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I, Ryan M Thomas, hereby submit this original work as part of the requirements for the degree of Master of Community Planning in Community Planning.

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University of Cincinnati
Recommendations for Favela Upgrading:

A Case Study of Portelinha, Rio de Janeiro

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Abstract

Successful slum upgrading projects must acknowledge the causes of informality. This thesis examines existing literature and a case study of Portelinha, an informal subdivision in Rio de Janeiro’s North Zone. The literature stresses the use of participatory processes to determine community needs. However, due to resource constraints, the participatory research process is substituted by a case study method that analyzes data collected using a variety of methods including site visits and a socioeconomic survey.

Site visits, interviews, socioeconomic survey, and satellite images all contribute to the case study of Portelinha. The site visits provide qualitative data about the housing stock and community dynamics in Portelinha. Information gathered from interviews gives a professional perspective on favela upgrading projects. The socioeconomic survey contains information about the lives of the residents in Portelinha. And the satellite images show spatial dynamics of the area.

This thesis draws on the author’s experience in Portelinha and the literature review to build a framework for slum upgrading. Specific recommendations are also submitted regarding the best course of action for planning in Portelinha. The researcher finds that the morphology of Portelinha is rapidly changing, so that open space needs to be preserved. The surrounding area lacks adequate green space and tree canopy, though the rights-of-way provide enough space to plant street trees. Within Portelinha, there are numerous safety hazards that could be improved with minimal investment.

Slum-upgrading policies should address three aspects of informality: regulatory, physical, and sociopolitical. Regulatory issues include legalization of land tenure security and
minimum requirements for building safety codes. Physical issues address slowing growth and improving access to open space and landscaping. And the sociopolitical dimension requires that slum residents be empowered to participate in upgrading projects. By employing this three-level approach, development workers can improve the housing situation for low-income residents of developing nations.
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Preface

While studying abroad in Rio de Janeiro, the author completed two workshops studying the area of Portelinha. The present project will serve as a culmination of these efforts along with individual research that expands the scope of the upgrading project and offers a framework for an upgrading project for Portelinha. During four months studying at the Federal University of Rio de Janeiro, the author participated in a workshop joining two academic departments, with the municipal government of Rio de Janeiro as our client. The resulting product was a functional map and census of a portion of the complex of favelas of Maré, and the accompanying suggestions for architectural improvements to that area. The Department of Social Sciences conducted a survey of the residents in Portelinha, while the Department of Architecture and Urbanism mapped and suggested physical upgrades for the area. During the workshop, the students and professors were faced with several problems, some that were unavoidable, and others that could be avoided in future iterations of such workshops. However, it is not within the scope of the project to recommend new approaches to slum upgrading. Rather, the conclusions attempt to pull out the most important considerations for slum upgrading projects.
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Chapter 1. Problem Statement

Urban planning is concerned with improving the quality of life in urban areas. Yet, analyses of implemented projects routinely show major shortfalls in expected outcomes - especially looking with hindsight at the damage some of our best-laid plans have done to urban areas. Yet, the overwhelming majority of planners are motivated by an ethical commitment to utilize their skills for the betterment of society. With the majority of the world’s population living in cities, urban poverty has become one of the most pressing problems facing the field of urban planning. Several relatively popular books, e.g. Mike Davis’ 2006 publication, *Planet of Slums*, have been published in the last ten years addressing the issue of urban poverty and the proliferation of slums in the developing world.

In addition to individual authors’ documentation of the proliferation of urban poverty, major multilateral agencies and non-governmental organizations have begun devoting more energy and attention to the problem. The Cities Alliance was developed in 1999 with the goal of creating cities without slums (The Cities Alliance 2012). United Nations Habitat Program initiated the *Global Report on Human Settlements* series in 1986, without publishing a second edition for ten years. However, since 1999 the Report has been published bi-annually (United Nations 2012). These organizations allocate substantial portions of their budget to smaller, grassroots organizations that provide services to low-income communities.

### 1.1 Scope of Study

The current project aims to provide a framework for improvement of Portelinha, a small portion of the neighborhood of Maré, in the North region of Rio de Janeiro. The plan will be focused on the specific issues in *Portelinha*, though these issues are commonly found in many
informal settlements, especially in Latin America. This project applies lessons from literature and interviews to improve the safety, health, and availability of green space in Portelinha. These aspects of the built environment are jeopardized by a lack of planning and resources to implement the ideal solution. For this reason, the plan has been informed by field visits to Portelinha and other data specific to the site, as well as a review of the literature surrounding both the problem of informal settlements in Latin America and slum-upgrading projects. By drawing on past experiences, this project hopes to avoid repeating some of the mistakes made by previous policies and plans. In doing so, the recommendations herein are meant to be transferable.

The shortage of information about Portelinha is common among projects in developing nations. In fact, planning decisions are made with the available information, without spending scarce resources digging to the bottom of specific phenomena. This approach may lead to mistakes, but it is part of the reality for practicing planners. Perhaps this is one of the reasons that participation has become such an important aspect of planning processes, so that at least planners are not dictating inappropriate solutions to community issues. It is not the mission of this thesis to delve into the theoretical justifications for acting with incomplete information, but it will become clear that the researcher accepts this tenet as a truth of practicing planners.

1.2 Organization of the Thesis

The next section of this thesis will review the relevant literature regarding the scope of informal settlements in developing countries, the development of favelas in Brazil, and the main strategies for upgrading of informal settlements. By addressing the context of informal settlements and the typical issues that affect them, the literature review sets up the appropriate methodology for the collection and analysis of data. Section three describes the methodology.
utilized for collection of data and justifies the case study method. The data are presented and analyzed in section four. Section five synthesizes the data and presents findings of the case study of Portelinha and proposes potential solutions. The research question is answered through the manifestation of findings and proposes solutions.
Chapter 2. Literature Review

2.1 The Problem of Informal Settlements in Latin America

2.1.1 Scope of the Problem

Global economic pressures have been driving migration rates to urban centers in Latin America for the last century. Housing shortages are growing as rural dwellers migrate permanently to urban areas. Unemployment and economic stagnation exacerbate the housing shortage, as new urban dwellers who do not have access to housing do not have resources to rent or build their own homes. The issue of housing shortages is inextricably linked to the lack of urban services. Rapid urbanization puts additional stress on the provision of housing and services each year. The cost of housing in these areas is not affordable to the poor residents who make up a large proportion of the population (Navarrete and Ferguson 2003). This leaves an estimated 78.2 percent of the developing world population living in informal settlements (Davis 2006). Lack of resources limits the government response to the issue of providing housing and urban services for poor citizens. Adequate housing is among the most basic and dire needs in developing nations. Planners have led developing nations to capitalize on global markets. Meanwhile, they have generally forgotten about the need to provide shelter, especially in plans for economic development (Shatkin 2004).

To make up for the gap in services, non-governmental organizations employ several methods of providing and securing housing for the poor. Sites and services, financing options, entitlements, self-help housing, and rental housing all contribute in some way to the improvement of the housing provision in developing nations (World Bank 2006). As development organizations experiment with a variety of these strategies, the issues facing urban centers continue to shift. In Latin America, development policies and projects are
shifting toward infrastructure improvements and communal tenure security over relocation strategies and individual ownership (Fernandez 2011). While these projects have had more success, the scale and rate of change needs to be improved.

Housing policy is typically provided on either a national scale or a municipal scale. National housing policies include financing distribution (possibly from multilateral aid organizations), sites and services, basically running the gamut of policies listed above. National policies often fail to address the poorest members of society. Incentives and other financial tools help households who are just on the margins, who can nearly afford a house. These tools help only those who know about them and have access to the institutions that administer them, not always the ones in most need. By taking a broad-level approach, national and municipal policies sometimes destroy neighborhoods in the name of eminent domain, such as Brazil’s actions in preparation for the World Cup 2014 (Philips 2011).

Urban services face some similar dynamics to those of housing issues. First of all, housing is insufficient unless it is connected to a network of services. Major shortages in urban service provision in developing nations include sewage, running water, electricity, roads, solid waste removal, and communications and technology infrastructure. These issues are dealt with on all scales from national and international to neighborhood scale. For example, building sewage gutters and providing running water and a road for a neighborhood could be a project financed by a municipal government. The same municipality may have an initiative to connect the outskirts of the city to the downtown with cell phone towers. Connections between municipalities may take place as regional or national initiatives, in the form of roads or communication technologies.
Urban service policies in developing nations have the potential to make a huge impact on the sustainability of the world’s energy usage. The proliferation of urban dwellers and the lack of service available in those urban centers represent a large and growing market for renewable energy. For instance, India’s National Plan on Climate Change outlines several strategies to provide Indians with the energy necessary to increase the standard of living, while mitigating the increase of fossil fuel consumption (United Nations Environmental Programme 2005). A successful solar energy policy, Solar India, helps households finance solar-powered batteries for their homes. Public transportation is widely known to be more sustainable than individual transportation systems.

Regardless of the scope of the housing woes in developing nations, development workers have reason for hope. The bottom line is that some policies have worked and others have failed. But the field is young and less than scientific. With diligent work, more broadly effective policies will emerge. Alan Gilbert wrote an article criticizing two major schools of thought concerning the scope of the housing crisis in developing nations (Gilbert 2009). First, Gilbert argues that the housing issue cannot be resolved in the near future, even with increased support from the international community. Second, he states that the proliferation of informal housing does not pose an insurmountable problem for development workers (Gilbert 2009).

The implications of this work aim to contribute to the UN Cities Alliance goal of cities without slums by advancing the lessons from previous slum-upgrading projects and proposing specific solutions. As such, this project is aimed at addressing two main issues in the Portelinha: the physical conditions of the area and the regulations governing land occupation.
It also addressed the sociopolitical dimension by suggesting that favela residents should be empowered to participate in planning and implementing upgrading projects.

2.1.2 Informal Settlements in Brazil

Like much of Latin America, Brazil experienced rapid urbanization in the mid-Twentieth Century as rural workers streamed to the big cities of Brazil seeking economic opportunity from the rapid service and industrial sector growth. Both São Paulo and Rio de Janeiro were the recipients of millions of migrants during the Twentieth Century, with much of that growth happening in poorer income brackets (Riley and Wakey 2005). Much of the growth resulted from rural-urban migration, with the highest growth happening in between 1960 and 1980 (Fernandes 2002).

The United Nations has identified four types of slums in Rio de Janeiro: favelas, loteamentos, invasões, and cortiços (UNHSP 2003). Favelas are defined as consolidated areas without infrastructure or access to public services that exist on invaded land. Loteamentos are illegal subdivisions that can be found primarily in the eastern portions of Rio. These types of settlements exist in locations that do have a titled owner, but are illegally occupied by greater than the permitted number of residents. Loteamentos can describe two possible types of land rights, either the legal owner subdivides the land without gaining proper regulatory permission, or illegal residents subdivide the land themselves. In some cases of loteamentos, the owner of the property may rent out the units. In other cases, the owner has abandoned the property and the area becomes occupied through complacency on the part of the owner or with permission of gangs that run the neighborhood. Land division often comes with greater access to services, and may result from once-occupied land, than invasions.
2.2 Upgrading Policies

2.2.1 Large Scale Versus Local Policies

As is the case for housing provision, the financial tools available to provide services for households in developing nations do not always help the poorest people. Usually, these incentives and low-interest loans bring the cost of service down so that only those on the margin of demand can afford them. This is especially true the wider the scope of the policy. For example, one of the major critiques of India’s solar policy, which offers loan subsidies for the upfront costs of purchasing solar powered lighting, is that only the marginally poor have access to the benefits of the subsidy (Prime Minister’s Council on Climate Change 2007; Mallah 2012). The policy is national in scope and cannot be adapted to special circumstances. More localized, neighborhood-oriented policies can tailor the incentives to reach those in the most need. Caccia Bava and Mullahy illustrate a successful policy of this type in Brazil in which the local government provided public transportation tokens to those who needed subsidies to get to work (1995). Smaller scales of analysis make more manageable the identification of specific problems faced by the poorest households.

Low-income households in many developing nations are making their way to low-middle income, making private investment a more feasible option for upgrading housing (Navarrete and Ferguson 2003). Microfinance can be used at all points in the value chain to make housing upgrades more affordable to low and middle income communities. One of the challenges combating the proliferation of slums is working out a financing solution. Low-income communities have had trouble gaining access to formal credit options until the “creation” of microfinance because lending to low-income households was generally believed to be high-risk. The use of sub-prime mortgages in the U.S. shone a spotlight on the dangers
of high-risk mortgages. However, according to Navarrete and Ferguson, funds that employ “appropriate underwriting practices have continued to perform reasonably, even when lending to lower-income groups” (Navarrete and Ferguson 2003).

In the rapidly-developing economies of Brazil, India, Peru, and Indonesia, market studies show that credit is highly demanded to finish the interiors of government-funded shells – for building materials as well as professional work (Navarrete and Ferguson 2003). Navarrete and Ferguson argue that this credit should be offered in a variety of ways to meet the demands of the market. Navarrete and Ferguson offer recommendations for developing the finance market to be more accessible to those with limited access. Informal credit markets should be allowed to perform alongside formal markets (Navarrete and Ferguson 2003). These informal markets are reliant on personal relationships and trust among community members. Navarrete and Ferguson cite a study showing that relationships of trust can take up to 10-15 years to reach the level necessary for both parties to feel comfortable entering into a lending self-help community (Navarrete and Ferguson 2003). The microfinance solutions should be integrated with business partnerships that spread lending across the supply chain for housing.

2.2.2 Land Tenure Issue

Security of land tenure has been one of the most complex debates in the international development literature. The United Nations Human Settlement Program report, The Challenge of Slums, greatly simplified the debate, boiling down the issue to two general strategies: freehold titling, and legal security without ownership (2003). This simplification provides a useful base to begin understanding land tenure security provision. Of course there are many complexities within both of these general strategies, and their popularity has ebbed
and flowed over time. Practitioners have more recently argued that freehold titles do not produce their intended results, but instead have a variety of side effects that have proven to be detrimental to low-income residents. Freehold titles often contribute to a cycle of informality caused by increasing property values in newly regularized areas.

For this reason, practitioners have argued for more participatory methods and customized approaches for each community, since each situation presents unique dynamics and histories. One such strategy is an incremental approach to land tenure security provision, beginning with communal rights and advancing to more individualized and easily transferable rights as time passes and community members agree to proceed. Provision of rights incrementally, as opposed to all at once, creates less of a shock to the housing market in low-income areas with informal housing (UNHSP 2003). Incremental tenure rights can be delivered administratively to a community or individuals. However, it is more common to provide security of tenure first to a community and move progressively toward individual and freehold titles. This strategy is more affordable and supportive of the community while still delivering on the intent of the project - security of land tenure. By reducing the administrative burden, the communal approach becomes more affordable to low-income residents and increases the likelihood of success (Urban LandMark 2010).

A variety of regularization frameworks exist with respect to the issue of regularization, either facilitating or complicating the provision of land tenure security. The trend in the international community has been moving away from outright titles (UNHSP 2003). Alternatives to outright titles are numerous and the specifics depend on the situation. UN-Habitat agrees that alternatives to titling are more effective for several reasons. Outright titling is a top-down method of providing security of tenure that often fails to reflect the needs
and desires of poor residents. In some cases, freehold titles are too expensive for poor residents to afford, either for the up-front registration costs or the maintenance fees and taxes associated with owning land. For these reasons, the cost of freehold titles can lead to a de facto eviction. However, residents are still able to take advantage of short-term monetary gains from full ownership by selling their properties. Property values typically increase when titles are issued; this acts as an incentive for residents of newly titled properties to sell their property and occupy another informal area. Not much is required of low-income residents who are given freehold titles, yet participation is key to improve success of development programs (UNHSP 2003). While traditional land ownership may be seen as the norm from the perspective of government employees, the majority of the world’s population lives without land ownership. Projecting the norms of the upper class onto the situation of low-income citizens often proves ineffective.

The main desired effect of tenure security is to guard against eviction. This makes land ownership a rather blunt tool for the job with side effects that may confound the situation. Projects that ensure security of land tenure and require community participation have been most successful (UNHSP 2003). To combat these complications, some programs have promoted collective ownership or leasehold and included stipulations restricting the transfer of properties within a specified amount of time or unless approved by a community counsel (Fernandez 2011). These projects can also include consolidation of the settlement while legal tenure is established. Consolidation mitigates some of the potential downsides to regularization while still delivering secure tenure and strengthening communities. Informal economic opportunities for favela residents often rely on social networks and informal credit (Riley 2001). Such social networks are especially important for low-income workers and
community cohesion contributes substantially to the success of projects because it is easier to communicate with organized groups. As mentioned previously, granting land ownership to residents of informal settlements can lead to a cycle, whereby residents sell their newly titled properties and move to other informal settlements.

Several authors have written about the importance of land tenure over land ownership or titleship. Strategies to increase the perception of security of tenure for a community are just as good with or without a provision to formalize the ownership of land. Many of the arguments in support of alternative land tenure are based in practical experience (Handzic 2010; Fernandez 2011; Urban LandMark 2010); policies that increase the perception of secure land tenure can be more successful without requiring legal ownership of the land. In some situations, outright titleship is regarded as an ineffective solution to the problem of land tenure – mostly because of its unintended consequences. For example, granting titles outright has in some cases shown to cause property values to rise out of the reach of current residents. This creates a cyclical problem, where residents, being priced out of their own neighborhood, sell their property and move to other informal settlements (Fernandes 2002). The process of issuing titles is expensive in itself and the cost may be prohibitive (Castro 1999). For these practical reasons and others, land tenure security is seen as a primary goal and titling has increasingly been regarded with caution.

The theoretical underpinnings of land legalization are also critical to understanding how to promote development effectively. Andres Blanco argues that development theory can provide a new way to think about property rights in order to justify the movement away from outright titling. The following section summarizes Blanco’s interpretation of the informal-formal distinction, further justifying the movement away from outright titling. Blanco states
that planning theorists have mostly justified land titling by appealing to the concept that property is a natural right, posited by John Locke (Blanco 2012, 35). However, there are several dimensions to property rights that interact in discourse as opposing forces, and these dimensions are not accounted for in the “natural right” conception (Blanco 2012, 22).

Blanco describes four land allocation discourses: market, rational-comprehensive, participation, and resistance. The culmination of these four discourses amounts to land entrepreneurialism, which Blanco criticizes as a force of oppression that stands in the way of more just land allocation. To illustrate his points, Blanco analyzes Bogotá using the four discourses.

First, the market discourse allows the pricing mechanism to allocate land according to strata, which are reinforced in the rational-comprehensive discourse by the provision of infrastructure to wealthier areas. Blanco explains that, in the absence of market controls, Bogotá has been left with “socioeconomic residential strata” (Blanco 2012, 26). The separation of residents of different socioeconomic status resulted from the combination of low-income residents, who have limited choices, and high-income residents, who are able to relocate to areas with better infrastructure, lower densities, and property titles. The spaces in between the two ends of the spectrum are occupied by middle-income residents (Blanco 2012, 25).

Second, the rational-comprehensive includes comprehensive planning and recommendations for how the city should grow. Blanco states that this could be the market-correcting discourse, but it reinforces the disparities created by the market discourse (Blanco 2012, 26). Planning in Bogotá has further entrenched the stratification of housing quality by allocating resources to wealthier neighborhoods by enforcing zoning restrictions that are
skewed to reflect the realities of high-income areas. The standardization of high-income norms was relaxed in the 1972 reform of planning standards that allowed for “minimum requirements” (Blanco 2012, 26). Further, the property taxation has not been collected at levels adequate to fund the installation of infrastructure improvements in the city. Even when compared to other cities in developing nations, the property tax collection rates in Bogotá are low (Blanco 2012, 27).

Third, the participation discourse deals with democratic processes of land allocation. Blanco states that participation is mandatory for many housing policy decisions, but the processes are mostly to fill protocol and lack depth. “Community participation has been conceived more as a way to legitimize the status quo than a real alternative for public decision making” (Blanco 2012, 28). This form of participation results in clientelism and partisan decision-making rather than empowerment.

Finally, the resistance discourse deals with the dynamics of eviction of “invaders” and tacit acceptance of illegal subdivisions. The difference between the two types of occupation is that landowners stand to gain nothing from invasions, whereas illegal subdivisions allow for exploitation through sale of property (Blanco 2012, 29). Law enforcement has protected the most valuable land from invasion by squatters, but the law is not enforced when title-holders illegally subdivide their land to increase density and profits (Blanco 2012, 29).

Blanco states that these discourses “collude” into land entrepreneurialism, where the legal framework is used to extract every benefit for those with power by systematically ignoring the law or utilizing it as needed (Blanco 2012, 30). Each of the discourses contributes to a spatial development pattern that divides the city by socioeconomic status, with low-income residents living in high-density areas and high-income residents in low-
density areas surrounded by middle-income areas of medium density. While the four discourses may be at play in any city in developing nations, they are each co-opted by the systematic abuse of power, resulting in “a distorted amalgam of the discourses governed by the ability of landowners and developers to win privileges at the expense of the community” (Blanco 2012, 30).

2.3 Favela-Bairro Program

Favela-Bairro attempted to remedy the past failures of housing projects in Rio de Janeiro by recognizing that there were too many informal settlements to remove them all. Instead, the strategy of Favela-Bairro was to improve the informal settlements with infrastructure to assure the residents that their housing is secure. The stated goal of Favela-Bairro is to integrate the informal settlements into the fabric of the city (Castro 1999). This strategy has proven in other locations to increase investment in housing upgrades, length of tenure, and contribute to higher quality of life for residents of informal settlements. It is important to note that Favela-Bairro is a comprehensive urban planning program aimed at providing better access to services and infrastructure without full legalization of land tenure (Handzic 2010). Prior to this plan, there was no systematic urban planning in informal areas (Castro 1999, 6). In addition to physical infrastructure upgrades, Favela-Bairro incorporated social programming that could contribute to the sustainability of the improvements. Much of the work will require continual upkeep and maintenance, which would pose a substantial cost to the state. However, Favela-Bairro required that the community provide long-term maintenance for most of the projects.

The program was created in 1994 by the municipal government of Rio de Janeiro, following the adoption of the Constitution of Brazil in 1988. The new country’s new
constitution gave considerable financial power to the states to administer and execute programs. Under the Brazilian Constitution, municipalities are also part of the federation. Because of this decentralization of power, Favela-Bairro was able to be adapted to the needs of specific neighborhoods. Rabello de Castro argues that this contributed significantly to the success of the program. The wealth of Rio de Janeiro, being one of the richest municipalities in Brazil, also contributed to the success of Favela-Bairro.

Prior to the Constitution, Brazil had implemented slum-clearing policies, which exacerbated rather than solving problems of poor people. The clearance of slums was not met with the necessary replacement housing developments, and most of the residents were left living in informal housing in other areas of the city, usually on the outskirts, where land is less sought-after. Many of the early settlements were under communal ownership. The municipal land policies eventually forbid the communal ownership of land and put further pressure on residents of informal settlements with the threat of eviction (Castro 1999).

Castro states that one of the catalysts for the transition from slum clearance policies to slum upgrading policies like Favela-Bairro is Article 429 of the Constitution. Article 429 requires due process and appropriate criteria for eviction of favela residents. Specifically, a community cannot be evicted unless there is are environmental, health, or safety risks caused by the location of the community. When there is an eviction, the following three procedures must be followed: A technical report is issued; the community must be included in the analysis and creation of solutions; and the new housing locations must be near employment or current dwelling (Castro 1999).

While Favela-Bairro did not include full legalization of land tenure, the program did eliminate the fear of eviction by showing that the state is willing to invest in infrastructure
Handzic uses a case study of the Favela-Bairro program to illustrate that full land tenure is not necessary for successful slum upgrading projects (2010). One of the reasons that Favela-Bairro excluded regularization is the cost of legal services (Castro 1999), which include each branch of government. Castro argues that a new system for regularization is necessary to provide legal tenure (Castro 1999), while Handzic believes that upgrading can be just as effective without legal land tenure (2010).

2.4 Participation as a Method

International policy has already begun to value more democratic and bottom-up processes. The following section will review various ways that participation has been used as a method in development, including the conditions that give rise to participatory processes.

2.4.1 Participation and Development

The government of Tijuana, Mexico, made a shift in 1995 to incorporate participation into projects that emphasized empowerment rather than handouts (Ruster 2003). This change was followed by three programs in succession that changed the focus of Tijuana’s stance toward slum upgrading. The three programs, Manos a la Obra (1995), Obra Social Communitaria (1996-97), and Más por Tijuana (1998), were accompanied by a shift in the types of projects being completed by the government (Ruster 2003). Previously, road improvement projects dominated the allocation of government funds for community development. The inclusion of public participation in community development processes led to increases in land tenure regularization, electrification, water supply, and sanitation (Ruster 2003). To accommodate the increased demand for land titles, the municipal government needed to be flexible with regard to building standards. Reducing the requirements allowed low-income residents to meet code (Ruster 2003). As in Brazil, the financial sustainability of
the programs relied on vertical revenue sharing. However, unlike the Brazilian case, revenue was distributed by need rather than by population (Ruster 2003).

Participatory projects are more often completed than projects that lack participation. Increased participation gives teeth to planning proposals because the community is more willing to take part in ensuring the completion of the project, often supplying some labor and paying for a portion of the supplies (Ruster 2003). For scaling up the project, Ruster suggests that a non-profit organization or cooperative that collected and distributed inexpensive supplies for construction and upgrading would greatly benefit the programs in Tijuana (Ruster 2003, 60). Funding is also an issue, and private microloans or a community infrastructure fund was suggested to contribute to this problem (Ruster 2003, 57).

The list of needed improvements can be very long in informal settlements, and it is difficult as an outsider to recognize the most pressing issues. Participatory processes help planners prioritize and research about participatory processes frequently includes the communities’ priorities. Paying attention to the priorities of favela residents can help inform planners as they create plans and policies for slum upgrading. In Pavão-Pavãozinho, a favela in Rio de Janeiro, the residents were asked to give their priorities for infrastructure improvements:

“Firstly they wanted legal land titles; secondly, electricity from the federal company Light; then, improvement of the water and sewerage systems; paving of staircases and passages; a local police presence; and lastly, medical and social services” (Riley 2001, 9).

When municipalities began implementing participatory budgeting processes in Brazil, the residents were able to control the allocation of public funds. This provided a brilliant
opportunity for a some social science research project – a group of traditionally oppressed people were suddenly given the power to allocate the capital budget. In Porto Alegre, “street paving, sewerage, housing and community equipment” are most important (Souza 2001, 167), while in Belo Horizonte, priorities are for “housing, sewerage, street paving, shantytown urbanization, health and education” (ibid). The priorities vary by location and each community will have differing needs. Anticipating the needs of the community and presenting options up front facilitates participatory processes.

2.4.2 Participatory Budgeting

In his 2000 report, *A Guide to Participatory Budgeting*, Brian Wampler explained that there are two basic conditions for PB (Wampler 2000). The first condition specifies the socio-political environment. Participatory budgeting is not practical on a national scale and therefore requires decentralization of budgeting powers to the local level (Wampler 2000). It is also important that the citizens participate. There must be a certain amount of trust for government so that citizens believe that their input will be received and acted upon. This fact makes it even more surprising that Brazil is the origin of PB, since corruption has been one of the major political issues even after the fall of the military régime. Without an engaged and committed citizenry, PB will not realize its potential for change.

Celine Souza (2001) also analyzed the conditions that preceded the PB wave in Brazil. She argues that there are three aspects of recent Brazilian history that have contributed to the rise in participatory budgeting (Souza 2001). While these aspects are discussed in the specific context of decentralization of municipal budgets, the principles apply to other policies that utilize participatory practices. The three aspects that Souza describes are: participatory experiences during the military regime, increase in local revenues, and increase in leftist
governments (Souza 2001). Before the decentralization that came from the constitution in 1988, localized efforts to include citizens in decision-making paved the way for PB. During the military régime as early as 1977, over a decade prior to the constitution, municipalities in Brazil had begun to incorporate participatory practices into local government initiatives (Souza 2001). Souza writes about the participatory experiences of Brazilians during the military régime. These efforts included community centers, decentralized government offices, and a range of committees, including the “Citizen’s Budgetary Committee” (Souza 2001).

The impetus for these changes was a basic discrepancy between what the government officials prescribed for poor people and the real needs of poor people. This concept has been shown in many places around the developing world in policies for housing, economic development, infrastructure improvements, financial sector reform, and many others. It should go without mentioning that participation is based on democratic principles. In fact, it is more accurate to say that democracy is based on participation. While there is nothing keeping a dictator from incorporating participation into his or her process of decision-making, the fact that the ultimate decision will be made by one person is insurmountable by any process of citizen input. There are several types of participation and a range of budgetary control is given over to citizens. Thus, the conditions for participatory budgeting processes are most feasible under strong mayoral governments.
Chapter 3. Methodology

3.1 Research Methodology

The purpose of this project is to propose a pertinent process for planning to upgrade in the community of Portelinha. As such, the goal of this project is not scientific. Because the project will include community organizing, a participatory process would have been ideal. It is essential to have community buy-in prior to taking action in upgrading project, and action research lends itself well to projects where community support is necessary (Fals-Borda 1991). The literature review supported a more participatory approach than was possible in this case. One of the most important aspects of this project from this author’s point of view is to reflect the culture of the community and to focus on empowerment. The lack of adequate information about the community also indicates that a community-directed study of the forces that shape its economic and land control conditions would be beneficial. Ultimately, the mapping survey conducted by UFRJ was beneficial to submit documentation to the local government of Rio de Janeiro, but this information might have been collected more efficiently with more community support and cooperation. The time and resources available to conduct the research did not allow for a more integrated approach to the research. The lack of resources and time really prohibited any action research, but the researcher did plan to incorporate participation into the research project.

In light of these difficulties, the author concluded that a case study would be an appropriate method to maintain the qualitative data and try to discern the context from the phenomenon. Yin describes the goal of a case study as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin 2009, 18). The
impetus was thereby placed upon the author to maintain a cultural awareness and include in the recommendations provision that would empower the residents of Portelinha.

Figure 3-1: Logic Model for Case Study (adapted from Yin, 2009, 57)

The study employed a variety of data-collection methods in a case study. The case study method used in this project includes site visits and personal interaction with the people of Portelinha without starting a process that would have to be halted before it could be completed. Relying on existing literature to build the main argument of the paper, the case study presents a practical application. The author participated in a two-month community-university partnership workshop to gain an understanding of the challenges of working in a favela and to see the built environment. The purpose of the workshop was to produce a map of a small portion of a favela in order to begin the process of establishing land tenure in that area. During the workshop, the author attended meetings, visited the favela five times, and interviewed professor Sônia Lecoq, who led the group. The methodology for this project uses a combination of observation from field visits, a student survey, and literature analysis of slum-upgrading projects. In addition, several informal interviews with professors and
practitioners in the field of slum upgrading were key in identifying issues and opportunities during the field visits. A team of students participated in the field visits and contributed to this project.

3.2 Data Collection Methods

3.2.1 Site Visits and Mapping Project

Data were collected on several visits, interviews, and group meetings. The recording of data was performed after the conclusion of meetings. Because of the nature of the research and the role of the researcher in the project, it was not possible to collect and record data at the same time. Photos were key to the documentation of the physical conditions of the housing stock and public space. The primary data consist of photos and journal notes about observations, potential opportunities, and the physical conditions of Portelinha.

A team of students from the Federal University of Rio de Janeiro (UFRJ) School of Architecture and Urbanism completed a survey of the physical layout of the area. The survey came about through a partnership between UFRJ and the Municipal Government of Rio de Janeiro. Dr. Sonia Lecoq initiated and coordinated the project as an opportunity for professional practice for the architecture and urbanism students of UFRJ. Dr. Lecoq also orchestrated the operations of mapping and helped aggregate the sketches. This project gave the author access to all the homes of Block B to measure interior walls and make observations about the quality of the housing stock.

The workshop was divided into teams of 8-12 students with one team leader who was Brazilian. The team leaders were Brazilian due to language and cultural facility and for financial reasons; the student leaders were paid. The area was divided into three Blocks: Block A, Block B, and Block C. The student teams were assigned to Blocks comprising one-
third of the area, and the teams were further divided into groups of 3-5 students. The groups
split up to work on measuring sub-sections of the area, periodically combining their

Figure 3-1: Location of Portelinha (left circle) in relation to the College of Architecture and Urbanism
(right circle) (Source: GoogleMaps, 2009).

measurements to ensure that they matched. Each dwelling unit was measured from the interior
and scale drawings were made by hand to illustrate the layout. From these hand drawings,
architecture students made plots of their subsection on AutoCAD, which were then aggregated into the Block level.

In addition to the architecture and planning students, a student from the College of Social Sciences who had developed a relationship with the community accompanied each group. First encounters with residents were always made in the presence of one of the Social Science students. The ambassadors were expected to explain that the group of students was from UFRJ and that we were measuring the houses to submit to the municipal government. However, this communication was not always effective and some of the residents were confused about the nature of our visits throughout the entire project.

The groups convened weekly to monitor progress and discuss strategies to aggregate the maps. One of the three areas, Block C is the dense and complicated area. It is more similar to the irregular construction typically found in favelas than are Blocks A and B, which were organized in and around the former factory building. This made the survey of Block C more difficult and time-consuming than the other two. News of a possible police invasion of the favela also caused concern about our project being cut short. We decided that it would be better to complete a survey of Blocks A and B and leave Block C unfinished than trying to survey the whole area and not finish any of the Blocks. Dr. Lecoq decided to forego mapping one of the three Blocks. After our fifth visit, the police did raid the favela and we were not able to return to the area. Due to these time constraints, the survey of Block C was not completed. However, Blocks A and B were surveyed and the results submitted to the municipal government.

Field visits were invaluable for gaining a sense of the layout in Portelinha and the quality of housing construction. However, there were some difficulties posed by the
environment that made collection of data difficult and ineffective. These difficulties are not necessarily unique to Portelinha, but rather can be found in any field research in a foreign developing country. Of course, there are specific examples that illustrate these common experiences. In our case, these difficulties contributed to the fact that the mapping project was not completed.

Safety concerns were ever-present and our project was halted permanently when the military division of the police occupied the large complex of favelas of which Portelinha is a part. Specific procedures had to be followed when entering and exiting the favela. Although Maré is not as dramatically hilly as some favelas, there is a moderate hill marking the boundary of the informal area. As a matter of safety, the group of students would always meet to buy a small meal and a bottle of water before climbing the hill to enter the favela. This functioned as a show of good faith by supporting the vendors in the favela and organizational meeting to gather members of the groups. After we would walk up the hill to the entrance to our study area, we would wait for a few minutes outside “announcing” our presence so as not to surprise anyone. The necessity for this habit became readily apparent when, on the first visit to Portelinha, we visited the rooftop and were greeted by a young man with a walkie-talkie who was keeping a watch out.

To complicate the safety issue, many of the students participating in the project were exchange students from around the world. Many of the students are French and, like myself, speaking Portuguese as a second language. Although English was well known by most of the students, we decided that it would be rude to speak English in the presence of the residents of Portelinha. Therefore, we were left speaking Portuguese to communicate about how to
measure the interior walls of residences. This made work slow and sometimes led to errors in
recording the lengths of walls that would have to be re-measured on subsequent visits.

3.2.2 Interviews and lectures

The researcher had access to two experts in the field of slum development who agreed
to conduct interviews and delivered lectures at UFRJ – Walter Lopez and Sônia Lecoq.
Walter Lopez is scholar at the Federal University of Bogotá and practitioner of architectural
slum upgrading. He has guided students in successful architectural projects for slum
upgrading in Colombia. Mr. Lopez delivered a lecture summarizing his experience and
lessons learned in the field of slum upgrading and spent one week attending classes and
serving as a visiting scholar at UFRJ in October of 2012. Mr. Lopez also agreed to speak
directly with the researcher about his experiences. This information was used to inform the
findings of the research and apply the literature to the specific site of Portelinha.

Sônia Lecoq is a professor of architecture and urbanism at UFRJ and
leads students on
projects to upgrade and legalize favelas in Rio de Janeiro. She has also worked with a group
to construct affordable housing for favela residents. Dr. Lecoq led the group of UFRJ students
in the mapping project described above and served as a mentor to the researcher in this
project. In addition to weekly class meetings, Dr. Lecoq gave two interviews to discuss in
greater detail the legalization process in general and the background of the partnership
between UFRJ and the municipality of Rio de Janeiro.

3.2.3 Social Science Survey

Students from the School of Social Sciences conducted a survey of the residents of
Portelinha. The survey dealt mostly with socioeconomic issues including income, family
statistics, and length of stay. However, the survey also covered some of the physical aspects
of the households – number of rooms, access to on-site utilities like running water and electricity, and access to other urban amenities like transportation and trash collection. The survey results were given to the researcher to analyze, although some of the questions were already aggregated and could not be analyzed further.

3.2.4 Satellite Images

Using Google satellite images, maps were made to analyze the tree canopy and building occupation and determine appropriate locations for increasing the network of tree coverage. Satellite images taken at three different times throughout the last several years are available on GoogleEarth. These images provided data about the transition of the area from a factory to a residential land use. The photos allowed the researcher to access spatial information about the site and its surroundings that would not otherwise have been accessible, since much of the research was conducted off-site. Green space and street width can be easily indentified using the photos. The photos were taken using screen shots and aggregated in Adobe Photoshop to increase the effective resolution.
Chapter 4. Data and Analysis

4.1 Site Visit Data

Site visits provided qualitative data in the form of personal experiences and photos, mostly about the physical conditions that need to be addressed. Drawing on concepts and anecdotes from the literature review, the researcher was able to validate trends and deepen the specific observations of the conditions in Portelinha. The analysis of data from the site visits is organized into categories of physical conditions and anecdotal evidence. The physical conditions observed during the site visits include information about common safety hazards and housing stock. The anecdotal evidence deals with some relevant activities that take place in Portelinha and general information about community dynamics. The next section outlines the physical conditions in Portelinha.

The built environment of Portelinha is a combination of self-built housing and the reused factory structure. The dynamic between the two types of building materials is readily apparent from inside the walls of the factory because the clay bricks often complete or extend walls created by the solid cement of the factory building (See Figure 4-1). Some of the transitions between the factory and the newer construction present safety hazards, especially in the placement of stairways. For example, one staircase (shown in Figure 4-2) connecting Block A and Block B has no landing and does not align with the doorway. The photo shows that the staircase does not reach the level of the upper floor. This particular staircase is also steep, with a run length much shorter than the rise, and there is no handrail.

However, the layout of housing units within the factory building requires a staircase in that location to access the unit. Similar examples of incongruencies between floors and unsafe
Figure 4-1: Clay bricks fill the old factory windows to create the exterior walls of new housing units.

Figure 4-2: This entry (shown left) is only accessible by a poorly designed staircase (out of picture bottom) that does not reach the level of the floor.
staircases can be found throughout Portelinha. This creates the need to better integrate the preexisting structure into the expansion of housing. The concrete slab on the bottom left of Figure 4-2 is part of the old factory and the clay construction on top of the slab is new construction.

In addition to the dangerous placement of stairs, exposed electrical wires extend from the street to individual units along the exterior of buildings, cross hallways, and hang from around light fixtures. These exposed wires create safety hazards in many of the public spaces and within the housing units. Figure 4-3 and Figure 4-4 illustrate how the wires are strung haphazardly through the area, both in a corridor and around a light socket. Many of the areas that children play in have exposed wires or construction materials in them.
As is the case in many favelas, Portelinha has been under constant construction for the past several years. This requires constant storage of construction materials and a shrinking space to store them. Another problem resulting from the constant construction is a familiar sight in informal settlements – that of rebar protruding from the ground. It is common practice with the clay brick construction in informal settlements in Brazil to run rebar through the middle of the bricks and fill the holes with concrete. This is a cheap and fast method for construction. In order to make vertical expansion more convenient, the rebar is often left to extend beyond the highest completed floor of construction. This poses a serious safety hazard
for tripping and impaling someone. Two methods could be used to improve upon this practice. The first is to change the rate of construction by either reducing the rate of expansion or increasing the speed of incremental construction. This would reduce the amount of time in construction limbo. The plan would include gardening for the rooftops, thereby reducing the tendency to build for expansion. Many of the housing units are finished with a concrete slab as a roof, with rebar extending through the roof to allow for easy upward expansion to the next floor. Because of this constant construction, building materials including clay bricks and waste from brickwork and excess concrete are stored throughout the site. Some of the housing unit are built to high standards and utilize quality materials.

The housing in Portelinha is partly self-built with an absence of formal construction work and code inspections; nearly all of the construction violates the respective building and zoning codes. (For more on effects of informal and illegal developments, see Riley, 2001.) The housing stock in Portelinha is a mix of typical clay brick architecture, constructed by residents and expanded incrementally, and the solid construction left over from the factory building. Still, within the factory walls are the same red clay brick seen on the outside. Some of the structures incorporate high quality materials like granite for flooring. Other structures are unfinished and lack basic amenities.

On the eastern edge of the site, there are five building units constructed in the right-of-way – three storefronts and two housing units (See Figure 4-5). Minimum sidewalk width in Rio de Janeiro is 1.2 meters to allow for pedestrian space (Riley 2001). These buildings are prohibited by code. Construction on the sidewalk forces pedestrians onto the street, causing a safety risk. These buildings need to be removed for the area to be legalized. While the area
does have wide sidewalks, the buildings occupy the entire width, preventing pedestrians from passing without walking in the street.

Figure 4-5: This two-story building was constructed in the generous right-of-way, causing pedestrians to resort to the street for walking space. (Source: Google Street View, 2010, Rua João de Magalhães, North)

The fourth floor of the old factory building is shorter than the other floors, creating a low-clearance ceiling. While no one from the community could speak to the previous use of the fourth floor, it is not suitable for residential units. There is only one window on the entire floor, which covers the entire footprint of the old factory building. To put this into perspective, other floors have as many as 14 windows for the same area. Tuberculosis is more common in favelas than the areas that are up to code because of the lack of circulating air. The lack of windows and low ceiling present an increased risk of respiratory infection. Figure 4-6 illustrates the scale of the unit’s ceiling, which does not extend much beyond the doorway.
During a field visit, one of the residents asked how long she had before she had to move her family – implying that she assumed we were working with the government to evict the community. She was quite surprised and relieved to learn that we were in fact attempting to help cement the community’s tenure. This is partly because of the dearth of detailed information about the residents, including registration of dwelling units and residents. Part of this problem was addressed by the workshop conducted by UFRJ to map the area and record the names of the heads of household. Any security that exists now is informal and provided either through community ties, by drug traffickers who control the favela, and through the good faith of the residents that the cost and trouble of eviction is greater than the benefit.

Figure 4-6: The doorframe (center) shows the approximate height of the ceiling of the fourth floor units.
4.2 Interviews and Lectures Data

Dr. Sônia Lecoq helped guide the groups from the Federal University of Rio de Janeiro (UFRJ) in the mapping project and in formulating our recommendations for upgrading in Portelinha. Certainly much of this project is indebted to her advice, but the following section covers information about Portelinha that was directly gained from lectures and interviews with Dr. Lecoq. Portelinha is a loteamento, or illegal subdivision of land. The first settlers occupied the area in 2004, after the factory on site was decommissioned. Formalization of the tenure of residents in loteamentos is a unique process with specific considerations as opposed to other types of informal settlements. The legal owner of the land must be involved in the process of formalization, and communal ownership of the property makes sense. The site was formerly consolidated as a manufacturing location. The current residents paid for permanent access to the land and then purchased and constructed housing.

Dr. Lecoq informed the researcher of the history of the partnership between UFRJ and the municipality of Rio de Janeiro. The partnership resulted from a professional relationship between Dr. Lecoq and an employee of the city government. Dr. Lecoq was aware that the College of Social Sciences had developed a relationship with the residents of Portelinha and reached out to expand the project to include a physical survey of the area to begin the regularization process. This is important because it highlights the arbitrary nature of the selection of Portelinha in particular. Of course, presence of favelas in Rio is substantial enough that any help to improve one favela is welcome. The leaders of the project from UFRJ, including Dr. Lecoq and the student team leaders, were compensated for their work. However, since this thesis is not a study of partnerships, the exact amount is unimportant and the researcher did not request that information.
The typical financing for the expansion of the favelas in Rio was explained by Dr. Lecoq in a lecture to the entire group of architecture students. The researcher created Figure 4-7 to illustrate the incremental financing mechanism. Incremental financing allows residents of informal settlements to finance the construction of their housing by selling the rights to build on the roof of their un-built house. This creates a situation in which the second story of residential units is planned before the first floor is built, expediting the vertical expansion of housing units. Of course, it is likely that other financing mechanisms are at work in Portelinha, including informal loans and potentially microfinance. However, the rapid upward expansion of Portelinha leads the researcher to believe that at least some incremental financing was used in the residential conversion of Portelinha.

**Incremental Housing**

- **Phase 1:** Land is purchased without construction financing.
- **Phase 2:** Sale of future rooftop finances initial construction.
- **Phase 3:** Speculation on third floor finances the second floor.
- **Phase 4:** Strain on infrastructure results from increased density.

*Figure 4-7: Flat roofed architecture allows favela residents to finance the construction of their un-built house by selling the rights to build an addition once the construction is completed.*
Dr. Walter Lopez visited UFRJ during the mapping project to deliver to the college of architecture and urbanism a guest lecture about his experience leading student teams on slum upgrading projects in Bogotá. Dr. Lopez’s lecture stressed the importance of simple, compact solutions. He told several stories about successful projects, and one memorable example included a second story church atop a residential ground floor unit. The solution presented by his student was to switch the location of the two uses so that the church would be accessible without having to enter a private residence. This is the kind of common sense solution that Dr. Lopez urged students to seek.

4.3 Social Science Survey Data

Students from the College of Social Sciences performed a survey of the residents of Portelinha. The results of the survey were shared with the students who were working on the mapping project prior to making their architectural recommendations to improve the area. Some of the data could not be analyzed because of the way it was aggregated on the survey. The tables below are the raw data collected from the survey. Still, the survey is an important part of the community profile and the only quantitative data available to describe the socioeconomic conditions of Portelinha.
4.3.1 Age and Sex

The age and sex information displayed in Table 4-1 shows that the female population of Portelinha outnumbers the male population by almost 30 residents. However, most of this difference is made up among children younger than 15 years old. The survey question for this category is aggregated unevenly, so that neither a population pyramid nor projection of natural population growth could be made. This is also a very small area and the assumptions necessary to project population changes, such as migration and fertility rates, would not hold.

Table 4-1: Age and Sex in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>0-6</td>
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<td>48</td>
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</tr>
<tr>
<td>7-14</td>
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<td>25-59</td>
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<td>60+</td>
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<td>7</td>
<td>11</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>199</td>
<td>369</td>
</tr>
</tbody>
</table>

4.3.2 Household Income

The household incomes in Portelinha are higher than might be expected in a favela. Portelinha is situated on paved streets, on the border of the Favela Complex of Maré. This is a relatively secure and well-served location for an informal settlement. Most of the participants (82.6%) responded in the range of 0-3 minimum wages, or US$9,735 per year (using a 1:1.77 conversion ratio). The most popular response is two minimum wages. The number of responses for two minimum wages is encouraging for the development of Portelinha’s housing quality because it shows that the residents are not generally in abject poverty. The
responses to some of the other questions will confirm that there are reasons for optimism about the development potential of Portelinha.

Table 4-2: Household Income in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Household Income (in Minimum Wages)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>18.3</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>40.4</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>23.9</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>7.3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3.7</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>No response</td>
<td>5</td>
<td>4.6</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.3.3 Homeownership

The survey question for home ownership helps to gauge the perceptions of Portelinha residents about their legal tenure status. The responses are somewhat ambiguous because the question may have been interpreted as ownership of the home, in other words the ownership of the building materials, and not the land on which the home is constructed. There are no deeds for the land in Portelinha, so none of the homes are located on a lot that the residents own. However, almost 90% of the participants responded that they do own their home. Whether or not the question was interpreted correctly, the responses do imply that the residents perceive that they own their home.
Table 4-3: Homeownership in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Home Ownership</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned</td>
<td>98</td>
<td>89.9</td>
</tr>
<tr>
<td>Leased</td>
<td>8</td>
<td>7.3</td>
</tr>
<tr>
<td>Rented</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Borrowed</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>No Response</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.3.4 Cost of Home Construction

The most common response to housing construction cost is “No response.” This could have to do with a lack of trust or suspicion that the results could be used to collect fees or property taxes. However, those that did answer the question most frequently responded that their housing construction cost less than R$5,000. This is extremely inexpensive to construct housing. It is likely that most of the housing under R$10,000 is self-built. The higher rate of response in the lower cost brackets implies that many of the participants that indicated “No response” had higher construction costs. This would also fit with the researcher’s assumption that some suspicion of a fee prevented the participants from answering this question.
Table 4-4: Maximum Estimated Cost of Construction in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Maximum Estimated Cost of Construction in Portelinha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Construction (R$)</td>
</tr>
<tr>
<td>5,000</td>
</tr>
<tr>
<td>10,000</td>
</tr>
<tr>
<td>15,000</td>
</tr>
<tr>
<td>20,000</td>
</tr>
<tr>
<td>25,000</td>
</tr>
<tr>
<td>30,000</td>
</tr>
<tr>
<td>40,000</td>
</tr>
<tr>
<td>50,000</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

4.3.5 Household Size

The size of households is fairly evenly distributed between 1 and 4 persons per household. This means that there is a mix of household sizes in Portelinha. By combining this information with the fact that about half of the population is working age and about half is under 18, it can be inferred that many of the households in Portelinha are families with children. There are also many one- and two-person households, so the community is diverse in make up.
### Residents per Household in Portelinha

<table>
<thead>
<tr>
<th>Residents per Household</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>15.60</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>21.10</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>17.43</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>20.18</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>14.68</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>4.59</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>6.42</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>1.83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>109</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

### 4.3.6 Housing Type

Table 4-6: Type of Dwelling Unit in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Type of Dwelling</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>80</td>
<td>73.4</td>
</tr>
<tr>
<td>Apartment</td>
<td>21</td>
<td>19.3</td>
</tr>
<tr>
<td>Second-story with commercial below</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Business</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Loft/room</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Studio</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Basement</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>109</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
4.3.7 Availability of Water

Over 90% of the residents of Portelinha have access to improved water, whether through the regular system of running water that serves the city or through the blue reservoirs that are commonly seen in favelas (see Figure 4-8). Since the vast majority of households have access to running water, it should be relatively inexpensive to extend the lines to those without water. This is only a problem for nine of the families who participated in the survey.

Figure 4-8: Blue reservoirs can be seen here placed on rooftops. This is a familiar sight, and an easy way to identify favelas from the highways of Rio.
Table 4-7: Availability of Running Water in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Availability of Running Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Source</td>
</tr>
<tr>
<td>Running Water</td>
</tr>
<tr>
<td>Reservoir</td>
</tr>
<tr>
<td>Container with Lid</td>
</tr>
<tr>
<td>No Water</td>
</tr>
<tr>
<td>Uses Neighbor's</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

4.3.8 Sewage

The access to sewage drainage in Portelinha is similar to the availability of running water. Over 90% of the participants in the study reported having access to sewage drainage. Ideally, all of the housing units would be connected to the general network of sewage removal, but septic tanks are a sanitary option. Many favelas in Rio have open-air sewers that collect wastewater and storm water. Only two of the participants in the survey reported having a combined sewer and storm water drain. Again, with the infrastructure already existing to link with the general network or utilize a septic tank, the cost to extend the sewage lines to the remaining ten residents should be low.

Table 4-8: Sewage in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Sewage</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linked to General Network</td>
<td>81</td>
<td>74.3</td>
</tr>
<tr>
<td>Septic Tank</td>
<td>18</td>
<td>16.5</td>
</tr>
<tr>
<td>Combined</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>No Sewage</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>No Response</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>
4.3.9 Trash Collection

Access to trash collection is also very high in Portelinha. While there is a significant amount of construction debris in the area, household trash is collected from the roadside. There is a sign in front of the façade of the old factory instructing residents to deposit their trash there in a pile. During each site visit there was a large pile of trash sitting near the sign waiting to be removed. The pile of trash was always wet, including food waste and other solid waste, and seeping onto the street. While the response rate was nearly 93% for the question about whether households have trash collection, the response rate was only 67% regarding the specific collector of trash. While a “No response” does not guarantee that CONLURB, Rio’s municipal trash collection agency, is not collecting the trash, the variation in response rates indicates that there may be an informal trash collector that serves the area.

Table 4-9: Trash Collection in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Trash Collection</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>101</td>
<td>92.7</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>No response</td>
<td>8</td>
<td>7.3</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4-10: Trash Collection in Portelinha (Source: Gabriela Lema Icasuriaga, 2011)

<table>
<thead>
<tr>
<th>Specific Trash Collector</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONLURB</td>
<td>73</td>
<td>67</td>
</tr>
<tr>
<td>No response</td>
<td>36</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100</td>
</tr>
</tbody>
</table>
4.4 Satellite Images

The satellite images allowed the researcher to access spatial information about the area that is not available elsewhere. Google Earth archives photos taken at different points in time to allow a longitudinal study of the changing built environment in Portelinha. Three series of photos taken between 2005 and 2009 illustrate the changes to the built environment of Portelinha shortly after the factory was decommissioned in 2004. These photos show that the factory building was more or less intact in 2005, lost its roof in between 2005 and 2006 and the area surrounding the factory was stripped to the ground. By 2006, the roof had been removed and the character of the area was beginning to change with new residents.

Figure 4-9: A close-up of Portelinha from a 2009 satellite image provides enough detail to discern among Blocks A, B, and C. This image also shows that there were very few buildings in Block A in 2009.
The satellite images also helped to identify changes over time in the built environment of Portelinha. Figure 4-9 shows the location of each Block as defined by the mapping teams. Block C, for which the mapping project was not completed, is denser and seems to be further developed in the 2009 image, above. By comparing the satellite images with the data from site visits, the researcher determined a rough morphology of the area and got an idea of the timeline for construction as Portelinha was transformed from a factory site into a residential zone. Judging from the satellite images and the site visit data, most of the growth in Portelinha happened between 2006 and 2009. The footprint is almost identical between 2009 and today with the exception of a newly constructed dwelling in the center of Block A (See Figure 4-10 and Figure 4-12).

In 2006, each of the three Blocks, A, B, and C, had a common area in the center with housing on the edge. The reason for this could be that the first residents chose to utilize the existing walls of the old factory structure. This would limit construction costs and provide a solid anchor for a housing structure. Between 2006 and 2009, there was substantial growth in the housing stock in Block C, while Blocks A and B were slower to develop. The most recent development has occurred in Block A, where a new dwelling is being constructed in the common space in the center of the existing housing developments.
Figure 4-10: Satellite image of Portelinha in 2005 (Graphic enhancements by author. Source: Google Earth, 2012).
Figure 4-11: Satellite image of Portelinha from 2006 (Graphic enhancements by author. Source: Google Earth, 2012).
Figure 4-12: Satellite image of Portelinha in 2009 (Graphic enhancements by author. Source: Google Earth, 2012).
In addition to analysis of the built environment in Portelinha, satellite images show the location of trees in the area and allow for measurements to be taken of the rights-of-way. Using satellite images of the area surrounding Portelinha, the researcher identified the existing green spaces and opportunities to expand and connect them to Portelinha. Figure 4-14 identifies the locations of trees surrounding Portelinha illustrating the lack of tree cover and green space.
These images helped to determine what kind of streetscape improvements might be possible given the available space in the right-of-way. The right-of-way in the area between Avenida Brasil (BR-101; the wide road in the left of the above image) and Portelinha (top right) are generous, providing ample space for street trees. In fact, the width of the sidewalks (between 12 and 18 feet) on these streets could accommodate street trees and pedestrians without having to encroach on vehicular traffic. This is a rather unusual occurrence in favelas, which are typically characterized by narrow, winding streets. The area to the west of Error! Reference source not found. has the typical favela street layout, and it is more difficult to
find space for trees in that area. However, there is space to plant tall, thin trees, like palms, in areas where the streets widen, providing small patches of trees to create a corridor.

Analysis shows that these routes are appropriate for the discussion of additional landscaping to create green corridors. The corridors were measured and grouped into types to organize the variety of road and sidewalk widths. There are five types of street: type one, type two, type three, irregular, and canal, with type one being the widest and the irregular streets being the most narrow (See Appendices 1 through 4). The canal (shown on the far right of Error! Reference source not found.) runs through the northern portion of the area and is bordered by wide rights-of-way on both sides (See Appendix 5). Chapter 5 will discuss the specifics of the potential for these corridors to accommodate landscaping.
Chapter 5. Recommendations

This chapter synthesizes the data and findings section to arrive at recommendations for an upgrading project in Portelinha. These recommendations are the result of a combination of collaborative work that the researcher performed with a team of students at UFRJ and individual work done by the researcher. In particular, the architectural renderings were created by Justine Girard, and the idea for the relocation was created by Simon Parent-Pontier.

5.1 Community Input

The community should be involved in creating the plan for upgrading, especially for the physical changes. The group of students performing the mapping project began to plan a visit to Portelinha to present their proposals before the Special Operations Police Force (BOPE is the acronym the Portuguese, Batalhão de Operações Policiais Especiais.) invaded the favela. The BOPE, the elite force of military police, are the first to enter favelas with known drug gangs to expel traffickers. Unfortunately, this safety risk prevented the students from returning to the area. The researcher also had to return to his home university before the situation was safe enough to return.

A non-governmental organization, called Redes da Maré serves the entire complex of favelas of Maré (See
Appendix 15) and helped to provide a library near the site of this study. The researcher recommends holding a meeting in the library to present the findings of the social science survey and the recommendations for architectural improvements. Once the recommendations have been presented, the community has given feedback, and the physical survey of Block C is completed, the final results should be presented to the municipal government of Rio de Janeiro. This would facilitate any efforts by the city to invest in the legalization of Portelinha and, given the proximity to Fundão and legalized areas, Portelinha is a reasonable area to expand social programming.

5.2 Relocation of Households

The physical upgrades to the Portelinha should improve the quality of life for residents without removing them from the area. There are two cases of housing that must be relocated. In one case, the housing is substandard and has a low ceiling that exaggerates the risk of respiratory disease. And in the other case, the housing is built on the right-of-way to the street, creating a public safety risk. Together with the two students mentioned above, Justine Girard and Simon Parent-Pothier, the researcher designed a solution to relocate the residents of these two areas to a safer area in Block B. The solution not only creates a safer environment for the residents of these units, but also proposes to widen a very narrow corridor, improving air circulation and access to light. (See Appendices 7 through 14 for a full description of the proposal.)

5.3 Slowing Growth

The upgrading project aims to avoid dislocating residents from Portleinha; it is also the recommendation of this paper to slow or stop growth in the area. The remaining open space adds to the quality of life for current residents and is used by children for space to play.
Some of the residences do not have access to basic services and further growth could jeopardize the quality of the existing housing stock. However, growth will not stop in Portelinha unless the area is planned. It is unlikely that market forces will reverse the trend of growth until the open space is depleted. This can be seen in Block A, which has already lost its large, central open space. Further depletion of the open space would be detrimental to the existing residences.

The remaining open spaces should be planned and programmed. Utilizing the open spaces for a specific use will create an incentive for the community to work together to preserve the space. The programming could take the form of a community garden or programmed park. However, since Portelinha is a decommissioned factory site, soil tests will be necessary to ensure that there are no contaminants in the dirt so that the produce is safe to consume. Also, the residents of Portelinha might not want to maintain a community garden. The main play activity for Brazilian children seems to be soccer, so soccer court would be a logical addition to the area. Since one of the objectives of the programming is to prevent construction, it is important that the community continues to maintain and use the area. A soccer court would certainly see use.

In addition to stopping construction on open space, the rooftops are an important area of expansion in Portelinha. The literature and data show that incremental construction is common in informal settlements as it provides a financing mechanism and makes building more affordable. Satellite images illustrate the speed of growth in Portelinha, but it is difficult to see the vertical growth from above. Most of the buildings are two to three stories in height, have flat roofs with rebar extending out, ready for the next level to be added. The roofs are
frequently used for drying laundry (See Figure 5-1), but the flat rooftops could also be used to grow fruit or vegetables.

![Figure 5-1: This rooftop is used to dry laundry.](image)

5.4 Land Tenure Security

Although the residents of Portelinha report owning their housing, there are no deeds for the land on which it is built. It is the recommendation of this thesis to provide legal security of tenure for the residents of Portelinha. The regulatory instrument used to provide security must be thoughtfully considered so as not to contribute to a *de facto* eviction or cycle of informality. When titles to land are given outright, the end result is often that current residents sell their land and relocate in another informal area. The goal of this project is to
provide increased security and a plan to incrementally formalize the ownership of property in Portelinha.

While titling Portelinha should be considered as a long-range option, other instruments may better serve the goal of allowing and encouraging the residents to remain in Portelinha. Based on the literature review and the case study of the situation in Portelinha, the best method for providing a legal solution to the issue of land tenure insecurity would be to consolidate the land under one title and organize the individual units similarly to a condominium (in the U.S. sense). The physical layout, with open spaces surrounded by housing, and history of the area as one parcel use for manufacturing suggest that a consolidated, communal option is appropriate.

5.5 Landscaping and open space

Portelinha currently has space to incorporate landscaping but the open space is jeopardy of being lost to construction. Since there is a lack of open space and parkland nearby, it should be a priority to set aside some of the area in Portelinha for recreational space. Maintaining the open space for recreation has the dual effect of slowing growth in the area and improving the health and safety of current residents. The largest area available for a small park or soccer court is in Block A. However, this area seems to be the location of the next growth, as there is a two-story building under construction. For this reason, it is important to act quickly to set aside an area for recreation before it is consumed by the expansion of residential construction.

Landscaping selections could utilize fruit trees or other edible plants and shade trees, although soil tests should be completed prior to eating plants grown in Portelinha to ensure that there is no contamination. The growing areas should include large open spaces as well as
available rooftops. Though the rooftops are currently used for hanging laundry, the installation of landscaping and gardens on rooftops would not interfere with this activity.

Rooftop gardens would also slow the vertical expansion of Portelinha’s housing and provide some relief from the heat, since gardens trap moisture from large rain falls, which evaporates, cooling the air.

Figure 5-2: The placement of new street trees could line the streets as indicted here, and three new green spaces could be added in the circled areas.
The wide roads and rights-of-way in the type one areas (yellow above) should utilize shade trees like *Mangueira* (See Figure 5-3), which also produce mango fruits. Many of the trees along the main roads are *Figueira Roxas*, which have a large root base canopy.

Figure 5-3: This mangueira tree, right, provides shade at a bus stop. Mangueiras are native to Rio de Janeiro and commonly used for street trees.

On the type two streets, which are narrower than type one streets, there is less space available for landscaping and buildings that line the street shade a larger part of the area. Still, shade trees contribute to walkability, especially in Rio, where high temperatures can make being outside uncomfortable. *Caesalpinia* trees would be appropriate for type two street because they are slightly narrower and still have a large canopy.
The irregular type streets present more limitations because they are very narrow. However, using satellite images, several opportunity areas were identified where the streets widen (See Appendix 5). Tall, fast-growing palm trees could be planted in the areas where the road widens. This would give pedestrians a place to rest in shade, though it may lack continuity. Note, however, that because of security risks, the author was not able to make site visits to the irregular type streets or the canal. All of the analysis for these areas was done utilizing satellite images.

5.6 Minor Improvements

Numerous minor improvements could be made in Portelinha to dramatically increase the safety of the built environment. The exposed electrical wires mentioned above and incomplete staircases cause safety risks that are fairly simple and quite inexpensive to fix. Because the solutions to these problems are readily available, it is not likely a lack of resources that prevents them from being fixed. Acceptance of these safety risks seems to be a cultural norm, where codes are not enforced and no system is in place to educate residents of the danger.

Cartoons and comics have been used in many contexts in developing nations to develop awareness and change cultural norms (Lent 2012). The UNICEF (UNICEF 2012) and United States Peace Corps (United States Peace Corps 1999) have both incorporated cartooning into development projects. An important step in the improvement of safety risks is changing the culture around them so that acceptance is not normal. A cartoon or comic depiction of the risks caused by exposed wires, rebar, construction material, lack of proper sanitation and ventilation in bathrooms, and hand railings could result in a culture shift and inspire simple solutions to these problems.
Chapter 6. Conclusions and Implications

The implicit goal of this project is to create a framework for planning an effective upgrading project in Portelinha. To accomplish this, the researcher reviewed the literature on previous slum upgrading projects and conducted a case study of Portelinha to investigate the essential issues any upgrading plan will address. The recommendations in Chapter 5 applied the lessons learned to the present needs in Portelinha. Chapter 6 will synthesize those recommendations into general suggestions to answer the question proposed in Chapter 1: What issues should a slum upgrading project address?

The key to improving the housing situation for the millions of people living in informal settlements lies in the implementation and expansion of upgrading projects that provide security of land tenure and infrastructure improvements. Legal solutions to land tenure security should be site-specific because these solutions can be very expensive and cause unintended negative consequences for residents. Namely, individual freehold titles, while the norm in Western contexts, may not be appropriate for low-income areas in developing nations. The literature also stresses that incorporating participation will likely increase the success of upgrading projects.

Certainly, the complexity of the problem requires a multifaceted approach that takes the specific site into account. However, some aspects of informality are pervasive and nearly ubiquitous. The lack of international interest on a scale commensurate with the problem is unlikely to change in time to meet the needs of the poor. To accomplishing the goal of “cities without slums,” development projects should encourage investment from slum residents by incorporating participation into the planning process, ensuring that slum residents will not be evicted, and by making the first step to invest public funds in infrastructure improvements.
This combination of approaches rationalizes the private investment of slum residents in their own properties. It is irrational to invest in housing upgrades on unimproved, unsecure land.

A slum-upgrading project should address three aspects of informality: regulatory issues, physical issues, and the socio-political dimension. First, the regulatory issues contribute to the proliferation of slums by creating barriers of entry to the formal market. Lack of legal titles, for all intents and purposes, is definitive of informal settlements. This means that construction in informal settlements is not reviewed for planning or building approval. The lack of legal titles for the land jeopardizes the security of residents’ tenure, and without administrative review of building plans the built environment is full of safety and health risks. However, upgrading construction to the existing building standards is often too expensive for low-income residents. Regulatory reform must therefore address land tenure security and minimum requirement zoning and building codes. Comprehensive planning should also address informal areas and suggest locations for growth instead of allowing the market alone to allocate land.

Second, both residents and public investment should contribute to physical improvements. Public investment should extend major infrastructure into informal areas and public education campaigns to raise awareness of common safety hazards may encourage private investment for minor improvements. In the case of Favela-Bairro, infrastructure improvements effectively increased land tenure security (Handzic 2010). Planned open space for recreation and incorporating landscaping is desperately needed in informal areas. Physical improvements should address this issue by utilizing remaining open space for recreation by installing landscaping on rooftops. Preserving these “lost spaces” has two benefits –
controlling expansion of the building and providing much needed comfortable public space for reflection and potential cultivation of fresh produce.

Finally, the socio-political dimension of informality should be addressed by empowering residents of informal settlements to participate in upgrading projects. Residents should only be forced to relocate in situations where health and safety are at risk. In general, including residents in the planning and implementation of projects results in more successful projects (Ruster 2003). However, there is a component of justice that comes with incorporating participation in upgrading projects. Uneven power relations contributed to the crisis in developing nations and empowering marginalized residents will contribute to the remediation of the crisis. For this reason, upgrading projects should include participatory processes in the both the planning and implementation stages.

These three aspects of informal settlements should be incorporated into the design of policies and projects for slum upgrading. Still, the problem of informal settlements is immense and meeting the goals set by the international community requires large-scale shifts in the way housing markets in developing nations function. Further research could investigate the potential for scaling up of successful projects, which is already emerging as an area of study in international development finance. However, a scaling up of legal solutions that incorporate site-specificity presents a significant challenge. Judging by the success and rapid growth of the participatory budgeting process, a similar policy related to land tenure security could be a viable solution. A large-scale participation process could help city administrators to develop a typology of neighborhoods and tailor legal solutions in that way.

Development practitioners continue to refine their methods by sharing information and learning from implemented projects. This thesis attempts to follow in that tradition and apply
the lessons from the literature to the case of Portelinha. With limited resources, development workers have to prioritize the aspects of informal settlements that require the most attention and have the most potential to create sustained improvements. Legalizing security of land tenure and educating residents of low-income areas about safety risks are high priorities based on this research. However, public infrastructure investments are required to incorporate informal settlements into the formal city. These investments will not happen without political support. In this way, a positive public perception of informal settlements could contribute to their development. There seem to be widespread misconceptions about the realities facing residents of low-income areas all over the world, not just in developing nations. To combat the housing crisis in developing nations, development practitioners have to shape the discussion and raise awareness of these issues by sharing information with the public as well as with their colleagues. The issue of housing in developing nations may not be one that can be “solved.” But with continued work development workers will contribute much needed improvements to the quality of housing in developing nations.
1-November.


Appendix

Appendix 1: Type One Street

Appendix 1 illustrates the width of right-of-way and distance between light poles on the main road, a type one street.
Appendix 2: Type Two Street (A)

Appendix 2 illustrates the width of right-of-way and distance between light poles on this type two street.
Appendix 3: Type Two Street (B)

Appendix 3 illustrates the width of right-of-way and distance between light poles on this type two street.
Appendix 4: Type Three Street

Appendix 4 illustrates the width of right-of-way and distance between light poles on this type three street. There are no sidewalks on some parts of the street.
Appendix 5: Irregular Street Width

Appendix 5 illustrates the outline of type three irregular street highlights the widest areas, which present opportunities to plant palm trees.

Creating a line of tree coverage from the northern end of Rua Carlos to the intersection of Linha Vermelha and Avenida Brasil constitutes the most difficult area in the study.

The highlighted corridor presents 5 opportunity areas.

The wide variation of street widths allows for arborization in some areas and prevents it in others. Thus, continuous connection would require interventions to the existing housing stock.

There is no street lighting in this portion of the site, and the electrical lines are strung from house to house, without posts.

Still, with the existence of 5 moderate open spaces, connectivity can be achieved through a series of patches.
Appendix 6: Canal Width

Appendix 6 illustrates the outline of the canal that runs on the northern edge of the study area. The rights of way appear from satellite images to be large enough to plant trees along the sides of the canal.
Appendix 7: Morphology of Block B

This blueprint and 3D mock-up of Block B, created by Justine Girard, illustrates the current morphology of the area. The bottom left corner of the blueprint corresponds to the right side of the 3D mock-up. A dirt lane runs in down the front of Block B.
Appendix 8: Block B Façade

Portelinha runs in between two roads that were constructed by the city. This front view of Block B from the dirt lane includes the rights of way that border on both sides of Block B.

Appendix 9: Light Diagram

The former factory building (right) shades the middle portion of Block B during much of the day.
Appendix 10: Ventilation Diagram

The narrow hallways in the middle portion restrict airflow.
Appendix 11: Proposal Blueprint

The blueprint of the proposal is shown here. Left to right: ground floor (Terreo), second floor (1. Andar), third floor (2. Andar), and fourth floor (3. Andar). In Portuguese, the “first floor” equates to the second floor as described in English. The arrows denote possible pedestrian routes through the proposal.
Appendix 12: Proposed First Floor

The proposed first floor would include three units and be able to accommodate 11 residents. Notice the gap between the second and third units to allow a passageway from inside the old factory garage. This allows for circulation of air and an alternate entry into the widened corridor.
Appendix 13: Proposed Second Floor

The proposed second floor would include three more units and accommodate 12 residents and be accessible from a staircase at the rear of the corridor.
Appendix 14: Proposed Third and Fourth Floors

The third and fourth floor includes two units (third floor) and a green house (fourth floor) that could be used to grow food for the residents of Portelinha. The third floor units are set back to allow for air circulation and light to enter the corridor. The green house is constructed atop the old factory building, which has a large, flat roof and could hold a substantial amount of weight.
Appendix 15: Map of the Maré Complex of Favelas (Redes de Deenvolvimento da Maré 2012)

This map of the entire Maré Complex of Favelas is also broken down into neighborhoods. Portelinha (indicated by the red dot) sits in Baixa do Sapateiro near the border of Morro do Timbau.