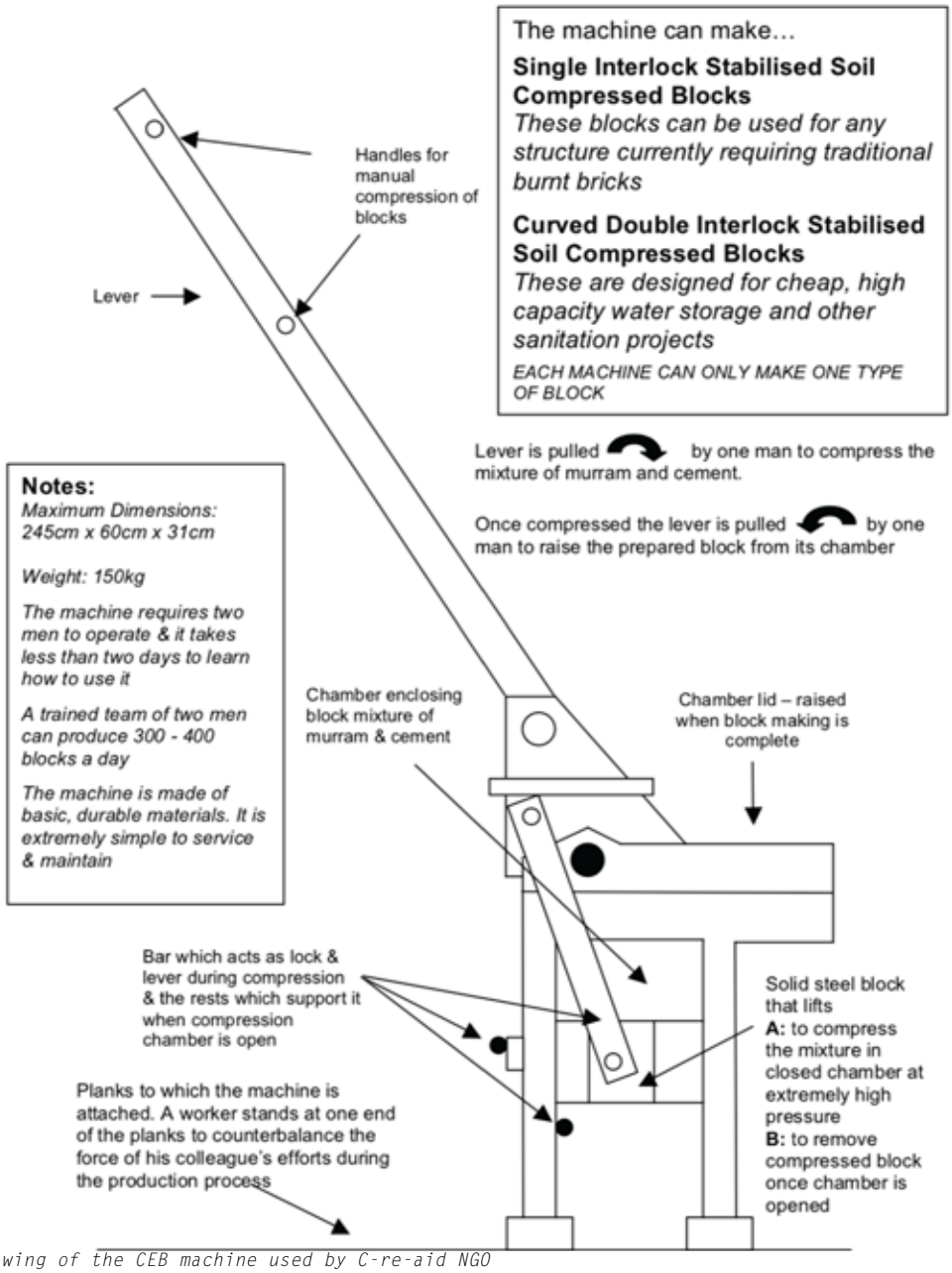


Figure 49: Drawing of the CEB machine used by C-re-aid NGO

Testing the Soil

Almost all types of earth can be used to build walls. The quality of the earth is determined by the proportion of clay to sand. There are many types of earth in the composition of an earth sample. It is often necessary to combine earth from one area with some from another part of the site, even when the lot is small. A rich earth which has a lot of clay needs to be balanced out with sand, and a poor earth needs to be enriched with clay.

In order to determine whether soil at a specific site can be used and in which specific mix, soil and mix tests should be conducted. Several points on a site need to be excavated to perform these tests.

First remove the upper layer of earth that contains organic material and vegetation. Then remove samples of earth from different depths.

Getting the right tools

MATERIALS


Sieved soil from the site


Lime / Cement / Additives...


Water

MAKING BLOCKS


3 to 6 Barrels
to put the water and lime in


2 Shovels
for making the CEB mix


1 Sieving mesh + wooden stand


2 Buckets


1 Watering can


1 Pickaxe
to dig soil


2 to 4 Working gloves


1 Knife and scissors

MACHINE


1 CEB machine


1 Liter of oil per 500 bricks
for oiling the CEB machine


1 Paint brush
to apply the oil


1 Spatula
to clean the CEB machine


4 Wooden planks
to stabilize the CEB machine

DRYING BLOCKS


Ropes around the CEB's
to tie the plastic sheets


Plastic foil (size: 150mm x 280mm)
to put under and on top of the bricks


Plastic sheets (8 sheets of 4m x 5m)
to cover bricks

7 Steps to Making Compressed Earth Blocks

1. Digging and Sieving Soil

The main materials for the CEB's is soil. This soil needs to be excavated from the site, dried and sieved. Roughly, it can take 2 people easily 1 week of digging and 1 week of sieving to get enough soil for making 5000 CEB's.

2. Mixing

Obtaining a mix with the optimum moisture content for compaction is crucial to the quality of the product. The lime should be placed in water for 1 day before using it, to be activated. Place water in a barrel and then add lime slowly while stirring and adding more water slowly. At the end, a white lime paste should be formed. The lime should be distributed evenly throughout the mix.

3. Oiling The Machine

Oil the inside of the machine with a brush, especially in the corners, to make sure the soil doesn't stick to the surface of the machine. Put new oil every 3 blocks (or more/less, depending on the type of oil and the type of soil).

4. Stabilizing The Machine

Place a piece of plastic at the bottom of the machine, this will help the CEB come loose more easily after the compression.

5. Making The CEB's

-Using a shovel, put the mix in the machine until the top without pressing the soil.
- Place also a piece of plastic on top to prevent the earth from sticking on to the machine.
- Close the machine and compress the soil. You have to close the machine completely, if this is not possible you have put too much soil in the machine.
- Open the machine completely so the CEB is pressed out of it.
- Take the CEB carefully and put it in the first curing area.

6. DRYING THE CEB'S

- The bricks need to be put next to each other to dry for 17 days.
- Full curing takes 28 days (the first 24h several times!)
- After the compressing, place the CEB's on the floor.
- Cover them with black polythene while they dry.
- Keep on watering.
- After this period, stack the blocks in layers of five.
- Cover again with black polythene and leave them to dry.

7. Quality Check

Introduce a fully cured block into a bucket of water for a day to observe its integrity and reaction. When pulled from the water, it should be immediately subjected to a compression test. To test without machines: an adobe block should withstand more or less 80 kg's, so we can assume that the CEB will be strong enough if it can withstand the same pressure.

Figure 50: Sieving soil. Source: Christelle Khoury

Figure 51: Making the CEB. Photo by Christelle Khoury

Figure 52: CEB drying, Malawi. Source: dwellearth

Figure 53: Strength check. Source: dwellearth

Figure 54: CEB construction, Pemba.Source: dwellearth

Figure 55: CEB construction, Nampula. Source: dwellearth

Figure 56: Two men working on CEB Wall. Source: dwellearth

Figure 57: CEB Wall, Pella, Iowa. Source: dwellearth

Part V
Design Proposal

in collaboration with

ESTAMOS JUNTOS

and

SOMOS DEL MUNDO

INTRODUCTION

Archstorming's new competition takes us to Mozambique, a country where 70% of the population lives below the poverty line. This difficult economic situation, most severely affects the situation of children. Frequently, the lack of financial resources is a significant barrier to the enjoyment of their fundamental rights. They experience many problems; such as the inability to access school, health-care, and housing...

In Mozambique, one child out of five is not educated. Preschool is neither mandatory nor free.

For those who go to school, study conditions are very different from the conditions of those in developed countries. The buildings, school equipment and facilities (chairs, tables, desks...) are in bad shape or absent.

Moreover, the figures show a discrepancy of the education between boys and girls. The classes have a majority of young boys. This is in part because of the profusion of harassment and sexual violence in schools toward girls.

Besides that, in Mozambique, 14% of children between two and nine years old are disabled. They are often hidden away by their families – in effect rendered invisible – and are vulnerable to discrimination as well as an increased risk of violence. These children need greater support from their families and better access to education, which would enable them to attend school with their peers. But that can only happen if the necessary facilities, equipment and training are provided.

In the current competition, we will help Assa, a Mozambican teacher, build a center for children with disabilities and affected by social exclusion, with the help of the Estamos Juntos Initiative and the NGO Somos del Mundo.

CULTURAL AND SOCIAL CONTEXT

Mozambique borders Tanzania, Malawi, Zambia, Zimbabwe, South Africa, and Swaziland. Its long, Indian Ocean coastline of 2,500 kilometers faces east to Madagascar. About 70% of its population of 28 million (2016) live and work in rural areas. It is endowed with ample arable land, water, energy, as well as mineral resources and newly discovered natural gas offshore; three deep seaports; and a relatively large potential pool of labor.

Unfortunately, families in Mozambique are struggling to cover even their most basic needs, such as running water, proper sanitation and regular access to food. Income distribution remains highly unequal in a country where the richest twenty per cent control over half of the national household income.

A few years after peace could be secured in Mozambique, disastrous floods destroyed much of the country's infrastructure during a time in which it was slowly rebuilding itself. Rural Mozambique is frequently affected by droughts. Famine is widespread and many locals suffer from illnesses that are directly related to it. For the average Mozambican, life expectancy is as low as 58 years. The country has one of the highest HIV rates in the entire world: 12.3 per cent of the population are HIV-positive, meaning that roughly 3.6 million Mozambicans are living with the disease.

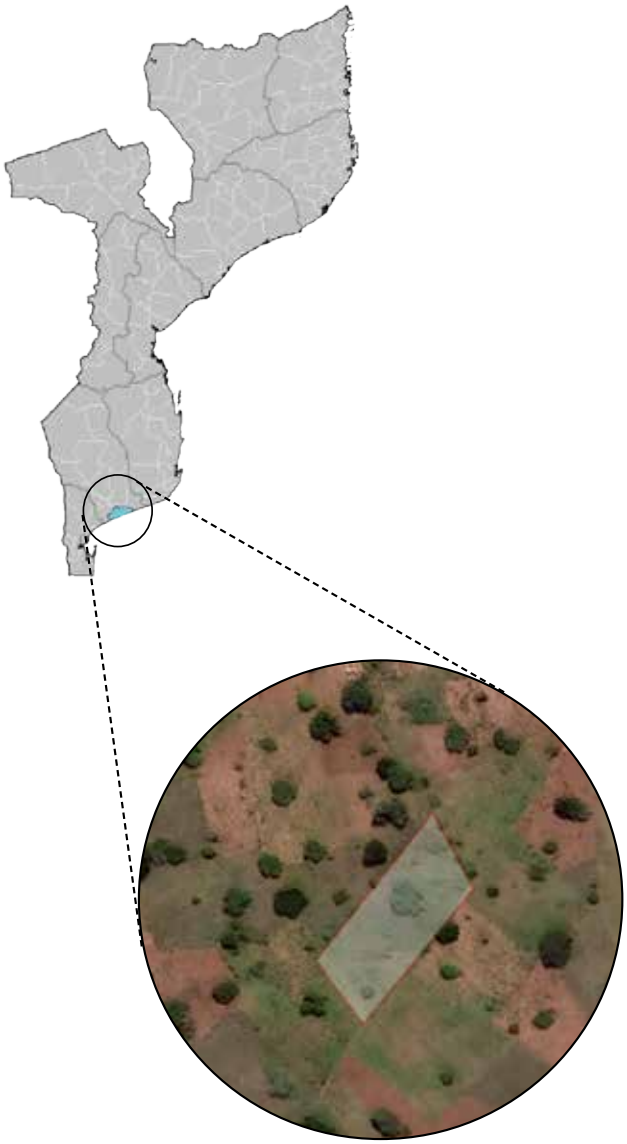
In March 2019, the coastal city of Beira was hit by a tropical cyclone that affected 1.7 million people across Mozambique, including an estimated 260,000 children. Devastating floods damaged bridges and roads, which stopped the delivery of food and other emergency supplies. Public water supplies were unable to be treated, leaving many Mozambicans susceptible to water-borne diseases such as cholera and malaria. Up to an estimated 50 per cent of the annual crop production was destroyed, leaving many without food or means to an income.

Although there have been impressive steps forward in terms of school enrolment, only 40 per cent of children who attend school complete their primary level education. From this, only 16 per cent of children go on to secondary education. Factors such as lack of safe school spaces and early marriage and pregnancy are major reasons for children to not complete school. Around 40 per cent of girls have given birth before they are 18 years old, and half are already married.

An estimated 1.2 million children do not attend school at all. At least a basic level of education is of considerable importance for growth and development and empowers the child to break the vicious circle of poverty when becoming an adult. On average, Mozambicans complete only 3.5 years of schooling.

3

LOCATION

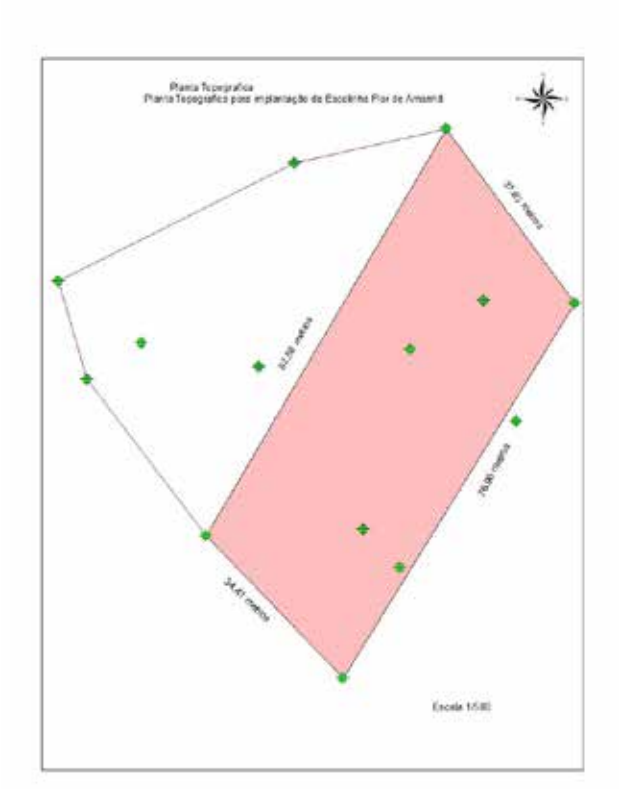


Archstorming is calling for proposals to design a preschool in the Xai-Xai District (Gaza Province, Mozambique).

Xai-Xai District is a district of Gaza Province in south-western Mozambique. The administrative center of the district is Chongoene. The district is located in the south of the province, and borders with Chibuto District in the north, Manjacaze District in the east, Bilene Macia District in the southeast, and with Chókwè District in the west. In the south, it is bounded by the Indian Ocean. The area of the district is 1,908 square kilometres (737 sq mi).

The school will be located in a plot between the cities of Xai-Xai and Chongoene, approximately 1 km away of the road that connects them.

THE SITE



In the current competition, the study of the site characteristics is very important, since **the school will be built by volunteers and construction workers with no help of heavy equipment like excavators**.

For that reason, **you must consider the current topography of the site and make sure the future school is adapted to it.**

The site has a rhomboidal shape. The long sides measure 82,58m and 76,96m, and the short ones 34,41m and 37,83m.

The plot has some **bushes that will be removed**, so there's no need to consider them in your design. Besides that, you will also find a big tree, known as Marula or Canhoeiro (Sclerocarya birrea), in the middle of the site. The fruit of that tree is commonly used in the zone to produce a cream liqueur known as Amarula. **That tree can be preserved or removed, it is up to you.**

The principal road that connects the cities of Xai-Xai and Chongoene is 800m northwest of our plot. **The access road of the school will come from the northeast and will be located on the side that measures 76,96m.**

The topography study reveals that **there's a slight sope in the plot**. The highest point has an altitude of 63m while the lowest point registers and altitude of 60m. Please remember that **the ground will be prepared and leveled with small equipment**, so take the topography into account in your designs.

A detailed topographic plan of the site will be sent after registration.

EARTH AND CLIMATE

Mozambique has a tropical to subtropical climate, with some semi-arid regions in the southwest of the country. The east consists of lowlands while the west is more mountainous.

Mozambique has a coastline of 2,700 km. Average temperatures are highest along the coast as well as in the south of the country (20-26°C) and lower in high inland regions. There are seasonal temperature variations, with a cool dry season from April to September (coolest months are June – August) and a hot humid season from October to March (warmest months are December – February).

Rainfall is highest in the north (1,000 mm/year) and lowest in the southeast (500 mm/year), but also varies according to topographic features – with most rainfall in higher areas and along the coast (800- 1,200 mm). The driest area of the country is the southern inland area, where some locations receive only 300 mm of rainfall per year. Rainfall mainly occurs during the hot season, from November to April – with the majority falling between December and February. The north receives 150-300 mm of rainfall per month during this season, while the south receives 50-150 mm per month.

Mozambique is frequently affected by tropical cyclones which mainly occur during the hot, humid season. In January 2012, for example, cyclone Leon-Eline affected 4.5 million of its population.

Actual site pictures

THE CHALLENGE

This competition gives you the opportunity to work in the **creation of a school in an underdeveloped country**. But not only that, in this case the school will be designed for disabled and socially excluded children, so the challenge is even bigger.

The goals of this project will be:

- **EDUCATE**: create a place where kids can start their educational journey. Make them feel like home by designing a space where they feel comfortable. Build kid-friendly spaces that are completely safe for them, a school where they can learn, play, run, and discover.

- **INTEGRATE**: since this school will accommodate disabled children and kids in social exclusion, it is fundamental to work in their integration in society. We can help them through architecture by creating adapted spaces where they don't feel rejected. A dynamic school where they can interact with each other and the surrounding environment.

- **BE SUSTAINABLE**: the projects will have to use locally sourced materials, easy to build constructive systems, and should be self-sufficient in energy terms. They have to be respectful with nature in order to teach the kids the proper way to interact with their natural environment.

THE PROGRAM

To achieve the objectives set, the following **indicative** program is proposed:

Type of space	number	m²	Total
Classrooms	6	42	252
Boys bathrooms	1	12	12
Girls bathrooms	1	12	12
Storage (cleaning material)	1	8	8
Dining room	1	70	70
Infirmary	1	12	12
Closed kitchen	1	40	40
Pantry	1	30	30
Open kitchen	1	15	15
Multipurpose space	1	100	100
Principal and secretary office	1	20	20
Management and janitor offices	1	20	20
Storage (school material)	1	9	9
Teacher's room	1	15	15
Adults bathroom	1	20	20
Covered schoolyard	1	100	100
Total			735

As said before, this program is indicative, **these spaces must appear in your project** but their size can vary according to your design. If you want to add more spaces that you think will benefit the development of the kids, you are free to do it.

11

THE PROGRAM

The proposed program should have the following characteristics:

Six classrooms: where the children will be grouped according to age, going from 0 to 5 years old. Each class will have a minimum of 25 students. They should include two accessible built-in closets where the kids will keep their belongings, and two built-in closets, in a non-accessible height to them, where the teachers will keep the teaching material.
Each class should have a storage space where the teachers will keep bigger materials such as mattresses, pillows, etc. In order to exploit all the available space of the room, this storage can be elevated and only accessible by teachers via a staircase. Although other ways to resolve it are also accepted.
Everyday, after lunch, the kids take a nap in the classrooms, so the space has to be adapted according to each activity.

Bathrooms: 4 toilets for boys, with 2 showers and 2 sinks, and 4 toilets for girls, also with 2 showers and 2 sinks.

Storage rooms: two storage rooms, one for the cleaning material and one for the school material.

Dining room: besides the dining space, it should also include a 8 sinks close to the entrance door where the kids can clean their hands, or one long sink with 8 taps.

Infirmary: with a sink and a built-in shelving, high enough to be inaccessible to kids.

Closed kitchen: it will have an industrial cook stove, kitchen appliances and two freezers. A large table (approximately 5m x 0,6m) to facilitate food handling and preparation. Three kitchen sinks with drainer and two built-in shelves (each one measuring 2.5m x 2m approximately).

Pantry: to store food and beverages. It will also have two fridges. All the walls should have shelves and this space has to be placed near the closed kitchen. It has to have a highly effective ventilation system while making sure animals and insects can't get in. It has to be placed in the coolest place of the plot in order to benefit the food conservation. In a country like Mozambique, creating an effective pantry is a huge challenge because of the climatic conditions and the abundant and resistant variety of insects and other pests.

12

THE PROGRAM

Open kitchen: in Mozambique it is very typical to cook in an open kitchen with a traditional wood stove. It is very important that the kitchen is open (and also roofed) so it can ventilate. At the same time, it is also crucial that the kids can't get in, since it could be dangerous for them. A solution for this is to build a low wall around the kitchen to prevent the students from getting in.

Multipurpose space: intended for different educational activities, celebrations or parent meetings. It will also be used for educational staff training sessions. Ceilings must support the weight of at least four fans.

Offices: one of them will be used by the principal and the secretary, and the other one will be used for the school management and janitor.

Teacher's room: a personal space for teachers during class breaks or meetings. It should have shelves and a table of approximately 50x180cm. It should also include two sinks with hot and cold water connection.

Adults bathroom: with two toilets, one shower and one sink. This space should be close to the teacher's room.

You should also consider a **big open space** where kids can play and have contact with nature. Part of this space will also **include an orchard** where kids can learn about care and cultivation of the land and collaborate in the long term with the self-sustainability of the Institution.

The escolinha will need a **covered schoolyard of approximately 100m²** where the kids will play protected from any weather conditions.

MATERIALS AND BUILDING TECHNIQUES

In this competition the winning project is going to be built, the chosen proposal will be used as the basis of the final project. That is why materials and building techniques will be crucial.

The main materials of the area currently used for construction are **clay, wood, stones and steel**. Clay and stones are used to make bricks, having two different brick typologies: clay bricks and concrete bricks. The first ones are more economical than the second ones.
The two other structures used as the most common structural systems are wood structure or metallic structure.
Material costs typically account for more than 50% of total construction cost. These costs have been high because the most valuable materials are imported with high transportation/logistic costs and import duties. **Only the most basic materials are sourced locally – e.g. cement and wood – even steel has to be imported.**

For that reason, it is very interesting to work with local materials for the preschool, like CEB (compressed earth blocks) and wood.

For the roof, they mainly use **dried grass ceilings or iron sheets**.

Participants can also consider the **option of improving the constructive systems and bring new ideas**, but always thinking that the resources and financial capacity of the project are limited. If a participant team decides to include a new material to the construction, make sure it is affordable and achievable for an NGO working in a third world country.

Remember that, since they still don't have electrical network, **solar panels will have to be considered in your proposals**. Also, in order to have hot water, the school will also have **solar thermal collectors**.

The water provision must be covered by a water tank of 16m^3, so participants will also need to keep an area to ubicate it. It would be really interesting to consider a **rainwater collection system**. This water should be directed to the tank. There's a system developed in Brazil that is starting to be used in Mozambique, you can check it out in this page: http://www.asabrasil.org.br/acoes/cisternas-nas-escolas

The school will have a **septik tank** to treat the wastewaters. Make sure the water tank and the septik tank are located where they work best for those spaces using water (bathrooms, kitchens, dining room, teacher's room and infirmary).

The ceilings will have to **hold the weight of big fans** in some of the spaces, for example two fans in each classroom, or four fans in the multipurpose space.

All rooms must have a sufficient number of windows to make the most of daylight and provide good ventilation to the environment.

The windows and doors that face the outside **should be very well protected from rain**, so the roofs should protect these openings

A **perimeter wall should be included to protect the school**, although, depending on your design, the building itself could function as a perimeter barrier.

The school must have **four emergency exits**.

All spaces should be adapted to children with disabilities.

Organizers

Assa Jacinto Mabai

Create a preschool for vulnerable and disabled children, that is the dream of Assa. In the area they are known as “escolinhas”, and there are only a few that depend on the State and some that depend on private entities, which leaves the vast majority of children without access. In addition, the fact that pre-school education is not compulsory in Mozambique makes this a luxury that very few can enjoy.

Assa dreams of a escolinha where everyone has a space. She studied for several years and became a child educator, and her motivation has always been to cover the most vulnerable population in the area where she lives, including children with disabilities, something that does not exist in the Gaza Province.

Children who do not have the possibility of entering pre-school enter the first grade with less intellectual and social skills and do not tend to preserve in the education system. School desertion is very high in the province, leaving children exposed to child labor. Assa is a member of an Association that is beginning to support her in thinking about ideas to carry out her project.

Estamos Juntos

When, back in the year 2000, Andreas and Marisol traveled to Mozambique, they knew that this country had something special and that there was no place the felt as useful as there. He spent two years helping to rebuild the villages devastated by the floods caused by the Limpopo River. She spent four years accompanying the communities to regain hope, empowering women and young people, the great protagonists of the post-catastrophe era.

After that stage, geography separated them a few years, he moved back to Germany and she moved to Argentina, but eventually they came together again to continue common project, a vision of life that would lead them to help people in countries like India, Bolivia, Nepal, Argentina, Italy or Germnay. Although always hoping they could return someday to the country they felt that special connection with: Mozambique.

Finally, the day arrived, and in January 2018 they returned to Mozambique to work on disaster risk reduction and adaptation of communities to climate change. They are now helping people like Assa and the children of the region to fulfill their dream: build a school.

Somos Del Mundo

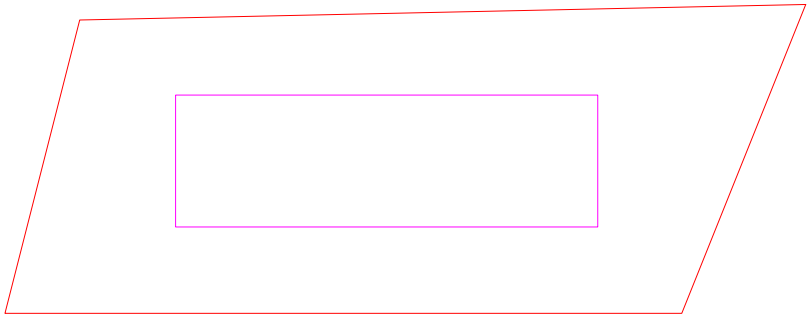
In 2012, a group of friends traveled to Mozambique to do some humanitarian aid work. For that, they prepared for 6 months, learning the official language, the local dialect and the necessary funds. Without a pre-established course, the fire of a classroom rushed them to help with their constructive knowledge and to work together with the community. That experience wouldn't be the only one.

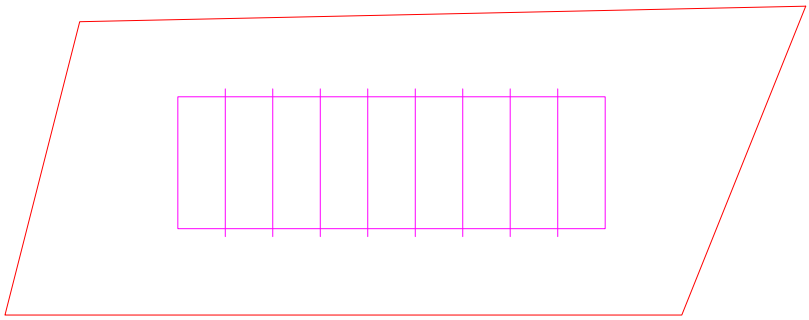
This is how Somos del Mundo was born, a network of people that promotes skills development programs for social impact, with two areas of work:

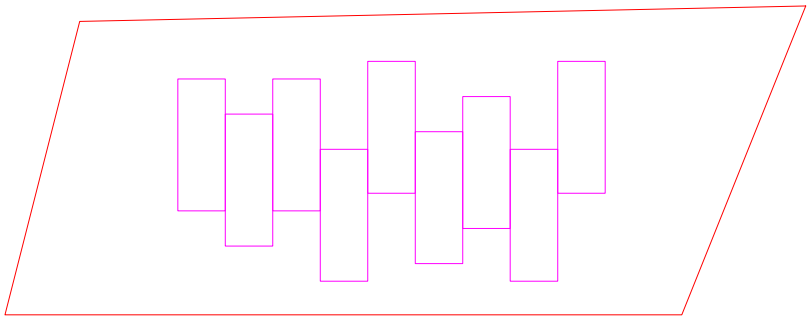
1) Promote the training of change agents through the development of skills
2) Generate solutions in rural communities

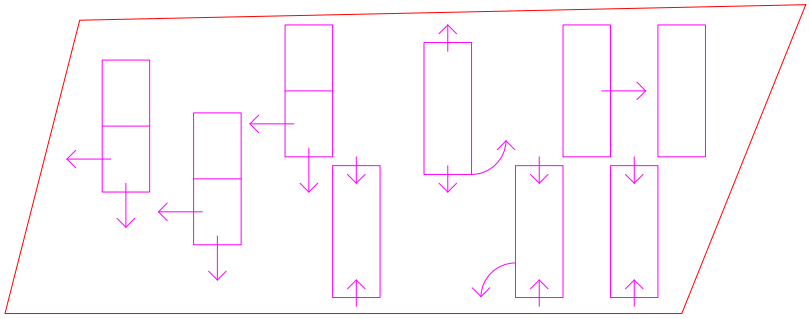
Nine years later, 86 classrooms have been built in around 50 rural communities in Mozambique, and 205 participants have been involved. Participants live with the rural communities for a month, working side by side and sharing their experiences. With every action of SOMOS DEL MUNDO, more and more children can go to school and their classrooms are not under a tree anymore.

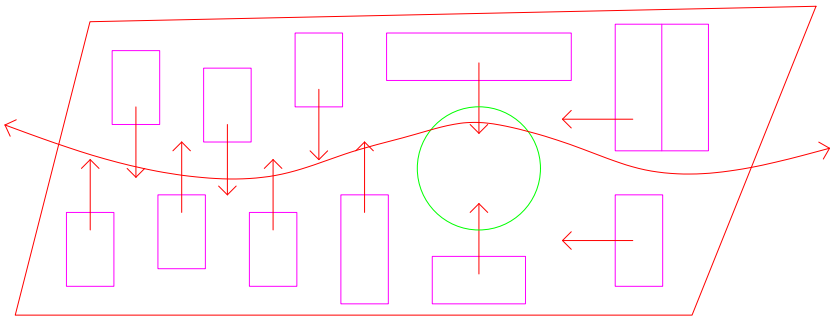
Design Concept





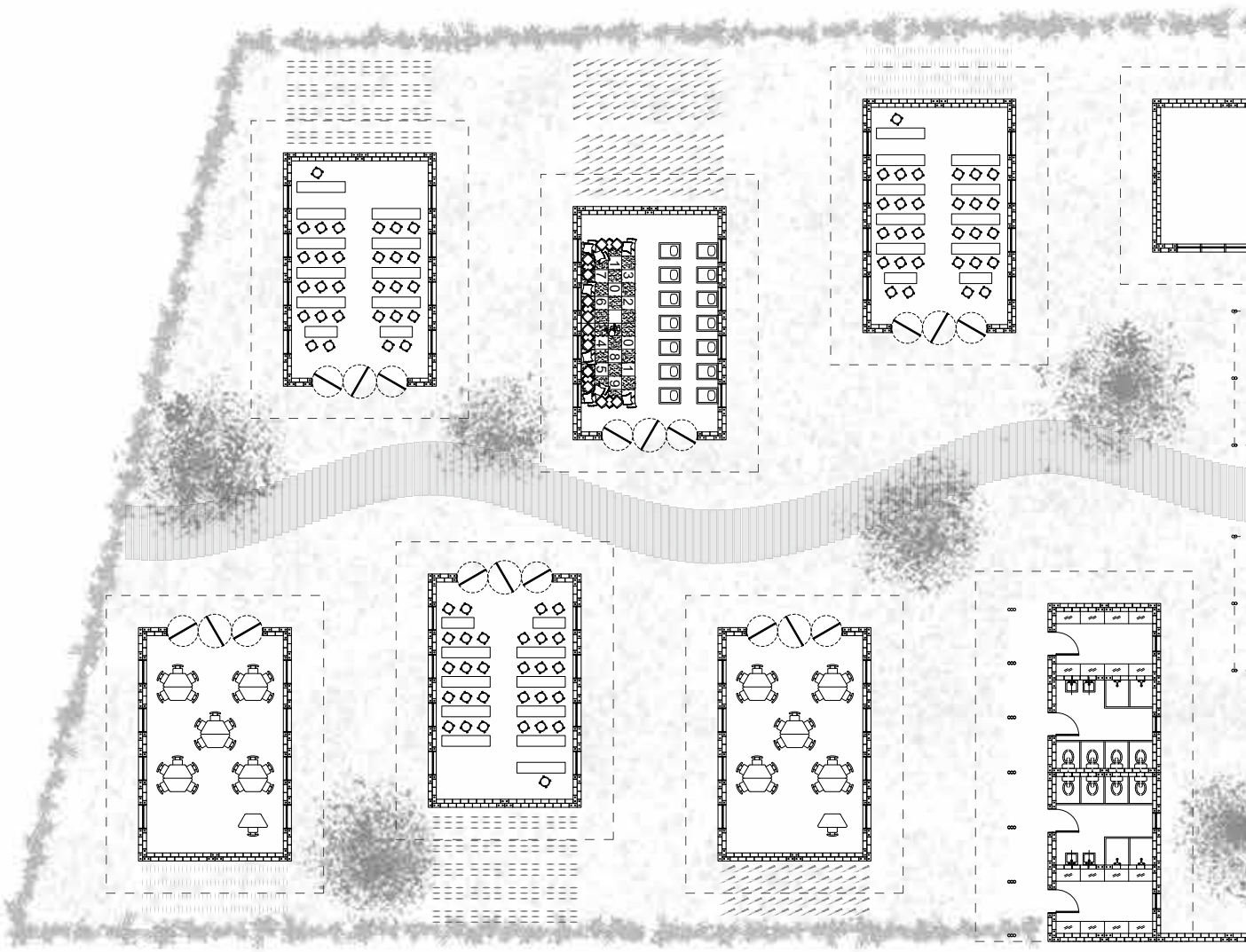


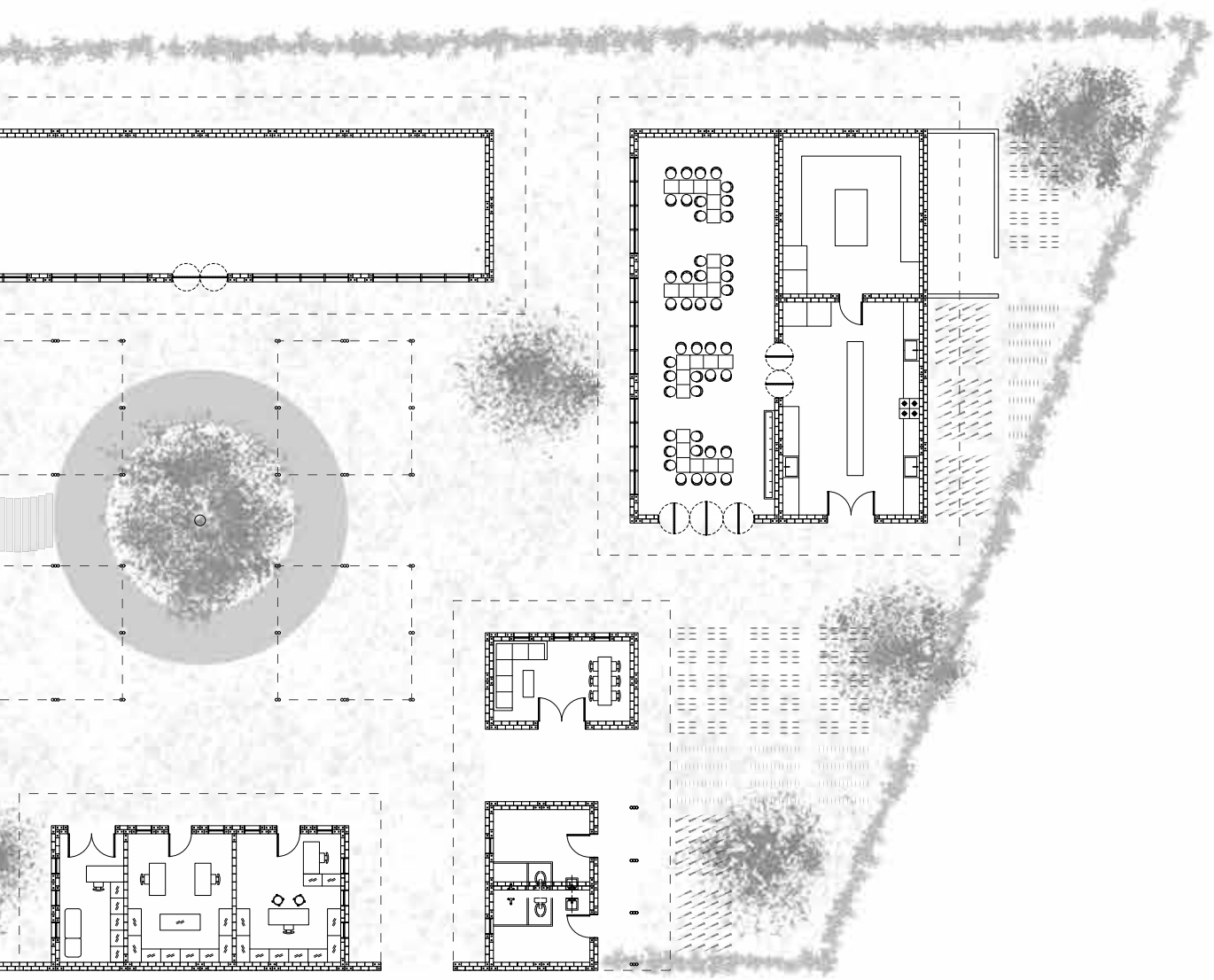




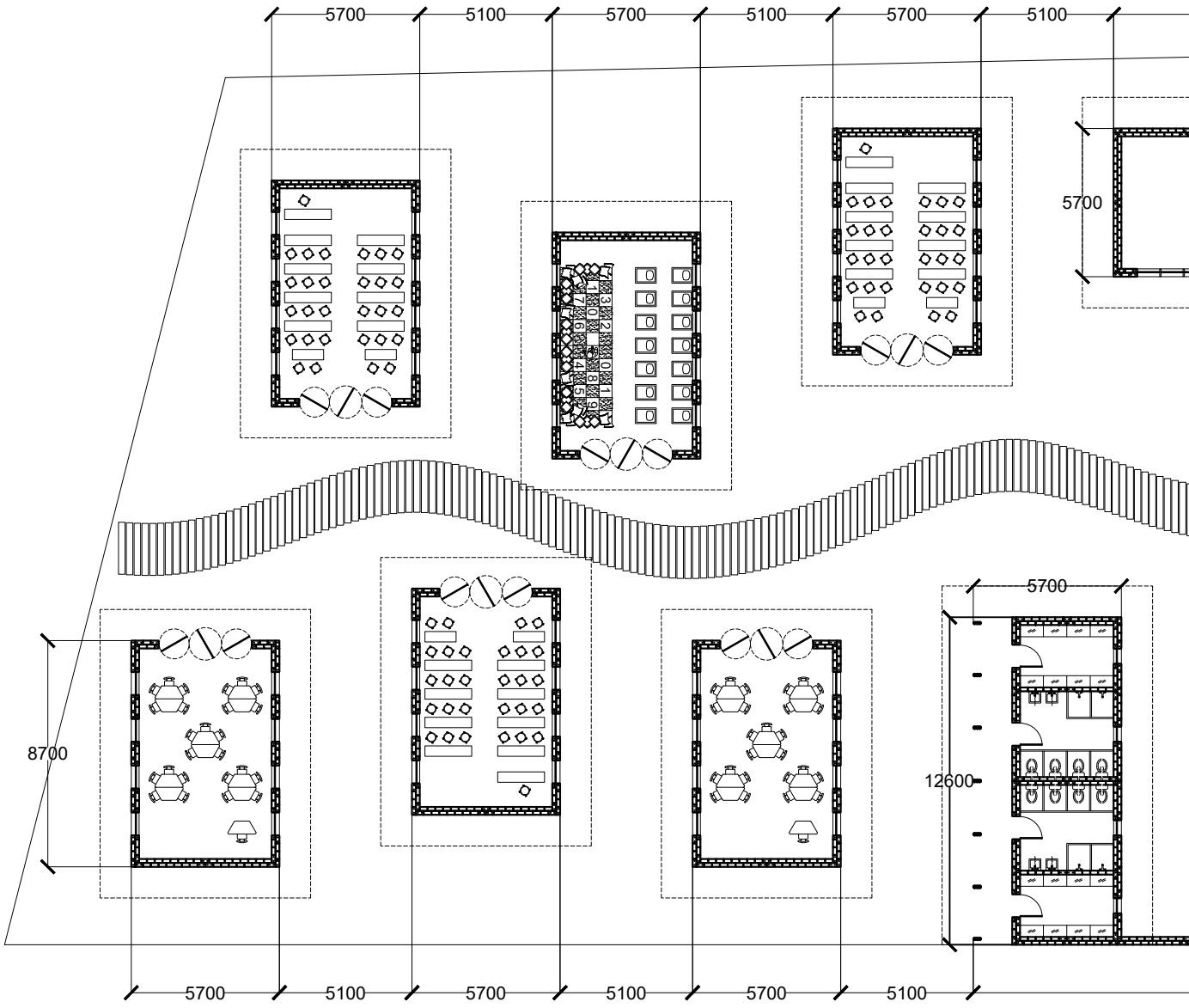
Through this succesion of modules, the great axis of the building is articulated, encouraging interaction betwen classrooms, relating the groups of children to each other and generating the different transitions between interior and exterior.

The project seeks the minimum unit of educational space, providing each clasroom, even each function, with its own apropriable natural outdor space, in this band children are able to develop all their educational activity. A place to learn, run, cultivate and discover nature.





Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Site Plan	Scale 1/2500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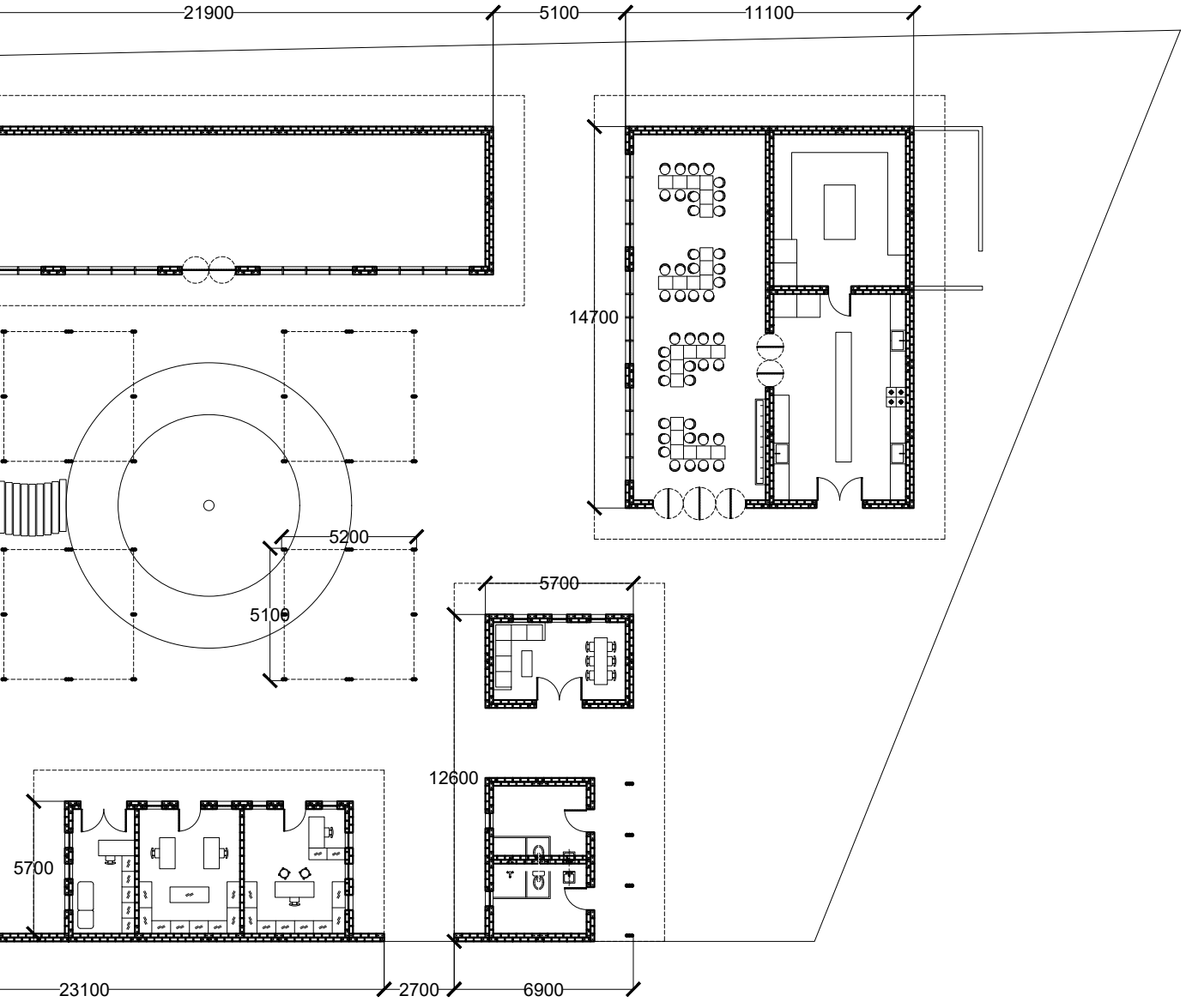
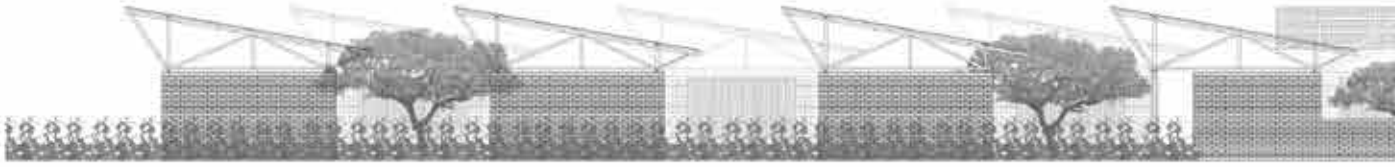
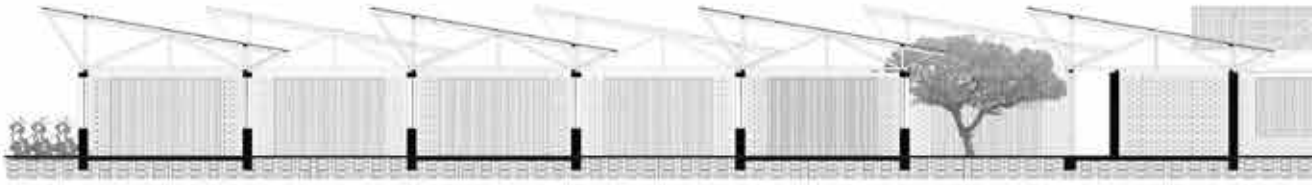
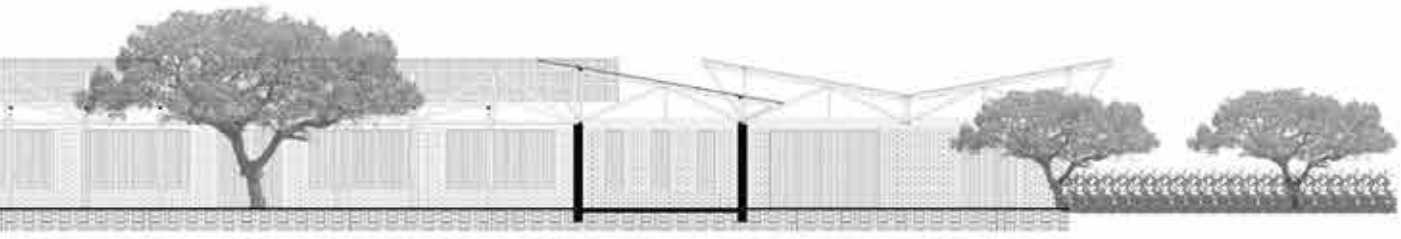


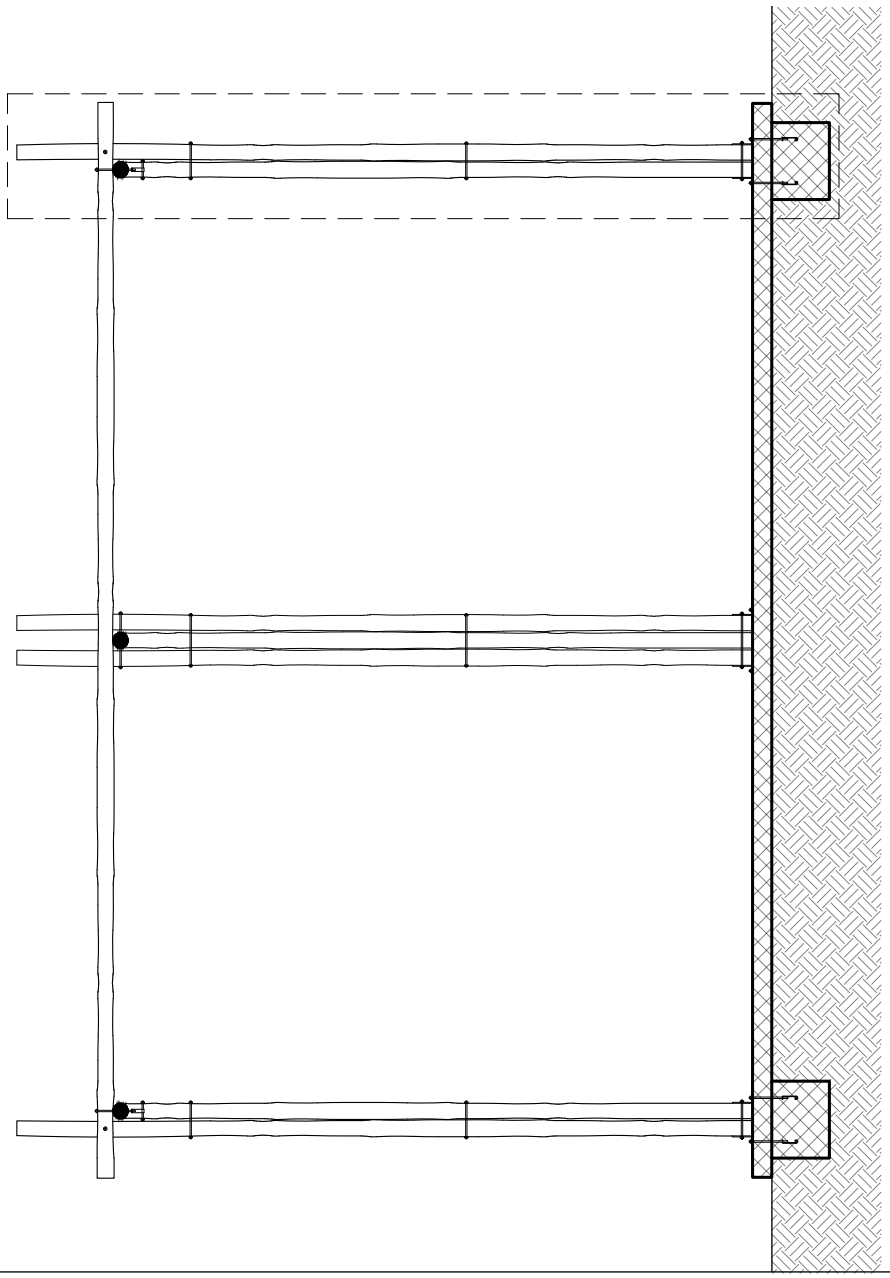
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Site Plan Dimensions	Scale 1/2500



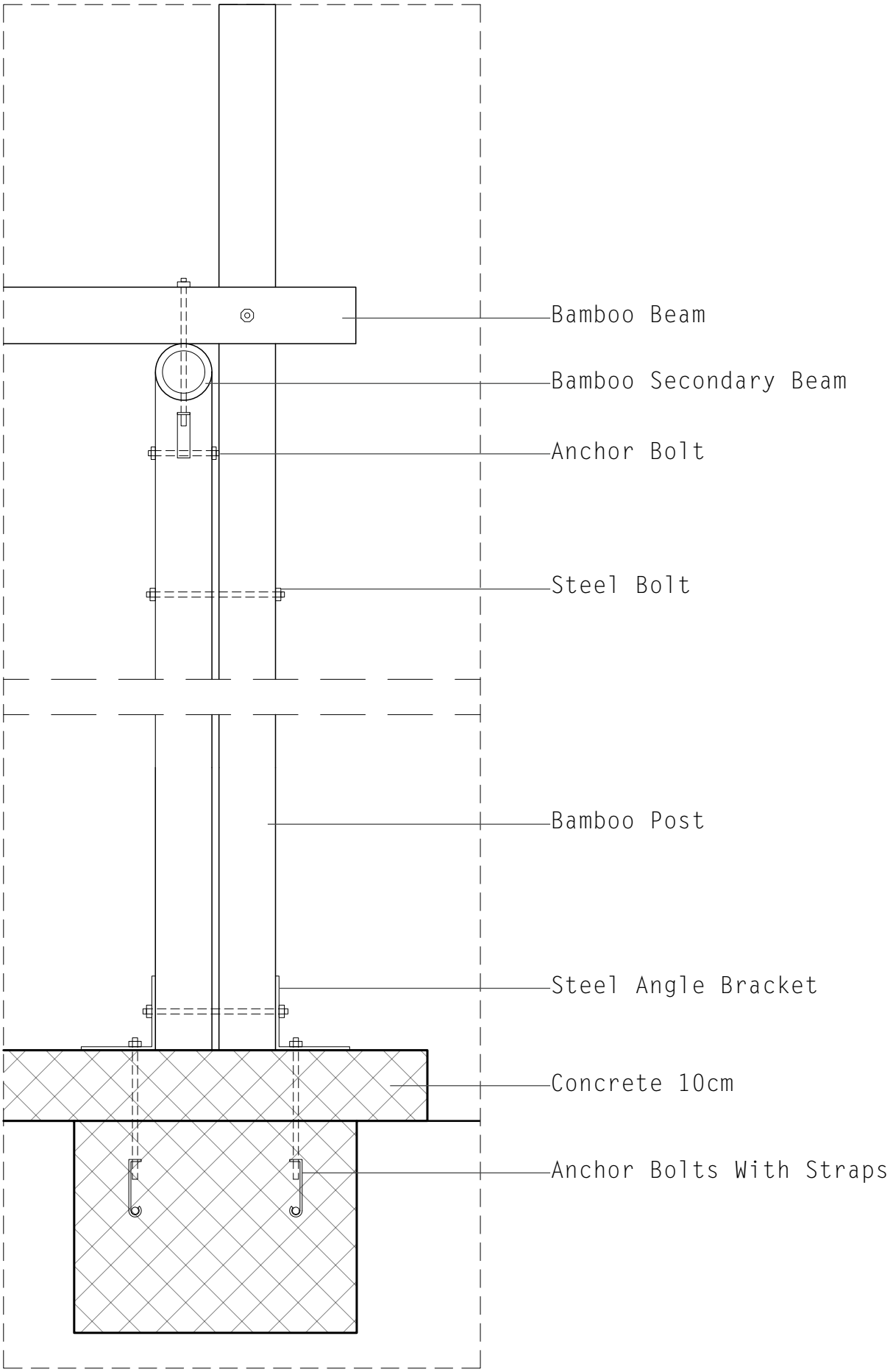




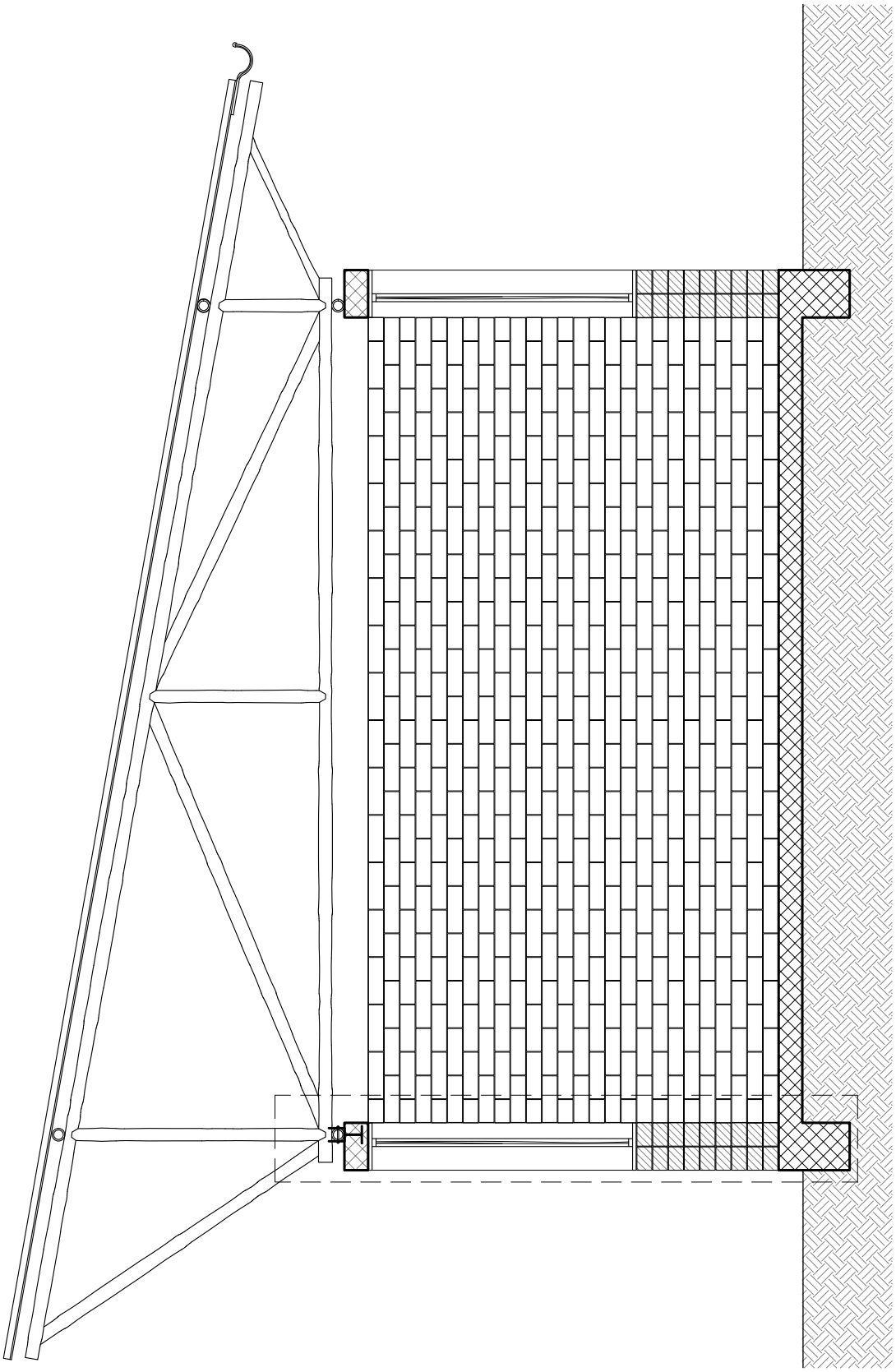
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Elevation and Section	Scale 1/2500



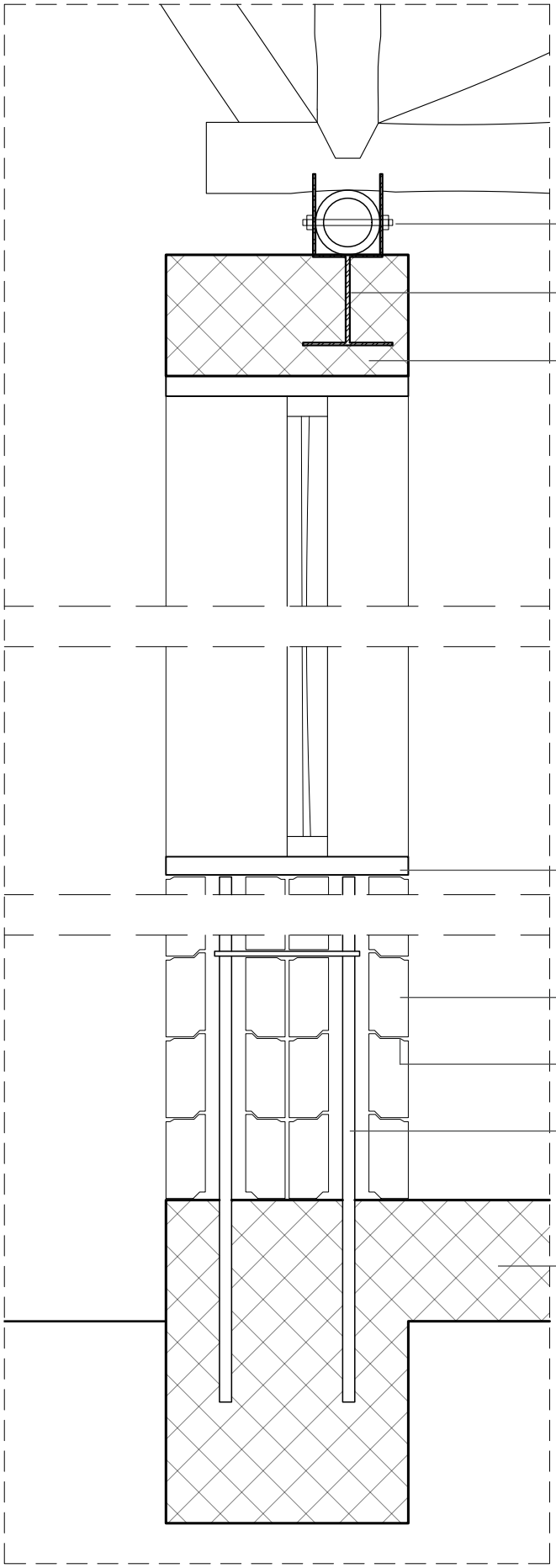
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 1	Scale 1/1500



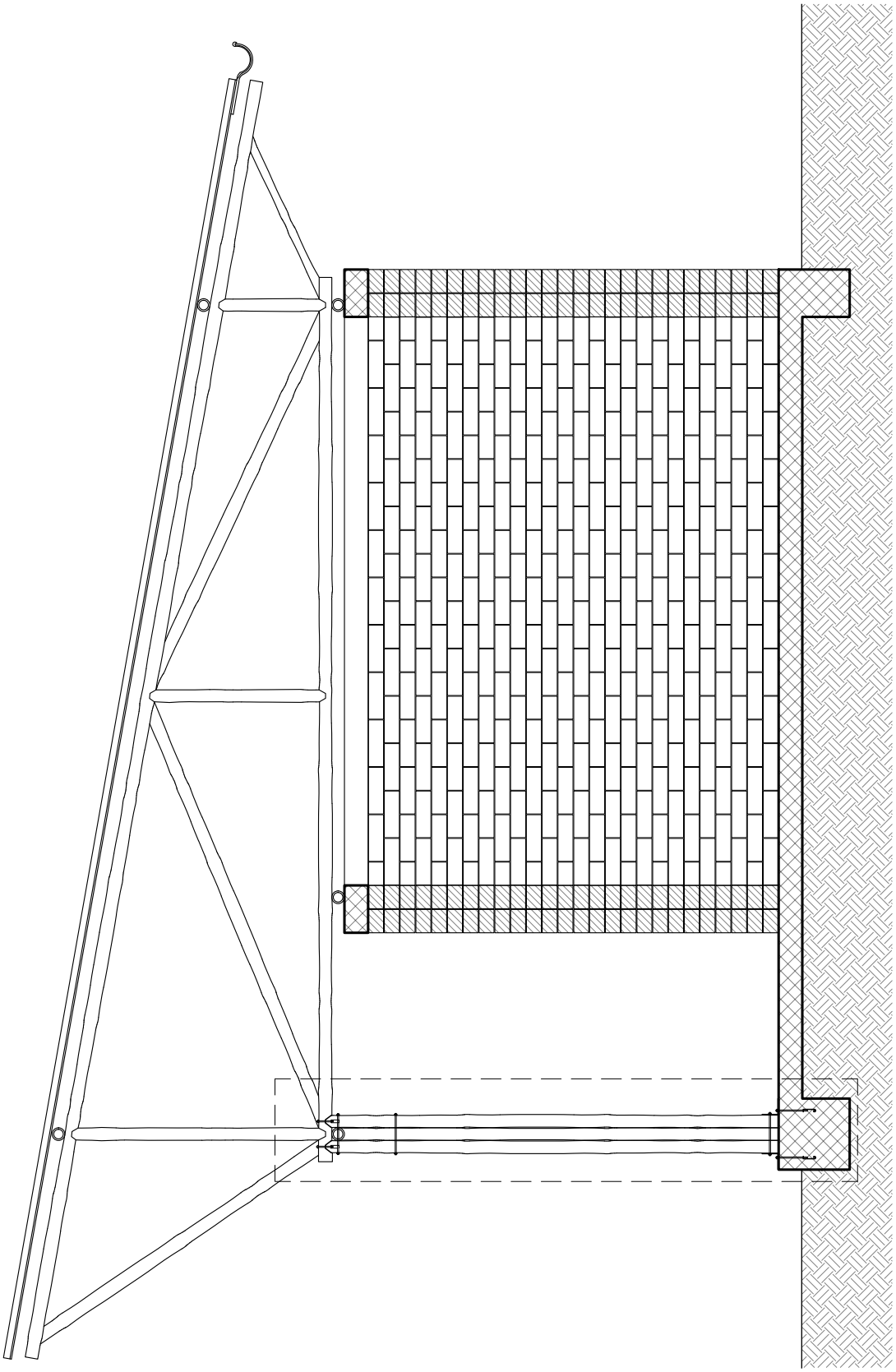
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 1	Scale 1/200



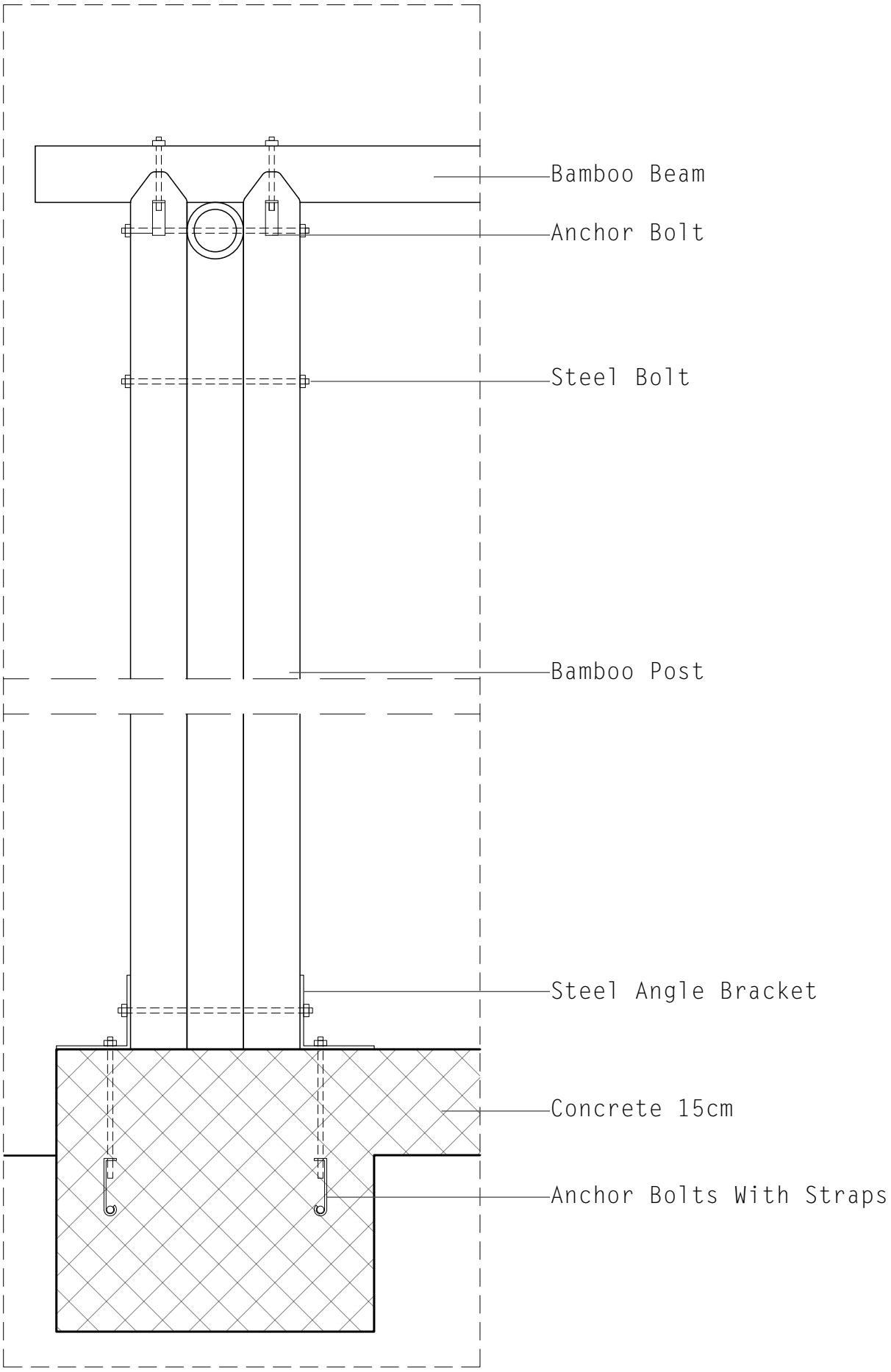
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 2	Scale 1/1500



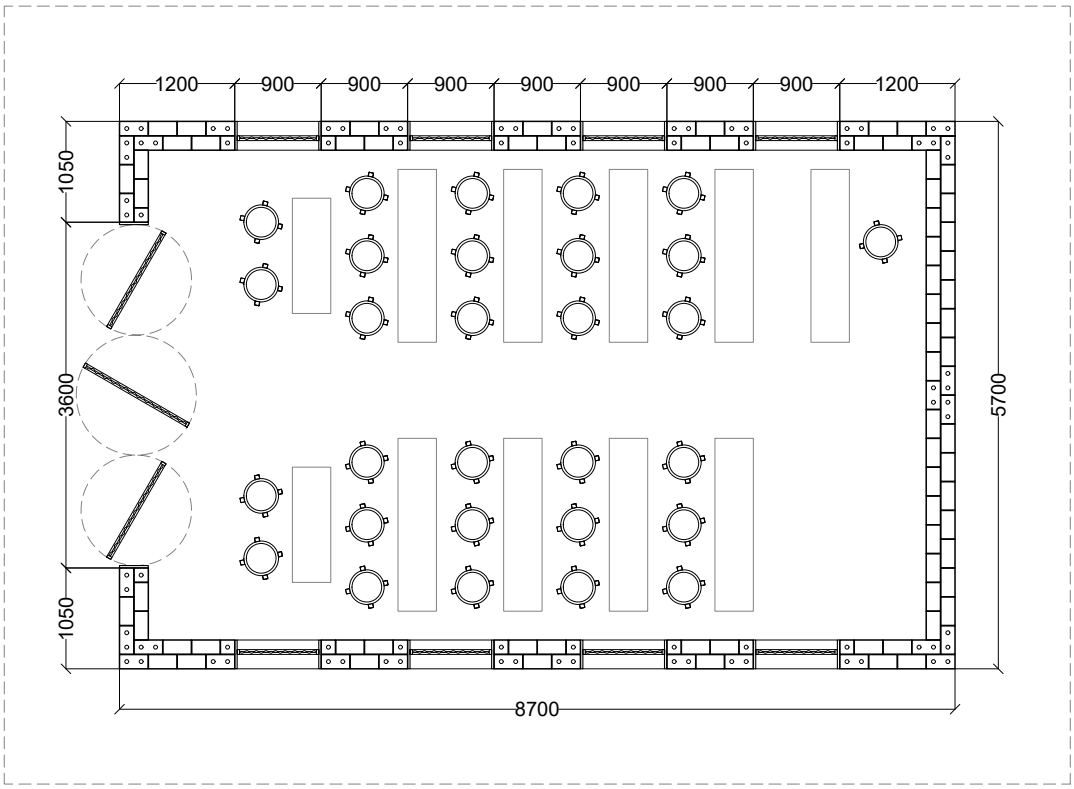
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 2	Scale 1/200

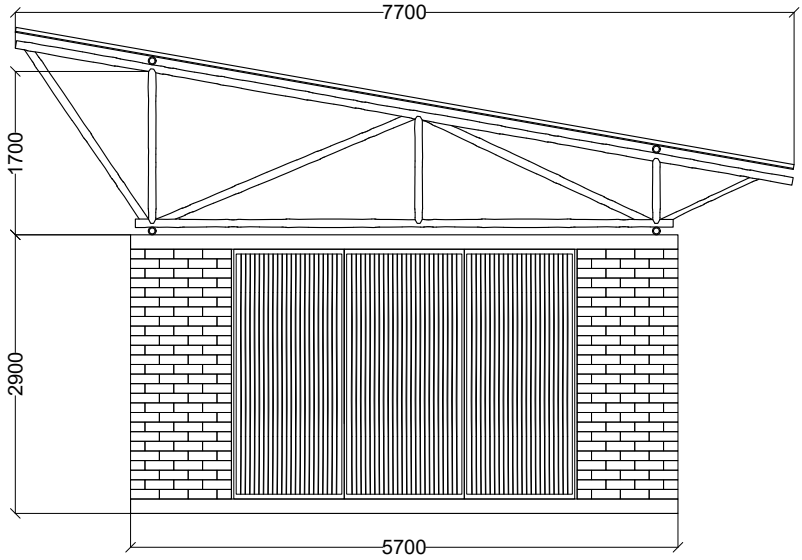


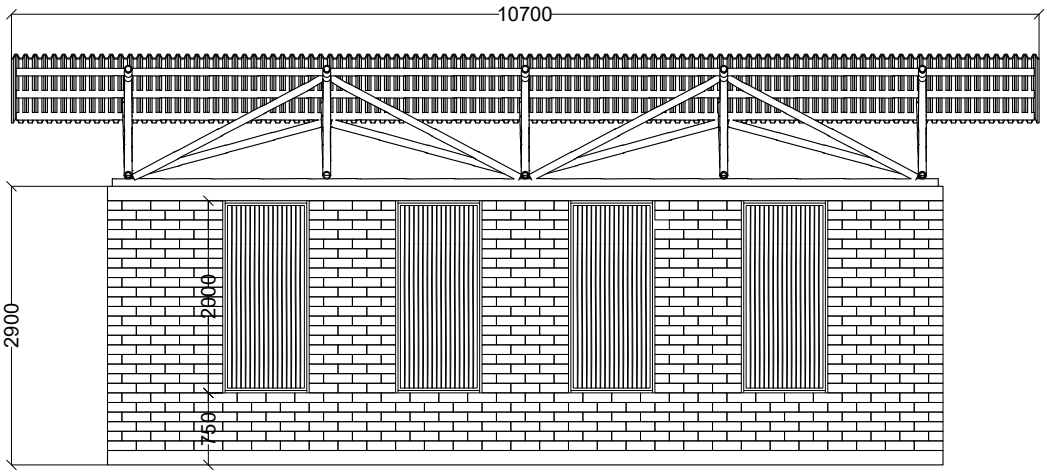
Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 3	Scale 1/1500



Politecnico di Torino - Architecture for Sustainability Design	
Designing Affordable pre-school with the inclusion of disabled children	
Wall Section Detail nb 3	Scale 1/200







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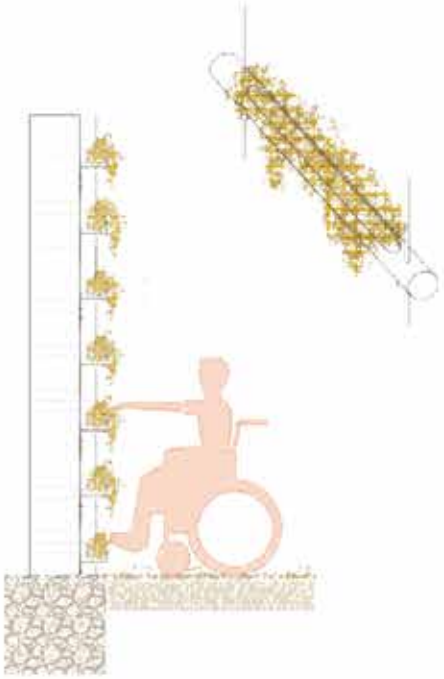
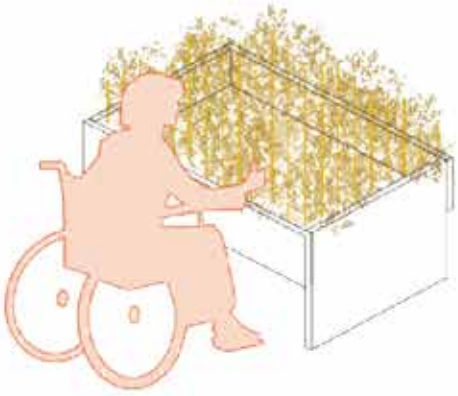
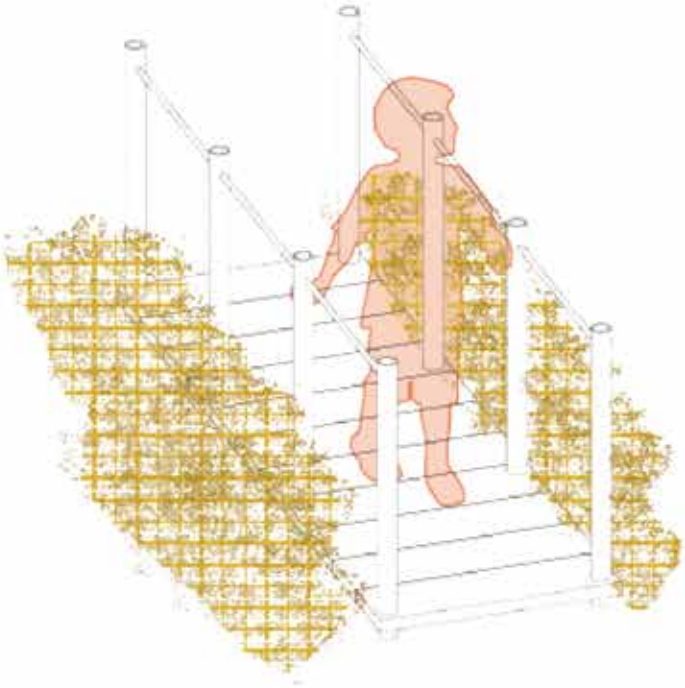
Designing Affordable pre-school with the inclusion of disabled children	
Plan and Two Elevations	Scale 1/2000



1. Vertical Orchard



2. Orchard Raised



3. Physical Therapy Garden

Part vi
Conclusion

Conclusion

In some countries “being disabled more than doubles the chance of never enrolling in school”, estimate the World Health Organization and the World Bank. According to UNICEF, 90% of children with disabilities in the developing world do not go to school. In a setting like Africa, developing countries, there’s several barriers between children with disabilities and learning. Of which, one of the main reasons is the accessibility, because of the poor infrastructure in the rural areas.

Sometimes, it’s not those obstacles that prevent children from learning, but the lack of schools in the cities and towns. The financing sector in developing countries is one of the key players in this ever-worsening situation. Which is why, promoting the usage of local materials would help the people to reach their needs in an affordable and sustainable way. For mechanical supplies, such as bio-digester, water tank for rain collection and solar panels can be implemented to harvest a self-sufficient building.

The involvement of the people in building their own town school would empower the community as a whole, open job opportunities and increase the social bond amongst the inhabitants. By learning to do so, it would be easier for them, for the future, to built many more schools and houses for themselves with the same techniques used in this project.

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