Land Use Planning in the Port of San Juan, Puerto Rico

by

Sebastiano Parmegiani

Laurea Humanities
University of Padua, 1990

D.d.R. Urban and Regional Geography
University of Pisa, 1995

SUBMITTED TO THE DEPARTMENT OF URBAN STUDIES AND PLANNING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER IN CITY PLANNING
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

FEBRUARY 2000

Signature of Author: _____
Department of Urban Studies and Planning
January 14, 2000

Certified by: _____
Henry S. Marcus
Professor of Marine Systems
Thesis Supervisor

Accepted by: _____
Paul J. Smoke
Professor of the Practice of Development and Planning
Chair, MCP Program

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ABSTRACT

This thesis addresses the question whether and how a large transportation infrastructure, in this case a port, can co-exist with a large metropolitan area. The case study analyzed is the redevelopment of the port and waterfront of San Juan, Puerto Rico. The first part reviews how the undergoing changes in the shipping and cruise industry affect ports and cities. It also reviews the developments currently proposed along the waterfront of San Juan. The second part develops a Trip Generation Distribution Computerized Model. This model proposes a methodology to analyze the traffic impact the proposed developments have on the overall roadway network. The third part constitutes an Urban Design and Land Use proposal for a district of the San Juan metropolitan area, Isla Grande. The conceptual transit-oriented development proposal shows a way to accommodate growth that benefits the city and the port, while contributing to alleviate traffic problems. As a contribution to enhance communication between all the stakeholders, a Web Site is developed as part of this thesis.

Key Words: Puerto Rico, Port Planning, Cruise Industry, Waterfronts, Traffic Modeling, Urban Transportation, Urban Design, Land Use Planning, Transit Oriented Development.

Thesis Supervisor: Henry S. Marcus
Title: Professor of Marine Systems

Table of Contents

Motivation

This research is an exploration into the future of San Juan's waterfront.

The overarching question this thesis addresses is whether and how a large transportation infrastructure, in this case a port, crucially important for the economy of the island, can co-exist with a large metropolitan area that is trying to re-invent and re-design itself, after decades of urbanistic neglect.

There are two main issues at stake:

What role will the Port play in the future of San Juan?

What development is possible and advisable for the waterfront?

These issues are not unique to San Juan. However, San Juan being an island, fairly industrialized and comprising a large metropolitan area, a commercial port will always be needed. On one hand the Port can co-exist with the city, in its present location, in which case it is worth thinking of the implications of this choice for the future development of San Juan. On the other hand its activities can be partially or entirely relocated elsewhere on the island, in which case large amounts of redevelopable land would be left: it is important to understand what impact this would have on the metropolitan development. In the present situation, the city development also poses constraints to the future of the port, both in terms of competition for land and in terms of accessibility.

In the first order of approximation, the activities of the port can be divided into two categories: cruise port and commercial port. The cruise port activities are very much

tied to the destination, i.e. to the characteristics of the city of San Juan. For this reason, it is unlikely to imagine that the cruise port will ever move away from San Juan. The commercial activity of the port has San Juan as its origin and destination for most of its traffic. However, other factors, like good sea and road access, larger marshalling areas, and the like, may counterbalance the location advantage if the port - or part of its activities -is moved elsewhere. As I describe later, current plans are proposing to concentrate all cruise activities along the San Antonio Canal, while the commercial port will be concentrated in Puerto Nuevo and along the southern shore of Isla Grande.

A number of developments are currently proposed or under way along the waterfront. Several studies have addressed a few of these projects. It is important to try to understand whether all of them can co-exist or are conflicting. This analysis could be done from several points of view. In this research, I have studied the impact that they would have in terms of transportation. This is particularly relevant in San Juan because of the high degree of congestion that the road network experiences for several hours every day.

In order to do this, I have produced a computer model. Its function is to evaluate the traffic impact of the developments. It gives two results:

- What is the impact of each single development in terms of trip generation;
- What is the impact on each roadway of one or more of these developments together.

The structure of the model is straightforward. It subtracts the generated traffic, as calculated according to the ITE Trip Generation manual[1], from the existing capacity of the roadway less the existing traffic. When a planned capacity improvement is the case, it also subtracts the same generated number from the planned capacity. This is done for every development. Finally, it calculates for each roadway the resulting capacity in the case that one or more of the planned developments actually occur. While this model is straightforward, it produces answers which planners do not currently have.

Once analyzed the relationship between city and port, and studied the impact that developments along the waterfront may have, I developed a Land Use and Urban Design scheme that proposes a transit oriented redevelopment for Isla Grande. This proposal is meant to redevelop the waterfront while maintaining a working port in the city, showing that this is in the advantage of both the port and the city. Its approach provides an alternative to automobile-based transportation, maximizing both the resource offered by the Bay as a potential for water transportation, and the new rapid transit system under construction, Tren Urbano. It is meant to accommodate future residential and office space growth in a high quality environment. It identifies new functions that can contribute to the cultural and economic progress of the city. Finally, it constitutes a first step towards what San Juan seems to lack the most: strategic thinking and a metropolitan plan.

Finally, I used Web based technologies to create a Web Site for the waterfront of San Juan. This is meant to help overcome the piecemeal approach and provide a virtual

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[1] INSTITUTE OF TRANSPORTATION ENGINEERS, 1997.

forum for envisioning the future of San Juan. Initially the target of this Web Site is the professionals who are in different ways involved with the various projects. Subsequently, though, I imagine that the population of San Juan at large may be interested in it.

One such tool may be valuable in San Juan where the planning environment tends to be very fragmented. There is no tradition of metropolitan strategic planning and each of the several agencies involved tends to work in loose connection with the others. This often leads to miscommunication and lack of the so-called "big picture".

1 Introduction

Recent Changes in the Shipping Industry and their Consequences on Ports

1 In the course of the past 40 years, the shipping and cargo industry has undergone dramatic changes. The traditional shipping methods and warehouse storage criteria have been replaced by the use of containers and the container port module has become widespread. Secondly, in search of economies of scale, the size of container ships have increased, to the extent that most of the larger ones can only enter a very limited number of ports worldwide. Accordingly, the circulation pattern that has emerged includes a number of large regional (i.e. sub-continental) transshipment ports, where containers are transferred from the large oceanic ships to smaller ships that serve a number of smaller ports in the region (and vice versa).

Transshipment, defined as "the transfer of cargo between an origin and a destination via an intermediate point"[2], optimizes the utilization of line-haul vessels, through the consolidation of containers whose origin or destination is a secondary port and the handling of these containers during a single port call. Thus, it is possible to reduce the number of ports of call for the long-haul ship minimizing the loss of potential customers, to efficiently serve local markets, and to link major global trade routes by pairing the origin of one route to the destination of another. In this way a carrier can

[2] VICKERMAN - ZACHARY - MILLER, 1997.

increase line-haul productivity maximizing vessel utilization and service offerings, without increasing the size of its fleet.

There is a direct relationship between transshipment activity and size of vessels. The tonnage of container ships has increased up to the Post-Panamax size, so called because they are too large to transit the Panama Canal, which may exceed the capacity of 5,000 TEU[3].

Two consequences derive from the size of these ships: first of all – as mentioned above - the larger ones can only be accommodated in the largest ports; secondly, their costs are such that shippers have to maximize time underway and minimize time in port. Both factors play in favor of the transshipment activity[4].

Another factor that recently has boosted transshipment services is the consolidation of the shipping industry, in itself a result of the search for economies of scale.

Among the relevant issues that shippers may consider in deciding where to locate their transshipment centers are the following:

- the accessibility of the port to the largest vessels
- the capability of terminals
- The proximity to major local markets
- The costs of the port, including pilotage, tugs and dockage
- The costs of handling cargo, including vessel stevedoring, terminal and wharfage.

The Caribbean islands constitute a possible location for a major port that serves the principal shipping routes between the Americas on the one side, Europe, Africa and the Suez Canal traffic on the other side. Indeed, the characteristics and state of its hinterland's economy drive the volume of traffic of a port. In the case of a small island, the geographical boundaries of the hinterland are constrained to the island itself. Accordingly, unless favorable changes occur in the economy, a Port Authority has little room for attracting new business, since the new entrant would probably take market share from one of the existing competitors. On the contrary transshipment may divert traffic from other ports thereby representing a growth opportunity. Some competition between Caribbean ports to attract transshipment activity is currently occurring. A number of proposals about building a major facility are talked about in the area but no such large infrastructure exists.

Major transformations have occurred also in the ports themselves and in the relationship between ports and cities[5]. Containerized ships can be as much as four times larger than traditional general cargo vessels. Accordingly, longer docks, deeper drafts, as well as larger marshalling areas (up to ten times larger) are required to handle all the operations. The adoption of advanced port technologies may imply further changes in the port layout. Landside accessibility by road and train is crucial for a major port because goods need to be easily transferred to trucks, trains and pipelines. In most cities these requirements are very hard to meet. Indeed, only a few cities

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[3] Twenty-foot Equivalent Unit: it's the standard unit of capacity used in the shipping industry, based on the size of a twenty-foot long container.
[4] The previous considerations about transshipment are based upon: VICKERMAN - ZACHARY - MILLER, 1997.
[5] BEINART, 1998.

(notably Vancouver, BC) have been able to expand their existing ports, while most others (among which Barcelona, Marseilles, Melbourne, New York, Singapore, and Sydney) had to build completely new ports far away from the city, in their search to preserve a competitive advantage.

The relocation of ports has profound effects on cities. It generated vast amounts of redevelopable waterfront areas, creating opportunities to re-connect the cities to the water. However, it also deprived cities of a once active environment, so that cities had to learn how to re-use their waterfronts.

2 Another, more recent trend is the growth of the cruise industry. The growth is due to both new customers and repeat users i.e. passengers who have had at least one cruise before. In the U.S. specifically, repeat users have been the majority of total cruise passengers since 1994[6]. Because of the presence of repeat users, cruise operators need to add new destinations and routes frequently, in order to compete effectively.

A number of reasons have been proposed to explain the recent growth in the cruise industry, among which certainly[7]:

- The increase in life expectation in the rich countries, which has increased the figures of elderly population
- The appearance of new countries as suppliers of tourism
- The accessibility of tourism products once reserved to a minority
- The generalization of specific or alternative forms of tourism.

An example helps describing the impact of the cruise activity on ports and cities. On January 17, 1999 twelve cruise ships owned by eight different cruise lines called at Port Everglades (Florida) disembarking 30,000 passengers. Port Everglades provided 2 million gallons of fresh water, 12,000 tons of fuel and processed 50,000 pieces of luggage. About $325,000 in Port revenues were generated in one day.

The growth in the cruise activity will force those ports that want to profit from this business to improve their facilities. In particular, berths must be able to accommodate

[6] PUERTO RICO PORTS AUTHORITY, 1996.

ships up to more than 800 feet long and terminals must accommodate up to 2,000 passengers (and luggage in the case of homeports).

One unresolved issue in the industry is how to define the optimal mix between home-porting vessels and port-of-call vessels. Homeport is the port where a ship starts and ends the cruise: therefore it is the location where it embarks and disembarks passengers, as well as where it is serviced. Ships usually leave and come back on weekends so home port terminals are very much used on Fridays, Saturdays and Sundays. The opposite is true for the so defined ports-of call, the locations where a ship stops during a cruise, without embarking or disembarking passengers. In this case ships call during weekdays, arriving in the early morning and leaving in the late afternoon or evening. As a result, from a scheduling point of view, home ports and ports of call present a significant degree of complementarity.

The contribution of port-of-calls to the local economy primarily goes to the shops and restaurants and tourist attractions, particularly to those located close to the port. Ground transportation modes (taxis and tour buses) may also benefit, depending upon the distance of major tourist attractions from the port.

Port-of-call terminals may be very simple, just providing gangways and minimal temporary parking spaces for taxis and tour buses. They generate less revenue but the capital investment needed is also much smaller.

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[7] CASTEJÒN, 1994.

The choice of ports-of-call is very much tied to the attractiveness of the place from a tourist standpoint. The presence of good facilities is an obvious pre-requisite but, because of the modest requirements, it is also easy to be satisfied. The natural setting, historical heritage, quality of retail, safety and security are more important.

Home-porting generates additional revenues for local businesses primarily because of:

- The use of the airport
- The use of ground transportation
- The eventual stay of cruise passengers at hotels before and/or after the cruise.

However, services and equipment for loading and unloading ships have to be provided. Terminal modules are much more expensive for homeports than for ports-of-call. They need to provide check-in/out facilities, baggage-handling systems, technical equipment to load and unload ships, parking. The addition of retail facilities may contribute to offset the operating costs of the terminal.

Operators consider five main factors in choosing homeports[8]:

- The size of the local market, that may contribute some traffic, and especially last minute passengers able to accept discount fares offered to fill a ship (wealthy retired citizen being the ideal market with respect to this)
- Passenger access, i.e. the presence of a major airport, with direct no-stop flights to/from major destinations and with a good record in terms of punctuality, baggage

[8] PUERTO RICO PORTS AUTHORITHY, 1996.

handling and the like, as well as good ground accessibility between the airport and the port

- The quality of the facilities available or the opportunity for a cruise operator to develop private facilities, individually or as a joint venture with other operators or the port authority
- The proximity to attractive ports of call
- The presence of local attractions, since a significant number of passengers spend one or two nights before and/or after the cruise, either for pleasure or to arrange a better transportation schedule to/from home.

As in the case of commercial ports, some cities have dealt with the requirements of the cruise activity by relocating the port outside of the city. Other cities, notably Barcelona, have transformed their old ports into attractive cruise ports.

3 The changes in the shipping industry and the growth of the cruise industry both play a strong role in San Juan. In order to accommodate the largest vessels and to gain better landside access, the Port Authority is consolidating most cargo activity in Puerto Nuevo, leaving the old San Antonio Canal port to cruise activities.

The San Antonio Canal is a very attractive location for the cruise ships because of its adjacency to the historic district of Old San Juan, by far the main tourist attraction in San Juan. Cruise ship passengers can walk to any destination in the old city, directly from the cruise terminals.

The presence of the cruise terminals and of Old San Juan has attracted hotel development towards the waterfront of the Isleta, the small Island where San Juan is located, which is connected to the mainland island via two bridges. Significantly enough, the latest hotel built, the Windham Hotel and Casino, sits across the street from the cruise terminals, on land formerly occupied by cargo port activities. The replacement of traditional industrial activities with hotels, retail, and other tourism-related activities is a dominant trend in San Juan.

All these transformations can have a beneficial effect on the city's economy, but also pose threats, in terms of traffic impacts as well as in terms of the quality of the urban environment they produce, that need to be carefully evaluated. This is the fundamental goal of this thesis.

Problems in Waterfront Redevelopment

"Strictly tied until a recent past, ports and cities have progressively gotten separated in physical and, even more, psychological terms in the course of the second half of this century. [9]" This evolution has provoked a disassociation of the ties between the port actors and the urban populations, who have lost the almost daily contact with the things-of-the-sea and of the ancestral solidarities city-port.[10] The population has been confined between the nostalgia and the glorification of a past with no relationship with the reality of the new activities.[11]

Since the 1970s, a number of projects have transformed the waterfronts. Initially they were primarily market driven, like in the case of Baltimore or London; subsequently, especially in Europe, it was the public sector that took the lead in these transformations. However, the common denominator of these projects was to wipe out the port and make the areas available for the real estate market and the tourism/entertainment industry.

In my opinion, no matter how successful these projects may have been from a financial standpoint, the risk is that they create an environment almost identical from city to city. In a survey of Canadian waterfront transformations, it has been noted that "emulation of successful schemes elsewhere is a recognized factor in waterfront

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[9] VIGARIÉ, 1972.

redevelopment".[12] The report was based on a series of interviews, and one comment was particularly on target: "They pretty well look all the same. I honestly don't believe there's a heck of a lot of difference ... They've got housing and restaurants and boutiques. Some are a little cuter than others, they all have a maritime theme about them, made to look like a ship or some kind of seashore walk ..."[13].

It's not just a matter of architecture. On the one hand, there is an issue of city form. The wall that once separated - metaphorically or physically - the city from the water has often been replaced by a long-shore promenade, generally pleasant in itself, but not necessarily linking the waterfront to the rest of the city. On the other hand, the preservation of some port function could have made these waterfronts less mall-ish.

Today the point is no longer that of declassifying obsolete port sites in the city center, in order to make them available for tourism or residential. This mono-functional antagonism has disappeared. The old basins are indeed the object of significant real estate developments, but the purpose of this is to pull towards the city the international activity it needs.[14] Therefore, there is a "... need to create places that reconcile this old and backwards-oriented image with a real and modern representation of the port.[15]"

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[10] CHARLIER - MALÉZIEUX, 1994.
[11] BAUDOIN - COLLIN, 1994.
[12] HOYLE, 1995.
[13] Interviewee, in: HOYLE, 1995.
[14] BAUDOIN - COLLIN, 1994.
[15] BAUDOIN - COLLIN, 1994.

The cruise activity offers a unique opportunity to transform what in the last fifty years has been the darkest part of cities, in a vibrant interface where the activities of the city and those of the port co-exist and complement each other. Tourism and entertainment are becoming the major component of many cities' economy (San Juan is certainly one of them): this change in function has to be reflected in a change in form. The latter can't simply be a beautification of the waterfront promenade. It must consist in rethinking the design, the use of land, the infrastructure needed to make the contemporary city work. Whereas ports often provide large chunks of wasteland which makes redevelopment possible, a piecemeal approach to their redevelopment can transform an opportunity in a threat (for instance in terms of traffic).

The question - dear to planners - of an "urban re-conquest" of the abandoned port spaces, based upon purely real estate projects or leisure activities, is nowadays leaving its place to the willingness of different local stakeholders to create an economic space at the center of the city. Avoid Disneyport where water is nothing but a decorative element, dear to architects, to attract new tertiary and service activities necessary to the place. This research of new economic potentials around these central urban spaces represents a new enterprise within which urban and port actors participate in a reflection on the city. [16]

A new attitude would be represented by a strategy of anticipation of the brownfield, in order to progressively create mixed functions, urban and maritime.[17] This thesis

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[16] BAUDOIN - COLLIN, 1994.
[17] PRELORENZO, 1998.

provides an example of this strategy in its third component, the Urban Design and Land Use proposal for Isla Grande.

Puerto Rico: Generalities

Puerto Rico is the smallest, easternmost island of the Greater Antilles. It is 110 miles long and 35 miles wide, the total area being 3,500 square miles. Columbus landed in Puerto Rico on his second voyage in 1493. At that time several tribes of "Indians" populated the island. In 1508 it became a Spanish colony. In 1899, as a consequence of the Spanish-American War, Spain ceded Puerto Rico to the United States. US citizenship was granted to Puerto Ricans in 1917. Since 1952, the Commonwealth of Puerto Rico is an independent state associated with the United States of America.

Puerto Rico: Basic Data	*Source: CIA (1999)*
Geographic coordinates	18 15 N, 66 30 W
Area	
total	9,104 sq. km
land	8,959 sq. km
water	145 sq. km
Coastline	501 km
Climate	tropical marine, mild; little seasonal temperature variation
Terrain	mostly mountains, with coastal plain belt in north; mountains precipitous to sea on west coast; sandy beaches along most coastal areas
Lowest elevation point	Caribbean Sea 0 m
Highest elevation point	Cerro de Punta 1,338 m
Population	3,887,652 (July 1999 est.)
0-14 years	24% (male 482,111; female 459,940)
15-64 years	65% (male 1,220,682; female 1,323,787)
65 years and over	11% (male 173,133; female 227,999) (1999 est.)
Population growth rate	0.59% (1999 est.)
Birth rate	15.9 births/1,000 population (1999 est.)
Death rate	7.87 deaths/1,000 population (1999 est.)
Net migration rate	-2.15 migrant(s)/1,000 population (1999 est.)

Table 1

The Puerto Rican economy is very much tied to the US's. The combined effect of duty free access to the US and tax incentives - initiated subsequently to the Cuban crisis - has driven US firms to invest heavily in Puerto Rico since the 1950s. In particular, a major role has been played by the so called 936 Program which granted a 100% offsetting tax credit to U.S. companies on the profits earned from Puerto Rican operations and the interest they earned on them, as long as the profits remained on the island. It is estimated[18] that the 936 Program generates, either directly or indirectly, one third of all jobs on the island.

From the 1950s to the 1970s economic growth averaged 6.5%. In the 80s and early 90s it fell to an average of 2.1 %. This induced the Government to develop the New Economic Development Model (NEDM), which emphasizes growth in external trade, science and technology, privatization and deregulation of industry.

One of the spin-offs of the NEDM is the Tourism Development Act of 1993 that provided tax exemptions on tourism-related income and assets. The three main tourism components of NEDM are the Puerto Rico Tourism Development Fund, which guarantees financing for qualified projects, the upgrading of tourism related infrastructure including the airport, new marketing and advertising campaigns.

In 1996 Section 936 was replaced with Section 30A, which basically eliminates tax benefits, simply allowing the existing industries to receive these benefits for a ten-year transitional period.

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[18]PUERTO RICO PORTS AUTHORITY, 1996.

Puerto Rico's per capita income is $7,711 (1996) i.e. 33% of the U.S. per capita income. It increased at a 5.5% rate between 1990 and 1996[19] (4,3% in the U.S). Unemployment was 13.47% in 1997.

Puerto Rico's main economic sectors are manufacturing (41%), trade (14%), services (11%), and Finance, Insurance and Real Estate (13%). The traditional sugar production has lost its historical preeminent role.

The main industrial sectors represented on the island are the following:

- Electronics
- Petrochemicals
- Pharmaceuticals
- Processed foods
- Textiles.

The United States is the main commercial partner of Puerto Rico (86.2% of exports; 69.2% of imports). The main Puerto Rican export commodities are the following:

- Apparel
- Beverage concentrates
- Canned tuna
- Electronics
- Instruments
- Medical equipment
- Pharmaceuticals
- Rum.

The main imports are the following:

[19] PUERTO RICO TOURISM COMPANY, 1998.

- Chemicals
- Clothing
- Fish
- Food
- Petroleum products.

The retail sector is expanding. Èstudios Tecnicos forecasted[20] the growth of retail space in the Municipality of San Juan[21] from 1,205,443 square feet in 1995 to 8,410,784 square feet in 2010.

Tourism is an important source of income on the island as well as in the whole Caribbean region. It's the first in tourist arrivals in the Caribbean and the third in cruise arrivals (after Bahamas and US Virgin Islands). The total number of visitors to Puerto Rico increased from 2.6 million in 1987 to 4.1 million in 1996, at an average growth rate of 5.1%[22]. The number of visitors is projected to be 6.1 million in the year 2005[23]. In particular, cruise ship visitors increased from 584,400 in 1987 to 1,045 million in 1996, at an average rate growth of 6.6%, while their expenditures grew at a 10.5% average rate. In the latter year, cruise ship visitors contributed $75.4 million i.e. 4.1% of total expenditures on the Island. The SPM forecasts a total of 650 cruise line vessel calls by the year 2000, and 775 by the year 2005.

Tourism on the island is negatively affected by seasonality, hotel daily rates higher than the U.S. or international averages and the short duration of stay[24].

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[20] PUERTO RICO TOURISM COMPANY, 1998.
[21] The Municipality of San Juan does not coincide with and is smaller than the San Juan metropolitan area.
[22] BAHÍA SAN JUAN INC., 1998.
[23] PUERTO RICO TOURISM COMPANY, 1998.
[24] PUERTO RICO TOURISM COMPANY, 1998.

The Puerto Rican economy may suffer from an intrinsic weakness or from a potential threat:

- The intrinsic weakness is due to the fact that its performance is very sensitive to the state of the US economy, both tourism and general trade depending upon it
- The potential threat is constituted by the future development of Cuba. The largest market and labor force in the Caribbean, Cuba may pose a threat because of its size, proximity to the U.S. coast, historical remnants.

Therefore, the need for defining or creating a competitive advantage for Puerto Rico is very strong. The infrastructure being relatively more developed than in other Caribbean islands, as well as the fact of being a US territory, may facilitate its role as a home port for cruise ships and a center for business meetings, form large Conventions to smaller, hotel-size type of meetings. Both these businesses require a relatively developed infrastructure, which cannot easily or quickly be developed by Puerto Rico's competitors.

Puerto Rico: Basic Economic Data		*Source: (*) Frederic H. Harris (1999); (**) CIA (1999)*
	1994*	1998 **
National Product	$26.1 bill	$34.7 bill
National product real growth rate	2.6%	3.1%
National product per capita	$7,050	$9,000

Table 2

The Port of San Juan

1 "The Port of San Juan (18°28'04"N; 66°07'04"W) is the leading commercial port in the Commonwealth of Puerto Rico. It lies approximately 30 miles westerly from Cape San Juan at the northeast end of the island, and about 60 miles eastward of Point Borinquen, the northwest end. Classified as the busiest and largest commercial harbor in the Caribbean, the Port of San Juan is also ranked the fourth largest port for container movement and the sixth in cargo movement in the United States. Worldwide, it is listed number 12 for container movement and number 14 for cargo movement."[25]

The Port of San Juan is owned by the Puerto Rico Ports Authority (PRPA), "a public corporation and instrumentality of the Commonwealth of Puerto Rico, created by Act No. 125 of 1942, as amended, to develop, improve and operate any and all types of air and marine transportation facilities in Puerto Rico and to promote the rendering of satisfactory transportation services from and to Puerto Rico in the most extensive and economical manner."[26] The Ports Authority also owns and manages the Luis Munoz Marin International Airport and a few other smaller ports and airports on the island, included the San Juan general aviation airport on Isla Grande.

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[25] PUERTO RICO PORTS AUTHORITY.
[26] PUERTO RICO PORTS AUTHORITY.

Regular transport service is provided by about 40 shipping lines to nearly 80 US and foreign ports. Average sailing time[27] is:

- 2.5 days to New York
- 3 to 4 days to other North Atlantic and Gulf Ports
- 10 days to the US West Coast
- 14 days to Europe

Port to Open Ocean time is about 30 minutes. From a legal standpoint shipments to/from the US mainland are domestic. According to the Strategic Master Plan, in 1993 75% of the total containerized trade was inbound.

The main container carriers calling at San Juan are Crowley, Navieras and Sea-Land. The Commonwealth of Puerto Rico formed Navieras in 1974 through the acquisition and subsequent merger of the then existing three major liner services (American Trailer Transport, Sea-Land and Seatrain). Navieras has been the dominant carrier in what is also its primary business, the line shipping between the island and the U.S. mainland. The company has been privatized in 1995. Sea-Land, a U.S. headquartered global intermodal transportation company, entered the U.S. - Puerto Rican trade again in the 1980s. Crowley American Transport is a subsidiary of Crowley Maritime, Inc., a large U.S. marine services company. Sea Barge has been operating barge services between Puerto Rico and the U.S. since 1985. Trailer Bridge is also a U.S. licensed motor carrier, thereby able to offer truck and ship service between Puerto Rico and anywhere in the U.S. mainland.

[27] FREDERIC R. HARRIS INC. (unpublished report: 01/08/99).

Cargo can be subdivided into four categories:

- Containerized
- Liquid Bulk
- Break Bulk
- Automobiles.

Containerized cargo is physically transported in containers and trailers. It accounts for the largest share of San Juan's trade. Three shippers (Sea-Land, Navieras and Crowley American Transport lease their own terminals from the Port while two of them (Sea-Barge and Trailer Bridge) use the Army Terminal. The shippers offer a variety of RO-RO, LO-LO vessels and barges.

Liquid Bulk is transported in tankers or tank barges. It is received at two locations on Puerto Nuevo, the Cantano Dock (Texaco, Esso and Shell) and the Gulf Oil Dock (Caribbean Petroleum Refining Corporation). Break Bulk is a small component of San Juan's activity, carried out on a non-regular schedule basis. Automobiles are a sub-set of the Break Bulk trade.

2 A report[28] by the consulting firm Vickerman - Zachary – Miller in association with Mercer Management Consultants identifies the following as competitive advantages of the Port of San Juan:

- The economy of San Juan, one of the strongest in the Caribbean
- The strong existing tenant base, constituted of several large carriers
- Its location, in itself an attraction for tourism and cruise departures
- The skilled labor force
- The developed road network
- The geographic advantage for certain transshipment routes.

The potential for transshipment activity in San Juan is tied to the competitive advantage that the port may offer in terms of costs, facilities and services. It may attract existing and future traffic that either passes through the region or is currently using a different Caribbean port.

The study by Vickerman - Zachary - Miller suggests that the route East Coast South America – United States East Coast is the only one for which San Juan has a geographic advantage. According to the study, the size of this route's market was 526,000 TEU (1994), including the containers that are already being transshipped. The conclusion of the study is that even if San Juan could capture 50% of the market, it would still need only a modest facility.

The report also identifies the relative strength of San Juan in terms of total storage space and terminal efficiency, if compared with other Caribbean ports. Though, some degree of terminal congestion, the limitation in the number and capacity of cranes and

[28] VICKERMAN-ZACHARY-MILLER, 1997.

the current lease agreements, that constrain an otherwise large berthing space, have the effect of somewhat reducing the competitiveness of the Port. Perhaps, the most difficult competitive issue to overcome for San Juan would be its costs, relatively higher than other Caribbean Ports'.

Some skepticism may arise about the road network. It is well developed in relation to any destination on the island but, focusing at the intra-city scale, a high degree of congestion exists.

The port facilities occupy an area of 482 acres, subdivided as indicated in the table to follow.

Summary Of Port Of San Juan Inventory Of Facilities, By Cargo Type	*Source: Strategic Master Plan (1996)*
Cargo Type / Use	Approximate Area (in acres)
Containerized / Ro-Ro Cargo Terminals	326
General Cargo Terminals	51
Automobile Terminals	32
Liquid Bulk Terminals	13
Dry Bulk Terminals	19
Passenger / Cruise Terminals	41
Total Acres	482

Table 3

The Strategic Master Plan computed the Maximum Practical Capacity (MPC) for each facility. The results are indicated in the table to follow.

Summary Of Existing Maximum Practical Throughput Capacity (MPC)		*Source: Strategic Master Plan (1996)*
Cargo or Passenger Facility Type	Quantity	
Containerized Cargo	1,644,500 TEU	
General Cargo	1,397,100 Short Tons	Short Tons
Automobiles	252,500 Short Tons	Short Tons
Liquid Bulk	8,015,600 Short Tons	Short Tons

Table 4

The MPC is then compared to the existing throughput capacity, as the table to follow shows.

Port of San Juan Annual Cargo Throughput – Actual versus Maximum Practical Capacity (MPC) - 1994			*Data in Short Tons (in 1,000s), based on 5.9 short tons per TEU*	*Source: Strategic Master Plan (1996)*
	Automobile	General Cargo	Liquid Bulk	Container
Actual	129	1,079	5,719	5,719
MPC	253	1,397	8,016	9,699

Table 5

According to the analysis presented in the tables above, the Strategic Master Plan estimated the future facilities need for the Port of San Juan. The estimate basically subtracts the MPC of the existing facilities from the 20-year forecasts. Further refinements were added, in order to reflect planned improvements. The result is outlined in the table to follow.

Summary of New Modules Required	*Total Includes Cruise Modules shown in a different table*	*Source: Strategic Master Plan (1996)*
	Total Modules Needed	Module Acres Needed
Container	6	60
General Cargo	4.5	90
Automobiles	1	15
Liquid Bulk	.75	15
Total	23	479

Table 6

Since this Strategic Master Plan is not currently implemented[29] by the Ports Authority (although being officially the Master Plan), a detailed description of the final recommendation and phasing would be redundant. However, it is worth highlighting the elements that still guide the actions taken by the Ports Authority:

1. The Strategic Master Plan identifies a bad allocation of the existing container facility configurations at Puerto Nuevo and Isla Grande. Several operators lease remote storage space. These satellite yards require drayage practices and higher costs

2. In terms of operations, the prevailing all-wheeled mode of operation uses much more land than other storage modes. Also, lengthy dwell times are commonly offered at San Juan

3. The Bar Channel, Army Terminal Channel are below the current standards adopted in the industry. The San Antonio Channel is adequate for cruise ships but lacks a turning basin, so that ships that call at the inner end have to be backed in by tugs.

[29] The source of this information is an interview with the Puerto Rico Ports Authority.

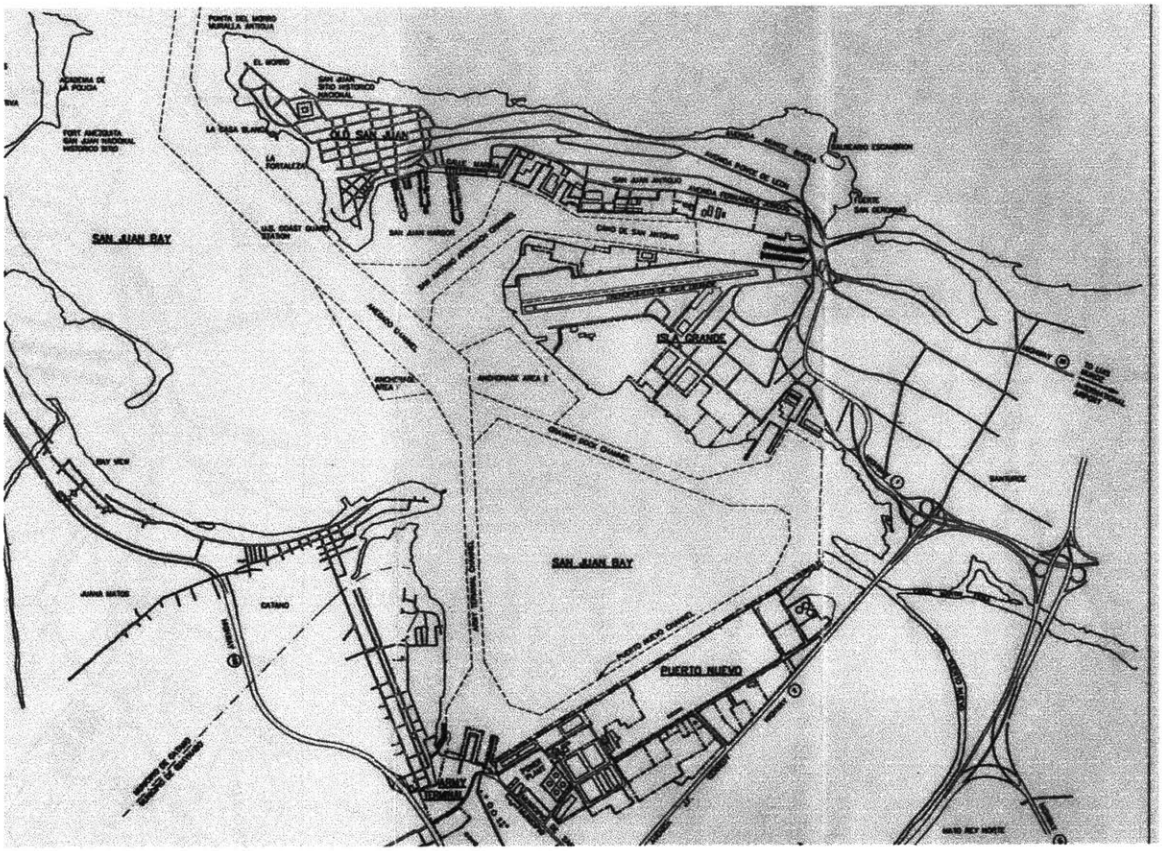

Figure 1

The Port of San Juan

Source: PRPA, 1997

3 San Juan is also the third largest passenger port in the Caribbean, after Nassau and Saint Thomas - St. John. According to the Strategic Master Plan, 112 cruise ship passengers visited S. Juan in 1994 and 67% of the ships were home-porting. Twenty-five different companies called San Juan, for a total of 55 different vessels.

San Juan Cruise Statistics, 1994			*Source: Strategic Master Plan (1996)*
	Homeport	Port-of-Call	Total
Passengers	588,253	379,859	968,112
Ship Calls	530	263	793
Passengers/Call	1,110	1,144	1,221
Average Size of Ship			
Length (feet)	656	698	670
Draft (feet)	24.7	23.6	24.3
GRT	35,634	47,171	39.441
Average Berths per Ship	1.131	1.510	1.256

Table 7

The forecast or the future is a steady growth, as outlined in the table to follow.

Compound Annual Growth Rates (Cagr) 1995-2015 - Baseline Forecast	*Source: Strategic Master Plan (1996)*
Commodity	CAGR to 2015
Passenger Cruise (Home Port)	4.4%
Passenger Cruise (Port-of-Call)	4.8%

Table 8

The advantage of San Juan for the cruise activity is due to:

- Its geographical proximity to the East Coast of the United States
- The availability of direct, often non-stop flights from the major US airports

- The existence of a good airport facility, relatively close to the cruise port
- The fact that Puerto Rico is a US Territory (same passport, same currency, no customs).

Because of these, Puerto Rico is well suited to be a homeport for the cruise ships. In the case of home-porting, the PRPA enjoys not only the revenues from the cruise ships, but also from the use of the airport. Strategically, this advantage is susceptible to becoming even more important in the future, if Cuba develops as a main tourist destination for the US market. The cruise activity requires expensive facilities, good air transportation and a skilled labor force that cannot easily be developed: therefore the relative importance of cruises in the Puerto Rican tourism economy may be higher in the future than it is today. The impact of cruises is not limited to the Port Activity but also generates revenues for the commercial activities (shops, restaurants) in Old San Juan and for the Hotel Industry (casinos, one/two nights of stay before/after the cruise). Currently 25 different companies call at San Juan.

Summary Of Existing Passenger/Cruise Maximum Practical Throughput Capacities (MPC)	*Source: Strategic Master Plan (1996)*
Passenger Facility Type	Quantity
Passenger / Cruise (Home Port)	622,000
Passenger / Cruise (Port-of-Call)	500,000

Table 9

The calculated MPC is then compared to the Annual Passenger Throughput, as shown in the table to follow.

Port of San Juan Annual Passenger Throughput – Actual versus Maximum Practical Capacity (MPC) - 1994	*Source: Strategic Master Plan (1996)*
	Revenue Passengers (in 1,000s)
Actual	968
MPC	1,122

Table 10

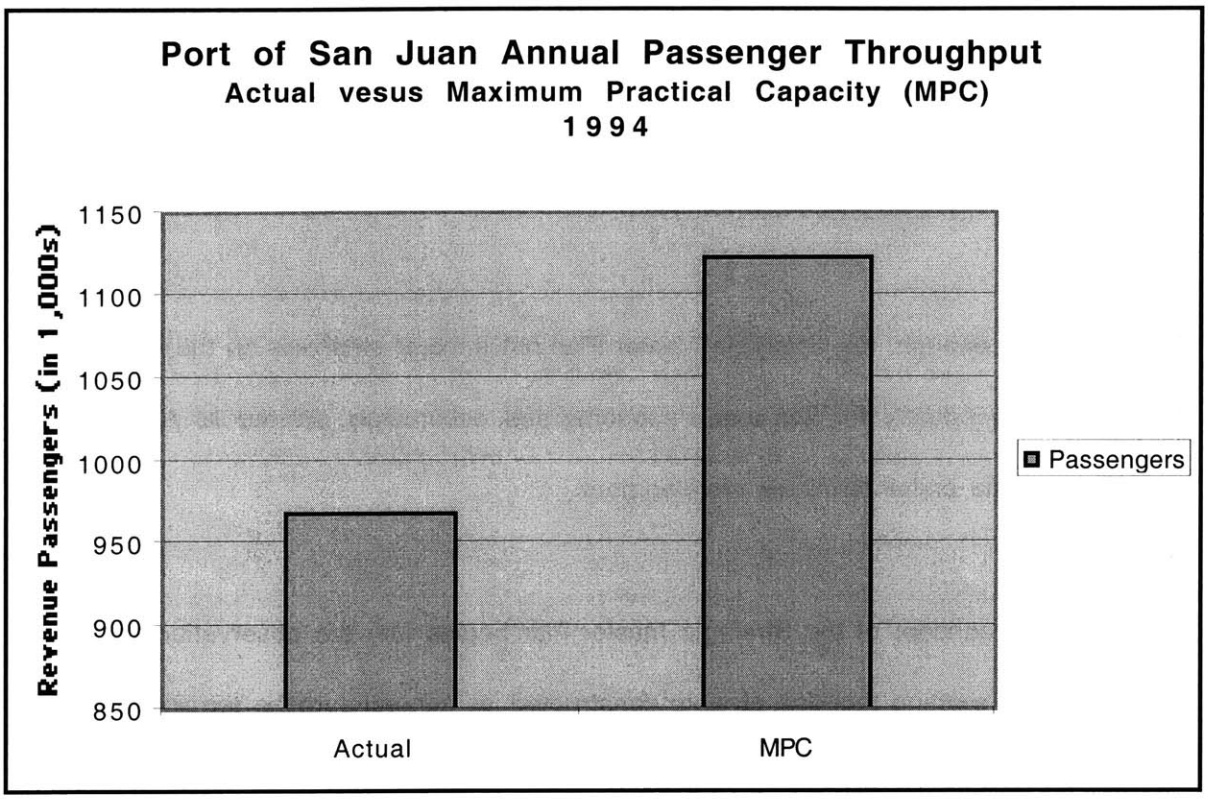

Chart 1

Finally, the Strategic Master Plan also estimates the number of modules that need to be built in a 20-year horizon. The forecast is shown in the table to follow.

Summary of New Cruise Ship Modules Required		*Source: Strategic Master Plan (1996)*
	Total Modules Needed	Module Acres Needed
Home Port	6	45
Port-of-Call	2	8

Table 11

In particular, although the port's infrastructure is relatively developed as compared to potential competitors, San Juan can profit from the cruise industry growth if it will be able to accommodate the largest ships.

Significantly enough, the Strategic Master Plan put a major emphasis on the importance of the cruise industry for San Juan's economy and, accordingly, started its Alternative Plans from the cruise terminals development.

The general concept of the Strategic Master Plan begins with the observation that some of the existing facilities at were constructed as general-purpose terminals, in order to handle both port of call and medium sized home ported cruise vessels. The assumption of a prevalence of port-of-call traffic and small/medium home-ported vessels didn't prove entirely true. Indeed, the larger growing market for San Juan has been large home ported vessels. Since most home-ported ships arrive during the weekend while most port-of-call vessels arrive during the week, a certain degree of sharing of facilities is possible. However, current facilities are inadequate to handle the larger home-ported vessels. Finally, the attractiveness of Old San Juan makes the San Antonio channel very attractive for the cruise operators.

The Strategic Master Plan proposes the redistribution of passenger/cruise activities, the relocation of existing cargo operators and the development of new cruise related facilities along the San Antonio Channel.

The Strategic Master Plan is not being implemented but the basic principles of consolidating cruise activities along the San Antonio Channel, relocating the existing cargo activities, and consolidating cargo on Puerto Nuevo and Isla Grande remain valid.

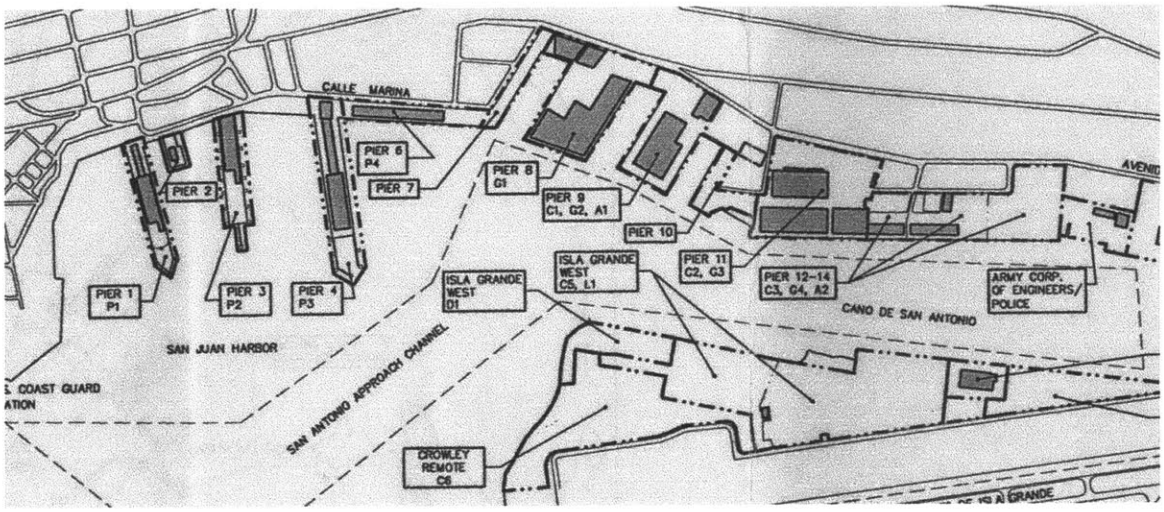

Figure 2

San Antonio Canal: Existing Piers

Source: PRPA, 1997

Plans for the Waterfront of San Juan

1 San Juan was founded in 1521 by the Spanish colonial government as a walled fortified city. The old settlement, including the fortified Morro is nowadays usually referred to as Old San Juan and is classified by UNESCO as a world heritage site.

The population of San Juan is just under one million, or a third of the entire island.

In the 20th century the city expanded beyond its walled confines, known as Old San Juan, to incorporate the suburban centers of Miramar, Santurce, Condado, Hato Rey and Río Piedras.

Nowadays the metropolitan area known as San Juan comprises 3 distinct areas: Old San Juan, the Beach & Resort area, and the other outlying communities, the most important of which are Río Piedras, Hato Rey, Puerta de Tierra, and Santurce.

San Juan is the largest city and processing center of the island, the metropolitan area has facilities for petroleum and sugar refining, brewing and distilling and produces cement, pharmaceuticals, metal products clothing, and tobacco. The port is one of the busiest in the Caribbean. San Juan is the country's financial capital, and many U.S. banks and corporations maintain offices or distributing centers there.

Figure 3

Aerial View of Isleta, San Antonio Canal, Isla Grande

2 The planning documents relative to the area investigated in this study are the following:

- "Plan Maestro para la Isleta de San Juan – Frente Portuario" (1988)
- 'Old San Juan Waterfront Development Traffic and Access Impact Study" (1991)
- 'Isla Grande – Plan Sectorial de Uso del Terreno (1992)
- "Strategic Master Plan for the Port of San Juan" (1996)
- "El Triàngulo Dorado" Vision for Waterfront Development in San Juan Bay (1997).

Two major planning efforts are supposed to update and give coherence to the above documents:

- The Master Plan for the Convention Center District
- The Master Plan for the Canal de San Antonio.

The first plan has been completed in June 1999, the second one is being prepared at the present time. Sasaki Associates, a planning firm based in Watertown, Massachusetts, is in charge of both.

In addition to the actual planning documents, a few other studies have been prepared for this area:

- "Golden Triangle Traffic Study" (1994), prepared by Gee & Jensen
- "Options for Intersection 5" (1996), prepared by Steer Davies Gleave for the Puerto Rico Highway and Transportation Authority (PRHTA)
- "Intersection 5 Bridge/Tunnel Interface Study" (1998), prepared by Barret & Hale / Frederic R. Harris for the Puerto Rico Highway and Transportation Authority (PRHTA)

- "Puerto Rico Trade & Convention Center District: Final Report" (1998), prepared by C. H. Johnson Consulting / Conventional Wisdom for the Puerto Rico Tourism Co.

Two studies currently being prepared, will update the above documents:

- A land-side traffic study of the container port, being prepared by Steer Davies Gleave for the Puerto Rico Ports Authority
- The Old San Juan Traffic Plan, being prepared by the San Juan municipal planning office.

The "Plan Maestro para la Isleta de San Juan – Frente Portuario" aims at the revitalization of the Isleta's waterfront, in function of both the tourists and the local users. It recommends housing development as well as offices, retail and restaurants. In particular, it proposes the conversion of Piers 8 and 9 into a small craft harbor and a marina, along with the creation of a "darsena" on axis with the Capitol Building. The Plan calls for a Transportation Plan that geared towards the promotion of public transportation.

The "Old San Juan Waterfront Development Traffic and Access Impact Study", prepared by Barton-Aschman Associates Inc., was meant to analyze the impact of the then proposed developments upon the road network, parking, public transit, also in relation with the cruise ship activity.

The 'Isla Grande – Plan Sectorial de Uso del Terreno" is the first planning document that proposes the urbanization of part of Isla Grande and the Convention Center. It proposes

the creation of a boulevard stemming out of Avenida Munoz Rivera and defines a grid for the Convention Center District. Most of the document focuses on traffic access and physical infrastructure issues. However, the main concepts will be found also in more recent documents, although significantly modified.

The "Strategic Master Plan for the Port of San Juan"'s recommendations more relevant to planning are:

- The proposal to consolidate the cargo activity on Puerto Nuevo and Isla Grande (South shore)
- The complementary proposal to relocate all the cargo activities currently along the San Antonio Canal, which in turn will be uniquely dedicated to the cruise ships.

"El Triángulo Dorado" Vision Plan isn't an official planning document. It's a vision or a framework, put out by the Tourism Company. The Triàngulo Dorado comprises three areas:

- the Isleta, including the old city and its expansion
- Condado, a narrow strip of land between the Atlantic Ocean and the homonymous lagoon, developed as a low-density residential in the twenties and now site of hotels, restaurants, retail and high-rise residential
- Miramar, which unites Isla Grande with the mainland, is a medium-density, high-income residential community.

The San Antonio Canal separates Isla Grande from the Isleta, and is connected to the Condado Lagoon.

The initiative started in 1996 and, for the first time, the three areas of Isleta, Condado and Miramar are considered together. The vision is built around the water (San Antonio Channel and Condado lagoon) both as connector and differentiating factor. It calls for a development that equally considers tourism development and the needs of the resident population. It aims to constitute an organizational framework, define a critical path for tourism development and establish a series of benchmarks for evaluation.

The major development concepts[30] of the Triángulo Dorado proposal are the following:

- Build on Existing Assets
    - Old San Juan historic preservation
    - Condado Hotels and restaurants
    - Frente Portuario projects
- Recapture Hi-Value Waterfront Sites
    - Connect Miramar to Isla Grande and Waterfront
    - Reevaluate use of land north of San Antonio Canal
    - Expand home port functions at Isla Grande
- Improve Transportation
    - Intersection 5 (connecting Santurce, Condado and Isleta)
    - Baldorioty De Castro and Munoz Rivera Expresssways
    - Isla Grande port and home port access
    - Ground transportation including Tren Urbano extension and junction
    - Possible watertaxi service
    - Pedestrian friendly traffic solution

[30] PUERTO RICO TOURISM COMPANY, 1998.

- Define Cohesive Set of Districts within the areas of
  - Isleta
  - Condado
  - Isla Grande
- Assemble Synergistic Mix of Attractions
  - High quality public spaces and waterfront experience
  - Cultural / entertainment venues
  - Interactive learning activities
- Offer New Residential/Office Options
  - Waterfront loft residential/offices
  - Timeshare/condos
  - Courtyard housing
  - Alternative mass transit connections to employment centers
  - Increased urban densities create both local and tourist retail, restaurant and entertainment demand

The Triángulo Dorado proposal favors residential and mixed-use development because of its synergy with tourism. Density generates a constant demand for retail, restaurants and entertainment, which stabilizes a demand that the fluctuations between the tourism high and off-seasons would otherwise make very cyclical. It also increases the actual and perceived security of the area. Some of the proposed uses, like a Public Market, arts and crafts bazaar, parks and plazas, may serve equally well tourists and the local population. Similarly the main regional-scale attractions, such as an Aquarium or a Children's Museum, can serve Puerto Ricans and tourist, possibly with the former using

these structures mostly during the off-season. Residences will offer housing to – among others - the employees of the Convention Center, the Cruise ship operations and the new businesses. This may contribute to avoiding the generation of additional commuting trips.

The Triángulo Dorado identifies several issues that need to be addressed, among which those more relevant for this study are the following:

- It underlines the importance of maintaining a working harbor, although re-arranging some of the facilities
- It stresses the importance to resolve traffic issues, with particular reference to Intersection 5, i.e. the intersection formed by the two (San Antonio and Esteves) bridges that lead to the Isleta, and the main highways in the island (Baldorioty De Castro Boulevard and Munoz Rivera Expresssway)
- It proposes to reclaim waterfront areas for development and public benefit purposes;
- It promotes the creation of new residential opportunities and to enhance retail choices
- It calls for additional hotel rooms and public facilities
- It proposes the creation of new entertainment/cultural opportunities.

From a design standpoint, the Triángulo Dorado proposal divides the area into Districts, some of which are developable, while others already have a defined function and only need to be tied to the new developments. The total developable area, as identified in the proposal, is just above 400 acres. The developable districts are the following:

- The Embarcadero, corresponding to Piers 8 to 10, proposed as the major spine of the district, which should intersect an axis linking the Capitol Building with the waterfront
- The Muelles, corresponding to Piers 11 to 14, where the proposed market should take place, together with the preservation of some fishery and mechanical watercraft activities, as well as some gallery space in some of the lofty vacant buildings. The upland streets would be connected to the water
- The Paseo District, a proposed waterfront drive and esplanade area between the restored Escambron Park on the north shore of the Isleta and the San Antonio Canal at Frontier Pier. Again, the upland streets would be extended to the water
- The Condado District, already an hotel and upscale residential district, which should be improved and connected to the other districts
- The Convention and trade Center District, including a residential area.

The main design concepts, as listed in the plan, are the following:

- Relocate cargo facilities currently on the San Antonio Canal
- Urbanize land along the Canal
- Extend Ashford Avenue to the Isleta as a "resort" drive
- Extend upland streets to the Channel
- Rebuild existing bridges (Intersection 5)
- Connect Escambron Park to the Waterfront
- Ensure public access to the waterfront, except for port facilities
- Connect waterfront development to Old San Juan to an alameda

- Develop a comprehensive regional open space plan through the connections of parks to greenways
- Develop the north side of channel into three districts, each with its own character
- Concentrate home port on the north side of Isla Grande
- Use the Convention Center district as the new gateway to the city
- Complete the esplanade all around the Condado lagoon
- Connect Miramar to the waterfront via street extensions in Isla Grande and towards the Condado lagoon.

Most of these goals objectives seem consistent with the idea of improving the quality of the urban environment and maintaining the relationship between port and city. However, it is not clear how the Convention Center can be used as a gateway to the city, since it has been placed close to what now is a container port, far away from Tren Urbano and the airport, and not connected to the cruise terminals.

The "Puerto Rico Trade & Convention Center District: Final Report" is a document containing an economic and market analysis for the future Convention Center. Basically a market and feasibility study, it includes an economic profile, a planning analysis, an analysis of facilities and infrastructure, organization and management, project implementation and a financing plan. It is primarily meant to assist the Tourism Co. in deciding about the type and size of the Convention Center (for which it suggests a number of alternatives) and in all the management, financial, implementation issues related with building and getting the Convention Center started.

The main projects concerning the waterfront are the following:

- The Convention and Trade Center District, described in a later section of this thesis
- An 80,000 square feet Aquarium
- The proposed redevelopment of Pier 3 and 4 by Royal Caribbean, which should be extended while the water in between should be filled, so as to build a large home-port terminal, capable of serving the largest cruise ships (Eagle Class), and including up to 300,000 square feet of retail and parking ($20-30 million)
- Other cruise-related developments, including the addition of two/three berths proposed by the PRPA on the site of Terminal 8 and 9, a $15 million investment proposed by Carnival Cruises for Pier 6, a $1.5 million proposed by Princess Cruises for the Navy Frontier Dock and a $1.5 million investment proposed by Celebrity Lines for pier development
- A proposed IMAX theater, to be built by International Theater Corporation
- The renovation of the Caribe Hilton Hotel, which initially will refurbish the existing 670 rooms and subsequently it will add 240 rooms to the property and add a residential building. Contiguously, a few buildings once belonging to the US Navy will be redeveloped as a major upscale entertainment and retail center and more parking will be addded, for a total 2300 spaces. It is expected to be an investment of $225 million
- The Park of the Third Millennium, once Escambron Park, will be redesigned as a passive recreational area
- The Condado Beach Resort will include a restaurant-retail area, a 400 room luxury hotel, a 120 unit time-share , a 75 units boutique hotel, a 75 units residence and

1500 parking spaces. The investment is supposed to be $230 million and be completed by the end of 2001

- The La Marina project, covering 1 acre of Land and comprising 2 residential buildings including 50 units of 1,500 sq feet each in the $300,000 range. The lower floors of the buildings will include 22,000 sq feet of commercial while 100 parking spaces will be provided for the residential component and 111 for the commercial
- The Galeria del Puerto project will include 75,000 sq feet for commercial establishments, 80,000 for office space. An investment of $25 million, it is scheduled to be completed by the end of the year 2000
- The Barrio Capitolio Sur (Capitolio Plaza) project, sponsored by the Puerto Rico Land Administration, a four-blocks wide mixed-use development covering , including 308 apartments, 2 parking lots with 736 spaces and 12,000 sq feet of retail. Construction is scheduled to begin by December 1999
- The shopping center proposed by Bahia San Juan, Inc. for 500,000 gross sq feet;
- The urban revitalization plan for the Puerta de Tierra community, designed to replace a five building public housing complex.

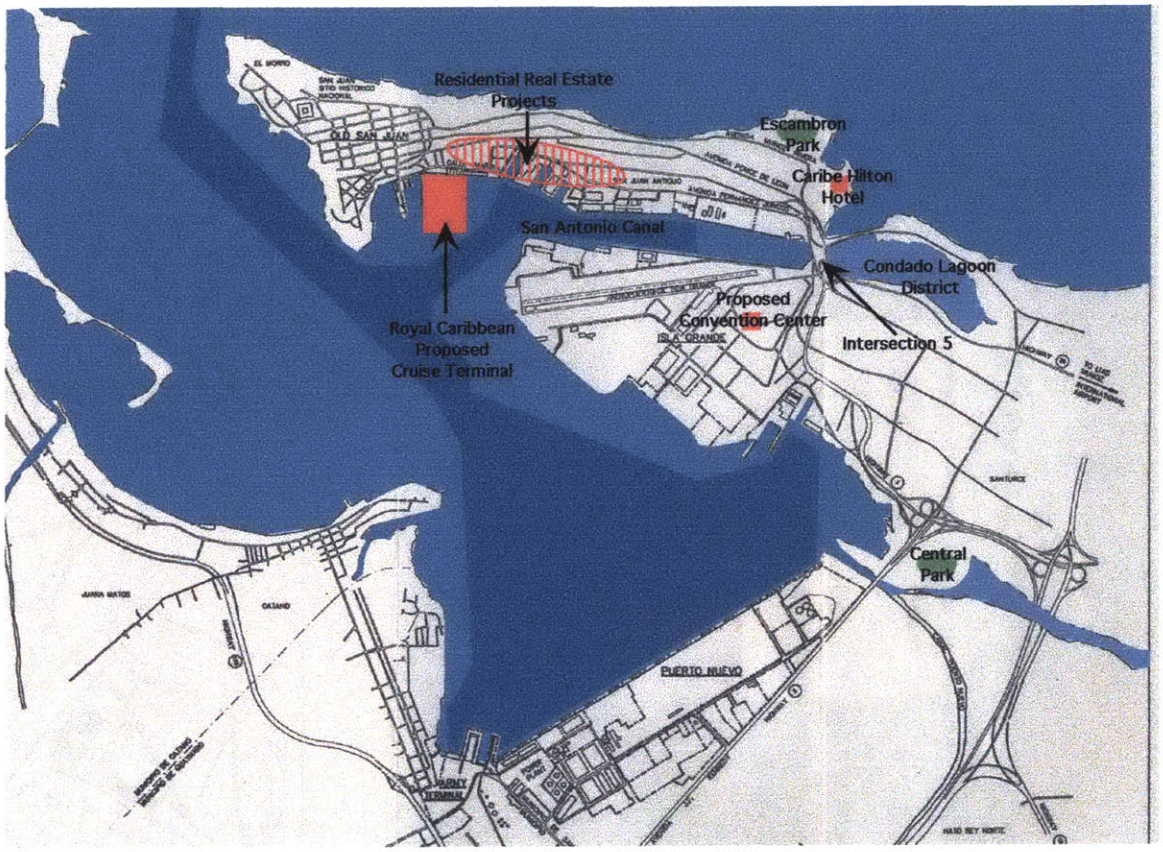

Figure 4

Location of the Proposed Developments

3 In the summer of 1998 Sasaki Associates, a planning consulting firm based in Watertown, Massachusetts, in association with Arquitectonica, an architectural firm based in Miami, Florida, were hired by the Puerto Rico Tourism Co. to develop a Master Plan for the Trade and Convention Center District.

The Puerto Rico Trade and Convention Center Site is 110 acres and occupies a central location in the metropolitan area. It is contained within the so-called Isla Grande, on land once occupied by a U.S. Navy base. It is bordered by the Rivas Dominici Regional Airport to the North and by areas belonging to the Ports Authority and primarily used for container storage to the South.

Most of what is now referred to as Isla Grande is in fact a peninsula resulting from the landfill of a large amount of water surface comprised between the mainland and the nearby areas of Isla Grande proper and Isla Miraflores. The latter island was the site of a XVIth century fortified structure built by the Spaniards, remains of which are located South of the Trade and Convention Center district. The landfill, dating back to the late thirties, was made by the United States Army Corps of Engineers. It was primarily used as a US Navy and Coast Guard base. The airport served both military and civilian purposes before the development of the Luis Munoz Marin International Airport. The airport and the areas north of it became property of the Puerto Rico Transportation Authority in the Fifties. The Navy developed most of what is now the Trade and Convention Center district according to a low-density single family housing scheme. The low-density created the condition[31] for the planting of a significant amount of

[31] PUERTO RICO TOURISM COMPANY, 1998.

vegetation, which nowadays differentiates this district from most other areas in the metropolitan area. Because of its origin as a landfill, the site is mostly flat.

The government of Puerto Rico began the process of acquisition of the base from the US Navy in 1970. Most recently the site was considered[32] as a possible location for the Olympic Village, when Puerto Rico bid for the 2004 Olympic Games.

A major constraint posed to the District is its separation from the neighborhood of Miramar due to the Munoz Rivera Expressaway. The site faces the waterfront only for about 900 feet, due to the presence of the airport, which also poses a severe height limitation, ranging from 0 to 150 feet between the runway and a distance of 1500 feet from it.

In order to make the District more accessible and to reconnect it to the Miramar neighborhood, the Master Plan proposes the construction of a new Baldorioty De Castro Boulevard, stemming out from the homonymous road, connecting to Fernandez Juncos Avenue and Intersection 5 (when it will be redesigned) and, to the South connecting to Munoz Rivera Expressway via an overpass. A new truck route serving the container terminal and the back of the Convention Center will also connect to the new boulevard, South of the Convention Center.

In terms of public transportation, Tren Urbano, the new rapid transit system currently under construction and scheduled to open in 2002, will not reach the district or the

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[32] PUERTO RICO TOURISM COMPANY, 1998.

Isleta in its first phase. As a matter of fact, a stop within the district is not even planned for a future phase, although the intensity of uses in the future makes it sound advisable. The Master Plan correctly points out the need for one such Tren Urbano stop and proposes the extension of the water taxi system to the Convention Center itself. A canal will be built right in front of the Convention Center, making this form of transportation from Old San Juan, the Bay and the Lagoon extremely convenient both for visitors and employees.

The canal constitutes the framework of the Sasaki design. The orientation of the district is related to the presence of the canal. The district is designed around the canal, in two edges:

- The "urban edge", east of the canal, will have restaurants, retail, and a promenade
- The "natural edge", west of the canal, will be a park, also hosting the Exploratorium.

All streets are supposed to be tree-lined, so as to create a pedestrian friendly environment.

The canal will be 1800 feet long, 66 to 436 feet wide (the narrowest portion being in front of the Convention Center, and 7 to 10 feet deep. The sloped bottom will ensure movement of water.

The urban edge will be lined along the canal by a promenade, divided in an upper level hosting the retail and restaurants, and in a lower boardwalk apt to receiving small vessels and watertaxi stops.

The Baldorioty De Castro boulevard will be 170.6 feet wide, including a 39.6 feet median, with three travel lanes in each direction. It will be planted along the walkways and the median. Each sidewalk will be 41.2 feet wide, making the environment suitable for cafes and retail. The other streets will be 69.3 feet wide, with two travel lanes in each direction, and 13.2 feet wide sidewalks. They will also be continuously tree-planted.

The land use program consists of:

- 1,1265,990 SF for the Convention Center, the main building consisting of 433,290 gsf and a 1.950 spaces underground parking garage
- 1,043,023 SF for hotels or 1720 rooms
- 844,967 SF of residential or 563 units
- 718,415 SF of office plus 53,819 SF of corporate learning
- 261,293 SF of retail
- 265,018 SF of cinema and entertainment.

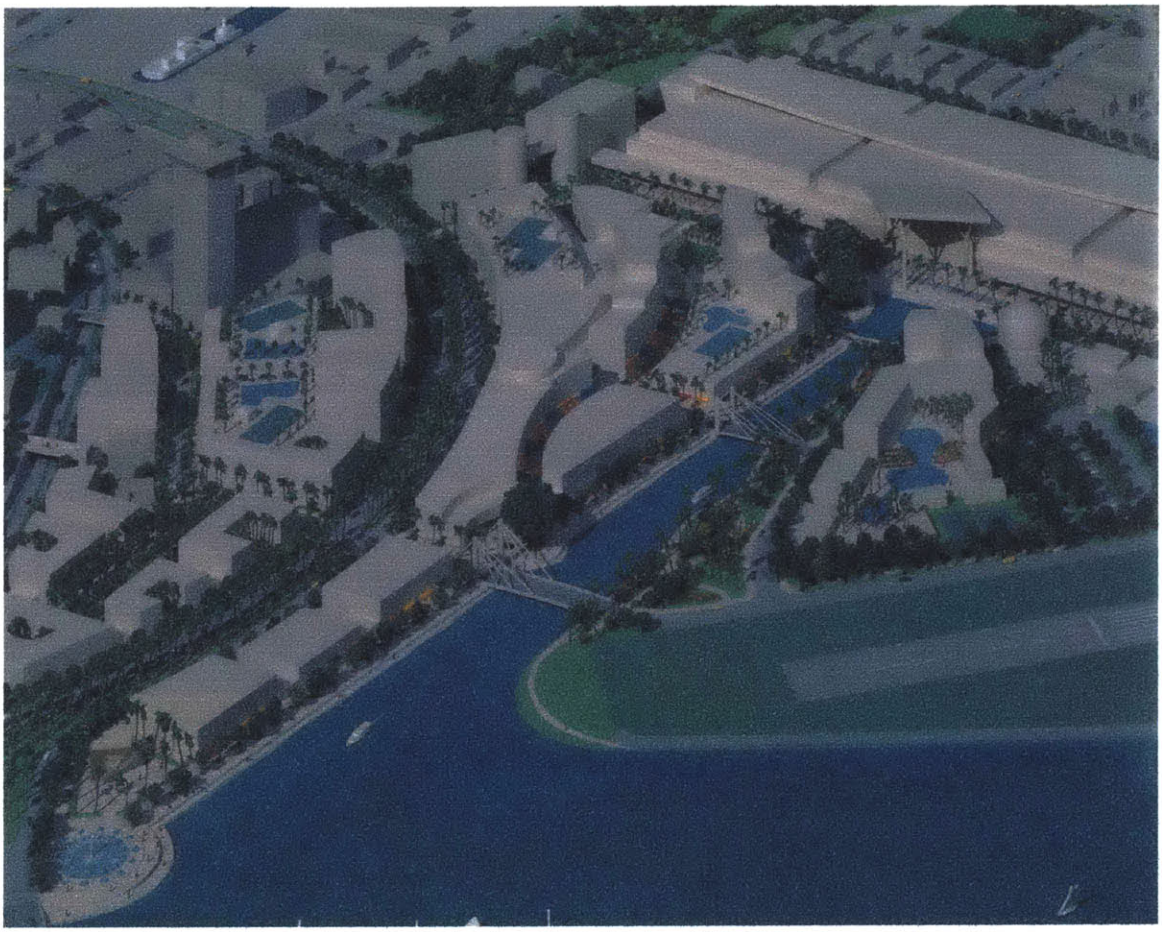

Figure 5

Model of the Proposed Convention Center District

Source: PRTA, 1997

4 The Triángulo Dorado proposal is perhaps the first effort to overcome a tradition of piecemeal approach to planning in San Juan. However, this proposal does not thoroughly evaluate the role of the "triangle" in the metropolitan area. It does not link its proposals with Tren Urbano, which is the single largest urban infrastructure undertaking ever attempted in San Juan. Also, it does not call for an impact analysis of the developments it proposes. In a congested roadway network as San Juan's, adding massive amounts of activities with high traffic generation characteristics, such as hotels, in the Isleta, is inconsistent with the goal of solving traffic problems. The next chapter of this thesis illustrates a computerized model that evaluates the traffic impact of the proposed developments. Finally, the identification of this triangle seems more justified by the current availability of development opportunities than by a strategic vision. Indeed, as this thesis shows in its third component, Isla Grande can offer a different and much more important contribution to both the city and the port of San Juan, while developing in a traffic-responsive way.

2 A Trip Generation Distribution Computerized Model

1 Often, the transformation of a waterfront from a purely port-related area to a mixed-use environment implies and relies upon a series of major real estate projects. The success of each project and, even more, of the whole waterfront transformation, depends very much on the quality of the urban environment that results. When, as it is the case in San Juan, the goal is to transform the waterfront in a tourist-related environment, this is even more important.

Each development can be looked at under several points of view, i.e. from a financial returns perspective, from a design point of view, and so forth. Traffic generation is difficult to analyze. The reason is that the number of trips that a development generates is only meaningful in relation to the existing trips, to the trips generated by other development, to the directional distribution of peak-hour flows, and to the distribution of these flows within the existing street network. Of course, such an impact can hardly be grasped with a purely qualitative analysis. That's why a computer model becomes useful. In particular, a model is useful because it allows the user to carry on simulations. It is possible to see what happens as a consequence of the implementation of each single development, and for every segment of roadway considered. It also allows these simulations to be re-done each time assumptions change. For instance, when the capacity of a roadway changes because of a physical improvement, a model can re-calculate what happens in the whole system because of this change.

The model devised in this study is straightforward and can be used without special training, besides a basic knowledge of computer spreadsheets and traffic concepts. It also easily allows modifications to be made for special purposes. It is based on the most

widely used spreadsheet, Microsoft Excel, which runs on all IBM-compatible and Apple computers.

The basis upon which this model (and all trip generation studies I have seen) is built, is the Trip Generation manual published by the Institute of Transportation Engineers[33]. For each land use code, this model provides an equation that allows the user to estimate the number of generated trips by each development as a function of the square footage, or the number of units or a similar parameter. The Manual is based on a series of sample studies and is currently in its 6th edition. The problem in using the manual is that for some land uses there isn't enough information to perform all the forecasts. In this case, a closest-match criterion had to be used.

Another reason for building a model was to experiment a methodology that could be used in different contexts, simply varying the parameters and layout of the matrix, based on the same logic. The advantage of one such methodology is that the outcomes can be represented on a map of the area, which makes them easily understandable, by a large set of readers.

[33] INSTITUTE OF TRANSPORTATION ENGINEERS, 1997.

2 The process of finding data was cumbersome. It took several contacts with several agencies to find out who had the data and even if those data were available.

In the course of my preliminary research for this part of my thesis, I contacted several local professionals and the following agencies in San Juan:

- Puerto Rico Ports Authority
- Puerto Rico Highway and Transportation Authority
- San Juan Municipal Planning Office
- Puerto Rico Tourism Company

All the agencies were able to provide some vehicle traffic information. However, there is no unified system of traffic data collection in San Juan. There is no comprehensive traffic study for the whole metropolitan area. Finally, there was no trip generation study for some of the developments proposed in the Triángulo Dorado area.

The process of communication between the different agencies involved in the Triángulo Dorado proposal seemed to be difficult. They operate independently of each other, and each one seems unaware of what the others do.

The trip generation model developed in this thesis is also a communication tool. It considers all the Triángulo Dorado developments together, and evaluates their impact together, overcoming the barriers among the different agencies.

3 Before describing the model, it is necessary to provide some definitions. Specifically, generated trips, capacity and Level of Service are defined below.

Generated Trips can be divided[34] into three categories:

- Primary Trips, destined to the concerned facility (ex: a shopping center) and whose pattern is home-facility-home;
- Diverted Linked Trips, that involved a route diversion from a trip generated for other purposes;
- Pass-by Trips, that consist in a stopover at the facility along the way.

Since little data is available for Diverted Linked and Pass-by Trips, in this study only Primary Trips have been considered.

Capacity is the measure of the ability of a traffic facility to accommodate a stream of moving vehicles[35]. It refers to the maximum number of vehicles that have a reasonable expectation of passing over a given section of roadway or through an intersection in a given period of time under prevailing roadway and traffic conditions. As Baumgartner (1996) points out, capacity is affected by a variety of traffic, roadway and environmental conditions.

Level of Service (LOS) is a qualitative measure that describes the quality of the traffic flow passing over a section of roadway or through an intersection under a particular

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[34] INSTITUTE OF TRANSPORTATION ENGINEERS, 1997.

[35] BAUMGAERTNER, 1996.

volume condition. It incorporates a variety of factors[36], such as speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience. Level of Service is classified by letters, A (best) to F (worst):

LOS A	Free flow; individual users unaffected by the presence of others in the stream. Delay at intersection: 0-5 seconds/vehicle.
LOS B	Stable flow; presence of other users become noticeable. Delay at intersection: 5-15 seconds/vehicle.
LOS C	Stable flow; individual user affected by the presence of other users. Delay at intersection: 15-25 seconds/vehicle.
LOS D	Stable flow but high density; speed and freedom of maneuver severely restricted; poor level of comfort and convenience. Delay at intersection: 25-40 seconds/vehicle.
LOS E	Operations at capacity level; speed reduced to a uniform low value; extremely poor level of comfort and convenience. Delay at intersection: 40-60 seconds/vehicle.
LOS F	Forced or breakdown flow i.e. the amount of traffic reaching a given section exceeds the amount that can traverse that point and queues form behind that section; stop-and-go unstable operations. Delay at intersection: 60+ seconds/vehicle.

Table 12

[36] BAUMGAERTNER, 1996.

4 Basically, what the model does, is to show how the generated traffic (as calculated according to the ITE Manual) splits between the various arteries and then to subtract the generated traffic from the available capacity i.e. the capacity resulting after having taken into account the existing flows. The model performs this operation for the AM inbound flows, PM outbound flows and also for the Average Daily Traffic. However, the assumptions made for the Average Daily Traffic are that the generated traffic splits among the different roadways in the same proportion as the existing ADT. However, the ADT figures available add traffic in both directions. Also, in order to subtract ADT from capacity, the model "thinks" of ADT as equally distributed in the 24 hours, which of course is a gross approximation. Therefore, the ADT figures only give a very rough estimate. It is surprising, however, that some roadways turn out to be overtaxed even based on these assumptions!

The model allows the results to be seen for each roadway, further subdivided into segments between major intersections. It shows the existing conditions in terms of capacity, flows and resulting net capacity. These figures are provided as before and after the contribution of the generated traffic. It is ready to calculate the same values for improved capacity, whenever these data will be available, for the arteries that will be improved. It finally shows the excess or deficit of capacity as a percentage of the capacity itself. The latter value can be considered an index showing the extent to which the road is overtaxed.

In the case of the ADT, the results of the model are given per roadway, not subdivided into segments. The assumption here is that the traffic splits according to the existing

flows on each roadway considered in its entire length (i.e. not considering that at each intersection part of the traffic leaves the roadway). The available ADT data do not even distinguish between the two directions, which makes impossible even to make more sophisticated assumptions.

Of course, the effect of the generated traffic dilutes while moving from the Isleta towards the rest of the Island. However, from a quantitative standpoint, and taking account of all the assumptions, the overall impact of all these developments on the automobile traffic in San Juan is very significant.

5 The data used in the model come from four different sources. The Puerto Rico Highway and Transportation Authority have provided all data about capacity, current average daily traffic and peak hour traffic (collection year: 1998). Data about traffic generation come from three sources: the Bahia San Juan study, the Plan Maestro Puerta de Tierra or were calculated according to the ITE Trip Generation manual.

As far as the Trip Generation manual is concerned, data were calculated as follows:

- Barrio Capitolio and Barrio Marina: Residential Condominium (Land Use Code 230) and, for the retail component, Specialty Retail Center (Land Use Code 814) for the ADT and Apparel Store (Land Use Code 870) for the AM Peak. The two components have been added, in order to show the total generated traffic of the whole development;
- World Trade Center: General Office Building(Land Use Code 710)
- Hotel Caribe Hilton: Hotel (Land Use Code 310)
- Convention Center (should be re-calculated - current datum from Land Use Administration)
- Convention Center District Hotels: Hotel (Land Use Code 710)
- Convention Center District Residential: Apartment (Land Use Code 220)
- Convention Center District Office: General Office Building (Land Use Code 710)
- Convention Center District Retail: Specialty Retail Center (Land Use Code 814) for the ADT and Apparel Store (Land Use Code 870) for the AM Peak.

The criterion has been to use the "best fit" in terms of Land Use Code. Indeed, not all Land Use Codes are covered in the Manual and some of them only partially. In particular,

it was not possible to calculate the Trip Generation of the Children's Museum (Exploratorium) and of the Cruise terminals. As far as the retail components are concerned, it was not possible to calculate the PM Peak flows. For the AM Peak I assumed an 80% in-flow, since the directional distribution is not available. This procedure is far from ideal, but the only alternative would have been to show no data.

6 The model is primarily meant to describe the contribution of generated traffic to the Peak hour traffic flows. The proposed developments considered are the following:

- Government Office Building
- Royal Caribbean Cruise Terminal
- Other Cruise Ship Terminals
- Shopping Center
- Residential Barrio Capitolio
- Residential Barrio Marina
- Hotel Caribe Hilton
- Convention Center
- Hotels
- World Trade & Port Center
- Children's Discovery Center
- Residential
- Office

The model considers AM Peak Hour inbound flows, i.e. towards and Inside the Isleta, and the PM Peak hour outbound flows. There is a sharp difference between the two peaks. While the AM peak hour is well defined the PM Peak hour is not. This is mostly due to the fact that most people start working at about the same time, but the time the finish and travel back varies much more. Therefore, it is the AM Peak that provides the sharpest definition of the contribution of generated traffic to total flows.

The model considers the main arteries. In the Isleta, there are four main roadways:

- Munoz Rivera Avenue, 3 lanes inbound
- Ponce Del Leon Avenue, 3 lanes outbound
- Juncos Avenue, 2 lanes each direction

- Marina Street, 1 lane inbound and 2 lanes outbound[37].

The Isleta is connected to the rest of the metropolitan area via two bridges:

- The Esteves bridge, 4 lanes outbound;
- The San Antonio bridge, 4 lanes inbound.

However, it is also possible to enter Isleta via Ashford Avenue, 1 lane both directions, that is connected to the Isleta just north of the San Antonio bridge.

In the mainland, the following arteries are considered, the first four having a West-East direction, the remaining ones a North-South direction:

- Baldorioty De Castro Expressway, 3 lanes both direction (2 after the intersection with PR-37);
- Ponce Del Leon Avenue, 2 lanes inbound;
- Juncos Avenue, 3 lanes outbound;
- Munoz Rivera Expressway, 3 lanes both direction[38];

In addition, the following two arteries have a North - South direction:

- Todd Street, 2 lanes each direction, after Constitution Bridge named Kennedy Avenue, 3 lanes each direction;
- De Diego Expressway, 4 lanes each direction (between PR-1 and PR-18).

Assumptions had to be made about how the generated traffic splits between the several arteries. The model assumes that the traffic splits according to the existing relative proportion of flows. For example, if 100 vehicles are travelling Juncos eastbound, when

[37] In order to make the graphic representation of the model simpler, Marina Street is only considered between

they reach the intersection between Juncos and Todd, they split in the proportion 35-65, which is the proportion of ADT traffic between Juncos and Todd right after that intersection. All intersections are treated with the same criterion.

All traffic enters the Isleta via de San Antonio Bridge and exists via the Esteves Bridge. However, traffic entering via Ashford, doesn't use the San Antonio Bridge.

The traffic related to the Convention Center district, for simplicity sake, is considered as coming from outside the Isleta. In other words, the Isleta and the Convention Center district are two ideal "points" that pull and push traffic. Although there certainly are flows between the two districts, i.e. with origin in one of them and destination to the other, these have not been specifically mapped in this model. Indeed, it would be very hard to estimate the percentage of flows directed to, say, the World Trade Center that comes from the Isleta. This information doesn't seem to be key anyway, in a stylized model as this is.

General Pershing Street and Del Muelle Street.

[38] In a similar way, Munoz Rivera is not considered in the section between PR-35 and PR-26.

7 The model defines which are the major generators of traffic and the state of the roadways once the generated trips are added to the existing flows.

The following chart summarizes the results for ADT Trip Generation. Looking at the results, the shopping Center proposed on the Isleta is the major generator of trips, followed by the hotels and the proposed retail in the Convention Center district.

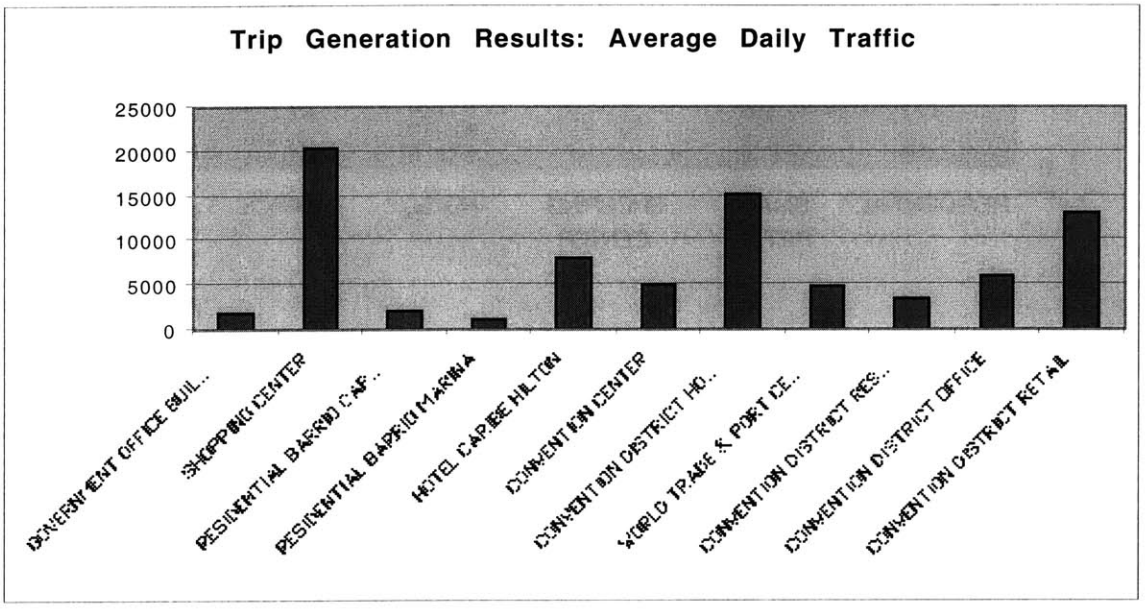

Chart 2

The results can be added by category, so as to identify the types of development that generate the more traffic. This is what the next chart shows:

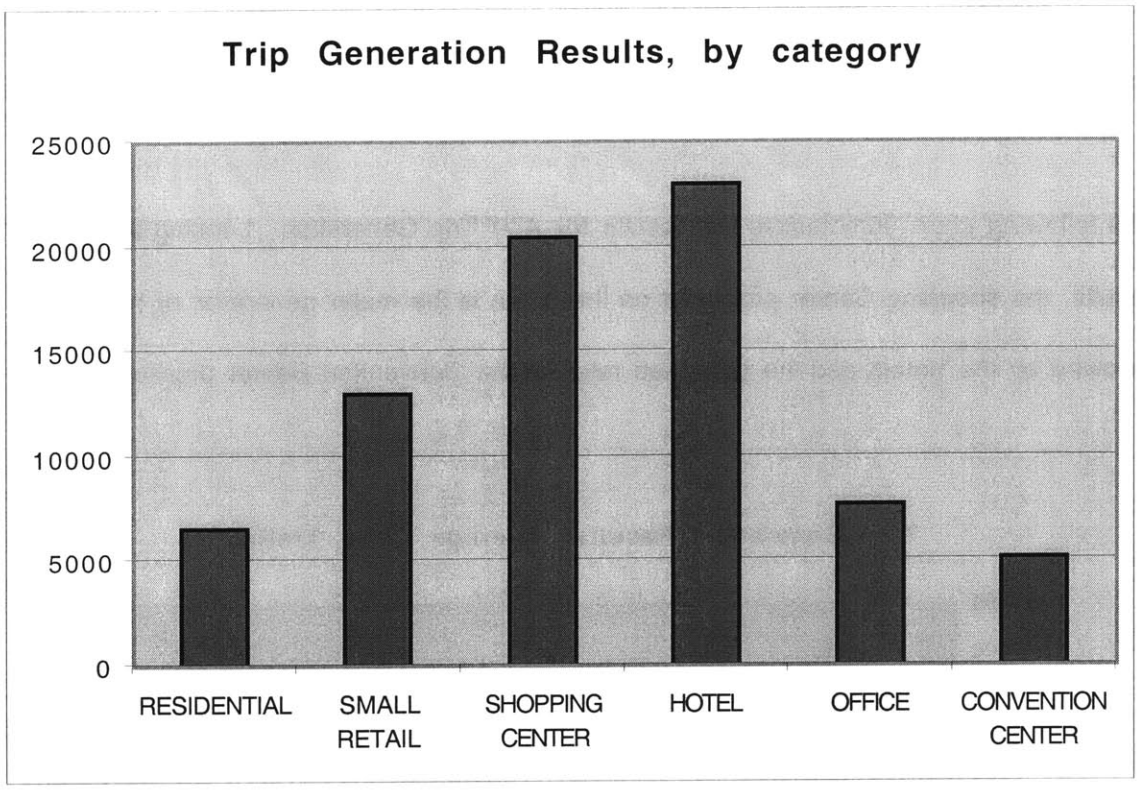

Chart 3

It is the hotels that generated the highest number of Average Daily Trips. The shopping Center on the Isleta is second and, significantly, counts for more than all the rest of the retail[39]. Another observation is that the Convention Center, although a formidable contributor in itself, will not play a preeminent role when all proposed developments are considered together.

This is an important conclusion from a planning standpoint. Since hotels add a significant amount of traffic, their location should be carefully planned so as to avoid the

generation of additional trips where there isn't much capacity left. In particular, because of the bottleneck posed by Intersection 5, the location of additional hotels on the Isleta should be discouraged.

Similarly, large shopping center complexes generate a high number of vehicle trips. The location of one such complex in the Isleta would worsen the traffic conditions, whereas a much more appropriate location would be close to a Tren Urbano stop.

The most important figures, however, are those concerning the Peak-hour flows. That's because in some cases at Peak times different generators can add traffic in opposite directions. For example, while offices will generate an additional inflow of vehicles towards the Isleta, residences will probably generate an outflow from the Isleta. Therefore, these trips do not add up to each other and only the inflow will add to the critical traffic in the morning.

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[39] Some Isleta retail is included in the residential, because part of the same development. If added to the small retail, however, the figures would change only slightly.

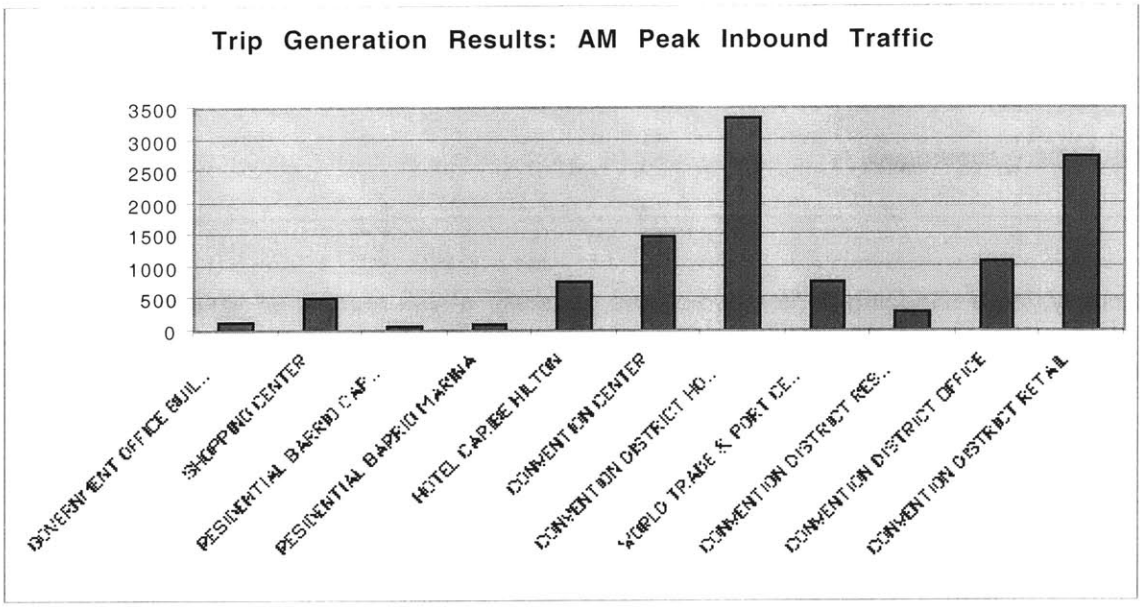

Chart 4

As expected, the residential component adds a very small proportion of trips. Also, the shopping center on the Isleta becomes relatively less important than the hotel.

In terms of PM Peak-hour flows (outflows), the results are somewhat different. On the Isleta, it is still the Shopping Center by far the most important generator. On Isla Grande it is now the Convention Center the main generator, followed by the hotels[40].

[40] Unfortunately, the ITE Manual does not allow to calculate the PM Peak for the Retail component, which would certainly add a major contribution.

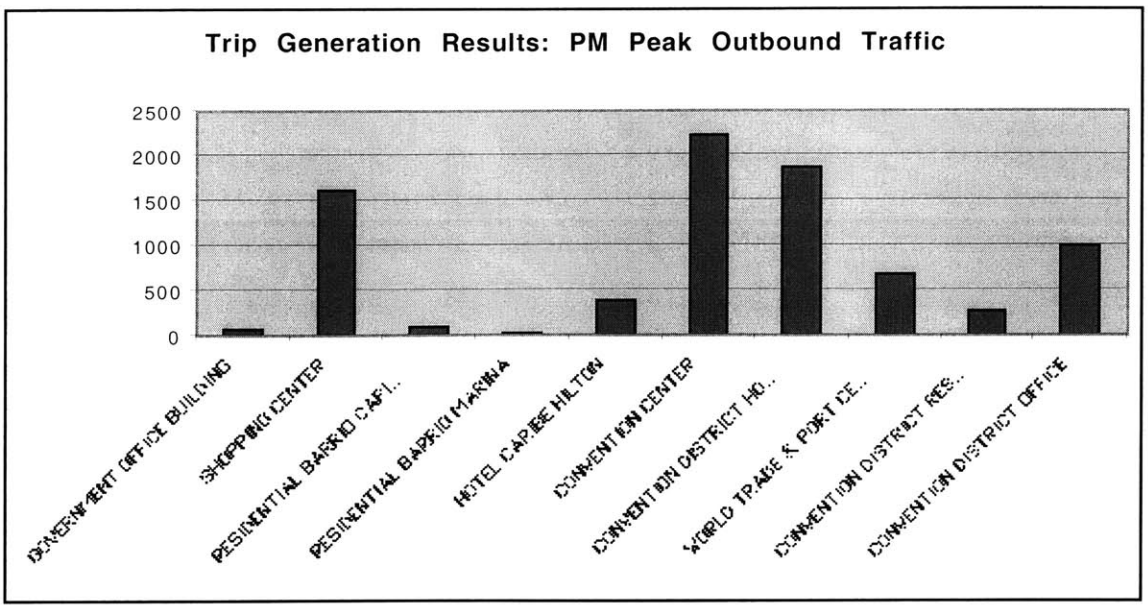

Chart 5

While the relative importance of the shopping center was easy to predict, since most customers shop on the way back from home to work, the contribution given by the hotel is significant also in terms of peak-hour flows. This reinforces the conclusion that the location of hotels is extremely critical. Also, alternatives to private automobiles and taxis for hotel residents should be considered.

The Convention Center generates a high number of trips during peak hours. A study should be encouraged about the origin and destination of those trips. The location of hotels, restaurants and amenities (retail, entertainment) close to the Convention Center itself can contribute to reduce the number of trips or, at least, contain them in a defined area. Also, since Old San Juan is the primary tourist destination in San Juan, in order to reduce the number of vehicle trips a water taxi service should be encouraged.

8 A second step in the analysis of the results provided by the model is looking at the different roadways. It is important to notice that the model only adds the generated traffic to the existing traffic. As a matter of fact, there is also a growth of traffic that is independent of generated traffic. It grows for instance because of the increase in population, or in income, and so forth. Travers Associates and Steer Davies and Gleave, for instance, use a background growth of 1%, for their Review of Options for Intersection 5. If the "natural" increment is added, the level of traffic in each artery is higher. However, this study is primarily concerned with showing the generated traffic, which appears more clearly by confronting it with the existing conditions. However, the yearly increase could easily be integrated in the model. It is worth noted, though, that if the natural increment is significant, the effect of generated traffic gets diluted over time.

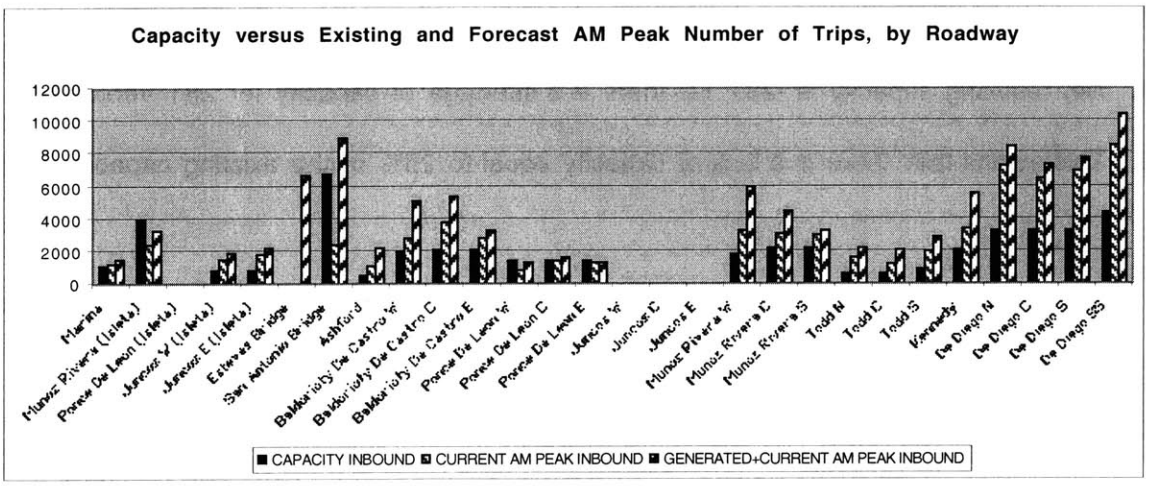

Chart 6

The relevant information is offered by the AM Peak flows. The above chart shows that only Ponce De Leon Avenue and Munoz River Avenue (the latter only on the Isleta) have some residual capacity. Also, the model shows that the influence of trip generation can be felt at a long distance from the development generating it. Therefore, clustering residential and office development together would benefit not only locally, but the whole roadway network.

The following chart measures the residual capacity as an indicator of congestion (net peak hour flows expressed as a percentage of capacity). In other words, the model subtracts all traffic (existing and generated) from capacity and then calculates what is the percentage of capacity left or needed. For example, in the case of Marina street:

1. Capacity inbound is 1133 vehicles/hour
2. Existing inbound traffic is 1196 vehicles/hr
3. Generated traffic is 218 vehicles/hr
4. Net resulting capacity is -281 i.e. there is a shortage of capacity for 281 vehicles/hr
5. This means that there is a lack of capacity equal to 25% of the existing capacity.

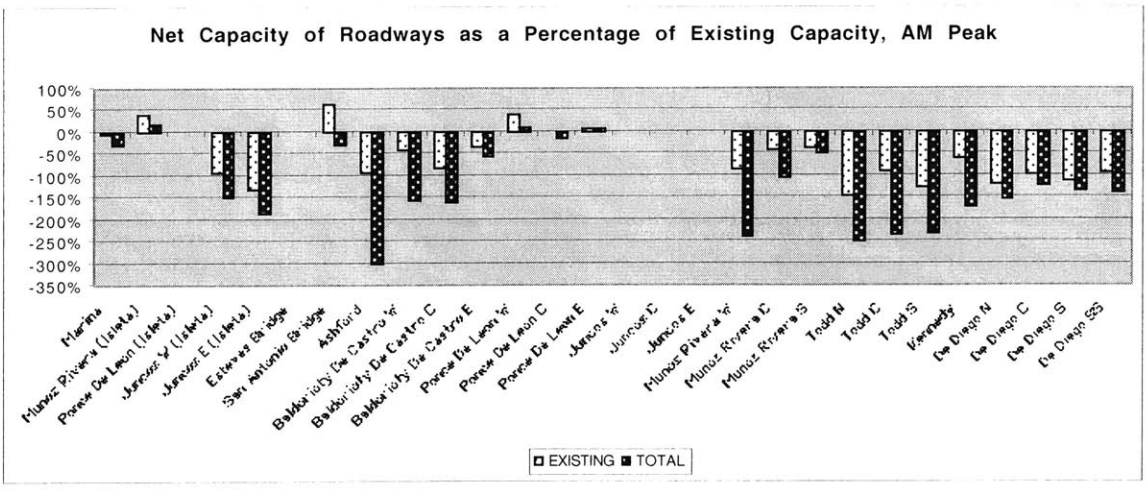

Chart 7

This chart shows that, in order to accommodate all the Peak Hour traffic without delays, it would be necessary to improve the capacity of all the roadways constituting the network. This means that modifying some sections of the roadway network or some intersection can't solve traffic problems in San Juan.

9 The model built as part of this thesis can be a powerful tool to help in evaluating the traffic consequences of any proposed development. Its main value consists in allowing the distribution of the generated traffic among the different roadways. As with most models, it relies upon some assumptions, which may have to be modified or refined as time passes. In this particular model, any changes can be rapidly made without having to restructure the model itself. Also, as it is always the case, the results of the model offer an approximate interpretation of the real world. More than any specific figure, it offers a base for thinking about development.

The traffic impact of any major development must be considered in terms of the overall roadway network. Changes made at the district master plan level can create an efficient local circulation system, but don't contribute to solving the overall problem.

In the case of San Juan, the situation of the roadways is extremely critical. Accordingly, and since some of the proposed developments are already under way, the city should starts thinking strategically about how to address the traffic issues. The construction of the new rapid transit system, Tren Urbano, will offer the possibility of orienting development towards the transit alignment. Also, an overall strategic plan for the metropolitan area should be considered. To intervene on the existing roadways can offer only a local contribution. For instance, the proposed Intersection 5 tunnel may ease out the intersection itself but it will add even more traffic to the Isleta, which is already in critical condition. Any new development should include a transportation plan that proactively encourages alternatives to the private automobile.

The renewed interest in the water transportation included in the Trade and Convention Center District Master Plan is an important step. It would also be appropriate to link the Water shuttle with Tren Urbano. The extension of Tren Urbano to the Convention Center District and the Isleta appears to be of foremost importance. In the meantime, a shuttle bus service between Miramar and the Isleta should be considered. Finally, a road pricing study should be done, to verify whether it could contribute to reduce the number of trips to the Isleta.

The city is undergoing a complex and exciting phase of redevelopment. It is an opportunity to rethink the whole metropolitan area in terms of transit and water orientation. The design scheme that follows shows that it is possible to accommodate future development that is oriented towards public transportation and that will integrate the city and the port.

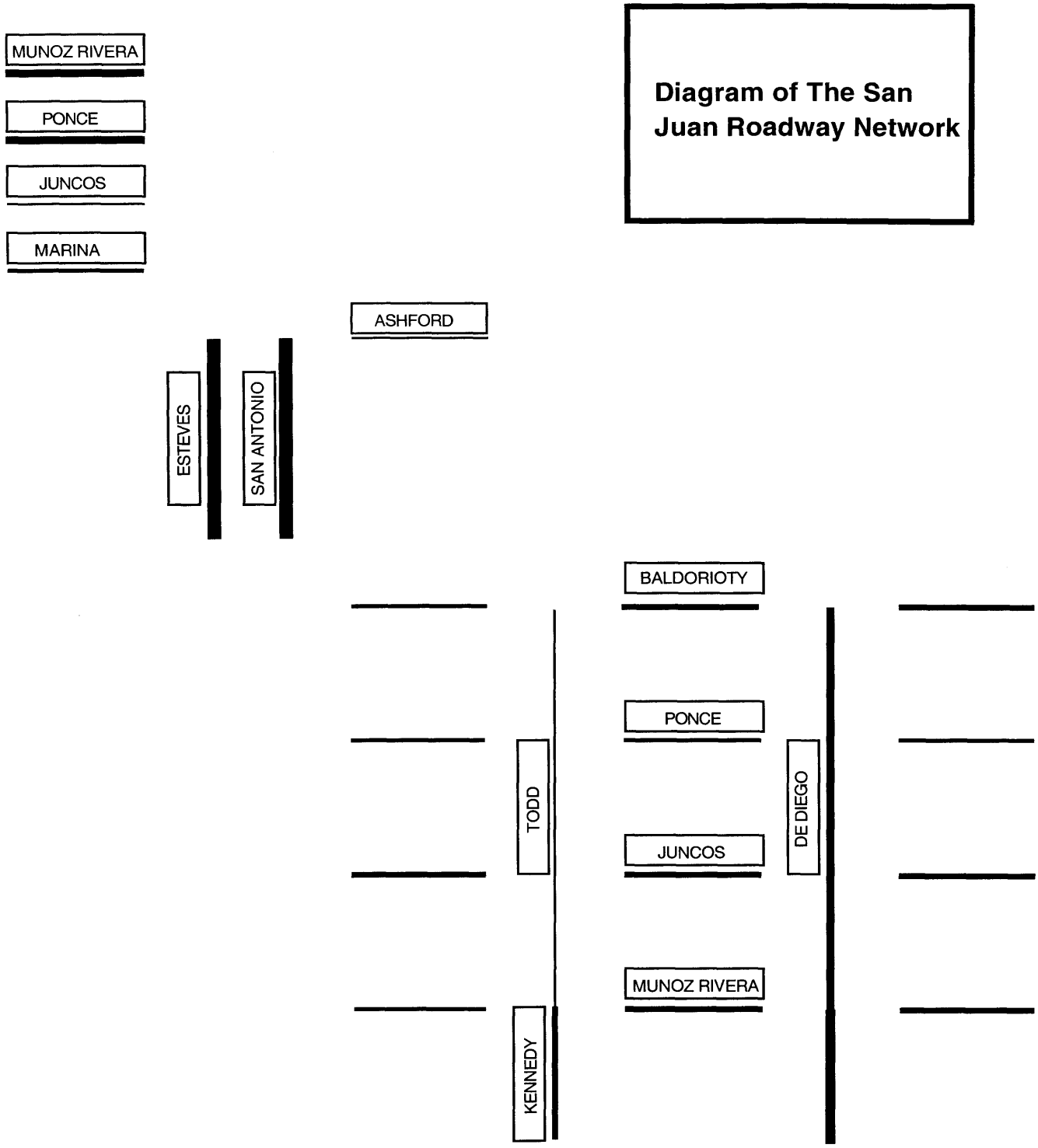
Diagram of The San Juan Roadway Network
MUNOZ RIVERA
PONCE
JUNCOS
MARINA
ASHFORD
ESTEVES
SAN ANTONIO
BALDORIOTY
PONCE
JUNCOS
MUNOZ RIVERA
TODD
KENNEDY
DE DIEGO

Chart 13

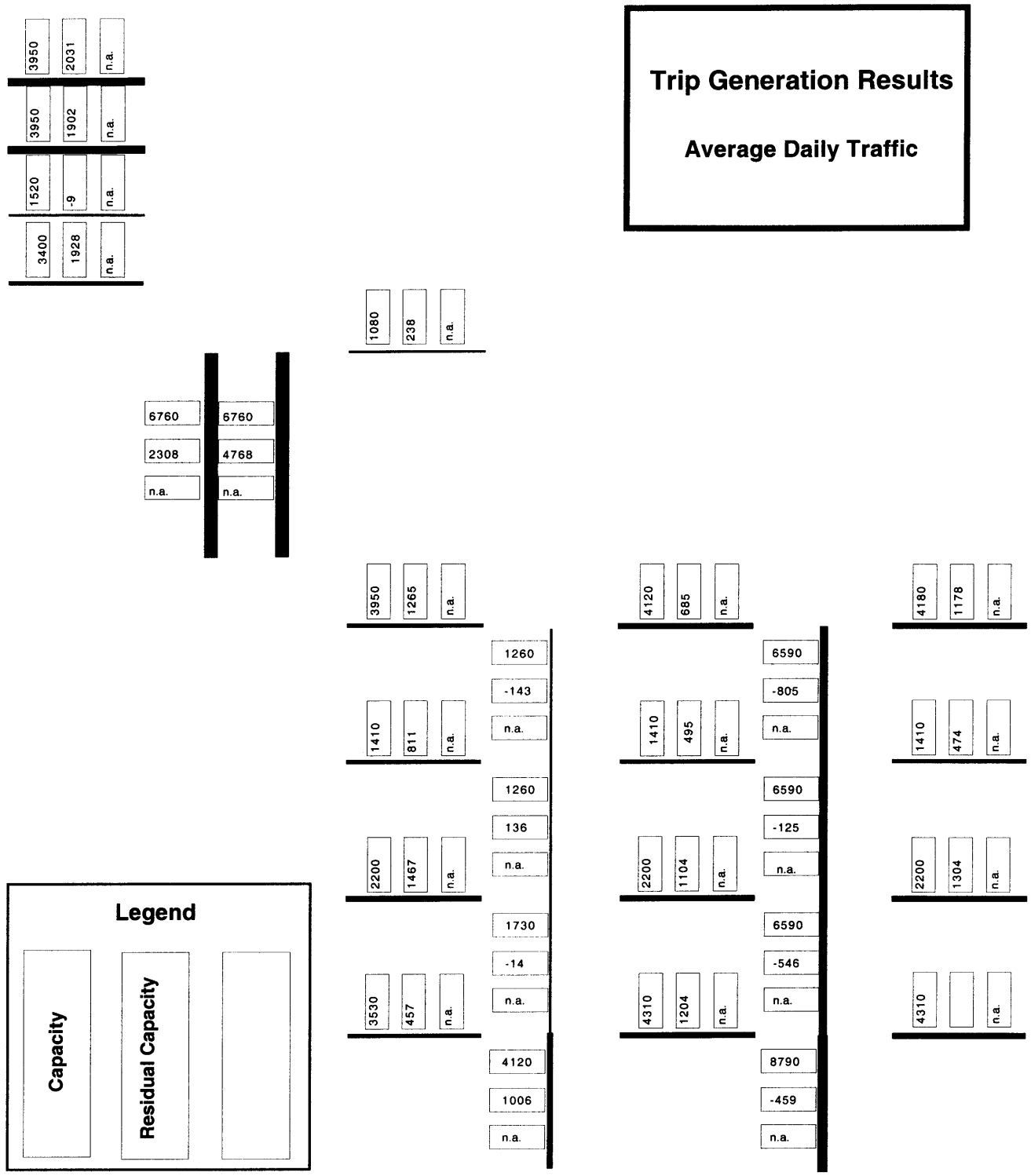
Trip Generation Results
Average Daily Traffic
3950
3950
1520
3400
2031
1902
-9
1928
n.a.
n.a.
n.a.
n.a.
1080
238
n.a.
6760
2308
n.a.
6760
4768
n.a.
3950
1410
2200
3530
1265
811
1467
457
n.a.
n.a.
n.a.
n.a.
1260
-143
n.a.
1260
136
n.a.
1730
-14
n.a.
4120
1006
n.a.
4120
1410
2200
4310
685
495
1104
1204
n.a.
n.a.
n.a.
n.a.
6590
-805
n.a.
6590
-125
n.a.
6590
-546
n.a.
8790
-459
n.a.
4180
1410
2200
4310
1178
474
1304
n.a.
n.a.
n.a.
n.a.
Legend
Capacity
Residual Capacity

Chart 14

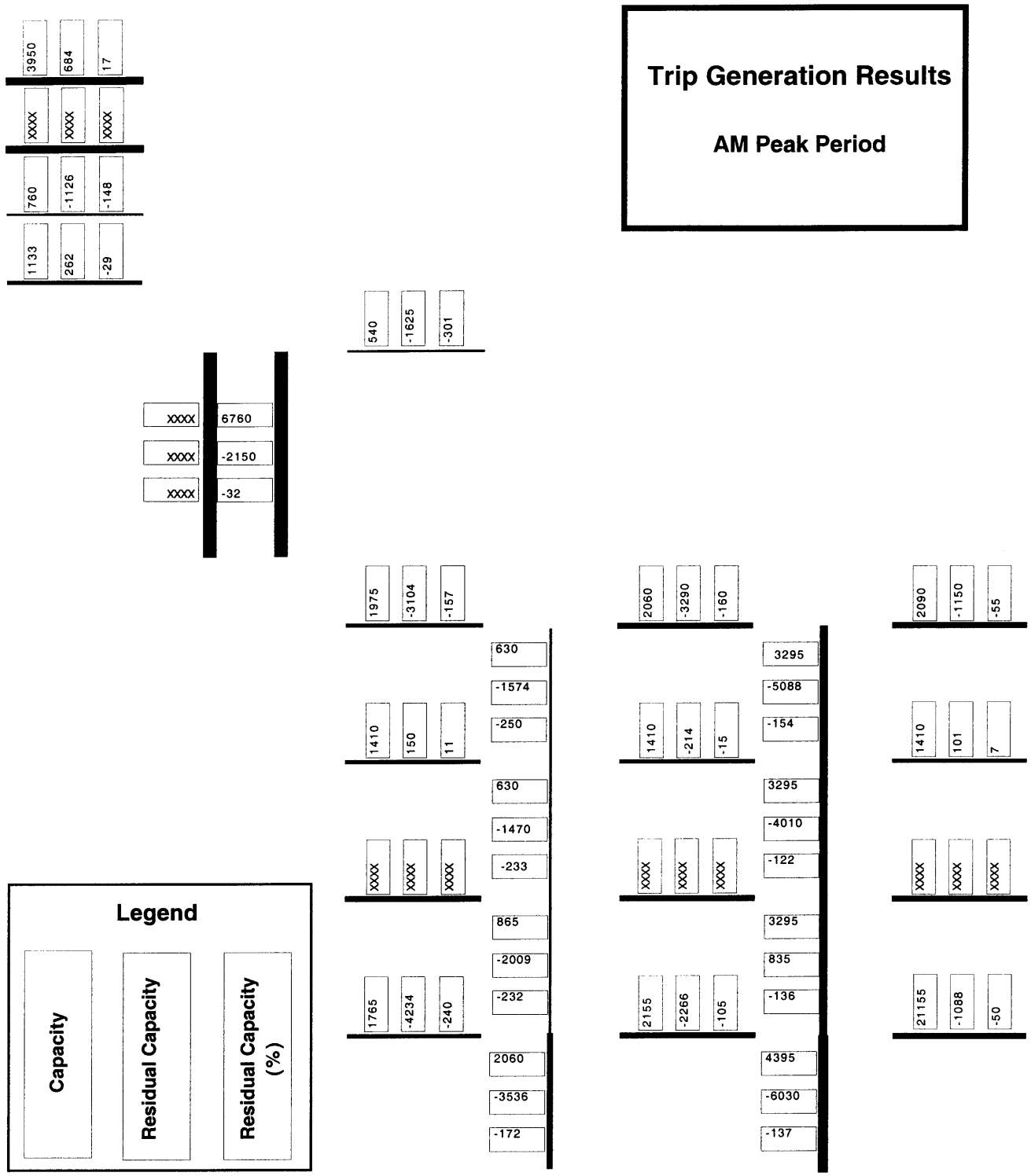
Trip Generation Results
AM Peak Period
Legend
Capacity
Residual Capacity
Residual Capacity (%)
1133
262
-29
760
-1126
-148
XXXX
XXXX
XXXX
3950
684
17
XXXX
XXXX
XXXX
6760
-2150
-32
540
-1625
-301
1765
-4234
-240
XXXX
XXXX
XXXX
1410
150
11
1975
-3104
-157
2060
-3536
-172
865
-2009
-232
630
-1470
-233
630
-1574
-250
2155
-2266
-105
XXXX
XXXX
XXXX
1410
-214
-15
2060
-3290
-160
4395
-6030
-137
3295
-4010
-122
3295
835
-136
3295
-5088
-154
21155
-1088
-50
XXXX
XXXX
XXXX
1410
101
7
2090
-1150
-55

Chart 15

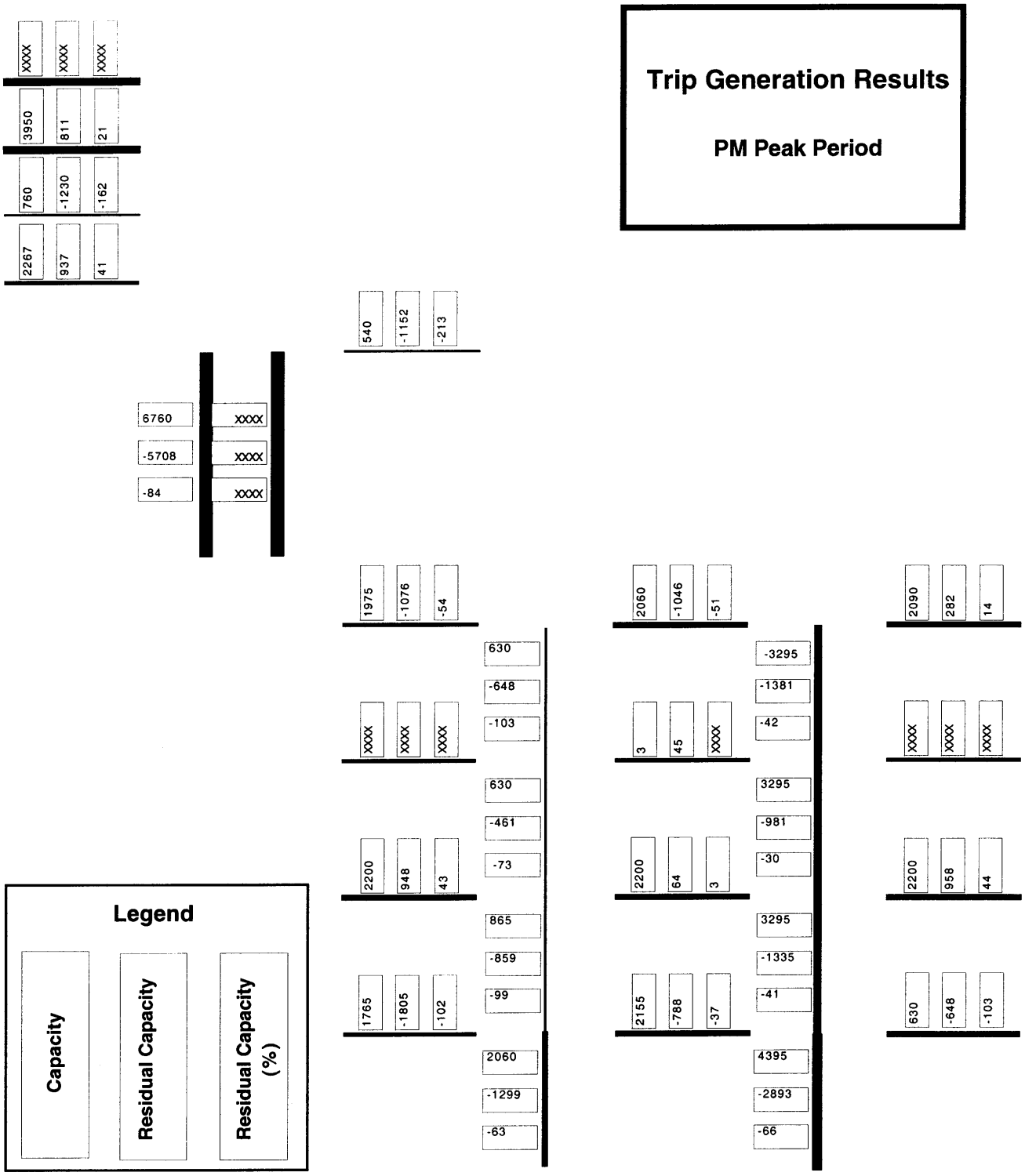
Trip Generation Results
PM Peak Period
Legend
Capacity
Residual Capacity
Residual Capacity (%)
2267
937
41
760
-1230
-162
3950
811
21
XXXX
XXXX
XXXX
6760
-5708
-84
XXXX
XXXX
XXXX
540
-1152
-213
1765
-1805
-102
2200
948
43
XXXX
XXXX
XXXX
1975
-1076
-54
2060
-1299
-63
865
-859
-99
630
-461
-73
630
-648
-103
2155
-788
-37
2200
64
3
3
45
XXXX
2060
-1046
-51
4395
-2893
-66
3295
-1335
-41
3295
-981
-30
-3295
-1381
-42
630
-648
-103
2200
958
44
XXXX
XXXX
XXXX
2090
282
14

Chart 16

6. An Urban Design and Land Use Proposal for Isla Grande

Introduction

The first chapter of this thesis proposed an interpretation of the relationship between cities and ports, and of the role that the cruise activity can play in re-establishing a link that the changes occurred in the shipping industry had previously broken.

The second chapter, with specific reference to the case of San Juan, proposed a technique to analyze the impact of waterfront real estate developments in terms of transportation.

This chapter is meant to be contribute a different scenario for the redevelopment of San Juan's waterfront, which responds to the analysis outlined in the two previous sections. This proposal for Isla Grande is aimed to respond to the needs expressed by the Triàngulo Dorado initiative while making sure that:

- They are part of a strategy for the whole metropolitan area
- They recreate a relationship between the city and the water
- They relate to Tren Urbano.

Indeed, the two major planning undertakings currently being implemented in San Juan, the Triàngulo Dorado proposal and Tren Urbano, have created the conditions to strategically re-think the San Juan metropolitan area, in order to improve the quality of the urban environment.

Tren Urbano creates a corridor of differential accessibility. There is potential to cluster development around the transit stops. However, the implementation of future phases of Tren Urbano will take many years. In the first phase, Tren Urbano reaches neither Old San Juan, nor the International Airport or the Convention Center District. The Miramar station is the only one that will serve the whole Triàngulo Dorado area. In order for the transit system to increase its ridership and for the city to fully take advantage of it, Tren Urbano will have to be linked with other public transit services, such as buses, vans, and water transportation.

Also, the traffic analysis previously outlined shows that the level of roadway congestion in San Juan not only is very high already, but is likely to worsen as a result of the several developments proposed in the Triàngulo Dorado. I believe that the lack of capacity to handle all the traffic can't be addressed only in terms of traffic engineering, for two main reasons:

- Increasing capacity may not be possible and can be very expensive
- The issue is not only how many cars can we make room for in a given area of San Juan, but what urban environment do we want to create and, accordingly, how many cars do we want to accommodate, and where.

In order to respond to both the goals of the proposal and the concerns resulting from the traffic analysis, the proposed redevelopment of Isla Grande is meant to:

- Reclaim waterfront land currently used for port activities for higher value options

- Ensure a long term relationship between the city and the port, by means of the cruise activity, so as to contribute to preserve the competitive advantage of San Juan in the cruise business
- Avoid the creation of a sterile waterfront
- Generate new residential choices, particularly for young well educated singles and families working in the main office districts of San Juan, such as Hato Rey, Isleta and the new Convention Center District
- Provide a good setting for business hotel and retail, thus contributing to the success of San Juan as a Convention tourism destination
- Create a new high quality marina, both for the local population and to enhance tourism choices in San Juan
- Create new entertainment and cultural opportunities, which serve the local population while also being instrumental to the Convention tourism and tourism at large
- Contribute to a long-term, metropolitan wide, transportation strategy for San Juan, in particular linking land use choices to transportation choices
- Provide a first step in the improvement of the quality of the urban residential environment in San Juan.

Isla Grande represents an opportunity to bring together all the ideas that have been put forward by the several, partial, planning efforts previously listed in this study.

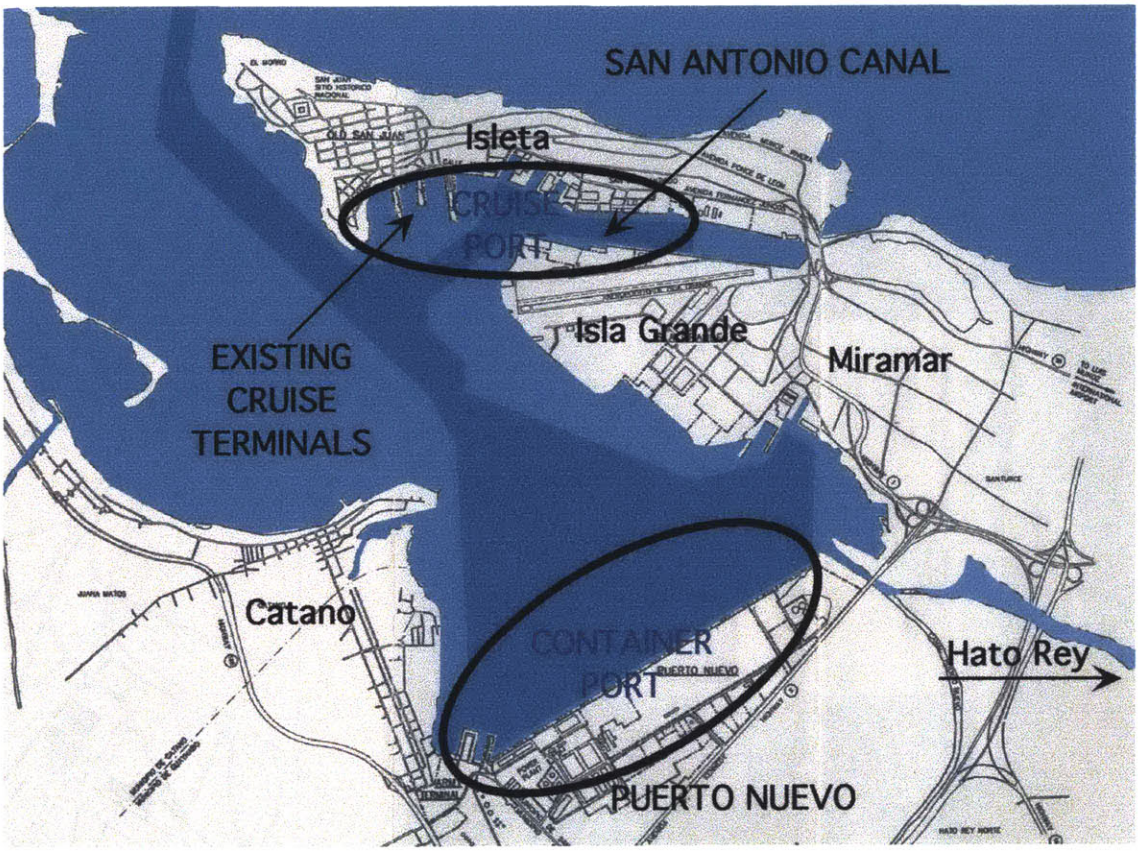

Figure 6

Locus Map

Figure 7

Aerial View of Isla Grande and San Antonio Canal

Assumptions

1 The Urban Design proposal focuses on Isla Grande, as it is redefined as a consequence of the location of the Trade and Convention Center District. The latter is assumed as a given of the proposal, according to the Master Plan prepared by Sasaki Associates, and described in a previous chapter of this thesis.

The main assumption about this area of the city is that the presence of the Convention Center District and the redevelopment of the San Antonio Canal will create the conditions to propose a different land use of the whole island. Also, other plans outlined the first chapter suggest the demand for entertainment venues, like an Aquarium, which need to be located where they don't contribute to increase traffic problems.

Presently, most developable land in Isla Grande, outside the Convention Center district, belongs to the Ports Authority. The design proposal is based on the assumption that if the land values will increase significantly, the Authority will find more profitable to lease or sell the land than using it for container storage. Therefore, I assumed the consolidation of most Port activity in Puerto Nuevo, which is already occurring, with perhaps the relocation of some activities, like the automobile shipping, elsewhere on the Island.

Indeed, nowadays most Port Authorities operate according to a "land-owner" approach. From this standpoint, it is possible to make the case that if the values of the land increase beyond some threshold, it may be in the interest of the Ports Authority to lease or sell the land for non port-related activities.

The proposal also assumes that the northern shore of Isla Grande will be primarily devoted to cruise-ship terminals, as required by the Port Strategic Master Plan. However, it reserves the western tip of the island for an entertainment use, in order to capitalize on the location of the tip itself, which is in the center of the San Juan Bay, the first thing that cruise ship passengers see when entering the bay.

The proposal does not contemplate the redevelopment of the General Aviation Airport, since its central location in the metropolitan area makes it convenient for business flights and local tourist excursion flights. However, the proposal recognizes that in the long run other considerations, first of all safety and/or land value issues, may prevail. Accordingly, it devises a development scheme that can be extended once the airport is no longer there, without having to modify the pre-developed areas.

The consolidation of cruise activities along the San Antonio Canal and the development of a residential component try to re-establish the relationship between the city of San Juan and its bay that the chaotic growth of the last few decades seems to have caused to be lost. . The goal is to create a high-quality, mixed-use, urban environment that constitutes a contemporary equivalent of the Old San Juan lifestyle.

2 Isla Grande can play a well-defined role in the metropolitan area. According to the Triàngulo Dorado proposal, there is need for high quality residential, entertainment activities that serve tourists and the local population, office space and education / interactive learning activities and, finally, for the expansion of cruise activities.

The Triàngulo Dorado proposal estimates Hotel, Retail and Entertainment, and Residential demand for the Golden Triangle area. The estimate is based upon a 20% capture of total San Juan demand in the Golden Triangle. In particular, it forecasts a demand for housing of 1,950 units over 15 years, subdivided as follows:

- Luxury condos ($250-275K): 600 units
- Mid-priced condos ($100-250K): 600 units
- Loft apartments ($125K): 300 units
- Courtyard housing ($75K) : 500 units
- Timeshare: 150 units

Overall, there are only 1,091 units planned in the Triàngulo Dorado at present. Accordingly, there is demand for 859 units in this area.

The development scheme devised in this thesis, and defined new Isla Grande Village, is an extension of the Triàngulo Dorado area, as originally defined. Therefore, a reassessment study of the 20% capture of San Juan growth would be appropriate. Higher captures in the proposed village should be encouraged, so as to foster its redevelopment.

Finally, if the Village is developed as a high quality residential environment, it will most likely end up having a competitive advantage with respect to other less pleasant areas of the city, which in turn will shift some growth towards this area.

3 I believe that in the future no growth should be accommodated on the Isleta. In fact, the Isleta already has a well-defined tourist role, some redevelopments are already planned and its accessibility, as already mentioned, is very difficult. Also, the road capacity of the Isleta is fairly limited, Tren Urbano will not serve it in the first phase, and it can only be served by water shuttle along the South shore. Finally, if the goal is to contribute to improve the whole metropolitan environment, there seems to be no good reason to concentrate development in what can probably be considered as the highest quality neighborhood of San Juan.

If Isla Grande Village is meant to be a new core of the San Juan metropolitan area, the demand for growth should be primarily met in the Village itself. Isla Grande is fairly central in the metropolitan area and it is accessible by water shuttle three sides out of four. Although Tren Urbano will not serve it initially, it is rather close to the Miramar station, from where shuttle-buses, regular buses or vans can be operated without having to go through the bridges of Intersection 5.

Target Population

The target residential population initially is young, well-educated singles and families, primarily working in the quaternary sector. Typically, this segment of the population looks for high-quality housing. If this opportunity is available close to the office districts it contributes to alleviating traffic congestion. If it is not, then it is accommodated in the suburbs, contributing to sprawl and traffic congestion.

In a longer-term projection, I believe that a second target is senior citizens. Besides those living in Puerto Rico, Puerto Rican who migrated to the US mainland, and are looking for a retirement location could represent a component. If the residential quality and urban environment are good, Puerto Rico, where a number of them may still have family, could be an appealing alternative to Florida. Perhaps, even a small number of US residents could find Puerto Rico as an attractive retirement location.

Isla Grande Village also targets quaternary businesses. Although Puerto Rico is not a world class R&D center, a number of research and educational activities are performed on the island. The increasing proportion of well-educated citizens, the fact that San Juan is an independent state and the location of the Trade and Convention Center, are all factors that can contribute to the growth of this sector. In particular, the Trade Center will spin off some Corporate Learning activities.

A second component of the quaternary sector is entertainment. Since this is nowadays one of the fastest growing industries, it generally doesn't need encouragement. However, I think that some specific activities would be very appropriate for San Juan:

- An aquarium - Museum of Science complex, focus on the water and the tropical features typical of the island environment, which could also run educational activities;
- An important Concert Hall - Opera House, possibly including an open-air component. Surprisingly for a city of 1 million with a college population and year-round high-income tourism, this feature is neither existing nor planned yet.

Site analysis

Isla Grande is divided into two separate entities by the General Aviation airport.

The northern portion of Isla Grande, owned by the Ports Authority and planned to be a cruise port, is bordered by the San Antonio Canal on its northern side, by the San Juan Bay on its western side, and by the airport on its Southern side.

The southern portion is bordered by the airport and the Convention Center on its northern edge, by the dry dock / ship maintenance port area on its eastern edge, and by the San Juan Bay water all along its southwestern edge.

The main opportunities of the site are the following:

- The views towards Old San Juan, the Capitol building and the San Antonio Canal northbound, and towards the San Juan Bay westbound and southbound
- The proximity to Old San Juan, just one minute by boat across the San Antonio Canal
- The large amounts of flat redevelopable land, primarily used for Port-related storage and therefore not requiring massive demolitions
- The fact of being surrounded by water along three sides, which create an opportunity for recreation, water transportation, and other water-related uses
- The presence of an historical site, the Miraflores fort
- The Trade and Convention Center, which will boost the redevelopment of the Island

The main constraints of the site are:

- The general aviation airport, which divides the island, and poses issues of noise and safety
- The presence of the Trade and Convention Center district, which defines the only edge the site has in common with the mainland, for which a Master Plan (as described earlier in this report) is already being implemented
- The dry-dock facility that separates the site from the Parque Central
- There is no link to Tren Urbano.

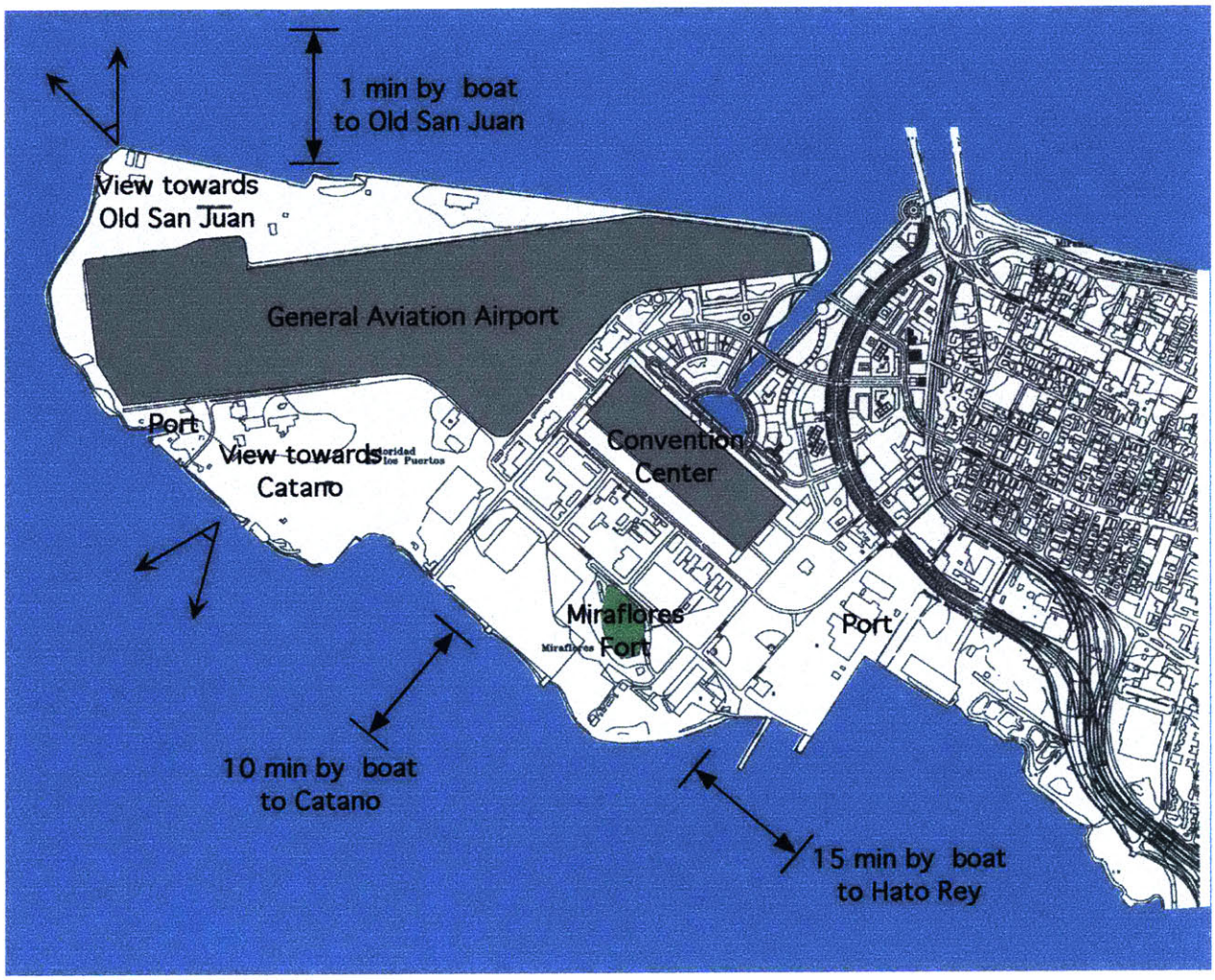

Figure 8

Site Analysis

Figure 9

View towards the Capitol Building

Conceptual Design

The conceptual design scheme organizes Isla Grande by means of two major boulevards leading to two important places. These two boulevards intersect each other in the center of the island, thus creating four quadrants. The first quadrant hosts the Convention Center district and an Office Park. The second quadrant hosts a Marina and a residential district. The third quadrant hosts another residential district. The third quadrant, north of the airport, hosts the cruise terminals and other cruise related activities. In a final stage both boulevards will end at two plazas, developed as major entertainment centers and comprising a small urban port including a water shuttle stop, similar to the water basin in front of the Convention Center.

The first boulevard (San Antonio Parkway) links the new Baldorioty Boulevard with the southern shore and ends at a major entertainment center, similar in character to the Embarcadero Center in San Francisco, where the location of the Aquarium is proposed. An Office Park constitutes a transition zone between the Convention Center and the area close to the southern shore, where a Marina and a residential district facing it are proposed. The second boulevard (Opera Boulevard) orthogonal and intersecting the first one, runs south of the Office Park and points towards the northeastern tip of Isla Grande. It divides the Office Park from the Marina residential district and, west of the intersection with the San Antonio Parkway, it separates the airport from a second

residential area (Bayview Residential). The Opera Boulevard ends at the airport in a first phase.

The northern shore is dedicated to cruise activities, with the exception of the tip facing Old San Juan, where a second entertainment center is located. A major Opera House is proposed in this location. Between the Opera House and the cruise terminals there will be a transition zone (Opera Plaza) including hotels and retail, as well as a water shuttle stop.

The design scheme will be completed in the future, if the airport is relocated. In this future phase, the Opera Boulevard will eventually reach the Opera House and the Opera Plaza. The area formerly occupied by the airport will turn into an industrial park, south of the cruise terminals, and in a third residential areas, south of the Opera House.

The rationale for this design and land use proposal is to create an opportunity for San Juan residents to live and work within a short distance.

Figure 10

Concept Plan

Infrastructure

The main infrastructure components of the design scheme are the following:

- The boulevards
- The open space
- The urban ports.

The Opera Boulevard is the main access point to the Isla Grande Village and divides the Office/Educational area from the residential area. It is planned as two lanes, 12 feet wide, per direction, with a 12 feet central median, and 12 feet walkways on both sides. The boulevard will be planted along the walkways and the central median. The logic of this boulevard is to create a spine, from which all the districts can be accessed, thus avoiding major roadways along the waterfront. In this way it is possible to make the waterfront itself part of the districts as opposed to a separate entity.

The orientation of the boulevard is parallel to the Convention Center, following the orientation of the existing pattern of streets. In the first phase, the airport by means of a heavily planted green buffer separates the boulevard itself. It ends at the airport itself, where thereby creating an opportunity for a passenger terminal, serving both executives and local tourist flights. Beyond that point, a road outskirts the edge of the airport and reaches the tip of Isla Grande. This road is meant to be replaced by the

boulevard extension once the airport is relocated. If in a future phase the airport is relocated, the boulevard and adjacent land uses will be extended towards northwest.

A second important boulevard (San Antonio parkway), composed by two roadways and a large linear park between them, separates the convention center from the airport and leads to the "Embarcadero" district. This boulevard also has two travel lanes per direction, each 12 feet wide and planted walkway on both sides. However the central green space is not simply a median but a linear park. The buildings facing the boulevard will have to have their front towards it. In particular, the plan proposes that the development of the northwestern side of the Convention Center will have to face the boulevard by means of a hotel defining the edge of the Convention Center. The landscaping of the two boulevards will have to be different in order to help visitors unfamiliar with the Village to orient themselves.

The open space is the second infrastructure component of the design scheme, after the boulevards. It must be though of as an area more than as a series of residual spaces, since it contributes to give a form, an edge, and to link the different districts among themselves and with the rest of the city. The main open space features of the redesigned Isla Grande are the following:

- The Miraflores fort, that will be included in an open space area accessible by the San Antonio parkway, and open to the public as a park
- A park east of the Village, buffering it from the residual port activities
- The linear park in the center of the northeast-southwest boulevard
- A buffer all around the airport

- The landscaped walkways-bikeways along the main boulevards
- The accessible waterfront in all the re-designed area, which in the future will allow the creation of a peripheral green path around the island
- The proposed link of the Miraflores fort with the Parque Central.

The third infrastructure component are two urban ports, on the southern shore, around which the Embarcadero center is developed, the second on the northern shore, between the Opera House and the cruise terminals. Both these ports provide a stop for the water shuttle in the main activity centers. They provide a spectacular setting that enhances the relationship between the city and the bay, and hosts the new hotel-entertainment functions ties to the cruise and convention related tourism.

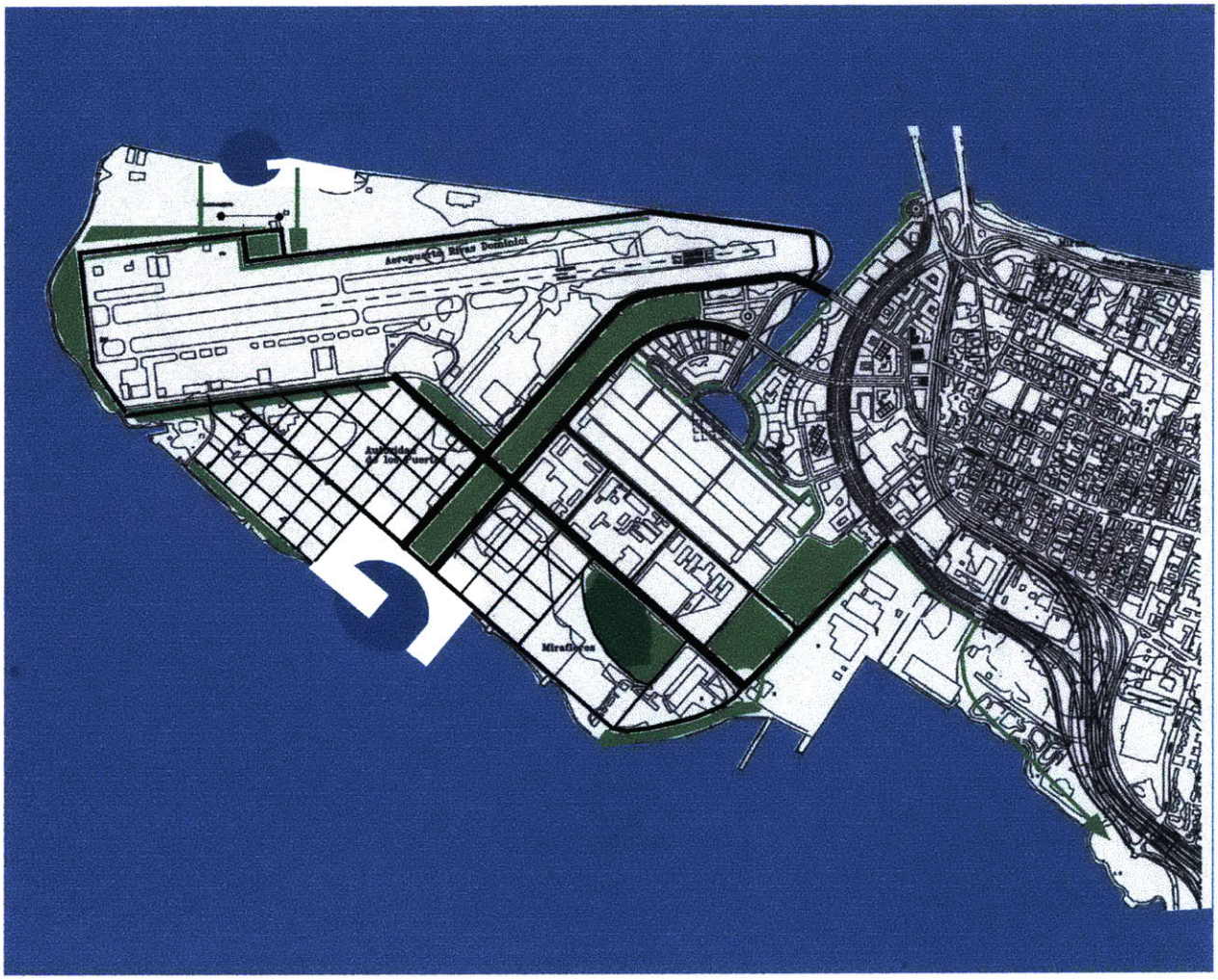

Figure 11

Infrastructure

Transportation

I believe that a shuttle bus service to the next Tren Urbano stop should be established for the employees of the Convention Center and adjacent businesses. As of today, there is no link planned between the Convention Center and Tren Urbano.

If Isla Grande is redeveloped according to the scheme outlined in this report, a scheduled bus service to the closest Tren Urbano stop should serve the Isla Grande Village along its main boulevards. One route could follow the spinal boulevard stopping at the Embarcadero Center, Airport Terminal, Opera House, and cruise terminals. A second route should follow the northeast-southwest boulevard, serving the Convention Center and Embarcadero Center.

As a matter of fact, since there is also a need for transportation from the Convention Center to the airport and vice versa, both routes could proceed to the airport. In this way, the bus routes would create an axis Airport - Tren Urbano stop - Convention Center, of primary importance for the city. This axis could also be used as an experiment for the feasibility of an extension of Tren Urbano itself (i.e. replacing the buses with a rapid transit line).

Water taxi, in particular, is suitable for transportation across the bay as well as along and across the San Antonio Canal. It may also serve the Hato Rey area, via the existing watertaxi (Aquaexpreso) route. This would make Isla Grande the center of a water taxi

service already called for by the Trade and Convention Center Master Plan and the Triàngulo Dorado proposal. If the service is of high quality and its ridership high, the consequences in traffic and environmental terms could be extremely beneficial.

The plan proposes that the main features of the site, i.e. the Opera House and cruise terminals, the Embarcadero Center, and the residential areas, in addition to the Convention Center, be served by water shuttle.

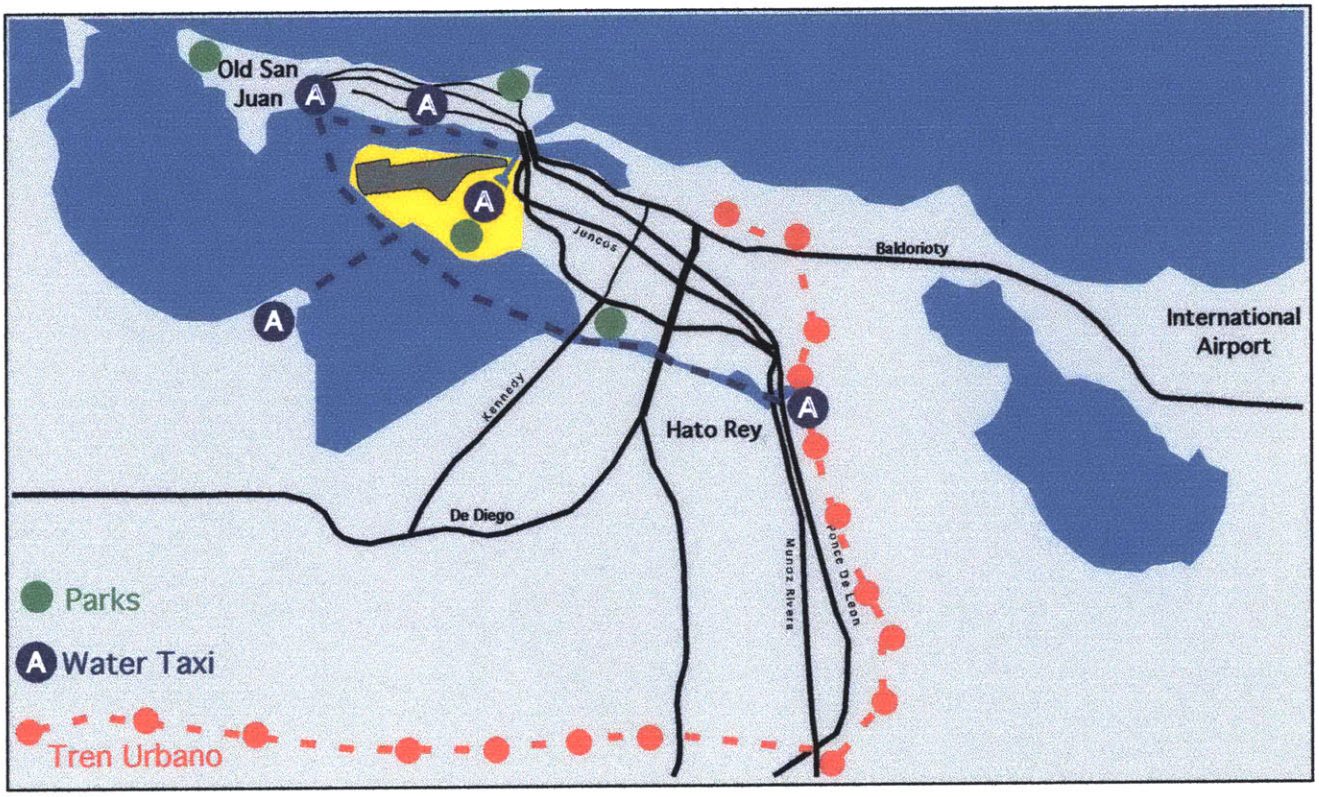

Figure 12

San Juan: Main Roadway and Public Transportation Network

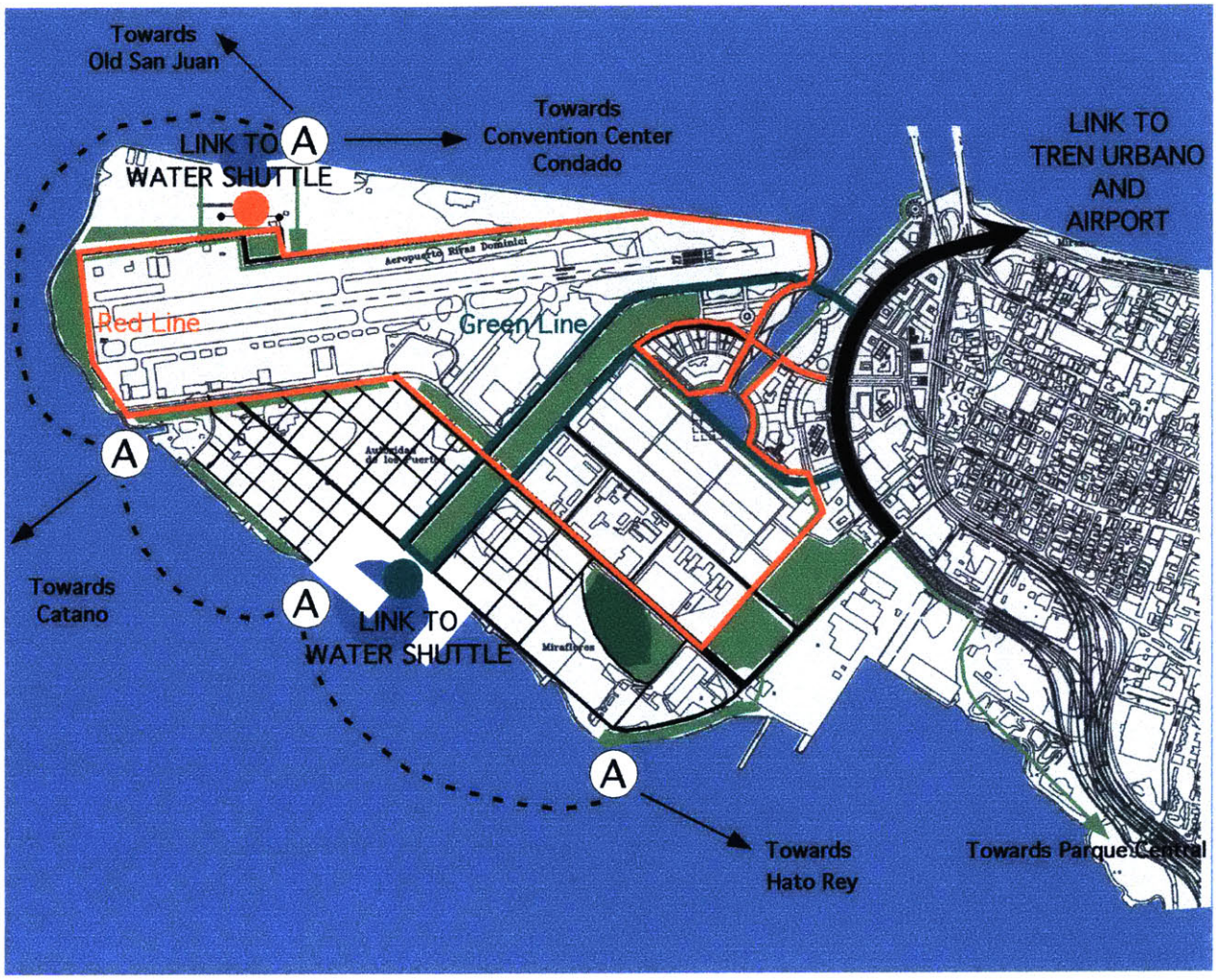

Figure 13

Proposed Public Transportation Network

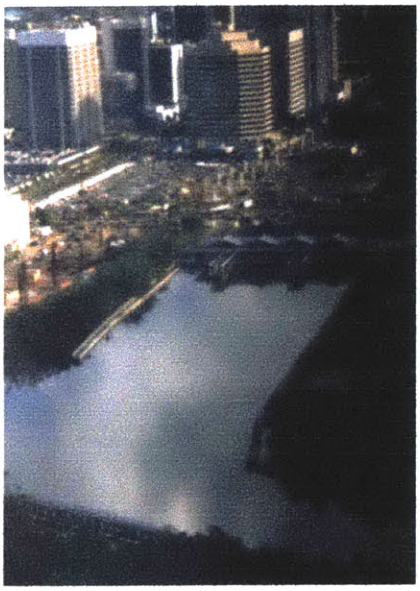

Figure 14

Hato Rey Aquaexpreso Station

OFFICE-EDUCATIONAL DISTRICT

The Convention Center poses the major constraint, but it is also an important engine for the redevelopment of the whole island. The plan creates a transition area on the back of the Convention Center, dedicated to Office and Educational uses. This area on one side relates to the Convention Center district, since some of the activities that will locate in it will be attracted by the proximity with the Convention Center or the Trade Center. On the other side it is bordered by the Opera boulevard proposed, across which sits one of the two residential areas.

The Office/Educational district is made of three relatively large blocks, which preserve the existing streets and can be subdivided by developers depending on the specific use. In this way the plan aims to provide a high degree of flexibility in the spatial configurations allowed on the site, while maintaining the concept of creating a transition between the Convention Center and the residential district.

Buildings along the Opera Boulevard will have to face it and define it as a continuous edge. Buildings at the northwestern and southeastern edge will have to have a façade in the same direction that defines the edge of the district making clear the transition to it.

The building height should also allow a transition between the Convention Center and the Marina residential district. A maximum height of 100 feet is proposed for the Office/Educational district.

EMBARCADERO DISTRICT

The Embarcadero is a major hotel and entertainment center. The plan proposes the location of the Aquarium - Science Museum as the main landmark of the area. The boat excursions will leave from this complex. The complex will have to be an important piece of architecture, visible from the boulevard leading to the Embarcadero. The site is completed by hotels, which primarily target Convention tourism, and retail. The landscaping of the site will have to define and separate it from the adjacent residential areas. In this way it is possible to protect the residential environments from an excessive inflow of tourists.

MARINA RESIDENTIAL DISTRICT

The Marina characterizes the eastern residential community. Residents and tourists will use the Marina alike. The district is bordered by the Embarcadero Center at one end, and by a small hotel district, adjacent to the Miraflores fort, at the other end. All buildings will face the water and the Marina itself. A unified waterfront environment will include the buildings facing the water and the marina. By avoiding an important road along the water, through traffic will be prevented from entering the residential area. It is envisaged as an area of high quality condos, arranged in small blocks. The target

population is young professionals working in the Office and Convention Center districts across the Opera Boulevard.

The district will have a decreasing height between the boulevard and the water edge, in order to maximize the views towards the bay. The height is proposed at 100 in the blocks closest to the boulevard, 50 feet in the blocks close to the water, and 75 feet in the intermediate ones.

BAYVIEW RESIDENTIAL DISTRICT

The western residential community primarily targets families. The theme again is the water and the edge is proposed as an active waterfront, with sport courts, a large swimming pool, a bike and jogging trail. It is landscaped and planted and, again, there is no large road facing the water. Although the waterfront promenade is public and part of a continuous green path around Isla Grande, there is no separation between the community and its waterfront. With respect to the Marina residential district, the western one is a lower scale environment, characterized by small condos facing the water and single family or small residential buildings in the back. An example can be the Back Bay neighborhood in Boston, Massachusetts. The grid is oriented towards the water, and the size of blocks is smaller than it is in the Marina district.

OPERA HOUSE DISTRICT

The northeastern tip of Isla Grande is the first thing that passengers entering the bay by ship see. It is about one minute by boat from the other side of the San Antonio Canal and Old San Juan. The plan proposes the development of this tip as a major landmark of the whole Bay. It has to be a spectacular modern architecture, of very high quality and in striking contrast with the neo-classical Capitol building and the colonial architecture of Old San Juan. In this way it will define the image of Isla Grande as the new, modern, high quality core of San Juan.

The plan proposes to build the Concert Hall / Opera House in this location. The image that comes to mind is the Sidney Opera House. Although the architecture will be very different, it has to be as powerful as that. If in the future will be relocated, the main spinal boulevard will end at the Opera House. For this reason, the building also needs to have an important face overlooking at the boulevard.

The location of the cruise-related area along the northern shore calls for a transition area of hotels ad retail between the Opera House and the terminals. These facilities will primarily cater the tourists. In order to accommodate future demand, some reserve space should be set apart, within the cruise area closest to the Opera House, that in the future may allow the extension of the hotel area.

The existing road that runs parallel to the shoreline, which should be landscaped, serves the cruise area. When the airport will be relocated, it will be possible to link the main spinal boulevard to the cruise terminals.

FUTURE DEVELOPMENT

If the airport is relocated extending the Opera Boulevard to the Opera House will eventually complete the plan. It will end in a major plaza facing the Opera House (Opera Plaza). Between the Boulevard and the cruise terminals, the plan proposes an industrial park for high tech industries. South of the Opera house district, a new residential area oriented towards the bay is proposed. Finally, additional open space, including a major central park, will result from the relocation of the airport.

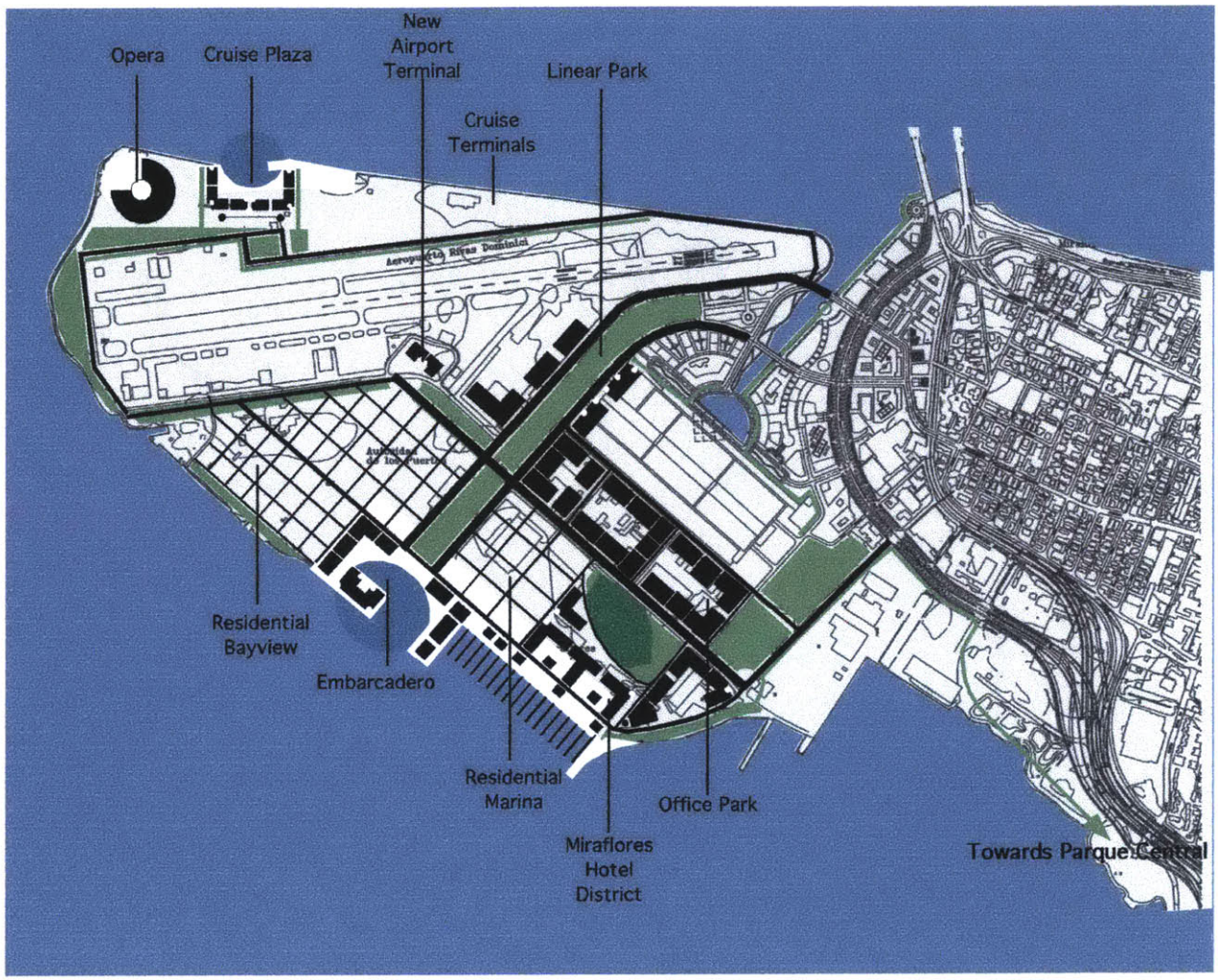

Figure 15

Composite Plan

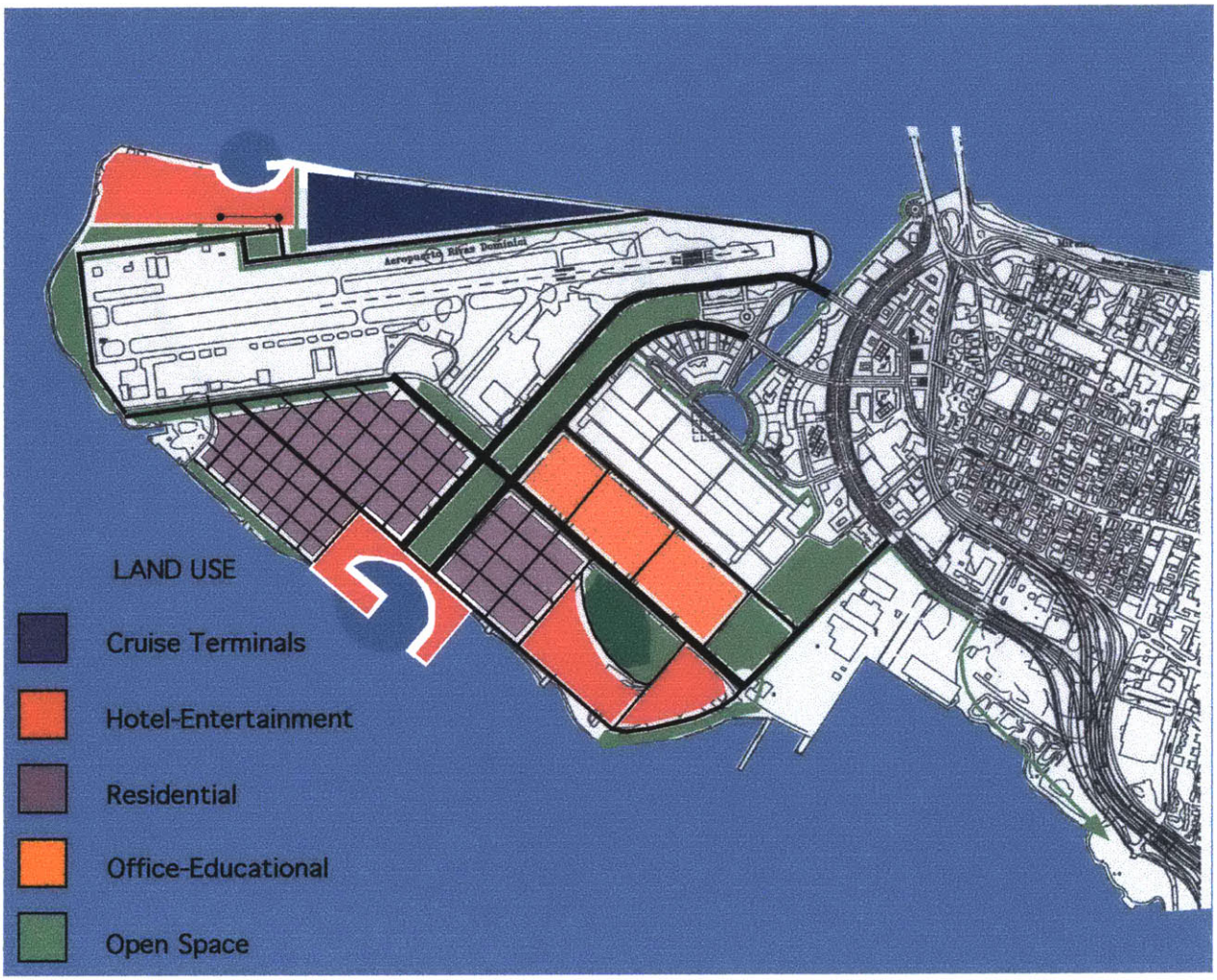

Figure 16

Land Use

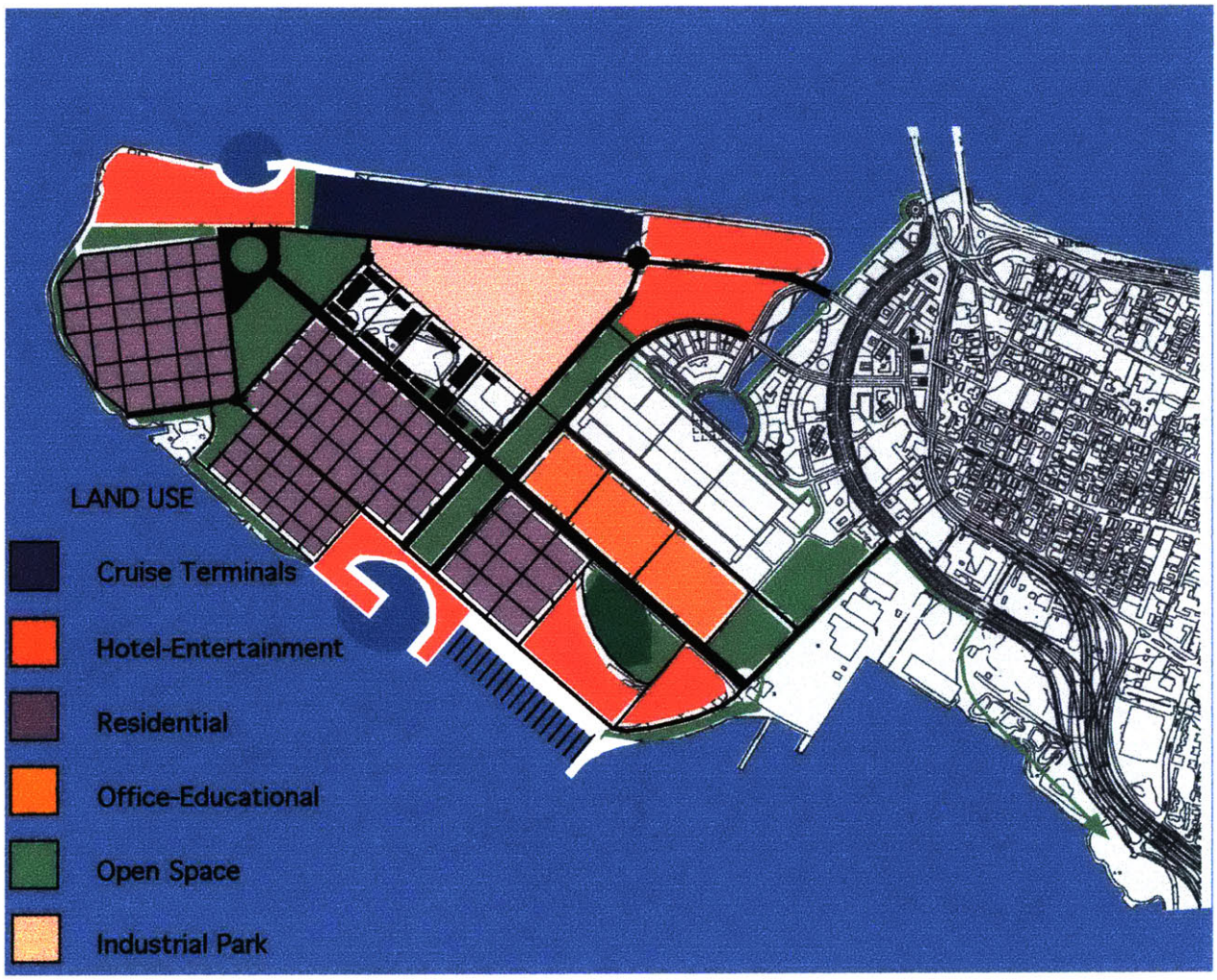

Figure 17

Future Land Use

Phasing

The redevelopment of the areas of Isla Grande located north and south of the airport can proceed independently. However, the first phase should comprise the construction of the two main pieces of infrastructure, i.e. the two boulevards, and all the open space and buffers, so as to create the setting for the development.

Northern portion:

- The development of the cruise terminals can proceed incrementally, as the demand arises. However, the first phase should include at least a first phase of the transition area towards the future Opera House, including the Aquaexpreso stop, inserted in an attractive public space including some retail and cafes, so as to encourage its ridership
- The Opera House will culminate the whole design scheme and transform the image of the city. Since it needs to be an important architecture, its construction will probably be expensive and not be immediately possible. Furthermore, it would probably be too isolated before the redevelopment of the cruise terminals.

Southern portion:

- The first piece of development needed is the Office/Educational parcel. Its development will help generating the demand for housing, and, by buffering it from the Convention Center, will make possible the growth of the eastern residential component
- The second parcel to be developed, possibly in parallel with the previous one mentioned, is the Embarcadero Center. The demand for its activities is tied to the Convention Center and therefore is already there. Its development will create a public space that can contribute to support the future residential development. It will also constitute a very important water taxi stop, thus helping to get the renewed service started
- The development of the marina can proceed incrementally in terms of boat space. However, a first stage will be necessary in order to give sense to the residential development facing it. This residential area should be the first one to be built, both because it is closer to the Office area, and because it is related to the Marina, whose construction is important in itself. Also, this is envisaged as the higher-income area and it may contribute more cash for continuing the development
- The western residential area can proceed incrementally, as demand arises, starting from the water edge. The first stage should be large enough to pay for the waterfront landscaping and furniture.

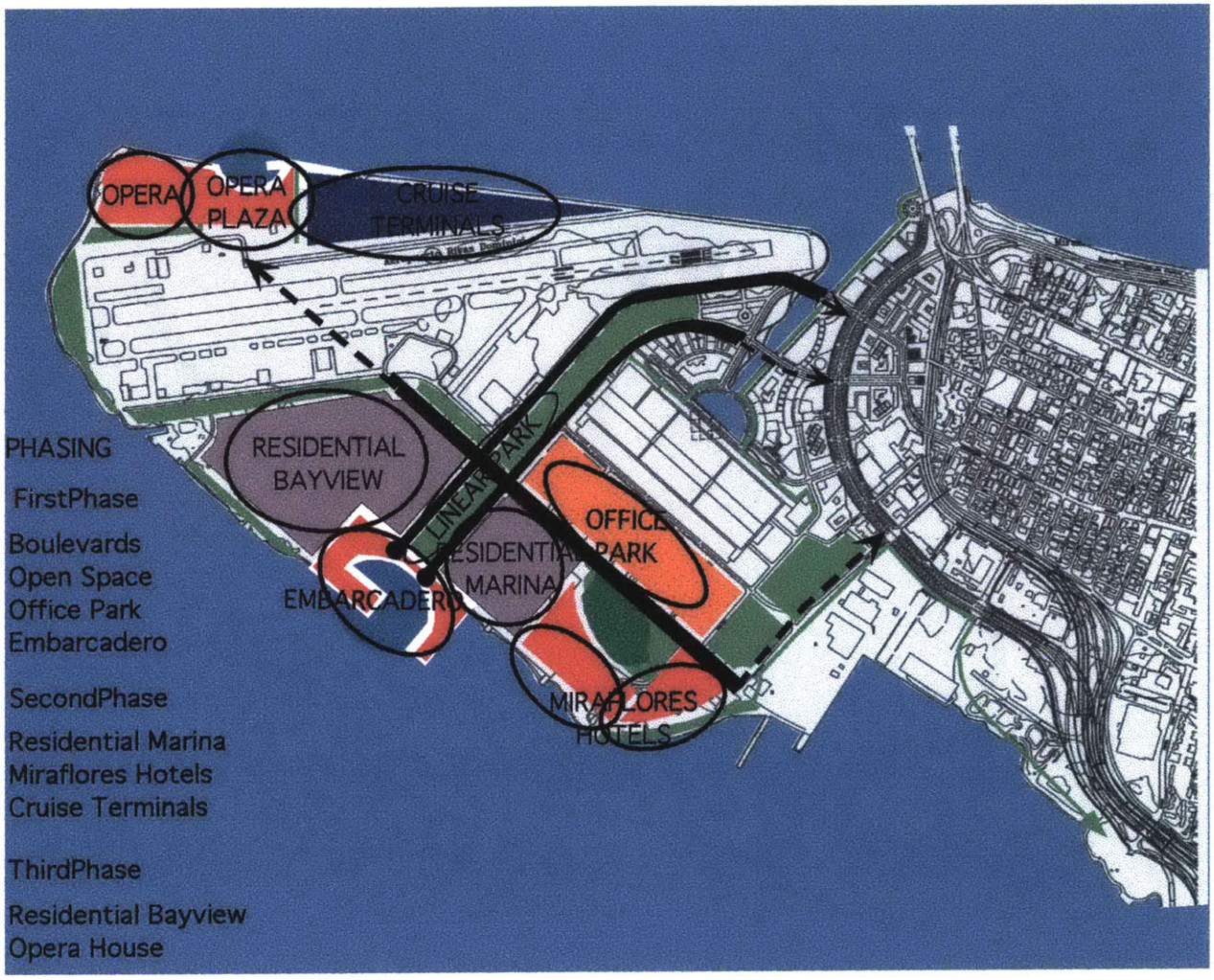

Figure 18

Phasing

Conclusion

The port and the city can and will live together. It is only in the last fifty years, out of five hundred in San Juan and up to five thousand elsewhere, that cities and ports have become indifferent to each other or even enemies.

It is primarily the cruise activity that will rejuvenate and reinvigorate the relationship. However, the ports will have to learn again how to live in a city, not despite the city, as much as the cities will not have to be afraid of their ports any more. The most difficult benchmark for this new collaboration will be the cargo activity. The possibility of coexistence resides in careful planning and high technology. After the years of the unfriendly technology and those of the expulsion of transportation infrastructure from the city, now technology can help cities and port to live adjacent to each other.

The delicate waterfront fringe should not be considered just a linear real estate opportunity. It is the occasion to give physical form to the relationship between cities and ports, and to start re-shaping the whole urban environment. The challenges posed to development in such a delicate area are innumerable. However, in the case of San Juan, the opportunity exists to re-conceptualize and re-design the city around its harbor and along the nodes of Tren Urbano, making Isla Grande the new core. If this scheme is carried forward, the opportunity for water transportation will arise by the geography of the place. Of course, the possibility of exploiting such opportunity resides in the careful planning and management of the whole public transportation system.

It would be a terrible loss, if the present redevelopment opportunities proceeded in a piecemeal approach, in the absence of a coherent vision. Indeed, what the city needs

the most is strategic thinking. A metropolitan strategic plan should be developed as soon as possible.

This thesis has contributed three elements:

- A framework to simultaneously analyze the plans for the port and the plans for the city
- A model to analyze the most troublesome, for San Juan, impact of the proposed developments on the whole metropolitan area, i.e. the traffic impact
- A design proposal to show an alternative, transit oriented, type of development for the future of San Juan's waterfront

Tren Urbano provides the opportunity to rethink the city. Besides providing an infrastructure of enormous importance, the value of the Tren Urbano initiative consists in making available human resources from outside the island, and in training human resources in the island.

In order to make the best possible use of the newly trained human resources, a new attitude towards collaboration and all stakeholders should encourage dialogue. The lack of communication between different agencies is a threat to the success of city planning. The most well known success stories in terms of planning (Barcelona, Lyon) are based on a strategic planning process that involves the stakeholders and promotes a continuous contribution, monitoring, updating of the plan itself. Within this framework more specific plans can be carried on.

The Web Site designed as a component of this study is meant to facilitate the dialogue between all the stakeholders in San Juan, as far as the development of the waterfront is concerned. Although a simple tool, it can be fairly apt to illustrate the outcome of the different proposals. The importance of this tool is tied to the quantity and quality of information that all the concerned parties will be willing to share. It would be extremely useful to the public dialogue if some entity in Puerto Rico would take charge of the Web Site. The Site could really become the Virtual Forum where the proposals for the future of the city are presented and discussed.

Appendices

The Web Site

The Web Site has been designed as a communication tool. It is meant to provide all San Juan's citizens a virtual forum about the future of their city, and in particular of its waterfront.

The Web Site contains three sets of information:

- Images of San Juan's Waterfront
- Text about San Juan, as well as Port and Waterfront related issues
- Links to other Web sites

The Web Site is organized around three frames. The upper left contains a clickable index. The bottom left contains text, "called" by the index, the right window contains images, "called" by various points in the index or text. As the viewer enters the site, the right window shows an aerial photo of San Juan; clicking on defined hotspots, the viewer is shown some images of the area.

As of the date of the present document the Webs Site's address is the following:

http://yerkes.mit.edu/yerkes1/11.52599/seba/rethinkingsanjuan.html

In the future, information about the Web Site and this thesis in general can be obtained by e_mailing the author at:

sp1@alum.mit.edu

Printout of the Trip Generation Distribution Computerized Model

AVERAGE DAILY TRAFFIC								
		ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
PROPOSED DEVELOPMENT	ADT total	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
Isleta								
GOVERNMENT OFFICE BUILDING	1724	431	500	500	310	310	1190	534
ROYAL CARIBBEAN CRUISE TERMINAL		0	0	0	0	0	0	0
OTHER CRUISE SHIP TERMINALS		0	0	0	0	0	0	0
SHOPPING CENTER	20400	5100	5916	5916	3672	3672	14076	6324
RESIDENTIAL BARRIO CAPITOLIO	2070	518	600	600	373	373	1428	642
RESIDENTIAL BARRIO MARINA	1057	264	307	307	190	190	729	328
HOTEL CARIBE HILTON	7949	1987	2305	2305	1431	1431	5485	2464
Isla Grande								
CONVENTION CENTER	5150	1288	1494	1494	927	927	3554	1597
HOTELS	15077	3769	4372	4372	2714	2714	10403	4674
WORLD TRADE & PORT CENTER	4926	1232	1429	1429	887	887	3399	1527
CHILDREN'S DISCOVERY CENTER		0	0	0	0	0	0	0
RESIDENTIAL	3383	846	981	981	609	609	2334	1049
OFFICE	6017	1504	1745	1745	1083	1083	4152	1865
RETAIL	12994	0	0	0	0	0	0	0
Total	80747	16938	19648	19648	12196	12196	46750	21003

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
69	276	276	276	103	103	103	155
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
816	3264	3264	3264	1224	1224	1224	1836
83	331	331	331	124	124	124	186
42	169	169	169	63	63	63	95
318	1272	1272	1272	477	477	477	715
206	824	824	824	309	309	309	464
603	2412	2412	2412	905	905	905	1357
197	788	788	788	296	296	296	443
0	0	0	0	0	0	0	0
135	541	541	541	203	203	203	304
241	963	963	963	361	361	361	542
0	0	0	0	0	0	0	0
2710	10840	10840	10840	4065	4065	4065	6098

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
155	155	276	276	276	103	103	103
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1836	1836	3264	3264	3264	1224	1224	1224
186	186	331	331	331	124	124	124
95	95	169	169	169	63	63	63
715	715	1272	1272	1272	477	477	477
464	464	824	824	824	309	309	309
1357	1357	2412	2412	2412	905	905	905
443	443	788	788	788	296	296	296
0	0	0	0	0	0	0	0
304	304	541	541	541	203	203	203
542	542	963	963	963	361	361	361
0	0	0	0	0	0	0	0
6098	6098	10840	10840	10840	4065	4065	4065

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
276	483	483	483	483
0	0	0	0	0
0	0	0	0	0
3264	5712	5712	5712	5712
331	580	580	580	580
169	296	296	296	296
1272	2226	2226	2226	2226
824	1442	1442	1442	1442
2412	4222	4222	4222	4222
788	1379	1379	1379	1379
0	0	0	0	0
541	947	947	947	947
963	1685	1685	1685	1685
0	0	0	0	0
10840	18971	18971	18971	18971

AM PEAK TRAFFIC								
		ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
PROPOSED DEVELOPMENT	AMPEAK in	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
Isleta								
GOVERNMENT OFFICE BUILDING	123	0	81	0	42	42	0	109
ROYAL CARIBBEAN CRUISE TERMINAL		0	0	0	0	0	0	0
OTHER CRUISE SHIP TERMINALS		0	0	0	0	0	0	0
SHOPPING CENTER	514	211	0	0	303	303	0	51
RESIDENTIAL BARRIO CAPITOLIO	58	11	33	0	14	14	0	0
RESIDENTIAL BARRIO MARINA	97	40	0	0	57	57	0	0
HOTEL CARIBE HILTON	776	0	776	0	0	0	0	691
Isla Grande								
CONVENTION CENTER	1490	0	0	0	0	0	1490	1043
HOTELS	3327	0	0	0	0	0	3327	2961
WORLD TRADE & PORT CENTER	755	0	0	0	0	0	755	672
CHILDREN'S DISCOVERY CENTER		0	0	0	0	0	0	0
RESIDENTIAL	286	0	0	0	0	0	0	0
OFFICE	1091	0	0	0	0	0	1091	971
RETAIL	2728	0	0	0	0	0	0	0
Total	11245	262	890	0	416	416	6663	6498

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
14	46	33	9	9	4	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	22	15	4	4	2	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
85	290	206	58	55	24	3	0
447	0	0	0	0	0	0	0
366	1244	883	247	237	104	11	0
83	282	200	56	54	24	3	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
120	408	290	81	78	34	4	0
0	0	0	0	0	0	0	0
1115	2291	1627	456	436	192	21	0

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
0	0	55	27	6	13	18	18
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	26	13	3	6	9	9
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	345	173	38	84	115	115
0	0	0	0	0	0	0	0
0	0	1481	740	163	361	493	493
0	0	336	168	37	82	112	112
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	485	243	53	118	162	162
0	0	0	0	0	0	0	0
0	0	2728	1364	300	664	909	909

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
46	24	17	17	38
0	0	0	0	0
0	0	0	0	0
21	11	8	8	18
0	0	0	0	0
0	0	0	0	0
288	148	106	106	240
0	0	0	0	0
1234	636	453	453	1031
280	144	103	103	234
0	0	0	0	0
0	0	0	0	0
405	208	149	149	338
0	0	0	0	0
2273	1171	835	835	1899

PM PEAK TRAFFIC								
		ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
PROPOSED DEVELOPMENT	PM PEAK out	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
Isleta			ADT%					
GOVERNMENT OFFICE BUILDING	72	0	0	49	23	23	63	0
ROYAL CARIBBEAN CRUISE TERMINAL		0	0	0	0	0	0	0
OTHER CRUISE SHIP TERMINALS		0	0	0	0	0	0	0
SHOPPING CENTER	1607	659	0	0	948	948	161	0
RESIDENTIAL BARRIO CAPITOLIO	101	18	0	58	26	26	0	0
RESIDENTIAL BARRIO MARINA	21	9	0	0	12	12	0	0
HOTEL CARIBE HILTON	377	0	0	377	0	0	332	0
Isla Grande								
CONVENTION CENTER	2235	0	0	0	0	0	1565	0
HOTELS	1872	0	0	0	0	0	1647	0
WORLD TRADE & PORT CENTER	680	0	0	0	0	0	598	0
CHILDREN'S DISCOVERY CENTER		0	0	0	0	0	0	0
RESIDENTIAL	279	0	0	0	0	0	0	0
OFFICE	1011	0	0	0	0	0	890	0
RETAIL		0	0	0	0	0	0	0
Total	8255	686	0	484	1010	1010	5256	0

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
9	27	19	5	0	0	0	6
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	67	48	13	0	0	0	14
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
45	139	99	28	0	0	0	30
671	0	0	0	0	0	0	0
225	692	491	138	0	0	0	148
82	251	178	50	0	0	0	54
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
121	374	265	74	0	0	0	80
0	0	0	0	0	0	0	0
1152	1550	1101	308	0	0	0	332

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
2	0	31	16	3	8	8	11
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
5	0	79	39	9	20	20	29
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
10	1	163	81	18	40	40	60
0	0	0	0	0	0	0	0
52	5	807	404	89	201	201	297
19	2	293	147	32	73	73	108
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
28	3	436	218	48	108	108	160
0	0	0	0	0	0	0	0
116	10	1809	904	199	450	450	666

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
27	14	14	15	28
0	0	0	0	0
0	0	0	0	0
68	35	35	39	70
0	0	0	0	0
0	0	0	0	0
141	71	71	81	144
0	0	0	0	0
701	354	354	401	716
254	128	128	146	260
0	0	0	0	0
0	0	0	0	0
378	191	191	217	387
0	0	0	0	0
1570	793	793	898	1604

TRAFFIC PERCENTAGES - ADT	GENERATED	ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
	100	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
GOVERNMENT OFFICE BUILDING		25%	29%	29%	18%	18%	69%	31%
ROYAL CARIBBEAN CRUISE TERMINAL		25%	29%	29%	18%	18%	69%	31%
OTHER CRUISE SHIP TERMINALS		25%	29%	29%	18%	18%	69%	31%
SHOPPING CENTER		25%	29%	29%	18%	18%	69%	31%
RESIDENTIAL BARRIO CAPITOLIO		25%	29%	29%	18%	18%	69%	31%
RESIDENTIAL BARRIO MARINA		25%	29%	29%	18%	18%	69%	31%
HOTEL CARIBE HILTON		25%	29%	29%	18%	18%	69%	31%
CONVENTION CENTER		25%	29%	29%	18%	18%	69%	31%
HOTELS		25%	29%	29%	18%	18%	69%	31%
WORLD TRADE & PORT CENTER		25%	29%	29%	18%	18%	69%	31%
CHILDREN'S DISCOVERY CENTER		25%	29%	29%	18%	18%	69%	31%
RESIDENTIAL		25%	29%	29%	18%	18%	69%	31%
OFFICE		25%	29%	29%	18%	18%	69%	31%
RETAIL		25%	29%	29%	18%	18%	69%	31%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%
4%	16%	16%	16%	6%	6%	6%	9%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%
9%	9%	16%	16%	16%	6%	6%	6%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%
16%	28%	28%	28%	28%

TRAFFIC PERCENTAGES - AM IN TRAFFIC	GENERATED	ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
	100	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
GOVERNMENT OFFICE BUILDING			66%		34%	34%		89%
ROYAL CARIBBEAN CRUISE TERMINAL		41%			59%	59%		60%
OTHER CRUISE SHIP TERMINALS		41%			59%	59%		60%
SHOPPING CENTER		41%			59%	59%		10%
RESIDENTIAL BARRIO CAPITOLIO		19%	57%		24%	24%		
RESIDENTIAL BARRIO MARINA		41%			59%	59%		
HOTEL CARIBE HILTON			100%					89%
CONVENTION CENTER							100%	70%
HOTELS							100%	89%
WORLD TRADE & PORT CENTER							100%	89%
CHILDREN'S DISCOVERY CENTER							100%	89%
RESIDENTIAL								
OFFICE							100%	89%
RETAIL							100%	89%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
11%	37%	27%	7%	7%	3%	0%	
15%	25%	18%	5%	5%	2%	0%	
15%	25%	18%	5%	5%	2%	0%	
	4%	3%	1%	1%	0%	0%	
11%	37%	27%	7%	7%	3%	0%	
30%							
11%	37%	27%	7%	7%	3%	0%	
11%	37%	27%	7%	7%	3%	0%	
11%	37%	27%	7%	7%	3%	0%	
11%	37%	27%	7%	7%	3%	0%	
11%	37%	27%	7%	7%	3%	0%	

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
		45%	22%	5%	11%	15%	15%
		30%	15%	3%	7%	10%	10%
		30%	15%	3%	7%	10%	10%
		5%	3%	1%	1%	2%	2%
		45%	22%	5%	11%	15%	15%
		45%	22%	5%	11%	15%	15%
		45%	22%	5%	11%	15%	15%
		45%	22%	5%	11%	15%	15%
		45%	22%	5%	11%	15%	15%
		45%	22%	5%	11%	15%	15%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
37%	19%	14%	14%	31%
25%	13%	9%	9%	21%
25%	13%	9%	9%	21%
4%	2%	2%	2%	3%
37%	19%	14%	14%	31%
37%	19%	14%	14%	31%
37%	19%	14%	14%	31%
37%	19%	14%	14%	31%
37%	19%	14%	14%	31%
37%	19%	14%	14%	31%

TRAFFIC PERCENTAGES - PM OUT TRAFFIC	GENERATED	ISLETA	ISLETA	ISLETA	ISLETA	ISLETA	BRIDGES	BRIDGES
	100	MARINA	MUNOZ RIVERA	PONCE DE LEON	JUNCOS W	JUNCOS E	ESTEVES BRIDGE	SAN ANTONIO BRIDGE
GOVERNMENT OFFICE BUILDING				68%	32%	32%	88%	
ROYAL CARIBBEAN CRUISE TERMINAL		41%			59%	59%	60%	
OTHER CRUISE SHIP TERMINALS		41%			59%	59%	60%	
SHOPPING CENTER		41%			59%	59%	10%	
RESIDENTIAL BARRIO CAPITOLIO		18%		57%	26%	26%		
RESIDENTIAL BARRIO MARINA		41%			59%	59%		
HOTEL CARIBE HILTON				100%			88%	
CONVENTION CENTER							70%	
HOTELS							88%	
WORLD TRADE & PORT CENTER							88%	
CHILDREN'S DISCOVERY CENTER							88%	
RESIDENTIAL								
OFFICE							88%	
RETAIL							88%	

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
ASHFORD	BALDORIOTY W	BALDORIOTY C	BALDORIOTY E	PONCE DE LEON W	PONCE DE LEON C	PONCE DE LEON E	JUNCOS W
12%	37%	26%	7%				8%
15%	25%	18%	5%				5%
15%	25%	18%	5%				5%
	4%	3%	1%				1%
12%	37%	26%	7%				8%
30%							
12%	37%	26%	7%				8%
12%	37%	26%	7%				8%
12%	37%	26%	7%				8%
12%	37%	26%	7%				8%
12%	37%	26%	7%				8%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
JUNCOS C	JUNCOS E	MUNOZ RIVERA W	MUNOZ RIVERA C	MUNOZ RIVERA E	TODD N	TODD C	TODD S
3%	0%	43%	22%	5%	11%	11%	16%
2%	0%	29%	15%	3%	7%	7%	11%
2%	0%	29%	15%	3%	7%	7%	11%
0%	0%	5%	2%	1%	1%	1%	2%
3%	0%	43%	22%	5%	11%	11%	16%
3%	0%	43%	22%	5%	11%	11%	16%
3%	0%	43%	22%	5%	11%	11%	16%
3%	0%	43%	22%	5%	11%	11%	16%
3%	0%	43%	22%	5%	11%	11%	16%
3%	0%	43%	22%	5%	11%	11%	16%

MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES	MAJOR ARTERIES
KENNEDY	DEDIEGO N	DEDIEGO C	DEDIEGO S	DE DIEGO SS
37%	19%	19%	21%	38%
26%	13%	13%	15%	26%
26%	13%	13%	15%	26%
4%	2%	2%	2%	4%
37%	19%	19%	21%	38%
37%	19%	19%	21%	38%
37%	19%	19%	21%	38%
37%	19%	19%	21%	38%
37%	19%	19%	21%	38%
37%	19%	19%	21%	38%

TRAFFIC PERCENTAGES - ISLETA	IN			OUT		
	m	M	J	m	P	J
m/M/J	19%	54%	27%			
m/P/J				18%	57%	26%
m/J	41%		59%	41%		59%
M/J		66%	34%			
P/J					68%	32%
m=marina; M=Munoz; J=Juncos;P=Ponce						

Printout of the Trip Generation Distribution Results by Roadway

ISLETA	MARINA				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1133	2267	3400
	AVERAGE DAILY TRAFFIC				18400
	PEAK AM		1196		1840
	PEAK PM			644	
	NET AVERAGE				2633
	NET PEAK		-63	1623	
	CURRENT NET AS % OF CAPACITY		-6%	72%	
GENERATED	AVERAGE DAILY TRAFFIC				16938
	PEAK AM		262		
	PEAK PM			686	
	NET AVERAGE				1928
	NET PEAK		-324	937	
	GENERATED NET AS % OF CAPACITY		-29%	41%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-767
	NET PEAK (CURRENT TRAFFIC)		-1196	-644	
	NET AVERAGE (GENERATED TRAFFIC)				-1472
	NET PEAK (GENERATED TRAFFIC)		-1458	-1330	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ISLETA	MUNOZ RIVERA				
			IN	OUT	TOTAL
CURRENT	CAPACITY		3950	0	3950
	AVERAGE DAILY TRAFFIC				26400
	PEAK AM		2376		2376
	PEAK PM			0	
	NET AVERAGE				2850
	NET PEAK		1574	0	
	CURRENT NET AS % OF CAPACITY		40%	#DIV/0!	
GENERATED	AVERAGE DAILY TRAFFIC				19648
	PEAK AM		890		
	PEAK PM			0	
	NET AVERAGE				2031
	NET PEAK		684	0	
	GENERATED NET AS % OF CAPACITY		17%	#DIV/0!	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1100
	NET PEAK (CURRENT TRAFFIC)		-2376	0	
	NET AVERAGE (GENERATED TRAFFIC)				-1919
	NET PEAK (GENERATED TRAFFIC)		-3266	0	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ISLETA	PONCE DE LEON				
			IN	OUT	TOTAL
CURRENT	CAPACITY		0	3950	3950
	AVERAGE DAILY TRAFFIC				29500
	PEAK AM		0		2655
	PEAK PM			2655	
	NET AVERAGE				2721
	NET PEAK		0	1295	
	CURRENT NET AS % OF CAPACITY		#DIV/0!	33%	
GENERATED	AVERAGE DAILY TRAFFIC				19648
	PEAK AM		0		
	PEAK PM			484	
	NET AVERAGE				1902
	NET PEAK		0	811	
	GENERATED NET AS % OF CAPACITY		#DIV/0!	21%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1229
	NET PEAK (CURRENT TRAFFIC)		0	-2655	
	NET AVERAGE (GENERATED TRAFFIC)				-2048
	NET PEAK (GENERATED TRAFFIC)		0	-3139	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ISLETA	JUNCOS W				
			IN	OUT	TOTAL
CURRENT	CAPACITY		760	760	1520
	AVERAGE DAILY TRAFFIC				24500
	PEAK AM		1470		2450
	PEAK PM			980	
	NET AVERAGE				499
	NET PEAK		-710	-220	
	CURRENT NET AS % OF CAPACITY		-93%	-29%	
GENERATED	AVERAGE DAILY TRAFFIC				12196
	PEAK AM		416		
	PEAK PM			1010	
	NET AVERAGE				-9
	NET PEAK		-1126	-1230	
	GENERATED NET AS % OF CAPACITY		-148%	-162%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1021
	NET PEAK (CURRENT TRAFFIC)		-1470	-980	
	NET AVERAGE (GENERATED TRAFFIC)				-1529
	NET PEAK (GENERATED TRAFFIC)		-1886	-1990	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ISLETA	JUNCOS E				
			IN	OUT	TOTAL
CURRENT	CAPACITY		760	760	1520
	AVERAGE DAILY TRAFFIC				29400
	PEAK AM		1764		2940
	PEAK PM			1176	
	NET AVERAGE				295
	NET PEAK		-1004	-416	
	CURRENT NET AS % OF CAPACITY		-132%	-55%	
GENERATED	AVERAGE DAILY TRAFFIC				12196
	PEAK AM		416		
	PEAK PM			1010	
	NET AVERAGE				-213
	NET PEAK		-1420	-1426	
	GENERATED NET AS % OF CAPACITY		-187%	-188%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1225
	NET PEAK (CURRENT TRAFFIC)		-1764	-1176	
	NET AVERAGE (GENERATED TRAFFIC)				-1733
	NET PEAK (GENERATED TRAFFIC)		-2180	-2186	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

BRIDGES	ESTEVES BRIDGE				
			IN	OUT	TOTAL
CURRENT	CAPACITY		0	6760	6760
	AVERAGE DAILY TRAFFIC				60100
	PEAK AM		0		7212
	PEAK PM			7212	
	NET AVERAGE				4256
	NET PEAK		0	-452	
	CURRENT NET AS % OF CAPACITY		#DIV/0!	-7%	
GENERATED	AVERAGE DAILY TRAFFIC				46750
	PEAK AM		6663		
	PEAK PM			5256	
	NET AVERAGE				2308
	NET PEAK		-6663	-5708	
	GENERATED NET AS % OF CAPACITY		#DIV/0!	-84%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2504
	NET PEAK (CURRENT TRAFFIC)		0	-7212	
	NET AVERAGE (GENERATED TRAFFIC)				-4452
	NET PEAK (GENERATED TRAFFIC)		-6663	-12468	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

BRIDGES	SAN ANTONIO BRIDGE				
			IN	OUT	TOTAL
CURRENT	CAPACITY		6760	0	6760
	AVERAGE DAILY TRAFFIC				26800
	PEAK AM		2412		2412
	PEAK PM			0	
	NET AVERAGE				5643
	NET PEAK		4348	0	
	CURRENT NET AS % OF CAPACITY		64%	#DIV/0!	
GENERATED	AVERAGE DAILY TRAFFIC				21003
	PEAK AM		6498		
	PEAK PM			0	
	NET AVERAGE				4768
	NET PEAK		-2150	0	
	GENERATED NET AS % OF CAPACITY		-32%	#DIV/0!	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1117
	NET PEAK (CURRENT TRAFFIC)		-2412	0	
	NET AVERAGE (GENERATED TRAFFIC)				-1992
	NET PEAK (GENERATED TRAFFIC)		-8910	0	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	ASHFORD				
			IN	OUT	TOTAL
CURRENT	CAPACITY		540	540	1080
	AVERAGE DAILY TRAFFIC				17500
	PEAK AM		1050		1750
	PEAK PM			700	
	NET AVERAGE				351
	NET PEAK		-510		
	CURRENT NET AS % OF CAPACITY		-94%	0%	
GENERATED	AVERAGE DAILY TRAFFIC				2710
	PEAK AM		1115		
	PEAK PM			1152	
	NET AVERAGE				238
	NET PEAK		-1625	-1152	
	GENERATED NET AS % OF CAPACITY		-301%	-213%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-729
	NET PEAK (CURRENT TRAFFIC)		-1050	-700	
	NET AVERAGE (GENERATED TRAFFIC)				-842
	NET PEAK (GENERATED TRAFFIC)		-2165	-1852	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	BALDORIOTY DE CASTRO W				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1975	1975	3950
	AVERAGE DAILY TRAFFIC				53600
	PEAK AM		2787		4288
	PEAK PM			1501	
	NET AVERAGE				1717
	NET PEAK		-812	474	
	CURRENT NET AS % OF CAPACITY		-41%	24%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		2291		
	PEAK PM			1550	
	NET AVERAGE				1265
	NET PEAK		-3104	-1076	
	GENERATED NET AS % OF CAPACITY		-157%	-54%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2233
	NET PEAK (CURRENT TRAFFIC)		-2787	-1501	
	NET AVERAGE (GENERATED TRAFFIC)				-2685
	NET PEAK (GENERATED TRAFFIC)		-5079	-3051	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	BALDORIOTY DE CASTRO C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		2060	2060	4120
	AVERAGE DAILY TRAFFIC				71600
	PEAK AM		3723		5728
	PEAK PM			2005	
	NET AVERAGE				1137
	NET PEAK		-1663	55	
	CURRENT NET AS % OF CAPACITY		-81%	3%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		1627		
	PEAK PM			1101	
	NET AVERAGE				685
	NET PEAK		-3290	-1046	
	GENERATED NET AS % OF CAPACITY		-160%	-51%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2983
	NET PEAK (CURRENT TRAFFIC)		-3723	-2005	
	NET AVERAGE (GENERATED TRAFFIC)				-3435
	NET PEAK (GENERATED TRAFFIC)		-5350	-3106	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	BALDORIOTY DE CASTRO E				
			IN	OUT	TOTAL
CURRENT	CAPACITY		2090	2090	4180
	AVERAGE DAILY TRAFFIC				61200
	PEAK AM		2785		4284
	PEAK PM			1499	
	NET AVERAGE				1630
	NET PEAK		-695	591	
	CURRENT NET AS % OF CAPACITY		-33%	28%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		456		
	PEAK PM			308	
	NET AVERAGE				1178
	NET PEAK		-1150	282	
	GENERATED NET AS % OF CAPACITY		-55%	14%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2550
	NET PEAK (CURRENT TRAFFIC)		-2785	-1499	
	NET AVERAGE (GENERATED TRAFFIC)				-3002
	NET PEAK (GENERATED TRAFFIC)		-3240	-1808	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	PONCE DE LEON W				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1410	0	1410
	AVERAGE DAILY TRAFFIC				10300
	PEAK AM		824		824
	PEAK PM			0	
	NET AVERAGE				981
	NET PEAK		586	0	
	CURRENT NET AS % OF CAPACITY		42%	#DIV/0!	
GENERATED	AVERAGE DAILY TRAFFIC				4065
	PEAK AM		436		
	PEAK PM			0	
	NET AVERAGE				811
	NET PEAK		150	0	
	GENERATED NET AS % OF CAPACITY		11%	#DIV/0!	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-429
	NET PEAK (CURRENT TRAFFIC)		-824	0	
	NET AVERAGE (GENERATED TRAFFIC)				-599
	TRAFFIC)		-1260	0	
	OF PROPOSED		#DIV/0!	#DIV/0!	

ARTERIES	PONCE DE LEON C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1410	0	1410
	AVERAGE DAILY TRAFFIC				17900
	PEAK AM		1432		1432
	PEAK PM			0	
	NET AVERAGE				664
	NET PEAK		-22	0	
	CURRENT NET AS % OF CAPACITY		-2%	#DIV/0!	
GENERATED	AVERAGE DAILY TRAFFIC				4065
	PEAK AM		192		
	PEAK PM			0	
	NET AVERAGE				495
	NET PEAK		-214	0	
	GENERATED NET AS % OF CAPACITY		-15%	#DIV/0!	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-746
	NET PEAK (CURRENT TRAFFIC)		-1432	0	
	NET AVERAGE (GENERATED TRAFFIC)				-915
	NET PEAK (GENERATED TRAFFIC)		-1624	0	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	PONCE DE LEON E				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1410	0	1410
	TRAFFIC				18400
	PEAK AM		1288		1288
	PEAK PM			0	
	NET AVERAGE				643
	NET PEAK		122	0	
	CAPACITY		9%	#DIV/0!	
GENERATED	TRAFFIC				4065
	PEAK AM		21		
	PEAK PM			0	
	NET AVERAGE				474
	NET PEAK		101	0	
	OF CAPACITY		7%	#DIV/0!	
PROPOSED	CAPACITY				
	(CURRENT TRAFFIC)				-767
	TRAFFIC)		-1288	0	
	(GENERATED TRAFFIC)				-936
	TRAFFIC)		-1309	0	
	OF PROPOSED		#DIV/0!	#DIV/0!	

ARTERIES	JUNCOS W				
			IN	OUT	TOTAL
CURRENT	CAPACITY			2200	2200
	AVERAGE DAILY TRAFFIC				11500
	PEAK AM		0		920
	PEAK PM			920	
	NET AVERAGE				1721
	NET PEAK		0	1280	
	CURRENT NET AS % OF CAPACITY		#DIV/0!	58%	
GENERATED	AVERAGE DAILY TRAFFIC				6098
	PEAK AM		0		
	PEAK PM			332	
	NET AVERAGE				1467
	NET PEAK		0	948	
	GENERATED NET AS % OF CAPACITY		#DIV/0!	43%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-479
	NET PEAK (CURRENT TRAFFIC)		0	-920	
	NET AVERAGE (GENERATED TRAFFIC)				-733
	NET PEAK (GENERATED TRAFFIC)		0	-1252	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	JUNCOS C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		0	2200	2200
	AVERAGE DAILY TRAFFIC				20200
	PEAK AM		0		2020
	PEAK PM			2020	
	NET AVERAGE				1358
	NET PEAK		0	180	
	CURRENT NET AS % OF CAPACITY		#DIV/0!	8%	
GENERATED	AVERAGE DAILY TRAFFIC				6098
	PEAK AM		0		
	PEAK PM			116	
	NET AVERAGE				1104
	NET PEAK		0	64	
	GENERATED NET AS % OF CAPACITY		#DIV/0!	3%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-842
	NET PEAK (CURRENT TRAFFIC)		0	-2020	
	NET AVERAGE (GENERATED TRAFFIC)				-1096
	NET PEAK (GENERATED TRAFFIC)		0	-2136	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	JUNCOS E				
			IN	OUT	TOTAL
CURRENT	CAPACITY		0	2200	2200
	AVERAGE DAILY TRAFFIC				15400
	PEAK AM		0		1232
	PEAK PM			1232	
	NET AVERAGE				1558
	NET PEAK		0	968	
	CURRENT NET AS % OF CAPACITY		#DIV/0!	44%	
GENERATED	AVERAGE DAILY TRAFFIC				6098
	PEAK AM		0		
	PEAK PM			10	
	NET AVERAGE				1304
	NET PEAK		0	958	
	GENERATED NET AS % OF CAPACITY		#DIV/0!	44%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-642
	NET PEAK (CURRENT TRAFFIC)		0	-1232	
	NET AVERAGE (GENERATED TRAFFIC)				-896
	NET PEAK (GENERATED TRAFFIC)		0	-1242	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	MUNOZ RIVERA W				
			IN	OUT	TOTAL
CURRENT	CAPACITY		1765	1765	3530
	AVERAGE DAILY TRAFFIC				62900
	PEAK AM		3271		5032
	PEAK PM			1761	
	NET AVERAGE				909
	NET PEAK		-1506	4	
	CURRENT NET AS % OF CAPACITY		-85%	0%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		2728		
	PEAK PM			1809	
	NET AVERAGE				457
	NET PEAK		-4234	-1805	
	GENERATED NET AS % OF CAPACITY		-240%	-102%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2621
	NET PEAK (CURRENT TRAFFIC)		-3271	-1761	
	NET AVERAGE (GENERATED TRAFFIC)				-3073
	NET PEAK (GENERATED TRAFFIC)		-5999	-3570	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	MUNOZ RIVERA C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		2155	2155	4310
	AVERAGE DAILY TRAFFIC				63700
	PEAK AM		3058		5096
	PEAK PM			2038	
	NET AVERAGE				1656
	NET PEAK		-903	117	
	CURRENT NET AS % OF CAPACITY		-42%	5%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		1364		
	PEAK PM			904	
	NET AVERAGE				1204
	NET PEAK		-2266	-788	
	GENERATED NET AS % OF CAPACITY		-105%	-37%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2654
	NET PEAK (CURRENT TRAFFIC)		-3058	-2038	
	NET AVERAGE (GENERATED TRAFFIC)				-3106
	NET PEAK (GENERATED TRAFFIC)		-4421	-2943	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	MUNOZ RIVERA E				
			IN	OUT	TOTAL
CURRENT	CAPACITY		2155	2155	4310
	AVERAGE DAILY TRAFFIC				56600
	PEAK AM		2943		4528
	PEAK PM			1585	
	NET AVERAGE				1952
	NET PEAK		-788	570	
	CURRENT NET AS % OF CAPACITY		-37%	26%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		300		
	PEAK PM			199	
	NET AVERAGE				1500
	NET PEAK		-1088	371	
	GENERATED NET AS % OF CAPACITY		-50%	17%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2358
	NET PEAK (CURRENT TRAFFIC)		-2943	-1585	
	NET AVERAGE (GENERATED TRAFFIC)				-2810
	NET PEAK (GENERATED TRAFFIC)		-3243	-1784	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	TODD N				
			IN	OUT	TOTAL
CURRENT	CAPACITY		630	630	1260
	AVERAGE DAILY TRAFFIC				29600
	PEAK AM		1539		2368
	PEAK PM			829	
	NET AVERAGE				27
	NET PEAK		-909	-199	
	CURRENT NET AS % OF CAPACITY		-144%	-32%	
GENERATED	AVERAGE DAILY TRAFFIC				4065
	PEAK AM		664		
	PEAK PM			450	
	NET AVERAGE				-143
	NET PEAK		-1574	-648	
	GENERATED NET AS % OF CAPACITY		-250%	-103%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1233
	NET PEAK (CURRENT TRAFFIC)		-1539	-829	
	NET AVERAGE (GENERATED TRAFFIC)				-1403
	NET PEAK (GENERATED TRAFFIC)		-2204	-1278	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	TODD C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		630	630	1260
	AVERAGE DAILY TRAFFIC				22900
	PEAK AM		1191		1832
	PEAK PM			641	
	NET AVERAGE				306
	NET PEAK		-561	-11	
	CURRENT NET AS % OF CAPACITY		-89%	-2%	
GENERATED	AVERAGE DAILY TRAFFIC				4065
	PEAK AM		909		
	PEAK PM			450	
	NET AVERAGE				136
	NET PEAK		-1470	-461	
	GENERATED NET AS % OF CAPACITY		-233%	-73%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-954
	NET PEAK (CURRENT TRAFFIC)		-1191	-641	
	NET AVERAGE (GENERATED TRAFFIC)				-1124
	NET PEAK (GENERATED TRAFFIC)		-2100	-1091	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	TODD S				
			IN	OUT	TOTAL
CURRENT	CAPACITY		865	865	1730
	AVERAGE DAILY TRAFFIC				37800
	PEAK AM		1966		3024
	PEAK PM			1058	
	NET AVERAGE				155
	NET PEAK		-1101	-193	
	CURRENT NET AS % OF CAPACITY		-127%	-22%	
GENERATED	AVERAGE DAILY TRAFFIC				4065
	PEAK AM		909		
	PEAK PM			666	
	NET AVERAGE				-14
	NET PEAK		-2009	-859	
	GENERATED NET AS % OF CAPACITY		-232%	-99%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-1575
	NET PEAK (CURRENT TRAFFIC)		-1966	-1058	
	NET AVERAGE (GENERATED TRAFFIC)				-1744
	NET PEAK (GENERATED TRAFFIC)		-2874	-1724	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	KENNEDY				
			IN	OUT	TOTAL
CURRENT	CAPACITY		2060	2060	4120
	AVERAGE DAILY TRAFFIC				63900
	PEAK AM		3323		5112
	PEAK PM			1789	
	NET AVERAGE				1458
	NET PEAK		-1263	271	
	CURRENT NET AS % OF CAPACITY		-61%	13%	
GENERATED	AVERAGE DAILY TRAFFIC				10840
	PEAK AM		2273		
	PEAK PM			1570	
	NET AVERAGE				1006
	NET PEAK		-3536	-1299	
	GENERATED NET AS % OF CAPACITY		-172%	-63%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-2663
	NET PEAK (CURRENT TRAFFIC)		-3323	-1789	
	NET AVERAGE (GENERATED TRAFFIC)				-3114
	NET PEAK (GENERATED TRAFFIC)		-5596	-3359	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	DE DIEGO N				
			IN	OUT	TOTAL
CURRENT	CAPACITY		3295	3295	6590
	AVERAGE DAILY TRAFFIC				158500
	PEAK AM		7212		11095
	PEAK PM			3883	
	NET AVERAGE				-14
	NET PEAK		-3917	-588	
	CURRENT NET AS % OF CAPACITY		-119%	-18%	
GENERATED	AVERAGE DAILY TRAFFIC				18971
	PEAK AM		1171		
	PEAK PM			793	
	NET AVERAGE				-805
	NET PEAK		-5088	-1381	
	GENERATED NET AS % OF CAPACITY		-154%	-42%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-6604
	NET PEAK (CURRENT TRAFFIC)		-7212	-3883	
	NET AVERAGE (GENERATED TRAFFIC)				-7395
	NET PEAK (GENERATED TRAFFIC)		-8383	-4676	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	DE DIEGO C				
			IN	OUT	TOTAL
CURRENT	CAPACITY		3295	3295	6590
	AVERAGE DAILY TRAFFIC				142200
	PEAK AM		6470		9954
	PEAK PM			3484	
	NET AVERAGE				665
	NET PEAK		-3175	-189	
	CURRENT NET AS % OF CAPACITY		-96%	-6%	
GENERATED	AVERAGE DAILY TRAFFIC				18971
	PEAK AM		835		
	PEAK PM			793	
	NET AVERAGE				-125
	NET PEAK		-4010	-981	
	GENERATED NET AS % OF CAPACITY		-122%	-30%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-5925
	NET PEAK (CURRENT TRAFFIC)		-6470	-3484	
	NET AVERAGE (GENERATED TRAFFIC)				-6715
	NET PEAK (GENERATED TRAFFIC)		-7305	-4276	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	DE DIEGO S				
			IN	OUT	TOTAL
CURRENT	CAPACITY		3295	3295	6590
	AVERAGE DAILY TRAFFIC				152300
	PEAK AM		6930		10661
	PEAK PM			3731	
	NET AVERAGE				244
	NET PEAK		-3635	-436	
	CURRENT NET AS % OF CAPACITY		-110%	-13%	
GENERATED	AVERAGE DAILY TRAFFIC				18971
	PEAK AM		835		
	PEAK PM			898	
	NET AVERAGE				-546
	NET PEAK		-4470	-1335	
	GENERATED NET AS % OF CAPACITY		-136%	-41%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-6346
	NET PEAK (CURRENT TRAFFIC)		-6930	-3731	
	NET AVERAGE (GENERATED TRAFFIC)				-7136
	NET PEAK (GENERATED TRAFFIC)		-7765	-4630	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

ARTERIES	DE DIEGO SS				
			IN	OUT	TOTAL
CURRENT	CAPACITY		4395	4395	8790
	AVERAGE DAILY TRAFFIC				203000
	PEAK AM		8526		14210
	PEAK PM			5684	
	NET AVERAGE				332
	NET PEAK		-4131	-1289	
	CURRENT NET AS % OF CAPACITY		-94%	-29%	
GENERATED	AVERAGE DAILY TRAFFIC				18971
	PEAK AM		1899		
	PEAK PM			1604	
	NET AVERAGE				-459
	NET PEAK		-6030	-2893	
	GENERATED NET AS % OF CAPACITY		-137%	-66%	
PROPOSED	CAPACITY				
	NET AVERAGE (CURRENT TRAFFIC)				-8458
	NET PEAK (CURRENT TRAFFIC)		-8526	-5684	
	NET AVERAGE (GENERATED TRAFFIC)				-9249
	NET PEAK (GENERATED TRAFFIC)		-10425	-7288	
	GENERATED NET AS % OF PROPOSED CAPACITY		#DIV/0!	#DIV/0!	

Trip Generation Distribution Computerized Model User's Manual

The model is based on the Microsoft Excel Spreadsheet, which runs on both Apple and IBM-compatible personal computers. The following description assumes familiarity with the program.

The model is composed of two main spreadsheets: <<Model>> and <<Roadways>>.

<<Model>> comprises two sets of tables. The first set, called <<Traffic Percentages>> contains the percentages needed to make work the other set, whose tables are called <<ADT Traffic>>, <<AM Peak Traffic>>, and <<PM Peak Traffic>>. These percentages indicate how generated trips split between the roadways. For instance, out of 100% of trips generated by the Government Office Building during the AM Peak period, 66% uses Munoz Rivera Avenue, and the remaining 34% Juncos Avenue. The model is based on the assumption that all the traffic comes from outside the Isleta (see text). So, out of 100% of trips coming from outside the Isleta, 89% enter via the San Antonio Bridge, 11% via Ashford Avenue. The traffic using the bridge is divided among the roadways of the network that lead to it: 37% uses Baldorioty De Castro Boulevard West segment, 7% Ponce De Leon Avenue West segment, and 43% Munoz Rivera Expressway West segment. Then, for each of these roadways, the trips are divided at each intersection between the two roadways that form it. For example, the 43% of Munoz Rivera West is the sum of 22% Munoz Rivera Central Segment, and 23% Kennedy Avenue (37% Kennedy Avenue less 15% that goes into Todd South). The same criterion governs the split of trips between segments. These proportions are not calculated but inserted in the model. The assumption is that traffic splits in proportion to the existing ADT of each roadway. The Puerto Rico Highway and Transportation Authority provided the data of the existing ADT. Should the reader be willing to use this model, he or she should update the percentages, based on updated data. However, the cells of the model contain the formula that allows calculating the percentage of trips for each segment, based on the proportion inserted. For instance, cell V90 shows a percentage of 22%, calculated as .5 (proportion inserted) times cell U90. Finally, these percentages are picked up in the top portion of the spreadsheet, i.e. in the Trip Generation tables proper. For instance, cell F7 shows the number of trips generated by the Government Office Building that uses Ponce De Leon Avenue on the Isleta. This figure is the product of cell C7 (the total number of generated trips) times cell F130 (the percentage of Ponce De Leon Avenue).

The second spreadsheet, <<Roadways>> calculates a series of figures for each single roadway segment. Some data are inserted, such as the capacity, others are calculated as a percentage of the total volume of traffic (the percentages were provided by the Puerto Rico Highway and Transportation Authority), the rest come from <<Model>>. Then <<Roadways>> subtracts from the capacity the current traffic so as to calculate the residual capacity. Then it subtracts also the generated traffic, to calculate again the residual. In both cases the residual is also calculated as a percentage of the existing capacity. <<Roadways>> is ready to calculate the same values in the case that capacity changes. This information is not available as of the date of this document.

Every change and extension of the model should be straightforward if the user is familiar with the Excel spreadsheet.

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