Developing High-Density Housing near Tren Urbano Stations:
Financial Feasibility for Transit Supportive Condominiums

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ABSTRACT

The confluence of rail transit and real estate development opportunities in San Juan, Puerto Rico raises a number of questions related to the future built form of the city and surrounding region. As the construction of Tren Urbano nears completion many advocate transit supportive development that captures the social benefits that results for public investment in Tren Urbano. Private developers have been slow to react to the potential for transit supportive real housing. This research brings together the urban design ideas expressed in New Urbanism and real estate investment decision modeling to forecast the potential for building transit supportive housing at the Martínez Nadal station within the next two years. The analysis shows that market demand for high-density housing in San Juan is strong, a reflection of rising income levels in Puerto Rico and an increase in the number of households. In addition, recent housing development in the Greater San Juan region has started to shift to mid-rise walk-ups and high-rise condominiums. However, the link between high-density housing and rail transit is still not firmly established

In terms of the financial decision modeling for future transit supportive housing, the Capital Asset Pricing Model (CAPM) is used to estimate a risk-adjusted discount rate for housing development. The Net Present Value (NPV) and Internal Rate of Return (IRR) investment decision rules are applied to four stylized housing programs synthesized from recent housing development practice in San Juan. The investment potential of the stylized housing projects is evaluated under different conditions. First, the result from a market development that ignores the impact of the transit system is established. The model then adjusts for reduced parking ratios to account for transit supportive housing. In one case, the results show that the investment will continue to be profitable up to a six percent reduction in the average price for a condominium unit when the parking is reduced from two spaces per dwelling to a more transit friendly ratio of one space. In another case, the size of the public subsidy that is required to develop the housing is estimated to be 15 percent of total development cost. The results show that there is a real opportunity for transit supportive housing in San Juan. However, Tren Urbano will need to play an active role in getting projects such as these off the ground.

Key words: Transit supportive housing, reduced parking, sound investment practice, densification, condominium ownership, developer's required return on equity.

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Chapter One

Transit Supportive Development for Tren Urbano

1-1: Introduction and Purpose

The purpose of this research is to estimate developer reaction to proposed transit supportive housing development proximate to the Martínez Nadal station of the Tren Urbano heavy rail transit system currently being built in San Juan, Puerto Rico. Reaction here is taken to mean a build/no-build decision that results from financial forecasting using available information that can potentially influence the Internal Rate of Return (IRR) and Net Present Value (NPV) of the planned real estate development. The study will model developer behavior using analytical tools drawn from modern corporate finance. Given the nature of the market for new homes in which supply is produced by the collective actions of developers and demand reflects the aggregate behavior of homebuyers, the housing purchasing patterns of households will also be modeled using analytical tools from real estate and urban economics research. The final result of the discussion is to interpret whether the transit supportive development options created by the large investment in Tren Urbano can be acted upon by developers in 2001, one year from the time of writing. Additionally, the decision on whether private developers will wait for a more opportune time to invest in transit-supportive properties will also be tested.

The research is confined to the housing sector for three reasons. First, several colleagues at MIT and the University of Puerto Rico have developed planning and urban design models for communities around the stations. While these projects resulted in elegant representations of strategic spatial visions for new or substantially redeveloped

communities, experience shows that little will result from renderings such as these without sound financial analysis. Second, given the nature of the Tren Urbano project and its influence on the construction industry in Puerto Rico, research on future transit-supportive property markets receives considerable attention and has reasonable data sets readily available. This year, another MIT student researcher, Randy Knapick, will complete analysis of the retail sector of the real estate development market. Finally, the collection of property data in Puerto Rico is heavily weighted towards housing. Even though this data is not as extensive as in US mainland cities, it is sufficient to allow for considerable analysis that makes a research such as this worthwhile.

1-2: Motivation and Background

Transit Oriented Development (TOD), with a focus on rail transit, is one of the most popular themes in architecture and urban planning today. As an increasing number of American cities build new rail systems or expand existing networks, the urge by transit authorities to encourage development of new transit supportive real estate proximate to stations is increasingly evident. New Urbanists and others in architecture and planning vociferously advocate mixed use developments that fully utilize the social benefit of public sector investment in rail. These benefits include reduced automobile traffic, cleaner air, conservation of agricultural land and reduced dependence on foreign oil.

The aim of building large and diverse real estate projects near transit stations is to create a critical mass of destinations in the city that can be accessed by transit. Such an urban development model allows city dwellers to travel from their homes to a range of amenities -- hospitals, universities, theatres, museums, grocery stores, shopping malls,

parks, and places of employment -- without ever having to ride in an automobile. In reality, with the exception of New York, Boston, Chicago, San Francisco and probably Washington DC, few American cities that have rail systems in place today provide efficient transit access to such a range of amenities. Auto-focused cities such as Atlanta, Los Angeles and Miami that also operate rail transit have achieved limited success in their attempts to provide transit access to the diversity of destinations that makes total reliance on this mode of travel a viable option for their residents.

While the combination of new buildings and modern transit is conceptually appealing, transit supportive development is tempered by the operational dynamics of real estate space markets and current practice in real estate capital markets. Since the early 1990s, the impact of the Savings and Loans (S&L) crisis of the late 1980s that led to high vacancy rates in many property sectors brought new discipline to the US real estate development industry. Equity capital providers such as pension funds and college endowments are more selective about the projects they choose for joint venture participation. Debt providers such as commercial banks and life insurance companies use underwriting standards for commercial real estate mortgages that are more streamlined than they were before 1988. Increasingly, developers are forced to place more of their own money into new projects and this means that they too have become more selective. The net result of all this is that new real estate development projects will only be financed when they are value creating investments. Speculative overbuilding driven by tax loopholes is a thing of the past and supply and demand in many US urban space markets are now aligned. Rents for most commercial real estate are at historic highs leading to favorable financial performance for owners of these assets -- both equity owners who

hold Real Estate Investment Trust (REIT) stock and high net worth individuals who own buildings free and clear or in partnerships.

The new discipline in real estate finance has a direct impact on the decision that private developers make with respect to transit supportive development. New projects near transit stations that are built are those that make sense economically. In most US cities, real estate developers have been slow to respond to the development opportunities created around new transit stations. Programs to encourage private developers to pursue transit supportive development that range from transit agency proposals that use the Request for Proposal (RFP) method, joint venturing and discounted land sales have failed to accelerate the pace of development. Further, many stations have little or no walking scale development. The reasons why real estate developers are leaving Transit Oriented Development deals on the table appear to be tied to the expected risk-adjusted return associated with this form of development.

In San Juan, the development of Tren Urbano with 17 km of track and 16 stations creates a number of opportunities for transit supportive development. These development opportunities can be likened to options contracts that will only be exercised if the proposed project is in the money. As with any option, the probability of profit or loss cannot always be precisely measured, especially when there are many variables that are difficult to quantify. In the case of development near Tren Urbano stations, what remains unknown is the reaction of San Juan developers to these opportunities. What is known is that developers are aggressive in the pursuit of projects in the wider San Juan market in which there is substantial profit. In order for Tren Urbano to convince these developers of the viability of transit supportive development, the process of measuring and

estimating the profit potential in this type of real estate must begin. Several approaches to measurement that consider separate property types, mixed use development with different combinations of properties, variable market conditions and so on, need to be carried out. With the summary of these research projects in hand, Tren Urbano will be well positioned to negotiate the terms and conditions for transit supportive development near the stations in San Juan.

1-3: Considering Transit Supportive Development for Tren Urbano

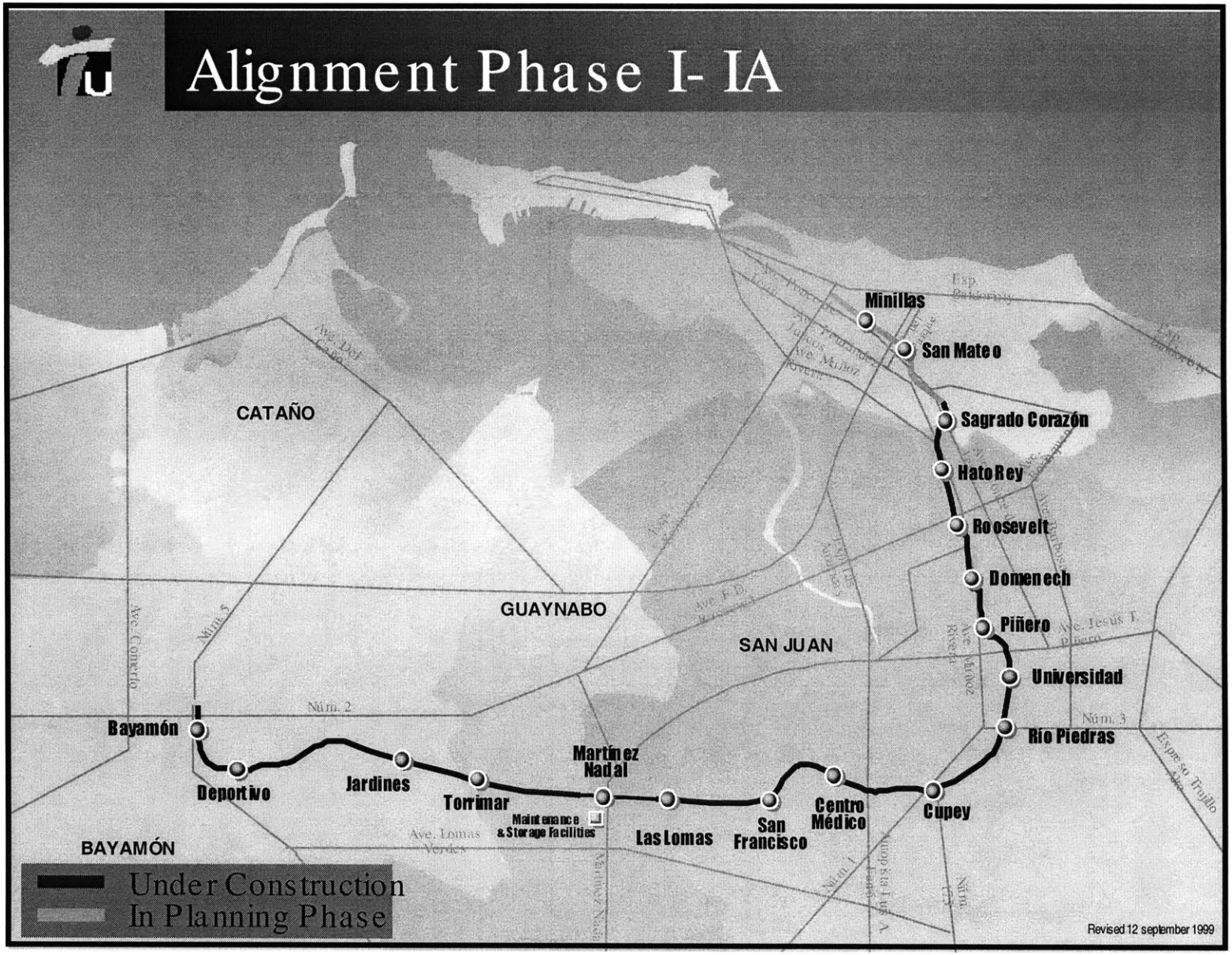
The decision by the Puerto Rican government to invest over $1.6 billion to build the first alignment of Tren Urbano, a heavy rail transit system in the San Juan Metropolitan Area (SJMA), is part of a strategy to relieve traffic congestion on the city's highways and develop a more efficient and viable city. As construction of the system's elevated guideway, tunnels and track takes shape and Tren Urbano begins to establish a visible presence on San Juan's landscape, property development around the new stations is advocated by several public agencies including the City of San Juan, the Puerto Rico Planning Board (Junta de Planificacion) and Tren Urbano. Between the present time and mid-2002 when the trains begin operation, land proximate to new transit stations that is being used as staging areas for the construction of the system will be available for real estate developers to acquire through purchase or lease. On these parcels, several property types can be located near a modern, efficient transit system that provides access to a large consumer and employment base. In addition, vacant parcels that are privately owned and blighted properties for which the actual ground rent significantly exceeds the capitalized ground rent will provide addition space for new building programs. The range of

properties that would complement the transit system include housing, retail, office, entertainment, industrial and hotel in mixed-use projects that compete in San Juan's real estate market while at the same time they enhance transit ridership.

Phase I of Tren Urbano provides transit service within a 5-minute walk of many residential communities, the Hato Rey financial district, commercial centers in Bayamón and Rio Piedras, and entertainment centers such as baseball stadiums and indoor arenas (Figure 1-1). These fixed origin and destination points are located in three of the San Juan Metropolitan Area's (SJMA) 13 municipalities Bayamón, Guaynabo, and San Juan. Intermodal connections using buses and publicos (publicly licensed vans) will provide transit access to a much wider region. As planned, future extensions of Tren Urbano will provide transit service to the Carolina municipality to the east of the Phase I alignment, the Minillas Government Center, Old San Juan, Luis Munoz Marin International Airport, and the Caguas municipality to the south of the Financial District (Figure 1-2).

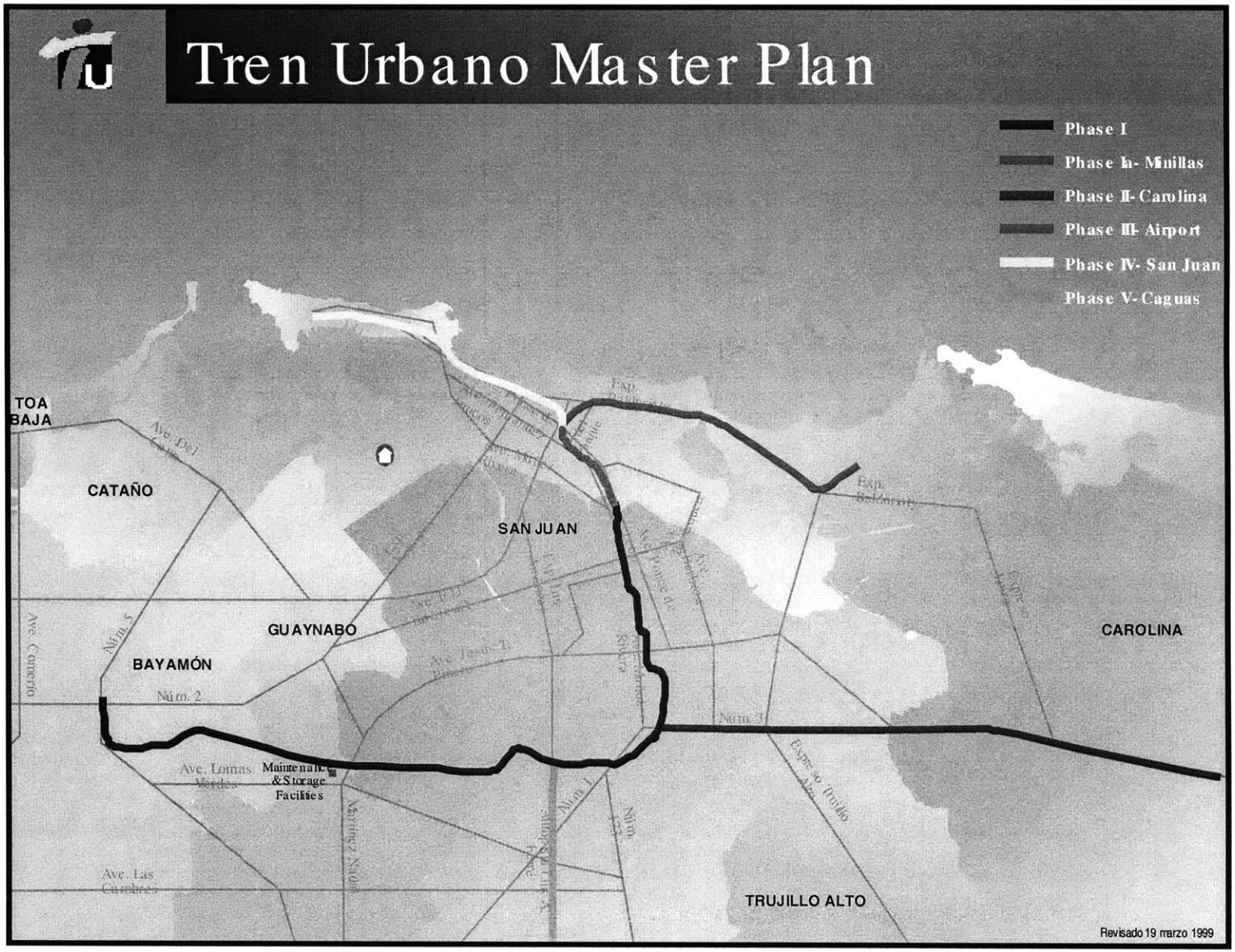
From a developer's perspective it is necessary to consider that Tren Urbano is being laid down over an existing urban fabric where development patterns are heavily influenced by a street and highway network built to accommodate private automobiles. The task of reorienting long established patterns of development in a major city with a strong automobile focus to produce the types of communities advocated for transit station areas could prove to be quite complex with a multitude of stakeholders having varying levels of influence on future outcomes. One of these interests -- San Juan's private real estate developers -- will be particularly important in the station area development process. This research places the emphasis on developers and attempts to model their

Figure 1-1: Tren Urbano Early Stage Alignment



Source: Tren Urbano

Figure 1-2: Tren Urbano Full Alignment



Source: Tren Urbano

investment decisions based on the development opportunities proximate to the new transit stations.

The pursuit of a transit supportive development by Tren Urbano management brings together several entities, some with competing interests. These entities include developers (investors), banks and other financial institutions (financiers), public authorities (Tren Urbano), transit riders, neighborhood groups, and space users (homebuyers; retailers; companies renting office space). The potential for transit-supportive real estate development in San Juan focuses attention on the differences between property development that is good for urban public transportation, and the financial decisions that provide adequate returns to developers. Some of the competing interests of the six entities identified are illustrated by the example presented in Figure 1-3. On closer examination it is evident that some of the interests of different entities are in conflict. Take for example the desire of homebuyers to have adequate parking consistent with recent development practice and the interest of Tren Urbano in increasing transit ridership. It seems that maintaining the current parking ratios would provide little incentive for residents to use Tren Urbano. One solution would be to reduce the parking requirement in the project in exchange for transit access. Whereas the offered solution is favorable to transit, developers will most likely offer some resistance until transit ridership patterns are established and there is hard evidence to guide investment decisions. These conflicts also increase the developers' perceived risks in transit supportive real estate development leading to more expansive real estate products.

Breaking the cycle of a competitive advantage of suburban housing development requires contributions from many sectors and significant coordination effort. Part of the

Figure 1-3 Some Issues for Groups with Interest in Transit Supportive Housing

Developers

- Maximizing profit
- Increasing market share
- Strategic business decision
- Public image
- Establish Relationships with Tren Urbano

Tren Urbano

- Increasing transit ridership
- Enhancing cash flows
- Public Image
- Develop model projects
- Establish relationship with developers

Homebuyers

- Own high quality housing
- Low interest rate mortgage
- Reduce monthly expenses
- Ride the new transit
- Purchase cheapest housing in good location

Puerto Rico Planning Board

- Maintain control of all land use decisions
- Manage the public agencies in land use
- Public Image
- Develop model projects
- Advise Tren Urbano

Neighborhoods Organizations

- Influence community design
- Reduce development impacts of Tren Urbano
- Control crime
- Improve public amenities
- Safeguard property values

Mortgage Banks

- Make good loans
- Influence design to add value
- Adjust underwriting standards for high-risk projects
- Develop and enhance relationships with developers

coordination in San Juan has started with the decision to build Tren Urbano. Additional steps including urban design, incentives to developers to invest in new projects, and support of Tren Urbano are important to the success of the system.

1-4: Methodology

This is a data intensive project. Most of the data used in this paper is taken from secondary sources. In San Juan real estate, most of the property market data is disjointed and is generally not standardized. Public agencies such as the San Juan Planning Board (Junta de Planificacion) and the Government Development Bank (GDB) provided data on construction permits, population estimates and aggregate economic performance. Private data providers such as Estudios Técnicos, Inc., and Vallejo y Vallejo, Inc., contributed data on housing projects, construction costs, and absorption rates. These data are combined to present an overview of housing market trends market from 1995 to 1999. In order to put all of this into perspective, interviews with developers, architects and city planners were carried out.

The second part of the research involves real estate capital markets data. Here, the terms and conditions of construction loans, investment alternatives, and the pricing of risk in housing development are taken from documents provided by financial institutions, the San Juan financial press and from Internet websites. Bond market data come from Doral Securities, Doral Mortgage, the Office of the Commissioner of Financial Securities (CFI) and the GDB. Interviews were also used to clarify this data especially in the area of how some of the information specific to US as a whole applies to Puerto Rico.

Part of the research involves looking at housing options in the city. This is documented with images, some of which are concept drawings provided by architects. Air photos and maps are provided by Tren Urbano and MIT, and are used to display elements such as the density of residential areas.

With respect to the data manipulation and the investor decision modeling, several scenarios are tested. The base case treats transit supportive housing development as projects that are built without consideration of the benefits Tren Urbano delivers in terms of increases in property prices or reduced development cost brought about by reduced parking requirements. One alternative scenario considers the investment decision that is influenced by early phase property price increases using the results of a research on Miami transit stations. A second alternative scenario tests the investment decision associated with land price rebates and construction cost reduction brought by reduced parking requirements. For each proposed property, Net Present Value (NPV) and Internal Rate of Return (IRR) calculations are tested under each condition. This allows for sensitivity analysis as variables are adjusted using reasonable assumptions.

1.5: Organization

Chapter two discusses the theory that explains the link between new transport corridors and real estate investment activity. Most of this chapter is devoted to New Urbanism and its application in a transit context. Research findings based on New Urbanism is introduced and, where appropriate, practical application of the design prototypes to other transit systems will be discussed. The link between New Urbanism and Transit Oriented Development is also discussed and recent performance evaluations

of these development schemes in the US are presented. Public initiatives in transit-supportive development such as the Federal Transit Administration (FTA) Livable Communities program are outlined and their applicability in San Juan assessed.

Chapter Three describes the San Juan housing market and profiles the aggregate investment patterns using housing permits data from 1988 to 1998. Demand forecasts for different price ranges of housing are also introduced to assess the market within which transit supportive housing will compete. The findings in this chapter will then be applied to the two station areas chosen for detailed analysis in Chapter Five.

In Chapter Four expected return rates for new housing investment in San Juan is compared with the returns in securities markets such as the Puerto Rico Stock Exchange (PRSE) and the New York Stock Exchange (NYSE). There return rates are compared to expected returns on a risk-adjusted basis using the Capital Asset Pricing Model (CAPM). Publicly traded housing development companies in the US will be compared to other sectors of the real estate industry and with publicly traded companies headquartered in Puerto Rico.

Chapter Five is devoted to the application of the investment analysis to the Martinez Nadal station along the alignment. Based on clearly defined housing development programs, a financial analysis is carried out using Discounted Cash Flow (DCF) techniques.

Chapter Six provides conclusions and recommendations based on the findings of the research. The recommendations will include the likely path that Tren Urbano should following the pursuit of transit supportive development to improve the competitive position of rail transit in San Juan transportation.

Chapter Two

Transit Station Area Development Programs:
Design Elements and Financial Results Considered

2-1: Introduction

The purpose of this chapter is to a review previous research on community design prototypes for Transit Oriented Development (TOD) and to present an assessment of the financial performance of housing built near transit in three North American cities. Proposals for the design of neighborhoods near the future Tren Urbano stations by Deeming (1999[1]), and recent models developed by the urban design staff at Tren Urbano staff are incorporated in the discussion. The end result is to specify appropriate design and density criteria for transit-supportive housing development in San Juan and to begin an assessment of the likely impact of Tren Urbano on multifamily condominium prices. Programs by the Federal Transit Agency through the 'Livable Communities Initiative' and efforts by the San Francisco transit authoriy in housing development will be presented.

2-2: Design Models for Transit Station Areas

2-2-1 Transit Oriented Development and the New Urbanism

Most of the research on Transit Oriented Development and the New Urbanism by Peter Calthorpe[2], Peter Katz[3] and other architects emphasizes two design attributes to be incorporated with housing development near train stations. These are increased density over typical suburban communities (density measured as Floor Area Ratio, FAR), and the relationship of houses and other buildings in mixed-use developments to the wider urban system, particularly transportation. The density ranges that Calthorpe proposes are moderate for typical urban

neighborhoods, clearly much higher than typical suburban developments, but in most cases only marginally higher than existing densities in San Juan. The FAR levels achieved in the most densely settled urban centers such as New York, London, and Boston's Back Bay where mid-rise and high-rise structures are used for multifamily housing are not emphasized in Calthorpe's proposals but are mentioned.

In terms of site layout and the relationship of the site to urban transport nodes, Calthorpe specifies several community design alternatives that focus development around a transit station. One of these design concepts is set for the "Urban TOD" a second alternative the "Neighborhood TOD" and a third for "Residential Areas". Each of these community prototypes is built to the walking scale with 2000 feet established as a comfortable distance for pedestrians. A closely related concept that Calthorpe advances is the "Pedestrian Pocket", a more detailed representation of what a community built around a train station might look like.

In establishing the contextual framework for the design Calthorpe argues:

> " ... the design alternative to sprawl is simple and timely: Neighborhoods of housing, parks, and schools placed within walking distance of shops, civic services, jobs and transit – a modern version of a traditional town (Calthorpe, 1993: 16).

Further, Calthorpe approaches new community design standards using the following argument:

> " ... the regional structure of growth should be guided by the expansion of transit, and more compact urban form; ...that the ubiquitous single-use zoning should be replaced with standards for mixed-use, walkable neighborhoods; and ... that our urban policies should create an architecture oriented toward the public domain and human dimension rather than the private domain and auto scale." (Calthorpe 1993: 17).

These principles are incorporated in the community design process to maximize the benefits of transit, open space, cleaner air, and to reduce the destruction of farmland. The minimum development density that Calthorpe applies to the residential portions of the developments is 10 dwelling units per acre (du/ac), which translates to an FAR for San Juan of between 0.35 and 0.50 based on a typical unit being in the 1200–1500 square-foot range. Calthorpe also estimates that the typical range for efficient transit use is 12–18 dwelling units per acre. Denser neighborhoods are encouraged where culture and the market allow but the mixed-use character and walking scale orientation of transit-supportive communities should always be maintained. However, this minimum density and typical range of density that Calthorpe recommends appear to be low for San Juan as pointed out by Deeming (1999).

In moving from general design concepts to specific building programs, Calthorpe considers three site-types. These are "Redevelopable Sites," "Infill Sites," and "New Growth Areas." Redvelopable and Infill Sites are characterized by vacant land mixed in with viable businesses and communities or where land is occupied by "low-intensity and auto-oriented uses". New Growth Areas have more open space and fewer buildings and can be areas for master planning that introduces many new buildings. The current condition near the Tren Urbano stations in San Juan places the surrounding communities in the Redevelopable Site and Infill Site categories.

Calthorpe's work however, is not without its detractors. Deeming (1999) isolated four main themes for the criticisms leveled against new urbanism:

> "... it is just another form of sprawl, it's only for the rich, it is all looks and no content, and it's not reflective of today's development realities." (Deeming 1999: 36)

Whereas these criticisms are valid academic arguments, the fact that new urbanism has started to influence real estate development practice needs to be emphasized. The focus of this research on development options for Tren Urbano stations signifies that close attention must be given to this type of development so that the financial evaluation may be hinged on the model most likely to emerge in future transit-supportive communities.

2-2-2: Practical Applications of the New Urbanism

While Peter Calthorpe stands at the forefront of current design for transit-supportive communities, his work is not alone in the field. Miami-based architects Andres Duany and Elizabeth Plater Zyberk (Duany-Plater-Zyberk and Company) have designed several new urban communities including Sea Side, Florida, and Harbor Town in suburban Memphis among others. Their work is gathering momentum as more developers contract their services for design And implementation – one example is North Richland Hills near Dallas being developed by Arcadia Realty Corporation whose two principals are MIT Center for Real Estate alumni.

While the designs produced by Duany-Plater-Zyberk and Company incorporate new urbanism principles, the developments are seldom built around transit and therefore do not fully test the Transit Oriented Development concept in its purest sense.

2-2-3: Federal Transit Authority Community Design Initiatives

The Federal Transit Authority (FTA) has also produced design concepts for transit supportive communities. The FTA models have similar elements to those of Calthorpe but they are worth expanding on because they provide important details of the relationship between transit and the built environment. More recently, the FTA Livable communities Initiative

teamed up with the Spanish Speaking Unity Council (SSUC) in Oakland and the Bay Area Rapid Transit District (BART) to build a transit village at the Fruitvale station[4] (FTA Document, September 1999). The cost of the Fruitvale project was $4.5 million and the FTA provided $2.3 million as a grant to the project. Another TOD project, the Clackamas County Sunnyside Village, 10 miles from downtown Portland, Oregon includes a $2 million plaza that was 80 percent financed by FTA grant funds. The designs for both communities are derivatives of the TOD models of Calthorpe and other new urban architects.

2-2-4: Design Initiatives for Station Area Improvements in San Juan

Community design for land proximate to Tren Urbano stations is a recurring theme of the MIT-UPR Technology Transfer Program. In 1994 Morelli considered walking scale neighborhoods for San Juan based on the New Urbanism. Morelli concluded that the walking scale neighborhood concept would be a positive development for San Juan and Tren Urbano[5].

The Urban Design Department of Tren Urbano developed a document in 1999 that has design concepts for most of the 16 stations. Each design is produced with site-specific issues in mind but the overall design paradigm is in concert with many of the precepts of TOD and New Urbanism. At the stations where residential development is emphasized, densification and mixed-use communities are central to the visioning process. Seven of the stations are designated as having substantial development opportunities.

Deeming (1999) wrote an extensive summary of the design considerations for one of the stations: Martinez Nadal. The design that Deeming proposes incorporates lessons learned from two developments in Portland, Oregon – one relatively successful and the other a failure – into the planning of a walking access community proximate to the station. While no hard numbers on

development cost, likely development entity structures, and sale prices are presented, the conclusions do provide enough information for some of these variables to be estimated.

2-3: Economic Impacts of Transit Corridors

2-3-1: The Theory of Location and Value

In theory, new transit corridors created by light rail, heavy rail, or exclusive busways are expected to deliver a competitive advantage to housing and other real estate development located near transit stops. This expectation may be summarized from urban economics where property values are determined by proximity to high value centers within the urban landscape. The pattern of land values that the monocentric city model predicts is one of decreasing prices with distance from the Central Business District (CBD).

At the metropolitan scale, monocentric city models begin with the assumption that the highest land values are found in the Central Business District (CBD). All other land values in the urban land market fall off at a constant rate based on transport cost per unit distance until development reaches the urban edge and land is priced for its agricultural utility (Mills 1967[6]; Muth 1969[7]; DiPasquale and Wheaton 1996[8]). These models conclude that proximity to the CBD is highly valued and locations near the center will command the highest rent in the real estate markets. Though the model is highly stylized and lacks the ability to predict land value changes in small areas, it does provide a good summary of the change in land values over much greater distances. Additionally, the model works best to predict the price of land in cities with a clearly defined center. In multi-center cities, the model is modified to account for several locations of value, taken here to be additional core areas within the wider urban landscape.

Similarly, in cities where walking access to transit is highly valued, the utility provided by location near a transit station should be capitalized into land prices, housing prices and contract rents as households bid up these values through competition for these most valuable location. The basic idea is that in a market economy, market participants will bid up the price for land in a competitive process. The supply of land is fixed and if the demand for land increases in response to the new station location, the price of land will increase.

While location theory provides an elegant description of what ought to happen in property markets, the results of recent research on the impact of new transit on single family house prices is mixed. Factors not related to transit access that are important to households are also valued in the property market -- crime; school quality; open space; access to shopping -- producing a more complex pattern of land values than the concentric circles generated by location theory.

2-3-2: The Impact of Proximity to Transit Stations on House Prices: Three Cases

Recently, several researchers have attempted to identify accessibility related rent gradients for real estate, particularly apartments and single family homes, located proximate to major transport nodes and routes. In 1993, Gatzlaff and Smith[9] evaluated the impact of Miami Metrorail on the values of single family homes near the stations. The data used in this study are taken from the property taxes for the period from 1971 to 1990. Two multiple regression models are specified in the study, a repeat sales method based on time series modeling and a hedonic model based on the cross sectional approach. In summary, the researchers found that "there was weak evidence that there was any major effect to residential values due to the announcement of the development of the Miami Metrorail stations."

This study is particularly relevant to Tren Urbano because it attempts to specify changes in station area property values relative to the announcement date for building the new system rather than the initial service date. Given that Tren Urbano is still being built the methods used in this study will provide valuable insights to help model developer behavior and homebuyer behavior with respect to transit in San Juan. However, the question of whether the announcement of Tren Urbano led to an increase in house prices near the stations will not be addressed in this study because of the lack of a reliable time series data.

Several studies have taken up the issue of property value changes for mature urban commuter rail systems in other North American cities. Dewes[10] (1976) compared property values for Toronto single family homes and multifamily dwellings with up to four units along the Bloor-Danforth corridor. The study compares the property values in 1961 when streetcars moved in traffic at an average speed of 10 - 12 miles per hour to values in 1968 after a modern heavy rail system replaced the streetcars and increased the average speed on the route to 22 miles per hour. Both specifications used the hedonic model with the transportation variable represented in distance and time. While it was shown that the travel times for the rail commuters decreased by about four minutes between 1961 and 1971, the expectation of a change in the rent gradient for house values over the period showed that "there is no evidence that the slope decreased as theory would suggest" (Dewes 1976: 48)

More recent studies on the property value adjustments attributable to transit access have found positive impacts on value. In a study of the Fitchburg/Gardner Massachusetts Bay Transit Authority (MBTA) commuter rail line in Boston, Armstrong (1984[11]) found that "there are indeed property value impacts on single-family residential properties resulting from commuter rail service." This value difference for properties in communities with a commuter rail station

measured using the hedonic model, was estimated to be "approximately 6.7 percent greater than that of residences in other communities."

2-3-3: Economic Valuation of New Urban Communities

New Urbanism is a relatively new concept in architecture and urban design that is gradually gaining acceptance by developers. If recent conferences and publications by the Urban Land Institute (ULI), Partners for Smart Growth, and the National Association of Homebuilders (NAHB) are guides to future development, then New Urbanism with narrow streets, densification, transit-supportive walking scale communities and mixed-use focus will become one of the major planning tools for communities in the US and, by extension, Puerto Rico.

New urbanism is defined by Fulton[12] (1996) as:

> "a movement in architecture, planning, and urban design that emphasizes a particular set of design principles, including pedestrian- and transit-oriented neighborhood design and a mix of land uses, as a means of creating more cohesive communities."

An additional definition by the Congress for the New Urbanism (CNU) defines new urbanism as city planning that:

> " ... seeks to reintegratge the components of modern life—housing, workplace, shopping, and recreation—into compact pedestrian mixed-use neighborhoods linked by transit ..."

Both definitions are important in guiding the design of several communities in US cities, most of which get only part of the way in completing what may described as pure New Urban communities.

According to New Urban News (September/October 1997) 12 new urban communities existed in or near US cities. In all Eppli and Tu[13] (1999) estimate that "more than 200 New Urban projects were in the planning stage or under construction."

The most comprehensive financial evaluation of the relative performance of new urban housing was carried out by Eppli and Tu (1999) on behalf of the Urban Land Institute (ULI). Eppli and Tu estimated the difference in value for single-family homes built in new urban communities and similar properties in "the immediate neighborhood" in four communities that were built between 1990 and 1994. The study is based on the hedonic pricing model that is used extensively in real estate market research to estimate the influence factors considered valuable to consumers (independent variables) such as lot size and density on house prices (dependent variable). These communities: Kentlands in Gaithersburg, Maryland; Harbor Town in Memphis, Tennessee; Laguna West in Sacramento California; and Southern Village in Chapel Hill, North Carolina incorporate most elements of new urbanism but they lack one key component; a rail transit station. However, even though Eppli and Tu did not estimate the utility of walking access to transit for single family house prices, the study offers important insights on how mixed-use development near train stations may be valued for the other major elements such as design, densification and mixed-use zoning. The study concludes:

> "...consumers are willing to pay more to live in communities designed with principles of new urbanism compared with surrounding conventional developments" (Eppli and Tu, 1996: 73).

Based on the regression results for all four communities, the study found that the "premium ranges from $5,000 [4 percent of house value] in Laguna West to $30,000 in Harbor Town [25 percent of value]."

2-4: Transit-Supportive Legislation in the US: Recent Examples

The emphasis on transit in large US mainland cities is accompanied by legislation at all levels of government. The Federal Common Grant Rule has "expanded the permissible use of federal transit grant funds to include transit-based development; the establishment of the Livable Communities program; and the greater prominence given to transit-based development in the evaluation of rail "new starts" proposals under section 5309 funding." (Bernick and Freilich[14]).

At the state level, California enacted the "Transit Village Planning Act of 1994" (California Government Code § 65460). The bill calls for "local, regional, and state governments ... to approve plans which direct new development close to transit stations and to provide financial incentives to implement the plans" (Bernick and Freilich 1998: 4).

2-5: Real Estate Development Deals by US Transit Authorities: An Example

The opportunities for transit authorities to partner with developers to build transit-supportive housing and other property types are expanding. The role of the transit authority includes assembly of land, infrastructure investment, parking development, and direct financial participation (Bernick and Freilich 1998). Two examples of collaboration between transit agencies and developers is the Richmond Transit Village and the Fruitvale Transit Village near BART stations in San Francisco. Fruitvale is a "$100 million new neighborhood of residential, retail, and public services, within the one-quarter mile station radius." (Bernick and Freilich 1998).

2-6: Summary and Conclusions

The confluence of architecture and urban design, rail transit, and investment decisions at transit stations produces an interesting mix of forces that help to reshape an urban landscape. In terms of the station area design, a substantial body of literature and design prototypes already exist for Tren Urbano to consider. These include Calthorpe's 'New Urbanism' and the practical applications of some of these concepts by Duany-Plater-Zyberk and Company.

In the context of Tren Urbano, many forces are at work as major stakeholders attempt to grapple with what will happen to the urban fabric in San Juan after rail transit begins revenue service. The community design that will most likely emerge for Tren Urbano is a form of modified New Urbanism. Modification of Calthorpe's design will adjust for the higher development densities that already exist in San Juan. Urban design initiatives for Tren Urbano have already been considered but these alternatives have not made the connection to the real estate development industry and San Juan's real estate capital markets. The fact that most New Urban communities are built in areas that do not have a transit station means that transferring the findings of the Eppli and Tu research to San Juan is not feasible. While the house price premiums in New Urban communities in US cities ranged from 5 percent to 30 percent, the absence of rail means that the apples-to-apples comparison that is always required in investment analysis will not be possible. The portion of this expected price premium that will apply to San Juan cannot be known until New Urbanism is tested in the city.

Probably the most important points to consider from this chapter are the research findings for three transit systems that that show only marginal increases in house prices near the stations. The fact that access to a train station does not deliver a significant increase in the sale prices of housing in three major cities is very important for Tren Urbano. This means that it is difficult to

justify a housing development program that claims access to transit as a yield-enhancing variable for developers. In other words, one cannot claim that developing new housing near Tren Urbano stations will provide developers with the opportunity to make superior profits based on higher prices for the same unit holding development cost constant. This means that the strategy of establishing a base case scenario that ignores any price premium brought by Tren Urbano is a reasonable starting point for the investment decision modeling of developer behavior. It also means that the strategy that Tren Urbano eventually pursues with respect to station area development may need to consider alternative measures to attract developers.

Chapter Two End Notes

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Chapter 3

Analyzing the Patterns of Population and Housing in San Juan:
Implications for Transit Supportive Housing Development for Tren Urbano

3.1 Introduction

The purpose of this chapter is to begin an evaluation of the prospects for developing transit supportive housing in San Juan from a real estate developer's perspective. The evaluation focuses on consumer (homebuyer) behavior in the context of the most recent market activity in the section of the San Juan through which Tren Urbano passes. The analysis excludes the urbanized area along the potential future alignment to Caguas. The market area that emerges includes Old San Juan, Santurce, Isla Verde, Condado, Hato Rey, Rio Piedras, Guaynabo, Carolina, and Bayamón[1]. The aim of studying just this portion of the Greater San Juan housing market is to gain an understanding of the factors that influence the prices for new multifamily housing units on a micro-level. At this scale, an area that covers 165 square miles, development projects similar to those proposed for future development near the Tren Urbano stations can be substantially analyzed. Chapter Four will expand on the concept of development feasibility for transit supportive housing in the current market by modeling developer behavior using analytical tools from real estate finance and corporate finance.

The second section of this chapter (3-2) presents a description of housing conditions in San Juan as they currently exist. This includes a summary of ownership patterns by municipality, total population, average household size, average prices for new housing among other variables. Data from the 1990 US Census provide summaries of population and housing aggregates, and the analysis also incorporates annual estimates for leading indicators that are compiled by the Puerto Rico Planning Board, and the Puerto Rico Development Bank. The use of annual data series

describes the current patterns as well as recent trends in housing market activity. The discussion then moves on to cover recent sales activity for the market area under review for all types of multifamily housing sold in San Juan. The sales data are used to provide an overview of recent activity in a manner that allows comparisons across the seven housing sub-markets along the Tren Urbano alignment.

As a benchmark for further analysis of the study area, the municipalities that adjoin the study area are used as a control area (Figure 3-1). These ten municipalities -- Cataño, Toa Baja, Naranjito, Comerío, Aguas Buenas, Caguas, Guarabo, Truillo Alto, Canóvanas and Loiza -- create a semi-circular ring around the central market area. The section also includes a review of the approaches to estimating the demand for housing that were used in research elsewhere in the US.

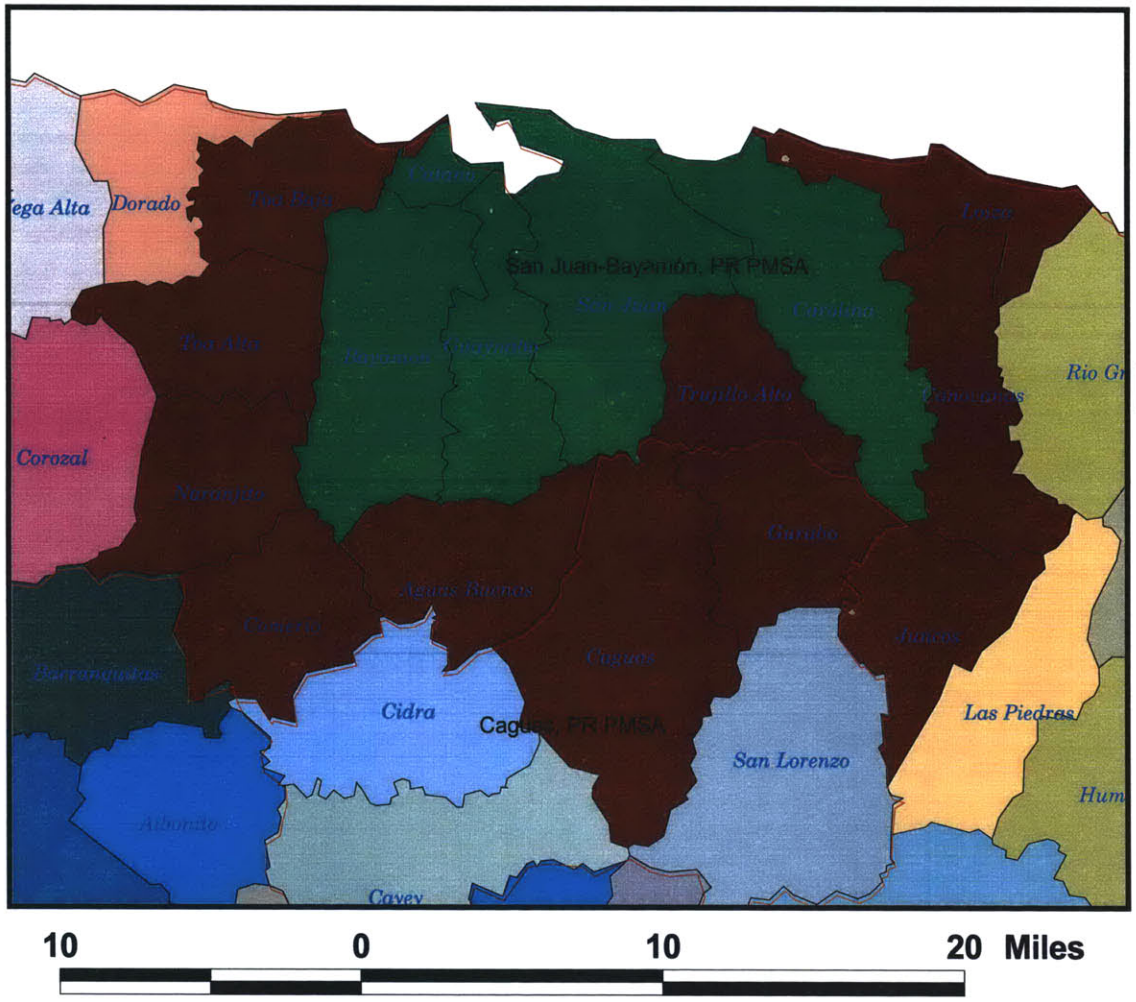
The third section of the chapter (3-3) provides a detailed analysis on two property types: high-rise and walk-up apartment condominiums. Both are covered because each fits the general description of the housing that is proposed by urban designers and city planners[2] for transit supportive housing development near Tren Urbano stations. At this level of detail, examples of floor plans, sales prices and absorption rates for individual projects are presented for recently completed high-rise and walk-up apartments.

The final section of the chapter (3-4) deals with the issue of price estimation for new multifamily housing. Price estimates are important for the financial decision modeling process that follows in Chapter Four and Chapter Five. In essence, this is an attempt to model homebuyer behavior using available data at the new housing project level.

Figure 3-1

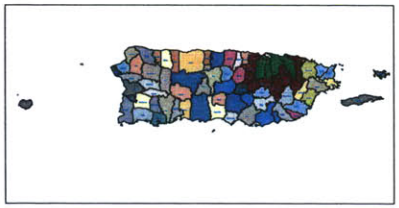
Tren Urbano Real Estate Market

Central San Juan Study Area



Control Area

Study Area



Island of Puerto Rico

3-2: Population, Income and the Demand for Housing in the Study Area

3-2-1: Population Density and Development Potential Near Tren Urbano Stations

The San Juan Metropolitan Area (SJMA) is made up of 13 municipalities. Tren Urbano will provide direct service to four of these municipalities: San Juan (including the housing market areas of Old San Juan, Santurce, Hato Rey, Condado, and Rio Piedras), Guaynabo, Carolina (including the Isla Verde high-income housing market) and Bayamón. When the construction of Tren Urbano is complete, San Juan's public transportation network will have a modern heavy rail system with over 30 stations as the backbone the system supported by buses and publicos[3].

Most sections of the alignment and many of the stations are being built in densely populated communities that have experienced moderate population growth and increases in the housing stock in recent years. In 1990 the total population of the study area was 928,699 (Table 3-1). The area also had 332,023 housing units of which 300,509 (90.5%) were occupied. The average housing density ranged from 3,514 dwelling units per square mile or 5.5 dwelling units per acre (5.5 du/ac) in San Juan to 1,202 dwelling units per square mile (1.9 du/ac) in Carolina. This crude density measure suggests that the opportunity for building new housing is highest in Carolina and Bayamón (2.5 du/ac) and lowest in San Juan and Guaynabo (5.4 du/ac). However, data on the number of vacant lots on which new housing can be built was not available. The average housing density used in this case should not be interpreted as a direct measure of the buildable land that remains in each municipality. Average building density expressed as Floor Area Ratio (FAR) would be better measure but the sources uncovered in the research provided FAR for small areas such as land near the train stations and does not cover the entire municipality.

Based on visual evidence, the most difficult areas to develop transit supportive housing are Santurce, Isla Verde and Condado. These three areas have many mid-rise and high-rise

condominiums mixed in with hotels of similar design (Figure 3-2, Figure 3-3 and Figure 3-4). The use of land is most intense in Condado and Isla Verde where access to beaches and other amenities places a premium on condominium prices. The difficulty of developing transit supportive housing in these markets once Tren Urbano stations begin to operate is compounded by high land prices and the tendency of residents to own two or more cars per household. In some ways, transit supportive housing already exists in these areas because of the high densities and the challenge for Tren Urbano will be to encourage transit ridership.

3-2-2: Estimating Demand based on Population and Income

The link between population increase and the demand for new housing units has long been established in urban economics. The basic idea is that as the population of an area expands, the propensity for people to form new households will drive the demand for additional housing stock. By definition, each new household occupies one more dwelling and in the process creates additional demand for housing that is supplied by private developers or the state. In expanding on the concept of housing market demand, DiPasquale and Wheaton[4] conclude:

> "In studying housing markets, we use two different measure of housing: housing units and housing services. The market for housing units is simply the demand for and the supply of units." (DiPasquale and Wheaton 1996, Chapter 8: 182)

Therefore, from one period to the next, the adjustment in the demand for new units must be equal to the number new households formed in the intervening period. Between 1990 and 1998 the population in the study area increased from 928,699 to 983,119; an increase of 0.73 percent per year. This rate is less than the population growth rate for Puerto Rico that had an average of 1.19 percent per year (Table 3-1). The population in each of the market areas also increased at a slower

Table 3-1

Population and Housing in Study Area

Municipality	Population 1990	Population 1998	Growth Rate 90-98	Total Increase	Household Size 1990	Housing Units Added (based on 90 HH size)
San Juan	437,745	453,578	0.4%	15,833	2.9	5,460
Guaynabo	92,886	100,094	0.9%	7,208	3.2	2,253
Bayamón	220,262	239,913	1.0%	19,651	3.3	5,955
Carolina	177,806	189,534	0.7%	11,728	3.3	3,554
Study Area Total	928,699	983,119	0.7%	54,420		
Puerto Rico	3,487,667	3,820,000	1.1%	332,333	3.3	100,707

Sources: US Census, 1990; Estudios Técnicos, 1998

rate than the Puerto Rican average. Within the study area, the highest population growth rate occurred in Bayamón where the population increased from 220,262 in 1990 to 239,913 in 1998, an average annual increase of 1.12%. None of the municipalities experienced a population decrease and each added at least 7,000 persons to its total population.

In 1990, the number of occupied housing units in the study area stood at 300,509 or an average occupancy of 3.3 persons per household. Similar data on the number of occupied housing units in 1998 were not available. However, holding the 1990 occupancy rate constant, an estimate of the expansion of the housing stock is calculated and presented in Table 3-1. For example, using this method, the addition of 19,651 persons to Bayamón's population implies that the housing stock increased by 5,955 units between 1990 and 1998. Similar estimates in the other markets of the study area imply that 2,253 new units were added in Guaynabo, 5,460 in San Juan, and 3,554 units in Carolina. With the population expected to grow at rates of between 0.5 percent and 1.25 percent[5] in the municipalities along the Tren Urbano alignment, proposed transit supportive housing development will supply new housing in markets in which there is a growing demand.

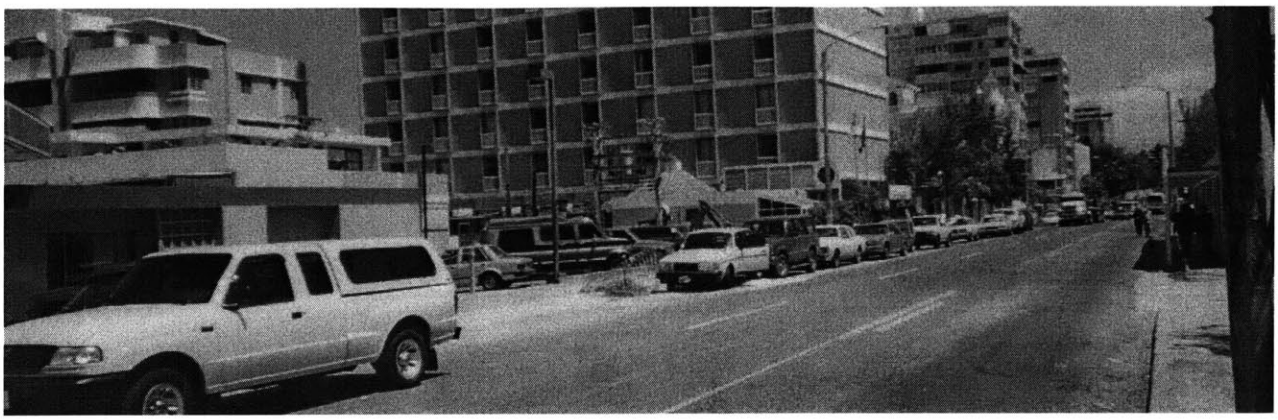


Figure 3-2: Multifamily housing along Munoz Rivera Avenue in Santurce. This is one of the more densely settled sections of the San Juan Metropolitan Area.

Figure 3-3: Walk-up condominium project on Munoz Rivera Avenue in Santurce overlooking Condado

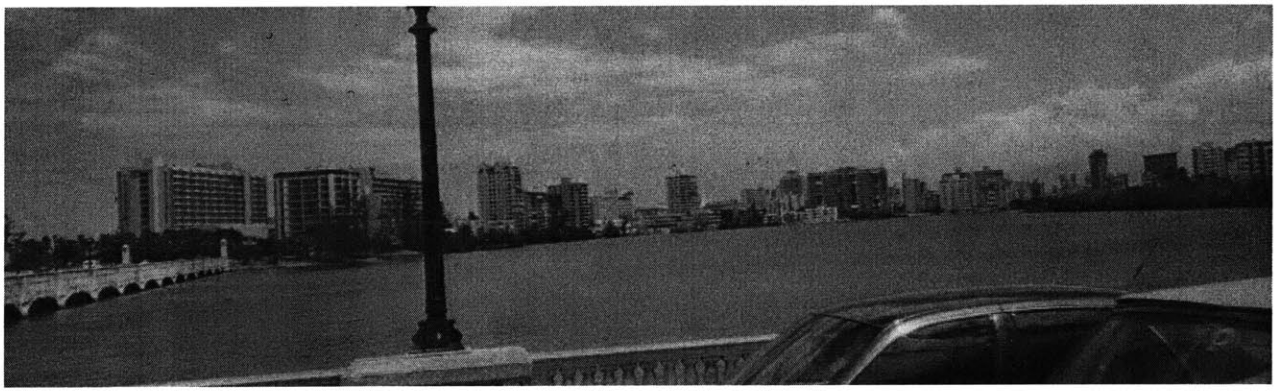


Figure 3-4: The Condado area of San Juan with hotels, high-rise, and walk-up apartments. This area has some of the highest land values in San Juan.

The variable that is missing in the analysis of demand for housing in San Juan is income. Household income levels drive the demand for the type of units that are supplied. HUD guidelines have long based the housing affordability index of on the premise that payment for housing should not exceed 30 percent of household income. Commercial banks in Puerto Rico and US use similar guidelines. Therefore, even though the demand for housing in San Juan will grow as a function of the population growth and average household size, the supply of housing will be priced based on income. For example, a high quality house that costs $200,000 in today's market requires that a household have an annual income of at least $56,000 to be able to afford such a house. Median household income in the municipalities in the study area ranged from $29,760 in San Juan to $38,993 in Guaynabo (Table 3-2). Based on the 1998 median household incomes and a 30-year mortgage payment with an 8 percent interest rate and a 90 percent loan-to-value ratio, the typical price for an affordable house in the study area ranged from $111,650 in San Juan to $146,164 in Guaynabo.

When the central study area is compared to the control area, the pattern of median household incomes in 1998 shows that the outer ring municipalities generally have lower median household income levels. The only exceptions to this general pattern are Caguas ($29,509) Toa Baja ($30,721), and Trujillo Alto ($33,354) that had higher median incomes than San Juan ($29,760). Taking into consideration the recent increases in income and the moderate population growth forecasts, the demand for in Puerto Rico housing can be expected to be quite strong for the next decade. Looking back at the relationship between growth in population and income on the one hand and the number of housing permits issued in San Juan on the other shows that there is a strong relationship between the variables. Projecting forward using Puerto Rico Government

Table 3-2
Median Household Income

Area	Median Income 1989	Median Income 1998	1998 Income in Constant 1989 $	Affordable House Price 1989	Affordable House Price 1998
Study Area					
San Juan	$10,559	$29,760	$22,309	$39,426	$111,650
Guaynabo	$15,041	$38,993	$29,230	$56,366	$146,164
Bayamón	$12,334	$33,689	$21,355	$46,172	$126,225
Carolina	$13,368	$35,776	$26,819	$50,070	$134,021
Control Area					
Cataño	$8,212	$24,013	$18,001	$30,731	$89,947
Toa Baja	$11,086	$30,721	$19,635	$41,525	$115,132
Naranjito	$7,703	$22,056	$16,534	$28,932	$82,601
Comerio	na	$20,004	$14,996	na	$74,955
Aguas Buenas	$8,367	$24,519	$18,380	$31,332	$91,895
Caguas	$10,420	$29,509	$19,089	$38,977	$110,635
Gurabo	$9,091	$26,311	$19,723	$34,029	$98,641
Trjillo Alto	$12,188	$33,354	$25,003	$45,723	$125,026
Conavanas	$8,646	$25,302	$18,967	$32,380	$94,894
Loiza	$8,319	$24,287	$15,968	$31,182	$90,996
Puerto Rico		$25,931			$97,142

Sources: US Census, 1990: Estudios Técnicos, Inc, 1998
Mortgage payments based on 30-year Fixed Rate Mortgage at 8% Annual Percentage Rate with a 10% downpayment

Development Bank[6] forecasts, household income is expected to increase by 3.5 percent year between 2001 and 2010. Population is also projected to increase by 1.2 percent per year over the same period[7]. These growth figures, once realized, will lead to a sustained increase in the demand for housing.

The most comprehensive demand forecast for housing in Puerto Rico was carried out by the San Juan economic analysis firm, Estudios Tecnicos, Inc. The estimating procedure used in this study relies on population and income projections and summarized in the following terms:

"... the primary elements in the model are a projection of household growth and household income by municipality." (Estudios Tecnicos, Inc. 1999:55)

The analysis covers the period from 1999 to 2003 and estimates of the demand for housing in different categories are presented for each municipality on the island. For the study area, the total demand estimate for new housing in the $90,000-$110,000 price range is 2,581 units and 2,764 units in the $110,000-$130,000 range (Table 3-3). The projection of the demand for new housing in market areas along the Tren Urbano alignment means that future transit supportive housing will have a relatively large supply market in which to compete. Total demand for all housing above the $64,000 minimum in-the-market price that the forecast uses, exceeds 16,000 units for the five-year period from 1999 to 2003.

Recently, the San Juan market has experienced rapid increases in the number of housing permits issued for construction. For the period from 1988 to 1998, 25,220 permits were issued for private home construction activity (Table 3-4). The number of permits in the surrounding market, referred to here as the control area, was 21,306. In six of the 11 years, more permits were issued in the study area than in the surrounding municipalities. The difference average 356 units per year over the period, which means that on average, the growth in new housing is balanced between municipalities along the Tren Urbano alignment and the surrounding areas. However, from 1995 to 1998, the number of permits issued outside the control area exceeded the study area in three of the four years. This suggests that the pace at which households are moving away from communities more centrally located in Greater San Juan is quickening.

Table 3-3
Demand Forecast for Housing by Estudios Técnicos

Area	Number of Housing Units by Price Range (Prices in $'000)					Total
	$64 - $90	$90 -$110	$110 - $130	$130 - $150	$150 +	
Study Area						
San Juan	1,746	703	721	491	967	4,628
Guaynabo	769	328	397	301	664	2,459
Bayamon	2,172	940	995	649	759	5,515
Carolina	1,277	610	651	410	503	3,451
Total (Study Area)	**5,964**	**2,581**	**2,764**	**1,851**	**2,893**	**16,053**
Control Area						
Catano	362	124	134	107	229	956
Toa Baja	887	348	373	238	193	2,039
Naranjito	280	76	63	31	19	469
Comerio	NA	NA	NA	NA	NA	NA
Aguas Buenas	NA	NA	NA	NA	NA	NA
Caguas	NA	NA	NA	NA	NA	NA
Gurabo	NA	NA	NA	NA	NA	NA
Trjillo Alto	551	247	257	151	179	1,385
Conóvanas	363	125	111	57	41	697
Loiza	349	141	128	59	30	707
Puerto Rico	**28,513**	**10,137**	**9,514**	**5,383**	**6,329**	**59,876**

Source: Estudios Técnicos

The typical housing units in most of sections of the study area that includes are one and two-story detached dwellings, many of which were built as part of government-sponsored programs since the 1950s (Figure 3-5). The urban residential landscape that has emerged from this building pattern is a combination of densely settled neighborhoods similar in design and appearance to neighborhoods in Kingston, Jamaica and other large Caribbean cities. San Juan also has many of what appears to be rental housing but many of these buildings are under condominium

Table 3-4
Housing Permits Issued: 1988-1998

Area	Building Permits Issued by Year												
Study Area	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	**Total**	**Annual Average**
San Juan	290	329	262	284	231	72	78	292	72	248	157	2315	210
Guaynabo	1032	708	781	658	281	606	363	1131	157	766	301	6784	617
Bayamon	590	1320	971	688	438	371	658	1031	729	649	620	8065	733
Carolina	1094	842	528	832	369	469	340	1142	960	584	896	8056	732
Total	**3006**	**3199**	**2542**	**2462**	**1319**	**1518**	**1439**	**3596**	**1918**	**2247**	**1974**	**25220**	**2293**
Control Area													
Catano	493	191	20	20	14	15	340	1,142	960	584	896	4,675	425
Toa Baja	112	81	91	92	177	260	647	688	583	527	295	3,553	323
Naranjito	10	12	15	18	24	47	44	27	44	21	24	286	26
Comerio	3	5	6	14	10	13	7	40	9	13	134	254	23
Aguas Buenas	29	18	17	28	38	71	94	42	42	60	57	496	45
Caguas	1,070	500	561	450	409	227	455	426	555	575	460	5,688	517
Gurabo	230	195	102	253	243	49	74	161	298	240	182	2,027	184
Trjillo Alto	301	295	292	618	338	426	422	593	502	1,056	614	5,457	496
Conóvanas	108	94	260	182	113	32	51	213	122	41	311	1,527	139
Loiza	165	14	77	17	4	7	9	6	6	11	43	359	33
Total	**2,521**	**1,405**	**1,441**	**1,692**	**1,370**	**1,147**	**2,143**	**3,338**	**3,121**	**3,128**	**3,016**	**21,306**	**1,937**
Difference	**485**	**1794**	**1101**	**770**	**(51)**	**371**	**(704)**	**258**	**(1203)**	**(881)**	**(1042)**	**3914**	**356**

Source: San Juan Planning Board

Figure 3-5: Typical single family houses in San Juan..

ownership. Even though rental apartments are part of the housing supply in San Juan, experienced industry professionals with detailed knowledge of the local market report that the island's real estate development companies are no longer in the rental apartment business[8]. What exists in the rental market are government–owned, multifamily buildings (public housing and HUD Section 8 apartments) and multifamily condominiums that individuals purchase as investments. These condominiums are rented by real estate agents mainly to long-stay visitors in the tourism market, and to US mainland and foreign professionals who work in San Juan for periods of one to two years.

Many of the communities through which Tren Urbano passes are medium density single-family housing areas with average density of 15 to 20 dwelling units per acre. Large tracts of vacant land are hard to find, particularly in Hato Rey, Santurce, Condado, and Old San Juan but some development areas exist on the Carolina and Bayamón extensions of the alignment. Transit Oriented Development that include housing will have a large target market once other variables such as income and mortgage interest rates remain favorable to homebuyers.

3-2-3 Recent Market Activities in the Study Area

Aggregate sales data for all housing in San Juan could not be obtained for the study area but data portions of the market such as high-rise, walk-up, single family and townhouses were provided. Between 1996 and 1998, 65 percent of all housing unit sales in the San Juan area were single family detached housing, an additional 27 percent of the sales were walk-up apartments, 4 percent were high-rise apartments and 4 percent townhouses. Recent activity in the home construction industry shows that the market has been quite active especially in the sale of units in the $70,000-$149,000 price range (Table 3-5). The sale of walk-up apartments shows that 87.6 percent of these units

Table 3-5

Percent of Sales by Price Range for Each Housing Type in SJMA: 1998

Price Range	Single Family	Townhouse	Walk-Up	High-Rise
$40,000 - $69,999	45.5%	0.0%	1.1%	60.8%
$70,000 - $89,999	21.0%	0.0%	18.6%	0.0%
$90,000 - $104,999	11.1%	34.1%	43.1%	1.3%
$105,000 - $124,000	2.4%	30.4%	20.9%	0.0%
$125,000 - $149,999	8.2%	22.8%	10.4%	1.3%
$150,000 - $199,999	1.4%	0.0%	3.6%	6.3%
Over $200,000	10.4%	12.7%	2.3%	30.3%
Total	100.0%	100.0%	100.0%	100.0%

Source: Vallejo y Vallejo, Inc.

were priced from $70,000 to $150,000. Further, the sale of walk-ups was concentrated in the $90,000-$105,000 price range with 34.1 percent and also in the $105,000-$125,000 price range with 30.4 percent of the units.

The sales data for high-rise apartments, one of the preferred property types for transit supportive housing reveals that most of the units (60.8%) are sold in the $40,000-$70,000 price range. This is the segment of the market that provides new housing for low and moderate-income families that meet Puerto Rican and federal government guidelines for special financing programs[9]. The involvement of the public sector in these programs means that there exists some level of control within the local government on where future housing developments are located. The financing of low-income units as transit supportive housing is more easily addressed by the government but this concept is not aligned with some of the new federal guidelines for housing development that emphasize mixed-income projects. The second largest portion of the high-rise apartment sales was in the greater than $300,000 segment of the market. These are luxury apartments built with

privately secured construction loans. Local government influence is limited in this case and this type of housing will not be considered for transit supportive housing.

In the walk-up and high-rise apartment sectors, a total of 6,155 new walk-up and 1,274 high-rise apartments were proposed between April 1996 and October 1999 (Estudios Técnicos, Inc.). On October 29, 1999, 1,339 walk-up apartments were under construction and 4,569 of these housing units were sold over the past 41 months. The absorption rate for the period under review was an average of 111.44 unit sales per month. This is significant given that this data only represents the sales for new housing.

The typical walk-up apartment has a total floor area of 1,200-1,400 square feet and provides three bedrooms and two bathrooms (Figure 3-6 and Figure 3-7). New walk-up projects that are being built in the San Juan area range in size from small four-unit developments to projects that have over 100 units. The developments are without elevators and range in height from four to six stories. In the recent sales, walk-up average prices ranged from $69,500 in Santurce to $275,000 in Condado.

The relevance of this type of housing to transit supportive housing near Tren Urbano stations can be supported at two levels. First, the walk-up unit is type of housing that is the preferred starter unit for young professionals in the San Juan market. Many of these professionals have benefited from recent growth in income and an improved labor market and are eager to own their own home at an affordable price. The density in these projects, which averages 20-40 units per acre, allows the developer to offer most units in the $80,000-$120,000 range, resulting in mortgage payments that are in the $750-$1,300[10] per month range. In a country where people value homeownership, when mortgage payments can be locked in at low interest rates, home sales will likely continue to increase.

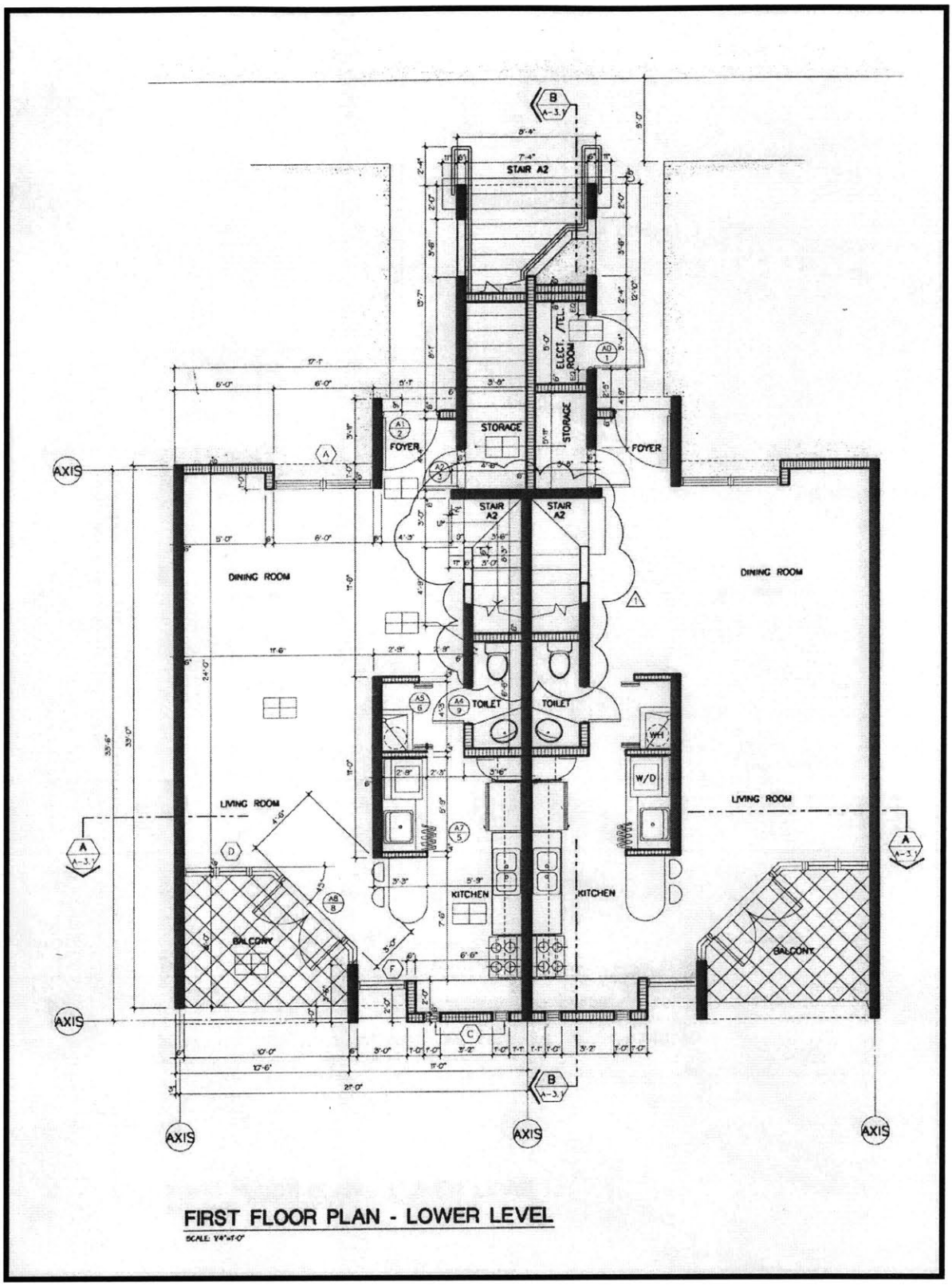


Figure 3-6: First floor plan for two units with a second floor above. These units are similar to a townhouse. (Used with Permission: Sierra, Cardona, Ferrer)

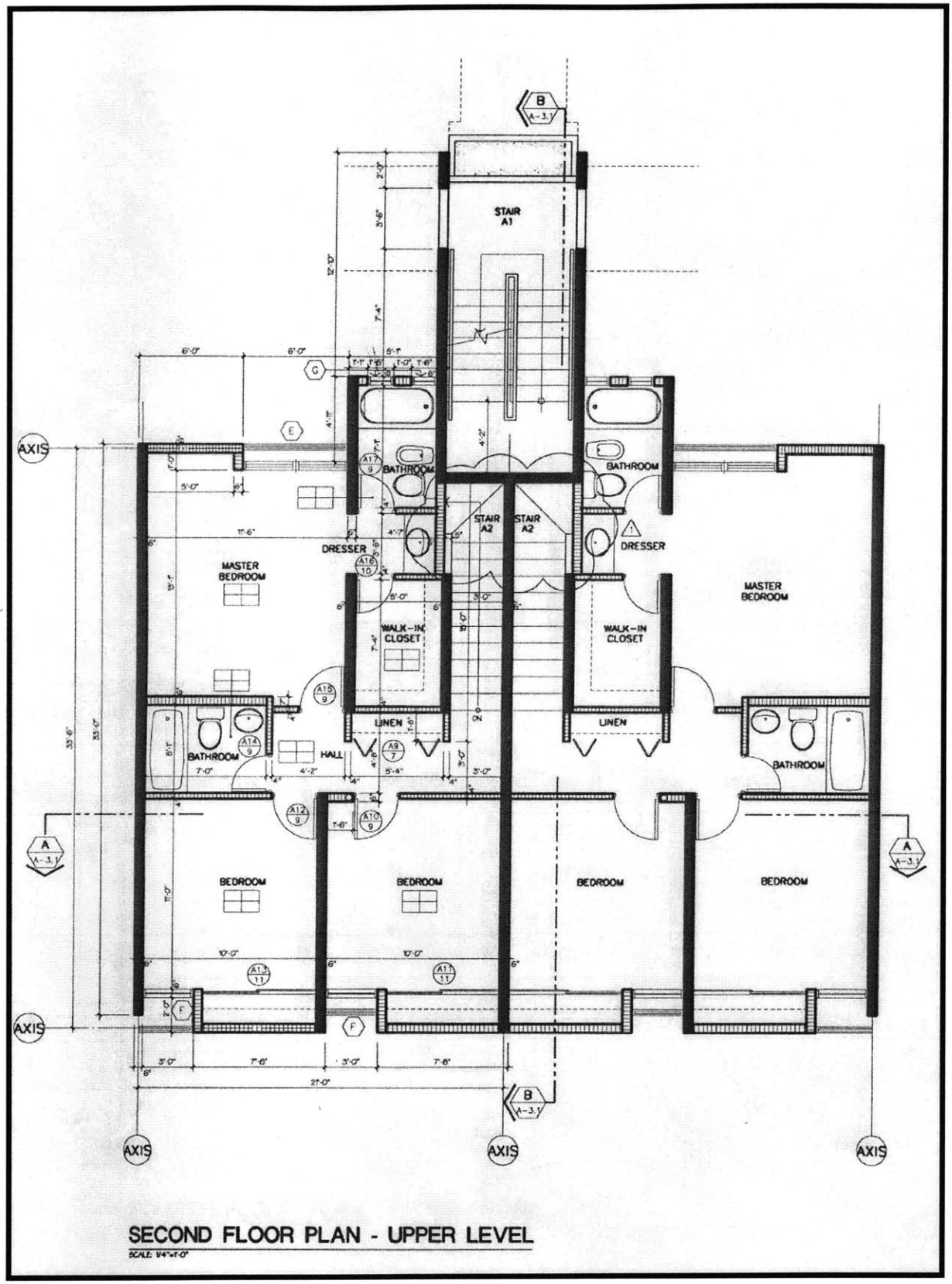


Figure 3-7: Second floor of walk-up unit. (Used with permission: Sierra, Cardona, Ferrer)

The second factor that supports walk-up apartments as a transit supportive housing prototype is the relative ease with which safety and security, issues that are highly valued among Puerto Rican households, can be provided in this type of housing. All new housing projects in the San Juan area[11] (and most new projects on the island) are gated communities. High-density developments such as walk-ups and high-rise buildings have an advantage over detached housing in that they spread the cost of providing security over a smaller area and across more housing units. When the cost of providing this type of security 24 hours per day is applied to a walk-up or high-rise development where only one guard per work shift is required, the annual cost to each household will be less than in an expansive project with fewer detached units that may require two or three guards per shift.

Already, there are some walk-up apartments in San Juan that have controlled access and that are located within walking distance of Tren Urbano stations. One such project is the Bayside Cove development near the Hato Rey station. This project was built in 1996 and 97 on vacant land and is near the Aqua Expresso terminal and several AMA and Metrobus bus routes. However, there is only one gate located on the opposite end of the project and pedestrian access to nearby Hato Rey financial and shopping areas is not encouraged in the layout and design.

3-3: Evaluating Recent Projects: Analysis of Two Walk-Ups and Two High-Rises

The process of focusing on the performance of the walk-up and high-rise versions of multifamily dwellings in the San Juan study area is an important step in determining the feasibility of building new transit supportive housing near future Tren Urbano stations. Several reasons influenced the decision to concentrate on these two housing types. First, most of the permits issued for the municipalities in the study area between 1988 and 1998 were for walk-ups. Second, many

local government programs through which housing is built in the city need to be constructed at high densities to account for the high land costs. Finally, the cost of land near Tren Urbano stations virtually forces the developers to build higher densities in order to make the risk-adjusted profit margins that were targeted in the planning stage.

Here, two recent walkup projects are analyzed. The first one is Bayside Cove in Hato Rey, mentioned earlier, and the second is Parque De Las Flores in Carolina. These were chosen because of their location in areas near transit (though not necessarily within the 5-minute walking distance that Calthorpe proposes) and also because detailed data on the costs, type of financing and total revenues were available.

Bayside Cove is a 246-unit walk-up project on Nuevo Centro de San Juan in Hato Rey. Units range in price from $100,900 on the first floor to $120,900 on the second floor[12]. Most of the units had two floors similar to the design in Figure 3-6. This is a gated community with very limited access. Sales began on January 1, 1996 and moved along at an average absorption of 5.5 unit sales per month. All units are built and the complex sold out in 45 months. Information on the sequencing of the construction and the total development time were not available.

Parque De Las Flores is a 140-unit walk-up housing complex built on Parque Escorial Avenue in Carolina[13]. The project offered 3-bedroom units with 2 baths for an average price of $106,000, and Penthouse units with 3 bedrooms and 2.5 baths for an average price of $125,000. The average size of the units is 1,300 square feet. Sales began on May 1, 1997 and units were sold at a brisk pace of 5.52 units per month and sold out in just over two years.

El Laurel is a 48-unit high-rise project developed on San Patricio Avenue between 1997 and 1999. The units vary in size from the 1,620 square foot basic model with two bedrooms and two

baths that sold for an average price of $245,000 and 4,245 square foot penthouse models with an average price of $640,000. Sales began on March 1, 1999 and absorption rates were not available.

The second high-rise development profiled is the Torres De Cervantes located on Calle Eider Final in Carolina. Here, 408 units were built in an FHA financed affordable housing project. These are 919 square-foot units provided with three bedrooms and one bath. The sale price was fixed at $52,200 and the absorption rate of 5.8 units per month was realized. On October 29, 1999, the date on which the data for this analysis were summarized, 144 units remained to be sold in the project.

The analysis presented on the walk-up and high-rise projects includes private development as well as publicly supported projects. The question of the financing sources that will be used to pay for transit supportive housing near Tren Urbano stations has not been answered. One development, El Laurel, is clearly a luxury high-rise project. Eventually, the type of project developed should aim for a mixture of choice riders and captive riders for Tren Urbano. This means a mix of income groups, one of the conditions that will guide the type of housing chosen for feasibility analysis in Chapter 5 and Chapter 6.

3-4: Estimating Prices for Multifamily Housing in San Juan

The approach to estimating the price of multifamily housing in new developments near Tren Urbano stations along the Phase I alignment uses expected price adjustments for future inflation and does not include the hedonic model. In this, the estimating process assumes all new projects will begin April 1, 2001, and will be ready for occupancy 18 months later on October 1, 2002. In financial evaluation terms it represents a one-and-a-half period world. In real estate development terms, the one-year period from April 1, 2000 will be used to secure land, design the buildings,

complete all permitting, secure financing, and mobilize for construction. It is anticipated that Tren Urbano will begin operation by mid 2002, which means that the opening of the transit supportive housing will virtually coincide with the opening of the transit service. Both processes ignore any price increase (or decrease) that may result from walking access to the transit system and also ignores any reduction in parking that may reduce construction cost and lead to cheaper housing. The price adjustment factor was excluded because it is virtually impossible to measure and the parking reduction factor was ignored because it is equally difficult to measure the trade-off between parking and price given that there is no precedent in San Juan.

The approach to estimating the price of units in a new walk-up or high-rise apartment built near a Tren Urbano station is to use the most recent average price for units of similar size taken from similar projects within the market area and then to apply an annualized growth rate based on an expected annual inflation rate of 2.5 percent. For example, based of 703 apartments in Carolina from March 1, 1996 to October 29, 1999 (44 months), the average sale price of the units was $116,258. For sales of walk-up apartments that took place after May 1, 1998 (the most recent 18-month period for which data are available), 167 units were sold in Carolina at an average price of $137,980[14]. Because the latter price represents sales in a more recent period, it is used to represent the base price for the Carolina region. Similar calculations are carried out for data in each of the other segments of the study area to produce a base that represents the average price for a walk-up apartment in 1999. An average annual growth of 2.5 percent is applied to these base prices to estimate the price in 2002. In the case of the Carolina, it is estimated that the average price of the unit will increase to $150,775. This means that a project with 150 units built in the time frame outlined in the method will have total revenues of $22,616,250. Profit from this project will depend

on construction cost, the interest rate on a construction loan, absorption rates, state of the Puerto Rican economy and housing market at the time sales are taking place among other factors.

The analysis of high-density housing development in Chapter Five uses the Martinez Nadal station as the area for analysis. Martínez Nadal falls within the Guaynabo market. This rigor of the analysis is constrained by the limited number of properties for which average housing prices are available. However, based on the assumption that housing built next to the Tren Urbano station at Martínez Nadal will trade at the going market price for similar units, estimating the price of multifamily housing in the area is very important from a developer's perspective. In the period from 1997 to 1999, walk-up apartments prices ranged from $125,000 to $134,000 (Table 3-7). Using a base price of $129,500, the average price of the units is expected to increase to roughly $135,000 by late 2002. This figure will be applied with some caution in the investment analysis in Chapter Five.

Table 3-6
Walk-Up Sale Prices in Guaynabo

Project	Year Completed	Number of Units	Average Price	Absoprtion units/mth
Boulevard Del Rio II	1999	138	$108,500	NA
Valles De Torrimar	1999	140	$134,000	NA
Prados Del Monte	1998	140	NA	NA
Torrimar Town Park	1998	57	$127,475	4.33
Monte del Rio	1999	142	$125,000	NA
Grand View	1997	58	$113,000	NA
El Bosque De Guaynabo	1997	160	$116,000	1.97
Porticos De Guaynabo	1994	204	$96,500	3.47

Source: Estudios Técnicos, Inc.

Summary and Conclusions

Despite the data limitations that hampered a more thorough analysis of future prices for multifamily housing, the information provided above provides a strong indication that the Tren Urbano system is being delivered an opportune time. Population growth and income figure were used to get a sense of the size and scope of the market for transit supportive housing. The data show that in the next few years, the size of San Juan's housing development industry will continue to increase as developers provide new units for an expanding population.

The density culture in San Juan is one that lends itself to transit supportive housing. Typically, residents of the city are accustomed to high-density living. The development of Tren Urbano will offer new opportunities to link the pattern of housing development that is already in place to a modern transit system that comes has the potential to provide many social benefits. The process of linking housing development and other forms of new real estate to transit needs to be established immediately.

End Notes

[1] The divisions used to represent the housing market in this research approximate the area used by Estudios Tecnicos, the leading market research firm in San Juan. There is no fixed real estate map for San Juan and street maps of the city are used by even the leading real estate agencies such as TIRI Real Estate.

[2] Eryn Deeming (1999) and the Tren Urbano urban design staff have advocated high-density housing for Tren Urbano stations. Deeming calls for high-rise and townhouse apartments near the Martinez Nadal station.

[3] Tren Urbano unpublished document, 1998.

[4] Denise DiPasquale and William C. Wheaton. 1996. **Urban Economics and Real Estate Markets,** Prentice Hall.

[5] Puerto Rico Planning Board, 1999. Unpublished graphs and figures.

[6] Government Development Bank, Annual Report, 1999: Caribbean Business, January 7, 1999.

[7] San Juan Planning Board document: Projectos de Ecomonica

[8] Interviews with Federico Sanchez, Manuel DeLemos, and Hector Del Rios.

[9] Puerto Rico Housing Finance Agency Annual Report, 1998.

[10] The mortgage payments are based on a 30-year Fixed Rate Mortgage with and Annual Percentage Rate of 8.00%.

[11] Interview with Federico Sanchez- Manager, Interlink Development Company; and Interview with Segundo Cardona, AIA-partner in Sierra, Cardona, Ferrer, a San Juan architecture company.

[12] Data provided by Estudios Técnicos, Inc

[13] Estudios Técnicos, Inc.

[14] Estudios Técnicos, Inc.

Chapter Four

The Performance of Housing Development as an Investment Asset:
Implications for Transit Supportive Housing in San Juan

4-1 Introduction

The final stage in preparing to analyze the performance of future transit supportive housing development near Tren Urbano stations as investments for Puerto Rican homebuilders is to estimate the discount rate (minimum expected return) on these investments from an equity investor's perspective. This discount rate will be used in the Discounted Cash Flow (DCF) calculations based on the development cost, revenues from sales and timing of cash flows associated with the development.

The investment analysis begins with the assumption that a private developer will finance new transit supportive housing with a combination of debt and equity in which the developer takes on the equity position. This capital structure is referred to as levered equity, one in which the developer's position will have a residual claim to the debt holder in the event of financial distress. The developer's position as equity interest in the project therefore carries more risk.

The analysis that is pursued in this paper establishes a base case scenario against which adjustments to a transit supportive housing development program are evaluated. This base case is taken to be a decision by a developer to build housing for middle-income homebuyers within a five-minute walking distance of a Tren Urbano station under market conditions. This means that future transit supportive housing projects in San Juan are first considered in a framework that excludes any potential benefit that Tren Urbano delivers. The base case analysis also ignores the impact that government intervention will have on developer profit. Once a profit function for new housing

development is established, adjustments are made to the model so that the effect of altering key variables on the profitability of new transit supportive housing can be accounted for.

The minimum expected return or discount rate for transit supportive housing is estimated using the Capital Asset Pricing Model (CAPM)[1]. The CAPM is used in an attempt to quantify the risk and return for new housing development in San Juan's real estate industry. This risk is assumed to be the same as the risk of any new housing development that falls within the sub-market area in which the station is located. The approach used here compares the risk-adjusted expected return in transit supportive housing as an investment to other financial instruments including stocks, bonds and mutual funds that are widely available to Puerto Rican investors. Essentially, this is an attempt to model developer behavior within the context of the nature and structure of the local financial market. The basic idea is that once the expected return on investment in new transit supportive housing development linked to Tren Urbano is competitive with other investments that carry similar risk, then raising the capital to build these projects should not be too difficult. In an efficient financial market where capital is widely available and competitively priced, there is a high probability that profitable housing projects will be built. Alternatively, if the investment analysis shows that the San Juan housing sector has weak fundamentals going forward and the expected return is inferior to other types of investments on a risk-adjusted basis, then sourcing development capital through mortgages and equity partnerships will be a very difficult proposition.

The first part of the discussion (section 4-2) describes the CAPM and explains its usefulness as a method for pricing the risk in new investments. Included in the CAPM discussion is a widely used method for estimating the appropriate risk-adjusted discount rate for any new investment. The application of the CAPM in the Puerto Rican context also means that the island's financial markets will be profiled. Additionally, the yield (Internal Rate of Return) for Puerto Rican municipal bonds

and will be compared to the expected return for transit supportive housing development using the CAPM.

The second section (section 4-3) provides a description and explanation of the investment decision modeling process as it applies to short-term commercial real estate investments such as for-sale housing. The relative strengths and weaknesses of three investment decision techniques that are widely used in US real estate are evaluated. The section takes the discussion back to general investment decision rules such as the Net Present Value (NPV) rule and Internal Rate of Return (IRR) rule as each applies to transit supportive housing development.

The third section of the discussion (section 4-4) focuses on the performance of recent walk-up and high-rise housing developments that were built in the San Juan area in the period from 1995 to 1999. Annualized returns on two of these developments are estimated as an Internal Rate of Return (IRR)[2]. In addition, the major variables that influence the profitability of new housing investment are identified. In order to calculate an IRR for these walk-up and high-rise projects, data on revenue and expenditures for the period in which each project took place are presented. The section also includes a stylized profit function that can be applied to any housing investment in San Juan -- both transit supportive development and other projects. The section ends with a description of recent housing development projects in San Juan and a short profile of the real estate development companies involved in large-scale housing development.

Finally, projections of total development cost for new transit supportive housing will be provided (section 4-5) in preparation for the evaluation of future development at the Martinez Nadal station that follows in Chapter Five. Where data are not available, reasonable estimates will be used based on a combination of qualitative and quantitative techniques.

4-2: The Capital Asset Pricing Model and Real Estate Investment Analysis in Puerto Rico

4-2-1: Establishing a Connection between the US and Puerto Rican Financial Systems

In order to use the CAPM to calculate the appropriate risk-adjusted discount rate for future transit supportive housing projects for Tren Urbano, it is necessary to have financial data on the annual returns of large Puerto Rican homebuilders for a sufficiently long period. Previous research that applied the CAPM framework to price the risk in US industry sectors relied on the Center for Research on Securities Pricing (CRSP) time series data maintained by the University of Chicago to perform the analysis[3]. For example, Vayanos and Willard (1999) used CRSP data and the CAPM framework to estimate the discount rate for Delta Airlines to be 12.8 percent[4].

In the case of Puerto Rico, a data series that is as comprehensive as the CRSP just does not exist. However, applying the CRSP data to the CAPM method to estimate a discount rate for the homebuilding industry is still relevant because the Puerto Rican financial system is a sub-sector of the US financial system. Similar to the stock exchanges in Philadelphia, Boston or San Francisco, the Puerto Rico Stock Exchange (PRSE) is a part of the US financial system and operates in tandem with Wall Street. For investors interested in equity positions, many well-known US financial services companies -- Merrill Lynch, Price Waterhouse Coopers, TD Waterhouse, Salomon Smith Barney among others -- maintain offices in San Juan and offer a full range of financial services to Puerto Ricans, the same as those provided at their US mainland offices[5]. Puerto Rican financial services companies such as Doral Securities and Banco Popular also provide similar investment opportunities as those offered by their mainland competitors[6]. For an equity investor living in the Conóvanas or Manatí municipalities, San Juan brokers located in Hato Rey's Golden Mile who are electronically linked to Wall Street can access the same universe of investments as a similar investor living in Maryland, South Carolina or another state[7].

In terms of debt instruments, commercial mortgages, construction loans, home mortgages and similar products are provided under similar terms in Puerto Rico as in the US[8]. In the case of construction loans made by commercial banks to local developers, the interest rate is usually set at 150 to 200 basis points (bp) above LIBOR (the London Interbank Offered Rate), similar to construction loans in the US[9]. These construction loans carry a 70 to 75 percent loan-to-value ratio (LTV) and are recourse to the borrower, just as it is on the mainland (stateside in local financial language).

On the regulation end, even though the financial services industry in Puerto Rico is regulated by the Office of the Commissioner of Financial Institutions (CFI) [10], the rules governing return on investments in Puerto Rico differ from those in the US mainly on the treatment of taxes. Puerto Ricans do not pay federal taxes but local taxes compensate for this difference placing investors in each area in a similar after-tax position. When the Federal Reserve Board raises interest rates, that increase has a similar effect on commercial bank lending rates in Puerto Rico as it does in the US[11]. Barring local stocks -- referred to in the local press as Stocks of Local Interest[12] -- which are more widely held by local investors, the financial system is just another part of the United States of America. In some cases, Stocks of Local Interest are listed on US exchanges including the NASDAQ, the American Stock Exchange (AMEX) and the New York Stock Exchange (NYSE) [13]. The connection between the US and Puerto is so strong that to apply the CAPM to price the risk and estimate a discount rate for new housing investments in Puerto Rico by using well-known averages such as short-term US Treasury Bond rates, the S&P 500 Index (Standard and Poors) and the long term Market Risk Premium is a reasonable approach to investment analysis.

Another important consideration in this context is a comparison of the US and Puerto Rican homebuilding industries. In the case of the US, over 20,000 homebuilders exist but very few of

them are public companies[14]. The preponderance of small companies that build less than 10 houses per year is driven by the cyclic nature of the housing development business. In periods when there is high demand for housing, these small, footloose companies will seek out land, secure construction loans and throw up a few houses -- primarily single family detached dwellings -- to take advantage of the market. In Puerto Rico, over 120 development companies are listed as members of the local chapter of the National Association of Home Builders (NAHB)[15]. Many of these are also small companies that build only a few houses per year. Given these similarities, using the financial ratios from the US homebuilding industry will shed considerable light on the financial decisions that Puerto Rican developers are forced to make.

One of the problems with analyzing a sector with few public companies is that the financial data that is usually available through quarterly filings with the Securities and Exchange Commission (SEC) or with the Office of the Commissioner of Financial Institutions (CFI) in Puerto Rico is not available. This prevents detailed scrutiny of the investment decision making of Puerto Rican homebuilders from taking place. However, two of the larger developers[16] and two investment bankers[17] did provide some data and useful explanation of the relationship between new housing development and the capital markets. Also, most of the smaller homebuilding companies that operate in Puerto Rico will not qualify to build the large-scale high-density walk-up and high-rise apartment developments envisaged for the Tren Urbano station areas. Therefore, concentrating on the financial performance of larger projects will provide more useful insights into the industry than an attempt to cover a sample of development projects by all companies, both large and small.

4-2-2: Estimating a Discount Rate for Transit Supportive Housing using the CAPM

Now that the link between US and Puerto Rican financial markets is established and the similarities of the housing development businesses in each area are highlighted, it is reasonable to conclude that many of the variables that are used to apply to the CAPM method to extract a discount rate for US companies can also be applied to Puerto Rican developers that are large enough to deliver sizable transit supportive housing projects for Tren Urbano.

The Capital Asset Pricing Model is generally regarded as one the most important innovations in finance since securities markets became highly specialized in the early 20th Century. Embedded in this widely used concept is the assumption that an investor only cares about the risk and return profiles in their investments. This means that when an investor establishes her objectives for a new project, she is looking to do one of two things:

- Maximize return for a chosen level of risk, or
- Minimize risk for a pre-determined level of return.

The basic idea behind the CAPM is that investors can hold a diverse pool or portfolio of financial securities and other assets such as direct interests in real estate and benefit from the weighted average of their returns while not being exposed to a weighted average of the risk in the return. This is derived from the mathematical proof that for a portfolio with two assets, the expected return is calculated using the formula:

$$E(R_p) = w_1[E(R_1)] + w_2[E(R_2)]$$ [18] (Equation 4-1)

Where:

$E(R_p)$ = Expected return of the portfolio
W_1 = Weight (percent) of portfolio invested in Asset 1 -- portion of wealth in Asset 1
W_2 = Weight (percent) of portfolio invested in Asset 2 -- portion of wealth in Asset 2
$E(R_1)$ = Expected return of Asset 1

$E(R_2)$ = Expected return of Asset 2.

Portfolio risk, measured as the variance in the expected return, is calculated by the following formula.

$$V(R_p) = w_1^2 V(R_1) + w_2^2 V(R_2) + 2w_1 w_2 Cov(R_1, R_2] \quad \text{(Equation 4-2)}$$

Where:
$V(R_p)$ = Variance in the portfolio
$V(R_1)$ = Variance in Asset 1
$V(R_2)$ = Variance in Asset 2
$Cov(R_1, R_2)$ = Covariance of the returns on Asset 1 and Asset 2.

Finally, the covariance of the two assets can be expressed as:

$$Cov(R_1, R_2) = \sigma_1 \sigma_2 (\rho_{1,2}) \quad \text{(Equation 4-3)}$$

Where:
σ_1 = Standard deviation of Asset 1
σ_2 = Standard deviation of Asset 2
$(\rho_{1,2})$ = Correlation coefficient between Asset 1 and Asset 2.

(Source used for formulas: Geltner 1998[19])

The calculations of a portfolio expected return and portfolio risk when there are three or more assets are extensions of Equation 4-1 and Equation 4-2. Expected return is a weighted average of the returns on each asset in the portfolio and risk is measured by considering each pair of assets including Asset 1 and Asset 2 as a separate pair from Asset 2 and Asset 1[20].

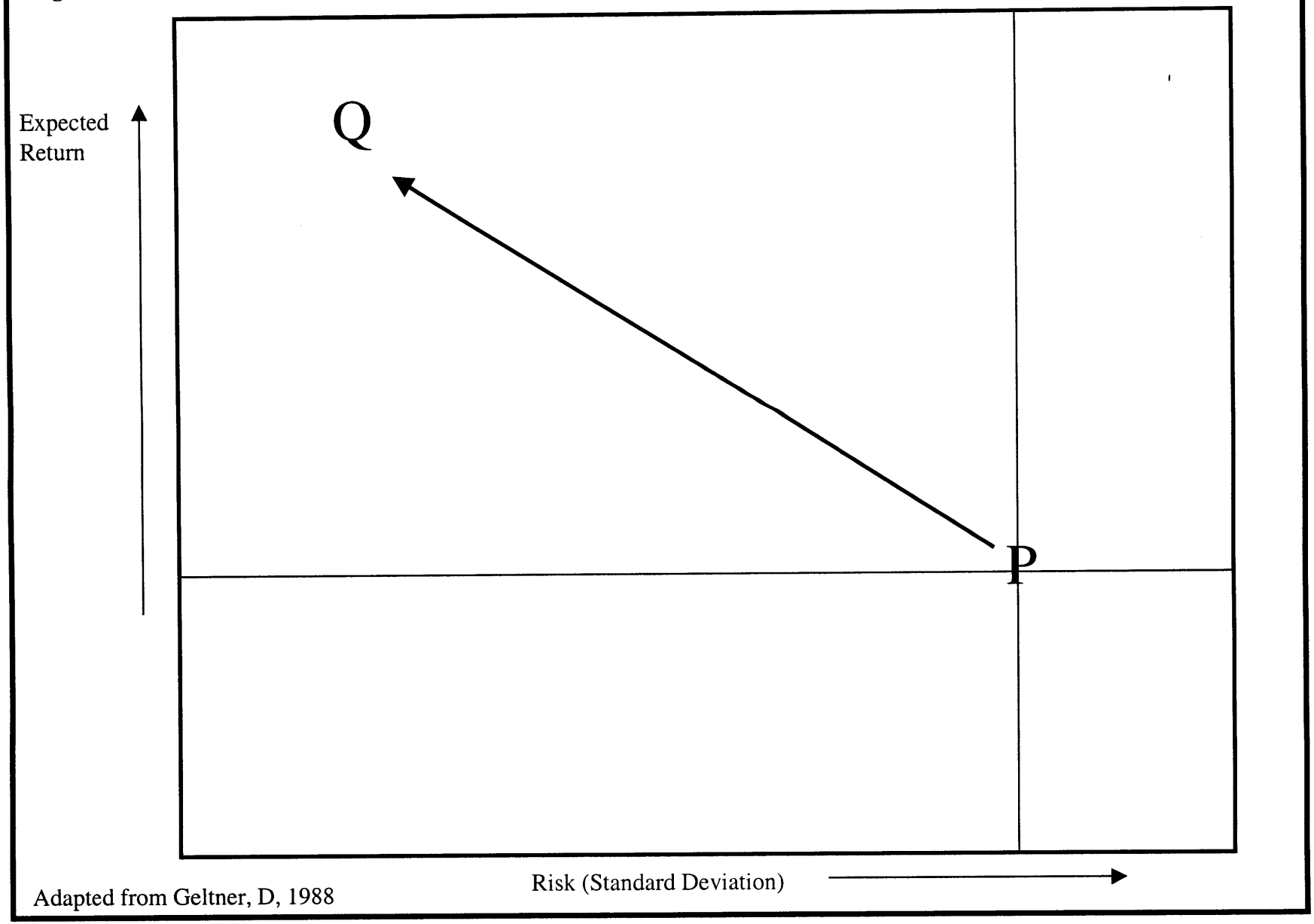
The benefit of a portfolio of assets derives from the situation in which there is small positive or negative correlation coefficient $(\rho_{1,2})$ between the two assets over time. This makes the covariance term in Equation 4-3 negative which means that the risk is less than a weighted average

of the returns on the assets. In the case of an investor who holds a single portfolio that has many stocks, several classes of bonds and other fixed-income securities, several partnership interests in real estate and other direct investments, the likelihood of finding pairs of assets within the pool that have small positive and negative correlation coefficients over time increases. Investors who end up holding portfolios of risky assets will benefit from diversification in that the risk in an individual asset (idiosyncratic or firm-specific risk) can be diversified away. What remains is systematic risk (market risk), the risk that cannot be diversified away. Market risk is what investors expect to be rewarded for when they make investments because idiosyncratic risk can be eliminated with diversification and will not be priced in the market.

The CAPM takes the analysis one step further by incorporating many combinations of risky assets in portfolios that form a frontier that maximizes expected return for a given level of risk and that minimizes risk for a given level of expected return. The basic structure of the risk, return diagram is provided in Figure 4-1. Take Point Q that has an expected return of 10 percent and a risk level measured as the standard deviation (square root of the variance) in the returns of 12 percent. Portfolio Theory on which the CAPM is based explains how diversification can move an investor from Point Q to Point P – less risk for higher expected return[21]. However, investors cannot move all the way to the north and west in the risk-return diagram because of there is always market risk that needs to be accounted for in the expected return of portfolios.

The feasible set of risk and return portfolios that emerges is similar to the graph displayed in Figure 4-2. A section of the curve is known as the Efficient Frontier and represents the highest returns for given levels of risk. The risky portfolios are then combined with a riskless asset to produce a tangent portfolio known as the market portfolio. This is the Two-Fund Theorem[22] in which investors borrow and lend at the riskless rate to obtain superior returns to the efficient

Figure 4-1: Risk and Return in Investment Analysis



Adapted from Geltner, D, 1988

frontier derived from portfolios of risky assets. This is a straight line known as the Capital Market Line (Figure 4-2) where expected return is represented on the Y Axis and the risk (standard deviation or square root of the variance) is shown on the X Axis. The CAPM claims that the relevant risk that an investor cares about in a portfolio or an individual asset is beta (β) or the contribution of the asset to portfolio risk. The beta is expressed as:

$$\beta_i = \frac{Cov(R_i, R_m)}{V(R_m)} \qquad \text{(Equation 4-4)}$$

The CAPM concludes that the expected return to an investment can be expressed as the sum of the risk free rate and a risk premium. For the risk free rate, analysts have used the average return on short term US Treasury Bills. The market risk premium is defined by the following equation:

$$\text{Market Risk Premium} = \beta(E(R_m) - R_f) \qquad \text{(Equation 4-5)}$$

This means that according to the CAPM, the expected total return on new transit supportive housing that is built near Tren Urbano stations in San Juan will be given by the equation:

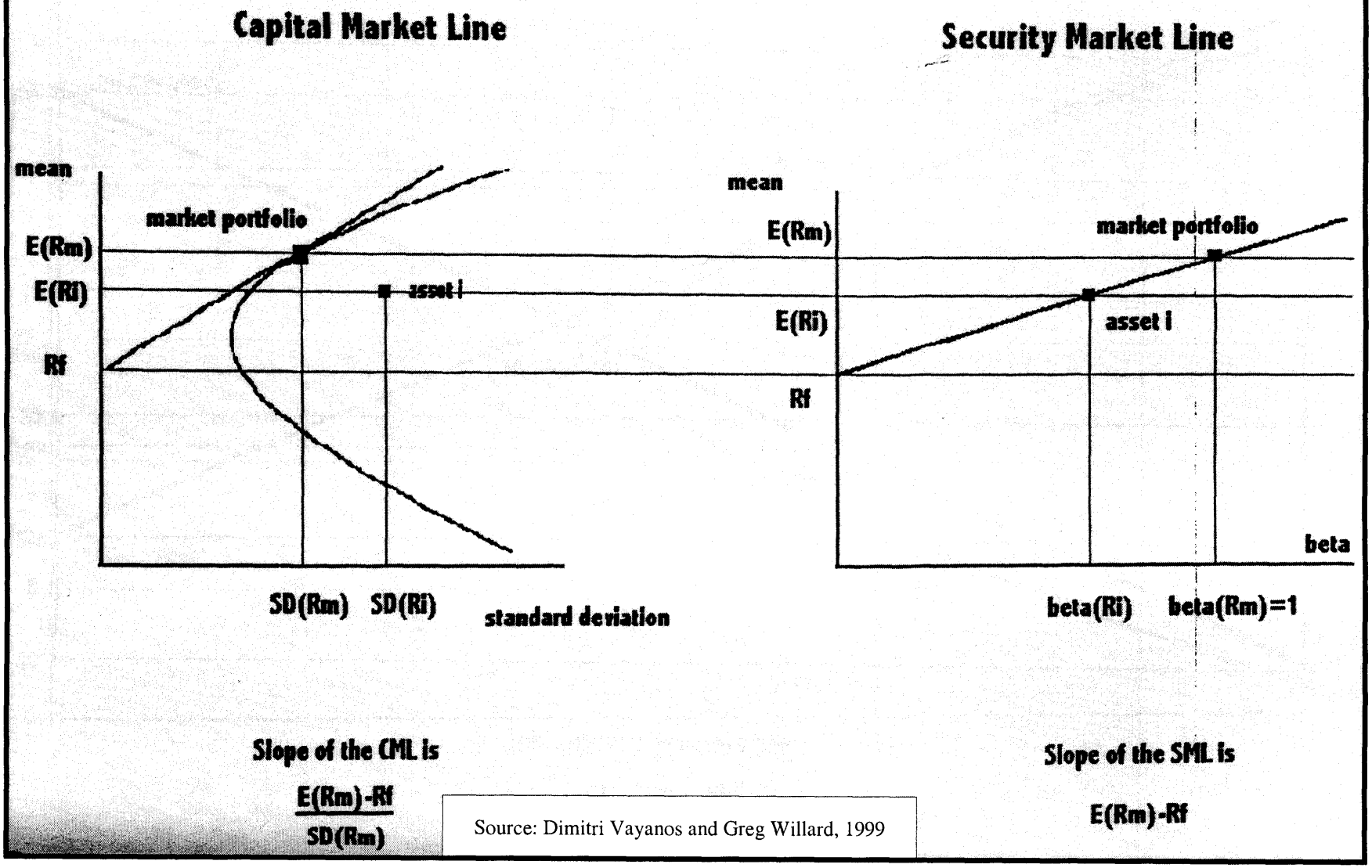
$$E(R_t) = R_f + \beta_t(E(R_m) - R_f) \qquad \text{(Equation 4-6)}$$

Where:

$E(R_t)$ = Expected return for transit supportive housing, and

Figure 4-2

Summary of the Capital Asset Pricing Model



Source: Dimitri Vayanos and Greg Willard, 1999

$$\beta_t = \frac{Cov(R_t, R_m)}{V(R_m)}$$ (Equation 4-7)

Therefore, to estimate the total expected return on future transit supportive housing in San Juan an estimate of beta (β_t) is needed. For this portion of the analysis, given there are only a small number of publicly traded housing development companies in the US and the fact that none exist in Puerto Rico, an average beta from the seven publicly traded US homebuilders for which beta estimates were available is used as a proxy. The average beta for these seven companies is calculated using estimates from YahooFinance.com®, Bloomberg.com® and SmartMoney.com®. In the Vayanos and Willard example cited earlier that estimates the discount rate for Delta Airlines, the betas are taken from Value Line® and an industry average was calculated based on seven companies. Even though the beta for Delta Airlines was 1.10, Vayanos and Willard took a conservative approach and applied the higher industry average for beta of 1.26 in calculating the expected return for the company.

Given the wide variation of the betas for the seven US homebuilders the mean is calculated as the average industry beta. This is presented in Table 4-1 and the result is combined with the three-month US Treasury rate on March 31, 2000, the widely used proxy for the risk free rate, and the Market Risk Premium calculated using the CRSP data (1926-1996)[23] to estimate the discount rate for the transit supportive housing development business in San Juan. The model shows that at the level of the firm the discount rate for the expected return on new housing investments in San Juan is 14.24 percent (Table 4-2). Alternatively, when the CRSP short-term data are used, the estimate of the discount rate falls to 11.83 percent. This 241 basis point difference could cause a developer to make very different investment decisions for the same project. In this research, the higher discount rate is used mainly because of its favorable comparison to the expected return of

"...15 percent ..." that was reported by Federico Sanchez of Interlink Development Company[24], "...15 to 20 percent ..." that was expressed by Hector Del Rio Jimenez of Doral Securites[25], and "...15 to 20 percent ..." an estimate provided by Oscar Mesorana Colon[26] also of Doral Securities.

Table 4-1
US Housing Development Companies and the CAPM

Company	Ticker Symbol	Core Business	Estimated Beta
Kaufman and Board	KBH	Design, build and market homes for first-time homebuyers	1.75
Centex Corp.	CTX		1.17
Capital Pacific Holdings	CPH	Builds and markets homes for entry-level, move-up and luxury homebuyers	1.96
Toll Brothers, Inc.	TOL	Develops middle- and high-income residential communities	0.52
Engle Homes, Inc.	ENGL	Designs, constructs and markets single-family and multifamily housing	0.99
US Home Corp.	UH	Builds and sells single-family and multifamily housing	0.99
Beazer Homes USA, Inc.	BZH	Designs, constructs and markets single-family homes	0.86
Sample Average			**1.18**

Source: SmartMoney.com: YahooFinance.com

Table 4-2:
Calcualting the Discount Rate for the Typical Housing Developer in San Juan
CRSP Data

Years	Risk Free Rate	Market Risk Premium	Standard Deviation of MRP	Discount Rate Estimate
1926-1996		8.34%	0.68%	
1967-1996		6.00%	0.79%	
Apr-00	5.65%			14.24%
Apr-00	5.65%			11.83%

Source of MRP: Vayanos and Willard, 1999.

Source for Risk Free Rate: Caribbean Business, April 7, 2000

4-2-3: Comparing Returns on Investments in Puerto Rico – Recent Examples

Whenever the CAPM is used to estimate risk-adjusted discount rates, one of the ways to check the validity of the method is to look at the performance of investments of different risk levels. This way, the basic premise that the expected total return on an investment is equal to the risk free rate plus a risk premium can be validated.

The range of investments that are available to Puerto Rican investors includes a number of debt and equity investments, and derivative securities that have varying risk levels. Government bonds such as US Treasuries, municipal bonds such as those floated by the agencies of the Government of Puerto Rico. Trading in local stock takes place on the Puerto Rico Stock Exchange (PRSE) and the performance of public companies in the island is tracked with the Puerto Rico Stock Index (PRSI). The PRSI benchmark is a weighted average of 12 local stock and information on stock prices, trading activity, and the movement of the benchmark is provided in the local media. The PRSI which is heavily weighted in the financial services sector is claimed to have "outperformed the S&P 500 between 1996 and 1999"[27].

Puerto Rico also has an extensive bond market that is heavily weighted towards municipal bonds. Several quasi-governmental entities periodically issue bonds that are used to finance development with debt. These bonds have varying maturity levels and trade in the public markets along with the investment vehicles. Among these bonds are zero-coupon bonds that offer a fixed payoff at maturity and coupon bonds that provide regular payments to bond holders. The bonds are also rated by rating agencies such as Moody's, and Standard and Poors (S&P). Recently bonds issued by the Puerto Rico Highway and Transportation Administration (PRHTA), for example, received BBB or investment grade ratings (S&P) and bonds issued by the Puerto Rico Housing Finance Corporation have received AAA ratings (S&P), an even higher investment grade rating.

The bond market in Puerto Rico is quite large with several government agencies issuing bonds to finance public sector and investments. As of November 30, 1998, $267,000,000 of Puerto Rico government guaranteed debt was outstanding[28]. Bond yields for most are related to their rating and have generally been in the 5.5% to 7% range[29]. This indicates that for a Puerto Rican company with significant capital reserves, the bond market offers a relative safe vehicle for building a portfolio that satisfies an investment objective that specifies low risk and moderate return. It is important to note in this case that the Puerto Rican bond market has periodic issues of bonds that are used to debt finance low-income housing development. These bonds are issued by the Puerto Rico Housing Finance Corporation (PRHFCA), and many of them have AAA ratings (Table 4-4).

Performance of the local stock market is also closely monitored. Most of the 'Stocks of Local Interest' are financial companies such as Popular, Inc and Banco Santendar. Twelve local stocks are combined to create the Puerto Rico Stock Index (PRSI). The PRSI was created by Wilshire Associates, Inc., and six of the member companies are financial companies. This means that the index is sensitive to fluctuations in interest rates and the claim made in a recent Government Development Bank publication that the PRSI had outperformed the S&P 500 may be dismissed using the CAPM. Probably this return is only good in the short term and does not account for superior returns to S&P 500 given the risk level in the 12 PRSI companies.

4-3: Investment Decision Models for Real Estate Development

In order to assess the potential profitability of new transit supportive housing near Tren Urbano stations, a set of common guidelines is needed. These guidelines can be applied to each proposed development in a market such as San Juan where information on major factors is unavailable.

First, investment decision rules that are based on Discounted Cash Flow (DCF) procedures are widely used by developers who are considering new projects. Two DCF techniques, the Net Present Value (NPV) and the Internal Rate of Return (IRR) are well known in real estate investment circles. The NPV approach to investment decision modeling requires that a risk-adjusted discount rate be chosen for the cash flows. The equation that is applied to calculate the NPV in a project is:

$$NPV = \frac{CF_1}{(1+R)} + \frac{CF_2}{(1+R)^2} + \ldots + \frac{CF_n}{(1+R)^n} \qquad \text{(Equation 4-7)}$$

Where:

CF_1, CF_2 etc. = monthly cash flows in the investment

R = risk-adjusted discount rate (derived from the CAPM)

In housing development, the cash flows sequenced over time will follow a pattern in which there are large outflows from the developer during the planning stage and large inflows when the houses are being sold. Developers of large projects such as walk-up and high-rise apartments will take out a construction loan that require a monthly interest payment and a repayment of the principal at a negotiated time – three years in most cases in San Juan. This means that for a large walk-up project that takes 18 months to build before sales begin, the NPV calculation will have 18 months in which there are all outflows and another 18 months during which there are positive cash flows. The NPV investment decision rule is summarized in the following statements.

- **Accept only positive NPV projects.**
- **When there are mutually exclusive choices at the same location; accept the project with the highest NPV.**[30]

The first statement in the NPV decision rule is relatively easy to deal within the framework of Transit Oriented Development (TOD). The fact that so many urban design ideas proposed by transit authorities in the US have not been built and the generally low levels of development at many transit stations in cities like Miami, Los Angeles and Atlanta means that developers look at these TOD proposals as negative NPV projects.

The second statement is also relatively easy to analyze. In cities where zoning laws preclude developments that are not transit supportive from being built near transit stations, the range of feasible alternatives is immediately narrowed. Such guidelines may include a certain number of housing units to encourage pedestrian use of the stations. This means that a developer's job is made much simpler – all she has to do is to analyze the city's development proposals and guidelines to see of they are positive NPV projects. At stations where positive NPV projects are identified, new TOD projects will usually be built. On the other hand, stations where the TOD projects have a negative NPV forecast, the land will remain as a development option.

The second investment decision rule, the IRR Rule, requires that a discount rate be chosen based on the risk in the transit supportive housing project. The discount rate is also derived from the CAPM and is referred to as a Hurdle Rate. The IRR is the discount rate that makes the NPV of a project equal to zero. Therefore, the IRR is expressed by the following equation:

$$0 = \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \ldots + \frac{CF_n}{(1+IRR)^n} \qquad \text{(Equation 4-8)}$$

The IRR calculated using projected cash flows in a new development are then compared to the Hurdle Rate. For projects that have projected IRRs greater than the Hurdle Rate, the decision will be positive and transit supportive housing will be built. In the case of developments that have

projected IRRs less than the Hurdle Rate, the decision will be to hold the land as a future development option until market fundamentals create a positive NPV investment environment.

The NPV and IRR decision rules of financial decision modeling are widely used by Puerto Rican homebuilders. Federico Sanchez of Interlink Development Company said that his company's minimum return rate is 15 percent on cost[31]. Hector Del Rios of Doral Investment Bank said that in order for his company to underwrite a construction loan on a large project, the standard is for a projected profit of at least 20 percent on cost. These are not IRR figures but when they are converted to an IRR, the figure is in the 12–15 percent range depending on the timing of the cash flows.

Another way to look at investment performance is to consider the gain on cost or gross profit method. Using this procedure, a homebuilder will aggregate the cost of the project -- land, architectural and engineering, construction, financing, marketing -- and aggregate the total revenue the project as the cash flows from sale of units. The profit is expressed in the following equation:

[Total Revenue/Total Development Cost] – 1 (Equation 4-9)

This method ignores the Time Value of Money effect and therefore excludes the impact of discounting and inflation. For investments that have short horizons, this approach provides a quick back-of -the-envelope calculation of returns but for large housing projects such as transit supportive housing, the NPV and IRR methods provide a much clearer understanding of the likely decision an investor will make using the CAPM framework.

4.4: An Investment Review of Recent Walk-Up and High-Rise Apartment Project

4-4-1: First, Consider a Stylized Example

The investment review presented here calculates the Internal Rate of Return on a recent walk-up development and a high-rise condominium that were recently completed in San Juan. The reason for performing the investment analysis after the fact is to summarize how well the projects performed and to begin to get a sense on the time it takes to plan, finance, build, and market a project that has 50-200 units. This is the scale at which the proposals for future transit supportive housing is being proposed and the financial analysis within the Tren Urbano research program needs to be more aware of how these projects are put together and what are the factors that lead to a successful investment.

Given the capital structure imposed by the terms of the construction loans in which only 75 percent of total development can be borrowed, the method that must be used to evaluate investment performance from the developer's perspective is the IRR for the equity cash flows. Based on the fact that the commercial bank has first claim to all revenues from the sale of housing, the construction loan and interest must be retired first before the developer receives any payments. In addition, the developer's 25 percent portion of total development cost must be paid before any loan draws can begin. This first-in, last-out position is high risk and based in the CAPM intuition, must be sufficiently rewarded. The example used to describe the developer's position is adapted from a land development example presented by Riddiough[32] and is adjusted to reflect conditions of home construction.

The example is based on the development of 100 units that each cost $30,000 to construct. The up-front land, architecture and other soft costs are $5,000,000 of which the developer pays $2,600,000. Each unit costs $30,000 to construct and sells for $100,000. Total development cost is $8,000,000 -- $5,000,000 for land and architectural services and $3,000,000 for hard construction

costs. Financing is based on a 90 percent loan-to-value construction loan at an interest rate of 1 percent per month. The construction period is 12 months and the unit sales in the phased project begin in Month 6. From Month 6 to Month 12, the $5,400,000 loan is repaid with seven equal payments of $821,234. In the end, the cash flows the developer sees are:

Month 0	=>	($2,300,000)	(Initial Investment)
Month 1 to Month 5	=>	($30,000)	(Monthly 10 percent equity)
Month 6 to Month 10	=>	$148,766	(Revenue from sales - equity – loan payment)
Month 11 to Month 12	=>	$178,766	(Revenue – loan payment)
Month 13 to Month 15	=>	$1,000,000	(Loan fully repaid: Residual cash flows to developer)

Source: Riddiough 1999:120

When the cash flows are plugged into the NPV formula at a 14.5 percent discount rate, the result is a positive $1,078,44. The result on the IRR formula is annualized at about 51 percent. An investment such as this would be highly valuable but there is one not of caution. In the Puerto Rican development context, the discount rate will has to adjusted upward because the project is more highly leveraged than a 75 percent loan-to-value ratio. In this case, the most significant factors influencing the high positive NPV is the short time horizon in which the developer's equity is at risk and the high absorption rate --10 percent of the project -- for the finished units.

4-4-2: Key Factors Influencing Profit in San Juan Housing

One of the issues that remains after the discount rate is calculated and the methods for calculating investment performance are presented, is to consider what are the main variables that can influence the profitability of a transit supportive housing project. The discount rate advances the investment analysis to near completion, but there still need to be cash flow inputs of revenue and expenditure to compute an IRR or NPV.

Total development cost is the first factor that the developer considers. This includes hard costs (land and construction costs) and soft costs (design and permitting expenses). For example, in San Juan sub-market areas such as Condado and Isla Verde where land is expensive, new housing projects are mainly high-rise condominiums. This increases the density and allows the developer to recover the cost of the land by spreading it out over a relatively large number of units. Building single family housing in these areas of the city is unprofitable.

The second factor that influences the profit in housing development is the absorption rate or the rate of sale of the finished units during marketing. Absorption is usually expressed as the percentage of the total units that is sold in a particular period. In this case, monthly cash flows are needed for the Discounted Cash Flow (DCF) analysis so the number of units sold per month is used as absorption. When the absorption rate is higher than forecast, the time taken to sell the units is shorter than expected. This reduced time of sale has the effect of increasing the IRR. When the absorption rate is higher than pre-development forecast, the IRR or NPV on the project is reduced and can lead to financial distress and foreclosure of the construction loan.

Finally, the cost of financing is another major factor in determining the profit of a housing development. Construction loans in San Juan carry a variable interest rate that is pegged to LIBOR. If during construction there are interest rate increases, the result will be interest payments that are higher than forecast. This occurrence can also lead to financial distress in which the borrower loses the initial equity and ends up with huge losses.

4-4-3: Backing Out an NPV for Two Recent Projects

The first project that is analyzed is Parque de Las Flores, a walk-up housing project that was built in Carolina between 1996 and 1997. The project has 140 units and was completed for a total

development cost of $14,086,547. The construction cost was $11,706,547 and the land cost was $2,380,000 on an area of 198,203 square feet or $12.00 per square foot (Table 4-3). An appraisal by Vallejo y Vallejo, Inc.[33], one of San Juan's most reputable real estate appraisers estimated the profit to be 14 percent based on total revenues of $16,100,000 from the sale of 140 units at an average price of $115,000. It is important to realize that this return calculation ignores the time value of money and treats cash all cash flows as if they occurred at the same time. The 16 percent return was calculated as a gain on cost over the entire period from the start of construction to the completion of sales and not as an annualized IRR that is needed for CAPM analysis.

In order to get the NPV the absorption rate is transferred into a monthly cash flow by multiplying the number of units sold per month by the average price for the housing units. To complete the NPV calculation, only the equity cash flows are considered – the cash flows the developer sees. Expenditures were placed in Month 1 to Month 12 and revenues from Month 13 to Month 37 (Table 4-3). Between Month 13 and Month 28, all the revenues are used to retire the construction loan. This 37-month period approximates the period over which a typical construction loan is outstanding and would account for most of the interest payments that were included in the total development cost in the post development appraisal at Parque De Escorial.

The total development cost is divided into a 75 percent debt and 25 percent equity investment, consistent with the underwriting criteria for commercial mortgages. The decision is made to ignore the interest payments on the loan. This is because interest payments for the development of the project are already captured in the total development cost. Adding interest again will result in a double counting of that component of the cost. In the end, using the 14.5 percent equity discount rate that a developer will most likely apply to the cash flows, the NPV of the project is calculated to be $466,452.

Table 4-3 NPV Calculation for Parque De Las Flores	
Number of Units	140
Total Development Cost	14,086,547
Debt (Construction Loan fully paid)	10,564,910
Equity	3,521,637
Absorption	5.6 unit/mth
Time for Unit Sales	25 mths
Average Unit Price	115,000
Cash Flows from Unit sales	644000
Total Revenues	16100000
Gain On Cost	14.29%
Cash Flows	
CF1 - CF12	(293,470)
CF13 – CF28	0
CF17	383,090
CF18 – CF37	644,000
NPV	466,452

4-5: Development Costs for Transit Supportive Housing

Four major costs are incurred in the building of a new high-rise or walk-up apartment project that would serve as transit supportive housing. These are:

- Land costs: determined by the competition for land at different locations along the alignment.
- Design and permitting costs (Soft Costs): includes architecture and design, legal fees, permitting costs and other non-construction costs.
- Construction costs: determined by the cost of labor and materials in the local market.
- Financing costs: determined by interest rates on the construction loan and the duration of the loan.

These payments costs do not all occur at the same time are added together after adjusting for time to produce a total cost.

Land prices near Tren Urbano stations prove to be the most difficult of the cost items to get data for. Data on seven recent transactions were provided by Vallejo y Vallejo, Inc. The data from Estudios Tecnicos included land prices for most projects. These data points are combined to produce an annotated map of sales prices in the study area in constant 1999 dollars (Figure 4-6). The map is complemented by land prices provided for the seven market areas by real estate professionals with knowledge of the San Juan land market.

Most estimates of the design and permitting costs provided by San Juan real estate professionals including architects, is in the range of 20 – 25 percent of total development cost. This means that for projects in which only the construction cost is given, the upper limit of the range will be used to estimate the contribution of design and permitting to total development cost.

Construction costs are estimated on a per square foot basis. These costs are available for several projects built over the last four years in San Juan. Based on the most recent average construction cost for walk-ups and a similar figure for high-rises, the total construction cost is adjusted for anticipated inflation by applying a growth factor based on the average annual growth in the CPI between 1990 and 1999. For the buildings presented, construction costs for walk-up apartments ranged from $51.00 per square foot for the Las Villas de Ciudad Jardin to $67.99 per square foot for the Boulder park project in San Juan.

Financing costs are based on the underwriting standards that commercial banks and investment banks use for short-term construction loans in San Juan. Generally loans for private housing development such as future projects near Tren Urbano stations are interest only loans with floating interest rates placed at 200 basis points above LIBOR[34]. Recently, interest rates on construction loans were in the 7.5 to 8.25%[35] range and the repayment period was usually three years. The loans were based on loan-to-value ratio of 75 percent. Therefore, for large projects with

more than 100 units, only deep-pocketed investors with $2,000,000 or more in equity will qualify. For transit supportive housing, this requirement narrows the list of developers to just a few companies in Puerto Rico.

4-6: Conclusions

The CAPM provides one method to estimate the discount rate for new transit supportive housing. In the case of San Juan where data on the financial performance of homebuilders is not available, applying the CAPM with US time series data turns provides a reasonable method to estimate the discount rate. The application of the CAPM only possible because of Puerto Rico's financial system's close connection with the US markets. The discount rate taken from the CAPM is very important to the investment analysis because most large housing projects will incur cash flows over a two- to three-year period.

The analysis shows that several variables can influence the investment outcome of a transit supportive housing project. These include components of total development cost and elements such as absorption and average price per unit. Components of the total development cost such as a sudden increase in the interest on a construction loan or a change in the rate of sale of finished units can have devastating effects on the housing project leading to financial distress.

The discussion in the chapter attempted to get at the annualized return of two recent projects so that the relative performance of the projects are analyzed relative to other investments available in Puerto Rico. Even though the estimated IRR is limited by the assumptions that were made on the sequencing

Chapter Four End Notes

[1] Three economists, Harry Markovitz, William Sharpe and John Linter shared the Nobel Prize in economics in 1990 for their work in the CAPM which is derived from portfolio theory.

[2] The IRR is the discount rate which when applied to a stream of cash flows makes the Net Present Value equal to zero. This is a time weighted investment performance measure which is widely used in real estate investment analysis, especially for short-term projects such as for-sale housing development.

[3] Willard and Vayanos, 1997, used the CRSP data series to estimate the Market Risk Premium for two periods (1926-1996 and 1967-1996) to estimate the discount rate for Delta Airlines. Most of the analysis used in this case follows the example outlined by these authors to get at the discount rate for housing development in San Juan.

[4] Vayanos, D and G. Willard. 1999. **Finance Theory Lecture Notes**, MIT Copy Technology Centers and Sloan School of Management.

[5] **Caribbean Business**: Various issues dated from October 1999 to April 2000.

[6] **Caribbean Business**: op cit

[7] Office of the Commissioner of Financial Institutions website – www.cfi.giv.pr

[8] Interview with Hector Del Rio Jimenez, CPA, Senior Vice President of Investment Banking, Doral Securities of San Juan.

[9] Doral Securities recent document for construction loan – not for public use.

[10] Office of the Commissioner of Financial Institutions, **Annual Report 1998**

[11] Interview with Hector Del Rio Jimenez, op cit.

[12] **Caribbean Business**, op cit

[13] **Caribbean Business**: op cit

[14] Interview with Timothy J. Riddiough, Professor MIT Center for Real Estate.

[15] Inteview with Wanda Navajas, Executive Director of Puerto Rico Chapter, National Association of Homebuilders.

[16] Interview with Federico Sanchez of Interlink Development Company; Interview with Segundo Cardona, AIA, of Sierra, Cardona, Ferrer, a San Juan architect who performs investment as single asset partnerships; and Interview with Tom Marvel, AIA of Marvel and Marchand, San Juan architects.

[17] Interview with Oscar Mesorana and Hector Del Rio, Doral Mortgage.

[18] Most financial texts include this equation but the formulas used in this case are taken from **Finance Theory I Lecture Notes** by Dimitri Vayanos and Greg Willard, MIT Sloan School of Management, Fall 1999.

[19] Geltner, D. 1988. **Real Estate Finance and Investments Lecture Notes**. MIT Center for Real Estate

[20] Geltner, D. 1998. op. cit.

[21] Geltner, D. 1999. op cit.

[22] For a discussion of Two-Fund Theorem, refer to Investments by Bodie, Kane, and Markus.

[24] Interview with Federico Sanchez

[25] Interview with Hector Del Rio, CPA, Senior Vice President of Investment Banking; and Interview with Oscar Mesorana Colon, Financial Consultant of Doral Securities.

[26] Interview with Oscar Mesorana Colon op cit.
[27] **Annual Report**, Government Development Bank of Puerto Rico (GDB), 1999.

[28] Puerto Rico Government Development Bank website at www.gdb-pur.com

[29] **Caribbean Business** op cit.

[30] For a detailed discussion of the NPV Decision Rule, refer to Chapter Five in **Principles of Corporate Finance**, Fifth Edition, by Richard A. Brearley and Stewart C. Myers (McGraw Hill, publishers.

[31]Interview with Federico Sanchez, op cit.

[32] Riddiough, T. J. 1999. **Real Estate Finance and Investments Lecture Notes**, MIT Center for Real Estate and MIT Copy Technology Centers.

[33] Vallejo y Vallejo is a Santurce based real estate appraisal firm. One of the principals of the firm, Jorge Vallejo has an MAI qualification from the Appraisal Institute.

[34] Riddiough, T. 1999.

[35] Interview with Oscar Mesorana, op cit.

Chapter Five

Financial Feasibility of Proposed Housing Development at Martínez Nadal: An Evaluation of Four Stylized Housing Programs

5-1: Introduction

The purpose of this chapter is to determine the financial feasibility of building high-density condominiums as transit supportive housing near the Martínez Nadal station of the new Tren Urbano rail network in San Juan, Puerto Rico. The housing development options that are considered include mid-rise walk-up apartments, luxury high-rise housing, a low-income high-rise building, and a mixed-income project. Each of the projects is designed to exploit the development opportunities associated with the vacant land parcels near the station. The investment analysis for each proposal is accomplished by applying the analytical framework developed in Chapter Three and Chapter Four to the four stylized housing projects synthesized from recent experience in housing development in the Greater San Juan area, from recent projects developed in Boston, and from urban design proposals put forward by Tren Urbano[1] and Eryn Deeming[2].

The analysis considers each housing development proposal as a separate, stand-alone project. This means that the vacant land at Martinez Nadal that is proposed as housing development sites in a mixed-use Transit Oriented Development program will be evaluated using only one program at a time.

The data that is used for the analysis is taken from recent reports by Estudios Técnicos, Inc., one of Puerto Rico's leading economic data providers, and Vallejo y Vallejo, Inc., one of the island's leading estate appraisers. Because of limitations in the data, the method of analysis excludes a forecast of the investment decision that results when two or more of the proposed

housing prototypes are combined. For example, the build/no-build decision that a developer would reach for a development that includes a mid-rise walk-up condominium for middle-income homebuyers, a low-income high-rise, and a luxury high-rise all on the same site is not considered. Instead, the method focuses on adjusting key variables in the profit function to establish minimum thresholds at which a developer will make a yes decision to build the project. Factors such as average unit price, absorption rates, type of financing, and total development costs are adjusted based on a set of reasonable assumptions. The sensitivity analysis that results is important for Tren Urbano and private housing developers to consider in the planning phase.

For each of the four examples, the investment analysis assumes April 1, 2000 to be the date on which development feasibility, design and permitting, and negotiation of the terms and conditions of financing will begin. Construction is assumed to begin on April 1, 2001 and take 18 months to be completed. The sale of units in each case would start on October 1, 2002, a few months after Tren Urbano is scheduled to commence revenue service.

The analysis that follows for each housing program begins by establishing a base-case scenario driven by current market conditions. The Net Present Value (NPV) is calculated using the CAPM-calculated discount rate for investment in this base-case scenario for each program[3]. In a few cases, the analysis then recalculates the NPV for alternative scenarios by adjusting parking ratios, rate of sale or absorption, average sale price for the finished units, among other key variables. The impact of changes in the total development cost with reduced parking and expected sale prices for the finished units are considered in alternative scenarios. The aim is to account for the effects of transit supportive housing development that specifically calls for reduced parking in new housing development around transit stations. The initial reaction may be to think of a decline in the demand for the units because the loss of parking. The result may not

be that simple. The compensating effect of access to a modern transit system, the ability of the Tren Urbano and the developer to market cheaper units, and the reduction in total development cost that is afforded by the construction of smaller parking structures need to be accounted for before any final decisions on transit supportive housing can be made. The rest of the chapter attempts to explain how some of the effects of these counterbalancing forces play themselves in San Juan's emerging rail transit realm.

5-2: Housing Demand Estimates for Guaynabo: 1999-2003

The Martínez Nadal station falls within the San Juan municipality but functions as part of the Guaynabo housing market area because of road connections. Guaynabo is one of seven sub-markets in Greater San Juan that were identified in Chapter Three. Any future transit supportive housing at Martínez Nadal must be able to compete with other new housing being built in the vicinity. Therefore, aggregate demand for housing in Guaynabo is an important consideration for Tren Urbano and private developers.

It was previously established that the projected demand for housing in the San Juan Metropolitan Area (SJMA) will be high; but a closer look at the Guaynabo market provides the close perspective that is required for the investment analysis. It was also established that the two important variables that drive the demand for new housing are population growth measured in terms of the formation of new households, and household income.

In 1998, the median income in Guaynabo was $38,993. This income level was among the highest for any municipality in the SJMA. At the same time, the number of households in Guaynabo (taken to be the number of occupied dwellings) stood at 34,780[4], up from 28,856 in 1990. Based on a projection model developed by Estudios Técnicos, the number of households

in Guaynabo is expected to reach 38,504, an increase of 3,725 units per year between 1999 and 2003 (Table 5-1). The model uses an average rate of increase for households of 2.1 percent per year for the five-year period from 1999 to 2003. The Estudios Técnicos analysis then subtracts the number of units in price ranges below the minimum threshold market price of $64,000 from the total estimated demand. The result is an estimated annual demand of 496 units that can be supplied by private developers. This leaves 249 units that cost less than $64,000 to be supplied by government programs, rental conversions and so on.

Table 5-1

Income Distribution and Projected Demand for Market Rate Housing in Guaynabo, 1999-2003

Income Bracket 1998		H-holds	H-holds	Price of Housing Unit		Effective	Market Demand
From	To	1998	2003	From	To	Demand	Per Year
$0	$7,999	4,214	4,666	$0	$24,709	452	0
$8,000	$15,999	3,877	4,292	$24,709	$49,416	415	0
$16,000	$25,999	3,969	4,394	$49,416	$69,522	425	33*
$26,000	$34,999	4,060	4,496	$69,522	$81,158	436	87
$35,000	$47,999	3,834	4,245	$81,158	$106,820	411	82
$48,000	$63,999	3,512	3,888	$108,820	$119,898	376	75
$64,000	$78,999	2,008	2,223	$119,898	$140,214	215	43
$79,000	$94,999	1,681	1,861	$140,214	$148,224	180	36
$95,000	$110,999	1,335	1,478	$148,224	$167,882	143	29
$111,000	$157,999	2,782	3,079	$167,882	$253,576	297	59
$158,000	Or more	3,507	3,882	$253,576	or more	375	75
Total		**34,779**	**38,504**			**2,479**	**496**

Source: Estudios Técnicos, In

The 2,479 units in the effective demand column represents the in-market demand only

* Represents the number of units in market for that income class

When the income profiles of the households in Guaynabo are considered, another Estudios Técnicos model predicts that there will be moderate increases in all groups between 1999 and 2003. For example, the less than $8,000 income group is expected to increase by 452 households, the $35,000-$48,000 income group will grow by 411 households and the $158,000 or more income group will grow by 375 households (Table 5-1).

The next stage of the process is to estimate the number of housing units that will be needed in each price range in Guaynabo. Here, another model by Estudios Técnicos is used. The calculation that Estudios Técnicos applies a 30-year fixed rate mortgage with a 10 percent downpayment and an annual interest rate of 8.5 percent to each income category to develop typical price ranges for households[5]. The price estimate uses 30 percent of annual income as the mortgage payment and then backs out the house price. The demand for housing by price from the Estudios Técnicos projections is presented in Figure 5-2. For example, the model predicts that 75 units that cost between $80,000 and $100,000 and 102 units in the $210,000+ price range will be needed in the Guaynabo area per year between 1999 and 2003 (Figure 5-2). However, it is important to recognize that this projection is static and does not account for household mobility within the SJMA or within Puerto Rico. Therefore, the projection could be higher is households move to Guaynabo from other areas, or lower if households leave Guaynabo.

Table 5-2
Estimated Average Annual Demand in Guaynabo

Price of Housing Unit		Number of Units Per Year
0	24,999	91
25,000	49,999	84
50,000	63,999	74
64,000	79,999	84
80,000	99,999	75
100,000	119,999	95
120,000	149,999	81
150,000	189,999	45
190,000	209,999	14
210,000 +		102
In-market ($64,000 +)		**496**
Out of market (0 to 63,999)		**249**
Total Demand		**745**

Source: Estudios Técnicos, Inc, 1998

Another relevant issue that emerges from the demand estimate is allocation of housing units to transit oriented housing versus other developments. This question cannot be directly answered by the research but it is reasonable to assume that if the transit supportive housing units are no different than other developments in Guaynabo, then homebuyers will look at them as just another housing option.

5-3: Housing Development based on the Deeming Proposal

To date, the most detailed land use allocation and urban design research project that explicitly considers transit supportive housing development near the Martinez Nadal station is the thesis by Eryn Deeming (Deeming 1999). The result of Deeming's research provides a conceptual framework that identifies the available parcels, allocates the parcels to different properties, and develops density criteria for the housing that is most desirable for a transit friendly, mixed use development.

Deeming's work begins with a critique of Peter Calthorpe's New Urbanist principles as they relate to Transit Oriented Development. The critique focuses on adding a measure of real estate economics and finance to the design ideas put forward by Calthorpe. In attempting to get a handle on the validity of Calthorpe's models in real estate market context, two New Urban projects in Portland, Oregon are analyzed from investment performance and level of success perspectives.

In keeping with the interest to anchor future Transit Oriented Development proposals at Martinez Nadal in the terms of New Urbanism, Deeming concentrated the analysis of development opportunities within walking distance of the station.

> "The site chosen ...is the area within a 1/4 mile radius around the Martinez Nadal station." (Deeming 1999: 99).

The development proposals that Deeming advocates are based on the number of available parcels and on the opportunity that exists to develop a few underutilized parcels within the 5-minute or quarter-mile walking range of Martinez Nadal.

> "There is substantial potential for development near the station ... because there is a great deal of developable land owned by the transit authority surrounding the station ..." (Deeming 1999: 99)

The proposal also includes the intent to convert land on which "light industrial uses" currently sit to transit supportive development including housing.

The location, accessibility and amenities that currently exist on the site are also deemed conducive to future development. Internal circulation of the development parcels will be enhanced through road improvements. In future Transit Oriented Development at Martinez Nadal, automobile connection to the adjacent neighborhoods will be provided by local streets such as PR-19 and PR-21; and connection to the Guaynabo town center to the south is by PR-20.

Among the several recommendations that Deeming presents is a housing density of no less than 20 dwelling units per acre (20 du/ac). Three sizable development parcels were identified (Figure 5-1) and presented as Figure 6. Deeming also includes housing in the preferred plan along with retail buildings at an FAR of 2, office space, a movie theatre, public spaces, street improvements and so on. Two housing proposals are forwarded in Deeming's extensive research -- one a high-rise tower built at the scale of 100 units per acre near Pueblo Extra; the other a townhouse development at 20 units per acre on the parcel north of the station (Figure 5-2). The two parcels are roughly equivalent in area and are estimated to be between three and four acres each.

In summary, Deeming mapped out the basic details of a credible plan for the Martinez Nadal station, which, once implemented, will take several years before it is fully built-out. One approach to the development could be to build the properties that are most highly valued by investors first and then wait for the market for the other properties to become more favorable. Such an approach may lead to a place that does not meet all the guidelines of TOD in the early stages, but which is viable from the developer's perspective. Another approach is for Tren Urbano, the San Juan Planning Board and the municipal government to package the development parcels and table a Request for Proposal (RFP) process that has both bonuses and penalties for the sequencing of buildings. In either case, the provision of housing at an early stage to create more active pedestrian movement will be a desirable goal.

5-4: The Stylized Housing Programs

In order to complete the investment analysis of the housing development options at Martínez Nadal, four building programs are proposed that are intended to take advantage of the land parcels that Deeming identifies. The programs take into consideration recent market activity for multifamily condominiums that is highlighted in Chapter Three and introduces the concept of a mixed-income housing project, a pattern of development that is gaining acceptance by US city governments, non-profit housing sponsors, and some private developers.

The way the San Juan housing market has operated in the last decade, three trends dominate the condominium market. These include the multifamily walk-up sector that targets the first-time, middle-income homebuyers; the luxury walk-up and high-rise market that caters to the need of high net worth individuals; and the low-income high-rise developments that provide affordable housing using government programs.

Typically, the walk-up apartments that dominate the first-time homebuyer market are mid-rise buildings that are three to five stories and range from 1,200 to 1,400 gross square feet of total floor area. Two and three bedroom models are offered and the price for these units is usually in the $90,000 to $130,000 range (Table 5-3). Developers usually provide two parking spaces per unit to cater to the high car ownership rates among San Juan's middle-income households.

Table 5-3

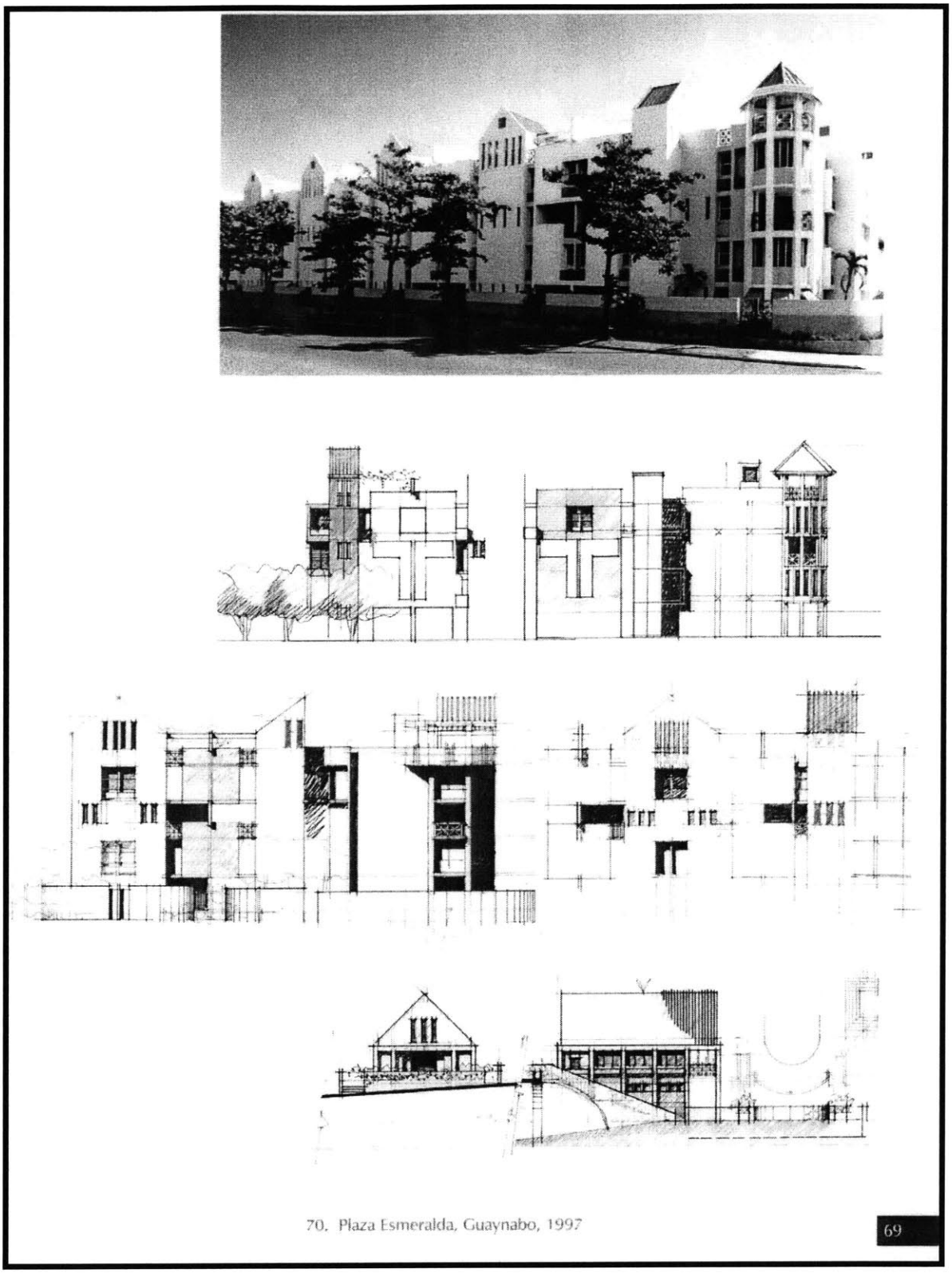
Comparable Walk-Up Projects Developed Recently in San Juan

Project	Location	Units	Unit Size (sf)	Const'n Cost/sf	Land Cost/sf	D'ment Cost/sf	Average Price	D'ment Period	Type of Financing
Boulders Park	San Juan	32	1,370	$67.99	$4.38	$72.37	$118,000	na	na
Parque de Las Flores	Carolina	132	1,319	$59.06	$12.01	$71.07	$115,000	96-97	FHA-Conv
Alexis Park	Carolina	72	1,437	$58.45	$0.41	$58.86	$125,000	na	na
Colinas De Bayamón	Bayamón	111	1,121	$58.21	$6.32	$64.53	$94,600	na	na
Paisajes del Escorial	Carolina	168	1,401	$56.58	$13.34	$69.93	$120,000	97-98	FHA-Conv
El Bosque	Guaynabo	160	1,272	$53.26	$3.55	$56.81	$116,000	95-96	FHA-Conv
Bay Side Cove	San Juan	246	1,248	$51.00	$2.43	$53.44	$110,000	95-96	FHA-Conv

Sources: Estudios Técnicos, Inc and Vallejo Y Vallejo, Inc.

In order to get a visual representation of this housing prototype, floor plans and elevation drawings of Plaza Esmeralda in Guaynabo are provide as Figure 5-2 and Figure 5-3.

In summary, the walk-up housing development that is proposed for investment analysis in this research is a 150-unit project with two- and three-bedroom units with an average size of 1,200 square feet. Total development area is 270,000 square feet of which 180,000 square feet are the residential buildings and 90,000 square feet are the parking structure.



70. Plaza Esmeralda, Guaynabo, 1997

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Figure 5-2: Plaza Esmeralda in Guaynabo
An example of a recent walk-up development in San Juan

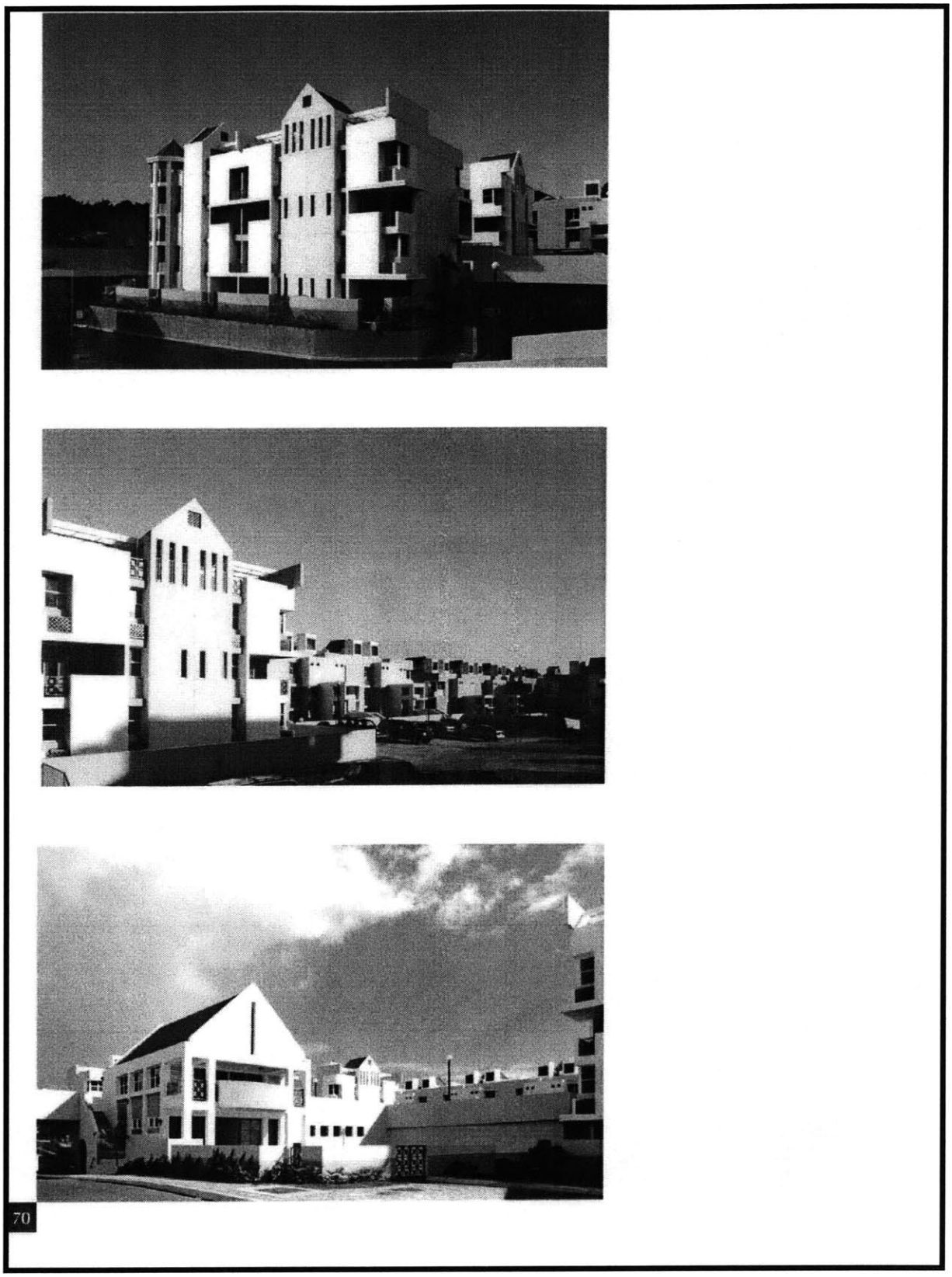


Figure 5-3: Plaza Esmeralda a Typical Three-Story Walk-Up in Guaynabo

Second, the low-income option is considered. Typically, San Juan developers build high-rises to cater for demand in the low-income market. Recent examples of this type of development are Torres De Cervantes, a 408-unit project in Carolina that was completed in 1996; and Canals Park, a 26-unit development in Santurce that was completed in 1997. Generally, low-income high-rise condominium units average 800 to 1,000 square feet in total floor area (Table 5-5). In 1998, Puerto Rico Housing Finance Agency regulations cap the price of these units at $64,000[6]. A developer working with these programs will require a public subsidy.

Table 5-4

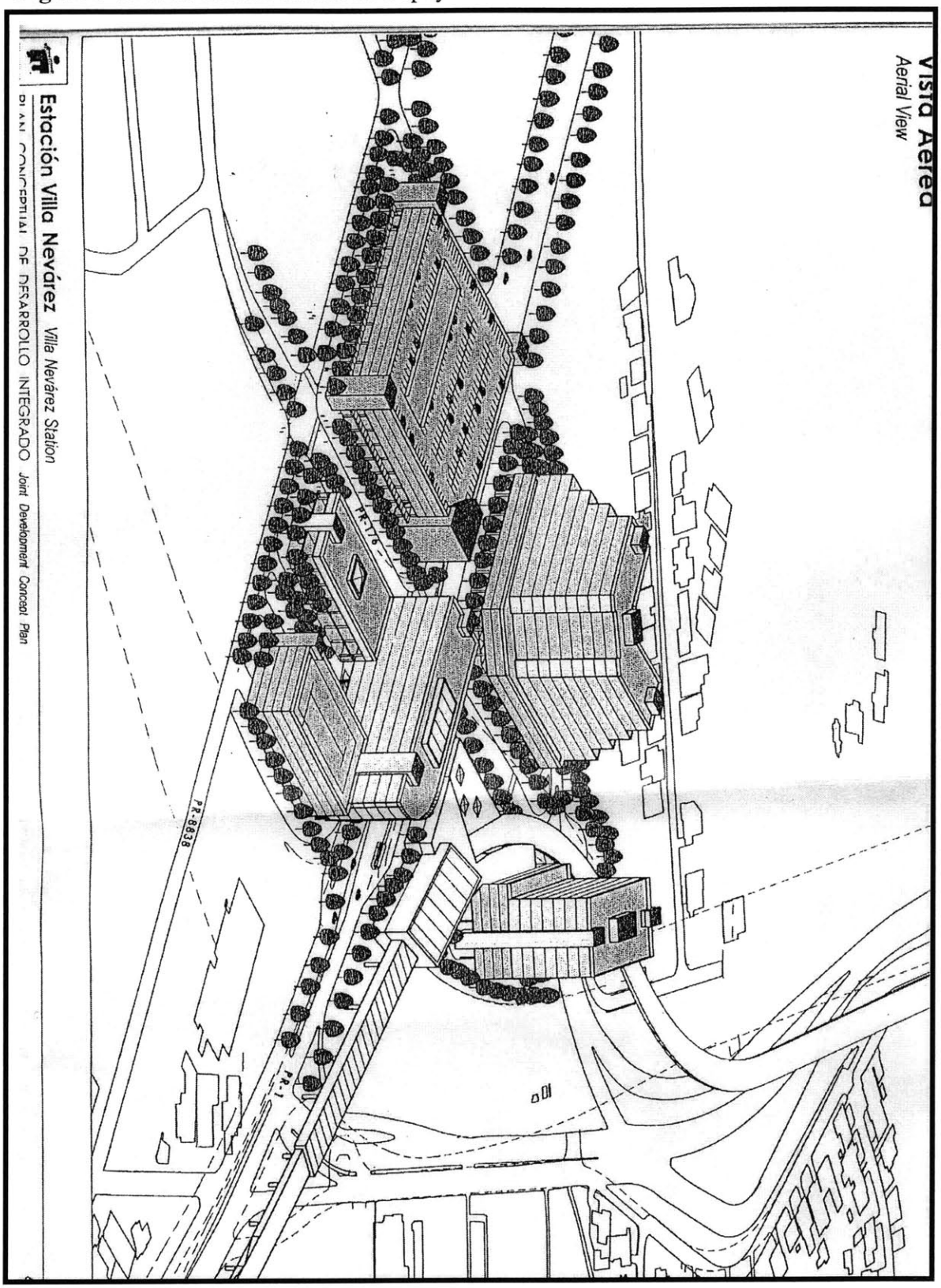
Recent Low-Income High Rise Developments - San Juan Area

Name	Location	Year Built	Number of Units	Unit Size	Rooms	Unit Cost	Absorption Rate
New Center	Hato Rey	96 - 97	196	700	2 BR - 1BA	$65,000	NA
				NA	3 BR - 1 BA	$97,000	
Garden View Plaza	Rio Piedras	97 - 98	186	NA	2 BR - 1BA	$53,000	1.22
				NA	3 BR - 1 BA	$64,000	
Canals Plaza	Santurce	98 - 99	38	NA	na	$85,000	NA
Torres De Cervantes	Carolina	95 - 96	408	919	3 BR - 1 BA	$52,200	5.8

Source : Estudios Técnicos

The low-income housing program that is proposed includes four 100-unit buildings that will be built in phases. In the first phase, only one building will be considered. The design will be similar to a recent Tren Urbano proposal at the Cupey station (Figure 5-3). Total development area is 90,000 square feet that is all dedicated to the residential building. Following current San Juan practice, only surface parking is planned in this type of development with only one parking space per unit.

Figure 5-3: Tren Urbano Model of Cupey Station



Source: Tren Urbano

The third housing program that is considered for investment analysis is a luxury high-rise development. Several luxury high-rise towers were developed in Guaynabo in recent years. These include Plaza Athenée (Figure 5-4) and Alhambra Real. Typical development costs have been over $200,000 per unit and average sale prices range from $182,000 to $350,000 (Table 5-5). All of these communities are fully gated and provide two or three parking spaces for owners. While at first this may not appear to be a transit supportive development it might still generate a small transit ridership, and its inclusion in the investment analysis provides another reference for housing market analysis near the station. The luxury high-rise that is proposed will be a 44-unit tower with 12 stories. Each of the first ten floors will have four units that are 1,500 square feet and the 11th and 12th floors will have two penthouse units each that are 3,000 square feet.

Table 5-4

High Rise Developments in Guaynabo

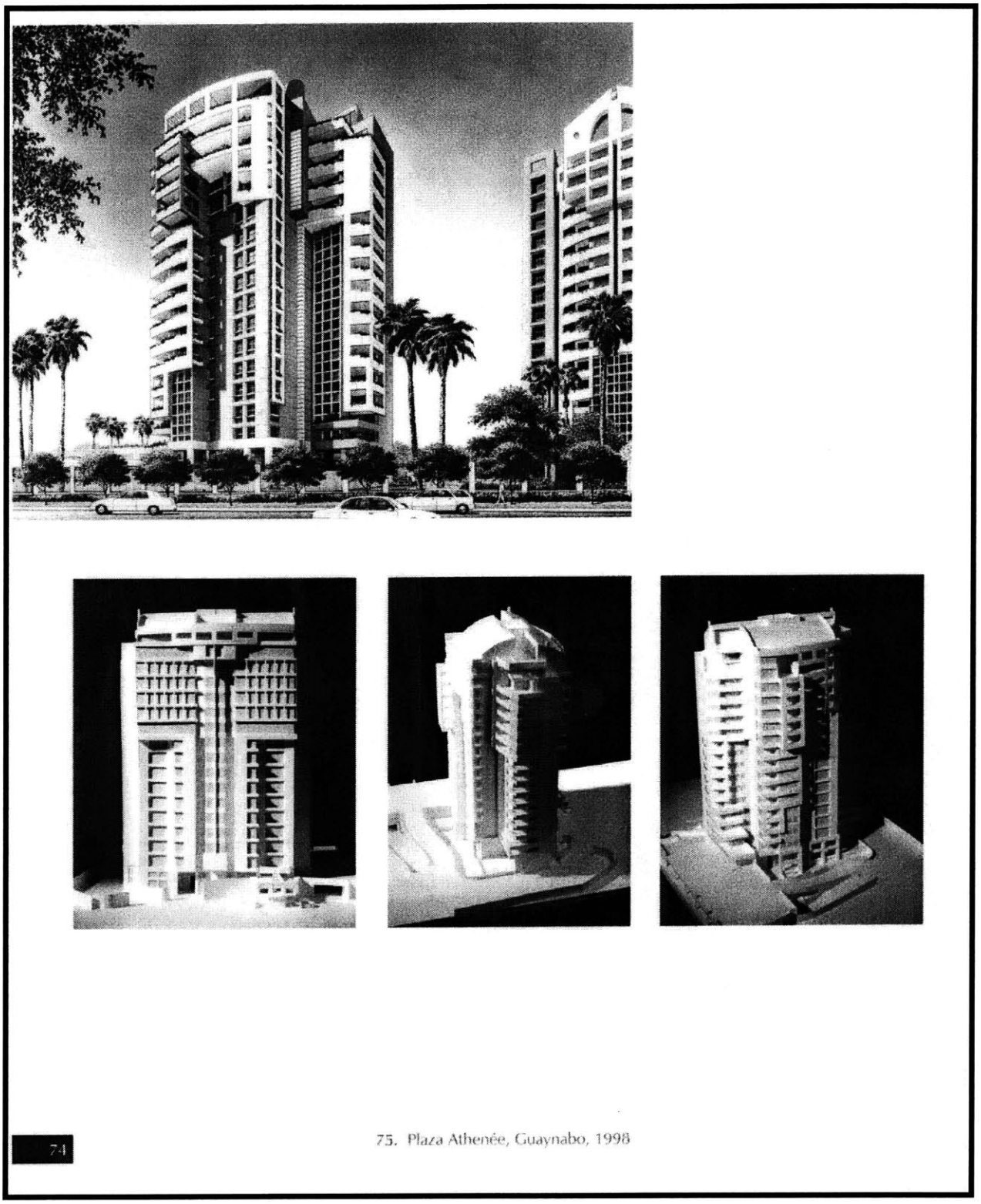
Project	Total Units	Construction Cost	Land Cost	Total Cost	Average Unit Price	Expected Profit
El Laurel	48	$11,471,000	$450,000	$11,921,000	$294,375	18%
Palm Circle	52	$9,750,000	$375,000	$10,125,000	$255,000	31%
Monte Palatium	140	$35,890,507	$2,470,000	$38,360,507	$350,000	28%
Plaza Athenée	45	$10,247,299	$285,000	$10,532,299	$285,000	18%
Alhambra Real	75	$10,681,003	$1,263,016	$11,944,019	$182,000	16%

Source: Vallejo Y Vallejo, Inc

* Expected Profit as calculated by Vallejo Y Vallejo represents a yield based on the calculation (Revenues from Unit Sales/Total Development Cost) – 1

The fourth housing option for which the investment analysis is performed at Martínez Nadal is a mixed-income development, one of the emerging patterns in affordable housing development in US mainland cities. The concept behind the mixed-income development is that

Figure 5-4: Plaza Athenee in Guaynabo



Source: Sierra, Cardona, Ferrer

some of the units will be subsidized either by the government or by internal cross-subsidies from the market rate units, and are sold to low-income families. The rest are sold off at market rates. Several recent mixed-income housing projects like this have been developed in the Boston area by Community Development Corporations (CDC) relying on a mix of financing and subsidies to provide quality housing for low-income families.

The mixed-income project that is proposed for Martínez Nadal is a 48-unit high-rise, a variation of the luxury high-rise development proposed earlier. In this project, 15 percent of the units (seven units) will be assigned to households that have a median income equal to 80 percent of the area median income (AMI) for Guaynabo. The 1998 AMI of $38,993 is projected to increase to $45,219 based on an assumed annual increase of 2.5 percent[7]. Based on this estimate, the seven subsidized units will sell for about $118,500. The rest of the units will sell at market rates.

5-5: The Walk-Up Alternative Considered

5-5-1: An NPV Calculation for Market Rate Walk-Up Project

In order to complete the analysis of the walk-up developments at the Martínez Nadal station, estimates of the development cost, absorption rates and average sale prices for similar units in the Guaynabo market area are required. For these estimates, the figures for the seven projects presented in Table 5-1 are used as a base. For the most recent walk-up projects, Paisajes Del Escorial and Parque De Las Flores in Carolina, the combination of hard and soft costs on a square foot basis was $56.58 and $59.06 respectively. Given that this cost was for the period from 1996 to 1998, an estimate of the construction cost for the proposed projects is calculated based on the higher cost assumed to be for January 1, 1997. When a 2.5 percent annual inflation

rate is applied the average cost for building the 150-unit walk-up project in 2001-2002 is estimated to be $65.72. Before the cost of land is included, the total cost of the 180,000 square-foot residential building is estimated to be $11,829,600. Because the data represent a post-construction appraisal, these development cost estimates include all interest and principal payments on the construction loan[8].

Typically, mid-rise walk-up condominiums are built at an FAR of about 1.5. This density is higher than the 20 units per acre (FAR 0.56) proposed by Deeming for townhouses on the site north of the station. The 150 units will require about 180,000 square feet (about 4 acres) to build. Land prices in the Guaynabo market are projected to be $24.56 per square foot. The land on which the walk-up housing will be built is projected to cost $4,420,800.

The total development cost of these 150 mid-rise walk-up condominiums is estimated to be $16,250,400[9] or $108,336 per unit.

Finally, the sale price of $135,000 that calculated for the Guaynabo market in October 2002 is applied to a number of assumed cash flows to produce the cash flow estimates. Based in these broad assumptions, the total revenue from the project is estimated to be $20,250,000.

The analysis assumes that the development is financed with a construction loan with an average interest rate of 8 percent and a 75 percent loan-to-value ratio, similar to the loans used to finance recent walk-ups in San Juan. This means that the developer will pay the bank $12,187,800[10] in principal and interest or $81,252 per unit. The balance of the cash flows that are left over after the construction loan is fully repaid compensates the developer for her $4,062,600 of equity that was invested in the project.

In order to calculate the Net Present Value of the project from the developers' perspective, the equity investment is divided into 12 equal payments of $338,550 and applied to

the 12-month period from April 1, 2000 to April 1, 2001 (Table 5-5). During the period from April 1, 2001 to October 1, 2002, the developer receives no revenue as the project is under construction. When the revenues from the project begin to roll in, the absorption rate or number of units sold per month will have an impact on the NPV. Generally, lower absorption rates will transfer into smaller monthly cash flows. Data on absorption rates in Guaynabo are unreliable. As a substitute, the research considers several absorption rates starting at 2 percent of the total 150 units or 3 condominium unit sales per month. At this rate of sale, the project will take 50 months to be completely sold off. Total monthly revenues of $405,000 will be used to pay off the construction loan in just over 31 months before the developer realizes any revenues[11]. When the 14.5 percent all-equity discount rate is applied at this absorption rate, the NPV of the project is negative at $545,414 (Table 5-6). A developer considering this project will walk away.

Table 5-6
Developer's NPV for Walk-Up Project at 2% Absorption

Cash Flows		Use of Funds
CF1 - CF12	(338,500)	Equity contribution
CF13 - CF30	0	Construction
CF31 - CF61	0	Construction Loan Repayment
CF62 - CF80	405,000	Developer's Profit
NPV	(545,414)	Size of Loss in Current $

Calculations based on spreadsheet model
Approximations by author allow for cash flows less than one month

The model then adjusts the absorption rate for the finished condominiums upwards by increments of 0.5 percent. This way, the absorption rate at which the NPV becomes positive can be estimated. At an absorption rate of 3 percent (4.5 unit sales per month), the monthly cash flows will be $607,500 and this pays off the construction loan in just over 21 months. The project is completely sold out in a little more than 33 months after sales begin. At this rate of

sale, the NPV of the project is estimated to be negative at $266,807. The developer seeing this loss will again reject the project.

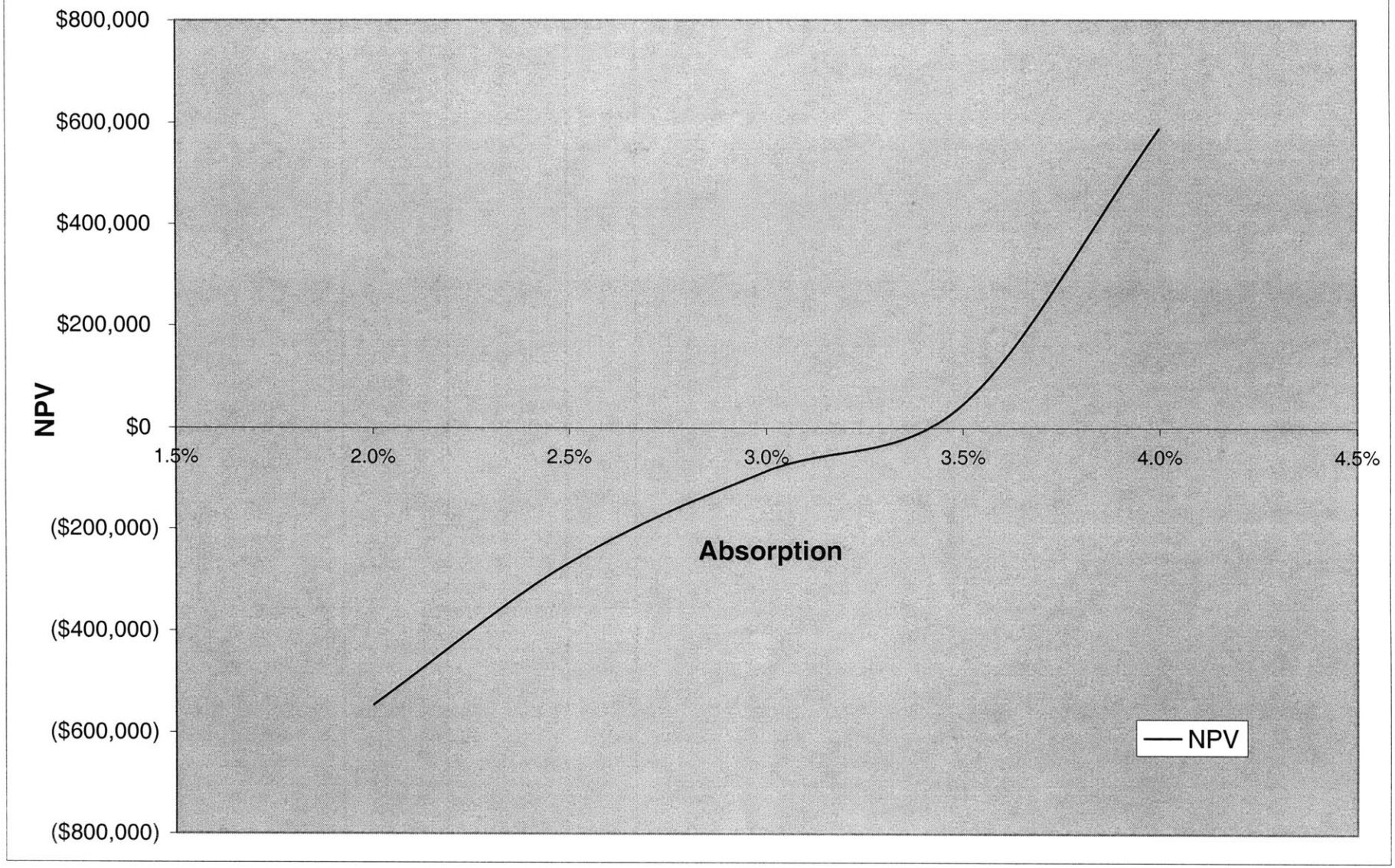
At the 3.5 percent absorption rate (5.25 unit sales per month) the revenues increase to $708,750. The time taken to sell the units is 28 months. The construction loan is repaid after 17 months and the NPV from the project is still negative at $84,899 and will be rejected by the developer.

Finally, at the 4 percent absorption rate (6 unit sales per month) the project produces a positive NPV of $46,070. This financial result would be acceptable to a developer. The results of the different absorption rate scenarios that were tested are presented in Figure 5-5. The graph shows that the faster the units are sold, the higher the all-equity NPV will be at the 14.5 percent discount rate. The project only begins to satisfy the financial feasibility test after the absorption approaches 4 percent for this project or about 6 unit sales per month. Given the recent performance of similar projects in Guaynabo and the rest of the Greater San Juan housing market, the 4 percent absorption rate or higher can be achieved.

5-5-2: Financial Feasibility of Walk-Up with Reduced Parking

One of the major potential social benefits of Tren Urbano is option that households get to purchase transit supportive housing with reduced parking. Once Tren Urbano Phase I alignment is completed and some of the AMA and público routes are adjusted to serve as feeder routes for the train, residents in transit supportive housing development such as the proposed walk-up units at Martinez Nadal, will have will have the option to give up one of their cars for reliable transit access. Buyers of transit supportive housing will save in two ways. First, an annual savings of

Figure 5-5 Relationship Between NPV and Absorption at Constant Price



about $6,000 per household, (the cost that is estimated by the American Automobile Association of owning, operating and maintaining an automobile), and second because of lower construction cost, the homebuyer will be able to purchase a unit at a lower cost. As the number of parking spaces is reduced from the current ratio of two spaces per household for mid-rise walk-ups in San Juan to a more transit-friendly one space per household, the average development cost per unit of housing will decrease by an amount equal to the cost of one parking space. In this project where structured parking is used, the average cost of building one space is estimated to be $6,000 or $20 per square foot. When this figure is aggregated across 150 units, the development cost is lowered from $16,250,400 to $15,350,500.

In order to keep the comparison of this scenario as close as possible to the base case evaluated above, the land area saved by the reduction in the parking structure is not converted into a development cost saving.

The size of the loan is now set at 11,512,800 of total repayment and the developer's equity contribution is $3,837,625. The developer's equity is again divided into twelve equal investments of $319,802 and applied to the first year of the development.

What happens to the sale price of the units is the cash flows that result from the unit sales is important. Because there have not been any recent mid-rise developments in San Juan that emphasized a reduced parking allocation from the market driven two spaces per unit to one space that is recommended for transit, it is not possible to measure the impact of this decision on the sale prices of units in Guaynabo. It is assumed in the analysis that the saving on the cost of parking is directly transferred to homebuyers in price rebate. Therefore, the average price of the units in the new project will decline from $135,000, to $129,000 with the reduced parking.

The savings that a household will receive from the same unit that has one less parking space can be aggregated across a number of variables. The difference in the mortgage payments based on a 30-year fixed rate mortgage with an interest rate of 8.5 percent and a 90 percent loan to value ratio is $498 per year. Additionally, the household choosing to purchase one of these units will pay $600 less in downpayment. However, an even larger saving is associated with the annual cost of owning one additional car. The American Automobile Association (AAA) estimates that the cost of owning a car is $6,000 per year. This includes the loan payments, insurance, licensing, fuel cost and maintenance. This cost is adjusted by a factor of 0.90 to cater for Puerto Rican conditions where the initial cost of the vehicle is marginally higher but the cost of insurance is substantially lower than on the US mainland. Making the further assumption that two individuals in the household will take Tren Urbano for five days a week, twenty trips per week will add $1,040 to the household budget. In the end the saving from giving up a car and relying on transit will transfer into a saving of $4,858 per year.

The final stage of the analysis of the reduced parking scenario is to look at what might happen if the homebuyers do not respond to the price of $129,000 that the developer asks for in October 2002. The first NPV test is run at an absorption rate of 5 percent of the project per month or 7.5 unit sales. Monthly revenues of $967,500 are generated and pay off the construction in 12 months. The NPV that results is positive and equal to $185,655.

It is possible that such a development will experience a negative price reaction because the homebuyers may want a larger compensation for giving up the parking space. To test the impact of this development, unit prices are reduced in $2,000 increments so that the reaction of NPV to reduced house prices can be evaluated. The results of this test show that the NPV crosses into negative territory between the $125,000 and $127,000 price range. Therefore, the

price of one unit of housing developed with one less parking space can sell for up to approximately $9,000 (about 6 percent) less than the units that are built with two parking spaces in the current market given that the developer accepts a zero NPV project.

5-6: Financial Feasibility for Low-Income High-Rise Housing at Martínez Nadal: Estimating the Public Subsidy

The alternative program at Martínez Nadal looks at the potential for developing low-income high-rise housing instead of the mid-rise walk-ups discussed in section 5-3. Currently, there is reasonable demand for this type of housing and building more low cost housing on relatively expensive land in the Greater San Juan area forces developers to push the FAR to higher levels.

The question that needs to be answered in this section is not so much whether the development will be built based on market outcomes. The relevant question is how to structure a financial package that will encourage a developer to build a project such as this near Martinez Nadal. This package will most likely include a rebate on the cost of land, most of which Tren Urbano already owns, or government subsidies that enhance the profit of the project for the developer. The size of the subsidies can be addressed by looking at the total development cost involved with a project of this size and the revenues from the sale of the units that will most likely be capped at the $72,000 in 1999[12].

The 100-unit tower that is proposed is estimated to cost an average about $80 per square foot to build (Table 5-5). The building is constructed in 10 stories on a 9,000 square-foot floor plate. The parking lot uses 21,000 square feet and an additional 6,000 square feet is allocated to common space. The cost of the 36,000 square feet of land at $24.56 per square foot is $884,160. Parking is provided at a ratio of 0.7 spaces per unit or 70 surface spaces. Total development cost

is projected to be $8,154,160 -- $7,200,000[13] in hard construction costs, $884,160 for the land and $70,000 to pave the parking lot.

Total revenues from the project are $7,500,000 based on a projected sale maximum sale price of $75,000 per unit[14]. Assuming an absorption rate of 5 percent per month (5 unit sales or cash flow of 375,000 per month), the NPV from the project is negative at 1,361,041 (Table 5-8). This NPV figure can be taken to be the size of the subsidy that a developer will require to make the project viable.

Table 5-7

Recent High Rise Construction Costs

Project	Location	Stories	Units	Unit Size	Cost per Sq. Ft
El Laurel	Guaynabo	14	48	1,866	92.88
Carrion Court	San Juan	17	46	1,854	90.77
Maxim	Carolina	15	33	1,831	90.50
Palm Circle	Guaynabo	15	52	1,609	86.53
Puerto Paseo	San Juan	22	82	1,585	83.93
Monte Palatium	Guaynabo	8	140	2,435	81.15
Plaza Athenée	Guaynabo	17	45	2,232	71.68
Condado Breeze	San Juan	4	3	1,564	79.06
Alhambra Real	Guaynabo	16	75	1,498	64.04

Source: Vallejo y Vallejo, Inc

5-7: The Luxury High Rise Development

The development of the 44-unit project proposed as the third housing option for the Martínez Nadal station will have a total development area of 99,000 square feet -- 72,000 square feet of occupied space and 27,000 square feet to accommodate 92 cars. The parking ratios that are applied in the development are 3 cars for each of the penthouse suites and 2 cars for each of the other units. The development costs that are used include $100 per square foot[15] for the main

Table 5-8

NPV Calculation for Proposed High Rise

Number of Units		100
Total Development Cost		8,154,160
Debt (Construction Loan fully paid)		6,115,620
Equity		2,038,540
Absorption		5 units/mth
Time for Unit Sales		20 mths
Average Unit Price		75,000
Cash Flows from Unit sales		375,000
Total Revenues		7,500,000
Gain On Cost		-8.02%
Cash Flows		
CF1		(2,038,540)
CF2 –CF18	Construction	0
CF19 – CF34	Sales	0
CF35	Sales	259,380
CF35-CF38	Sales	375,000
NPV		(1,462,138)

Table 5-9

Development Cost for Luxury High-Rise Project

Number of units	44
Total area (sf)	72,000
Cost of housing	$7,200,000
Parking spaces	92
Cost of parking	$690,000
Land area (sf)	15,000
Land cost	$390,000
Total Development Cost	$8,280,000
Construction Loan (Fully repaid with interest)	$6,210,000
Equity	$2,070,000

Source: Vallejo y Vallejo, Inc and Interlink Development Company

building and $7,500 per space[16] for the parking structure. The land for the project is estimated to be about 15,000 square feet that costs $368,400. Total development cost for the project is estimated to be $8,280,000 (Table 5-7). The project will take an average of 18 months to build and will be marketed at a rate of 5 units per month. In order to calculate the NPV to the developer, the cash flow scenario is presented in Table 5-8.

In terms of unit prices, the wide variation in prices for luxury high-rise housing has occurred in recent years (Table 5-8). This wide range of prices is accounted for by taking the low end of the range as the safest bet in the investment analysis. The smaller units are projected to sell for prices in the $250,000 to $300,000 range, and the larger units from $400,000 to $600,000 based on recent prices. In the NPV analysis that follows, $250,000 and $400,000 are used as prices for the units. The smaller units are sold in eight months and the smaller units are sold in the ninth month. The cash flow analysis and the resulting NPV calculation is presented in Table 5-9.

The result of the NPV analysis at an absorption rate of five unit sales per month is $745,395. Such a large positive NPV will lead to a yes decision by a developer and the project will proceed. The question that remains, however, is the appropriateness of such a project as a transit supportive option for Martínez Nadal. Recent development in Guaynabo shows that the luxury development market is increasing. Forging a linkage between Tren Urbano and developers of this type of housing may raise question about the use of public funds for the wealthy and the capture of the social benefit for the wealthy individuals.

Table 5-10

Comparable High-Rise Projects Developed Recently

Project	Location	Units	Unit Size (sf)	Const Cost/sf	Land Cost/sf	D'ment Cost/sf	Average Price	D'ment Period	Type of Financing
Carrion Court Plaza	Condado	46	1,778	$90.77	$19.67	$110.45	$425,000	96 - 97	Conven
Maxim	Carolina	33	1,831	$93.92	$4.69	$98.61	$395,000	Na	na
Plaza Athenée	Guaynabo	45	2,232	$71.68	$4.58	$76.26	$285,000	Na	na
Puerto Paseo	San Juan	82	1,585	$83.93	na	Na	$253,000	na	na
El Laurel	Guaynabo	48	1,620	$92.88	$3.64	$96.53	$245,000	98 - 99	Conven
			4,245				$640,000		
Palm Circle	Guaynabo	52	1,609	$86.53	$3.33	$89.85	$255,000	93 - 94	Conven

Sources: Estudios Técnicos, Inc and Vallejo Y Vallejo, Inc.

Table 5-11

Net Present Value for Luxury High-Rise Project

CF1 to CF12	Equity investment	($172,500)
CF13 to CF30	Construction period	$0
CF31 to CF34	Construction loan repayment	$0
CF35	Payment to developer	$40,000
CF36 to CF37	Payment to developer	$1,250,000
CF38	Payment to developer	$1,600,000
NPV at 14.5 %		$745,395

5-8: Investment Analysis for a Mixed-Income Development

In order to address some of the concerns that may be raised in the San Juan press and elsewhere if Tren Urbano were to develop a luxury high-rise development a Martínez Nadal, the investment of analysis for a mixed-income development is tested. This type of development that mixes market rate units with affordable units will be built at the same cost as the market rate

luxury development analyzed in section 5-7. The only variable that changes in the NPV analysis are the number of units -- increased from 44 to 48 by substituting eight small unit on the 11th and 12th floors for the four penthouse units. This changes the cash flow analysis and extends the sale period from eight to 10 months. The price of the units will be $250,000 for the market rate units and $118,500 for the eight subsidized units.

The development will have some form of public or internal cross subsidy but it is important to run the NPV calculation before the subsidies are added. The effect of the subsidy is to reduce the equity investment that the developer has to contribute to the project. The results show that even without the subsidy, the investment in the project still results in a large positive NPV of over $200,000 for the development. However, the results here should not be interpreted as a triumph for mixed-income development as a transit supportive option for Tren Urbano and San Juan housing. The real test is what will happen to the prices of the market rate units in mixed use developments. It can reasonably be expected that high-income homebuyers will not be willing to pay the same high price for housing in a mixed-income development in San Juan as they would pay for a similar unit in luxury development. The magnitude size of this price volatility may include too much risk for the developer and he will walk away from the development if the government or some other agency does not step with profit maintenance guarantees.

5-9: Summary

The analysis in the chapter provides a broad overview of an approach by a developer to four proposed housing programs at the Martinez Nadal station. In real terms, more precise estimates of construction cost will be applied as the developer moves closer to making a decision

on whether or not to build the project. The estimates used here are based on the most reliable market research and post construction appraisals that are available in San Juan -- Estudios Técnicos, Inc and Vallejo y Vallejo, Inc. A developer will access the same databases, but will also have local knowledge that adds value to the project.

The analysis shows that the most important elements in a successful project are strong demand for the finished units that is expressed as the absorption rate, and stable sale prices for the units. The way the San Juan housing market has operated in recent years, there is little question that a transit supportive housing program based on most of the models presented can result in success for both Tren Urbano and a private developer.

One of the findings of the research is that with decreased parking ratios in the popular walk-up segment of the market, there are certain price ranges for the units in which a private developer may in fact be in a better financial position with respect to walk-up apartments. When the reduced construction cost associated with reducing the structured parking from two spaces per unit to one is transferred to homebuyers in a direct reduction in the price of the unit, the NPV of comparable development increased at fixed absorption rates.

Another important finding of the study is that after the price for a walk-up condominium for middle-income homebuyers is reduced by an amount equal to the cost saved by building one less space, further reductions in the price of housing can be tolerated by the developer before the project becomes a bad investment. In the case of the mid-rise market for which this type of analysis is carried out, there is about a six-and-a-half percent price reduction cushion that can be accommodated from the estimated average market price. This is transferred into a $9,000 price reduction effect that offsets at least some of the expected negative reaction that homebuyers would have to the loss of one parking space.

In terms of the low-income housing development as a transit supportive development, the size of the subsidy that is required to build this type of housing on expensive land was also estimated. The study found that the size of the subsidy required to build the low-income housing is about 15 percent of the total project cost. In a city where land near the center is getting scarcer and housing demand in the low-income segment of the market will continue to expand, there is a need for subsidized housing for households that cannot afford market prices. This 15 percent subsidy can be used as a bargaining tool by Tren Urbano or a developer to solicit public subsidies for low-income housing in which a case could be made that the subsidy is not a very large proportion of total development cost. What is unclear is whether a purely low-income housing project as proposed in this research is acceptable to Tren Urbano, the municipality, or the planning authorities. Many American cities are moving towards mixed-income projects but this type of development is rarely used in San Juan.

Finally, the luxury housing development near Martínez Nadal also turned out to be a good investment based on current market trends. In pure investment analysis terms, this type of development represents the optimal investment because it results in the largest NPV. Based on the second investment decision rule that was established in Chapter Three, in a pure market context, the developer will accept the luxury project. However, Tren Urbano owns a substantial amount of the land near the station and this control right affords the transit authority a degree of flexibility. Deciding on what happens to the land is not a trivial issue. Developing luxury housing near the station is not the optimal use from a transit supportive development perspective because of high automobile ownership rates among the wealthier households. Transit ridership tends to be low for high-income households in US cities and San Juan will at least experience similar results.

The financial feasibility of developing a mixed-income housing project as transit supportive housing near Martínez Nadal was also explicitly considered in the research. The use of internal cross subsidies is applied but the lack of data that allows the price reaction for the market units made the findings of this section of the research inconclusive. How much of a price hit the market rate units will take in a mixed income project in the Guaynabo market remains unknown. However, using current market prices for luxury units, the project resulted in a yes decision by the developer. The development of a mixed-income project is new to San Juan and the thought of mixing the highest and lowest income classes may prove to be a very difficult sell for a developer and the reaction of the wealthy households to this type of development is yet untested in the San Juan market.

On the developer end, the analysis presented did not take into consideration any social goals -- only the financial evaluation of their position was evaluated. However, given that there are only a small number of development companies in Puerto Rico that implement projects of the size proposed here, the most important element that remains to be worked out is the relationship between Tren Urbano and these developers. Movement in this direction needs to be accelerated.

Chapter Five End Notes

[1] The Tren Urbano urban design team has presented proposals for most of the stations. The plan for Martinez Nadal is mixed-use Transit Oriented Development (TOD).

[2] Eryn Deeming, a graduate of the Master of City Planning Program at the MIT School of Architecture and Planning carried out extensive research on the land use and development potential at the Martinez Nadal station. Deeming's work is the subject of a thesis written as part of the MIT Center for Transportation Studies Tren Urbano research program.

[3] A discount rate of 14.5 percent is applied and, in some cases, 15 percent is used to keep calculations simple.

[4] The 1998 estimates of household income and population were compiled by Estudios Técnicos, Inc. The information was taken from tax returns data and other records from the Puerto Rico Department of the Treasury.

[5] Demand estimate by Estudios Técnicos, Inc, 1999 to 2003.

[6] Puerto Rico Housing Finance Agency document: Making Affordable Housing a Reality, Fall 1999.

[7] Notwithstanding the rapid income growth of the 1990s, a growth rate of 2.5 percent is used to trend the data forward. This is consistent with income growth models produced by the US Department of Commerce.

[8] Interview with Javier E. Porrata, Vallejo y Vallejo, Inc. on March 22, 2000.

[9] The data presented by Vallejo y Vallejo, Inc for total development costs of recent projects in San Juan includes the interest payments that are made on the construction loan. Because the time over which each loan was repaid is not presented, the size of the loan is impossible to calculate. The analysis used in the chapter does not include the interest payments on the loan because these payments are already captured in the total development cost estimate.

[10] This total for the construction loan reflects the prepaid interest and principal payments that are made by the developer. Typically, banks in Puerto Rico calculate the interest payments on the construction loan for 36 months and add provide a loan for this amount. Any project that takes more than 36 months to repay the bank will accrue interest over and above the total development cost provided in the Vallejo y Vallejo data.

[11] The calculation of the loan repayment applies a penalty equal to the 0.708 percent of the original mortgage to all cash flows past the 36th month. This is an attempt to account for additional accrued interest in projects with slow cash flows based on the rate of absorption of the units.

[12] Puerto Rico Housing Finance Agency Annual Report 1999.

[13] The cost of construction for low-income housing was taken to be a 90 percent of the cost of building a luxury high-rise. The cost difference is accounted for by factors such as the quality of finishing materials and higher quality elevators.

[14] The sale price is expected to be adjusted upward by the PRHFA to cater for construction cost increases and general inflation. Current price is $72,000 and $75,000 is taken to be a reasonable estimate of where the price will be set in 2002.

[15] This is based on current construction costs of about $95 per square foot. This is projected to grow to about $100 per square foot when construction is assumed to begin.

[16] The most recent estimate of the cost of structured parking is in the $7,000 range. This is expected to increase to about $7,500 by April 2001,

Chapter Six:

Summarizing the Research

6-1: Conclusions

The development of Tren Urbano now makes it possible for transit supportive housing to be developed in Greater San Juan at locations proximate to the new train stations. Even though the announcement and early construction of Tren Urbano did not result in a rush to develop transit supportive or another real estate project, the opening of Tren Urbano is not until mid-2002. Conceivably, there is still time for private developers to invest in real estate around the stations to coincide with the start of revenue service.

Many architects and urban designers, including those at the Tren Urbano office, have already put forward design ideas that fall in the transit supportive realm. However, before any new investment in housing around the stations is realized, several questions need to be addressed. This paper attempts to answer some of the major questions that Tren Urbano faces for its future real estate program, particularly in the areas of finance and investment. An attempt is also made to merge current housing development practice in San Juan with various spatial visions for transit supportive housing development.

First, in terms of design and development, several of the criteria that Peter Calthorpe and other new urbanists promote as key ingredients that make transit supportive housing successful are already part of current development practice in San Juan. Densification is already happening in San Juan even though it has more to do with scarce land than with transit development. This study identified three main building prototypes of high-density housing. These prototypes are luxury high-rise condominiums, mid-rise walk-up condominiums and low-income high-rise units that are sold in the private market. All of these projects significantly exceed Calthorpe's

minimum density requirement of 12 dwelling units per acre. The vast majority of these recent housing projects are gated communities, a reaction to public safety concerns by households in San Juan. Even though the gates make pedestrian connection to transit and shopping difficult and sacrifice a sense of neighborliness in the larger community, building a gated transit supportive housing project will be a positive step for Tren Urbano.

Where the recent developments fail to achieve the transit supportive criteria is on parking ratios. Typically, new housing developments in the San Juan market are being delivered with two and three parking spaces per unit, far above the transit supportive ratios of one or fewer parking spaces per dwelling. Currently, there is little effort on the part of developers to link the accessibility of the units with any mode of travel other but the automobile. Now that a modern transit is being built, a real option now exists for housing that is less reliant on the automobile to be developed.

The idea of building mid-rise walk-up and luxury high-rise condominiums apartments as privately financed transit supportive housing projects is viable in San Juan. This is because of two main reasons. First, developers have gained substantial experience designing, financing, building and marketing high-density housing. The depth of this experience needs to be highly valued at all levels of the planning process. A program that draws on the strengths of the developers' collective experience is more likely to succeed than one that relies on reinventing the wheel in San Juan.

The second reason why privately funded housing will likely succeed as transit supportive housing is that future homebuyers already have significant knowledge of what this type of housing delivers. On the demand side, a homebuyer can assign premium or discount to the price of transit supportive housing in a relatively easy manner because the units will reflect all the

other amenities that are currently available elsewhere in the market. The only variables that are left to price are the reduced parking ratios and the proximity to the Tren Urbano stations.

In terms of the economics of San Juan's housing market, this study projects the demand for housing units in different price ranges. Forecasts for the two factors that drive housing demand -- household income and household formation -- show that positive growth in both variables are expected for Greater San Juan and the rest of Puerto Rico for the period from 1999 to 2003. The research relies on a demand projection model that was developed by the San Juan economic research firm, Estudios Técnicos. The model applies a widely used quantitative procedure from urban economics to estimate housing demand. Based on the model's forecasts, there will be a high demand for new housing units in San Juan between the current time and 2003. Once the economic conditions in the housing market hold, then a case can be made for transit supportive housing. One good thing about the current housing economy in Puerto Rico is that the transit supportive housing concept is being proposed at a time when there is a high demand for housing. This booming market offers developers some flexibility that allows new ideas to be tried. For example, ideas such as reduced parking and building near public transit can be tested in the market at a moderate level.

A major portion of the economic analysis in San Juan focuses on the supply of new housing. Here, housing permits data are used to show that the market for new units has fluctuated around a 3,000-unit per year average for the 11-year period from 1988 to 98 for the municipalities through which Tren Urbano passes. Many of these units represent an increasing trend for developers to deliver high-density housing in the form of walk-ups and high-rises. Increasingly, this type of housing is being developed for all income groups. This shows that

there is an increasing willingness among San Juan households to live at higher densities than the typical suburban single-family suburban housing communities.

An attempt is also made to analyze the financial markets that the private developers face in their attempt to raise capital for transit supportive housing. The study found that mortgage bankers and private developers (investors) are receptive to the transit supportive housing idea as long as the project meets the stringent mortgage underwriting criteria. Generally, mortgage bankers are more interested in how well the development will perform as a financial investment than whether it is a transit supportive development.

From the developers' end, the Net Present Value (NPV) and Internal Rate of Return (IRR) investment decision rules are applied in the research to evaluate two recent projects and to forecast the financial feasibility of developing four stylized projects at the Martínez Nadal station. The two recent projects achieved positive NPV results and the results for the four proposed projects are discussed below.

The main issue in financing any future investment such as new housing development is that the a discount rate is used that is high enough to account for the systematic risk associated with transit supportive housing development. The Capital Asset Pricing Model (CAPM) is applied and a discount rate of 14.5 percent is estimated using Market Risk Premium data taken from the Center for Research and Securities Pricing (CRSP) and US 3-Month Treasury Bond rates for April 1, 2000. This discount rate was tested qualitatively in interviews with bankers and developers who consistently reported using discount rates around 15 percent. This all-equity discount rate accounts for risks associated with current construction loan underwriting standards. In terms of the risks specific to transit supportive housing, based on the findings of three previous research projects for Miami, Toronto, and Boston this study finds that there is usually a

small positive impact of the arrival of rail service on property prices in the immediate vicinity. None of the studies found negative price reactions for houses located near the transit stations. Therefore, this study assumes that any additional risk for transit supportive housing will be negligible and can be ignored.

The investment in housing that is required for the scale of transit supportive housing proposed is generally between $10 and $20 million. This amount of capital can be raised from San Juan's mortgage banks for housing development but the construction loans must be accompanied by good appraisal information. These loans are designed to minimize the risk from the banks' perspective. Therefore, even though transit supportive housing appears to be a feasible investment, the next stage is to find a developer with the experience and reputation to deliver a large project. This creates a role for Tren Urbano and the government to step in as managers of the process. When required, guarantees and other incentives can be used to help private developers reach a yes decision to proceed with the projects.

The final stage of this research evaluated the financial feasibility of developing transit supportive housing at Martínez Nadal using different scenarios. Results are presented for four stylized housing programs: three are taken from recent local developments and the fourth introduces the mixed-income concept that is growing in popularity in US mainland cities such as Boston. The evaluation of the proposed housing programs begins with a development that ignores any benefit or costs that are associated with proximity to Tren Urbano. After the base case that delivers a yes decision to build transit supportive housing is established, adjustments are made to key variables to produce a development that is more reflective of transit supportive housing than the market currently delivers. These adjustments focus on reducing the parking ratios and assigning the money saved in construction costs to the homebuyer. In the case of the

mid-rise walk-up housing that targets the first-time, middle-income homebuyers, the results show that there is a six-percent cushion on the downside of the market price when one parking space is taken away before the project is rejected. This means that the developer can put forward a transit supportive housing project that reduces the parking ratios by 50 percent as long as the price the homebuyer is willing to pay is within six percent of the projected market price. For housing that costs $135,000 there is a one-time direct saving of about $9,000 and annual savings of nearly $5,000 associated with owning one less automobile. The impact of these numbers on the savings of the average Puerto Rican household can be significant. This type of information can also be used as a marketing strategy for Tren Urbano and the developers of transit supportive housing

The luxury high-rise condominium proposal provided the highest NPV under the assumptions used to test its viability in the current market and, therefore, is the 'best' financial investment at Martínez Nadal. However, several questions remain about the appropriateness of a luxury development as transit supportive housing. These questions range from the low levels of ridership that luxury housing will generate, to the transfer of public land to private developers to build housing for the very rich.

With respect to the low-income high-rise housing development that is tested at the Martínez Nadal, the results show that the estimated size of the public subsidy that is required to build such housing is about 15 percent of total project cost. In terms of what this means, a Tren Urbano or Puerto Rican government contribution of land alone can effectively cover the public subsidy required for building low-income housing near the station. The main point about the size of the subsidy that is required to keep private developers interested in a deal such as this one is that credible case can be made for at least some of the money that is currently being spent on

low-income housing programs elsewhere in the city to be redirected to transit supportive housing. This is largely a political issue that in some ways appears much easier to solve than arranging market rate financing. However, even though development of housing for separate income groups is the norm in San Juan, the long-term viability of this type of development is under threat. In the case of developments that rely on HUD subsidies, guidelines for programs such as HOPE VI recommend mixed-income development for new housing projects.

The fourth transit supportive housing prototype tested is the mixed-income development. This analysis is the least convincing since there is little contemporary experience with this type of development in San Juan and the rest of Puerto Rico. Too many variables remain unknown for this type of development, some of which are crucial to investment decision making. One of these variables has to do with the reaction of the price of the market rate units in San Juan to the mixed-income concept. Given that the surplus revenues generated from the sale of market rate units will determine the level of internal cross subsidies for the development, it is important to have an indication of the direction and magnitude of this price reaction. The expectation is that the average sale price of market rate units will fall but there is no way of knowing how much this decrease will be. However, the mixed income development that was evaluated included a luxury high-rise development in which 15 percent of the units were subsidized. The result of the analysis shows that the development will have a positive NPV if the market units were sold at a price equal to the current market average.

6-2: A Parting Word

San Juan, Puerto Rico is an interesting place to study housing markets or other real estate markets. Several similarities exist between San Juan and cities of similar size on the US

mainland. The most compelling area in which this comparison rings true is finance where mortgage terms and return expectations to both debt and equity in Puerto Rico can be linked directly to the US commercial mortgage banking industry. Apart from this financial connection, the similarities with the US end and the operational dynamics of the local building industry take over. Therefore, the analysis drawn from this research can account for most of the decision making with regards to what happens to the land around the stations. However, before any transit supportive real estate development can begin in San Juan, several non-quantitative factors must be taken into consideration.

First, the San Juan Planning Board appears to have only a limited role in development of Tren Urbano. This entity needs to pay more careful attention to the implications of the transit system to the form and function of the Greater San Juan area. Given that Tren Urbano may have a significant impact on the city in the future, the planning authority needs to begin to answer how this building process will be managed. Transit supportive development will be a new addition to the current construction, and its relative position in a competitive environment needs to be decided. This decision can be made now. Waiting until Tren Urbano begins revenue service will cause valuable time to be lost.

Second, Tren Urbano itself needs to move beyond the stage of designing the areas around the stations and begin to think in terms of implementation. It is clear that transit supportive development is one of the priorities of the comprehensive plan to shift some of the burden of commuting in San Juan from the automobile to rail transit. Therefore, it is important for all of the questions raised in this research to become part of the discussion at Tren Urbano. This will allow for more precise forecasting of future development such as new housing, offices or another property type.

Third, in keeping with the need for more detailed forecasts of development potential, the data collection in all property sectors in Puerto Rico needs to be revised. In efficient capital markets, good decisions are based on quality information. It is important for Tren Urbano to keep a closer eye on the land market and the property development market. This will facilitate more effective decision making by its managers who negotiate property development deals with private developers. Based on the state of the information that was provided by Tren Urbano and the interviews with some of the senior managers, it is clear that this is one of the weakest links in the entire process.

Finally, most successful real estate projects involve partnerships between the public and private sectors. Currently, the lack of a clear vision for future land use at any of the stations will prevent a successful partnership from being formed. The critical link in this process is the participation of developers, particularly on the housing side, that is not always easy to arrange.

6-3: Recommendations

The factors that can bring about a successful transit supportive housing project in San Juan can be summarized in the following terms:

- **Enhance the real estate development division at Tren Urbano**

  Many transit authorities have large real estate divisions that actively pursue development deals of the type and scale proposed here. These divisions play a coordinating role in the implementation of real estate projects near the stations.

- **Begin a discussion with developers:**

There are only a small number of property development companies in Puerto Rico that have the capacity to raise the large equity investment requires to develop transit supportive housing at the scale proposed in the paper,

- **Consider a model project:**

  The development of a high profile model project at one of the stations will help Tren Urbano to achieve two objectives -- market the new transit system and provide walking access to the station. This model project can include walk-up condominiums in which Tren Urbano provides the coordination effort and opens the project to a competitive bidding by developers.

In the end, the new transit system will be built out over the next decade and the real estate component around the stations will develop over an even longer period. One of the characteristics of land development is that decisions made on what to build have long term consequences that can extend for decades. Getting it right the first time for Tren Urbano is imperative. The viability of the system in the future years will hinge on appropriate property development decisions today.

6-4: Areas for Future Research

The development of transit supportive real estate remains a rich area for research. Several topics on Transit Oriented Development are already well represented in urban planning and architecture journals, but rigorous treatment of the topic is only beginning to emerge in the real estate finance and economics journals[1]. The study of transit supportive development needs to be populated with more finance and economics studies in the following areas:

- The impact of the Location Efficient Mortgage on homebuyer demand.
- The impact of the Location Efficient Mortgage on financial institution response to transit supportive housing development.
- A comparison of prices for market rate units in mixed-income developments with market rate units in the same city.
- The public reaction to transit supportive housing in San Juan. This study could use a qualitative approach that is based on a focus group method.
- A detailed analysis of the homebuilding industry in Puerto Rico and its reactions to Tren Urbano.

Chapter Six End Notes

[1] After, an extensive search of the journals at the MIT libraries and the Lexis/Nexis® online database, there was very little in real estate finance journals on the Transit Oriented Development. Most of what exists on TOD is confined to architecture and urban planning journals. Only the Urban Land Institute publication by Eppli and TU (Valuing the New Urbanism, 1999) provides an indication of rigorous financial treatment of this emerging (or re-emerging) form of real estate development.

Appendix A

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