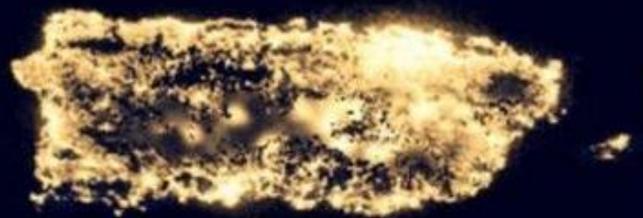




Puerto Rico 2040 Islandwide Long Range Transportation Plan

FINAL REPORT
September 2013



COMMONWEALTH OF
PUERTO RICO
Department of Transportation
and Public Works



Puerto Rico

Islandwide 2040

Long Range Transportation Plan

Puerto Rico
Highway and Transportation Authority

September 2013

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act
AMA	Metropolitan Bus Authority
ARRA	American Recovery Reinvestment Act
BRT	Bus rapid transit
CAA	Clean Air Act
CAFE	Corporate average fuel economy
CAGR	Compound annual growth rate
CCTV	Closed circuit television
CFR	Code of Federal Regulations
CIP	Construction improvement program
CMP	Congestion Management Process
CRT	Commuter rail transit
CVO	Commercial vehicle operations
CY	Calendar year
DOP	Directoria de Obras Publicas/Public Works Directorate
DR	Designated recipient
DRNA	Department of Natural and Environmental Resources
DTPW	Department of Transportation and Public Works
E+C	Existing plus committed network
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ETC	Electronic toll collection
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTZ	Free Trade Zone
FY	Fiscal year
GARVEE	Grant anticipated revenue vehicle program
GDB	Government Development Bank of Puerto Rico
GDP	Gross domestic product
GIS	Geographic information system
GNP	Gross national product
HRT	Heavy rail transit
HUD	U.S. Department of Housing and Urban Development
IAP	Immediate action program
ITS	Intelligent transportation system
LDV	Light duty vehicle

LOS	Level of service
LRT	Light rail transit
L RTP	Long Range Transportation Plan
LULC	Land use land classification
MAP-21	Moving Ahead for Progress in the 21 st Century
MBA	Metropolitan Bus Authority
MPG	Miles per gallon
MPO	Metropolitan Planning Organization
MVM	Million vehicle miles traveled
MY	Make year
NAAQS	National ambient air quality standards
NBIS	National Bridge Inventory System
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NOAA	National Oceanic and Atmospheric Administration
ORT	Open road tolls
PWD	Public Works Department
PIP	Public involvement program
PPP or P3	Public-private partnership
PREPA	Puerto Rico Electric Power Authority
PRHTA	Puerto Rico Highways and Transportation Authority
PRMBA	Puerto Rico Metropolitan Bus Authority
PRSADEM	Puerto Rico State Agency for Emergency Disaster Management
PRTSC	Puerto Rico Traffic Safety Commission
PWD	Public Works Department
SAFETEA-LU	Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users
SIP	State implementation plan
SPO	Strategic Planning Office
SSPP	System safety program plans
STIP	State transportation improvement program
STRAHNET	Strategic highway network
TAZ	Traffic analysis zone
TDM	Travel demand management
TEU	Twenty-foot equivalent container unit
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation improvement program
TMA	Transportation management area

TMC	Traffic management center
TOD	Transit-oriented Development
TPR	Transportation planning region
TSM	Transportation system management
TTI	Texas Transportation Institute
UA/UZA	Urbanized area
USDOT	U.S. Department of Transportation
V/C	Volume-to-capacity ratio
VMT	Vehicle miles of travel
WTI	West Texas Intermediate (crude oil)

Chapter 1

INTRODUCTION

Transportation is the public resource that enables people to fulfill their daily needs, to live, work, learn, play, shop, and access other personal, medical services. Likewise, it enables businesses to provide goods and services, to receive and distribute supplies, products, and materials. It binds the island together, and vitally supports the economic and social activity that defines quality of life. The transportation network is comprehensive and diverse in its structure, and it is a visible and essential part of today's dynamic, interconnected, and ever-changing world.

In Puerto Rico, responsibility for the oversight of the transportation system is lead by the Puerto Rico Department of Transportation and Public Works (DTPW) and its Puerto Rico Highway and Transportation Authority (PRHTA). These agencies have prepared this Islandwide 2040 Long Range Transportation Plan (LRTP) to assess trends, conditions, and changes in factors that affect the transportation system: demand for its use, funding available for its maintenance and improvement, priorities for system management, new requirements on how the system relates to land use and the environment, and other concerns.

This Islandwide LRTP is the overarching 28-year blueprint that will guide the collaborative efforts of the DTPW/PRHTA and the various stakeholder agencies throughout the Commonwealth as they pursue the transportation planning process intended to improve and integrate the interdependent transportation modes. Whether roadways, transit, pedestrian and bicycle facilities, airports, seaports, or the freight network, each of these modes serves constituencies that expect efficient, effective, economical, and environmentally sustainable transportation. This plan thus considers policies and strategies to meet the expectations of Puerto Ricans, help promote economic development, create more livable communities, and advance environmental sustainability. In so doing, the plan:

- Builds on previous LRTPs, but provides a fresh look at critical demographic and financial resources.
- Provides a sound basis for transportation planning and investment.
- Fulfills federal reporting and planning requirements.
- Reaffirms the PRHTA's commitment to move forward with essential planning programs and policies.

In short, the plan provides a framework and guidance for addressing the Commonwealth's transportation challenges ahead.

This chapter provides an overview of the role of islandwide transportation planning, describes the involvement of the Puerto Rico Metropolitan Planning Organization (MPO) in the transportation planning activities, and addresses the role of the DTPW and the PRHTA in working with the MPO. It then discusses the importance of this Islandwide Plan to the constituents of the Commonwealth, and summarizes how this document is organized. The plan is prepared in accordance with Title 23 of United States Code, Part 450-Planning Assistance and Standards, Subpart B- Statewide Transportation Planning and Programming. For the Commonwealth of Puerto Rico, the terms "Commonwealth" or "islandwide" are used in place of "statewide" in recognition of Puerto Rico's unique governmental status.

1.1 Background

The transportation planning process provides an opportunity to update and redefine the vision for development of the surface transportation system in Puerto Rico to 2040, taking into consideration global and local challenges, from climate change to reconfiguring communities and cities into livable places. Transportation infrastructure is not just a road network, it comprises multimodal access to transportation modes (transit, carpooling, bicycle facilities, and the like) for the elderly, people with disabilities, or communities with economic disadvantages, improving the levels of services and travel times for these users.

Puerto Rico possesses a substantial and well-developed multimodal transportation system. This system, in which the Puerto Rico government partners with other agencies and jurisdictions, comprises a large network of roadways and streets, publicly operated airports, a ferry system serving the San Juan harbor and the islands of Culebra and Vieques, important coastal seaports, and a federally designated marine highway encircling the island. It also includes a network of widely dispersed pedestrian and bicycle facilities and a variety of municipal and regional transit services addressing the mobility needs of both the general public and special transportation markets.

Collectively, these transportation facility and service assets provide a broad array of essential and strategic travel options that impact the daily lives of Puerto Rico's residents and critically underpin the diverse movement of freight and goods across the island. This composite transportation system plays an economically significant role in supporting the movement of workers, students, retirees, visitors, tourists, businesses, raw and manufactured goods, military personnel and assets, and a vast array of other elements. The importance of this transportation system to the island's economy cannot be overstated.

While for most movements across the transportation system, the destination rather than the journey is the priority, still it is the swift, efficient, convenient, reliable, and resilient execution of the journey to reach a given destination that is the system user's paramount priority. Effective management of the collective islandwide and regional transportation assets and transport services across the public and private sectors is vital to sustain the anticipated increases in Puerto Rico's population as well as growth in the business, manufacturing, agriculture, military, and tourism sectors, and to serve the transportation needs of that growth. Addressing the transportation system's challenges, a long-time priority of the PRHTA, continues with this plan update.

The federal government has, for decades, been legislating requirements for a "continuous, cooperative, and comprehensive" transportation planning process. The Puerto Rico MPO is the federally designated transportation planning authority charged with implementing this process, to serve the mobility needs of the population. MPO responsibilities include the planning and programming of federal funds through the LRTP and the State Transportation Improvement Program (STIP), respectively, and the approval of highway, transit, and non-motorized transportation-related projects across the island. Federal regulations require that this Islandwide 2040 LRTP be coordinated with the MPO, nonmetropolitan officials, and other partner Commonwealth, regional and local agencies.

The MPO has been developing 2040 LRTPs for each of its seven transportation planning regions across the island, so the preparation of this plan was closely coordinated with those of the MPO, including planning resource data, public outreach coordination, the results of technical analyses and travel demand model results. As part of its 2040 LRTPs, the MPO has conducted studies about islandwide everyday journey and travel patterns to assess infrastructure needs and define alternatives and projects to be constructed and developed over several 5-year planning periods, facilitating economic development, prosperity, and quality of life for the citizens of Puerto Rico.

It is informative to underscore that the Puerto Rico MPO's structure is unique in that it constitutes a single islandwide MPO. As such, the MPO coordinates the transportation planning activities for each of the seven identified transportation planning regions across the island, that is, the five non-metropolitan transportation planning regions (TPRs) -- North, Southwest, South, Southeast, and East -- that share a common LRTP and the two transportation management areas (TMAs) -- San Juan and Aguadilla -- that each have their own LRTPs. In addition, the DTPW and the PRHTA have been designated as the operating arm of the MPO for all urbanized and metropolitan areas, providing the staff for the MPO. The DTPW, as an umbrella organization for a number of agencies and public corporations, uses the technical resources of the PRHTA to conduct studies and develop plans and programs that are presented for consideration and adoption by the MPO.

Consequently, there is a strong one-to-one correlation between the DTPW/PRHTA and the MPO, as their geographic areas of responsibility are identical; this may be the only situation of its kind under federal transportation planning regulations. Close coordination between the two processes is thus actually standard operating practice, and allows for congruence in parallel planning activities and transportation system oversight, policies, and priorities.

1.2 Plan Context and Importance

Puerto Rico is a densely populated island of 3,425 square miles. Ninety-four percent of its population lives in urban areas; in the U.S. mainland, this sector represents 79 percent, according to the 2010 Census. Even though the local population decreased by 2.2 percent from 2000 to 2010, the trend of urban sprawl continues in Puerto Rico, compelling the need for a new vision in developing roads, highways, and transit infrastructure for future generations as these have a direct impact on community land uses, urban development, and the built environment. The DTPW and PRHTA, in partnership with the MPO, envision surface transportation improvements as a means to provide better access and connectivity as well as economic development, so as to build more livable and sustainable places for island residents.

The Islandwide 2040 LRTP will consider policies and practices that affect the relationship of transportation to land use and to the natural and built environments, including the following:

- **Livability:** The Interagency Partnership for Sustainable Communities, formed among the U.S. Department of Transportation (U.S. DOT), the Environmental Protection Agency, and the Department of Housing and Urban Development, have advanced six livability principles that are being reflected in existing and new federal programs across these three agencies, reflecting initiatives through transportation, housing, and the natural and built environments.
- **Transportation Facilities:** The U.S. DOT has promoted the concepts of Context-Sensitive Design and Complete Streets. Context-sensitive design employs the principal of developing road improvements that are integrated into rather than intruding into their setting, in terms of project definition and design, project features (lighting, landscaping, streetscaping, drainage), and accommodation of non-motorized travel movements, if present. Complete Streets employs the concept of improving a street for all users and all applicable modes of travel, promoting walkable environments, bicycle facilities, and attractive aesthetics. Furthermore, the Puerto Rico Complete Streets Act, (Law No. 201 approved in December 2010) ordered the implementation of the Complete Streets program as public policy through an Evaluation Commission, which submitted its report in September 2012. Currently, PRHTA has programmed activities to address Complete Street projects and programs.

- **Sustainability:** The Governor of Puerto Rico recently issued three Executive Orders that call for the creation of a Sustainability Action Council, a study of Climate Change as it relates to Puerto Rico, and a study and policy analysis of Greenhouse Gases in Puerto Rico.
- **Transportation System Management:** The PRHTA is advancing the implementation of the mandated Congestion Management Process in the San Juan and Aguadilla regions, developing a comprehensive islandwide bicycle and pedestrian plan, developing an implementation plan for intelligent transportation systems benefiting highway and transit, advancing its collaborative traffic safety program with the Puerto Rico Traffic Safety Commission, and formulating a strategy to develop more quality transit services on the island.

The federal, Commonwealth, and local governments have differing roles and responsibilities in relation to the application of these and other policy initiatives. For example, the MPO, PRHTA, and the Planning Board (a Commonwealth agency charged with coordinating land use and forecasting activities) have been coordinating on the longer-term importance of incorporating livability into their planning activities and proposals. Actually, in the San Juan region, considerable planning has been done for transit-oriented development around the Tren Urbano rail system stations, which has been deterred by real estate market and economic conditions.

These policy guidelines provide the framework to analyze surface transportation needs, strategies, and alternatives to link land use and transportation systems in the urban space for communities throughout the Commonwealth. Land uses generate travel demand which traverses the transportation system and may impact the built and natural environments. The movement of goods and resources, essential to economic activity, occurs on many of the same facilities that serve general traffic and transit operations. Highways, roads, and especially local streets, all basic elements of the transportation system, also constitute critical elements of urban public spaces, where people interact and a sense of identity and place is created. This becomes clearer when it is recognized that the users of roads and streets include not only drivers of automobiles and trucks, but also cyclists and pedestrians.

Transportation plays a prominent role in shaping the quality of life experienced by Puerto Rico's residents, businesses, visitors, and tourists, influencing nearly every aspect of travel choices, including place of work, place of residence, and the distances people are willing to commute for shopping, work, education, health care, and entertainment. The intent is that mobility needs are addressed and developed to ensure that people have the opportunity of living their daily lives, at both local and regional levels, with effective travel choices.

There is widespread traffic congestion in Puerto Rico. For example, based on analyses by the Texas Transportation Institute (TTI), San Juan's cost of congestion in 2011 was about \$1 billion, having increased from \$514 million in 2000. San Juan ranked 25th in congestion among the urban areas analyzed. By comparison, Florida's Miami-Fort Lauderdale-West Palm Beach region, which ranked 5th, experienced \$3.7 billion in congestion costs in 2011. This congestion translates into an average cost per peak auto commuter in the San Juan area of \$625 per year and annual excess fuel consumption per peak auto commuter of 24 million gallons. Both the average cost per commuter and the annual excess fuel consumption in San Juan have increased since 2000, from \$514 and 19 million gallons, respectively.¹

As the population and economy of Puerto Rico grow over time, so does the demand on the existing transportation system, which requires innovative investments and collaborative strategies to curtail the rising costs of congestion and expand travel choices. Land development patterns that occur, whether urban sprawl or compact urban development, also affect transportation needs. Long-term transportation planning aims to address all of these issues, while striving towards a vision of the type of

¹Texas Transportation Institute, Urban Mobility Report, 2012.

community, city, and region citizens and their jurisdictions have embraced through an informed and inclusive public participation process. The Islandwide 2040 LRTP update process relied extensively on public input through public involvement meetings and workshops.

This Islandwide 2040 LRTP outlines the strategic objectives necessary to develop an efficient, multi-modal transportation system and establishes the priorities for transportation improvements. The plan updates information, analyses, and recommendations of the prior plan, so that the public interest can be best served.

Transportation system planning thus involves local governments, various agencies, and public corporations as well as transit operators and freight users. These diverse stakeholders have different and sometimes conflicting perspectives and needs. The development process for this plan serves to gain consensus among these stakeholders, identifying the needed improvements to the transportation network, strategizing a long-term investment framework to address current and future challenges, and identifying policy priorities and actions to be pursued to advance transportation system performance.

1.3 Report Organization

This document comprises seven chapters; together they describe the essential elements in the process of developing the Islandwide 2040 LRTP. How each chapter contributes to the plan is summarized below. Documents and websites consulted during the planning process are listed in Appendix R.

- **Chapter 1: Introduction.** This chapter introduces the basis for developing the Islandwide 2040 LRTP and its role in the planning, management, and improvement of transportation facilities and services.
- **Chapter 2: Plan Framework.** This chapter explains the framework for developing the plan, including federal transportation legislation; the goals and objectives for the plan; and trends and forces that influence plan development.
- **Chapter 3: Public Outreach.** This chapter describes the planning process followed in updating the plan. It describes the public involvement plan that provided interaction with citizens and interested parties about transportation issues and needs.
- **Chapter 4: Islandwide Characteristics.** This chapter summarizes the characteristics of the island as a whole, including development and urbanization, land use patterns, environmental resources, and demographics.
- **Chapter 5: Transportation System.** This chapter discusses all the modes of the transportation system, with emphasis on regional corridors, public transportation, pedestrian and bicycle facilities, airports and seaports, and the freight network. It concludes with a discussion of transportation issues and needs.
- **Chapter 6: Finance.** This chapter reviews existing sources of transportation funding in Puerto Rico, discusses other possible funding sources, and forecasts the revenues available to fund transportation systems needs to 2040 as well as the uses of those funds.
- **Chapter 7: Strategic Direction.** This chapter describes plan findings and recommendations to address identified needs and challenges, as developed in the prior chapters.
- **Chapter 8: Implementation and Performance Monitoring.** This chapter addresses the advancement and implementation of plan strategies, as well as the topic of performance monitoring to track progress on plan recommendations and priorities.

Chapter 2

PLAN FRAMEWORK

This chapter of the Islandwide 2040 Long Range Transportation Plan (LRTP) discusses the framework for plan development, explaining the importance of identifying the guiding goals, and objectives in conjunction with an interactive and informative public involvement plan. The connection between this framework and eight federal planning factors contained in Title 23, Part 450 of the Code of Federal Regulations (CFR) is described. The framework is also connected to goals that have been established for the Congestion Management Process (CMP), which is a federally required program to address congestion in transportation management areas (TMAs).

2.1 Trends and Forces Affecting the Transportation System

2.1.1 Changing Travel Demand

The Puerto Rico Department of Transportation and Public Works (DTPW) and the Puerto Rico Highway and Transportation Authority (PRHTA) and their transportation partners face challenges in addressing the broad transportation needs of the island to 2040. These challenges include assurance of the safety of its systems, preservation of the health of an aging infrastructure, and provision of economic opportunity brought in part by personal mobility and efficient freight and goods movement.

The movement of people and goods is a primary output of social and economic activity, increasing the demand for transportation services. The following trends will have a significant impact on efforts to provide needed transportation services and infrastructure over the next three decades:

- The island's population declined 2.2 percent over the 2000-2010 decade, and recent data show a continuation of that trend. Emergence from the recession and the beginning of a decline in unemployment suggest that the economy will slowly rebound over coming years. The forecast of population and employment prepared for the Metropolitan Planning Organization's (MPO) LRTPs projects a return to a modest but positive growth trend leading to a 30-year growth from 2010 to 2040 of 5 percent in population.
- From 2000 to 2010, Federal Highway Administration (FHWA) data shows that vehicle miles of travel in Puerto Rico increased from 17.56 billion miles annually to 19.21 billion miles, an increase of 9 percent. Due to population loss and the effects of the weak economy, this trend has moderated since, with 18.59 billion miles recorded in 2010. National trend data in over the last 10 years show that the per capita rate of travel miles has moderated. Reasons are the aging of the population, cost of travel, and stagnant household income growth.
- From recent surveys of households and transit users, as reflected in U.S. Census data, there are many Puerto Rico households without access to an automobile and many more with only one vehicle. These households are reliant on public transportation, walking, and rides from friends and service organizations.
- The aging of the population will challenge efforts to provide mobility for this age sector and to ensure safety of motorists, as many people are living longer and older residents form a growing percentage of the total population.
- Over the last two decades, Puerto Rico has exhibited a pattern of outward development from its historical city centers; the maps of urbanization show the rapid expansion of suburban

development across the island. This trend has affected travel patterns on the major expressways and the desire for road improvements in developing areas on the urban fringe.

- The travel demand model developed for the MPO L RTPs projects an 11.3 percent increase in vehicle miles of travel islandwide, over the 2010-2040 time frame and an 11.9 percent increase in total trips made.

2.1.2 Transportation Infrastructure Condition

While DTPW/PRHTA and its public and private transportation partners have invested heavily in Puerto Rico's transportation infrastructure, the infrastructure "health" is in some jeopardy. This issue affects all transportation modes in the Commonwealth. Preserving the existing transportation infrastructure in sound physical condition will require more resources than are available today. The challenge ahead will be to augment existing revenue sources to pay for preservation of our transportation infrastructure.

2.1.3 Changing Freight Movement Needs

Puerto Rico businesses rely on freight movement to compete in the domestic and today's global economy; as such, the Commonwealth's economic prosperity hinges on the ability of goods to be transported in an efficient and cost-effective manner. The major ports in San Juan, Ponce, and Mayagüez are important international gateways for containers, construction materials, consumer goods, petroleum products, both imports and exports. Likewise, the airports in San Juan and Aguadilla are the principal air cargo portals for the island. The strategic highway network links, shown later in this document, serve as the primary trucking cargo arteries. Completion of priority segments of this network to expressways or toll roads is a system priority.

2.1.4 Financial Sustainability

Adequate financing is fundamental to the delivery of transportation services and infrastructure. The need for a comprehensive funding approach for all aspects of transportation operations and expansion is recognized, but revenues are not adequate to address accumulated needs to serve the demand for transportation in Puerto Rico.

There is a need to identify stable, long-term sources of transportation funds that can address the funding needs in a meaningful way. Traditional sources, including gas tax receipts, have declined in value in recent years, a function of the economic downturn, more fuel-efficient vehicles, and the lack of inflation indexing.

This adverse impact on revenues is expected to accelerate with implementation of the new federal fuel efficiency standards, resulting in a long-term decrease in the consumption of motor fuels. The purchasing power of money for transportation maintenance and construction has shrunk in recent years. Moreover, federal funding programs remain uncertain, with possible cuts to the overall programs driven by the need to reduce national deficit and changes to grants and formula programs under the new Moving Ahead for Progress in the 21st Century (MAP-21) legislation. To address this challenge, DTPW/PRHTA continue to seek economies in program delivery and to identify strategies to extract more revenue from existing sources and tap new and innovative funding options.

2.1.5 Environmental Stewardship

Preservation of the environment and efforts to meet the mobility needs of society sometimes lead to unavoidable impacts on the natural and built environments. The transportation agencies must address the environmental challenges facing the Commonwealth's transportation sector, while also supporting economic opportunities leading to a high quality of life for all residents.

While this challenge is substantial, DTPW/PRHTA and the government are taking several actions to address it. The Complete Streets law, and recent executive orders by the Governor addressing climate change, greenhouse gases, and sustainability, as mentioned in Chapter 1, are major policy steps in that direction, complementing the stewardship of the transportation agencies to carefully manage environmental impacts.

2.1.6 Transportation Opportunities

With challenges come opportunities. These are noted below:

- In the coming years, DTPW/PRHTA and their partners can focus on efforts to provide mobility in the context of improving the health and well-being of the island's residents.
- Scarce and dwindling financial resources leverage the greatest economic benefit when the Commonwealth promptly responds to transportation needs of industries and businesses and infrastructure investment strategies are consistent with evolving commercial opportunities.
- Innovative and flexible funding initiatives, including public-private partnerships and new funding sources, could help address the funding gap.
- Sustainable transportation solutions, including better policy linkages between land use and transportation decisions, expanded and enhanced multimodal options, and increased use of green technology in the delivery of transportation services, could result in more efficient trip making and energy savings.

2.1.7 Decision-Making Support Tool: the Travel Demand Model

As part of the MPO's preparation of updated 2040 L RTPs for the seven regions of the island, a new travel demand model was constructed that includes the entire island at the same level of detail and refinement. The computerized travel demand model used in developing the 2040 L RTP comprises a software package whose purpose is to estimate and replicate existing travel patterns on the transportation network and then calibrate that result to existing conditions to project future travel patterns on the network. This version of the travel demand model offers several advancements over the prior model development processes:

- The model was constructed to reach the entire island in its coverage. Previously, detailed models were developed for the Aguadilla and San Juan TMAs, and a simplified model was developed for the island. This new islandwide model will serve as a useful foundation for a variety of future transportation planning applications, including local area studies, corridor and alternatives studies, and development impact analyses. This model provides detailed coding of roadway and transit links in a consistent manner across the entire island. The result is better representation of the network in all regions, more accurate determination of trips between regions or multiple regions, and better definition of larger-scale projects with an influence area affecting multiple regions. The travel demand model is configured to report output statistics for each individual region. Information on the travel demand model structure is provided in Appendix H. Other supporting information is found in Appendices I, J, and K
- The model is data driven. Given the limited extent of prior available data to support model development, this plan update was supplemented by an extensive travel data collection program involving traffic volume counts, public transit and público service surveys, and travel time studies and surveys. Transit onboard survey and household survey reports are provided in Appendices F and G.

- The model components were developed after an extensive review of “best practices” in travel demand models across the U.S. After review and assessment of the various features, a preferred approach for each component was selected for incorporation into the model framework.
- Transportation analysis zones (TAZ) were carefully redefined to consider U.S. Census data boundaries, road and natural geography boundaries, and other factors.
- There are over 35,000 links in the defined islandwide transportation network. Population, household, employment, and other data were carefully distributed to the TAZs, and a Geographic Information System (GIS)-based land use analysis technique was used to assist in the distribution of growth to the TAZs. The model draws from detailed travel and demographic data in the 2000 and 2010 Censuses.
- A variety of model enhancements were incorporated, including additional trip types and other features, to refine the ability of the model to capture trip-making characteristics.
- The highway network was defined at the same level of detail across all seven regions so that statistics as to network features or performance can be compiled easily for each region.

Table 2.1 summarizes the number of links, nodes, and TAZs in the islandwide network.

Table 2.1
TRANSPORTATION NETWORK PARAMETERS

Region	Nodes	Links	Zones
Aguadilla TMA	5,449	12,412	454
East TPR	756	1,722	123
North TPR	5,198	11,840	488
San Juan TMA	11,925	27,163	2,175
South TPR	2,128	4,847	476
Southeast TPR	1,612	3,671	136
Southwest TPR	4,779	10,886	444
Total Islandwide	31,847	58,407	4,296

Source: Travel demand model for LRTP planning process

The islandwide model thus supports travel needs analysis in each of the two transportation management areas and five transportation planning regions of the island. Since it has islandwide coverage, the model can better replicate longer distance trips across regions. After the travel demand model had demonstrated the ability to reasonably replicate existing travel, it was then applied to forecasts of 2040 population, employment, and other socioeconomic parameters that are used to generate travel activity and to yield forecasts of future travel in the region.

2.2 Regulatory Framework

The development of this plan is guided by federal regulations contained in Title 23 of the CFR, Part 450, Subpart B, that specify requirements for the development and content of long range transportation plans. Specifically, the following sections address aspects of the planning process:

- Part 450.206 - Scope of the Statewide Planning Process. This part calls for a continuing, cooperative, and comprehensive transportation planning process that addresses eight planning factors. These factors are shown in Table 2.2 later in this section, and a discussion is included in Appendix D.

- Part 450.208 - Coordination of Planning Process Activities. This part discusses coordination with various involved parties and stakeholders in the transportation planning process. These points are discussed further in Chapter 7, Section 7.4.4.
- Part 450.210- Interested Parties, Public Involvement, and Consultation. This part describes the requirements for public outreach activities. These points are discussed in Chapter 3, Section 3.4.
- Part 450.214 - Development and Content of the Long Range Statewide Transportation Plan. This part describes topics to be addressed in the plan and required consultations. These points are discussed further in Chapter 7, Section 7.4.4.

2.3 Vision, Mission, Goals, and Objectives

2.3.1 Vision and Mission of the DTPW and PRHTA

The vision of the DTPW and PRHTA is stated as follows:

To develop and promote an integrated transportation system, together with the road infrastructure, public works building and the provision of services, facilitate economic development of Puerto Rico in harmony with the environment.

Further, the mission of the DTPW and PRHTA is defined as follows.

Our mission is to stimulate the economic development of Puerto Rico through the effort to administrate the infrastructure with transportation systems that innovate and facilitate the movement of people and goods in harmony with the environment.

2.3.2 Goals and Objectives

The agency vision statement was formulated into four practical goals whose pursuit will advance the accomplishment of the agency's mission and vision. These goals are based on a review of the previous goals in the prior islandwide LRTP, the goals and objectives used in the past transportation plans in Puerto Rico, and on the intent of the vision statement. They are focused around the themes of Effectiveness, Efficiency, Economy, and Environment. The goals are further supported by objectives that contribute to the achievement of the goals.

The updated goals and objectives were newly crafted to reflect current interests of the public, current planning requirements and trends, and the goals and objectives of other companion initiatives such as congestion management and livability. They were then presented for comment at meetings with municipality and advisory committees and at the several rounds of interactive public workshops held as part of the public involvement plan discussed in Chapter 3 and provided in Appendix Q. Workshop participants examined presentation materials and participated in surveys that identified what elements of the goals and objectives were more important to them when investing in transportation infrastructure. There was general consensus with the overall framework and minor refinements were incorporated to reflect public input. The vision, goals and objectives were presented to the MPO committees over three meetings on March 13-14, 2012 and were part of action items presented to the MPO committees for their approval.

Table 2.1 presents the resulting goals and objectives framework to guide the development of the Islandwide 2040 LRTP. The order in which the goals are presented does not indicate priority or importance, since all are to be addressed and they complement each other. How these goals and supporting objectives shape the strategic direction of the plan is described in Chapter 7. This goals and objectives framework parallels that of each regional LRTP prepared by the MPO because of the unique relationship between the MPO and the Commonwealth transportation agency in Puerto Rico. More detailed discussion of these goals and objectives is contained in the LRTPs for the respective regions.

Table 2.1
GOALS AND OBJECTIVES

FOCUS	GOALS		OBJECTIVES
EFFECTIVENESS	1	Improve transportation mobility and access for people and freight.	1.1 Improve connectivity between primary activity centers, including employment, tourism, and dense residential districts.
		<i>Improve mobility and access for all system users with improved travel choices, connections between major centers, and integration between and within modes.</i>	1.2 Enhance system integration within and between modes.
			1.3 Increase travel choices for residents, visitors, and workers.
EFFICIENCY	2	Improve transportation system performance.	2.1 Reduce congestion and travel time, through the congestion management process and other similar projects.
		<i>Maintain and operate Puerto Rico's transportation facilities and services proactively for better economy and efficiency, leveraging available capacity, with adequate safety and security.</i>	2.2 Optimize use of transportation assets and leverage efficiency of prior investments.
			2.3 Maintain transportation assets in a state of good repair.
			2.4 Improve efficiency in the cost of managing and operation transportation systems.
			2.5 Improve transportation system safety and security, and ability to support emergencies.
ECONOMY	3	Reinforce economic vitality.	3.1 Enhance economic competitiveness by facilitating efficient movement of freight and goods.
		<i>Enhance global and economic competitiveness by facilitating the efficient movement of freight, business and tourism activity.</i>	3.2 Generate potential public-private opportunities.
			3.3 Provide strategic network connectivity and capacity across Puerto Rico.
ENVIRONMENT	4	Promote environmental sustainability.	4.1 Minimize adverse impacts to natural and built environments.
		<i>Incorporate responsible environmental stewardship in transportation investments through reduced impacts, smaller carbon footprint, "smart" growth, and more livable communities.</i>	4.2 Reduce greenhouse gas emissions and energy consumption, and improve air quality.
			4.3 Support integrated transportation and land use planning for more livable communities and reduced travel.
			4.4 Enhance alternative modes and travel demand strategies.

2.3.3 Relation to Planning Factors and Congestion Management

The goals and objectives for the 2040 LRTP were integrated with the eight planning factors introduced under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) and retained under the Moving Ahead for Progress in the 21st Century (MAP-21) legislation. They were also integrated with the goals that have been established in the CMP for the San Juan and Aguadilla TMAs, again because of the transportation planning linkages between the PRHTA and the MPO. Table 2.2 below summarizes how each of the 2040 LRTP goals relates to the planning factors and congestion management goals.

MAP-21, the successor surface transportation legislation to SAFETEA-LU, was signed into law in early July 2012 and became effective as of October 1, 2012. This is now the authorizing legislation for future LRTPs.

A set of performance measures relating to the goals and objectives was defined so that differences in the transportation network performance could be generated as outputs of the travel demand model as markers of the change in performance caused by transportation investments. Performance measure information is discussed further in Section 5.7.

Table 2.2**COORDINATION OF PLAN GOALS**

PLANNING FACTORS		2040 LRTP GOALS	CONGESTION MANAGEMENT GOALS	2040 LRTP GOALS
1	Support economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.	1, 2, 3	Improve intermodal connectivity.	1, 3
2	Increase the safety of the transportation system for motorized and non-motorized users.	2	Minimize incident delay.	2
3	Increase security of the system for motorized and non-motorized users.	3	Optimize average travel time.	1, 3
4	Increase accessibility and mobility for people and freight.	1, 3, 4	Reduce traffic demand.	1, 2, 4
5	Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements State and local planned growth and economic development patterns.	4	Maximize existing capacity.	2
6	Enhance transportation system integration and connectivity, across and between modes, for people and freight.	1, 3	Provide reliable travel times.	2
7	Promote efficient system management and operation.	2, 3	Improve travel safety and security.	2
8	Emphasize the preservation of the existing transportation system.	2		

2.3.3.1 Federal Transportation Planning Factors

The eight planning factors (from 23 CFR 450.206) that must be addressed in the development of the plan are shown above in Table 2.2. In developing the goals and objectives for the 2040 LRTP, the intent of the eight planning factors was incorporated. More information as to how the eight planning factors have been reflected in the LRTP planning process is provided in Appendix D.

2.3.3.2 Congestion Management System

The Transportation Equity Act for the 21st Century (TEA-21) established the Congestion Management System, currently evolved to the CMP as an integral part of the transportation planning process and required that all states, including the Commonwealth of Puerto Rico, develop, establish, and implement a statewide CMP in cooperation with their MPO agencies. The purpose of this process is to apply a

systematic approach, collaboratively developed and implemented throughout a metropolitan region, which provides for the safe and effective management and operation of new and existing transportation facilities using demand reduction and operational management strategies.² More information on the CMP is provided in the San Juan TMA and Aguadilla TMA LRTPs.

² As cited in www.fhwa.dot.gov/resourcecenter/teams/planning/cms.cfm

Chapter 3

PUBLIC OUTREACH

The Islandwide 2040 Long Range Transportation Plan (LRTP) incorporates the results of an extensive transportation planning process, involving public involvement and technical analysis of the transportation system. This chapter includes a description of the public involvement activities undertaken as part of this effort. The public involvement plan is included in Appendix Q.

3.1 Public Involvement Program

Good transportation planning recognizes the valuable input that the public can provide to the long range planning process and provides appropriate and numerous mechanisms to gain this input. Furthermore, since implementation of proposed transportation actions presented in the plan potentially affects the travel and daily lives of citizens in terms of the quality of their mobility and the environment, it is important that they have the means to provide input and comment on the development of these plans. Therefore, opportunities for participation were provided to stakeholders, including citizens, public agencies, transportation providers, and the public through an interactive public involvement plan (PIP).

The PIP followed guidelines provided by several federal regulations, and complied with the guidelines adopted by the Department of Transportation and Public Works (DTPW)/Puerto Rico Highway and Transportation Authority (PRHTA) and Metropolitan Planning Organization (MPO) Policy Committees. The resulting public outreach and participation allowed the public many opportunities to provide their comments, opinions, and ideas and have them considered in the process.

3.1.1 Overview

The PIP established strategies and mechanisms for participation in the planning process to provide for the involvement of agency representatives, mayors, interest groups, and the public. It was formulated to provide multiple channels for the public and interested stakeholders to be engaged in the planning process.

The process considered various audiences, including:

- General public.
- Citizen Advisory Committee.
- Economic Development Advisory Committee.
- Other Commonwealth and federal agencies (see Page 3-2).
- Regional contacts (including regional MPO committee members).
- Traditionally underserved individuals.

The goals of the PIP for this project were:

- **To inform and involve the public during the process.** This program was structured to inform, listen to, and learn from the public throughout the plan development process. The success of the process relies on the input of the public, based on awareness of the issues and needs.
- **To consult with the public and stakeholders to gather their ideas for solutions to transportation needs.** This process is an opportunity for the community to voice concerns and

opinions about current and future transportation policies, programs, and plans across Puerto Rico.

The PIP objectives included the following:

- Develop a proactive, and ongoing public participation process that includes the public, stakeholders, and other governmental bodies at the island, regional, and local levels.
- Publicize the project to increase public awareness about transportation issues, and publicize the role of DTPW/PRHTA in the plan development.
- Create communications channels with the public and others to encourage public participation and input.

The approach of this PIP to accomplishing these goals and objectives includes these components:

- Address federal requirements and DTPW/PRHTA PIP guidance for public involvement.
- Leverage and coordinate with the existing MPO committee structure and MPO public involvement outreach activities.
- Augment the Islandwide 2040 LRTP with additional outreach and communication strategies.
- Provide regional accessibility for engagement of the general public across the island.
- Address environmental justice aspects of public involvement.

As an integral part of plan development, the public was consulted at different stages of the process. The plan development process began in March 2010; by the end of the year, an outreach program was initiated with a general orientation about the process. This early orientation was important as part of the overall outreach. First, it provided an introduction to the transportation plan development process; second, it provided an initial opportunity for citizens to get involved and provide input as to transportation issues, needs, and solutions.

This Islandwide 2040 LRTP was developed contemporaneously with the preparation of the 2040 LRTPs for the respective seven transportation planning regions. The regional LRTPs included the development of a new travel demand model, based on household surveys and studies necessary to capture the travel behavior of urbanized areas not considered in the previous model. This work included extensive data

collection about the highway network, transit routes, and público routes. This travel demand model also captured information about the geographical structure needed to reflect the relevant data about the island and the respective regions.

By 2011, household surveys, on-board transit surveys, travel time studies, and socioeconomic projections with new 2010 Census data were in progress, along with the compilation of other key data. This intensive and extensive process was accomplished in coordination with the following government agencies, among others:

- Puerto Rico Labor Department.
- Puerto Rico Planning Board.

- Environmental Quality Board.
- Metropolitan Bus Authority.
- Maritime Transportation Authority (ferries).
- Puerto Rico Ports Authority (airports and seaports).
- Authority for Transit Integration.
- Traffic Safety Commission.
- Office of the Attorney for Persons with Disabilities.
- Office of the Attorney for Pensioners and Senior Citizens.
- Department of Natural Resources.

While this model development process was taking place, the PRHTA designed a public participation program as an extension of the PIP. This programmatic effort created ad hoc committees to assure representation of special populations (the elderly, handicapped, and disadvantaged), as well as engaging freight interests, universities, municipalities, regional economic development agencies, and professional organizations. Representation occurred through both a Citizens Advisory Committee and a Regional Economic Development Committee. Through the end of 2011, outreach efforts continued, with reports on the progress of the plan development and its studies, the various surveys, and feedback regarding the participatory process. Other outreach efforts were conducted as well, including presentations about the Islandwide 2040 LRTP to special interest groups, including the elderly. The Ombudsman for the Elderly, as part of the Citizens Advisory Committee, arranged a meeting with directors of elderly centers across the island for a progress presentation about the plan. These outreach presentations were important communications channels to gather important issues and concerns.

In addition to the above meetings, the PIP incorporated additional rounds of public meetings, structured as interactive workshops, across the seven transportation planning regions of the island. These public meetings were structured into three rounds:

- **Round 1:** Publicizing the plan development process, providing an orientation to the plan purpose, and seeking initial input through surveys and dialogue with participants about their use and perception of the transportation system.
- **Round 2:** Building on the first round, this round sought feedback on proposed goals and objectives and specific opinions about transportation needs for highway, transit, non-motorized travel, and freight movements.
- **Round 3:** Presenting plan findings, strategic direction and recommendations.

Two rounds were held in May and June 2012, both with the objective to gather input from the public for plan development, including transportation usage, opinions, and needs as well as input on the proposed goals, and objectives for the plan. A third round of was conducted in late July and early August of 2013 to present the draft plan to the public for their comments. Prior to the first round of meetings, islandwide and region-specific data were gathered during on-site visits for input into the travel demand model. Local agencies were contacted to prepare them for this plan development process.

Meeting locations were chosen to be accessible from different municipalities. Consequently, residents from all over Puerto Rico had the opportunity to attend a public meeting within a reasonable distance of their homes.

Environmental Justice Executive Order 12898, ordered in February 1994, directed all federal agencies to make environmental justice a key part of their mission by identifying and addressing the impacts of

programs, policies, and activities on both minority and low-income populations. Throughout the plan development process, the environmental justice provisions, as federally defined, were considered to ensure that the 2040 LRTP was consistent with these requirements. Efforts were made during the planning process to include affected parties from varying socioeconomic groups to ensure that their input was considered in the 2040 LRTP.

For example, representatives of these groups were included on the Citizens Advisory Committee, and other special outreach efforts were extended to these groups to publicize public meetings. In addition, a specific meeting with representatives of these groups was scheduled for July 2013 to solicit their input to the draft LRTP documents. These groups have been included in publicity outreach for prior public meetings and MPO meeting advertisements. Efforts included direction to municipalities to coordinate with their contact lists and with other groups such as the American Association of Retired Persons, who sent email blasts to their membership rosters. While it was not possible to identify the specific attendance of these constituents at the numerous public meetings, the presence of elderly and handicapped persons was observed at the various public meetings. Feedback from these population groups was considered along with other public feedback, as described below in Section 3.2.

Meetings were held from 4 PM to 8 PM in each of the two TMAs and five TPRs. The DTPW/PRHTA, in concurrence with the MPO, decided on the timing of these meetings to allow people the flexibility and convenience to come during the afternoon or evening, depending on their particular schedules, thereby reaching as many people as possible. Since the meetings were conducted as open houses, attendees could benefit from the presented materials, regardless of the time they came. Meeting locations were varied to be accessible from different municipalities and to provide broader access opportunities to the planning process.

Efforts were made to reach and serve disadvantaged and target populations during the LRTP update process. Information about LRTP plans was posted on the Office of Strategic Planning's website to broaden accessibility to project information. E-mail blasts were made to a basic mailing list that included professional and technical organizations, the 78 municipalities across the island, the American Association of Retired Persons, and other entities and organizations. In turn, these groups were asked to communicate the project and meeting information to their constituencies.



Furthermore, municipal officials were asked to distribute meeting announcements to their constituents. Meeting surveys, agendas, information sheets, and comment cards were produced in Spanish and English to promote participation and comment. Spanish- and English-speaking staff were in attendance at all the public meetings to facilitate communications in a comfortable manner for participants.

The DTPW/PRHTA is committed to further improve its strategies and methods of outreach to targeted populations. As part of the plan development work, a very detailed multi-dimensional analysis of population demographics was performed using the most recent 2010 Census data, looking at race, ethnicity, income, auto ownership, education level, and language. This data analysis provides a valuable foundation for use in future outreach strategies.

3.1.2 Informative Workshops and Infrastructure Needs Surveys

In addition to the extensive outreach efforts, the informative workshops were structured to create the opportunity for further interaction with the public regarding their concerns and issues related to transportation and infrastructure needs. Seven public meetings were held May 1-3, 2012.

The purpose of these meetings was to inform citizens and interest groups about the plan and its goals and objectives, and seek initial input as to concerns and opinions. Input from the public focused on their current use of the transportation system, what issues they perceived, their perception as to needs, including opinions related to investment priorities. This round of meetings provided an opportunity for the public to express opinions about their personal needs and those of their communities. Their input was also used to refine the draft goals and objectives framework.

A variety of communication tools and techniques were used to publicize the PIP process, including:

- Establishing methods of communication in both Spanish and English, including emails, toll-free phone line, fliers, and presentations.
- Providing emails to the PRHTA email address list, and including the municipalities, committee members, service, trade, and other organizations, including professional groups such as the area's American Planning Association, Institute of Transportation Engineers, and American Institute of Architects.
- Forming Citizen Advisory and Economic Development Committees and conducting meetings with these bodies. Membership in these groups was identified jointly by the MPO and PRHTA to provide a broad cross-section of representation of transportation stakeholder interests across user groups, freight interests, affected and benefited partners, modal interests, transportation disadvantaged groups, and others. These candidates were appointed by the Executive Secretary of the Puerto Rico MPO. Their work began after the model development in early 2012 and continues through the project completion. These groups also participated in the survey instruments, which are described below.
- Making presentations at the MPO meetings. MPO meeting dates at which the LRTP process and status were discussed include meetings in November and December of 2011, September 2011, March 2012, August 2012, and March 2013.
- Making presentations at the MPO meetings.
- Requesting agency and organization email recipients to send email blasts to their respective organizations and constituencies.
- Posting information on the existing PRHTA website (Office of Strategic Planning).
- Developing bilingual press releases, public service announcements, and notices for distribution through the PRHTA Communications and Press Office to media outlets.



During the workshop meetings, the following methods were used to exchange information with the participants:

- Preparing and presenting a DVD video summary of the plan purpose, approach, process, products, and contacts.
- Providing a range of meeting wall exhibits that portrayed information about the project purpose, demographic conditions and forecasts, and transportation network elements and demands.
- Distributing a survey form soliciting input from the public focused on their current use of the transportation system, what issues they perceived, their perception as to needs, including opinions related to investment priorities (see Appendix E).
- Distributing a survey form soliciting input from the public regarding specific problems and needs relating to roadways, transit, and bicycle/pedestrian facilities in their region.
- Providing information about the plan and providing the agency web address and telephone hot line at presentations and workshops.

The information gathered from this round of informative workshops was garnered through the opinion survey about transportation usage patterns, system issues, and transportation needs compiled and summarized in the form of a PowerPoint presentation that was used at subsequent meetings. Opinions in the second survey about specific issues and needs were also summarized into presentation materials and considered by the plan development team.

Committee input was similar to the public input relative to key issues. The committees provided forward-looking opinions regarding the importance of the transportation-land use connection, but recognized that the Planning Board's current endeavors on advancing regional plans across the island would not be completed in time for the 2040 LRTP and that work still remains to institutionalize planning regulations that would deter the trend of sprawl from major city centers. The committees also recognized the need for more public education as to the "rules of the road" and for better maintenance of traffic markings, signs, and signals to reduce traffic congestion.

A second round of seven public meetings -- held June 26-28, 2012 --was conducted to gather input on several topics, including seeking feedback on the proposed goals, and objectives framework.

These meetings reiterated basic project information about the plan and its goals and objectives, purpose, and process as well as basic information about future transportation conditions. In addition, feedback was obtained on the proposed goals and objectives framework. In addition, opinions on transportation investment needs for highways, transit, bicycle/pedestrian facilities, and freight movements were solicited from attendees. This round of meetings provided another opportunity for the public to express opinions about important transportation issues and concerns to them. The variety of communication tools and techniques listed before were used during this phase to publicize the process. In addition, activities included:



- Conducting another meeting with the Citizen Advisory and Economic Development Committees.
- Providing an updated set of meeting wall exhibits that portrayed information about the project purpose, demographic conditions and forecasts, and transportation network elements and demands.

- Distributing a survey form soliciting input from the public regarding the relative importance of the set of goals and objectives.

Input from goals and objectives survey as well as the opinion survey and the transportation needs survey were compiled as before and presented at later meetings. The completed survey forms from both sets of meetings are on file at the PRHTA.

The third round of meetings, conducted on July 16, 17, and 19, and August 6 and 7, 2013, had the objective to gather public comment and input on the proposed plan recommendations. The meetings provided a recap of information about future transportation conditions, and summarized the plan recommendations. As before, diverse communication tools and techniques were used to publicize the process. Comments received at these meetings were documented, and any appropriate revisions to the plan considered and made. These changes were tabulated for the record, and consideration in the final plan approval.

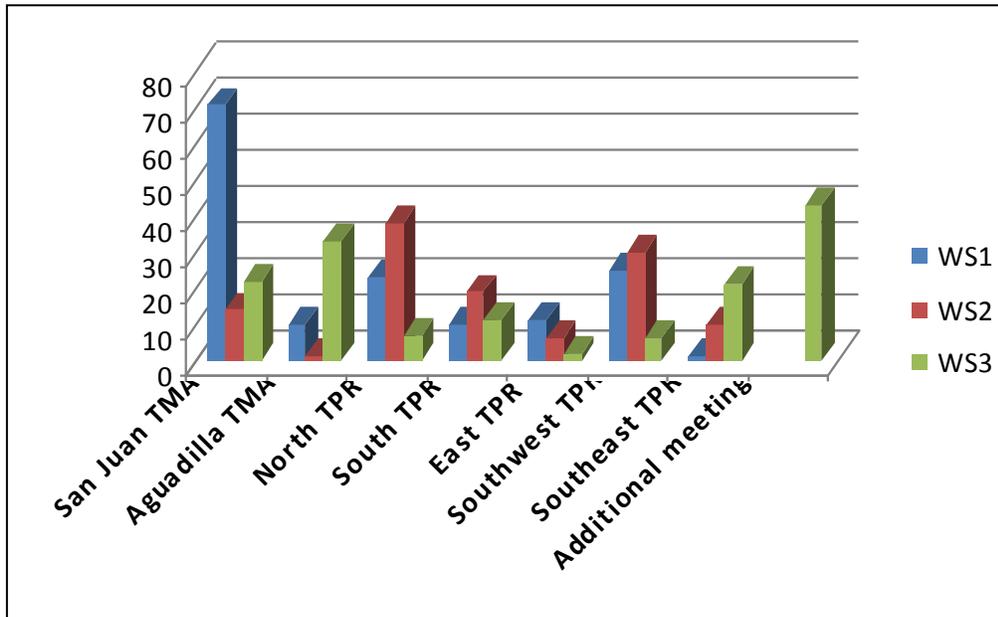
Table 3.1 summarizes the attendance at the three rounds of meetings by region while Figure 3.1 shows the information graphically.

Table 3.1
SUMMARY OF MEETING ATTENDANCE

Region	WS1	WS2	WS3	TOTAL
San Juan TMA	71	14	22	107
Aguadilla TMA	10	1	33	44
North TPR	23	38	7	68
South TPR	10	19	11	40
East TPR	11	6	2	19
Southwest TPR	25	30	6	61
Southeast TPR	1	10	21	32
Additional meetings			43	43
Total	151	118	145	414

WS = Workshop

Figure 3.1
SUMMARY OF MEETING ATTENDANCE



3.2 Citizen and Stakeholder Feedback

The feedback from the public was utilized in several ways. Results of prior feedback were conveyed at subsequent public meetings to share the opinions being received and provide an informational feedback loop. This same information was also shared at the meetings with the Citizen and Economic Development Advisory Committees and at the MPO meetings. Opinion survey results were tabulated and summarized in an informative set of slides that were used in various presentations and considered in the plan development process. Feedback on specific improvement concepts was also captured in summary spreadsheets, reviewed, and summarized for consideration in the plan development process.

This input was structured to inform the technical process of plan development through public input regarding:

- Comments from the LRTP vision, goals and objectives statement to offer changes and to rank the relative importance of each element.
- The survey on perceptions, priorities, and preferences regarding transportation issues and needs.
- The survey on transportation investment choices and priorities, as well as input on specific project needs by mode (highway, bicycle/pedestrian, transit, and freight).

This feedback was considered in the analytical process of the plan in several different ways:

- Improved understanding of public opinions about transportation conditions, needs and general preferences,
- Refinement of the Vision, Goals and Objectives statement, and ranking of relative importance of the goals and corresponding objectives.

- Identification of transportation priorities by project types.
- Identification of specific project improvement needs, which in some cases reinforced certain projects under consideration for implementation.

This public feedback process was a valuable component to plan development, and was a consideration in the development of set-aside funds for future bicycle/pedestrian projects in each region, and for set-aside funds for future congestion management projects in the San Juan and Aguadilla TMAs. This type of public opinion solicitation had not been obtained before and it should serve as a useful benchmark in the MPO's future planning work. While some of the input that participants provided at each of the regional meetings addressed specific local concerns, when it came to the participants' responses to the big picture issues of needs and priorities, several themes were expressed repeatedly across the island. Examples of the input received are summarized below:

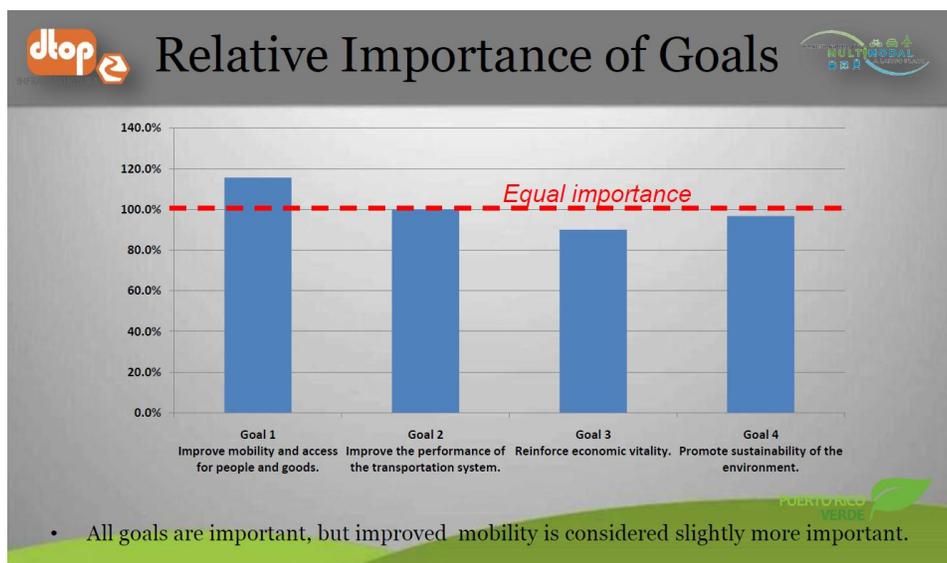
- **Recurring Themes**

Improve Maintenance of Existing Facilities. Many public comments focused on the need for better maintenance and repair of existing facilities, including traffic signals, marking, and signing. Some people felt that this would improve safety for motorists, bicyclists, and pedestrians alike. There were also comments about locations that experience flooding during rains.

Reduce Congestion. People at the meetings talked a lot about congestion on the principal roads at peak hours and other times. This daily congestion aggravates travel and can affect other important services like transit and emergency vehicles. Better signal timing and adding traffic lanes at intersections were two common suggestions.

Need for Better Transit. A frequent observation was the need for more and better transit, in terms of coverage, frequency, and operating hours. It was broadly observed that públicos as a reliable form of transit are disappearing, and that access for the elderly and those without cars is becoming more difficult. There was also sentiment for better connections between transit services and for services operated by municipalities.

Need for Improved Sidewalks and Bicycle Facilities. There were significant comment about improving sidewalks and their condition, removing obstructions, adding intersection ramps, and completing missing sections of sidewalks. It was also requested that more bicycle routes and paths be developed to provide better options to driving.

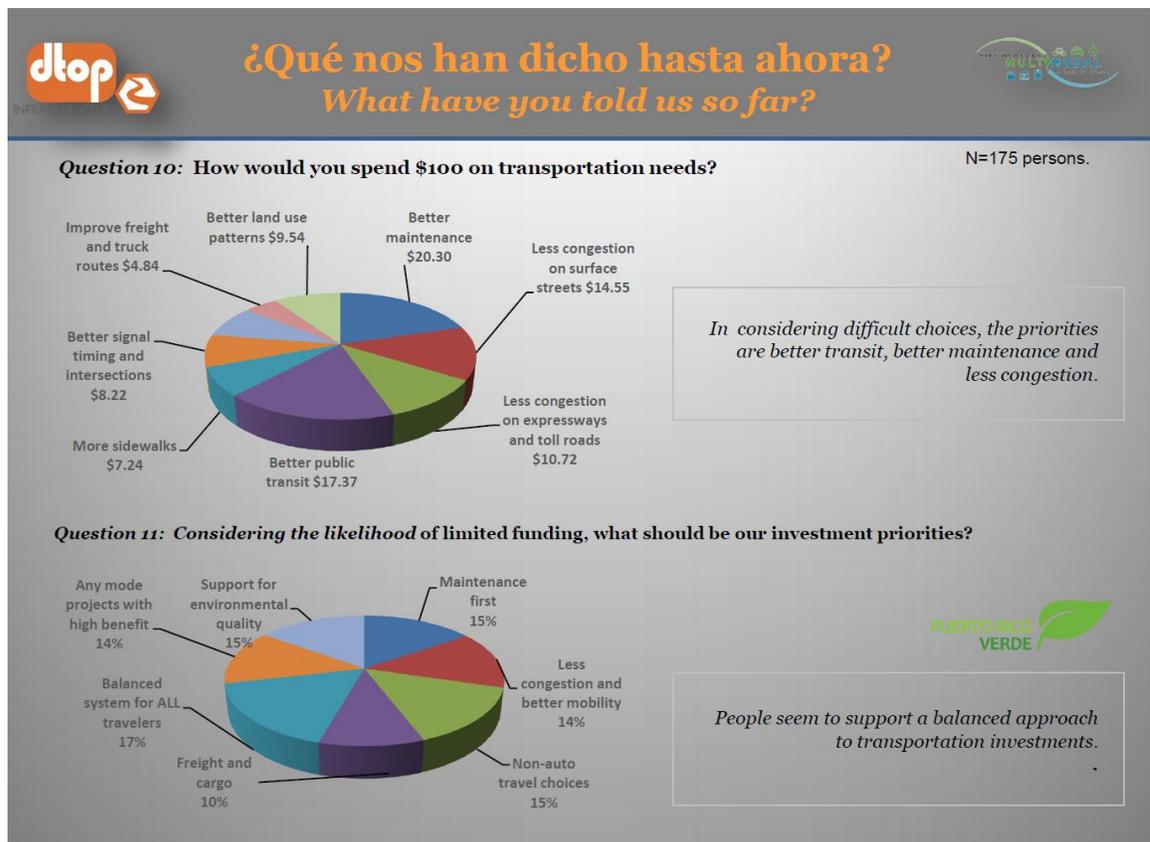


Reducing Impact on the Natural Environment. Though less frequent, there were nonetheless many comments on the need to reduce reliance on the automobile by changing development patterns to encourage smart growth with mixed uses, providing better transit services, and developing better pedestrian and bicycle networks.

Better Coordination of Transportation and Land Use. Many persons attending the meetings, including younger students, felt that stronger policies to improve the interrelationship of land development and transportation were needed. They felt sprawl creates significant traffic congestion in key highway corridors. Better control of land development would lead to fewer environmental impacts, reduced transportation needs, and a more sustainable environment.

- **Goals and Objectives**

One of the surveys provided at the public meetings asked participants to review and rank the goals and objectives by their perceived importance. This exercise provided useful insights into the public's preferences about the importance of various approaches and priorities for dealing with transportation needs. The graphic below shows how the public perceived the relative importance of the four goals. While all of the goals were thought to be appropriate, Goal 1, improve mobility and access for people and goods, was considered the most important of the four.



- **Transportation Investment Priorities**

The survey of transportation opinions included two questions about transportation investment priorities. When participants were asked how they would spend \$100 on diverse transportation needs, better transit was the single most popular choice; but over 50 percent of the choices combined to address various highway system priorities, including better maintenance and less congestion. There was a balanced approach across various investment strategies in the second question about investment priorities when funding is limited, as shown in the graphic below.

3.3 Agency Coordination

The plan development process was coordinated with the Puerto Rico MPO and its MPO Committees, composed of representatives of all the municipalities included in the Puerto Rico urbanized areas (UAs) as well as several partnering agencies. As noted in Chapter 1, the MPO has three such Policy Committees:

- One for the San Juan Metropolitan Area or TMA a UA encompassing 38 municipalities and over 1 million inhabitants.
- One for the Aguadilla Metropolitan Area or TMA, a UA encompassing 11 municipalities and over 200,000 inhabitants.
- One for the other nine UAs with populations between 50,000 and 200,000, grouped into five TPRs.

In addition to the involvement of these committees with the development of the plan, DTPW/PRHTA partnering agencies were participants in the process, and will participate in a review of the draft plan. Several coordination meetings were also held with a Technical Committee and with the staff of the Puerto Rico Planning Board. Numerous and periodic meetings with PRHTA staff and management were also conducted.

A final report reflecting federal and other comments was prepared in August 2013 and was presented to the MPO policy committees and accepted on September 4 and 5, 2013.

3.4 Summary of Public Outreach Compliance

The following narrative summarizes how the Islandwide LRTP public involvement process is addressing the requirements of Title 23 CFR 450.210, Interested Parties, Public Involvement, and Consultation.

- **Establish early and continuous public involvement opportunities that provide timely information about transportation issues and decision-making processes to citizens, affected public agencies, representatives of public transportation employees, freight shippers, private providers of transportation, representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, providers of freight transportation services, and other interested parties.** The Islandwide LRTP endeavored to be inclusive in the outreach efforts. The advisory committees and review meetings included representatives from the disabled, the elderly, freight transportation providers, Commonwealth agencies, transit service providers, non-motorized transportation groups, regional economic development agencies, professional planning and traffic engineering societies, and educational facilities. This cross-cutting membership yielded stimulating discussions and valuable insights and inputs into the planning process, which is the

intended outcome. These contacts were also used to leverage publicity of project meetings to their user groups.

- **Provide reasonable public access to technical and policy information used in the development of the long-range statewide transportation plan.** The plan development process utilized the website to post various project information, including the public involvement plan, draft plan documents, presentations and other materials. Specific requests for information from agencies, MPO committee members and advisory committee members were also fulfilled.
- **Provide adequate public notice of public involvement activities and time for public review and comment at key decision points, including but not limited to a reasonable opportunity to comment on the proposed long-range statewide transportation plan.** The plan development process included public advertisements in newspapers 7-10 days before meetings, press releases, public service announcements, and posting on the project webpage. Email notices were also sent to the municipalities, MPO and advisory committee memberships, and a number of other identified agencies and organizations, asking them to further distribute the information to their memberships. Draft versions of the document were distributed for comment. The final draft of the document will be available for public comment for 45 days.
- **Ensure that public meetings are held at convenient and accessible locations and times, to the maximum extent practicable.** The Islandwide LRTP process included meetings with the MPO committees, the Citizens Advisory Committee, the Economic Development Advisory Committee, and other outreach meetings and presentations. Most of these were held during the day as is customary. The public meetings were held within each of the seven transportation management areas/transportation planning regions of the island, on Tuesdays, Wednesdays and Thursdays to avoid Mondays and Fridays, which are tied to weekend activities.
- The meetings were structured as open house meetings from 4 pm to 8 pm to afford a large time window for citizens to attend at their convenience during daylight hours if preferred, after work or dinner if preferred. The open house format permitted persons to come when convenient, stay as long as needed, discuss issues with the study team, fill out survey forms and review the exhibits and video. The meeting locations were selected to be convenient, identifiable locations. The meetings were held at community centers, municipal offices, schools and other similar facilities. The specific facilities were generally not repeated to provide for additional geographic coverage within the regions. Some of these methods had not been used before, but were considered to be successful and will be considered again in the future.
- **To the maximum extent practicable, use visualization techniques to describe the proposed long-range statewide transportation plan and supporting studies.** The Islandwide LRTP has used several visualization techniques to convey project information. Graphics were used to depict transportation funding sources and uses as well as public survey response patterns using pie charts. Numerous maps showing traffic volumes, traffic service, key facility locations, transit services, traffic count locations, and other data were prepared. GIS-based mapping was used to prepare a variety of other graphics showing locations of proposed transportation improvements, demographic trends and other characteristics. These graphics were used in numerous PowerPoint presentations to MPO and advisory committees, PRHTA and other agencies. An informative video presentation using graphics was prepared, recorded onto a DVD, and used at public meetings to provide basic information to the public about the planning process. Some of these products were also provided on the project website available for downloading.

- **To the maximum extent practicable, make public information available in electronically accessible format and means, such as the World Wide Web, as appropriate to afford reasonable opportunity for consideration of public information.** Public information about the plan development process was posted on the PRHTA Strategic Planning Office webpage, and also on the webpage developed specifically for the LRTP, general information about the LRTP process was also posted, along with project documentation. These weblinks were publicized in press releases, meeting advertisements, meeting handouts, the video, and at the various meetings conducted.
- **Demonstrate explicit consideration and response to public input during the development of the long-range statewide transportation plan.** A new technique employed during the development of this plan was the use of survey forms at the meetings to solicit public input as to opinions and preferences on a variety of topics and questions. Most of these were preformatted, but there were also numerous open-ended questions. All of the survey responses were tabulated into spreadsheets. Standardized question responses were tabulated and graphical pie charts developed to illustrate the pattern of responses. For open-ended questions, all responses provided were also tabulated into spreadsheets, reviewed, and summarized. These notes were then referred to by the study team in identifying suggestions for improvement needs by type or category, and also by specific improvement recommendation. As noted in the plan text, these tabulated comments were considered along with other sources used to identify potential transportation system improvements.
- **Include a process for seeking out and considering the needs of those traditionally underserved by existing transportation systems, such as low-income and minority households, who may face challenges accessing employment and other services.** The MPO is committed to further improve its strategies and methods of outreach to targeted populations. As part of the plan development work, a very detailed multi-dimensional analysis of population demographics was performed using the most recent 2010 Census data, looking at ethnicity, race, income auto ownership, education level and language proficiency. This GIS-referenced data analysis provides a valuable foundation for the MPO in its future outreach strategies.
- This information informed a strategy to reach out to disadvantaged and target populations during the plan process. Communications were made to the American Association of Retired Persons, social service agencies and others, who were requested to forward to their email distribution lists. Municipal governments were in the distribution list and were also requested to forward notices to their departments serving target groups and further disseminate meeting notices. Plan information and notices were posted on the agency and project websites as well. While it was not possible to identify the specific attendance by target populations, the presence of elderly and handicapped persons was noted at the various public meetings.

Chapter 4

ISLANDWIDE CHARACTERISTICS

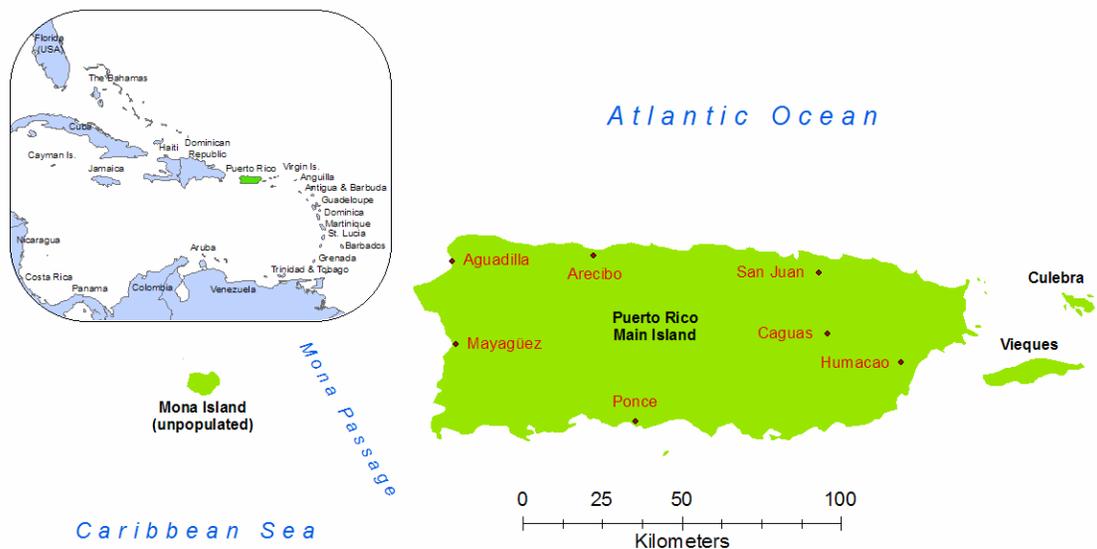
This chapter provides the land use, environmental, and demographic background for evaluating the transportation program needed to best serve the people of Puerto Rico while conserving the island's unique natural and cultural resources. It also looks at the current islandwide planning areas and transportation system.

4.1 Introduction

Puerto Rico lies at the eastern end of the Greater Antilles chain, which also includes the islands of Hispaniola (Haiti and the Dominican Republic) and Cuba, forming part of the northern boundary between the Caribbean Sea and the Atlantic Ocean, as seen in Figure 4-1. Puerto Rico has a main island and a number of smaller islands, the largest of which are Vieques and Culebra (a collection of 23 closely-lying small islands). The archipelago also contains a number of unpopulated smaller islands and keys, including Mona Island situated halfway between Puerto Rico and the Dominican Republic.

The main island of Puerto Rico is by far the largest; covering about 9,000 square kilometers, it measures roughly 180 kilometers east to west (Punta Puerca to Punta Higuero) and 65 kilometers north to south (Isabella to Punta Colón). Puerto Rico's mountainous interior, formed by a central mountain chain commonly known as the "Cordillera Central," extends across the interior of the island. The highest summit, Cerro de Punta, reaches 1,338 meters above sea level. Besides the mountainous region, two other types of topography define much of Puerto Rico. A coastal plains zone, relatively flat in some areas and rolling and hilly in others, surrounds the mountainous area, except in the southeastern corner of the main island, where steep cliffs tower over the sea. In the northwest portion of the main island, numerous limestone karst formations exist.

Figure 4-1
LOCATION OF PUERTO RICO



4.2 Development and Urbanization

During the 1990-2000 decade, a period of reasonably good economic prosperity, a noticeable pattern of urban expansion could be identified across much of Puerto Rico. This period of more rapid population growth as well as a trend of suburbanization, led to more areas being defined by the U.S. Bureau of the Census as urbanized. While part of this designation is due to the fact that many areas were already approaching the population threshold for an urbanized area and some growth took them over that threshold, it is also apparent that more of the island's municipalities were experiencing new development and the concomitant population growth, much of it in outlying residential land use. The trend moderated over the 2000-2010 decade, a period that included the economic recession and troubled real estate and development markets. Nevertheless, expansion of urban areas away from the coast and into the island interior with lower density development has continued, if at a much slower pace, as shown graphically in Figure 4.2.

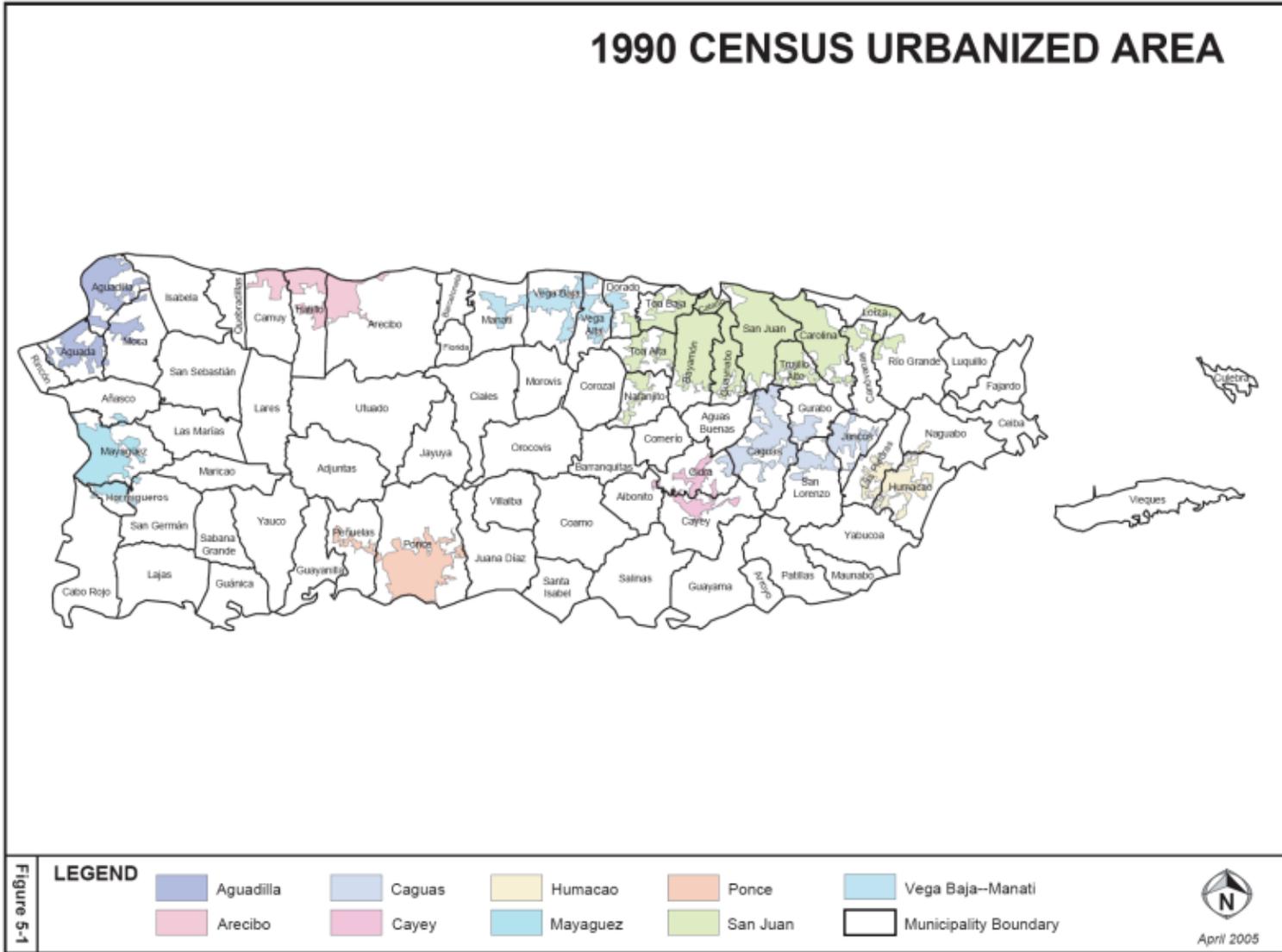
Because a transportation system functions as the underlying building block and driver of a productive society, it must be carefully planned to meet society's diverse needs. Rapid urbanization however, such as the type Puerto Rico has experienced over the last decades, often occurs discontinuously when appropriate infrastructure is not already in place to support it. This growth then fuels the need for even more support systems, including those within the realm of transportation. Accordingly, this Islandwide 2040 Long Range Transportation Plan (LRTP) is committed to the principle of a sustainable and environmentally responsible transportation system, and supports the development of alternative transportation energy sources for today and tomorrow.

4.2.1 Urbanized Areas

As defined by the 2000 U.S. Census, an "urbanized area" (UA) consists of a central place and adjacent territory with over 50,000 people and a minimum average density of 1,000 people per square mile (or 386 people/square kilometer). As described in the August 24, 2011 Federal Register (76 FR 53030), the 2010 Census made a few UA criteria modifications; among others these include using census tracts as points of reference, eliminating the designation of central places, and adding smaller airports within 0.5 miles of the urban area and with at least 2,500 passengers.

The UA boundaries cover areas that are urban in the traditional sense, such as core residential and employment centers, areas that are more suburban in nature, and adjacent non-urban territory as well. The San Juan UA, in particular, incorporates territory well beyond what is generally accepted as the San Juan Metropolitan Area, including suburbs, small towns, and adjacent areas with little settlement. In fact, the San Juan UA now covers most of the eastern half of the main island.

Figure 4.2
PUERTO RICO URBANIZED AREAS 1990, 2000, AND 2010



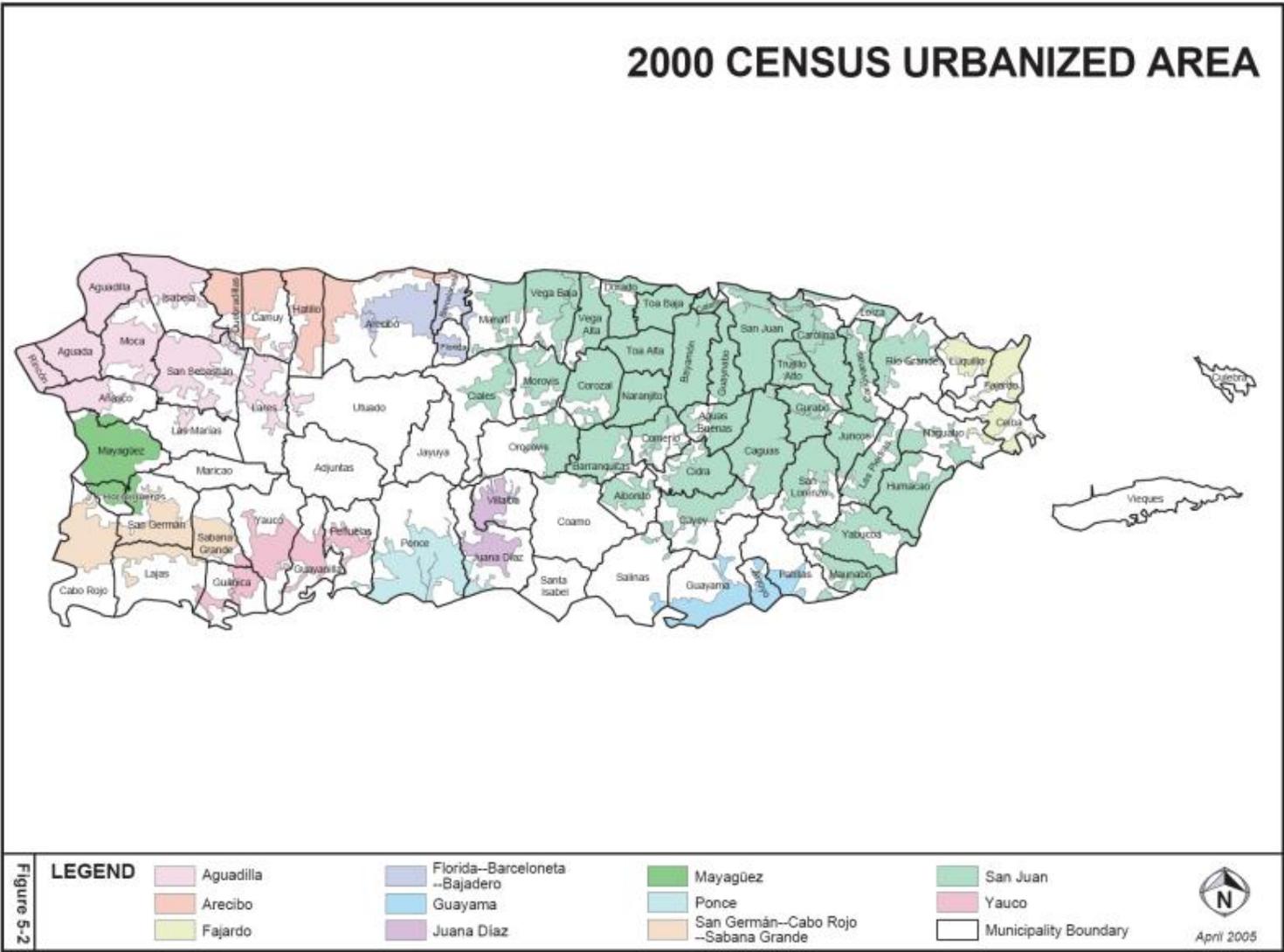
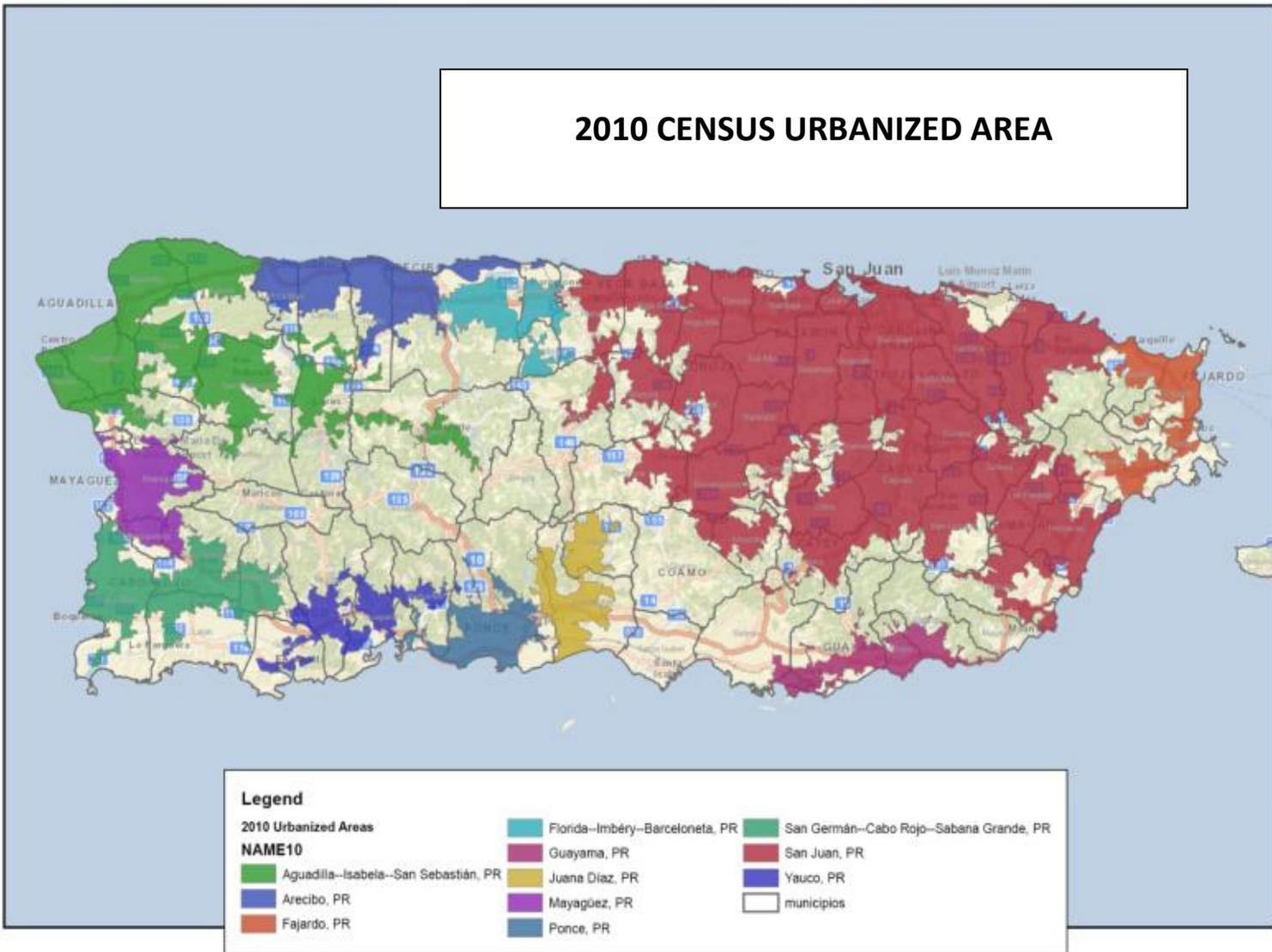
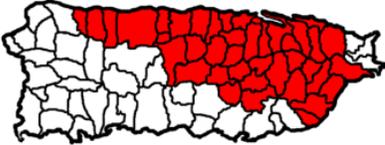


Figure 4.2 (Continued)

Figure 4.2 (Continued)



The major urbanized areas in Puerto Rico include San Juan, Aguadilla, Ponce, and Mayagüez. Numerous large municipalities and towns lie directly on the coast, although the Caguas and Cayey urbanized areas in the central-eastern region have grown substantially during the past few decades, largely due to improvements in the highway system and the sprawling growth of the San Juan region, now designated as the San Juan-Caguas-Guaynabo Metropolitan Statistical Area (MSA), highlighted in the adjacent map.



The Ponce UA, traditionally the second largest metropolitan area in Puerto Rico, and the Mayagüez UA, the third largest metropolitan area, were not expanded significantly in the 2000 Census. Instead, areas that could be construed to be the urban sprawl of these two UAs were declared new smaller UAs. The Aguadilla UA, itself a relatively small municipality, was, however, expanded significantly to include sparsely settled semi-rural areas along the PR-111 corridor all the way to Utuado. The resulting changes to the Aguadilla UA increased the number of residents to more than 200,000, resulting in its classification as a transportation management area (TMA), requiring a separate LRTP, similar to that for the San Juan TMA.

In response to changes in UA boundaries resulting from the 2000 Census, and the need to coordinate transportation systems at higher than a local level, the Commonwealth has been divided into five transportation planning regions (TPR) in addition to the two TMAs - San Juan and Aguadilla -- as shown in Figure 4.3.

The 2010 U.S. Census determined that, of the 3.7 million residents of Puerto Rico, 60.2 percent live in the San Juan UA, an increase over the 58.2 percent living there according to the 2000 Census; 8.5 percent live in the Aguadilla UA, up from the 7.8 percent living there according to the 2000 Census. The remaining 31.3 percent of the population live in the other small urban and non-urban regions, as shown in Table 4.1.

Figure 4.3
TRANSPORTATION PLANNING AREAS AND REGIONS IN PUERTO RICO



Table 4.1 shows the population by these regional designations.

Table 4.1
Population by TMA and TPR, 2010

Area	Population	Percent of Total
San Juan TMA	2,241,938	60.2%
Aguadilla TMA	316,173	8.5%
Southwest TPR	250,068	6.7%
South TPR	414,266	11.1%
Southeast TPR	115,292	3.1%
East TPR	81,811	2.2%
North TPR	306,241	8.2%
Total	3,725,789	100.0

Source: U.S. Census, 2010.

4.2.2 Transportation Planning Regions

This section presents a brief description of each of the two TMAs and five TPRs in the Commonwealth. The respective LRTPs for each of these regions provide additional information about them.

4.2.2.1 San Juan TMA

The San Juan municipality is the capital and largest city in Puerto Rico, covering nearly one-half of the island. The San Juan TMA, with its 38 municipalities, contains a wide variety of community types. It includes the traditional core of San Juan, which is dense and highly urban in character, and major suburbs and outlying municipalities, such as Caguas and Humacao, most of which have traditional town centers, but less density. It includes outlying towns, such as Naranjito and Juncos, and semi-rural communities, such as Ciales and Aibonito. This is a very diverse set of settlement types within the same TMA, each with distinct transportation challenges. Figure 4.4 shows the municipalities and towns in the San Juan TMA.

The central mountain range extends east-west through the enlarged San Juan TMA. The range generally divides the area into a northern section that includes the former San Juan 1990 UA and a coastal corridor east to Fajardo and west through Guaynabo and Bayamón and beyond, and a southern section that includes Caguas and the communities along the PR-30 corridor to Humacao. These two sections have very different urban development forms and characteristics, although over the last 10 to 15 years, there has been increasing commuting from the communities south of the mountains destined to jobs in the northern section.

4.2.2.2 Aguadilla TMA

The Aguadilla TMA can be characterized as a grouping of traditional town centers around which enough development has accumulated to exceed the population density of 1,000 persons per square mile. This loosely structured agglomeration of towns has Aguadilla as its core, and the towns that comprise the other municipalities as secondary centers. Figure 4.5 shows the municipalities and towns in the Aguadilla TMA.

Figure 4.4
SAN JUAN TMA

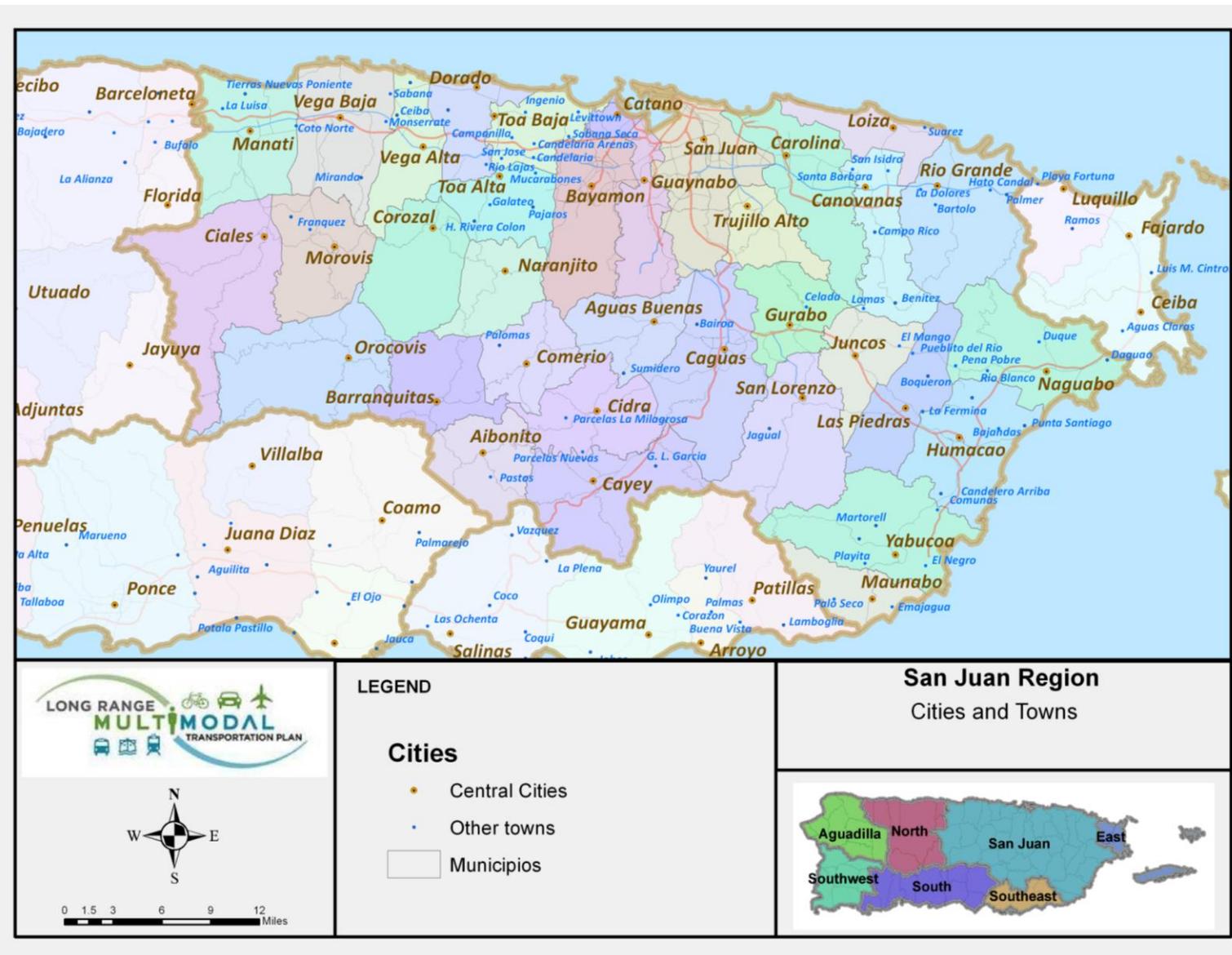


Figure 4.5
AGUADILLA TMA



Principal anchors of the region are the Aguadilla traditional town center, commercial development along the PR-2 corridor, the Rafael Hernández International Airport, the other smaller traditional town centers in the interior of the region, and newer urbanizations that have evolved along the principal road corridors. The area economy is distinguished by the airport and nearby industrial and manufacturing sites, tourism, numerous federal and Puerto Rico agency regional offices, and several colleges and universities. The region has been proactive in marketing its resources and building on them for the future.

4.2.2.3 North TPR

The North TPR, shown in Figure 4.6, comprises nine municipalities, with a global area of 493 square miles (1,279 square kilometers), representing approximately 14.2 percent of the total Puerto Rico surface area.

The main UAs in this TPR are the Barceloneta-Florida-Bajadero UA and the Arecibo UA.. The Barceloneta-Florida-Bajadero UA includes large portions of the municipalities of Arecibo, Barceloneta, Florida, and a very small portion of Manatí. The populated area lies slightly inland from the north coast and is constrained on the south by environmentally sensitive areas and mountains. The area immediately adjacent to the coast has important wetlands, environmental reserves and the Guajataca state forest.

The Arecibo UA includes major portions of the municipalities of Hatillo, Camuy, and Quebradillas, while including only a corner of the municipality of Arecibo. The populated area lies along the north coast, loosely structured in a linear pattern following PR-2 (and its connections to the south), with the town of Arecibo as its main focus. Travel generators such as town centers, regional shopping centers, regional government service offices and tourist attractions are found predominantly along the coast and PR-2. The habitable area in this UA is constrained to the south by sensitive environmental features, such as state forests, limestone karst formations and lakes, and the Guarionex mountain range, all of interest to area visitors. Other towns that lie along PR-2 in this UA include Hatillo, Camuy and Quebradillas.

4.2.2.4 Southwest TPR

The Southwest TPR, shown in Figure 4.7, comprises seven municipalities, with a global area of 348 square miles (901.6 square kilometers). This represents approximately 10.1 percent of the total island area.

The primary UAs in this region are the Mayagüez UA and the San Germán-Cabo Rojo-Sabana Grande UA.

The Mayagüez UA, surrounded by the Añasco River flood plain to the north, mountains to the east, the Guanajibo River flood plain to the south, and the sea to west, includes most of Mayagüez and Hormigueros, and small portions of San Germán and Añasco. This UA, centered on the municipality of Mayagüez, remains the center of population and employment for the western coast of the main island. The city center itself lies adjacent to and slightly inland from the coast, but its urban structure still remains closely linked to the port area, once second only to San Juan's and still considered a potential focus for further development. In addition to the port area, major travel generators in this area include the University of Puerto Rico Campus (the second largest campus, specializing in technology and engineering), Zoológico Dr. Juan A. Rivero (Puerto Rico's official zoo, lying to the north of the municipality), and cultural attractions in the municipality itself.

Figure 4.6.
NORTH TPR

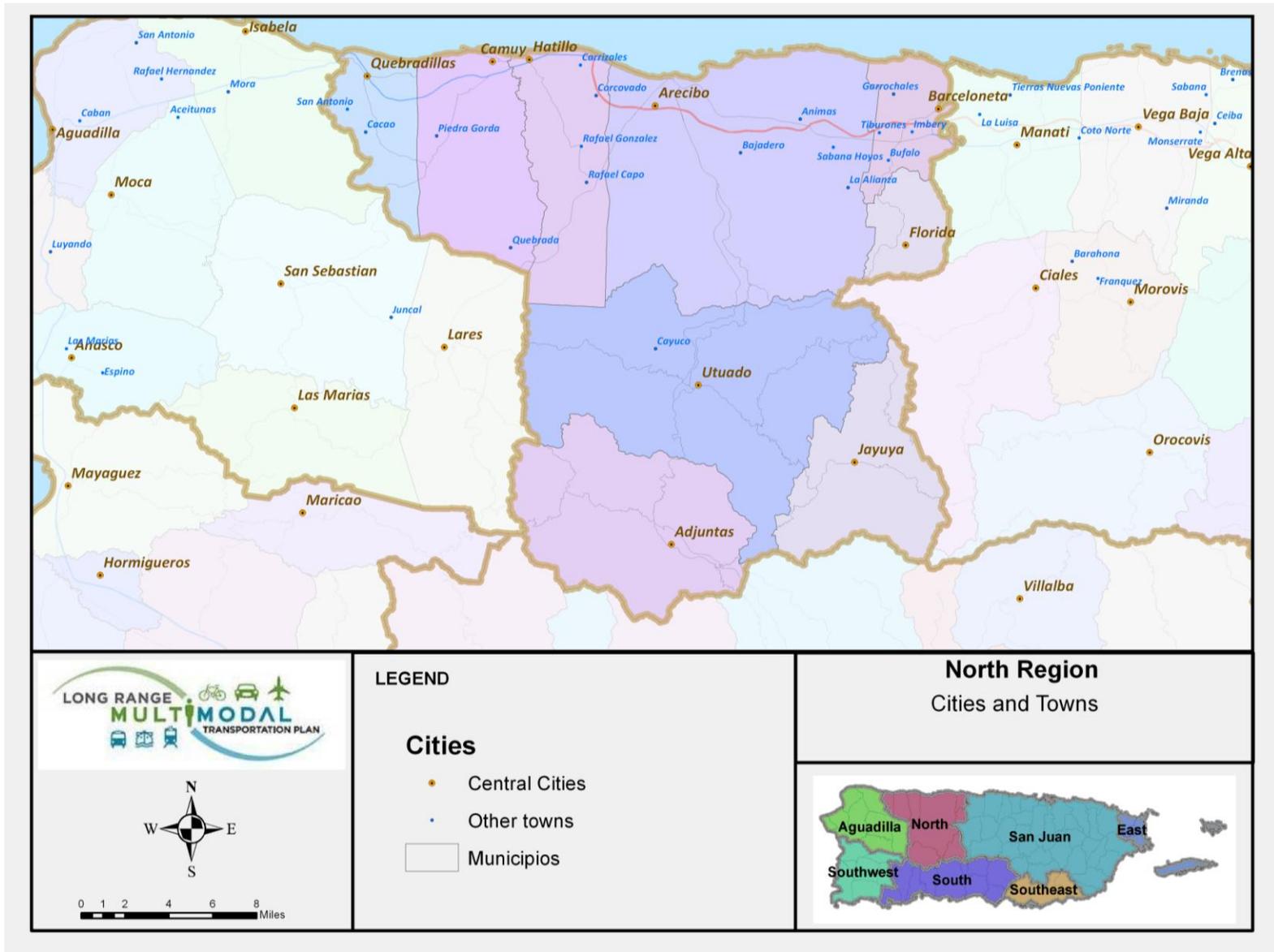
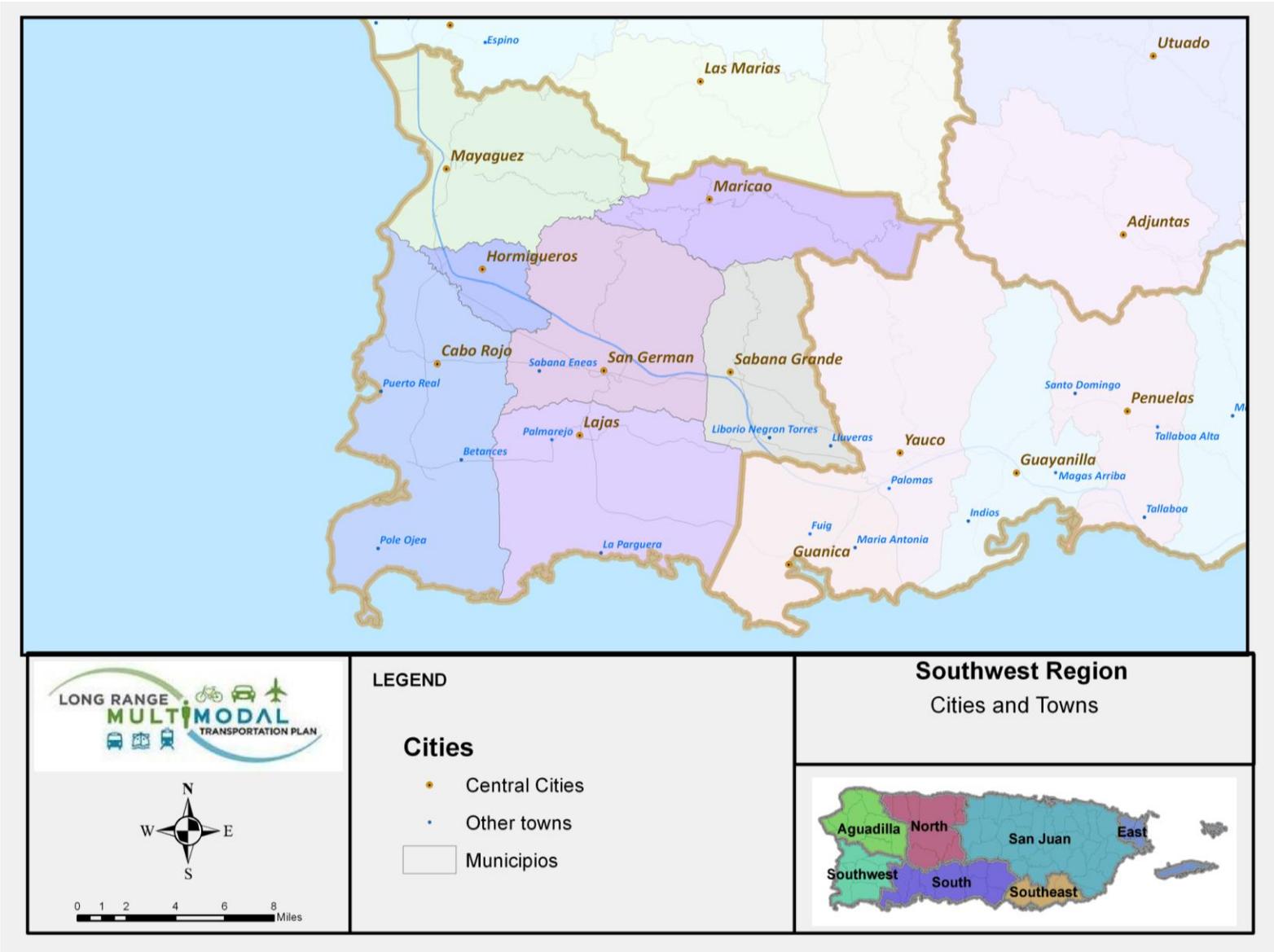


Figure 4.7
SOUTHWEST TPR



In addition, the Mayagüez Mall (one of Puerto Rico's largest) and other major shopping centers, government facilities, the Ramón Emeterio Betances Regional Medical Center and other regional medical centers and a major industrial area to the south, are all adjacent to PR-2. Studies are being conducted of fixed route transit service and bus rapid transit service in Centra; Mayagüez.

The San Germán-Cabo Rojo-Sabana Grande UA includes portions of each of these municipalities, as well as part of Lajas. The collection of small towns and cities in this UA grew alongside the present and previous alignments of PR-2, extending inland from the Cabo Rojo coast. Habitable areas are constrained on the north by the Maricao state forest and on the south by the Sierra Bermeja mountain range and the "Valle de Lajas" agricultural reserve, natural features of regional environmental importance. The area also contains important cultural and historic resources, such as the town center of San Germán, the second oldest settlement of the Spanish colonization of Puerto Rico. Virtually all towns in the southwest of Puerto Rico began as subdivisions of this settlement.

The historic town centers, the large "Hospital La Concepción" by PR-2 near San Germán, the Boquerón beach resort and numerous other tourist destinations along the coast in this area all generate significant travel in this area. As a result, seasonal traffic congestion problems in this area are common.

4.2.2.5 South TPR

The South TPR, as shown in Figure 4.8, comprises nine municipalities, with a global area of 518 square miles (1,441 square kilometers). This represents approximately 15 percent of the total Puerto Rico surface area.

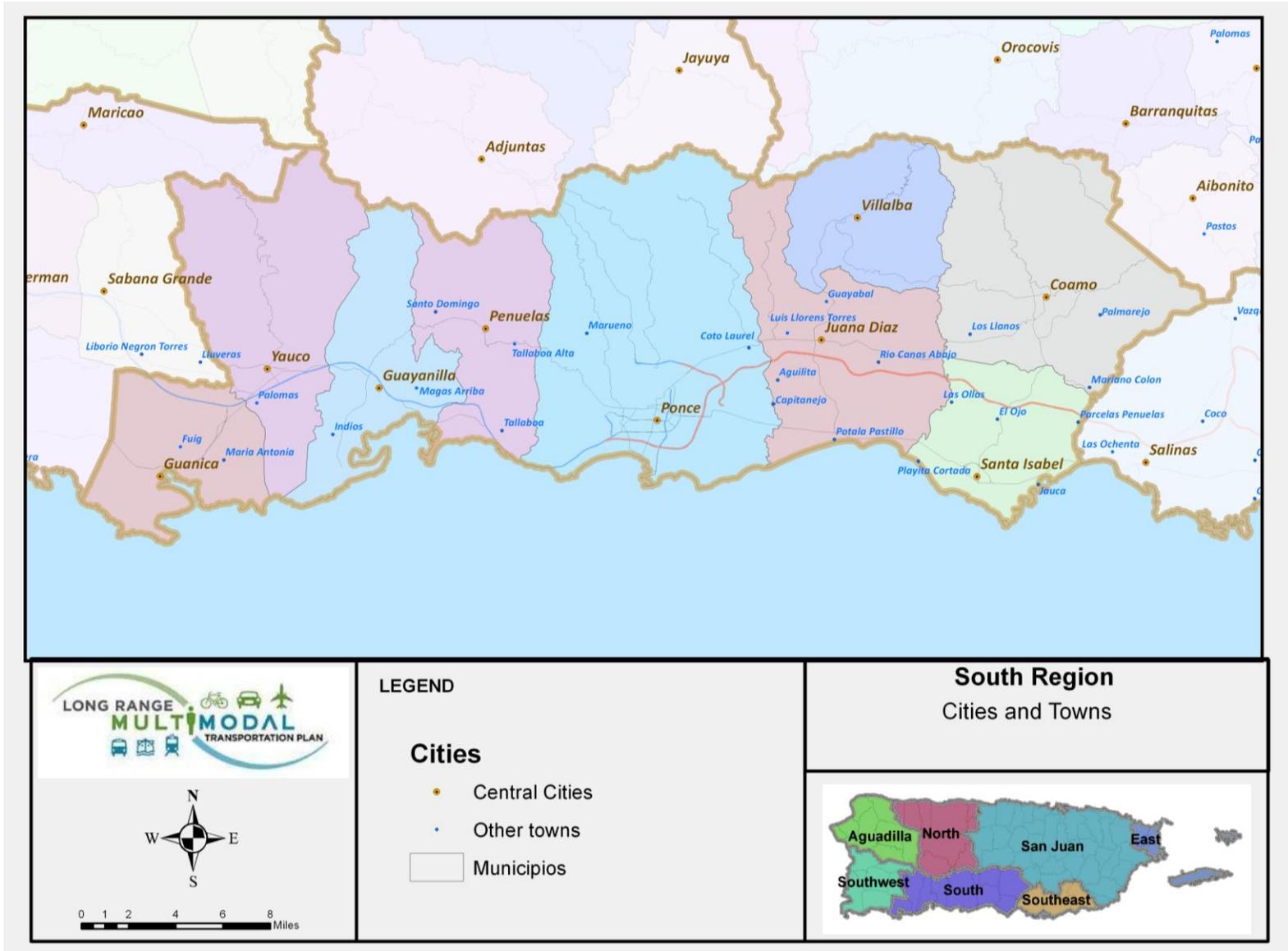
The primary UAs in this region are Yauco, Ponce, and Juana Díaz.

The Yauco UA includes portions of Yauco, Guánica, Guayanilla and Peñuelas. Its origins and evolution, as a string of towns between Mayagüez and Ponce, are tied to PR-2 and the economic history of the southwest in much the same way as the Cabo Rojo-San Germán-Sabana Grande corridor. Although Yauco's commercial importance has been increasing, there are at present no major travel generators in this UA. In the recent past, the coastline and bays of Guánica, Guayanilla and Peñuelas have been important centers of industrial activity; however, the collapse of the petrochemical and refinery industries has diminished travel in this UA.

The Ponce UA lies almost entirely within the municipality of Ponce, with very small portions in both Juana Díaz and Peñuelas. Ponce, traditionally recognized as the second largest municipality in the Commonwealth, comprises a mature urban area with a strong center, a good employment base and well-developed infrastructure. Ponce enjoys major cultural centers, such as the world-class Ponce Art Museum, along with other important tourist destinations, large private and public hospitals, and major shopping centers, in addition to a small campus of the University of Puerto Rico and the main campus of the Ponce Catholic University. To the north of Ponce, other tourist attractions such as the Tibes Taíno Indians Ceremonial Grounds and Hacienda Buenavista also generate trips from outside the area.

A major recent development in the Ponce UA, which could result in important growth benefits for the entire southern portion of the Commonwealth, is the Port of the Americas transshipment port, centered on the Ponce Bay area. The intent of these port facilities is to provide an entirely new basis for economic growth centered on value-added activities and logistic services focused on the international transshipment industry.

Figure 4.8
THE SOUTH TPR



The Juana Díaz UA includes portions of Juana Díaz, Villalba, and a small portion of Ponce, the municipality to which the UA is historically and economically linked. The populated area lies inland, functioning as a bedroom community for the municipality of Ponce to the southwest.

4.2.2.6 Southeast TPR

The Southeast TPR, as shown in Figure 4.9, comprises four municipalities, with a combined area of 196.02 square miles, representing approximately 6 percent of the total Puerto Rico surface area.

Guayama is the primary UA in this region. The Guayama UA includes portions of Guayama, Arroyo and Patillas, and a small portion of Salinas. The populated area lies along the south coast, mostly in Guayama proper and is constrained to the north by rugged terrain. Development is loosely structured in a linear pattern along PR-3, but has been recently influenced in some areas by the opening of PR-53. The UA includes the towns of Guayama, Arroyo and Patillas, but not Salinas.

4.2.2.7 East TPR

The East TPR, as shown in Figure 4.10, comprises five municipalities, with a global area of 164.45 square miles, representing approximately 5 percent of the total Puerto Rico surface area.

Fajardo is the primary UA in this region. The Fajardo UA includes large portions of the municipalities of Luquillo, Fajardo and Ceiba, and a very small portion of Naguabo. The resident population and most of the commercial activity in this UA concentrate around the towns and developed areas close to PR-3. Urban expansion is constrained on the west by the Caribbean National Forest (El Yunque). El Yunque, along with the beaches and other natural and cultural attractions found in this area generate substantial local and inter-regional traffic, and are expected to continue growing over time. The municipality of Ceiba faces substantial and unique opportunities and potential impacts from the redevelopment of the recently-closed Roosevelt Roads Naval Station, one of the largest US naval facilities in the world, encompassing more than 100 miles of paved roads and 1,300 buildings that once housed as many as 7,000 personnel. The redevelopment master plan for this area will provide for both extensive natural preserves and intensive use of the port and airport facilities for tourism, residences, commerce, and services. (See Section 4.3.1.1 below as well as the East TPR plan for additional information about the Roosevelt Roads redevelopment plan.).

4.2.3 Non-Urbanized Areas

Many small, rural towns lie within the mountainous region, interconnected by local roads that are often narrow, twisting, and under-maintained. Several of these roads lack traffic signals, stop signs, and directional signage. Partially because of improvements to highway access into these areas, but mainly as a result of urban sprawl, many mountain roads are experiencing substantial increases in traffic, including heavy vehicles and construction equipment.

The increase in heavy equipment traffic is often associated with the wide dispersion of quarries and related industries throughout the mountains, which serve the islandwide construction industry. The ongoing trend toward larger personal vehicles, particularly sport utility vehicles (SUV), also place an additional strain on mountain roads. Transit, meanwhile, is an ever-decreasing component of traffic on these roads, as públicos and private bus services continue to decline throughout Puerto Rico, as discussed elsewhere in this document. The business model for these services has not adapted to changing cost and demand trends; however, feedback from public surveys shows that preserving these services is considered an important priority. This need is considered in Chapter 7.

Figure 4.9
SOUTHEAST TPR

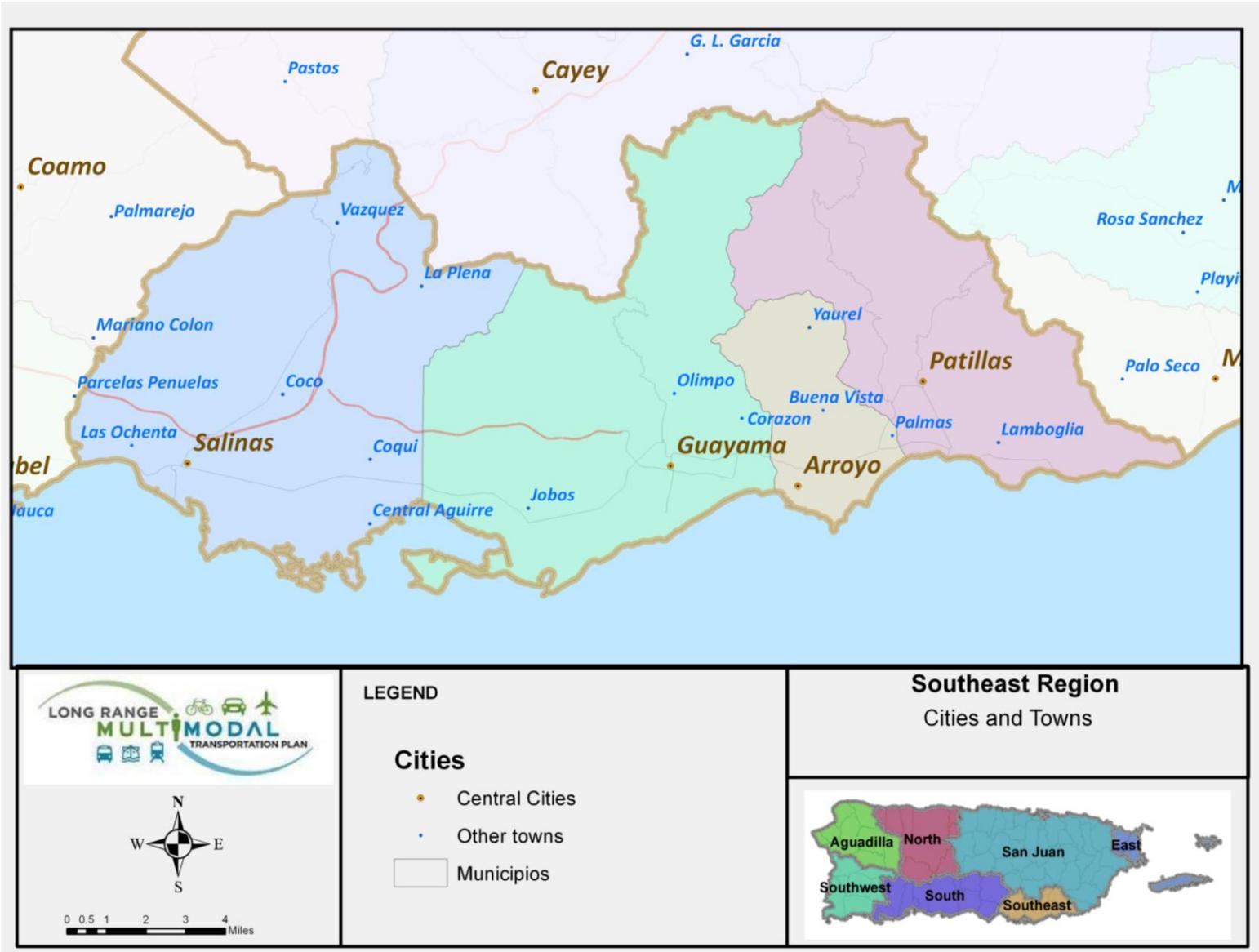
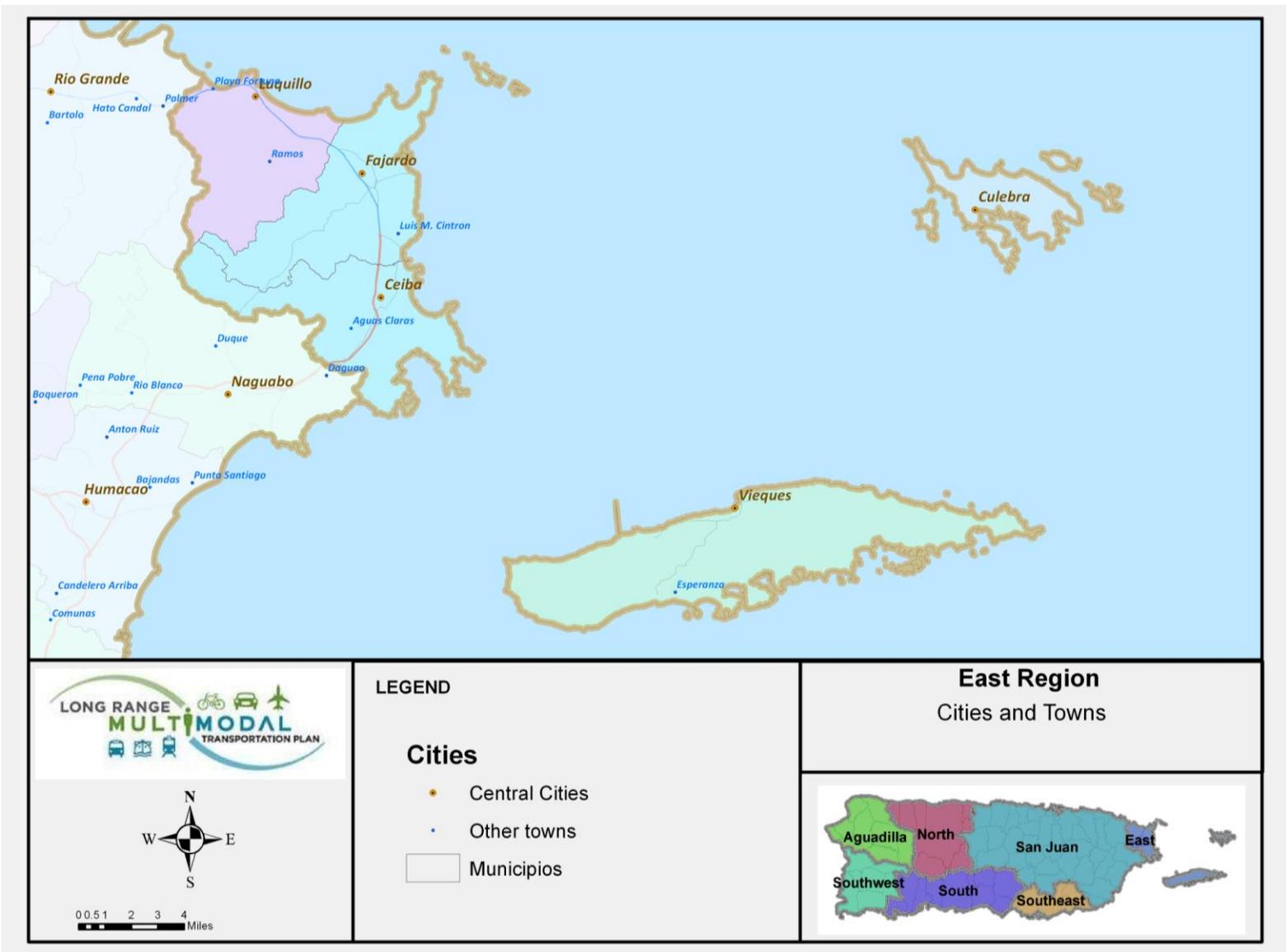


Figure 4.10
EAST TPR



4.2.4 Urban Sprawl

As shown previously in Figure 4.2, the urbanization of the island has accelerated in the last decades. Continuing development on the fringes of urbanized areas makes individual trips more distant and time-consuming, both increasing costs and lowering the quality of the travel experience by shifting the use of an automobile from a convenience to a necessity. This movement toward the periphery puts urban centers at risk of losing their economic viability and even character. Suburbanization consumes land at a fast pace, often negatively affecting natural resources, critically important issues for relatively small, densely populated tropical islands such as Puerto Rico. Urban sprawl also has negative consequences for the social and cultural character of Puerto Rico as a whole, resulting in a diminished quality of life.

As part of this planning process, a summary of land use planning in Puerto Rico has been prepared and is included as Appendix M. The Planning Board is charged with coordination of planning efforts across the island. Recognizing the need for better links between land use and transportation policy, the Planning Board is working on a plan to coordinate land use and transportation planning at the regional level. Over the last two years, it has been working on an Integrated Plan for Strategic and Sustainable Development. While that effort is fairly advanced through its process, it has not arrived at final findings and recommendations. It is aiming to develop a new planning model for the island, which would result in updated regional plans.

Another strategy to foster desirable land use decisions was taken with the Tren Urbano corridor to incentivize land development through legislation and regulations. This strategy included advance planning for transit-oriented development (TOD) at Tren Urbano stations, and enactment of Puerto Rico Law 207 of August 25, 2000, which enabled the PRHTA to foster and facilitate TOD projects, as well as the opportunity for value capture. The progress has slowed because of the weak real estate market and economy, and the need for further coordination with the involved municipalities. In Puerto Rico, sprawl containment presents added challenges because of the number and diversity of Commonwealth and municipal level institutions involved in decision-making.

The planning and regulation of land use in Puerto Rico continues to evolve over time. While efforts have been made to devise regional and islandwide plans and supporting policies, control over land development historically is managed at the municipal level. As a result, developing a regional or islandwide level of control over land use policies and practices has been slow to advance.

4.3 Land Use Patterns

Land use patterns across the island are oriented to a large degree around the primary highway corridors of the region, and to a lesser degree at the traditional town centers. Larger scale industrial development is more concentrated in the area between PR-2 and the Rafael Hernández Airport, around which additional industrial development is anticipated over time. Residential development is occurring in areas away from the coast, including interior valleys. Land use patterns in the region are shown in Figure 4.11 while Figure 4.12 shows the area types or categories that were utilized in developing the islandwide travel demand model for the 2040 L RTPs for the island's respective TMAs and TPRs in Chapter 5.

Many of Puerto Rico's forest, mountain, and agricultural areas have been under development pressure for some time now. Yet, these areas are of critical importance, providing not only basic necessities that increase self-sufficiency (as Puerto Rico is increasingly reliant upon imports, particularly energy, to sustain the population), but also serving as primary tourist attractions. "Growth," in and of itself, is not bad, but unplanned and undirected growth has the potential to wreak havoc on the very amenities that new developments tout.

As shown in Figure 4.11, current and proposed urbanization abuts or even overlaps environmentally sensitive areas in most regions of Puerto Rico. Approximately 40,000 acres of land is classified as “proposed urbanization.” The expansion of urban growth into rural areas and the center of the main island extends and multiplies the pressure over Puerto Rico’s fragile tropical island ecology, thus necessitating a renewed emphasis on actions that advance smart growth and sustainable development policies, particularly as applicable to transportation.

4.3.1 Land Use Development Opportunities

Several areas of potentially large-scale development are proposed for Puerto Rico over the next decades. These include the following opportunities.

4.3.1.1 Roosevelt Roads Redevelopment

Following completion of a Redevelopment Master Plan commissioned by the Roosevelt Roads Local Redevelopment Authority (RRLRA) for the use of the former Roosevelt Roads Naval Air Station in Ceiba, development is beginning on a \$137 million infrastructure improvement plan for the site. The plan focuses on primary infrastructure: electric and water lines, major roadways, sewer and water treatment facilities, and telecommunications facilities in the central areas of the former Navy base.³

The long-term phased plan envisions creating a \$2.5 billion world-class tourism destination over the next 25 years with a 2,500-room hotel and a large casino and entertainment complex, as well as an ecotourism component and several small-business initiatives targeted for the adjacent communities. The adjacent airport (Jose Aponte de la Torre) and a new ferry terminal will serve to connect the resort with the off-island municipalities of Vieques and Culebra. The complex is seen as a significant economic development and job-creation opportunity.

4.3.1.2 Islandwide Tourism Development

Throughout the island, the Commonwealth as well as the varied municipalities and regions are exploring opportunities to expand their touristic resources. For example from Río Grande, through Luquillo and Fajardo on the northeast corner of the island, and extending south as far as Humacao (and also in the off-shore municipalities of Vieques and Culebra), the Commonwealth is promoting tourism development. From Isabela in the northwest corner, extending south as far as Guánica, development focuses on enhancing the tourist industry. Also, development related to growth in the use of Rafael Hernández International Airport for freight, tourism, and industry, and the development of a technology-research-industry corridor from Aguadilla to Mayagüez are being pursued.

Along the west coast of the main island, all of the municipalities have recently joined together to promote the many natural and built attractions as the basis for strengthening the tourist industry in the area. This coordinated effort could create employment growth and improve the overall quality of life for regional residents. Another strategy for development is taking hold in the area, with the alliance of government, private industries and universities (mainly the Mayagüez Campus of the University of Puerto Rico) to develop advanced technology industries around the PR-2 corridor from Aguadilla to Mayagüez. Improvements to the Rafael Hernández International Airport and expansion of the area’s energy and water infrastructure, as well as more efficient surface connections from the Rafael Hernández International Airport to San Juan and Ponce are important elements for development of both of these strategies.

³ “Caribbean Business,” September 27, 2012 | Volume: 40 | No: 38.

Figure 4.11
ISLANDWIDE LAND USE PATTERNS

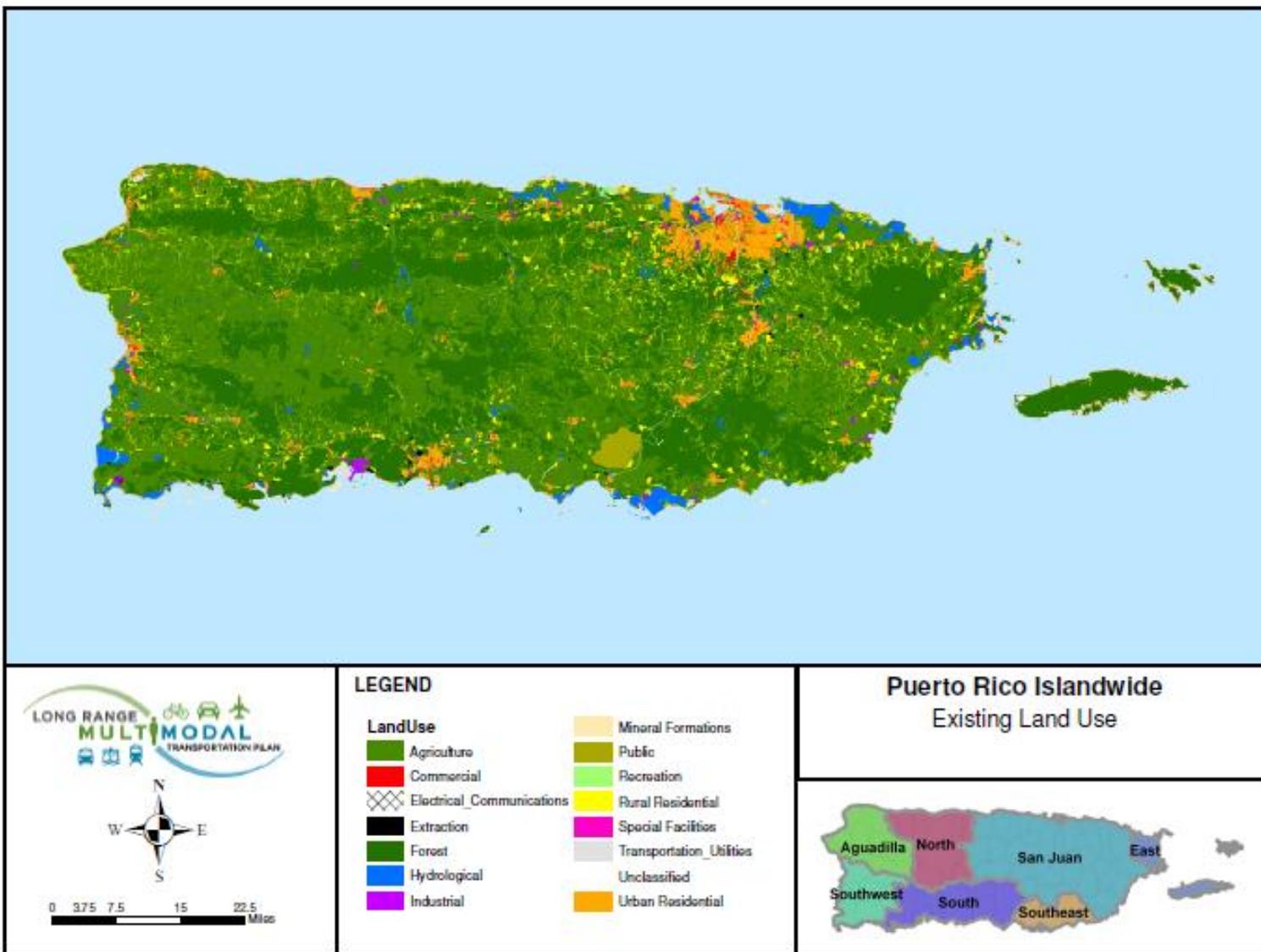
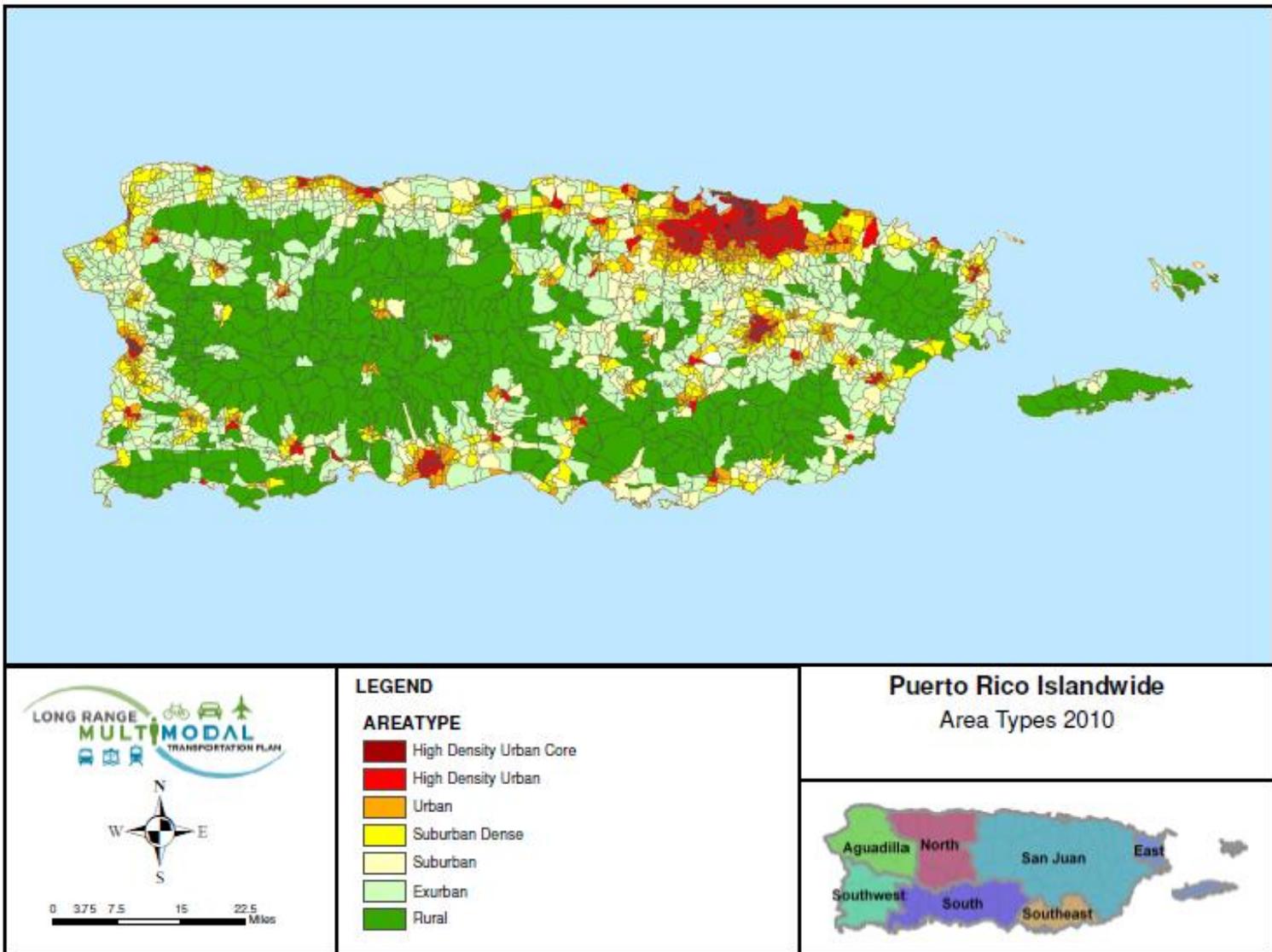


Figure 4.12
ISLANDWIDE AREA TYPES



Maintaining or upgrading transportation infrastructure to improve accessibility to these sites will encourage tourism and increase the visibility of Puerto Rico's multifaceted cultural history and promising future.

4.3.2 Environmental Resources

Each of Puerto Rico's diverse regions possesses important natural resources and ecosystems due to geologic evolution and rainfall variations. The tropical marine climate, slight temperature variations, and diverse topography give rise to considerable biodiversity and landscape settings.

Though relatively small, Puerto Rico has a variety of tropical ecosystems. Weather systems typically move from east to west, with moisture-laden air condensing as it moves over the cooler mountain regions. Most precipitation remains on the windward side, blocked by the central mountain divide. Thus, some of the higher-altitude interior regions of Puerto Rico can receive up to 260 centimeters of rain a year, while others, such as the southwest region, are semi-arid and get as little as 75 centimeters annually.

Puerto Rico's tropical marine climate and relatively small temperature variations year-round make it amenable to many different plant and animal species, some of which are found nowhere else in the world. Indigenous species include the Coqui Frog, virtually the island's emblem, and the rare and brightly colored Puerto Rican Parrot. Off the west coast, Mona Island has been preserved specifically as an undisturbed habitat of endemic species, comparable only to the Galapagos. This biodiversity, combined with spectacular geographical features, pleasant weather, cultural attractions, and the old world charm of historic settlements, have helped to foster national pride and encourage tourism.

4.3.2.1 Coastal Plains

The majority of Puerto Rico's population lives within coastal plain regions, which extend 13 to 19 kilometers inward on the northern part of the island and 3 to 13 kilometers inward on the south. Environmental characteristics of the coastal area include extensive mangrove forests, dry forest preserves, agricultural valleys, lagoons and wetlands, beaches, and zones of porous limestone karst formations.

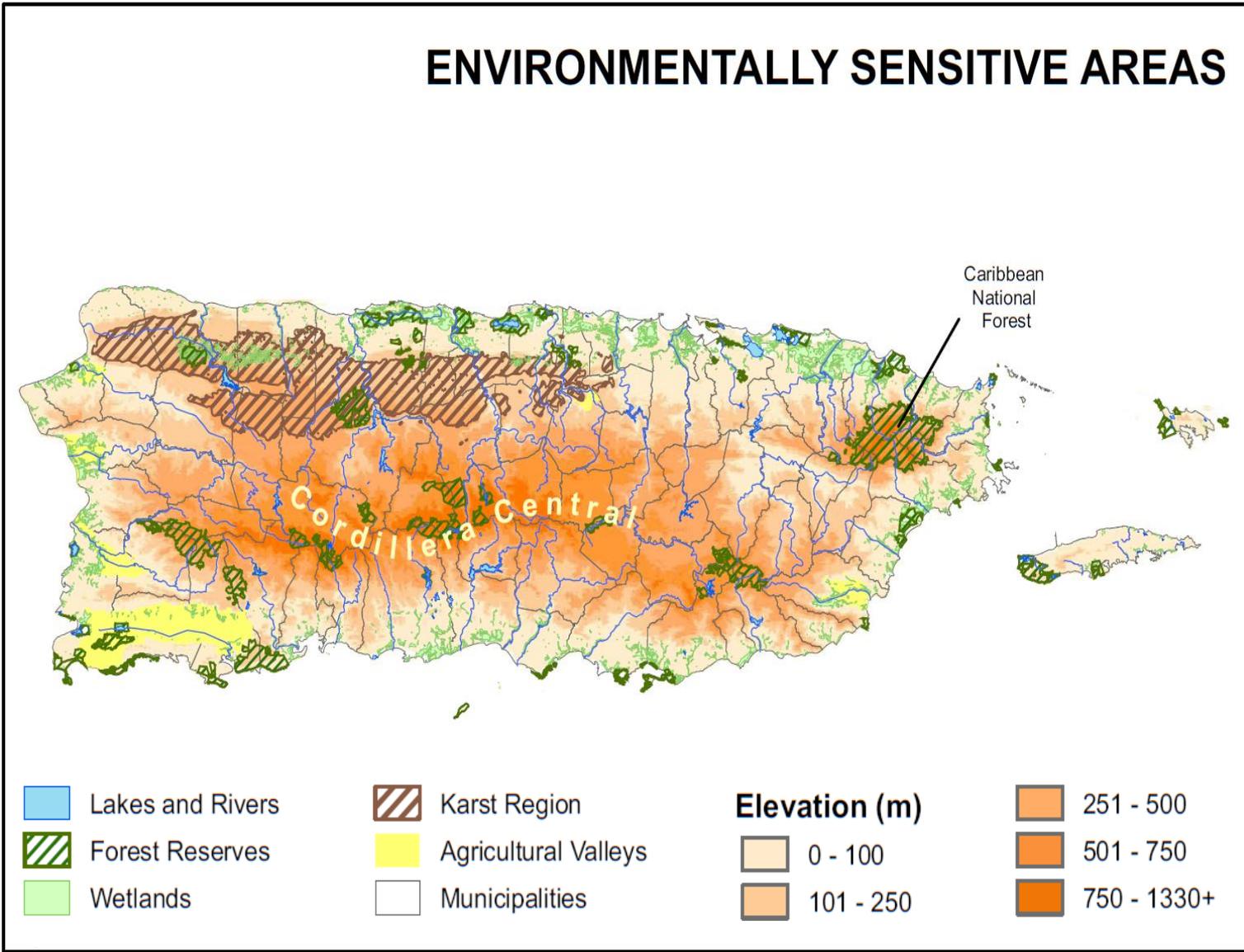
In Puerto Rico, the karst areas are characterized by rugged terrain with steep pinnacles, river valleys, and extensive cave systems, making land and infrastructure development very challenging. The Río Camuy Caves, karst formations located in northwest Puerto Rico, are considered to be among the most spectacular caves in the world, and contain the world's third largest underground river system.

Exhibits of the karst's porosity, sinkholes and hollow formations of varying sizes funnel water into extensive groundwater reserves underlying the area. Because of the rapid entry and spread of water throughout the aquifers, karst regions can be highly susceptible to groundwater contamination, a trait that adds to the environmental sensitivity in this portion of the Commonwealth. Figure 4.13 shows the karst regions of Puerto Rico as well as other significant and sensitive features, such as mountains and agricultural valleys, discussed in following sections.

4.3.2.2 Mountains

Mountains and foothills cover three quarters of Puerto Rico, built up by tectonic plate movement and prehistoric volcanic eruptions. The largest range is La Cordillera Central, while smaller chains include La Sierra de Cayey, La Sierra de Luquillo, and La Sierra Bermeja. Though La Cordillera Central's Cerro de

Figure 4.13
ENVIRONMENTALLY SENSITIVE AREAS



Punta is the island's highest peak, El Yunque (1,066 m) in the Caribbean National Forest is the most famous, as it is surrounded by a tropical rainforest and is only about an hour's drive from San Juan.

Besides extensive forestland, environmental features of the mountainous interior regions include areas with caves and springs, agricultural lands, and acute slopes subject to frequent, sudden landslides. Because any infrastructure in the mountains may be subject to rapid deterioration or storm wash-outs, these regions remain relatively rural, with abundant tropical flora and fauna.

4.3.2.3 Agriculture

While tropical soil is often relatively unproductive, it is well suited towards high biomass products such as coffee, tobacco, and sugar cane, historically a significant crop in Puerto Rico. Until the 1950s, agriculture was Puerto Rico's largest source of economic activity. During that time, government programs steered activities towards urbanization and more modern industry, causing many large plantations to close; some of these plantations are now popular tourist attractions. Today, sugar cane no longer dominates Puerto Rico's remaining agriculture; rather crops include coffee, bananas, pineapples, plantains, and other high-value specialty products. Dairy production and other livestock products provide the most agricultural income. Several large agricultural valleys are located primarily in the southwest region of the main island, as seen in the previous Figure 4.13. Small farms also exist throughout Puerto Rico.

4.3.2.4 Forest and Wildlife Preserves

Puerto Rico's mountain ranges house numerous state forest preserves, where the tallest peaks lie, and other extensive, but unprotected forested areas. In the Sierra de Luquillo mountain range at the northeast corner of the main island is "El Yunque," the 28,000-acre Caribbean National Forest and the only tropical rainforest on U.S. soil, administered by the U.S. Forest Service. Set aside as a preserve in 1876 by the Spanish crown, El Yunque contains pre-Columbian woodlands, which are estimated to cover less than 0.2 percent of the main island now, due to massive agricultural deforestation in the eighteenth and nineteenth centuries. Even El Yunque, however, is surrounded by still unprotected secondary forests that continue under strong development pressure. Further habitat fragmentation due to increased development may cause already threatened species to become extinct, as small island-based populations are more susceptible to the effects of natural or man-made disasters than are large ones. Figure 4.14 shows the protected forest reserves on the island.

Well-established environmental regulations and procedures are in place and are coordinated by the Environmental Quality Board and various federal environmental agencies. Further transportation improvements will need to consider avoidance, minimization and mitigation of and identified environmental impacts. The MPO, through the PRHTA agency, supports coordination with federal and Commonwealth agencies to promote the consultation process.

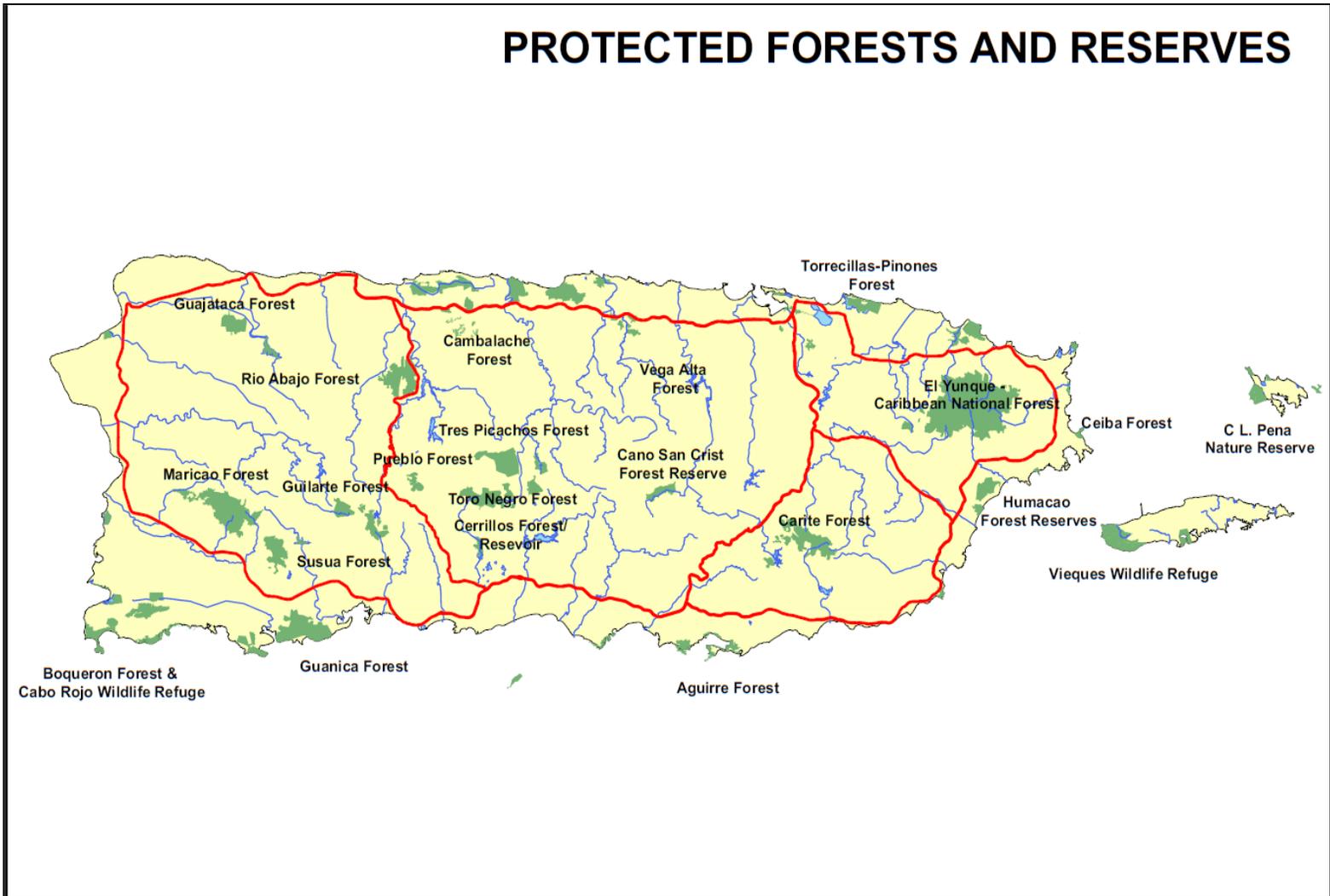
4.4 Demographics

4.4.1 Population

Demand for transportation relates not only to the pattern and extent of land use development, but also to the sheer number of people and the demography, or defining characteristics, of the population. This section looks at population growth, and a variety of other factors expected to affect the need for transportation services of various types throughout the island through the 2040 planning horizon.

Over the past century, Puerto Ricans have seen significant changes in their way of life, as the Commonwealth shifted from an agriculturally based economy to an industrial one, with the help of Operation Bootstrap, a massive modernization program begun by the U.S. government in the 1940s.

Figure 4.14
PROTECTED FORESTS AND RESERVES



This transition attracted many new residents and Puerto Rico experienced substantial population growth, much of it occurring since 1970 as the new economy gained momentum. In 1970, Puerto Rico's total population was 2,712,033 people; in 2010, it was 3,725,789, based on the 2010 U.S. Census, an increase of more than a million people over the past forty years. The recession in the latter part of the previous decade caused a slow-down in population growth, as many people left the island for economic reasons; without that recession, growth could have been even more substantial.

The next decades are forecast to see a continuing increase of residents, albeit at a somewhat lesser pace than in prior decades. While the vast majority of people will continue to live in or near San Juan, population growth is projected to occur throughout the island. The 2040 islandwide population is anticipated to reach 3,919,580, based on the planning forecasts for this LRTP update, as seen in Table 4.2. Supporting information can be found in Appendices B and L.

Table 4.2
PROJECTED POPULATION GROWTH 2000–2040

Year and Percent Change								
Region	2000	2010	Absolute Change 2000-2010	2020	2030	2040	Absolute Change 2010-2040	Percent Change 2010-2040
San Juan TMA	2,274,56	2,241,938	-32,622	2,261,113	2,319,030	2,373,366	131,428	5.9%
Aguadilla TMA	323,663	316,173	-7,490	320,352	330,173	340,101	23,928	7.6%
Southwest TPR	257,681	250,068	-7,613	248,975	249,400	250,229	161	0.1%
South TPR	435,106	414,266	-20,840	409,939	416,187	424,267	10,001	2.4%
Southeast TPR	114,683	115,292	609	117,053	119,715	121,726	6,434	5.6%
East	89,507	81,811	-7,696	83,283	84,461	86,542	4,731	5.8%
North	306,236	306,241	5	311,519	317,468	323,349	17,108	5.6%
Total	3,801,43	3,725,78	-75,647	3,752,234	3,836,434	3,919,58	193,791	5.2%

Source: U.S. Bureau of the Census (2000 and 2010) and planning forecasts (2020, 2030, and 2040) for this LRTP update.

The population in 2010, by region, is shown in Figure 4.15, the population estimated for 2040 is shown in Figure 4.16, and anticipated change in population is illustrated in Figure 4.17. This projected increase in population will translate directly into greater travel demand for work, school, shopping, and other activities. The concurrent additional demand for consumer goods will also result in increased freight movement from the ports and airports, since most articles consumed in Puerto Rico are imported. The government's increased emphasis on tourism will also create additional travel demands.

4.4.2 Age

Due to lower birthrates and good healthcare, the average age of Puerto Rico's residents is expected to increase over time. In 2009, 14.1 percent of the population was 65 or over (Table 4.3). This is an increase from the 11.2 percent of the population aged 65 and over identified in 2000. Extrapolating this percentage to 2040, it is clear that this aging trend will continue. For women, the percentage of the population 65 and over is, and will continue to be, higher than for men.

Figure 4.18, taken from the *Puerto Rico State Housing Plan, 2011-2015*, shows how the population 60 years and over is dispersed throughout the island, with concentrations in the Southwest, North, and East regions as well as in San Juan.

Figure 4.15
POPULATION 2010 BY REGION

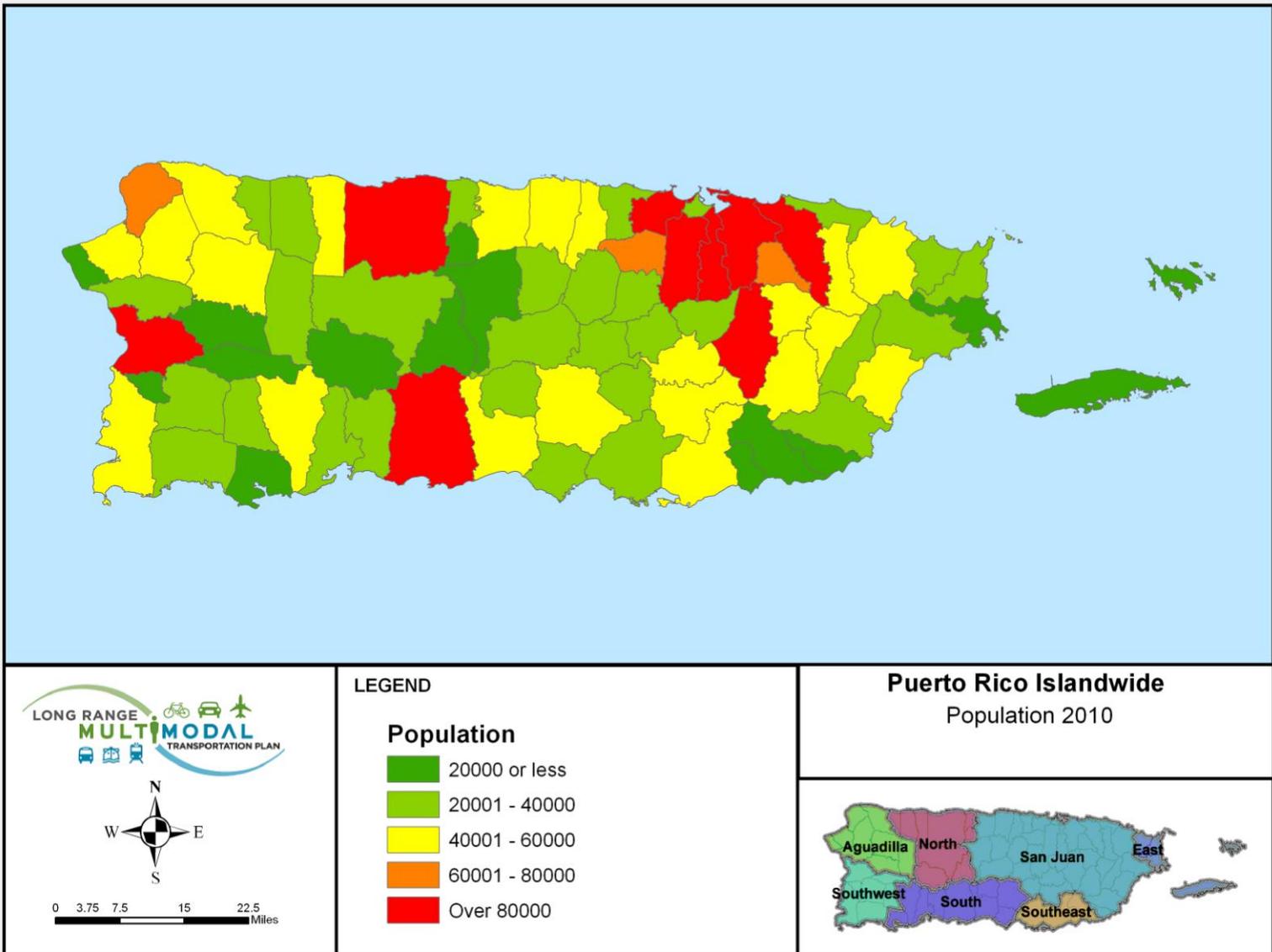


Figure 4.16
POPULATION 2040 BY REGION

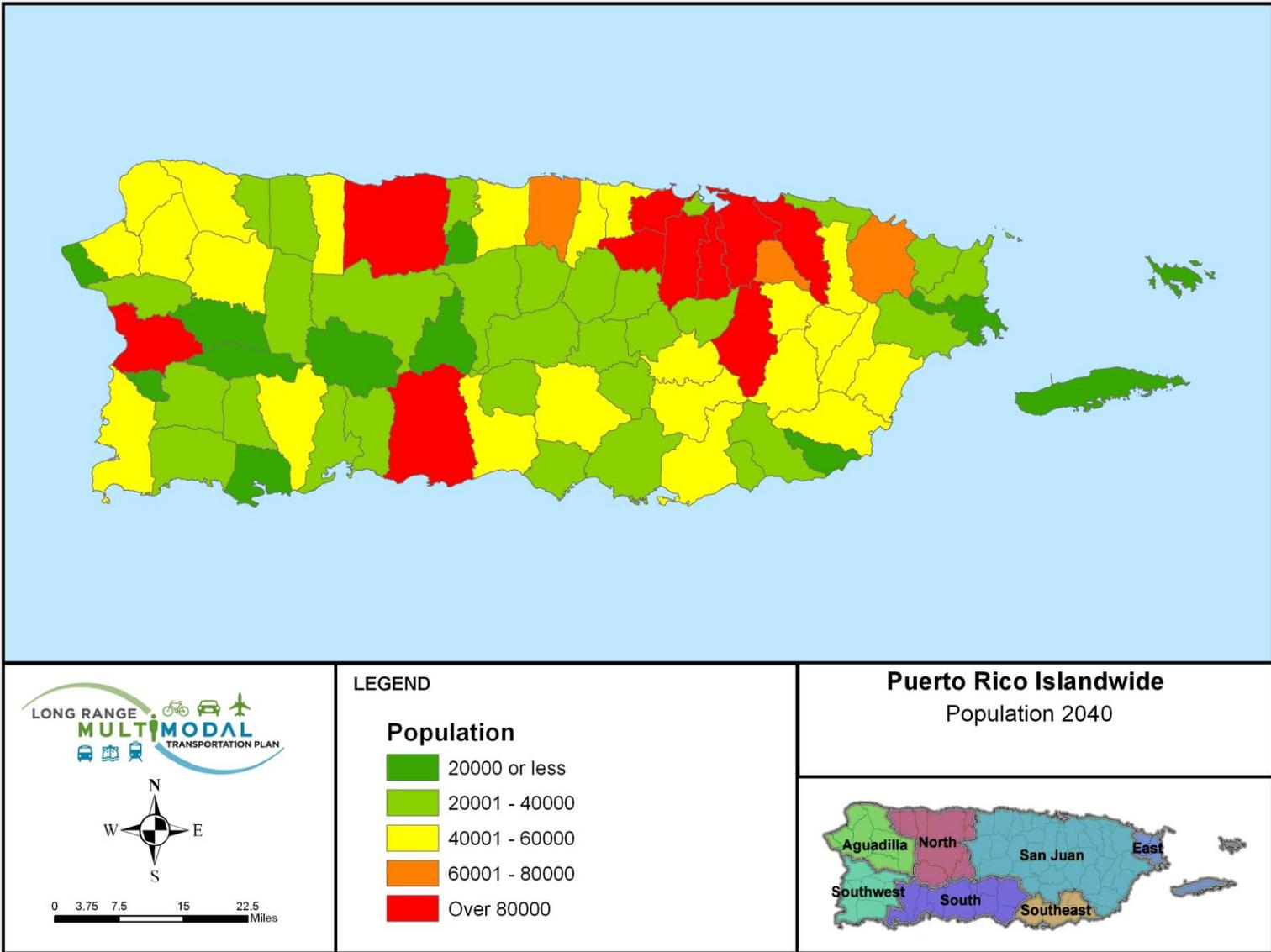
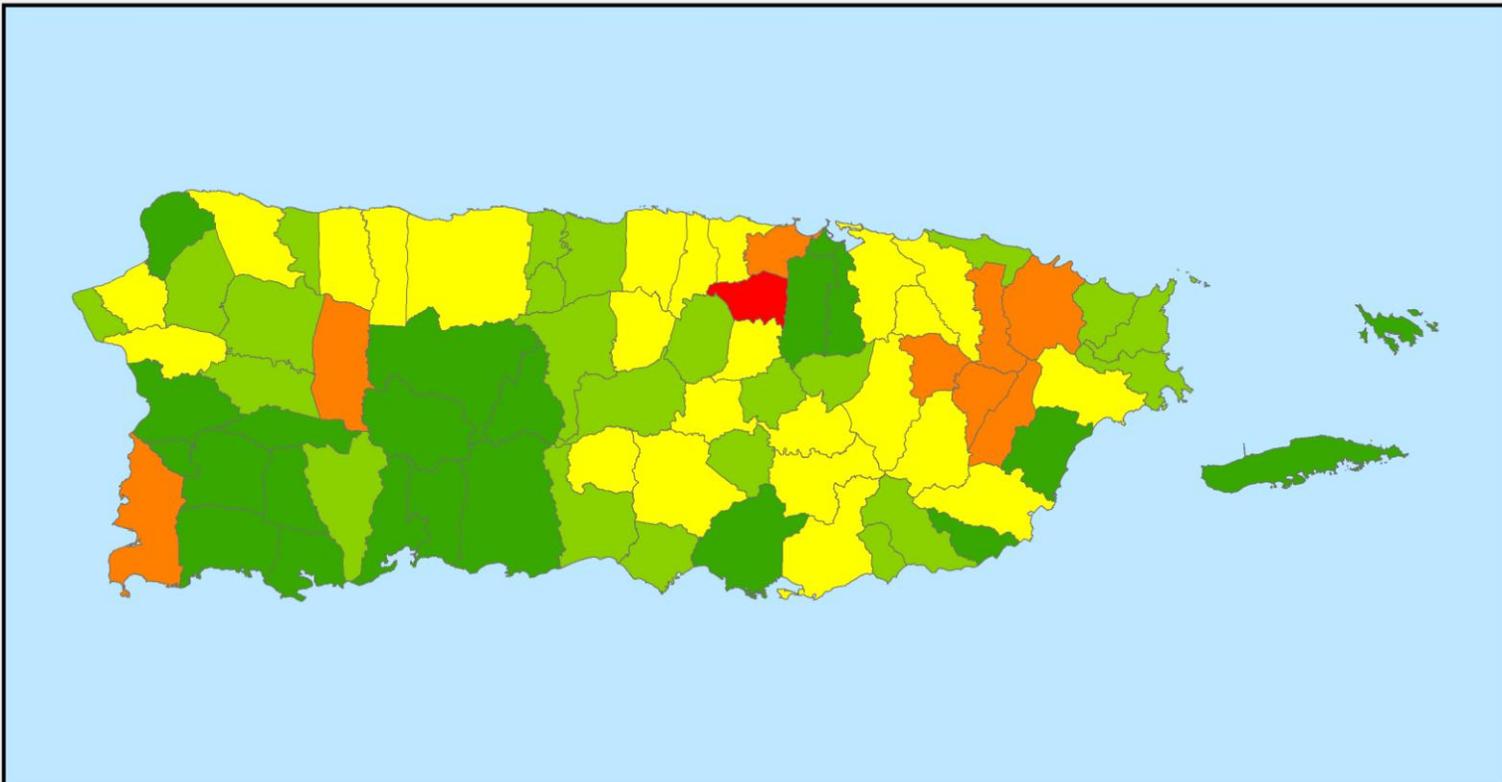
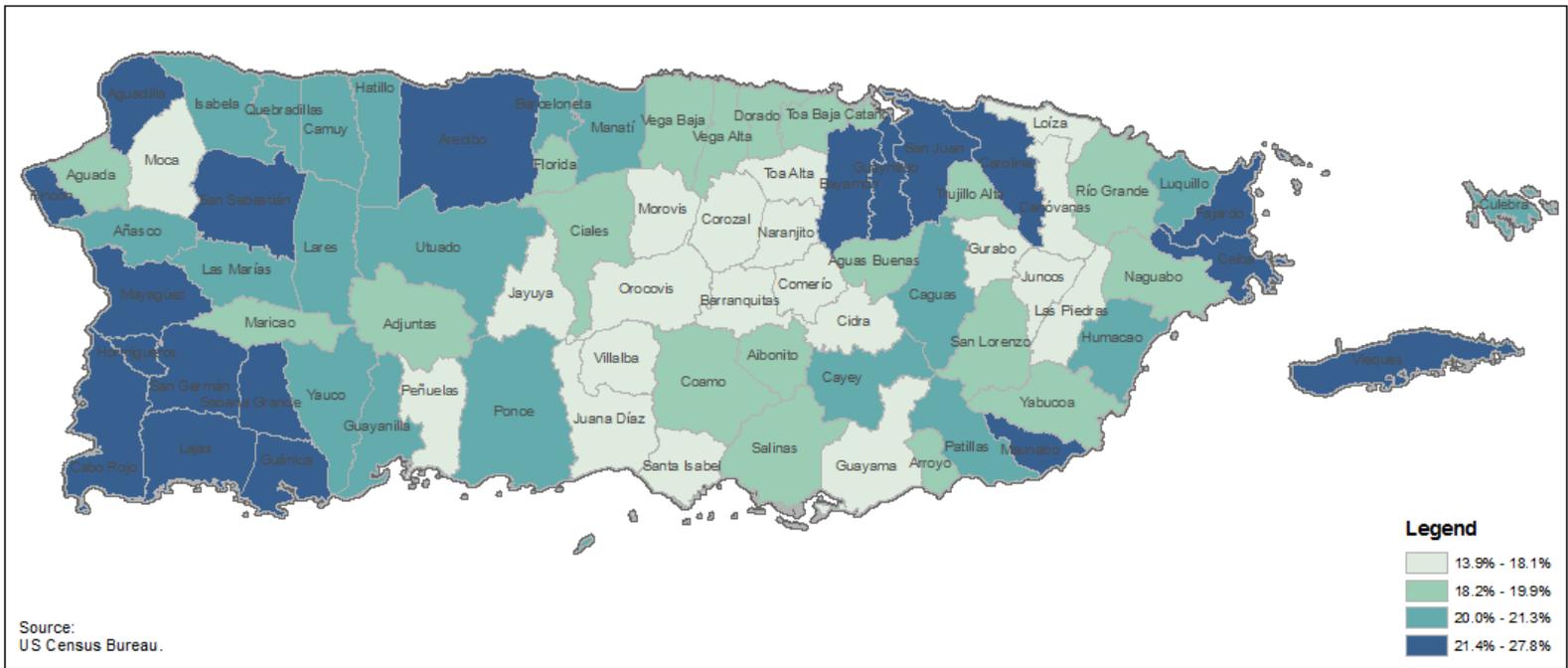


Figure 4.17
POPULATION CHANGE 2010–2040 BY REGION



 <p>LONG RANGE MULTIMODAL TRANSPORTATION PLAN</p>  	<p>LEGEND</p> <p>Population Change</p> <ul style="list-style-type: none"> 1000 or less 1001 - 2500 2501 - 5000 5001 - 10000 Over 10000 	<p>Puerto Rico Islandwide Population Change 2010-2040</p> 
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Figure 4.18
PERCENT OF POPULATION 60 YEARS AND OLDER, 2010



The aging of the population has significant implications for personal mobility levels and daily travel behavior, particularly with regard to modes of travel alternative to the automobile. This upward shift in the average age of the population will result in distinct demands being placed on the transportation system. Awareness of these demands must be addressed in the transportation planning process, in policy development, and even project design.

Today, much of the older population is reliant on the use of a personal vehicle due to the lack of sufficient or convenient public transportation. To effectively provide public transportation, stations should be located within an acceptable walking distance of origins and destinations. Buses, trains, and stations must be accessible to people with disabilities and door-to-door services must be considerably expanded throughout Puerto Rico. Also, according to the American Association of Retired Persons, older populations are often intimidated by modern roadway designs because reduced vision or reaction time are not taken into consideration in highway and traffic signal design. These concerns should be taken into account in new and rehabilitated infrastructure design projects.

Table 4.3
AGE OF PUERTO RICAN POPULATION

Age Characteristics of Puerto Rico Population		
Age	Population Estimate	Percentage
Under 5 Years	233,657	5.9%
5 to 9 Years	250,900	6.3%
10 to 14 Years	300,475	7.6%
20 to 24 Years	282,238	7.7%
25 to 34 Tears	541,548	7.1%
34 to 44 Years	533,184	13.7%
45 to 54 Years	510,276	13.4%
55 to 59 Years	225,347	5.7%
60 to 64 Years	225,750	5.7%
65 to 74 Years	314,267	7.9%
75 to 84 Years	173,673	4. %4
85 Years and Over	71,462	1.8%

Source: U.S. Census Bureau, 2009 Puerto Rico Community Survey

4.4.3 Disability

While many people incur physical limitations as they age, a sizable portion of the entire U.S. population is considered disabled. In 2009, according to the most recent American Community Survey, 19.5 million people, or 9.9 percent of the civilian noninstitutionalized population age 16 to 64, had a disability. People 60 and over were more likely than the total population to have a disability. In 2009, 32.4 percent of the civilian noninstitutionalized population 60 and over reported having a disability compared with 12.0 percent of the total civilian noninstitutionalized population. For many disabled people, however, their impairments do not preclude them from gainful employment, as 27.1 percent of the population 60 and over reported being in the labor force, an increase from 26.7 percent in 2008. These statistics are considered generally applicable to Puerto Rico where 21.8 percent of the population, or approximately 808,000 people five years and older, were identified as having a disability.

Regardless of manifestation, minor disabilities should not prohibit people from traveling from one location to another to satisfy basic needs or to work. To preserve the day-to-day independence of these citizens, an increasingly important goal of the transportation system should be a focus on accessibility. While the most beneficial action to improve accessibility would involve increasing the mixture of land uses so that people could travel shorter distances between their origin and destination (thus increasing non-vehicular mode choice), improving accessibility through transportation facility design and transit routing is also possible, as previously mentioned.

4.4.4 Income and Vehicle Ownership

Household income is typically correlated with vehicular ownership and daily travel mode. In Puerto Rico, the median household income is \$19,370 according to the U.S. Census Bureau 2010 American Community Survey. This median income actually declined by 3.7 percent in 2011 to \$18,660 and is significantly lower than the averages in the mainland U.S. Households with lower incomes, typically in more rural and interior municipalities as well as in some barrios within urbanized areas, are less likely to own cars and are more likely to utilize public transportation options where available.

Availability of these options, especially públicos, is, however, currently declining in less densely populated areas. In 2008, the latest data available from the FHWA, 2.4 million private and commercial automobiles were registered in Puerto Rico. This translates to a rate of 1.7 cars per household and a rate of 0.6 cars per capita, which is slightly higher than the mainland U.S. per capita average. The average of 1.7 cars per household is a very large amount considering the relatively low average income of the Puerto Rican population.

4.4.5 Housing Type and Household Size

Planning forecasts for this plan estimated that there were a total of 1,378,541 households in Puerto Rico in 2010; by 2040, this total is estimated to increase by 11.3 percent to 1,534,488 units. Of these households, over 70 percent are in owner-occupied, predominantly single-family detached structures, according to the U.S. Bureau of the Census. The islandwide household size is 2.71 people per unit, although this varies from municipality to municipality, from a low of 2.43 to a high of 3.11. Like income, household size positively correlates with transportation demand characteristics, as larger households tend to generate more trips (though they generate fewer trips per capita).

Detailed rates of persons per occupied housing unit were developed from U.S. Census data. These data for 1990-2010 showed a significant drop in household occupancy, from 3.35 persons per household to an islandwide average rate of 2.70. The change mirrors the trend in the United States which has occurred previously. Persons per occupied housing unit rates going forward were developed based on those U.S. national trends, which are expected to bottom out at an average rate of 2.55-2.60 persons per occupied unit. These patterns were captured using a logarithmic regression relationship. This relationship was then used for estimating the persons per occupied housing unit for the 2018-2040 period. This is an average rate; based on census data; the travel demand model characterizes households against a combination of demographic and economic factors, one of which is number of persons. Detailed analyses of household size were performed at the municipality level.

4.4.6 Employment

Along with population demographics, employment demographics also dramatically affect the demand for transportation. As Puerto Rico has shifted from a small-scale agrarian economy to an industrial and service-oriented one, employment is increasingly located in urban areas. The planning forecast for this 2040 LRTP estimates total islandwide employment at 1,092,770 workers. By 2040, this employment is expected to reach 1,264,306, an increase of 15.7 percent.

The planning forecast for this 2040 LRTP estimates 2010 total islandwide employment at more than 1.1 million workers. By 2040, this employment is expected to reach 1,264,306, an increase of 15.7 percent, as shown in Table 4.4.

Table 4.4
TOTAL EMPLOYMENT BY REGION 2010, 2020, 2030, and 2040

Region	Employment							Absolute Change 2010-2040	Percent Change 2010-2040
	2010	2015	2020	2025	2030	2035	2040		
San Juan	676,643	703,570	721,219	739,004	754,220	769,910	783,996	107,353	15.9%
Aguadilla	88,624	92,723	95,870	99,048	101,630	104,407	106,834	18,210	20.5%
Southwest	74,527	74,178	75,772	77,459	78,830	80,351	81,548	7,021	9.4%
South	123,920	120,596	125,093	129,296	133,041	136,771	140,085	16,165	13.0%
Southeast	27,319	27,761	28,761	29,774	30,683	31,496	32,240	4,921	18.0%
East	24,587	25,288	25,989	26,808	27,409	28,024	28,573	3,986	16.2%
North	77,150	79,798	82,356	84,813	86,955	89,031	91,030	13,880	18.0%
Total	1,092,770	1,123,914	1,155,060	1,186,202	1,212,768	1,239,990	1,264,306	171,536	15.7%

Source: U.S. Bureau of the Census (2010) and plan development forecasts for this LRTP update (2015-2040).

Regional employment dispersion for the 2010-2040 period is shown by percentage in Table 4.5. Figures 4.19, 4.20, and 4.21, respectively, show the islandwide employment in 2010, the forecast employment in 2040, and the percent change between 2010 and 2040.

Table 4.5
PERCENT OF TOTAL EMPLOYMENT BY REGION 2010, 2020, 2030, AND 2040

Region	2010	2020	2030	2040
San Juan TMA	61.9%	62.4%	62.2%	62.0%
Aguadilla TMA	8.1%	8.3%	8.4%	8.5%
Southwest TPR	6.8%	6.6	6.5%	6.5%
South TPR	11.3%	10.8	11.0%	11.1%
Southeast TPR	2.5%	2.5	2.5%	2.6%
East	2.3%	2.3	2.3%	2.3%
North	7.1%	7.1	7.2%	7.2%
Total	100.0	100.0	100.0	100.0

Source: Planning forecasts for 2040 LRTP.

The San Juan TMA is and will remain the predominant employment center in Puerto Rico with approximately 62 percent of the total employment. The municipality of San Juan and the municipalities in its immediate vicinity have been the focus of population and employment growth, historically, and this pattern is expected to continue for the foreseeable future. Continuing urban development in the San Juan region may, however, include further development to the south, toward Caguas and beyond, and may also include new development on the corridor connecting Caguas east to Humacao. Ponce will remain a strong employment area and be reinforced by the transshipment port in development. On the west coast continued employment growth will occur in Mayagüez and Aguadilla areas. Employment growth is also anticipated in Arecibo and Manatí, in between the San Juan and Aguadilla

Figure 4.19
PUERTO RICO EMPLOYMENT 2010

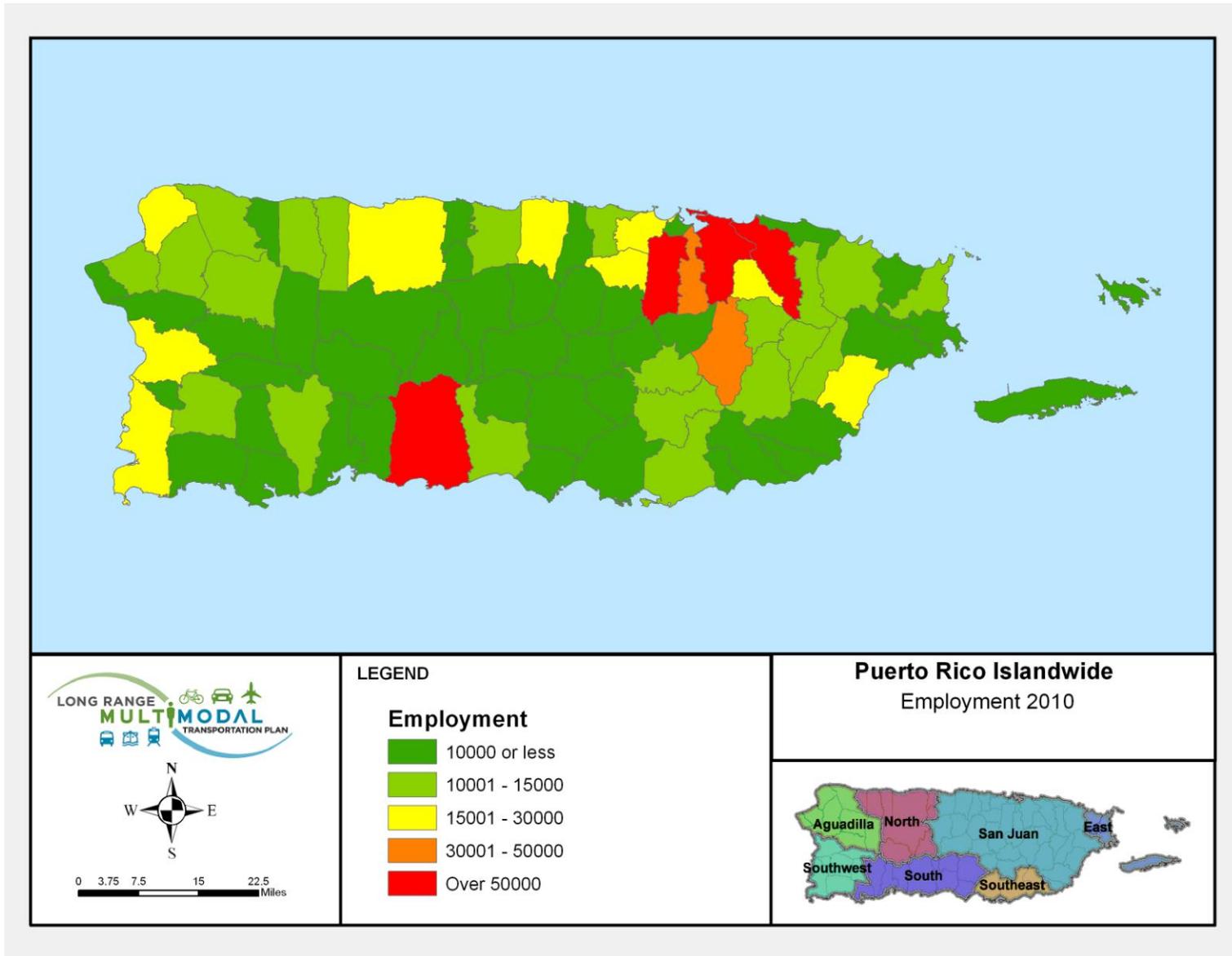


Figure 4.20
PUERTO RICO EMPLOYMENT 2040

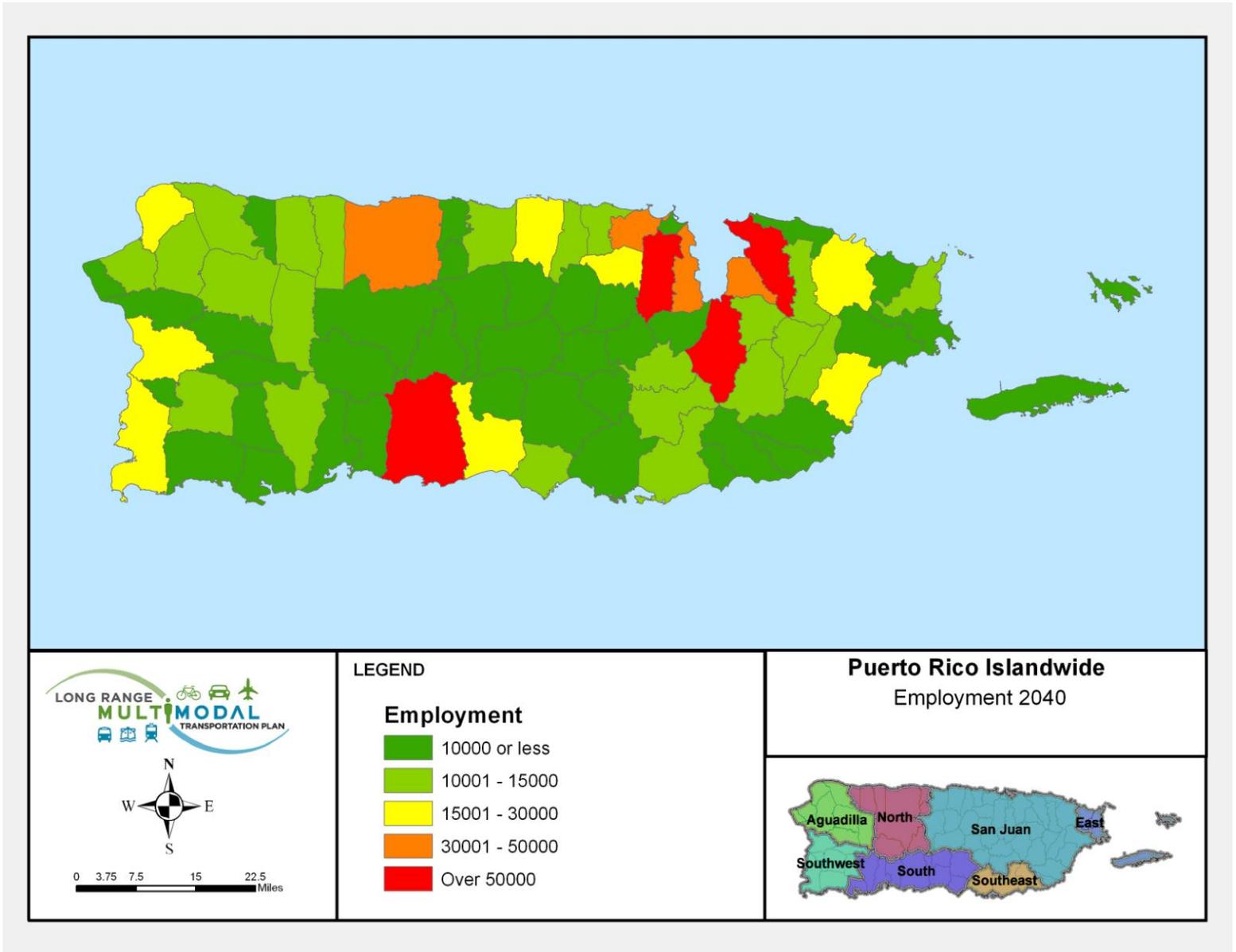
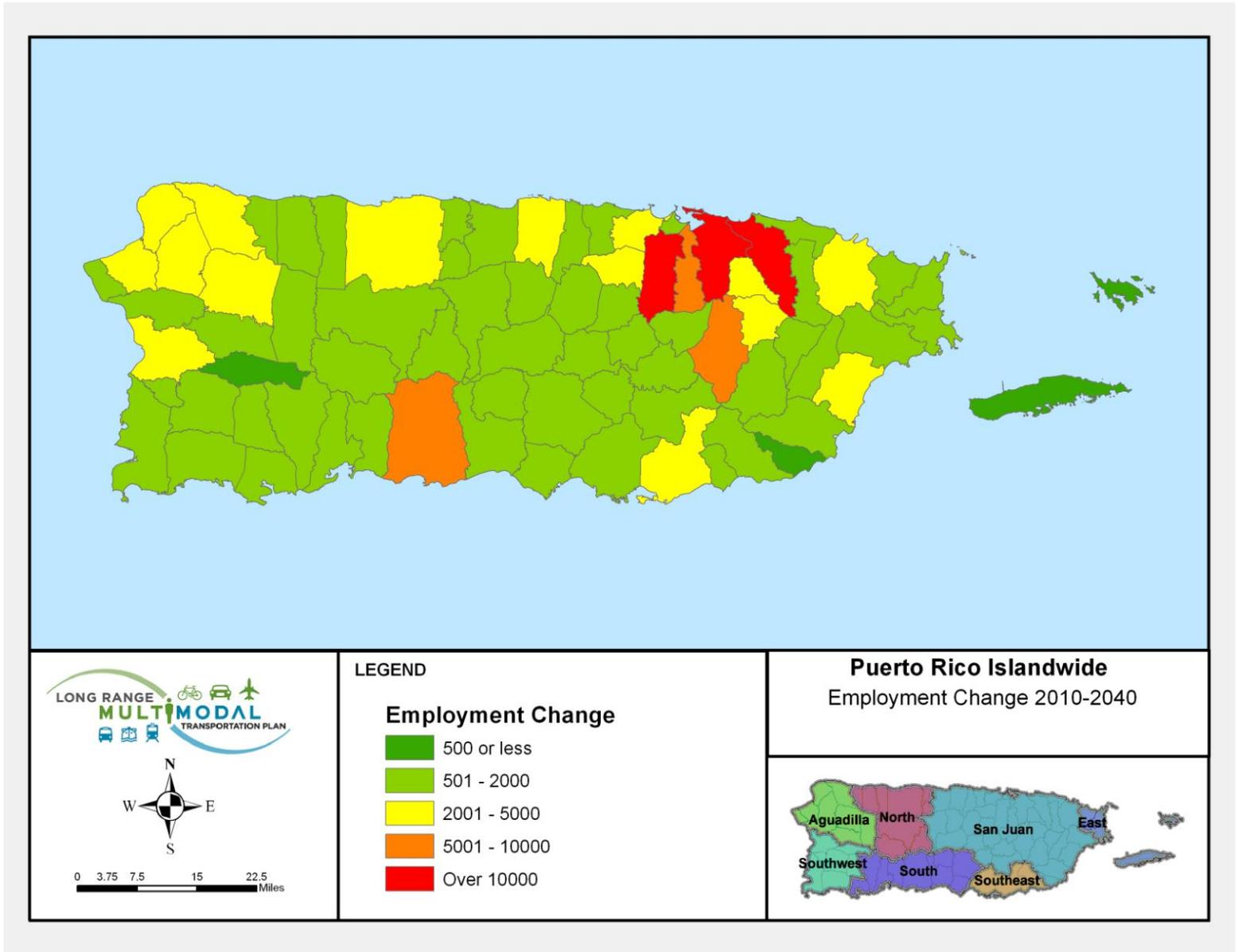


Figure 4.21
PUERTO RICO EMPLOYMENT CHANGE 2010-2040



UAs. New development activity may occur in several other areas of the Commonwealth; but no development is expected to be of such magnitude as to alter fundamentally the proportional distribution of employment among regions in Puerto Rico.

As shown in Table 4.6, jobs in retail and services predominate in Puerto Rico, with government jobs also playing a significant role in islandwide employment.

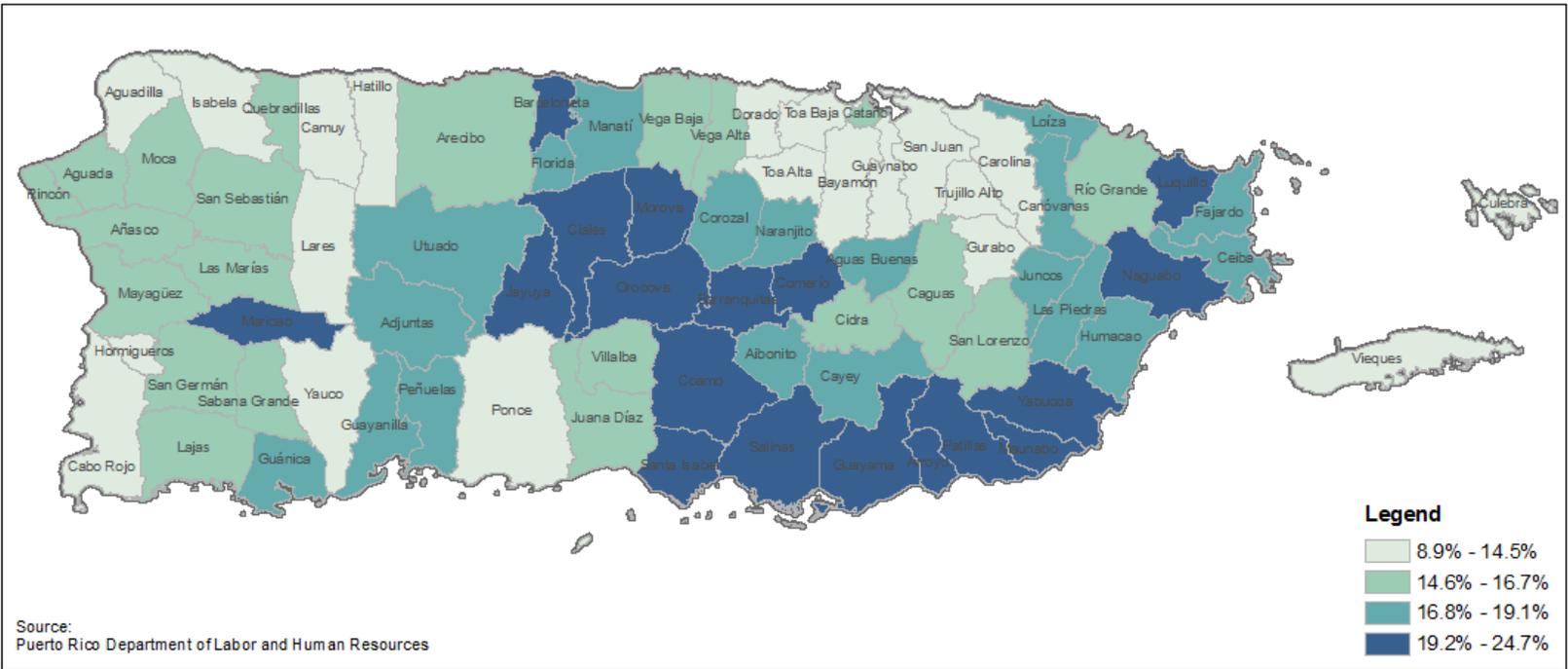
Table 4.6
ISLANDWIDE CATEGORIES OF EMPLOYMENT

Region	Employment Categories 2010*										
	Retail		Service		Manufacturing		Government		Other		Total
	Jobs	Percent Retail	Jobs	Percent Service	Jobs	Percent Mfg.	Jobs	Percent Govt.	Jobs	Percent Other	
San Juan	166,433	24.6%	188,580	27.9%	79,719	11.8%	157,952	23.3%	83,905	12.4%	676,589
Aguadilla	27,823	31.4%	17,336	19.6%	8,712	9.8%	22,739	25.7%	12,028	13.6%	88,638
Southwest	23,322	31.3%	15,670	21.0%	8,235	11.1%	18,333	24.6%	8,935	12.0%	74,495
South	39,266	31.7%	32,648	26.4%	6,552	5.3%	31,714	25.6%	13,718	11.1%	123,898
Southeast	6,761	24.8%	5,606	20.5%	4,404	16.1%	9,519	34.9%	1,016	3.7%	27,306
East	7,935	34.6%	5,238	22.8%	3,282	14.3%	5,443	23.7%	1,064	4.6%	22,962
North	21,584	28.0%	20,255	26.3%	10,502	13.6%	21,085	27.3%	3,702	4.8%	77,128
Total	293,124	26.9%	285,333	26.2%	121,406	11.1%	266,785	24.5%	124,368	11.4%	1,091,016

Source: Planning forecasts for 2040 L RTP.

During the economic recession, Puerto Rico experienced severe unemployment, with several areas of the country seeing rates over 19 percent, as shown in Figure 4.22. As of August 2012, the island's unemployment rate stood at 13.5 percent, which has, in addition to its impact on individual lives, had a significant effect on infrastructure development throughout the island due to reduced transportation revenues.

Figure 4.22
AVERAGE UNEMPLOYMENT RATE 2010



Chapter 5

TRANSPORTATION SYSTEM

The Puerto Rico transportation system is a multimodal network of highways, transit and ferry services, and bicycle and pedestrian facilities serving the general public, businesses, tourists, government, defense, ports and seaports. This system supports work commuting, trips to school, freight and goods distribution, recreation, shopping, and many other functions of society. It provides an interconnected network of accessibility and mobility that supports the economy, commerce, and quality of life of all who live, work and visit within Puerto Rico. This chapter of the report provides an overview of the key features of each of the transportation systems components.

5.1 Highway System

Puerto Rico has an extensive highway system, which reaches from its largest urban areas into each of its 78 municipalities and into and through its rural areas. In 2012, according to the Federal Highway Administration (FHWA) Office of Policy Information, Puerto Rico had a total of 16,691 miles of roadways. This mileage, which is comparable to that in several New England states, consists of the following classifications:

- National Highway System: 412 miles, 351 miles urban and 61 miles rural.
- Other Federal-Aid Highways: 3,092 miles, 2,594 miles urban and 498 miles rural.
- Non-Federal-Aid Highways: 13,186 miles, 10,641 miles urban and 2,545 rural.

State (Commonwealth)	Total Miles
Vermont	14,290
Alaska	16,675
New Hampshire	16,076
Puerto Rico	16,691
Connecticut	21,440

Table 5.1 shows the miles on Puerto Rico’s urban and rural roadways for each of the functional system classifications. The urban areas contain 81 percent of the total mileage.

Table 5.1
MILEAGE BY FUNCTIONAL SYSTEM

Interstate	Other Freeways and Expressways	Other Principal Arterials	Minor Arterial	Major Collector	Minor Collector	Local	TOTAL
RURAL							
42	0	42	231	244	245	2,300	3,104
URBAN							
240	52	400	1,009	1,245	0	10,641	13,587
TOTAL							
282	52	442	1240	1489	245	12,941	16,691

Source: FHWA, December 2012.

Table 5.2 summarizes the composition of the islandwide roadway network by functional classification. Functional classification refers to the hierarchy of the road system, ranging from local and collector roadways usually with 2 or 4 travel lanes serving small districts, arterial roadways which connect residential and business districts and range from 2 to 6 lanes, and expressways and toll roads which

provide for access across and through the region for longer distance trips and which may have from 4 up to 12 travel lanes.

Table 5.2
MILEAGE BY FUNCTIONAL CLASSIFICATION

Functional Classification	Route Miles							
	Aguadilla	East	North	San Juan	South	Southeast	Southwest	Islandwide
Interstate	30	18	45	107	45	8	29	282
Other Freeways & Expressways	0	0	0	44	8	0	0	52
Other Principal Arterials	44	7	48	259	44	16	25	442
Minor Arterials	143	24	146	580	158	63	127	1,240
Collector	185	63	270	715	259	99	143	1,733
Local	1,578	305	1,315	6,506	1,644	594	998	12,940
Total	1,980	417	1,823	8,210	2,158	780	1,322	16,689

Functional Classification	Lane-Miles							
	Aguadilla	East	North	San Juan	South	Southeast	Southwest	Islandwide
Interstate	120	76	178	558	179	27	123	1,260
Other Freeways & Expressways	0	0	0	210	33	0	0	243
Other Principal Arterials	105	18	160	962	140	55	74	1,513
Minor Arterials	286	54	299	1,259	331	130	259	2,617
Collector	367	126	536	1,494	524	199	286	3,532
Local	3,156	610	2,630	13,011	3,288	1,189	1,996	25,880
Total	4,034	882	3,804	17,494	4,494	1,599	2,738	35,045

Functional Classification	Vehicle Miles Traveled (1,000s)							
	Aguadilla	East	North	San Juan	South	Southeast	Southwest	Islandwide
Interstate	1,133	520	1,704	8,719	1,570	239	1,168	15,054
Other Freeways & Expressways	0	0	0	2,668	183	0	0	2,851
Other Principal Arterials	722	84	859	7,378	662	264	384	10,352
Minor Arterials	1,044	148	856	5,720	1,231	427	906	10,331
Collector	560	162	677	3,889	838	209	411	6,746
Local	341	97	353	3,552	786	110	358	5,596
Total	3,799	1,010	4,449	31,926	5,270	1,249	3,227	50,930

Source: FHWA Highway Performance Monitoring System as of December 13, 2011.

The FHWA also reports that Puerto Rico has 2,222 bridges under its jurisdiction. As of 2012, 251 bridges were structurally deficient and 859 were functionally obsolete (that is, do not meet current geometric standards), for a total of 1,110 deficient bridges (See Table 5.3). Therefore, about 11 percent require structural repair or replacement, and another 29 percent desirably would be widened or otherwise improved to resolve other deficiencies.

Table 5.3
BRIDGE CONDITIONS

Category	Island Highway	County or Other Highway	Municipality	Local Park	Private	Island Toll Agency	Other Federal Agencies	Total
Total	1,561	12	327	1	1	313	7	2,222
Acceptable	722	11	137	1	1	238	2	1,112
Deficient	839	1	190	0	0	75	5	1,110
Structurally	164	1	42	0	0	43	1	251
Functionally	675	0	148	0	0	32	4	859

Source: FHWA, December 2012.

Clearly, these and other components of the highway system, including drainage, lighting, safety devices, and other features, are built infrastructure that requires ongoing maintenance and eventual replacement. The associated costs are referred to as maintaining a “state of good repair.” Studies demonstrate that timely maintenance of the correct type applied at the proper time can maximize the service life of the built infrastructure. In addition to maintenance of these physical system assets, there are other system maintenance requirements such as mowing, vegetation removal, light fixture replacement, painting, trash removal, drainage system cleaning, and the like. The level of funding applied to these needs helps determine the condition of facilities and the cycle of replacement needed.

The roadway system can be classified as the primary system, which is smaller but carries the majority of the travel demand, or vehicles miles of travel; the secondary system, which feeds to and from the primary system and connects to municipalities off the primary system; and the tertiary system which connects to smaller towns and rural areas, completing the system. In addition, there are miles of local streets in municipalities, which are their responsibility for maintenance.

The strategic highway network is defined as the core roadway network linking all regions of the island. It has a coastal ring road looping around the island and cross-island corridors including PR-10 from Ponce to Arecibo, and the PR-52 corridor linking San Juan through Caguas to Ponce, with a branch corridor from Ponce to Humacao connecting to PR-53 on PR-30, which itself has a short branch corridor, PR-60 on the north side of Humacao also connecting to PR-53. This network is vital to the island’s domestic economy and businesses, to its trade offshore through its airports and seaports, to the personal needs of its citizens, and to the island’s large tourism industry.

The transportation planning process uses level-of-service (LOS) standards to assess traffic conditions on the roadway system. LOS is a quantitative measure that describes the operational conditions on those facilities. A range of six LOS categories is used to evaluate the traffic conditions, typically in the peak hours of travel. Each category is described by a range of volume-to-capacity (v/c) ratios: LOS A (v/c less than 0.3), LOS B (v/c from 0.3 to 0.5), LOS C (v/c from 0.5 to 0.7), LOS D (v/c from 0.7 to 0.85), LOS E (v/c from 0.85 to 1.0), and LOS F (v/c over 1.0).

The first two of the following set of figures -- Figures 5.1 and 5.2 -- depict the strategic highway network and the broader roadway system serving all corners of the island. As noted, the strategic highway network serves the majority of vehicle miles of travel, and carries the highest volumes of traffic in every region of the island. Figure 5.3 shows the existing traffic volumes by bandwidth on the island's highway system and Figure 5.4 shows the forecast volumes in 2040, developed through the islandwide travel demand model.

The traffic volumes around the island are heaviest on the strategic highway network links. (The inset maps that follow show the San Juan region central area.) The heaviest volumes are in the San Juan region on the principal expressways and on PR-22 extending to the west and PR-52 extending south to Caguas. Volumes moderate on the strategic highway network outside of these areas, but are still significant. The changes in traffic volumes projected to 2040 are mostly small to modest increases over 30 years in the 5 percent to 15 percent range; those changes vary by link. A table presenting 2010 and 2040 traffic volumes at selected locations around the island is provided in Section 5.7 later in this chapter (see Table 5.9).

The Puerto Rico highway network experiences recurring congestion within its urban areas due to daily commuting traffic and the variety of other concurrent travel. Similar to other urban areas, this congestion is the result of the nature of the urban form, which concentrates suburban work trip commuting into few corridors, and has insufficient funds to resolve fully these capacity deficiencies. Figure 5.5 illustrates the 2010 levels of traffic service across the island and Figure 5.6 illustrates those in 2040.

The levels of traffic service on roadways in Puerto Rico are worst in the municipalities comprising the central core of the San Juan region, including Bayamón, Guaynabo, San Juan, Carolina and Trujillo Alto. Congestion in peak hours also encompasses parts of Caguas. Elsewhere, congestion is found on segments of the strategic highway network connecting to the other regions, in the central cities of the larger outlying cities of Aguadilla, Mayagüez, Ponce, Humacao, and Arecibo, where the older streets are narrow and constrained.

While the change is subtle on the maps, the traffic service incrementally worsens slightly on many roadway links around the island, including segments of the strategic highway network, and on roads serving urban fringe areas and outlying communities where some residential development is foreseen over the 30 years between 2010 and 2040. As for the traffic volumes, the inset maps that follow show the San Juan region central area. The previously referenced Table 5.9 presenting 2010 and 2040 traffic volumes at selected locations around the island, which is provided in Section 5.7 later in this chapter, also shows the level of traffic service at those locations for both 2010 and 2040.

For clarity, Figure 5.7 shows the existing traffic volumes by bandwidth in the central area of San Juan in 2010 and Figure 5.8 shows the forecast volumes in 2040, developed through the islandwide travel demand model. Figures 5.9 and 5.10 then show the levels of traffic service in the central area of San Juan in 2010 and the forecast levels in 2040, respectively. While a large area of the San Juan core metropolitan area has peak hour congestion on many expressway and arterial roadways, as indicated by a "D" level of traffic service or worse, other nodes of congestion also occur in the other larger urban areas including Caguas, Humacao, Mayagüez, and Ponce, with smaller areas of congestion on the strategic highway network in Aguadilla and Fajardo.

Figure 5.1
STRATEGIC HIGHWAY NETWORK

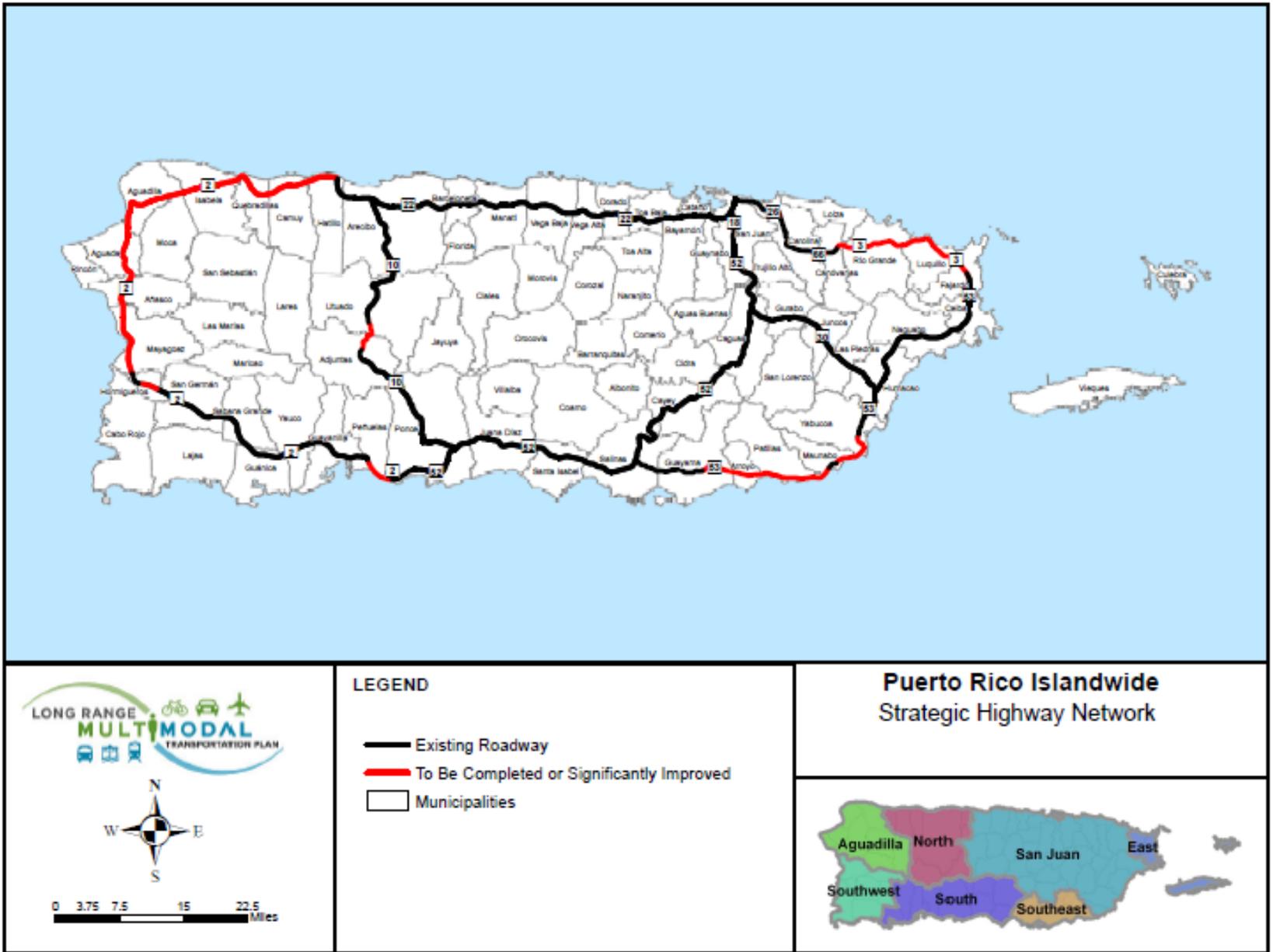


Figure 5.2
ISLANDWIDE ROADWAYS

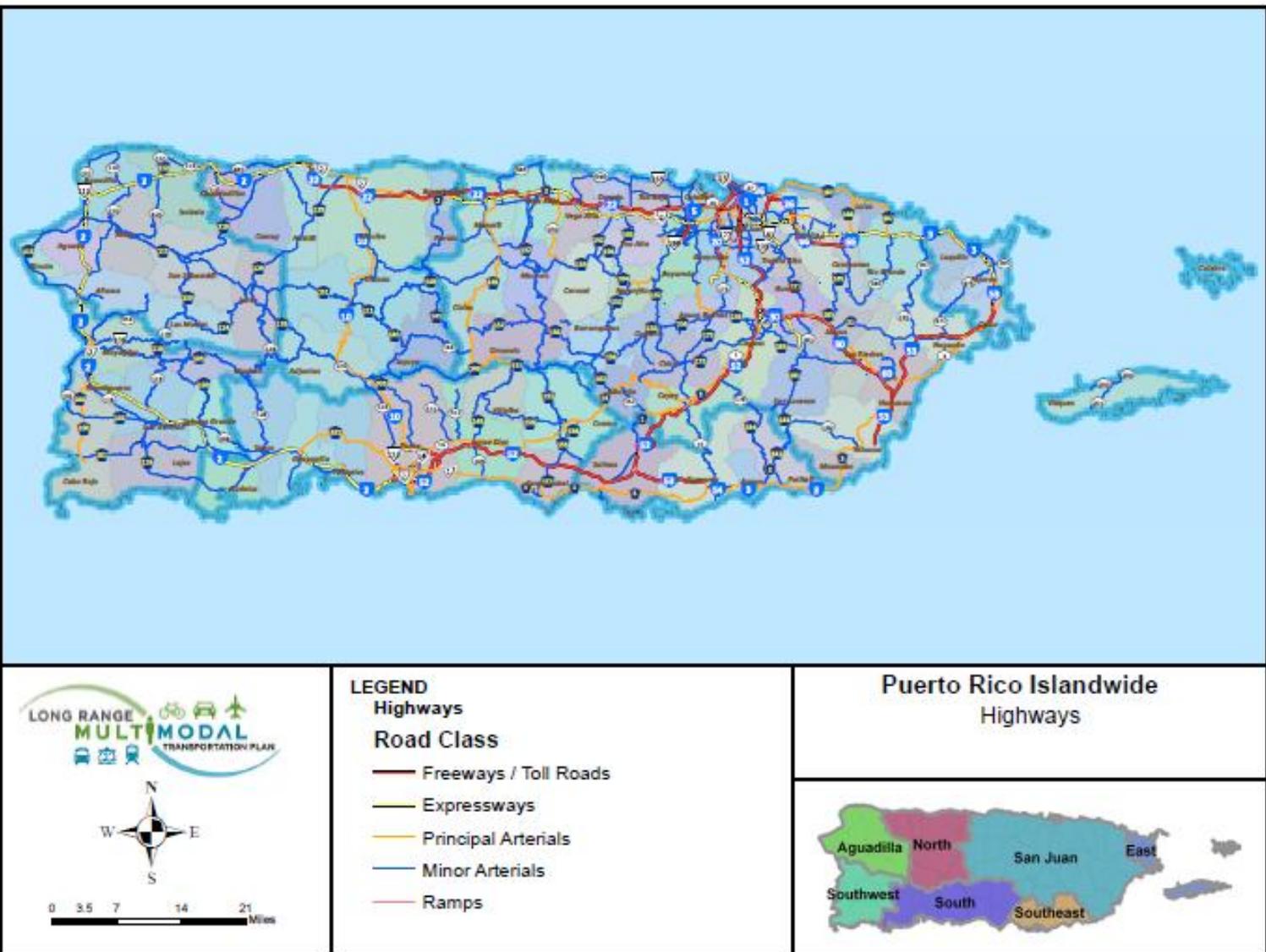


Figure 5.3
ISLANDWIDE DAILY TRAFFIC VOLUMES 2010

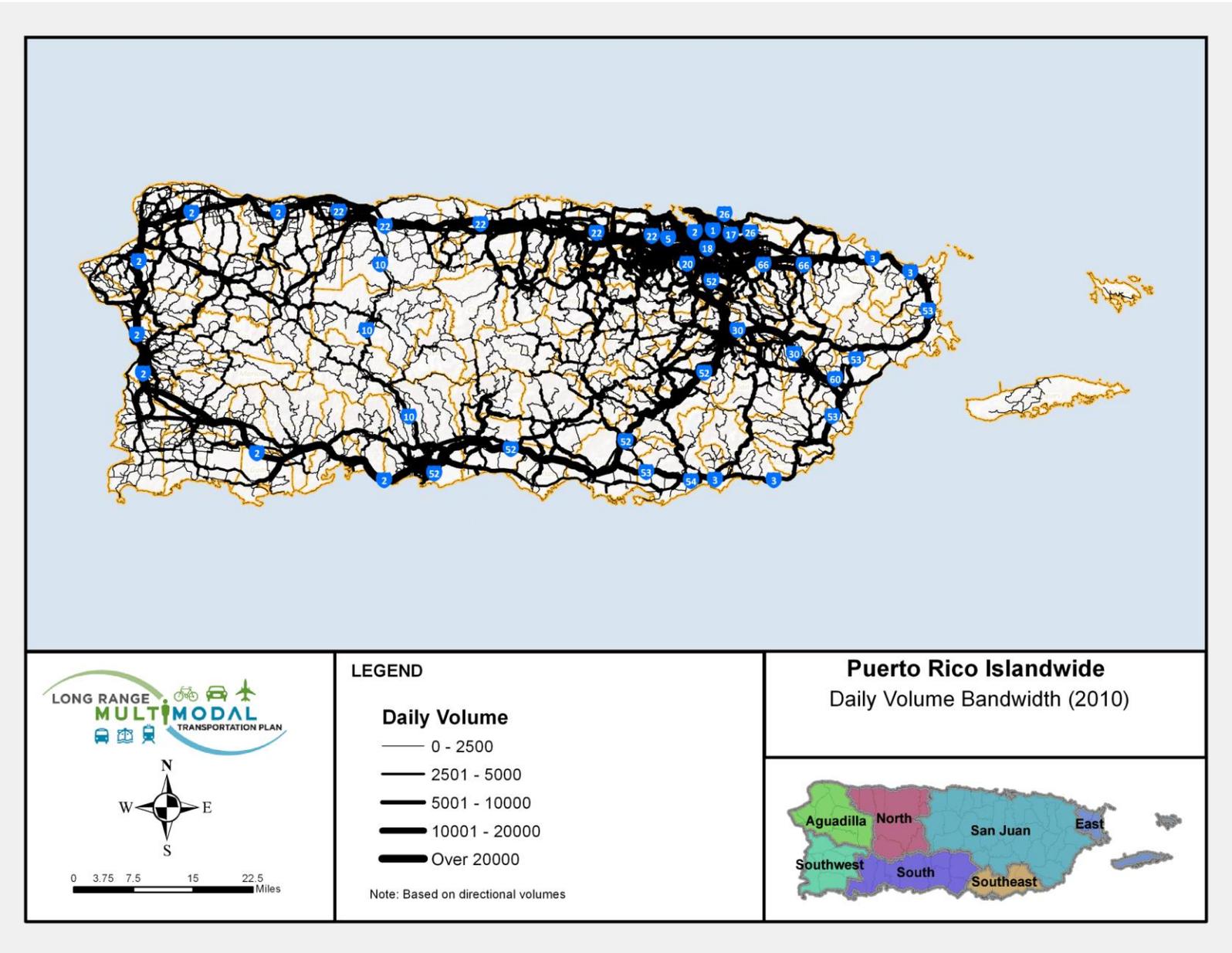


Figure 5.4
ISLANDWIDE DAILY TRAFFIC VOLUMES 2040

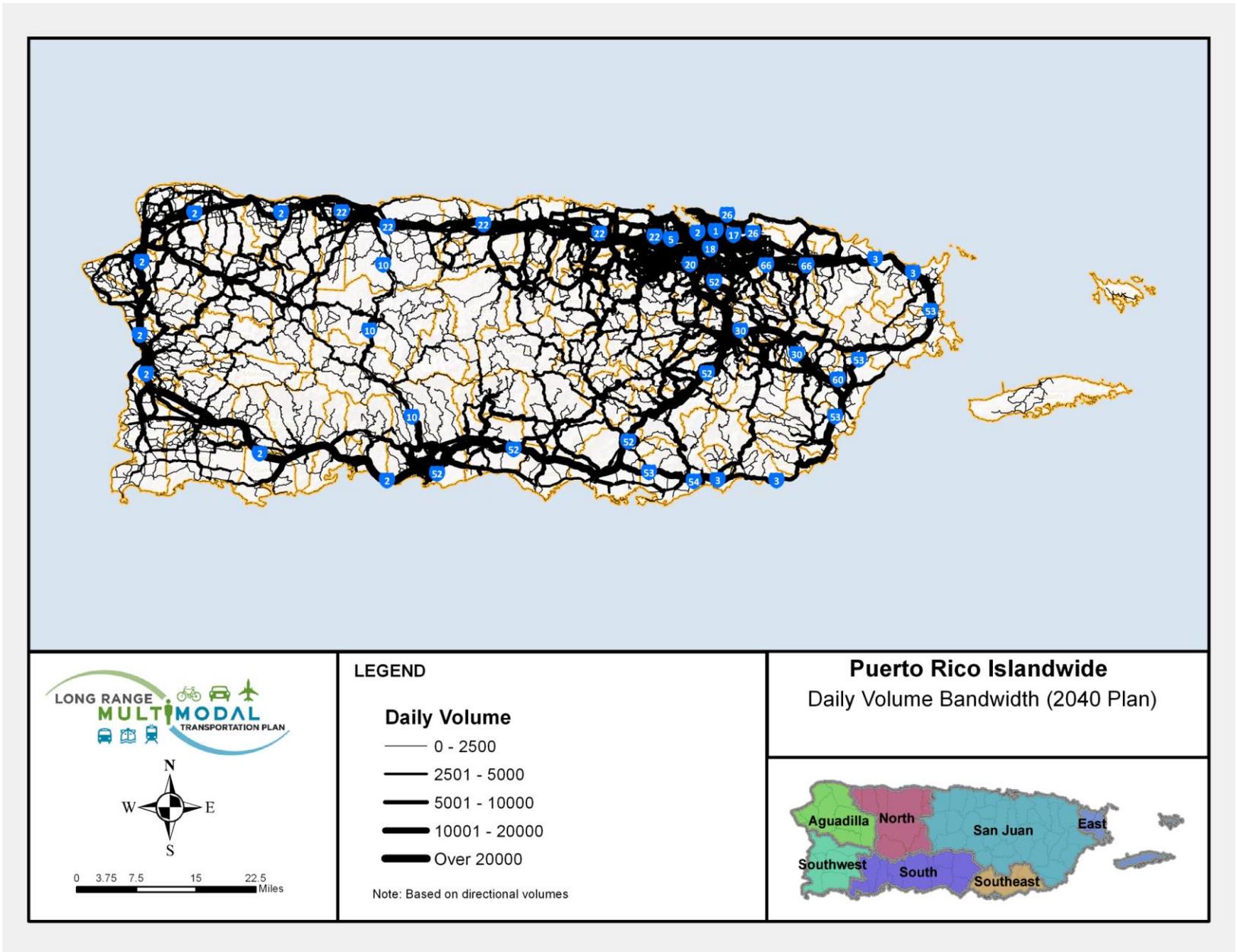
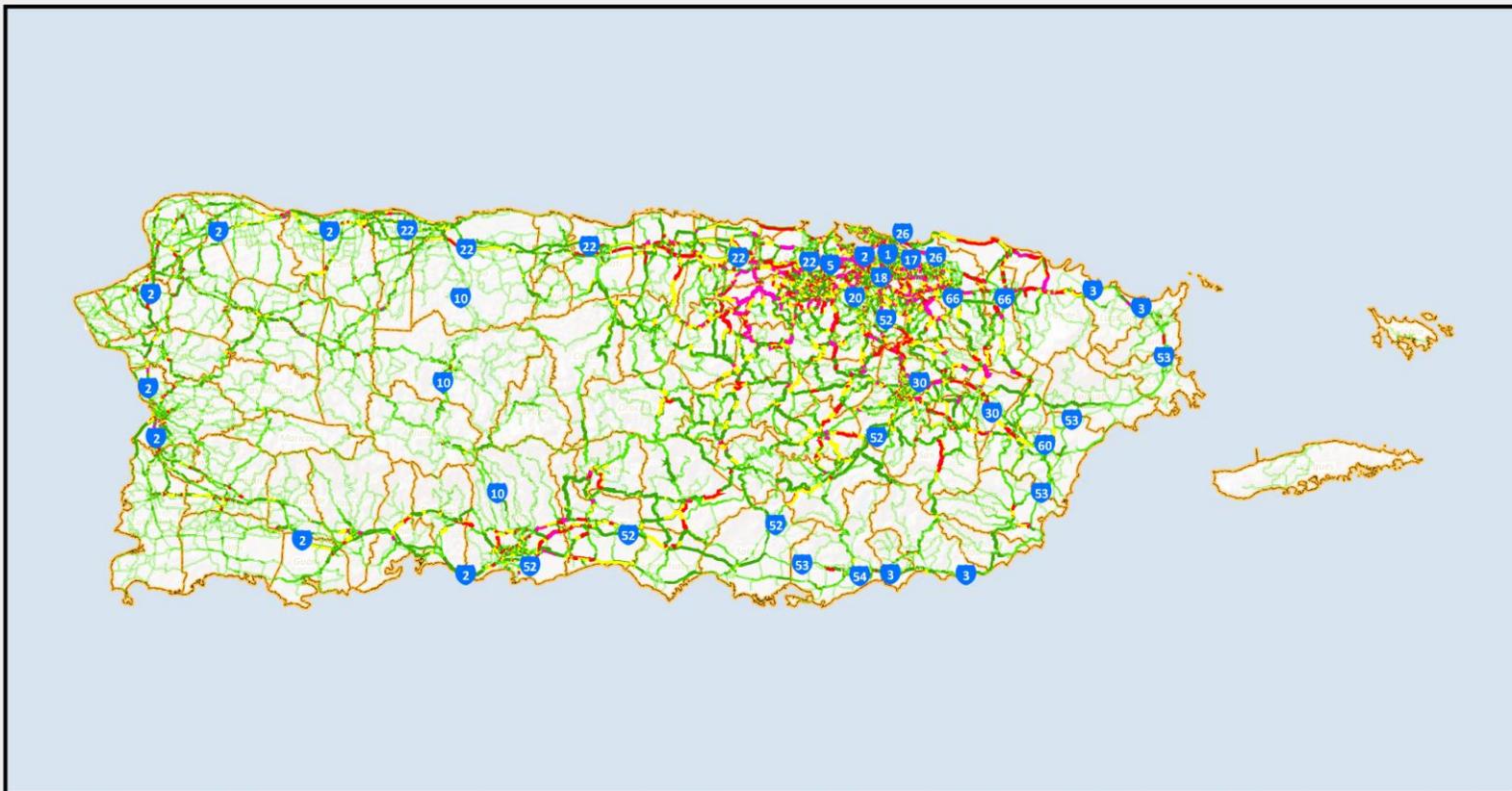


Figure 5.5
ISLANDWIDE LEVELS OF SERVICE 2010



LEGEND

Level of Service

- Level of Service A (V/C = 0.0-0.3)
- Level of Service B (V/C = 0.3-0.5)
- Level of Service C (V/C = 0.5-0.7)
- Level of Service D (V/C = 0.7-0.85)
- Level of Service E (V/C = 0.85-1.0)
- Level of Service F (V/C > 1.00)

Based on the highest V/C ratio of the day over all periods

Puerto Rico Islandwide
Level of Service (2010)



Figure 5.6
ISLANDWIDE LEVELS OF SERVICE 2040

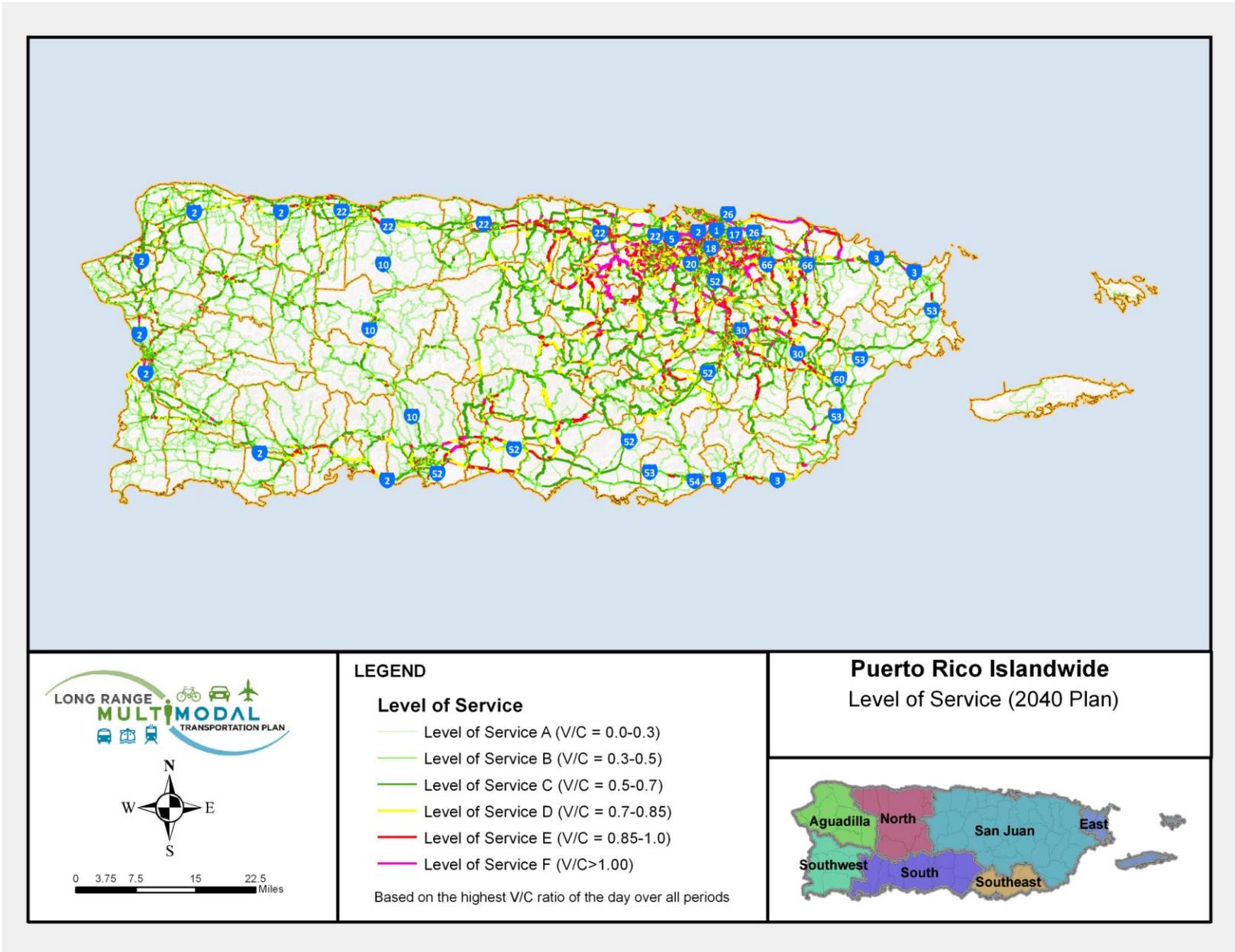


Figure 5.7
SAN JUAN CENTRAL AREA DAILY TRAFFIC VOLUMES 2010

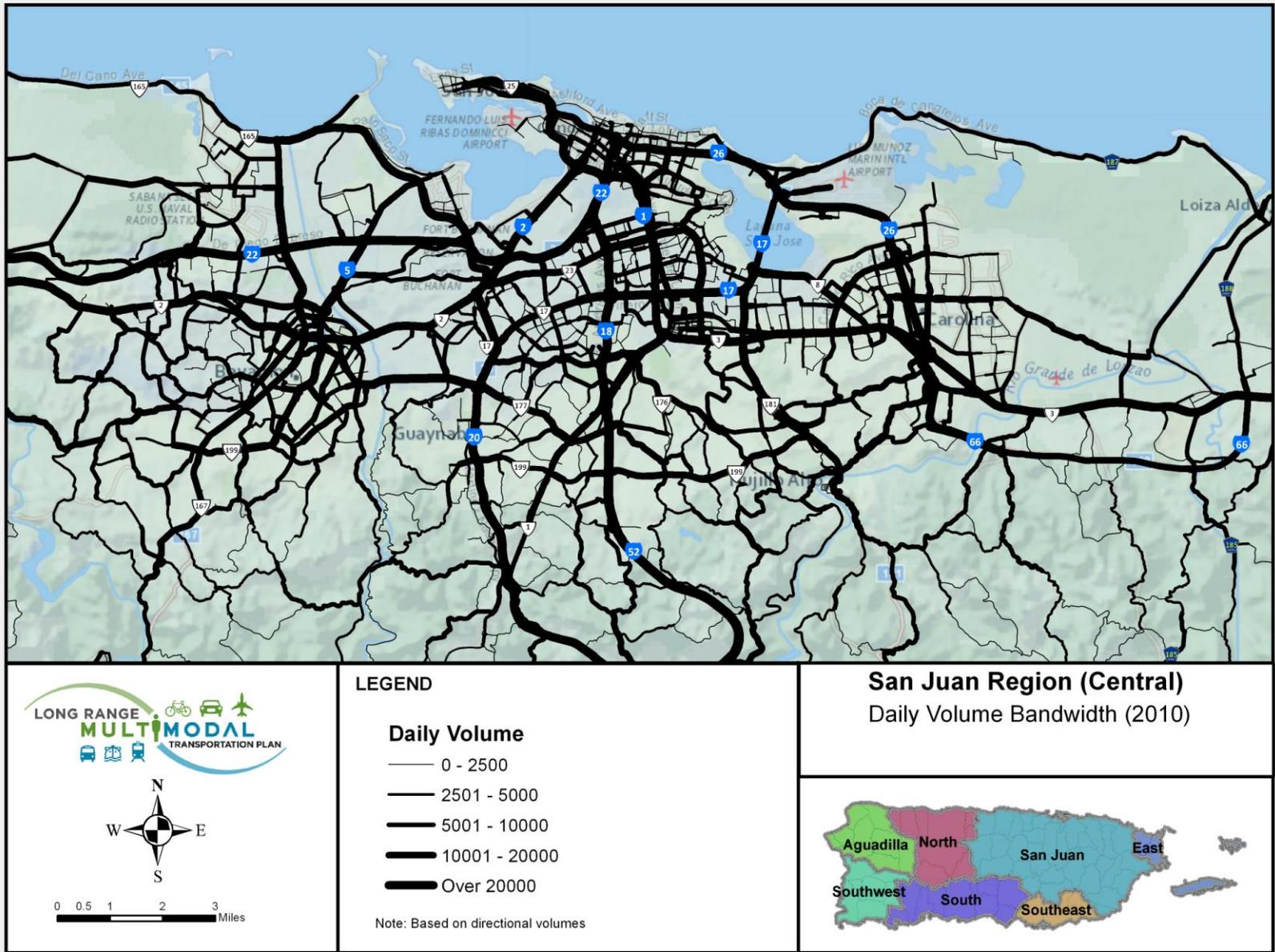


Figure 5.8
SAN JUAN CENTRAL AREA LEVELS OF SERVICE 2040

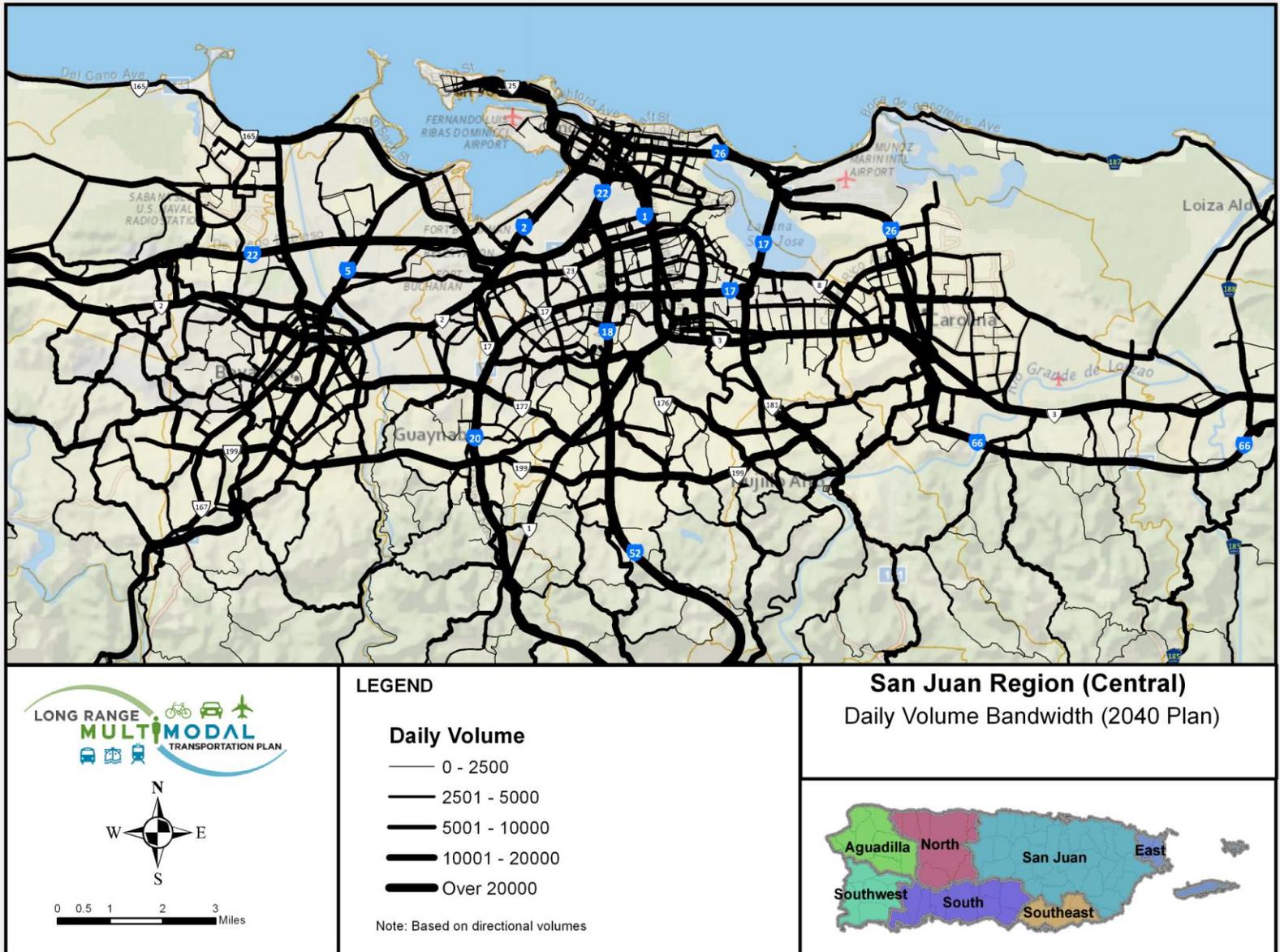


Figure 5.9
SAN JUAN CENTRAL AREA LEVELS OF SERVICE 2010

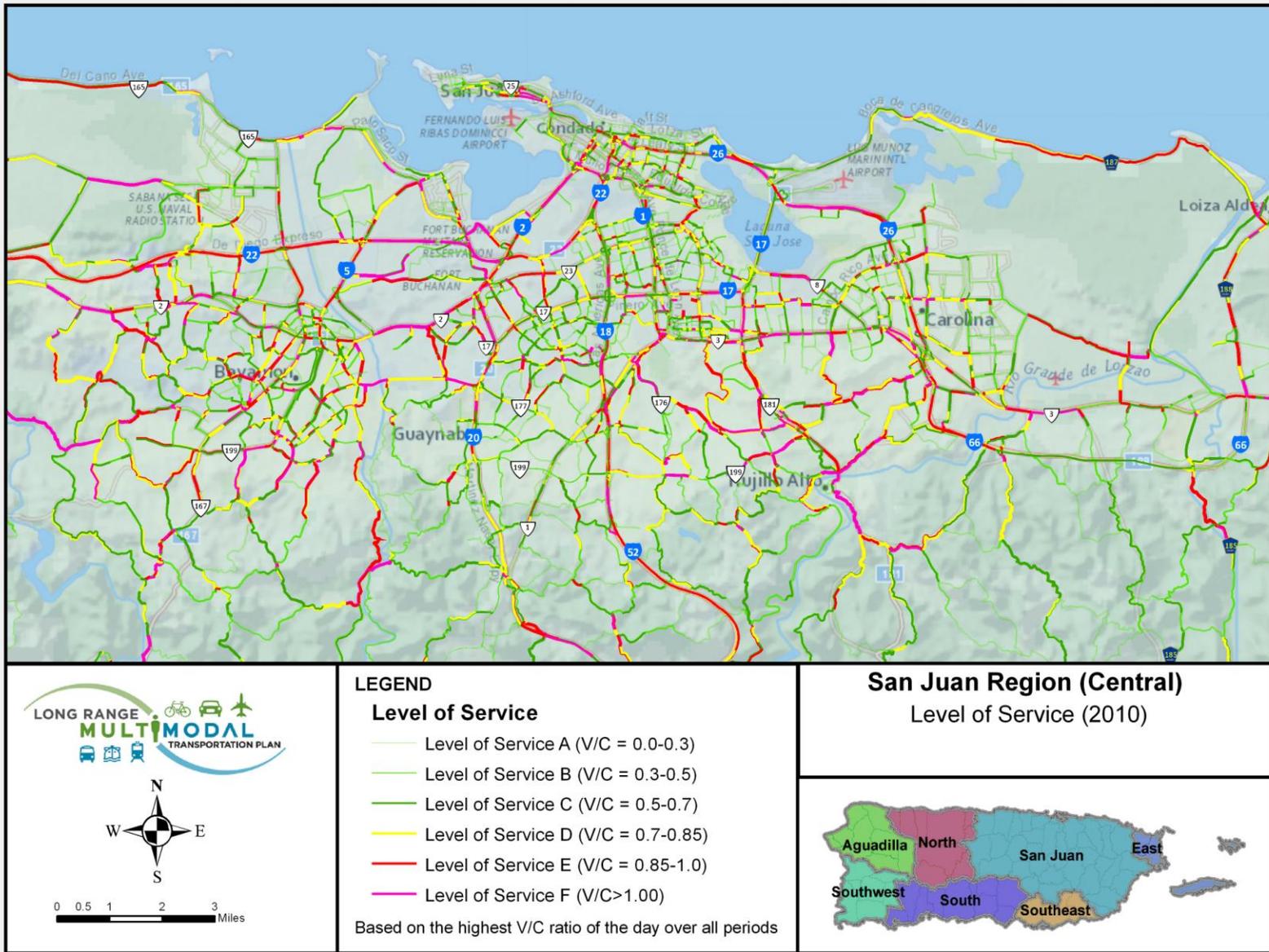
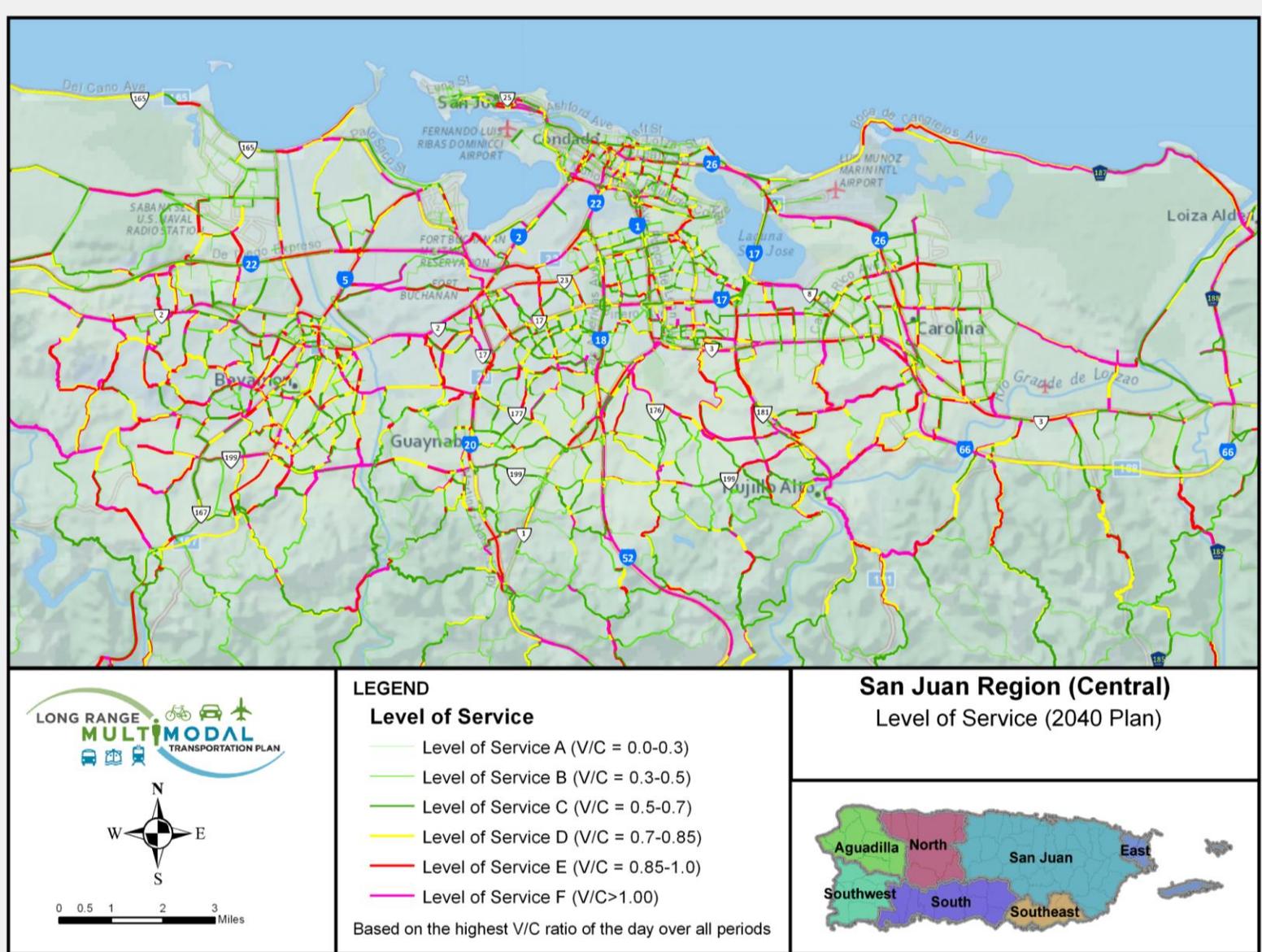


Figure 5.10
SAN JUAN CENTRAL AREA LEVELS OF SERVICE 2040



5.1.1 Primary Regional Corridors

The primary regional corridors across the island are described briefly in the following paragraphs. Additional information is provided in the LRTPs for the San Juan and Aguadilla TMAs and the five TPRs.

5.1.1.1 PR-2/PR-22 Northwest Corridor

The PR-2/PR-22 corridor is the essential link for trucking freight between San Juan and much of the western half of the Island. A 40-kilometer segment between Aguadilla and the current terminus of the PR-22 toll road near Hatillo presents a substantial challenge to the completion of the circumferential corridor. Existing PR-2 is heavily traveled and lined with roadside development for much of the corridor, making it expensive to upgrade to expressway standards. An improved PR-2/22 corridor is also essential to the revitalization and growth of Rafael Hernández International Airport and its planned related economic development as well as to the success of the Porta Del Sol tourism plan for the west coast. Because the circumferential corridor remains the only east-west link on the north coast between the eastern and western halves of the island, improvements to capacity and safety in this corridor are essential to the future quality of life and economic growth of Puerto Rico.

New alignment alternatives for an extension of PR-22 to Aguadilla would, however, likely run mainly south of PR-2, passing through environmentally sensitive limestone karst areas as well as agriculturally important lands. These concerns have led the PRHTA to look closely again at the potential for rebuilding the existing PR-2 alignment to expressway standards, to increase capacity and improve operational safety. This would involve building interchanges at major intersections, grade-separating other important crossings, consolidating access to roadside development, and creating frontage or marginal roads to serve this development. The use of urban interchange design standards and concepts could accomplish much within existing right-of-way, but displacement of some roadside development would be unavoidable. Furthermore, in areas such as Quebradillas, the topography also presents significant constraints both to upgrading PR-2 and to finding an alternative alignment while minimizing potential environmental impacts. DTPW/PRHTA is continuing its assessment of these alternatives and may consider a combination of new alignment and upgrading of the existing corridor.

5.1.1.2 PR-2 West Corridor

South of Aguadilla and on to Hormigueros, the PR-2 highway often presents conditions incompatible with its importance as an element of the strategic highway network. Traffic congestion problems occur throughout most of the day between Añasco and Hormigueros. Crossing Mayagüez proper is a complex proposition; options may need to consider partially diverting through traffic to other existing or proposed north-south connectors, such as PR-64 and PR-102, which would then require upgrading, along with new connections to PR-2 south of Mayagüez. Both the PR-2 mainline and its possible north-south connections in the area, however, traverse already heavily developed urban lands interspersed with floodplains and wetlands. These considerations will have to be addressed in detail in specific project studies and environmental impact assessments. A conceptual planning study a few years ago looked at the cost of upgrading the existing corridor. Further detailed studies of options are needed.

5.1.1.3 PR-3/PR-66 Northeast Corridor

The PR-3 corridor between San Juan and Fajardo has long experienced congested and hazardous conditions and, like the PR-2 west corridor, is lined with roadside development. Within the last decade, the PRHTA has constructed the 20-kilometer PR-66 toll road from the PR-3/PR-26 interchange eastward to PR-3 near PR-186. A gap of approximately 20 kilometers remains along existing PR-3, which has two existing interchanges east to Fajardo's PR-194 interchange. The eastern 20-kilometer section, between

Río Grande and Fajardo, will be completed by upgrading the existing PR-3 alignment to expressway standards. One interchange is also needed on the south side of Fajardo at the PR-194.

Filling this gap in the strategic highway network is critical to the future quality of life and economic growth of eastern Puerto Rico. This corridor links San Juan's residents, airports, and port with the communities, businesses, and recreational/tourism activities of the northeast coast and with the islands of Culebra and Vieques, via ferry connections at Fajardo. This access improvement will also be critically important to the redevelopment of the former Roosevelt Roads Naval Station in Ceiba, just south of Fajardo, as a resort complex.

5.1.1.4 PR-3/53 Southeast Corridor

There is a 35-kilometer gap in the PR-53 toll road along the southeast coast between Yabucoa and Guayama. Design and construction is underway on various portions of the western half around Guayama and Arroyo. A 2.5-kilometer section with a tunnel segment has been completed near Maunabo, but other costly tunneling remains to minimize potential impacts to environmentally sensitive areas and several small communities.

The completion of PR-53 through this area is critical to increasing accessibility for residents and businesses and to enhancing economic development opportunities. PR-53 will also allow greater access for Puerto Ricans and visitors to the scenic and recreational resources of the southeast coast.

5.1.1.5 PR-2 Southwest Corridor

The 74-kilometer section of PR-2 between Ponce and Mayagüez has been PRHTA's continual focus over the last 10 years of conversion from arterial to an expressway with access control. With the inclusion of projects in the current Construction Improvement Program, the conversion will be completed.

The upgrading of this corridor is important to the long-term development of the recreational and tourism opportunities of western Puerto Rico and especially the southwest coast. It is the only truck freight link between the south and west coasts and, together with the PR-2 West corridor, its role in the islandwide freight system will grow with the development of Rafael Hernández International Airport in Aguadilla as an important air cargo center and the Port of the Americas in Ponce as a major transshipment port.

5.1.1.6 PR-10 Corridor

Construction is continuing on the last sections of the PR-10 expressway across the mountains between Arecibo and Ponce. This connection has encountered frequent major engineering challenges throughout its many years of development, because of the difficult topography and ground conditions. Construction of the remaining missing segments between Utuado and Adjuntas is programmed to begin over the 2013-2017 period and when completed will provide quality connectivity between the interior regions and both the north and south coasts.

5.1.1.7 PR-30 Corridor

PR-30 between Caguas and Humacao operates with 4- to 6-lane capacity throughout its alignment. Roadway and safety conditions have, however, deteriorated in recent years as a result of heavy freight traffic from adjacent industrial areas. In addition, some aspects of PR-30's design, especially ramp configurations, need upgrading to current standards for safety and traffic operations. Nevertheless, the most important and costly improvement needed for PR-30 is the reconstruction of its interchange with PR-52 near Caguas.

5.1.2 Rest Areas on the Strategic Highway Network

The needs of long-distance travelers of all modes include rest/service areas. During the planning of any new freeway segment, and in the operation of existing ones, construction or reconstruction of rest/service areas should be considered. At least five rest/service areas have already been proposed for construction in the San Juan area. The five identified locations are: south side of Toa Baja-Dorado toll plaza, south side of the Buchanan toll plaza in Bayamón, west side of the Caguas south toll plaza, PR-52 between PR-184 and PR-1 in Cayey, and PR-52 between Cayey and Salinas. As other corridors of the strategic highway network are developed, rest/service areas should be considered at strategic locations, although this is a lower priority in the array of system needs.

5.1.3 Access to Local Communities from the Strategic Highway Network

In designing expressways along the principal islandwide corridors, PRHTA includes appropriate interchanges and other road improvements to connect to the local road system in the immediate vicinity. Usually, however, further local road improvements are needed, beyond the immediate vicinity of interchanges, to complete effective connections to towns and communities not directly served by expressway facilities. During the past decade, therefore, PRHTA has implemented a program to improve these connections to the strategic highway network. This program has gradually brought improvements to several important corridors, such as PR-100 from Hormigueros to Cabo Rojo, PR-111 from Aguadilla to San Sebastián, PR-203 from PR-30 to San Lorenzo, and PR-149 from Manatí to Ciales and from Juana Díaz to Villalba.

5.2 Public Transportation

Various modes of motorized public transportation are in use in Puerto Rico, including heavy rail (Tren Urbano), local buses, trolleys, públicos, ferries, and taxis. Local buses, and trolleys are typically owned by specific municipalities and thus exist exclusively within them. In addition to the Tren Urbano rail line, DTPW operates the Metropolitan Bus Authority fixed route bus system in the San Juan core area. The Puerto Rico Maritime Authority operates passenger ferries in San Juan harbor, connecting between Hato Rey, Old San Juan, and Cataño, and passenger and vehicle service between Fajardo and the islands of Vieques and Culebra off the east coast of the island. The latter are important both to residents of those islands and to tourists.

There are several transit services in the region, which include:

- The Tren Urbano rail corridor traversing Bayamón, Guaynabo, and San Juan municipalities, with 16 stations and several park-and-ride lots.
- MBA fixed route bus system serving parts of the San Juan, Guaynabo, Carolina, Loiza, Trujillo Alto, Bayamón, and Cataño municipalities.
- MetroBus express service on two routes in San Juan.
- MetroUrbano BRT service operating on PR-2 and PR-5 between the Bayamón Tren Urbano station and a park-and-ride lot at the PR-165 interchange on PR-22.
- Special transportation services operated through MBA.
- Several activity center bus circulators operating in Carolina, Old San Juan, Río Piedras, Guaynabo, Caguas and other locations.
- Público services, privately and independently operated routes, which blanket the region.
- Passenger ferry service in the San Juan harbor, connecting between piers in Old San Juan, Hato Rey and Cataño.

The Tren Urbano rail line instituted service in 2005 and serves 16 stations from Santurce on the north in the San Juan municipality, through the Guaynabo municipality and ending to the west in the Bayamón municipality. This heavy-rail transit system is mostly elevated with one tunnel section and short segments at-grade. Its daily ridership was 30,400 in 2010, and that figure has grown to approximately 34,000 in 2012, with a reduction in fare, and some improvements in connecting services. Daily boardings at the stations are between 1,000 to 3,600, except for three stations with lower activity. Six of the stations have park-and-ride lots to encourage the “drive and ride” travel market.

The DTPW has investigated strategies to increase ridership on the system, and has conducted extensive planning for transit-oriented development at the stations to create livable communities around transit stations and increase ridership; real estate market and economic conditions have prevented advancement of this initiative. Tren Urbano is considered the transit mobility spine of the regional center, and DTPW has focused on identifying feeder transit services that can extend the reach of Tren Urbano and encourage growth in transit ridership.

The new Metro Urbano BRT line on PR-22 is the first of its kind in Puerto Rico, and connects from the Bayamón station via PR-5 to the reversible dynamically tolled lanes constructed in the median of PR-22 westward to the PR-165 interchange where there is a park-and-ride lot for commuters.

The long established Metropolitan Bus Authority fixed-route bus system operates 35 routes across the municipalities of San Juan, Carolina, Loiza, Guaynabo, Bayamón, and Cataño. Ridership on these routes was 24,386 daily passengers in 2010. The service has had some issues with reliability of service in maintaining schedules, due in part to issues with its fleet which are being addressed. Recently, an interdisciplinary team worked to identify improvements and refinements to the system route structure to improve operations and service to customers, and to improve connections to Tren Urbano where possible. Phase 1 of those improvements have been implemented and are being monitored; Phase 2 improvements are pending. MetroBus routes also operate in the Río Piedras, Hato Rey, Santurce, and Old San Juan corridor and the Avenida Roosevelt corridor from Hato Rey to the San Patricio Plaza in Guaynabo, carrying approximately 6,800 daily riders combined.

There is growing interest in community and activity center circulators on the part of municipalities. These are being conceived and put into operation to support town center businesses and redevelopment, for citizen access to community services, and in some cases to support tourism. In addition, the municipality of Caguas has taken the lead on an effort involving 11 regional municipalities to develop an improved transit service across the area from outlying cities and towns to Caguas, and also with a connection from San Juan to Caguas. This improved service was developed in partnership with the público operators, and can serve as a prototype for other areas around the island seeking to enhance transit service over what público operators are able to provide independently under current market and economic conditions.

The Caguas region has developed an innovative transit service partnering with públicos across eleven municipalities to provide improved transit service, including connections to Tren Urbano in San Juan; this service could serve as a prototype for other regions. Carolina has also partnered with public operators financially. San Juan has proposed a light rail corridor connecting from Tren Urbano to Old San Juan, and previously Carolina investigated a light rail service from PR-3 to the Luis Muñoz Marín International Airport and Isla Verde tourism district. There is considerable interest in premium transit options. Figure 5.11 illustrates the prominent elements of the San Juan urban area transit system, and Figure 5.12 shows the extent of the islandwide público services. In the eight years since the Tren Urbano

heavy rail system opened to service, much progress has been made in advancing transit as a mobility choice in the San Juan region:

- MetroBus express bus service on contra-flow lanes has continued operating through the Hato Rey-Santurce-Old San Juan corridor.
- A portion of the AMA routes have been reconfigured to improve service and effectiveness and a second phase of revisions is being planned.
- The Caguas region has improved transit services across several municipalities by forming a partnership with the existing público operators to provide more reliable service.
- Several municipalities have initiated central city shuttle buses.
- PRHTA has implemented the innovative PR-22 BRT system operating within new dynamically tolled vehicle lanes. This project extends the reach of the Tren Urbano system and is a model for feeding riders to the Tren Urbano corridor and its underutilized capacity rather inexpensively.
- PRHTA has begun planning for a potential future extension of the PR-22 dynamically tolled lanes concept to the west, which could also include a BRT component.
- Planning and conceptual design have been conducted for the San Juan Light Rail project.
- Planning has been conducted for the Tranvía de Carolina transit project from PR-3 northeast to the Airport/Isla Verde tourism district.
- Planning has been conducted for the Bayamón-Hatillo corridor running along PR-2.
- Planning and design have been conducted for the PR-3 East BRT corridor from Tren Urbano east to Carolina.
- Planning and preliminary engineering have been performed for the Caguas premium transit corridor extending from Tren Urbano south along PR-52 to the north side of Caguas.
- A preliminary concept for BRT in the PR-5 corridor has been developed.
- Upgraded priority transit corridors along Avenida Roosevelt between Guaynabo and Hato Rey and other corridors are under consideration.
- A public-private partnership (PPP) approach was used in implementing the PR-22 project and there has been consideration of the PPP implementation approach for the San Juan Light Rail, the Caguas Corridor, and the Tranvía de Carolina transit projects.

This developmental work demonstrates a commitment to advancing transit in the San Juan region, and points to the prospects for introducing new services in strategic corridors across the region. The next important steps, however, are to formulate a transit system plan and practical financing strategy and sources that will enable the preparation of a funded plan of transit project priorities that can be incorporated into the five-year improvement program and the next L RTP.

Observations about the ridership data by mode from 2002 to 2011, based on statistics reported to the National Transit Database, is provided below; information for 2012 is not yet posted to the database.

- Tren Urbano ridership has ranged from 30,000 to 33,000 over the last four years. A fare reduction and a gradually improving economy account for a recent gradual increase in ridership. This mode accounted for about 15 percent of transit trips in 2011, so despite its limited coverage, the train is well used by those whom it serves.
- Metrobus service in the central San Juan area has averaged 7,600 daily riders over the last five years, with an upward trend since 2009, reaching over 8,000 daily riders in 2011. This premium bus transit service has maintained fairly steady ridership over the years.
- MBA fixed-route transit service across the metropolitan San Juan area has steadily decreased over the last decade, declining from a peak of nearly 102,000 daily trips to a low of 32,000 in 2011. This is attributed in part to a decline in service quality, frequency, and reliability, causing some users to turn to other options for essential mobility. The agency has been working to improve maintenance and reduce service interruptions.
- Público ridership, as reported, has varied widely between 101,000 to 181,000 daily riders. The irregularity is partly a function of a sampling procedure used to generate estimates of ridership, since reporting by operators is erratic. The average daily ridership over the last decade has been nearly 135,000 riders, close to the reported 2011 ridership of 136,222. This accounted for about 65 percent daily transit ridership, so clearly público usage remains an essential component of transit in Puerto Rico, despite its limitations in terms of schedule, frequency, wait times, and service quality.
- Overall, total transit ridership has declined from nearly 225,000 in 2002 to about 208,000 in 2011. While there are variations in intermediate years due to large fluctuations in estimated público ridership, these figures are representative of about a 7.5 percent decline in transit usage. This is due to the net difference between a large decline in MBA fixed-route ridership, and gains in ridership on públicos and the introduction of Tren Urbano in 2005.
- The current government in Puerto Rico has proposed several actions to reverse declines in transit. These include implementing the new Metro Urbano BRT service operating on PR-5 and PR-22 from the Bayamón Tren Urbano station. A proposal for a similar service along PR-52 from Tren Urbano southward to Caguas is also in development. To address issues with the MBA fixed bus route service, there is a proposal to integrate the MBA with the office operating Tren Urbano, referred to as the Integrated Transportation Alternative (ATI by its Spanish acronym). This is expected to provide management and operational efficiencies and provide for a more coordinated oversight of the several transit services provided through DTP.
- As discussed elsewhere in this plan, there are opportunities for transit to capture significant shares of commuter markets, especially in major travel corridors. A more definitive approach to funding strategies for both upfront capital costs and ongoing operating costs is the highest priority need in this regard.

Figure 5.11
SAN JUAN TMA TRANSIT SERVICES

Historical Transit Ridership by Mode

Year	Tren Urbano	Metrobus	MBA Fixed Routes	Públicos	TOTAL
2002	0	10,665	91398	122,412	224,475
2003	0	5,817	101,866	111,828	219,511
2004	0	9,172	98,903	181,770	289,845
2005	26,719	6,375	92,642	163,729	289,465
2006	22,300	5,651	73,908	135,330	237,189
2007	26,790	8,426	57,912	108,704	201,832
2008	29,974	7,176	46,662	101,558	185,370
2009	32,825	6,777	59,328	137,614	236,544
2010	30,416	7,657	37,852	146,853	222,778
2011	32,153	8,038	32,023	136,222	208,436

Summary of Historical Transit Ridership by Mode

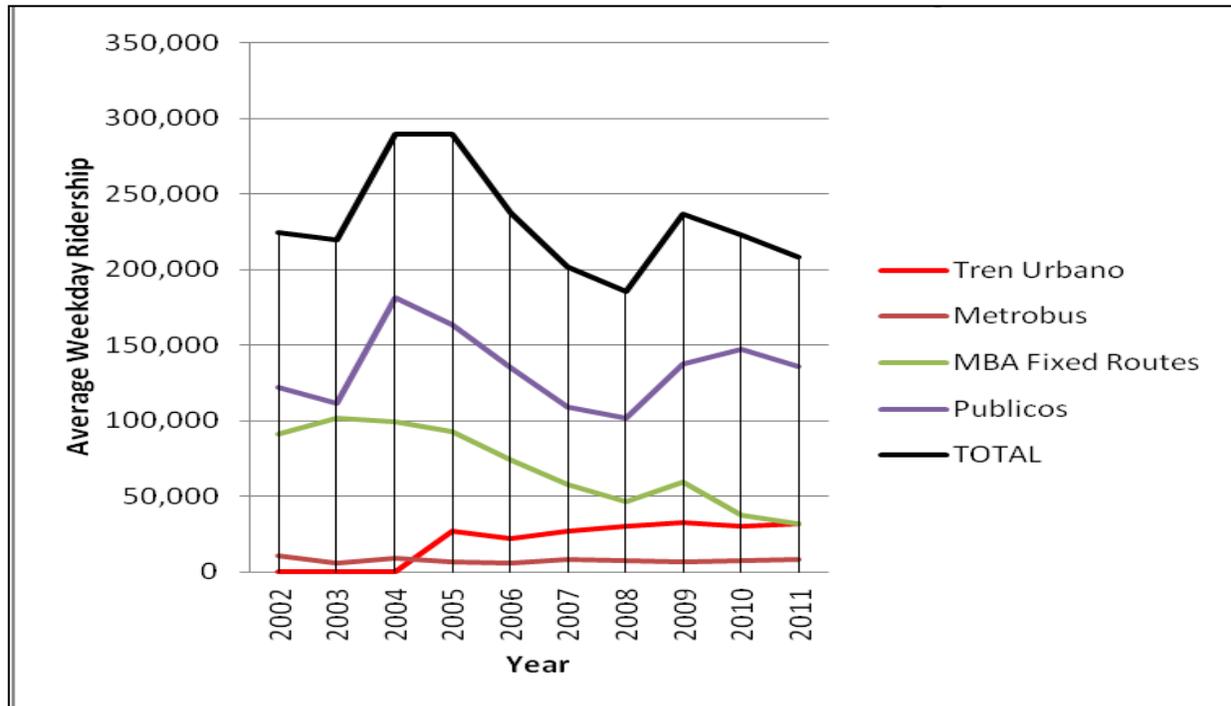
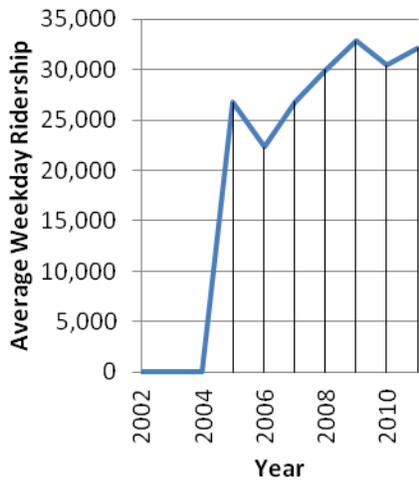


Figure 5.11 (Continued)

Tren Urbano

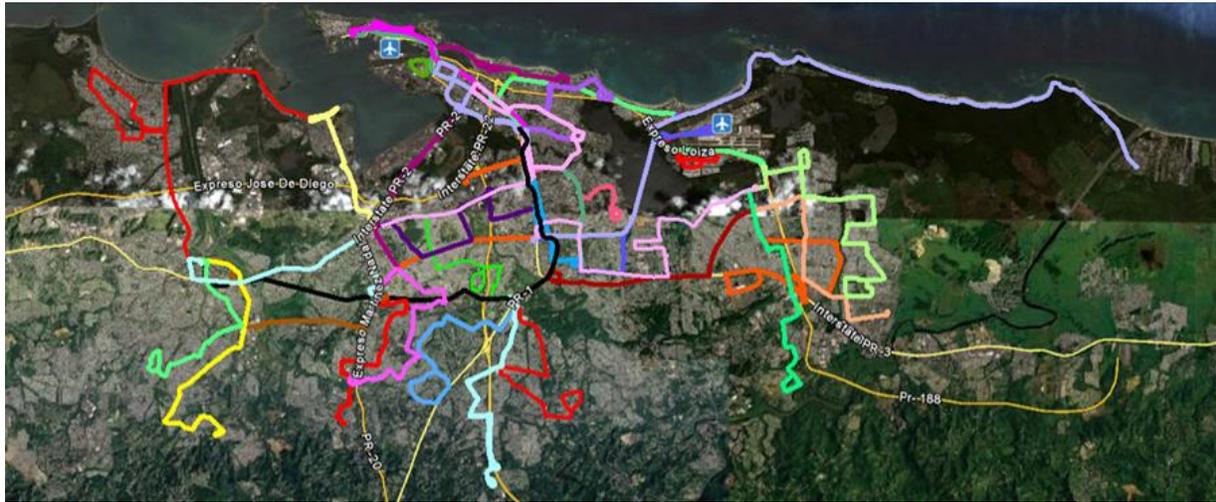


Year	Average Daily Ridership
2002	0
2003	0
2004	0
2005	26,719
2006	22,300
2007	26,790
2008	29,974
2009	32,825
2010	30,416
2011	32,153

Station	2010 Average Daily Boardings	Percent of Total
Bayamon	3,589	11.8%
Deportivo	3,489	11.5%
Jardines	544	1.8%
Torrimar	728	2.4%
Martinez Nadal	2,118	7.0%
Las Lomas	816	2.7%
San Francisco	1,610	5.3%
Centro Medico	2,454	8.1%
Cupey	1,408	4.6%
Rio Piedras	2,708	8.9%
Universidad	2,035	6.7%
Pinero	1,187	3.9%
Domenech	1,122	3.7%
Roosevelt	1,541	5.1%
Hato Rey	1,558	5.1%
Sagrado Corazon	3,509	11.5%
Total	30,416	100.0%

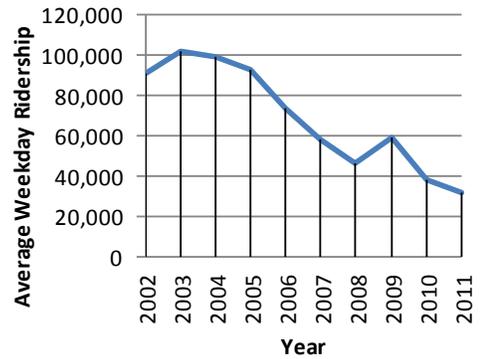
Figure 5.11 (Continued)

MBA Fixed Route Bus Routes



Aug. 2010 to March 2011 MBA Ridership by Route			
Route Number	Average Annual Weekday Ridership	Route Number	Average Annual Weekday Ridership
1	1,216	27	642
T2	2,757	28	407
T3	1,855	29	468
4	880	30	184
T5	2,785	31	354
6	1,240	37	217
T7	274	40	569
8	237	41	736
T9	1,945	43	360
10	418	44	268
11	478	45	267
15	483	46	72
16	354	49	121
17	765	50	117
18	404	52	202
19	345	53	529
21	966	91	318
22	251	92	404
26	499	Total	24,386

Year	Average Daily Ridership
2002	91,398
2003	101,866
2004	98,903
2005	92,642
2006	73,908
2007	57,912
2008	46,662
2009	59,328
2010	37,852
2011	32,023



Year	Average Daily Ridership
2002	10,665
2003	5,817
2004	9,172
2005	6,375
2006	5,651
2007	8,426
2008	7,176
2009	6,777
2010	7,657
2011	8,038

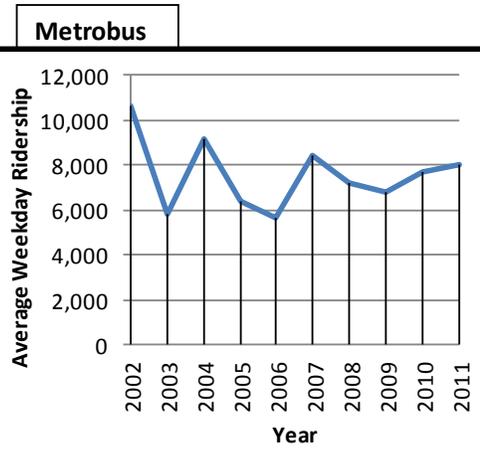
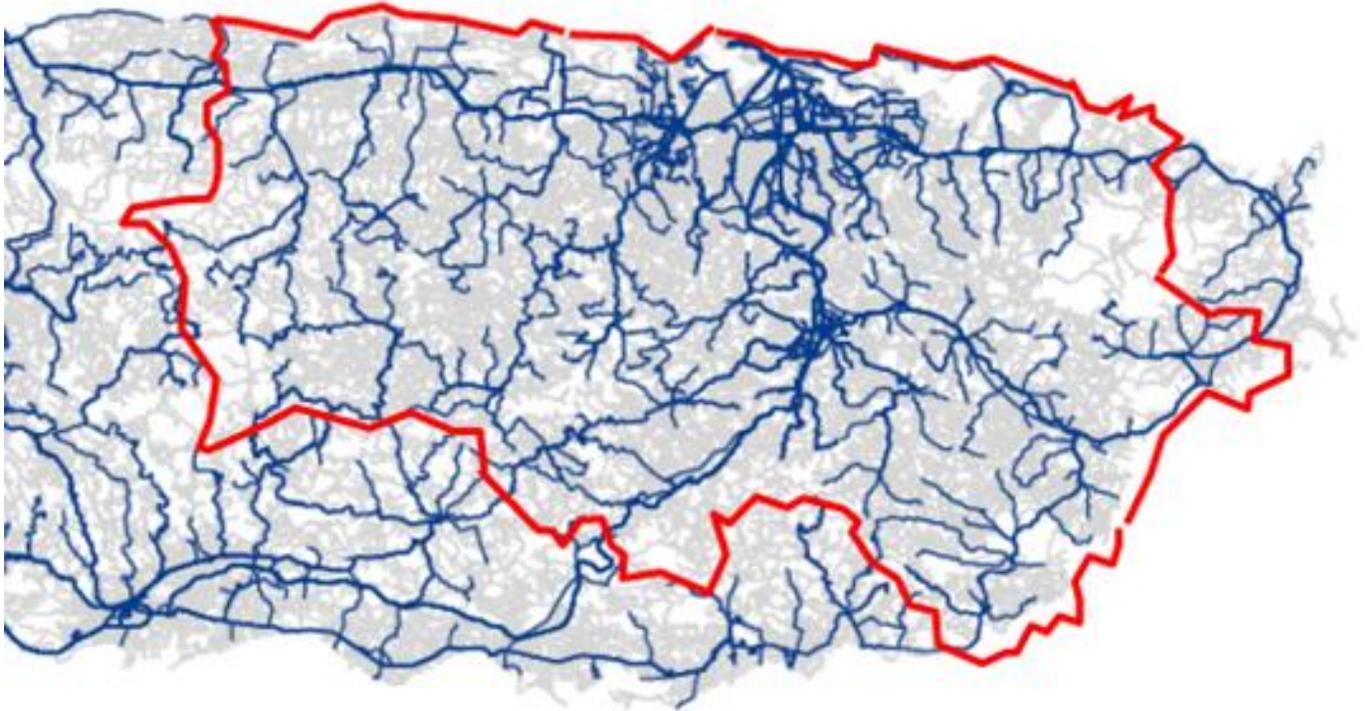


Figure 5.11 (Continued)

Público Routes – San Juan



Year	Average Daily Ridership
2002	122,412
2003	111,828
2004	181,770
2005	163,729
2006	135,330
2007	108,704
2008	101,558
2009	137,614
2010	146,853
2011	136,222

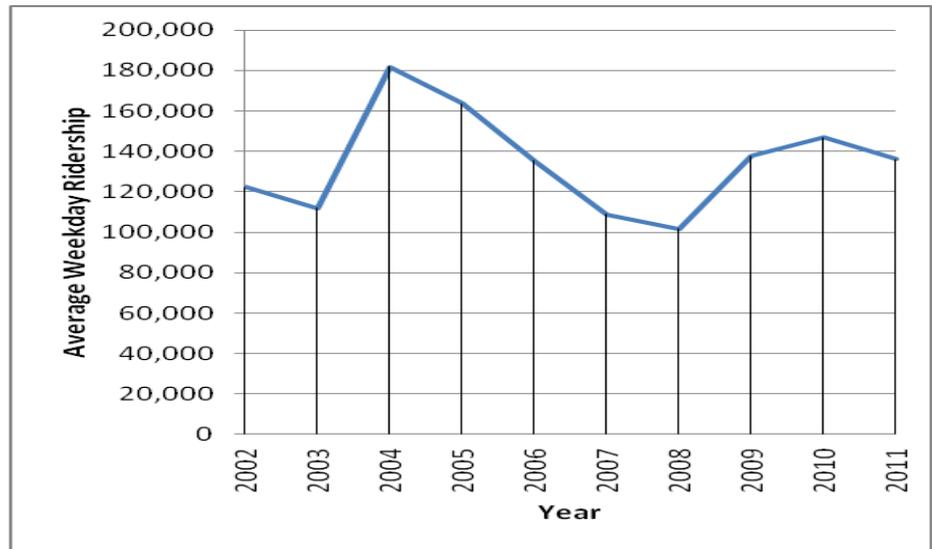


Figure 5.12
ISLANDWIDE PUBLICO COVERAGE

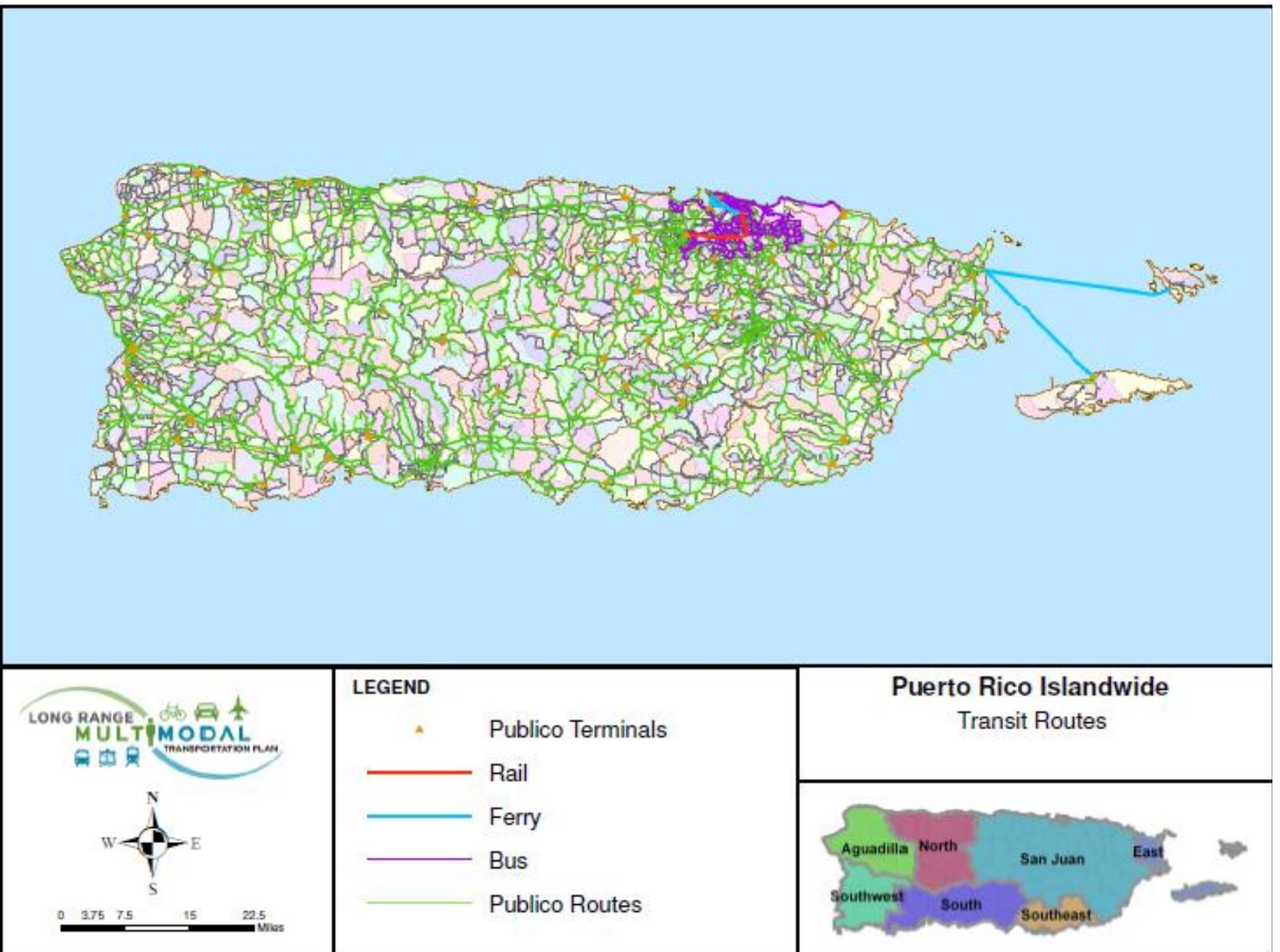
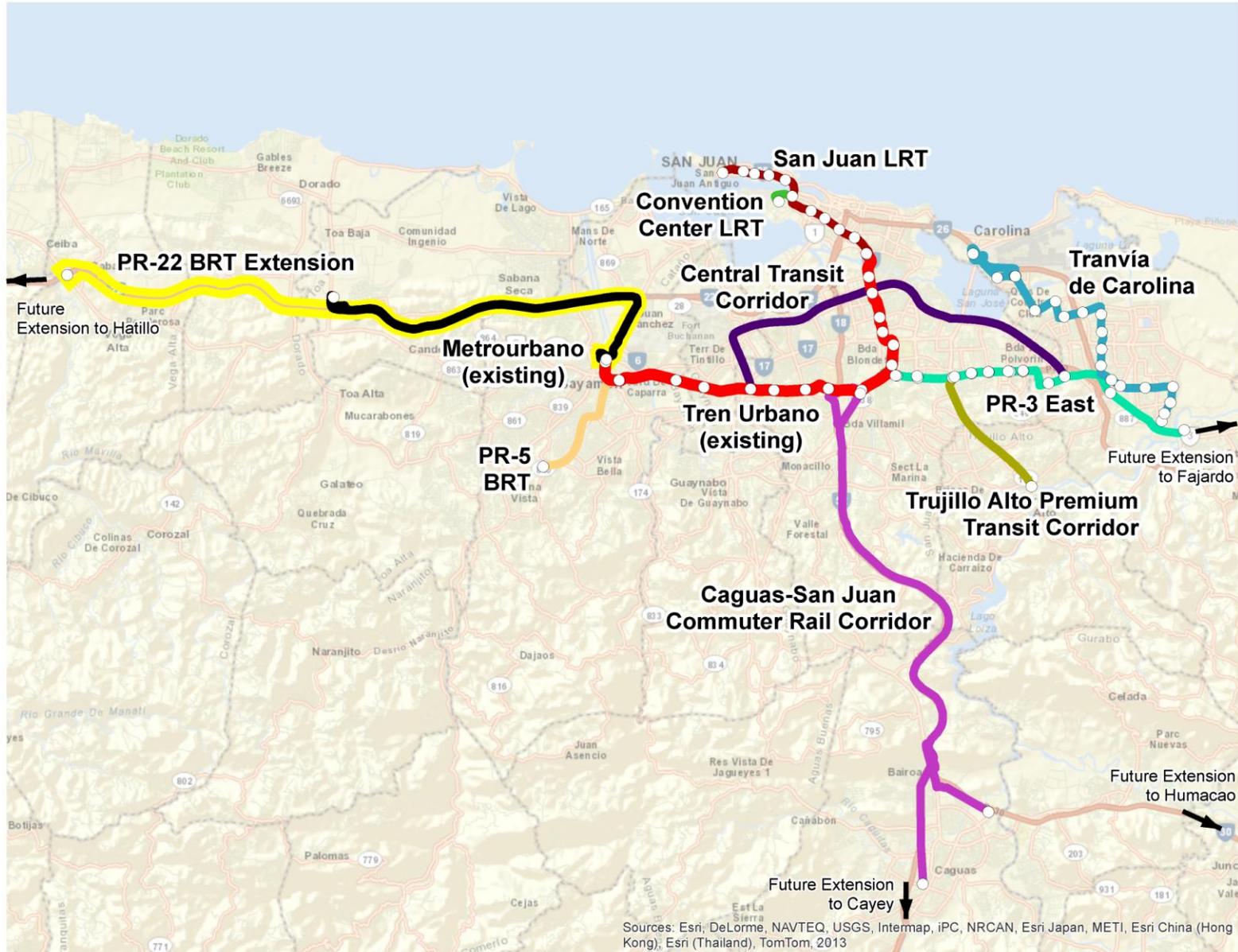


Figure 5.13
SAN JUAN TMA ILLUSTRATIVE TRANSIT PROJECTS



- **Caguas-San Juan Commuter Rail Corridor:** This proposed 24.33-km. corridor is presently proposed as a commuter transit service named the NOVOTREN, and extends from the Cupey and/or Centro Medico Tren Urbano stations south along PR-52 to terminal stations with park-and-ride lots at Plaza Catalinas on PR-52 and Plaza Centro on PR-30. Originally planned as LRT, it was later proposed as BRT and as magnetic levitation (maglev) modes. As the project advances, the transit technologies are not limited to a specific mode, but are open to alternatives that are technically and economically feasible. The proponents of the project include the municipality of Caguas, and DTPW and PRHTA. An alignment analysis and environmental report were prepared a few years ago as an LRT project; an extension of the environmental study was requested and was granted in July 2013. Cost figures have varied, the most recent being an estimate of \$400 million. Ridership estimates have ranged up to 14,000 daily passengers for rail service. This project has been proposed as a public/private Design/Build/Operate/Maintain (DBOM) procurement process.
- **PR-3 East Corridor.** This 13-km. corridor was originally planned for heavy rail transit, running along PR-3, but due to the cost of rail, has been revised to a BRT corridor extending east to a park-and-ride lot at the Roberto Clemente Stadium east of the Río Grande de Loíza. The current concept includes significant aerial structures, accounting for the estimated \$378 million in cost. Engineering and environmental documents have been developed. This corridor could be a candidate for an at-grade configuration with lower cost for much of the corridor, coupled with traffic signal prioritization, but this approach would require further analysis. The DTPW has been leading the project development for this corridor.
- **Trujillo Alto Premium Transit Corridor:** This project is proposed to extend from the PR-3 transit corridor south along PR-181 for approximately 6.5 km to the south into Trujillo Alto. The concept is sponsored by the municipality of Trujillo Alto and has had initial conceptual development work accomplished to date; no cost estimate is available. Service concepts being considered would be a light rail transit service and a BRT arterial style project where the BRT vehicles would operate in mixed flow but with signal priority and preemption and potential queue jump treatments at congested intersections. This premium service would interconnect with five municipal route providing access into the sectors of the municipality.
- **PR-22 BRT Extension.** This project would be an extension of the recently completed first phase of the PR-22 dynamically tolled lanes/BRT (MetroUrbano) project that extends premium transit service from the Tren Urbano Bayamón station via PR-5 and then westward along PR-22 to a park-and-ride lot at PR-165. Phase 2 would extend the same highway/transit concept westward another 11 km. to the PR-2 interchange near Ceiba. The comparable length of Phase 1 cost approximately \$120 million, including the park-and-ride lot; this cost was mostly for the roadway improvements which will generate additional toll revenue. This same concept could be extended westward in additional incremental phases. Project development would be subject to the terms and conditions of the concession agreement finalized in 2012 for this corridor.
- **Tranvía de Carolina.** This corridor was studied in 2006-2008 as an LRT project. Several alignments were reviewed and a final route was recommended. Total cost was estimated at approximately \$600 million for a route extending from the traditional town center at PR-3 north and east, past Plaza Carolina to the Isla Verde tourism district. A second route traversing western Carolina was also identified. Ridership was estimated at approximately 13,000 daily riders. While not part of the study concept, a third segment from the airport southeasterly to Hato Rey was also tested and obtained about 12,000 daily riders. While the project was originally proposed as a PPP project, this process never advanced. It is possible that the

proposed LRT route could be developed as a BRT corridor, but this approach has not yet been explored. Cost would be considerably less due to the cost of a two-lane roadway versus an LRT double-track alignment with electrification and communications systems and an expensive maintenance facility.

- **PR-5 BRT.** This project was proposed through DTPW/PRHTA several years ago and would extend from the Tren Urbano Bayamón station southward for 5 km. to the PR-199 intersection. A specific concept was not described and no cost is available, but since PR-5 is an expressway, it is likely that it would be a line-haul route with limited station locations. With the planned development in the Cost-Feasible Plan of the missing segment of PR-5 between PR-199 and PR-167, the concept could be extended that length or even further south along the other completed segment of PR-5 south to the Naranjito area.
- **Central Transit Corridor.** This project has been under consideration by MBA as an express bus or possible BRT arterial service extending from the Martinez Nadal station of Tren Urbano north along PR-20, past the San Patricio Plaza shopping center and then eastward along Ave. Roosevelt/PR-23 to Hato Rey, intersecting with the Tren Urbano Roosevelt station, and then continuing eastward along Ave. Roosevelt and other streets, reaching PR-8 and traversing it to the east and south to PR-3. The general alignment would tend to preclude an exclusive lane BRT treatment, but a BRT arterial or express bus treatment is possible, along with signal priority/preemption treatment and queue jump treatments. No development work or cost estimation has been developed.
- **Future Extensions.** In the longer term, extensions of the PR-3 corridor east towards Fajardo, the Caguas corridor on PR-52 southwest towards Cayey and southeast to Humacao as well as the further extension of the PR-22 toll/BRT treatment to Vega Baja, Barcenoleta, and Arecibo and Hatillo could be considered.

Other prospective transit projects across the island include the following unfunded projects:

- Aguadilla fixed route bus system of five routes.
- Mayagüez BRT corridor, small fixed route system expansion, and potential light rail corridor from the central city to the resort and seaport area on the south coast.
- Cabo Rojo fixed route transit system.
- Ponce BRT route, light rail line from city center to the south coast, and expansion of the existing city center shuttle service.
- Yauco expansion of the existing small fixed route system.
- Regional routes in the South TPR.
- Expansion of the single route system in Fajardo.
- Expansion of the multi-municipality transit service in partnership with público operators.
- Other municipal partnerships with público operators.
- Partnerships with público operators for interregional services around the island, augmenting the remaining such services provided by públicos.

These projects were listed as illustrative projects in their respective regional LRTP documents prepared by the MPO. Recommended strategies and actions for addressing the continuing issue of funding the

capital and operating costs of existing and new transit services in Puerto Rico so that they can be implemented are presented in Section 7.1.3.

5.3 Bicycle and Pedestrian (Non-Motorized) Facilities

Planning for pedestrian and bicycle transportation is coordinated through the municipalities and the PRHTA. There are several biking routes and trails in throughout the island, as listed in Table 5.4.

Table 5.4

ISLANDWIDE BICYCLE AND PEDESTRIAN TRAILS

Trail	Location	Length (km)	Primary Use
Aguadilla Coastal Trail	Aguadilla	35.2	Recreation
Albergue Olimpico	Salinas	16.0	Recreation
Cambalache	Arecibo	5.6	Recreation
Cambalache Forest	Arecibo	10.9	Recreation
Enrique Marti Coll Linear Park	Hato Rey	17.6	Recreation and Alternative Transportation
Guánica State Forest	Guánica	32.0	Recreation
Isabela Bicycle/Pedestrian Trail	Isabela	2.4	Recreation and Alternative Transportation
Julio Enrique Monagas Park	Bayamón	17.6	Recreation
Las Pardas	Guánica	8.0	Recreation
Mayagüez Linear Park	Mayagüez	2.4	Recreation and Alternative Transportation
Monagas	Bayamón	16.0	Recreation
Paseo del Morro	San Juan	0.0	Recreation and Alternative Transportation
Piñones Trail	San Juan	9.9	Recreation
Playa Sucia	Cabo Rojo	n/a	Recreation
Rincón Scenic Bicycle/Pedestrian Route	Rincón	9.0	Recreation and Alternative Transportation
Ruta Olimpica	Salinas	9.9	Recreation
Sierra de Cayey Nature Trail	Cayey	0.0	Recreation
Susua	Sabana Grande	16.0	Recreation
Tradewinds National Recreational Trail (El Toro)	El Yunque National Forest	12.8	Recreation
Tripeo	Ponce	16.0	Recreation

Source: PRHTA.

In general, pedestrians and bicyclists may utilize numerous on-road facilities (including sidewalks), though dedicated off-road facilities are lacking in much of Puerto Rico. As with roads, sidewalk maintenance is relatively inconsistent, and in some areas sidewalks are commonly used as parking, thus

inhibiting pedestrian and bicycle travel. Many sidewalks lack intersection ramps, and are often obstructed by power poles, trees, and sign posts. There is considerable interest in expanding non-motorized facilities, but funding limitations have limited the number of projects that can be implemented.

There is still great opportunity for new and improved dedicated trails; several have been pursued in the larger metropolitan area of San Juan. In the west and southwest regions, an extensive trail system could be developed to serve the Aguadilla and the Mayagüez areas by connecting Aguadilla, Rincón, Mayagüez, and Cabo Rojo. This system would tie into and extend urban trail sections already under development in Mayagüez and would also traverse a largely untapped scenic area, offering hikers and bicyclists a variety of natural environments to explore. A bicycle tourism market is developing in the Cabo Rojo area and other municipalities, including Mayagüez, Humacao, Fajardo, Caguas, and several others have proposed new projects. In other areas, pedestrian and bicycle trails could be developed in conjunction with major highway facilities along the circumferential and cross-island corridors.

A summary of bicycle/pedestrian facilities across the island's regions serves to provide a good profile of the interest in this form of travel. Several recent projects in the San Juan Metropolitan Area include bicycle and pedestrian facilities and Complete Streets elements. The municipality of San Juan included a bike lane on Ashford Avenue and Magdalena Street in the Condado area and "Share the road" signs are marked along the McLeary Street in the Ocean Park area.



Also the PRHTA provides adequate space for pedestrian and cyclists in the "San Antonio Bridge" and "Estevez Bridge" rehabilitation project at the entrance to the Isleta de San Juan as well as in the new "Dos Hermanos Bridge" in the Condado area.



The municipality of Bayamon completed Phase II of the “Paseo Rio Bayamon” from PR-22 in Bayamon to the Toa Baja waterfront. Also the PRHTA installed "Share the road" signs are marked along PR-165, from “Punta Salinas” in Toa Baja to the Dorado City entrance. The PRHTA completed the design of the Toa Baja Recreational Trail, an earmark project to be developed in the short term.

Several projects are under study to provide continuity and connectivity between existing and proposed bicycle and pedestrian projects. One of them is the "Vereda Metropolitana," a continuous pedestrian route to connect the parks, squares, and gardens from Old San Juan to Rio Piedras, will be developed in the short term. The municipality of Caguas has identified potential bicycle corridors around the city, as part of the “Transcriollo,” its new transportation system; one of these corridors will be developed in the short term. Other projects under consideration will be developed in the medium term; these include bicycle corridors in Cataño, Canovanas, Carolina, Cayey, Dorado, Loiza, Toa Baja, and Trujillo Alto.

The conceptual network includes a bicycle and pedestrian corridor along the northern edge of the San Juan Islet which is already in design and will be developed in the short term. Other projects under consideration to be developed in the medium term include about 90 km. of bicycle corridors in Cataño, Canovanas, Carolina, Cayey, Dorado, Loiza, San Juan, Toa Baja, and Trujillo Alto, as included in Appendix L (see Table L-4 which identifies illustrative non-motorized projects).

The Dorado Bicycle Master Plan, proposed by the autonomous municipality of Dorado, is aimed at implementing safe cycle routes throughout the municipality’s public roadways with the intention of connecting communities, destinations, and public facilities with cyclist infrastructure. This plan includes an analysis of the following routes to provide bicycle infrastructure, adding 40.9 km. of bicycle facilities to the region:

- Dorado’s main cycle route along PR-693 and PR-6693 (14.4 km)
- A cycle route connection between Route 693 and the future Avenida Higuillar project
- Pedestrian and cyclist infrastructure improvements for Calle Méndez Vigo, Dorado’s main street
- A cycle route for PR-697 to connect the proposed main cycle route with Costa de Oro and Dorado’s public beach
- An improved bridge crossing at Río La Plata to connect with Dorado’s main park and PR-165, a popular cycle route

The target roadway for an initial phase implementation (PR-693 / PR-6693) was selected with the purpose of connecting an existing cycle path at Sabanera with a popular cycle route on PR-165 (share the road) as well as other routes frequented by cyclists in Dorado. The proposed first-phase of 14.37 km. of bicycle routes will give residents of neighborhoods along the corridor safe access to the Dorado’s traditional center.

This proposal envisions the target corridor as a complete street, in compliance with Complete Streets Law 201 of December 2010, and as a contribution to the efforts of the Decade of Action for Road Safety (2011-2020), which calls on the world to unite to prevent road injury and deaths.

The autonomous municipality of Caguas, as part of its strategy to promote the use of non-motorized transportation modes, proposes the development of four main routes for cyclists, reaching about 11 km.: PR-189, 3 km in length, from the “públicos” terminal to the University of Turabo; PR-1 Sur, between Luis Munoz Marin Avenue (PR-32) and Jupiter Street / PR-33, 1.5 km; PR-1 north between “públicos” terminal and Calle 21 and Bairoa River, 2.5 km.; PR-156 between PR-784 and PR-34 (Villa Hermosa and Bonneville sectors) and the “públicos” terminal, 4 km. Another proposed project is the Phase II Rio Caguitas Greenway, between PR-1 and PR-156 (2 km.).

Several cities within the Aguadilla TMA have begun to focus on developing new pedestrian and bicycle facilities and recreational trails, as the region enjoys a degree of tourism and vacation activity in the Isabela, Aguadilla, and Aguada/Rincón areas. Several municipalities have identified greenway and trail projects that would support this trend.



The municipality of Isabela has completed the construction of the “Paseo Lineal Zona Costera”, a bicycle and pedestrian trail, 7.2 km in length, adjacent to PR-466 from Villa Pesquera at Barrio. Guayabo to Jobos Beach at Barrio Bajura.

The PRHTA has completed the design of Paseo Rincon, a bicycle and pedestrian trail of approximately 3.5 kilometers, from the Municipal Beach, along the PR-413 and other municipal streets, to El Faro and Playa Domes. This project will be developed in the short term.



The bicycle conceptual network for the Aguadilla TMA includes approximately more than 65 km. of bicycle and pedestrian facilities for the region. The municipality of Aguadilla has proposed projects to improve the quality of the urban environment, and provide transportation alternatives such as cycling and walking to improve access to its scenic attractions, drawing commercial activities and encouraging densification. The three projects in the urban center cover approximately 4.8 km:

- Paseo Real Marina - 2.5 km. of pedestrian facilities in the urban center waterfront along PR-111, PR-2, and local streets in the Aguadilla's urban center, from Colón Park to Fisherman's Square. The points of interest include Colón Park, El Parterre Park, and museums, among others.
- Boulevard La Vía - The purpose of the project is the widening and construction of a bike lane in La Vía Street, from PR-2R to PR-460, located in Aguadilla's urban center (1.9 km.)
- Callejón del Fuerte Connector – This project consists of the widening and construction of a bicycle lane in Fuerte Street, from PR-111R to La Vía Street, located in Aguadilla's urban center.

The municipality also recently proposed the study of a bicycle route from Paseo Real Marina in the urban center that would connect the municipalities of Isabela and Aguada, improving access to scenic attractions and connecting other projects already developed in neighboring municipalities. The approximate length of this route would be about 27 km.

In addition, the municipality of Aguada proposed the Paseo Mary Tierra, a series of bicycle and pedestrian facilities along PR-115, PR-441, and local streets to integrate the center of Aguada with its waterfront for a total of 12 km. of facilities. The purpose of this project, included in the rehabilitation plan for the Aguada urban center, is to provide non-motorized transportation alternatives to connect several important destinations within the municipality and create new opportunities for economic and social development as well as tourism, recreation, education, and cultural activities for the benefit of both Aguada residents and visitors. Another purpose of this project is to improve road safety conditions to redirect runoff into the Quebrada San Jose channel to reduce congestion and accidents due to flooding in this area. The bicycle conceptual network for the Aguadilla TMA also includes the study of a 25-km. bicycle route bordering the coastline between Rincon and Añasco.

In the North Region, the Municipality of Camuy has been completed the design of the "Paseo Camuy", a bicycle and pedestrian trail, 3 km in length adjacent to PR-485, from the Municipal Government Center connecting recreational area, the "Peñon Brusi" Beach and the "Villa Pesquera". This project is ready to begin construction this year.

The bicycle conceptual network for this region includes some of the principal coastal roads in the municipalities of Quebradillas, Camuy, Hatillo, Arecibo, and Barceloneta. Some projects under consideration include bicycle routes adjacent to PR-681, PR-682, and PR-684 in

Barceloneta and Arecibo, to connect the Natural Reserves of Hacienda la Esperanza, Cueva del Indio and Caño Tiburones, and the Cambalache State Forest.

In the South Region, the municipality of Ponce completed the construction of Phases I and II of the Linear Parks of Buchana and Portugues Rivers (14 km). Also has been identified the potential bicycle corridors around the city as part of the Bicycle Plan included in the Public Transportation Planning Study for the SITRAS Sistema de Transportacion del Sur. Four major corridors are suggested to link important travel patterns within the municipality: Ponce Centro, Canas Urbano, Portugués Urbano, and Ponce Playa.

The Bicycle Conceptual Network for the Southeast Region includes for study a bicycle route of 30 km approximately, along the state highways PR-3, PR-703, PR-705, and PR-7710, to connect the Guayama center with Aguirre State Forest, and also to connect the Salinas center with Jobos Bay National Estuarine Reserve.

The Southwest Transportation Planning Region has proposed a bicycle network to connect natural resources, forests and open spaces adjacent to waterways and along the urban waterfront, as well as, recreational and cultural areas with urban centers. Some of the proposed routes are currently used by cyclists groups, especially in Cabo Rojo and Lajas. The final alignment of the routes will be defined in collaboration with the municipalities and the Department of Natural and Environmental Resources to harmonize with forests, reserves and other natural and cultural resources in the region.

Appendix P contains maps showing the conceptual bicycle and pedestrian network for 2040 for Puerto Rico's respective TMAs and TPRs.

The recently enacted Complete Streets legislation, created under Law 201 of December 16, 2010, supports the philosophy of designing streets for all anticipated users: vehicles, transit, pedestrians, and bicyclists. A committee — the Evaluation Commission — was appointed to explore how the law can be applied to future transportation projects and what steps need to be taken to implement the strategy. This Evaluation Commission for the adoption of the complete streets concept has completed the required report with recommendations for the implementation of the complete streets policy in Puerto Rico. Complete streets principles and practices will be taken into consideration in all planning efforts, as well as in capital improvement projects and maintenance projects in all public roads in Puerto Rico. The DTPW and PRHTA will also be updating the design standards to incorporate the complete streets principles. The 2040 LRTP adopts the goals set forth by the Puerto Rico Law 207 of August 25, 2000 for transit-oriented development along the Tren Urbano Corridor as well as by the Puerto Rico Law 201 of December 16, 2010 for Complete Streets.

The Strategic Planning Office of the PRHTA included as a task Phase I of the Complete Streets and Livability Initiative in the State Planning and Research Program for FY 2012-2013 (SPR-PR-PL-1(50)). The objectives of this task are to:

- Provide safe and affordable access for people of all ages and abilities in accordance with the FHWA's Livability Initiative, the goals set forth by Law 207 of August 25, 2000 for development along the Tren Urbano Corridor and by Law 201 of December 16, 2010 for Complete Streets.
- Improve and provide pedestrian and bicycle access to the public transportation system and specifically to the Tren Urbano stations.

The task includes preparing the preliminary criteria to establish the design guidelines for complete streets, including the provision and reconstruction of sidewalks and ramps for people with disabilities, removal of architectural barriers, provision of bike routes, tree planting and landscaping, new public lighting and other necessary facilities to provide a safe and attractive access for all. The Strategic Planning Office completed the preliminary inventory of the existing land use and conditions of the infrastructure for walking and cycling in the surrounding areas of the Tren Urbano stations.

In addition, the new Government Program for the short term includes an action for the implementation of the Complete Streets public policy. It will begin with pilot projects in corridors and major avenues in the San Juan Metropolitan Area, Mayagüez, Ponce, and other large urban centers of the island, to be followed by identifying Complete Streets projects in each region.

The Transportation Alternatives Program (TAP) authorized under Section 1122 of Moving Ahead for Progress in the 21st Century Act (MAP-21) provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities. One of the eligible activities is the “Conversion and use of abandoned railroad corridors for trails for pedestrians, bicyclists, or other non-motorized transportation users”.

As part of the plan for non-motorized modes, PRHTA will identify the existing sections of the old railway easement around the island, abandoned for many years, to consider reuse as bicycle and pedestrian trails. This heritage of historical and cultural value offers great potential for reuse to provide safe and accessible routes for everyday walking or cycling to the workplace and school, developing initiatives for ecotourism and sustainable travel. It also offers the opportunity to promote active lifestyles for all ages, sporting and recreation consistent with new social demands, encouraging the development of local small businesses and stimulate economic revitalization.

The initiative of “Rails-to-Trails Conservancy” in the United States, and the “European Greenways Association” promote the transformation of disused railway lines into greenways, to ensure that railway heritage is preserved and maintained, and at the same time generates local economic opportunities. In addition, these initiatives safeguard the continuity of transport corridors so that, if necessary, the trails could revert to their original use as railway lines.

5.4 Seaports

Figure 5.14 shows the locations of Puerto Rico’s seaports. The Port of San Juan, located on the north coast, is Puerto Rico’s primary commercial port, handling the preponderance of the maritime cargo moving through the island’s seaports as well as serving the substantial number of passengers cruising from Puerto Rico, either on homeporting ships or on port-of-call visits. The ports of Mayagüez in the west and the Port of Ponce to the south also move cargo and have limited port-of-call cruise operations. The remaining seaports, such as Arecibo and Aguadilla have lost importance, following the decline of local agricultural activity. Specialized ports in Guayanilla and Yabucoa, among others, have at times been of particular value in the commerce of petroleum derivatives or some other specific commodity.

5.4.1 Port of San Juan

Located in San Juan on the harbor waterfront at several distinct sites, the Port of San Juan serves both cargo and passenger movements. The port has 34 docks and 46 berths in total, including a berth in Old San Juan for the passenger ferry service, which connects to both Cataño and Hato Rey. The largest cruise ships can be accommodated at six berths adjacent to Old San Juan and another two adjacent to the Fernando Luis Ribas Dominicci Airport in the area referred to as Isla Grande. The cruise terminals have modern baggage-handling, passenger-processing, and passenger amenities. Like other cruise ports in the region, the Port of San Juan is serving ships that are considerably larger than in the past, many

carrying upwards of 5,000 passengers, and it is not uncommon to have several behemoth cruise liners in port at one time. Cruise ships dock on both the Old San Juan and Miramar sides of Canal San Antonio.

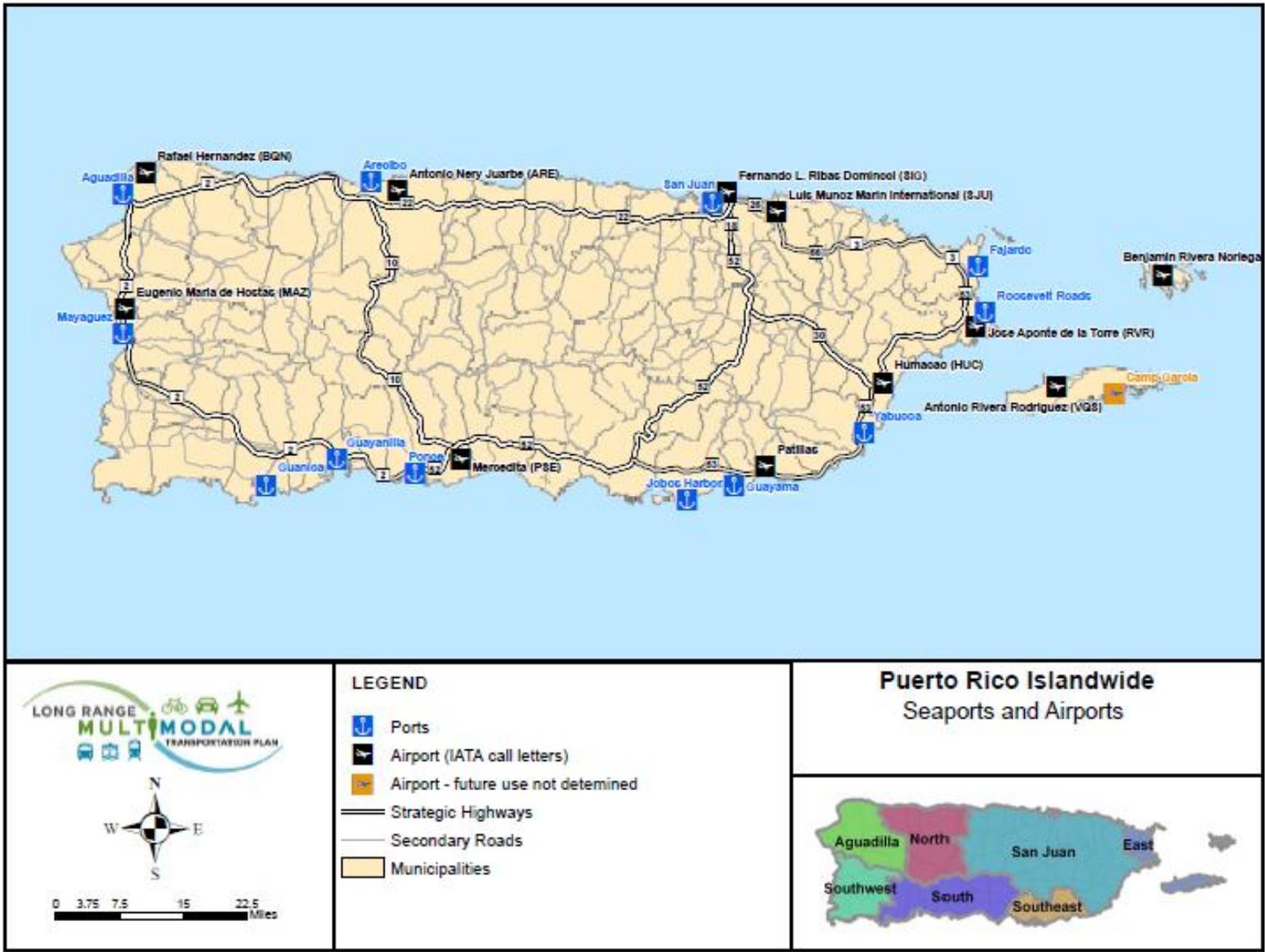
In 2012, there were 1,127,842 reported passengers, down slightly from 1,164,989 in 2011 and from the peak of 1,496,853 in 2008 (see Table 5.5). The number of cruise calls at the port has declined to 470 annual visits from levels over 600 in the years before 2006, but this is due to the larger size of ships. Often called the Cruise Capital of the Caribbean, the Port of San Juan serves about 3 percent of global cruise embarkations, similar to the Port of Tampa.

Table 5.5
SAN JUAN CRUISE PASSENGERS AND VESSEL CALLS 2000–2011

Year	Passengers	Vessel Calls
2000	1,211,118	678
2001	1,355,245	674
2002	1,276,301	625
2003	1,163,937	537
2004	1,348,163	661
2005	1,386,211	606
2006	1,299,323	550
2007	1,374,749	563
2008	1,496,853	581
2009	1,236,256	470
2010	1,185,780	466
2011	1,164,989	475
2012	1,127,842	470

Source: American Association of Port Authorities and Puerto Rico Ports Authority.

Figure 5.14
SEAPORTS AND AIRPORTS



The Port of San Juan handles virtually all types of cargo from ocean-going vessels: bulk cargo, general cargo, construction materials, containerized cargo, automobiles and other roll-on/roll-off cargo, fuel and chemicals, and others. The port is the busiest in Puerto Rico in terms of cargo movements, and it ranks 12th among the North American ports in containerized cargo. It moved 1,484,595 twenty-foot equivalent units (TEUs) in 2011, compared to 1,525,532 in 2010 and approximately 1,700,000 in 2001.

5.4.2 Port of the Americas (Port of Ponce)

The Commonwealth's development of a world-class port and related Free Trade Zone at the Port of Ponce has introduced a significant addition to Puerto Rico's seaport system. This project is intended to greatly expand Puerto Rico's share in global shipping and build upon the important role already being played by the Port of San Juan.

The Rafael Cordero Santiago Puerto de las Américas is a megaport being built in phases in Ponce with the goal of converting the existing Port of Ponce into an international shipping hub. Over the years, despite ups and downs with changing economic trends and public policies, the Port of Ponce has been an essential element in the economic development of the south coast of Puerto Rico and Ponce itself.

Phased work began several years ago to expand and modernize the port so that it could accommodate the large post-Panamax ships expected to traverse the new Panama Canal locks when these are completed in 2015. The Port currently has a modern post-Panamax berth, with 50-foot depth, and a container yard with capacity of up to 250,000 TEUs per year. To date, improvements and investments of \$250 million have been made to the port, and two post-Panamax cranes have been installed. Additional investment will be required to take the port to its intended annual container capacity of up to 500,000 TEUs and storage capacity of 2.2 million TEUs.

Late in 2011, legislation was approved that transferred control of the Puerto de las Américas to a new public corporation called the Port of Ponce Authority. This entity will be in charge of managing and financing both the Puerto de las Américas and the Port of Ponce. The objective is to merge the operations of the two ports so that the Puerto de las Américas can become the port that attracts international commerce and support waterborne trade lane logistics, and the Port of Ponce can continue its primarily break-bulk operations while expanding local containerized-cargo activity.

As part of what has been called the "Ponce Solution," an additional objective is to enhance the tourism sector by developing a regional cruise ship industry and facilities for megayachts. To this effect, the Sea Dream Yacht Club and Crystal Cruises both have scheduled calls at Ponce in late 2012 and early 2013.

5.4.3 Other Ports

Other ports in Puerto Rico serve various types of cargo and occasional cruise calls.

The **Port of Mayagüez**, a multi-purpose seaport that handles various types of cargo, is also an important part of the freight and passenger connectivity equation. Located northwest of downtown Mayagüez, the port is Puerto Rico third busiest seaport. Owned now by the municipality of Mayagüez, the port receives weekly visits by ships serving the Dominican Republic and other calls are being promoted. Currently, the Port of Mayagüez is the only port on Puerto Rico's western coast capable of docking large cruise ships. Formerly Mayagüez was the main tuna processor and packer in the world; however, most of the production closed, having moved to South America.

Guayanilla, **Guayama**, **Yabucoa**, and **Arecibo** are specialty ports that serve fuel/chemical traffic. The Puerto Rico Ports Authority owns and operates all of these ports.

On Puerto Rico's east coast, ferry service is operated between the **Port of Fajardo** and the off-shore islands of Culebra and Vieques. In 2009, 1,004,579 passengers were carried on the routes between Fajardo and the two islands, for an average of 576 passengers per day.

5.5 Airports

Air cargo and passenger traffic in Puerto Rico is dominated by San Juan's Luis Muñoz Marín International Airport. Ten other airports have paved runways that are lighted for 24-hour operations. These ten regional airports include one facility on each of the off-shore islands of Vieques and Culebra. One of the regional airports (Isla Grande) is located in San Juan. All eleven airports are owned and operated by the Puerto Rico Ports Authority, although the privatization of Luis Muñoz Marín International Airport through a public-private concession to run the airport for 50 years is being pursued.

Air passenger traffic through Puerto Rican airports has remained relatively stable over the past ten years. Back in 2001, the airports carried about 10 million annual passengers. In 2011-2012, 9.2 million passengers moved through these airports. Table 5-6 lists the passenger movements carried by Puerto Rico's airports in 2010-2011 and 2011-2012. Between the two years, the total movements increased by 1.9 percent. Air passenger traffic has tended to concentrate at Luis Muñoz Marín International Airport, with its share of island air passengers at 88.5 percent in 2011-2012. The remaining 11.5 percent is distributed among the other airports.

Table 5.6
TOTAL PASSENGER MOVEMENT THROUGH PUERTO RICO AIRPORTS

Airport	Location	2010-2011 Passengers	2011-2012 Passengers
Luis Muñoz Marín (SJU)	Carolina	8,143,095	8,143,095
Diego Jiménez Torres (FAJ)	Fajardo	N/A	Closed in 2008
Antonio Rivera Rodríguez (VQS)	Vieques	155,186	152,513
Eugenio María de Hostos (MAZ)	Mayagüez	12,108	13,205
Rafael Hernández (BQN)	Aguadilla	479,101	453,765
Fernando L. Ribas Dominicci (SIG)	Isla Grande	79,030	54,384
Benjamín Rivera Noriega (CPX)	Culebra	12,108	62,260
Mercedita (PSE)	Ponce	200,590	212,425
Jose Aponte de la Torre	Ceiba	101,969	102,050
Humacao Regional (HUC/PPD)	Humacao	984	1,464
Antonio Nery Juarbe (ARE)	Arecibo	3,515	8,145
Patillas	Patillas	N/A	N/A
TOTAL		9,032,500	9,204,106

Source: Puerto Rico Ports Authority (IATA Call Letters) .

Luis Muñoz Marín International Airport is also the primary air cargo facility for Puerto Rico and the Caribbean. Table 5-7 lists the cargo volumes in landed pounds carried by Puerto Rico's airports in 2010-2011 and 2011-2012. Between the two years, the total volumes declined by 2.4 percent.

5.5.1 Luis Muñoz Marín International Airport

This facility is located in Carolina on the north coast, and is the primary aviation gateway for Puerto Rico. The airport reported 3.99 million enplaned passengers in 2011, a decline of 6.1 percent from the prior year, attributed to the weakened Puerto Rico economy and a slight downturn in tourism activity. This level ranks the airport as the 47th busiest in the nation, on par with San Antonio, Indianapolis, and Pittsburgh. Over the last 12 years passenger traffic peaked in 2005 with 10.77 million total passengers, declining to 7.99 million passengers in 2011; the drop is attributed to the global and local recession, and in part to the restructuring of its Caribbean service by American Airlines, though Jet Blue and Airtran airlines have replaced much of the void. About 20 airlines provide service presently, some of it seasonal, and 10 air charter operations provide seasonal and year-round service.

The airport serves as a regional hub for Caribbean islands, and provides connections to stateside destinations in the eastern half of the US. The busiest U.S. destinations are New York City, Orlando, Miami, Atlanta, Fort Lauderdale, Philadelphia, Tampa, Charlotte, Newark, and Boston. Services to Europe are few, and available connections change frequently due to market demand.

In terms of air cargo, there were 867 million pounds of landed weight in 2011, a slight decline from the prior year, ranking the airport 27th nationally, above Orlando, Boston, and Salt Lake City, and below Fort Worth, Seattle, and Minneapolis-St. Paul. Twelve air cargo services are available, and the airport houses facilities for the U.S. Air Force Air National Guard and the Puerto Rico Air National Guard.

Table 5.7
TOTAL AIR CARGO MOVING THROUGH PUERTO RICO AIRPORTS

Airport	Location	2010-2011 Landed Pounds	2011-2012 Landed Pounds
Luis Muñoz Marín (SJU)	Carolina	882,936,872	867,078,992
Rafael Hernández (BQN)	Aguadilla	207,261,105	195,511,506
Mercedita (PSE)	Ponce	13,327,908	14,143,110
Eugenio María de Hostos (MAZ)	Mayagüez	4,511	1,974
Fernando L. Ribas Dominicci (SIG)	Isla Grande	588,437	631,838
Antonio Rivera Rodríguez (VQS)	Vieques	742,944	737,675
Benjamín Rivera Noriega (CPX)	Culebra	162,994	208,607
Diego Jiménez Torres (FAJ)	Fajardo	N/A	N/A
Antonio Nery Juarbe (ARE)	Arecibo	N/A	N/A
Humacao Regional (HUC/PPD)	Humacao	N/A	N/A
Patillas	Patillas	N/A	N/A
TOTAL		1,105,024,771	1,078,313,702

(IATA Call Letters) Source: Puerto Rico Ports Authority.

There are 88 aircraft based at the airport, mostly fixed wing; 10 of these aircraft are military. Total aircraft operations in fiscal year 2011-12 were nearly 160,000, dominated by air carriers, followed by air taxi, and general aviation traffic. The airport has been undergoing significant improvements in recent years including airfield work on runways and taxiways, support facilities, cargo area access, parking facilities, and terminals.

5.5.2 Fernando Luis Ribas Dominicci Airport (SIG)

This airport is located in San Juan, near the San Juan harbor, and provides general aviation activity, a low level of commercial aviation service, and a small military unit. The airport reported 20,353 enplaned passengers in 2011, a sharp drop of 47 percent from the prior year, due mainly to the transition of Seaborne Airlines, which had accounted for 70 percent of the commercial passenger traffic, to the nearby Luis Muñoz Marín International Airport. The airport is now served by Vieques Air Link and Air Flamenco; the connections provided are to the islands of Vieques, Culebra, St. Croix, and St. Thomas. There is also a charter airline at the airport, and a small military presence.

There are 232 aircraft based at the airport, mostly fixed wing. Total aircraft operations in fiscal year 2011-12 were 72,700, about 200 daily. The long-term role of the airport is not certain, and while most of its aircraft operations are general aviation, it is still a working commercial airport.

5.5.3 Rafael Hernández International Airport

Rafael Hernández International Airport, the former Ramey Air Force Base, has a 1,100-acre site and an 11,470-foot runway that is capable of handling the largest cargo aircraft in the world. This is a unique advantage and resource that the Commonwealth is trying to exploit by marketing this airport as an international air cargo and logistics center for the Caribbean and possibly Latin America. In 2000, the airport landed 683.2 million tons of cargo. This volume dropped to 549 million landed tons in 2004, but is since returning to the 2000 levels, with 666.2 million landed tons in 2011.

This airport is the officially designated reliever airport for Luis Muñoz Marín International Airport in San Juan. It is at the extreme northwest corner of the island and, while offering excellent coverage for the western half of the island, it is not well positioned to serve passengers or freight destined to the San Juan region.

Air passenger traffic has varied significantly over the last 20 years, reaching a peak in the early 1990s of nearly 290,000 passengers, but then declining for the next several years to levels of about 75,000 to 85,000 passengers. The Ports Authority is actively promoting increased air passenger service at Rafael Hernández Airport with several airlines, including low-cost carriers. These efforts emphasize the potential for growth in tourist travel and are coordinated with the Commonwealth's Porta Del Sol tourism plan for western Puerto Rico. Data from the Federal Aviation Administration for 2011 show 230,556 passenger enplanements, suggesting a rebound to historical levels.

The government has been assessing factors that will influence further development of the tourism industry at the western end of the island. In this increased tourism scenario, Rafael Hernández Airport would serve as a destination airport to provide tourists with air access closer to new western recreational and tourism developments. Regional land use planning anticipates the development of residential and related retail and service activities to support commercial and industrial land use around the airport.

In a recent development, on August 21, 2012, the federal Free Trade Zone (FTZ) granted to the Rafael Hernández Airport the designation of Site 24 FTZ No. 61, which is an expansion of FTZ No. 61. This expansion is the result of efforts involving the Puerto Rico District Export Council, the Puerto Rico Economic Development and Commerce Department, the municipality of Aguadilla, and others. The FTZ designation enhances the attractiveness of the airport as an air cargo super hub for regional and intercontinental air cargo movements, and is an important step in the future of the airport as an economic development engine for the region. FedEx shipping has designated the airport as its Caribbean hub, and while this will generate more activity on the airside rather than the landside of the airport operations, it is still a significant accomplishment. While of benefit to the region economically,

the expected increase in activity will raise travel demand to and from the airport vicinity, affecting traffic conditions and the need for improvements.

5.5.4 Other Airports

In addition to Luis Muñoz Marín International Airport and Rafael Hernández International Airport, the other seven regional airports also accommodate limited passenger service and carry small amounts of air cargo. Several also conduct specialized activities.

Mercedita Airport is a public use airport located six kilometers east of Ponce's central business district. Inaugurated as an international airport on November 1, 1990, the airport is Puerto Rico's largest airport in terms of military personnel volume and the second largest in terms of military freight.

The Federal Aviation Administration's *National Plan of Integrated Airport Systems for 2011–2015*, categorizes Mercedita as a primary commercial service airport, one that has more than 10,000 enplanements per year. Between April 2011 and March 2012, the airport carried 192,000 passengers, primarily on Jet Blue, which serves Orlando, Florida and New York City. In the past, the airport has also provided inter-island service. FEDEX and DHL provide ground service for the distribution of freight.

The airport has been enlarged on various occasions. Most recently, in conjunction with the development of the Port of the Americas, it was decided to expand the runway to 8,000 feet. (2,438 meters) to accommodate the additional air traffic anticipated in the area. Construction began in February 2011. As of July 4, 2012, a bill in the Puerto Rico Legislature was seeking to transfer airport ownership and management to the municipal government from the Commonwealth.

The **Patillas Airport** in the Southeast TPR is a small general aviation airport with a 2,000 -foot runway. Owned by the Puerto Rico Ports Authority, it is located about one mile (2 kilometers) southwest of the central business district of Patillas and is used primarily for recreational purposes.

The **Antonio Nery Juarbe Airport**, owned by the Ports Authority and included in the *National Plan of Integrated Airport Systems for 2011–2015*, is a small general aviation airport located five miles southeast of Arecibo's central business district and 50 miles west of San Juan. Frequented by light sport aircraft and ultra lights, this airport is a center of sport aviation on the island and is popular with skydivers, as it has an active private skydiving school, Xtreme Divers.

Eugenio María de Hostos Airport is the principal airport in the Southwest TPR. Located 6 kilometers north of the Mayagüez central business district, it is one of the regional airports that has service to the Luis Muñoz Marín International Airport in San Juan as a connection with flights to the U.S. and the Caribbean. Cape Air provides service between the two airports. This airport is included in the Federal Aviation Administration's *National Plan of Integrated Airport Systems for 2011–2015*, which categorized it as a non-primary commercial service airport, a category serving between 2,500 and 10,000 enplanements per year. In recent years, enplanements have averaged about 4,500 annually.

Humacao Airport is a small general aviation airport located in Humacao, near the southeast coast just off the PR-53 toll road. The airport caters to recreational and tourism aviation activity.

5.6 Freight

Sixty years ago, the island economy was dominated by agriculture. Since then, a dramatic shift has occurred so that today manufacturing is the dominant economic sector. As Table 5.8 shows, manufacturing occupies nearly half of the island's gross domestic product (GDP), with only 9.1 percent of the labor force, indicating that this is a value-added category. The trade sector accounts for 7.6 percent of the GDP while using 22.2 percent of the work force, indicating that it is a labor-intensive

activity. Manufacturing requires raw products or components as inputs and finished products as output. A significant part of the manufacturing activity in Puerto Rico is associated with pharmaceutical and medical supply companies. While this sector experienced some decline with the ending of tax incentives, it is still an active and significant business activity. This sector is one example of an industry that requires manufacturing components to be shipped in to Puerto Rico, produced or assembled, and then shipped out to consumer markets in the United States and elsewhere.

Table 5.8
GROSS DOMESTIC PRODUCT AND LABOR FORCE SHARES BY ECONOMIC SECTOR

Economic Sector	GDP Share by Sector (2011)	Labor Force Share by Sector (2012)
Manufacturing	48.6%	9.1%
Finance, Insurance, Real Estate	17.8%	3.4%
Services	12.7%	33.0%
Government	8.3%	22.2%
Trade	7.6%	22.2%
Transportation and Utilities	2.9%	3.8%
Construction and Mining	1.4%	4.8%
Agriculture	0.7%	1.6%

Source: <http://www.gdb-pur.com/economy/documents/PRFactsheet2013.pdf>

The large consumer and services markets in Puerto Rico must be supplied, largely from offshore sources, with such commodities as food, building supplies and materials, furniture, automobiles, household goods, clothing, office supplies, petroleum products, and a range of other items. These items are shipped to the island from the United States and other countries. Freight movements touch the lives of businesses and residents throughout Puerto Rico. The efficiency of freight movements affects the competitiveness of individual businesses on the island, but along with the capacity and capabilities of the island's seaports and airports, also influences Puerto Rico's broader competitiveness as a transportation distribution center. Freight mobility and connectivity are thus important contributors to the overall economy.

The importance of freight in the island-wide transportation system is recognized in the plan's goals and objectives framework. Freight interests were part of the plan development process through their representation on the Citizen Advisory Committee that was formed as part of the public outreach program discussed in Chapter 3. The Committee expressed interest in seeing continued improvements to the island's strategic highway network and efforts to reduce congestion.

More broadly, the importance of freight movement is recognized in the government's economic planning for the island. Like other niche users of the transportation system, the freight industry needs to be a proactive participant in the transportation planning process so that its key needs can be identified and addressed.

Since all freight in Puerto Rico is moved by truck, the major highways on the island can carry significant truck volumes. Shown in Figure 5.15 are the roads that make up the initial freight network used for the distribution of consumer goods coming into the island, daily commerce involving trucks that are accessing business clients with deliveries or services, construction project and material deliveries, parcel deliveries, agricultural activities, and shipment of manufactured products within the island or to an airport or seaport for offshore destinations. This network was defined during the LRTP development process and reviewed with the Citizen Advisory Committee and Economic Development Committee, which include members from the freight industry and from the regional economic development

Figure 5.15
FREIGHT NETWORK



agencies across the island. It is anticipated that this network will be further refined over time with continuing input from freight stakeholders by way of a freight working group coordinated by the MPO.

Figures 5.16 and 5.17 illustrate existing islandwide truck activity as well as that in the San Juan core, wherein the width of the band indicates the daily truck volume and the color of the band describes the truck trip percentage of the total daily trips. These figures show that truck trips generally represent 4 to 8 percent of total traffic on most links in the region, outside of the metropolitan area.

Figures 5.18 and 5.19 show the hotspots on the freight network across the island and in the San Juan central area. These comprise the areas around the airports, seaports, warehouses, distribution centers, manufacturing sites, and industrial sectors of the respective communities across the island.

How freight moves is affected by national and regional economic factors. In Puerto Rico, a shift between freight modes is not a factor, as trucking is the only distribution means within the island. Thus, this important economic function is tied to the performance of the highway system, especially the strategic highway network. Improvements to this network will clearly benefit the freight industry as well as the other highway users. In developing the travel demand model for this planning cycle, attention was paid to the collection of truck traffic volume data and the definition of a truck trip purpose in the model coding to better represent this travel demand element. With this refinement, truck-type movements can be better isolated for further analysis, as needed.

Complementing the internal movement of freight within Puerto Rico are the island's freight links to the Caribbean region, the United States, Latin America, and trans-Atlantic markets. These links occur through Puerto Rico's primary airports, which carry air cargo, and its major seaports, which serve as portals for the import and export of containerized and other cargoes, as well as potential transshipment points in the regional shipping lanes. These shipping lanes may well experience a greater influx of cargo once the Panama Canal expansion, now scheduled for 2015, is complete.

Various government initiatives have focused on expanding these air and sea cargo hubs and the essential land access connections to them. As noted, freight movement in Puerto Rico shares the same highway network used by the public and businesses.

Recognizing the critical role of trucking in islandwide freight distribution, the ongoing intelligent transportation system (ITS) development program will be considering the incorporation of the Commercial Vehicle Operations (CVO) User Services Bundle into the ITS Program Plan, which will require private sector participation. With the CVO component is the Freight Mobility User Service which provides information between drivers and dispatchers to take advantage of real-time traffic information, as well as vehicle and load location information. This element can enhance industry productivity and incrementally complement congestion management efforts. The ITS program will also consider the implementation of weigh-in-motion technology to improve enforcement productivity and increase compliance sampling rates.

The new federal transportation legislation, Moving Ahead for Progress in the 21st Century (MAP-21) includes a number of provisions to improve the condition and performance of the national freight network and support investment in freight-related surface transportation projects. Among these are the creation of a national freight policy, the identification of a national freight network, and the development of a national freight strategic plan in consultation with the states and other stakeholders as well as other detailed initiatives. As an element of future transportation planning initiatives through the MPO, it is recommended that freight planning in Puerto Rico be elevated by the formation of a Freight Advisory Committee that can provide input into industry needs and potential solutions.

Figure 5.17
SAN JUAN CENTRAL AREA EXISTING TRUCK ACTIVITY-

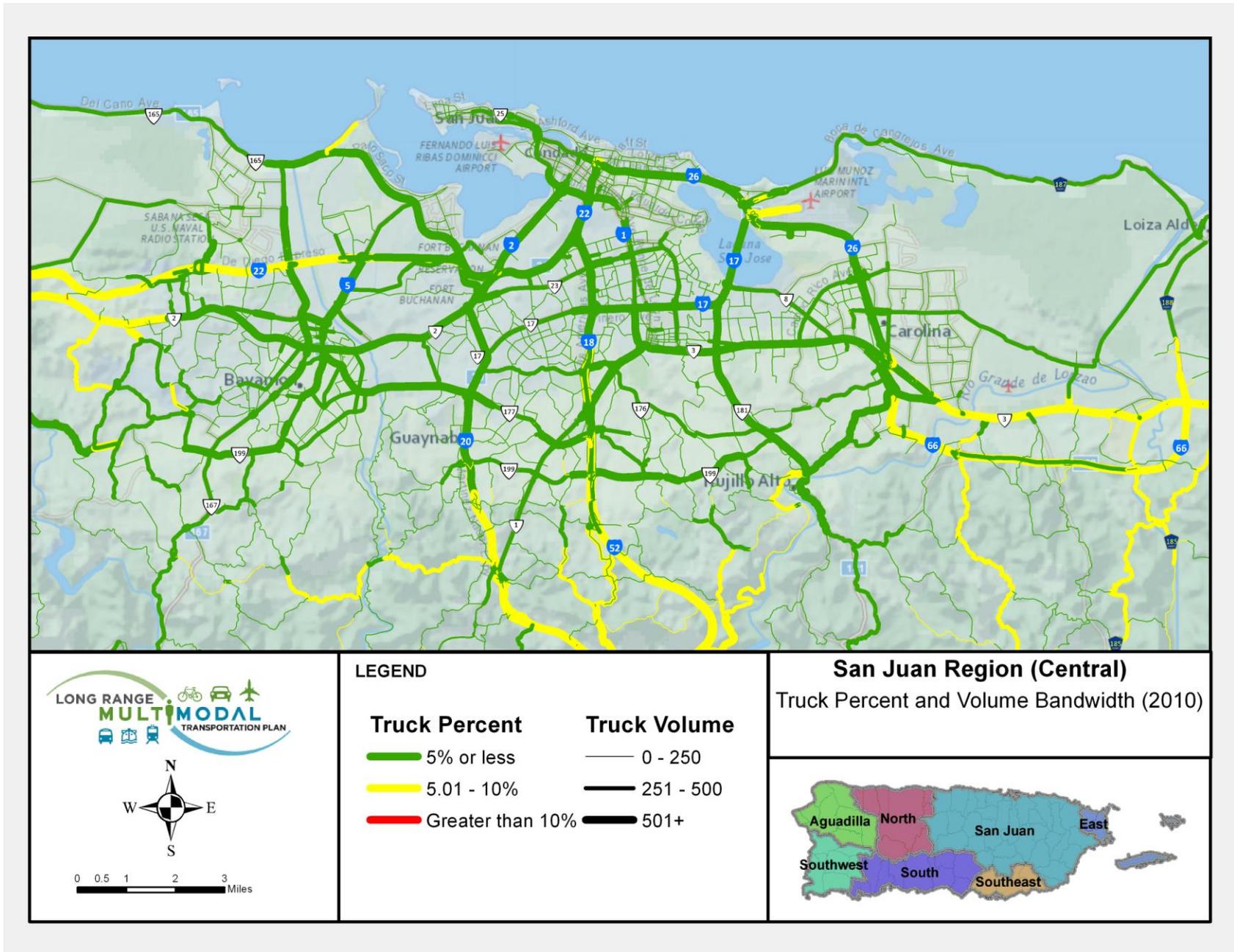


Figure 5.18
ISLANDWIDE FREIGHT NETWORK HOTSPOTS

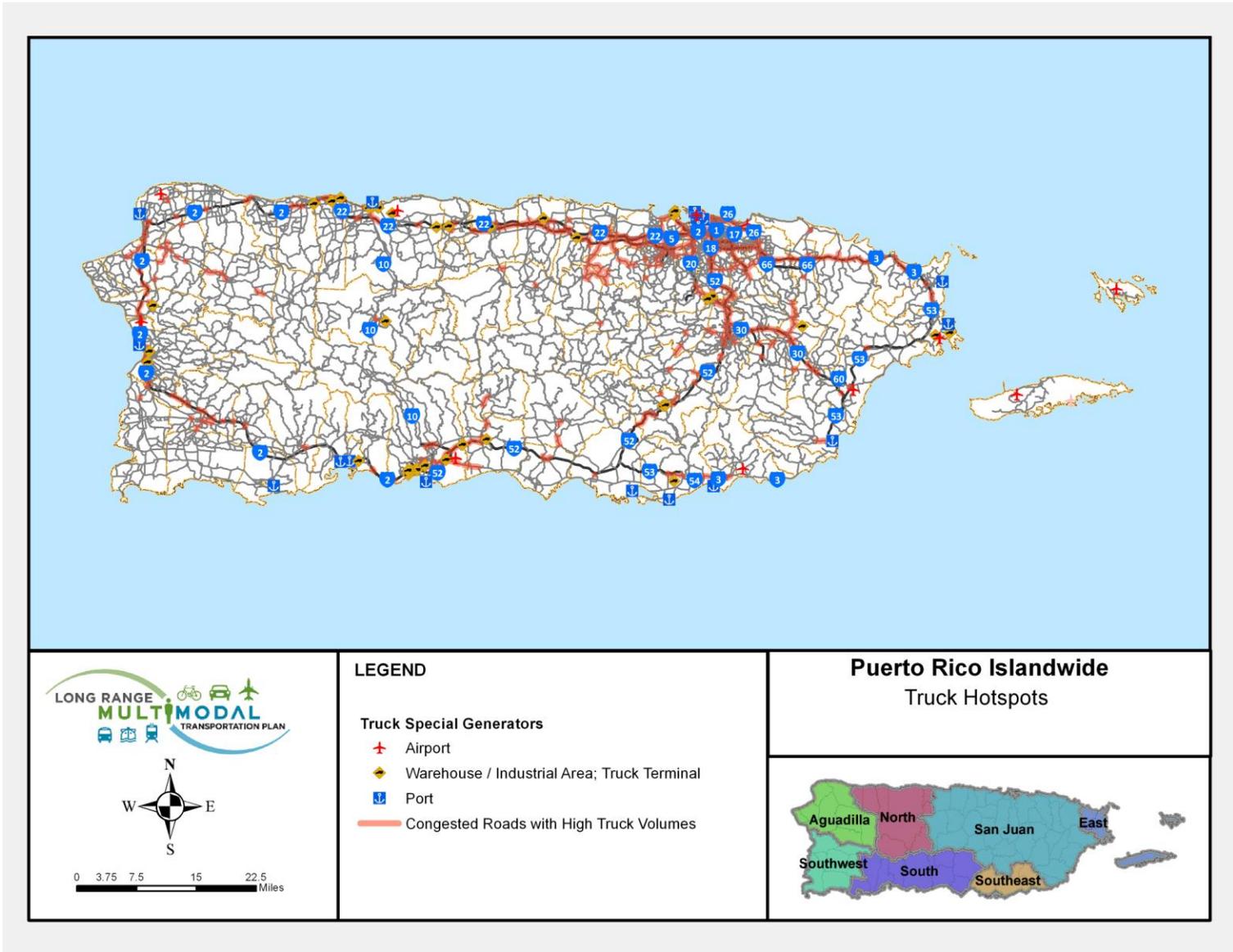
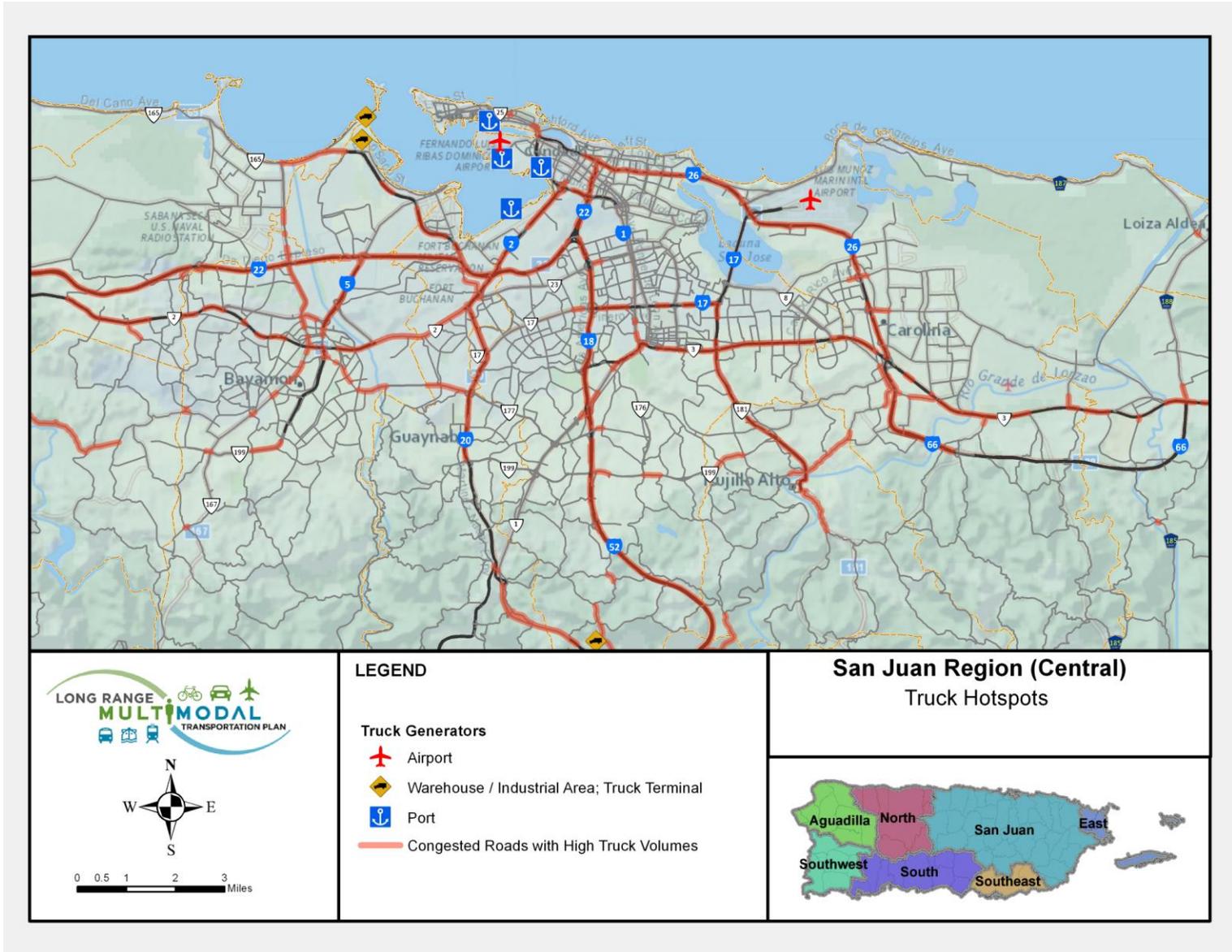


Figure 5.19
SN JUAN CENTRAL AREA FREIGHT NETWORK HOTSPOTS



Freight planning and analysis in Puerto Rico can be structured to reflect the three geographical and functional levels at which freight moves:

- The international flow of imports and exports between the island and the rest of the world, primarily by ship, but with significant air-freight for time-sensitive cargoes.
- The collection and distribution of freight within the island, primarily by truck but also by coastal vessels, between ports, airports, communities, and major industrial and agricultural activities.
- The collection and distribution of freight within major urban areas, exclusively by truck, between specific generators and consumers of the goods and materials that comprise the freight shipments.

Intra-island truck freight traffic is concentrated in the circumferential coastal highway corridor (PR-2, 22, 3, and 53) and the three principal cross-island corridors (PR-52, 30, and 10). Major routes within the San Juan region, especially near the Port of San Juan, exhibit truck percentages do not exceed 5 percent of total daily traffic in the core area, but range up to 10 percent in the urban fringe. Caguas emerges as a significant focus of truck activity as a result of its strategic location at the junction of the PR-30 and PR-52 corridors and the extensive commercial and industrial activity in and around the city. Radiating southwest from Caguas to Cidra, PR-172 is a significant freight corridor in this area.

On the south coast, Ponce is another hub of truck freight traffic. In addition to truck traffic generated by the Port of Ponce, the PR-52 corridor brings trucks from the San Juan region and the rest of the island to the Ponce area. Humacao on the east coast and Mayagüez on the west coast are also significant centers of truck activity.

5.7 Transportation Issues and Needs

5.7.1 Overview

As noted in the beginning of Chapter 2, several important trends and forces are shaping the challenges to which the transportation system needs to respond. While the forecasts for population and employment growth are modest, given the recent population loss, and vehicle miles of travel and person trips are expected to grow about 11 percent by 2040, network analysis shows that even this growth will put greater demand pressures on the transportation system, and a gradual worsening of traffic service and congestion.

The Puerto Rico transportation system, like many state transportation systems, has labored under an extended period of insufficient financing to properly fund ongoing maintenance, modernization, and development of the transportation system. Over an extended period, this leads to what is called a “backlog” of needs, transportation investment that would have occurred and should have occurred were funds available. This accruing need causes a decline in the condition of the highway system (pavement condition, bridge condition, extent of poor traffic service), and represents an overdue investment to maintain and improve the system to a minimally acceptable condition.

This is a primary challenge of the transportation system in Puerto Rico, not unlike many states on the mainland. The situation has been exacerbated in recent years by a weakened economy, increased gas prices, and the growing cost of transportation improvements and operations, which have put the squeeze on investment decisions from both the availability of funding and the cost to implement – fewer funds to be spent on more costly needs.

This challenge extends across all the modes, and across the entire island. Significant sections of the strategic highway network in Mayagüez in the west, from Mayagüez to Hatillo in the northwest, from

Rio Grande to Fajardo in the northeast, and from Yabucoa to Guayama in the southeast are not completed. The strategic highway network is important to the general economy of Puerto Rico, to the freight trucking and distribution industry, and to tourism islandwide.

There is a pressing need to focus on the Congestion Management Program in the San Juan region, and Aguadilla as well, applying a mix of capacity, operational, and travel demand management strategies to achieve incremental reductions in congestion. Likewise, as part of this strategy, new premium transit corridors and additional bicycle/pedestrian facilities are needed to provide more alternative mode choices. Some of these same needs apply to the smaller urban areas of the island as well.

Part of the solution also lies in working the transportation-land use connection, serving those markets of the population with a willingness and desire to reduce their energy and cost footprint, by using autos less and by walking and using transit more. Livability and transit-oriented development policies and initiatives, targeted marketing to the willing audience, and development of the first prototype projects to demonstrate the merit and value of these policies are part of the transit demand management approach, and support the concept of promoting sustainability.

The synopsis of this analysis includes the following:

- Demand continues to grow, albeit modestly in recent times.
- Needs are increasing, and unfulfilled needs are accumulating.
- Traditional funding sources are declining, and continued reliance on borrowing is problematic.

So broadly, these planning responses present themselves:

- Doing more with less.
- Reducing or moderating system demand.
- Making intelligent and strategic investment choices.
- Seeking opportunities to increase revenues and reduce costs.

These and other strategies are considered in the formulation of recommendations and directions for this transportation plan.

Based on the analysis of trends and forces, of the projected travel demand, and of financial resources, the principal challenges confronting the Puerto Rico transportation system include the following:

- **Basic mobility and accessibility for quality of life.** Transportation is the lifeblood of the daily activities of the public, commerce, freight, government, schools, medical centers, and dozens of other social resources. Changes in the age and income profiles of the population will cause changes in transportation system needs. Lower income and elderly citizens have greater reliance on transit and social service agencies for mobility. Younger members of society are placing more importance on proximity and convenient access to daily needs and lifestyle as opposed to commuting by auto. Providing for the mobility needs of all users is essential in contributing to the quality of life of all citizens.
- **Regional connectivity.** Important projects remain on the strategic highway network to complete quality transportation connectivity between the regions. Missing segments in the west and northwest of the island and the southeast as well as needed capacity improvements on several completed segments are important priorities, relating to freight mobility, tourism, and economic competitiveness. Developing more interconnections within and between modes can expand travel choices and help make more efficient use of the entire built infrastructure.

- **Trade and tourism.** While Puerto Rico’s transportation system is the envy of other Caribbean islands, continuous coordination with stakeholders in freight and cargo movements (manufacturers, shippers, seaports and airports) and the tourism industry are vital to maintain and advance Puerto Rico’s standing in these industries which are critical economic engines for the island. A well-functioning transportation system with good access to trade and tourism portals and good domestic accessibility are important ingredients to capturing and keeping market shares.
- **Reshaping the land use-transportation equation.** Despite the high value placed on environmental preservation, the island has experienced two decades of widespread suburbanization of its urban centers, while declines have occurred in many city centers and traditional town centers. Completion of the islandwide land use plan is a priority, followed by the institution of policies to incentivize redevelopment of city centers and reduction of sprawl.
- **Financial sustainability for transportation investment.** The erosion of the buying power of traditional transportation funding sources, coupled with the use of interim borrowing, has hampered the formulation of workable, longer term strategies for consistent funding of transportation needs, both for ongoing maintenance, preservation, and modernization, and for investment in strategic new capacity projects for all modes. A comprehensive restructuring of financing sources and strategies would facilitate a more focused implementation approach to priority needs, and is the key to opening the door to a more sustainable flow of funds for heightened investment in transportation in Puerto Rico.
- **Developing more capacity for alternative modes:** The relatively low level of available funds for system expansion, coupled with the need to identify sources of funds for operating costs, have hampered the development of transit, bicycle and pedestrian facilities. Creative multimodal projects, such as the PR-22 dynamically tolled lanes with bus rapid transit services and a new park-and-ride lot, are one approach to leveraging the use of highway capacity improvements for alternative modes. Improvements to transit system reliability and connectivity, coupled with urban livability initiatives, should over time expand the role of transit in meeting mobility needs.
- **Environmental sustainability.** The management of the transportation system can support environmental sustainability, and the PRHTA and MPO can play active roles in this effort by implementing travel demand management strategies, developing alternative travel choices, advancing the congestion management process, and proactively participating in the Governor’s new initiatives for climate change, greenhouse gases, and sustainability. Integration of transportation investment decisions with the pending land use master plan is another important strategy to support sustainability.
- **Safety and Security.** The emphasis on safety improvements, educational publicity, and enforcement over the last decade has reduced fatalities on the highway system. More can be done, however, to integrate transportation system management with safety and security initiatives for all modes, including disaster evacuation, emergency response, and the daily use of the transportation system.

Responding to these challenges in Puerto Rico requires the leadership of several transportation agencies, most notably the DTPW/PRHTA in partnership with the Puerto Rico MPO, which is responsible for formulating the LRTPs for the two TMAs and five TPRs within the Commonwealth.

In developing recommended transportation investments in each region for the 2013-2040 plan timeframe, the MPO, working with PRHTA, considered the goals and objectives that were established for the plan, within the following limitations:

- The level of available transportation investment funds.

- Developing a cost-constrained plan for each TMA and TPR.
- The capital costs of candidate projects.
- The completion of projects initiated in the short-term.

Given that the geography of the two TMAs and five TPRs comprises the entire area of Puerto Rico, the seven LRTPs prepared for these regions collectively then define the entirety of the future investment program of the DTPW/PRHTA for the 2013-2040 timeframe. As a result, these regional LRTPs essentially fully account for the cost-feasible investments that are before the DTPW/PRHTA over the 2013-2040 time period.

The development of these MPO plans was constrained by the level of transportation funds available for investment in the transportation system, for both non-capacity programs including safety, bridges, and system preservation, and for capacity improvements to the transportation system. The level of funds available for transportation investment, operations, maintenance, and improvement is discussed in Chapter 6. Reflecting this foundation, the following narrative summarizes the proposed transportation investments across the respective regions for 2013-2040 and also describes the performance of the transportation system as a result of these transportation investments.

5.7.2 Recommended Regional Transportation Investments

The tables listing the recommended transportation investments and improvements for the each of the two TMAs and the five TPRs are provided in Appendices N and O. As noted, these cost-feasible investment tables present both funding allocations for non-capacity programs to operate and maintain the existing transportation system, as well as capacity projects that improve the ability of the system to handle the forecasted travel demand in Puerto Rico. The cost-feasible capacity projects for the 2013-2017 period covering the islandwide Construction Improvement Program (CIP) of PRHTA (referred to as Existing Plus Committed Projects), and that for the central San Juan area are shown in Figures 5.20 and 5.21, respectively; the capacity projects for both the 2013-2017 period and the 2018-2040 period for the islandwide and the San Juan central area are shown in Figures 5.22 and 5.23, respectively.

Figure 5.20
ISLANDWIDE EXISTING PLUS COMMITTED NETWORK PROJECTS

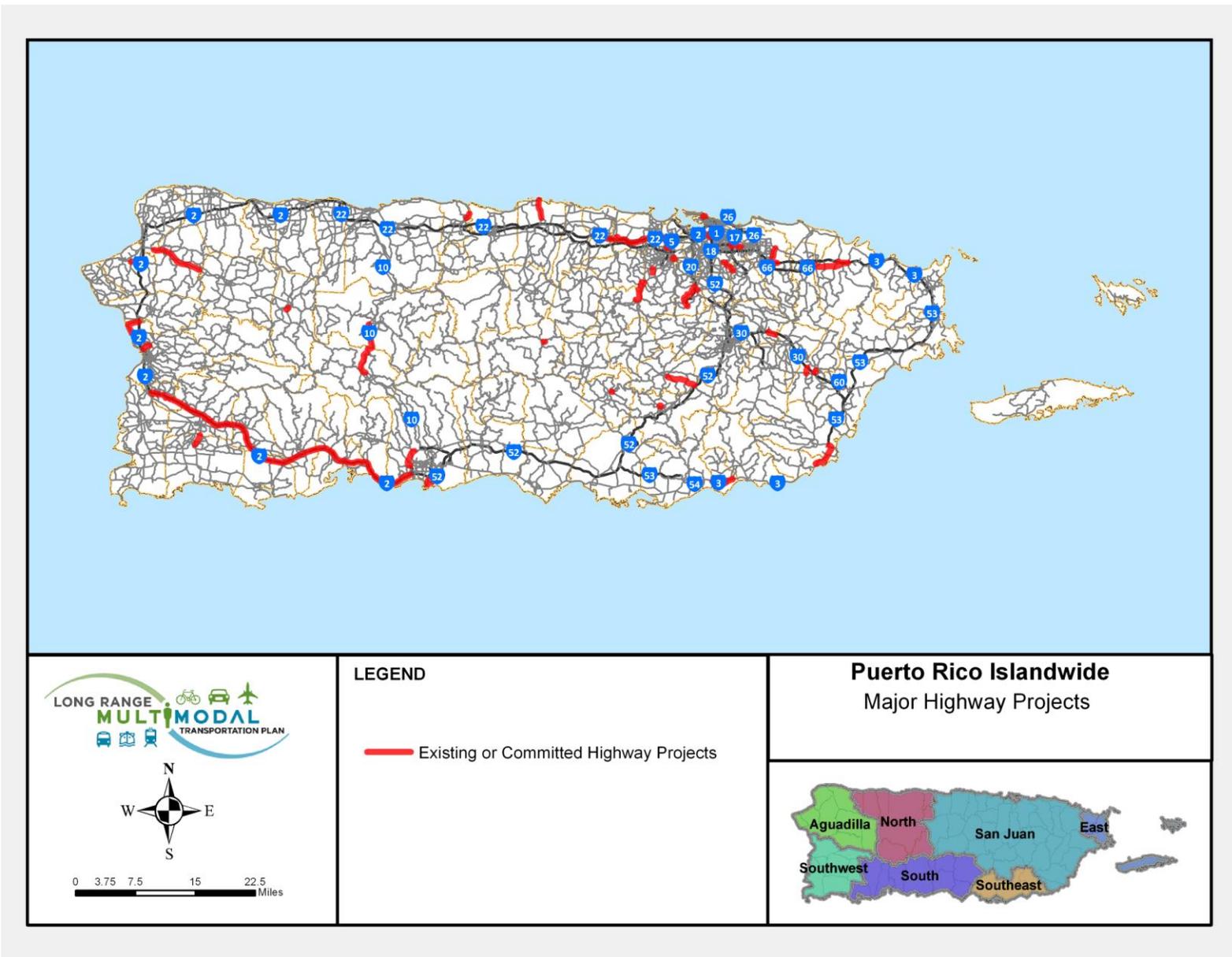


Figure 5.21
SAN JUAN CENTRAL AREA EXISTING PLUS COMMITTED NETWORK PROJECTS

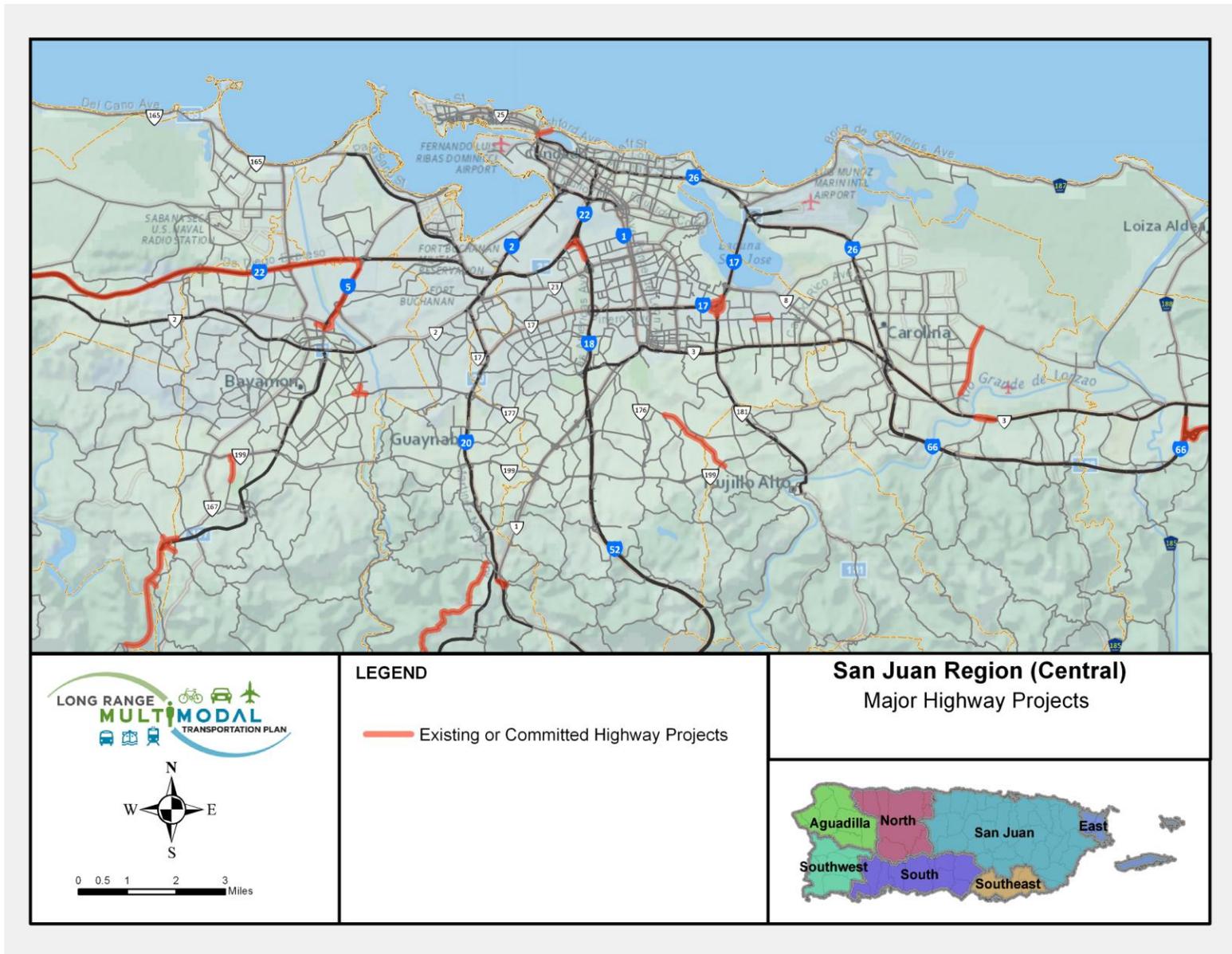


Figure 5.22
ISLANDWIDE 2040 Cost-Feasible Plan

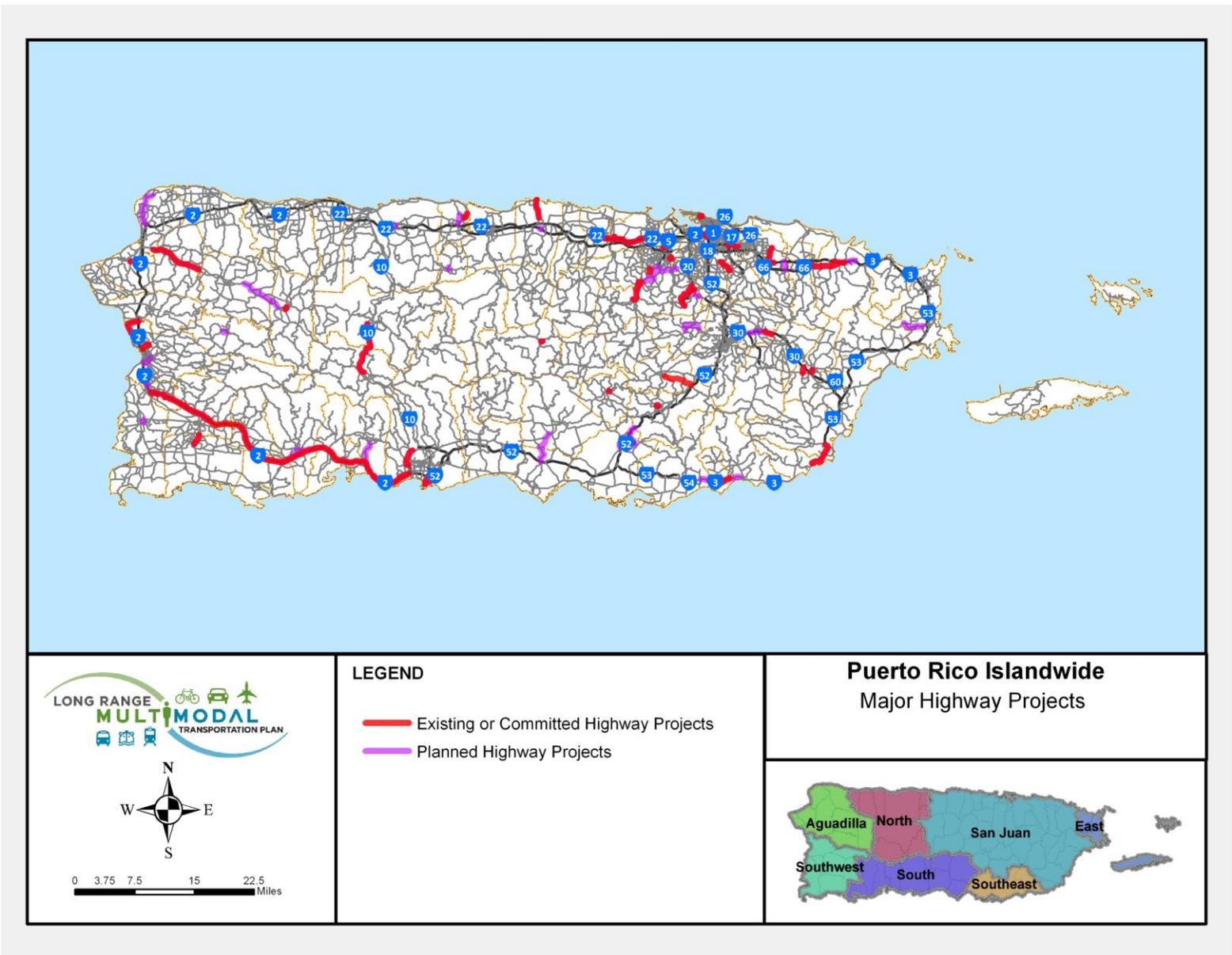
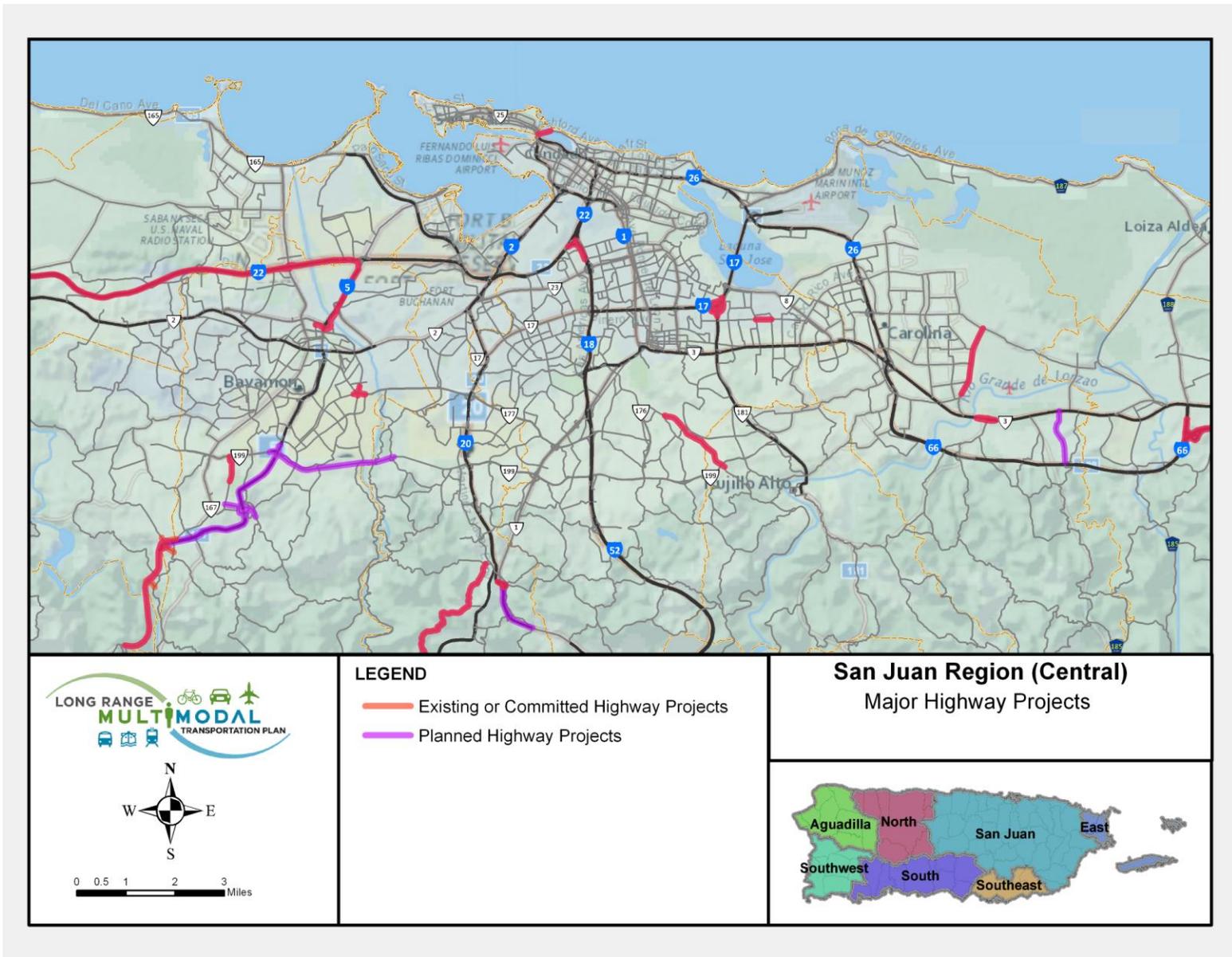


Figure 5.23
SAN JUAN CENTRAL AREA 2040 COST-FEASIBLE PLAN



Among the recommended projects to be developed over the 2013-2017 timeframe (and including projects between the 2010 Base Year and 2013) are:

- **Aguadilla TMA:** PR-111 widening near Moca.
- **North TPR:** Relocation of PR-10 near Utudo and Adjuntas.
- **Southwest TPR:** Several projects along PR-2 to upgrade to expressway standards.
- **South TPR:** Completion the of PR-9 beltway on west side of Ponce, improvement of PR-12 to the Port of the Americas, and projects along PR-2 to upgrade to expressway standards.
- **Southeast TPR:** 3 km. section of PR-53 including a tunnel section, and widening and improvement of PR-3 in Arroyo.
- **East TPR:** No capacity projects.
- **San Juan TMA:** Construction of PR-5 and PR-147 south to Naranjito, PR-22 dynamically tolled lane project with BRT services and park-and-ride lot, construction of the PR-6671 connector in Vega Baja, new connection road from PR-20/PR-167 interchange in Guaynabo, PR-66 extension to Rio Grande, PR-845 widening in Trujillo Alto, and start of construction of the Cidra connector from PR-52.

Among the recommended projects to be developed over the 2018-2040 timeframe-- as well as priority needs for which there are insufficient funds --are:

- **Aguadilla TMA:** PR-111 relocation near San Sebastián, and widening of PR-107 from PR-2 to the international airport; insufficient funds to improve PR-2 or extend PR-22.
- **North TPR:** Completion of the relocation of PR-10 near Utudo and Adjuntas; insufficient funds to improve PR-2 or extend PR-22.
- **Southwest TPR:** Conversion of one segment of PR-2 in Mayagüez to expressway standards; insufficient funds to further improve PR-2 in Mayagüez.
- **South TPR:** Widening of PR-385 connector to Peñuelas, relocation of PR-545 connector to Coamo from PR-52; insufficient funds to improve PR-52 from Juana Díaz to PR-10.
- **Southeast TPR:** Widening a segment of PR-53 to four lanes, construction of a truck lane on PR-52; insufficient funds to further extend PR-53.
- **East TPR:** Widening of PR-977 west of PR-53; insufficient funds to further upgrade PR-3 to expressway standard.
- **San Juan TMA:** Construction of Aguas Buenas bypass, construction of Ave. Las Cumbres from Carlle Borbon to PR-833 in Guaynabo, widening PR-30 from PR-203 to PR-181 in Caguas, extension of PR-5 expressway from PR-199 to PR-167, conversion of PR-3 to expressway east of PR-187 in Río Grande, and completion of construction of the Cidra connector from PR-52; insufficient funds to further extend PR-22 dynamically tolled lanes westward, for extension of PR-53 on south coast, improvement of PR-52 to Caguas, and for a variety of other needed projects.

The capacity projects shown in the preceding figures include a number of highway projects and a few bicycle/pedestrian projects. No specific transit-capacity projects were recommended due to ongoing issues with defining the sources of capital and operating costs. For larger projects in the San Juan region, there is the additional issue of the relatively high cost of proposed projects in relation to the level of funds available for capacity projects. Given the interest in transit and multimodal travel choices by the public, this is a problematic issue in which the DTPW/PRHTA can and must play a role, as discussed further in Chapter 7.

5.7.3 System Performance with the Cost-Feasible Plan

The effect of recommended transportation system capacity improvements in the Cost-Feasible Plan can be assessed by reviewing traffic assignments and other network performance statistics. Figure 5.24 shows the 47 traffic checkpoints selected to provide snapshot of daily traffic volume changes on major roadways across the island. Collectively, they experience 2.64 million daily vehicles in 2010, and 2.89 million daily vehicles in 2040, an increase of 9.3 percent for these locations. This is representative of the travel demand change islandwide where the number of person trips and vehicle miles are both projected to increase approximately 11 percent over the 2010-2040 period.

From Table 5.9, the following changes in traffic volumes and LOS can be observed:

- Traffic volume increases range from 0.4 percent to 134.1 percent with most increases in the range of 2 to 20 percent, or less than 1 percent growth per year.
- There are six increases in traffic higher than 20 percent:
 - Site 9 on PR-10, where the improved road will attract additional traffic.
 - Site 27 on PR-66 east of PR-853, where the PR-66 Phase 2 extension increases traffic.
 - Site 32 on PR-53 south of Humacao.
 - Site 38 on PR-9 in Ponce, where the completed expressway draws more traffic.
 - Site 39 on PR-2 in Ponce, where the increase represents traffic rerouting to use the new PR-9.
 - Site 42 on PR-2 southeast of Mayagüez, where the improved expressway attracts traffic from other routes.
- There are three locations where volumes declined:
 - Site 13 on PR-177 in Bayamón, where the completion of PR-199 to the south diverts some traffic.
 - Site 28 on PR-3 east of PR-187 in Rio Grande. where the extension of PR-66 east diverts some traffic.
 - Site 41 on PR-1 west of PR-52 in Caguas where the decline is only 1.2 percent.
- In terms of traffic service levels:
 - The number of segments at LOS A, B, or C in 2010 is 17 and goes to 14 in 2040.
 - The number of segments at LOS D in 2010 is 6 and goes to 8 in 2040.
 - The number of segments at LOS E in 2010 is 11 and goes to 7 in 2040.
 - The number of segments at LOS F in 2010 is 12 and goes to 18 in 2040.
- In terms of traffic service levels:
 - The number of segments at LOS A, B, or C that stay in that range from 2010-2040 is 13.
 - The number of segments at LOS A, B, or C that decline to LOS D from 2010-2040 is 4.
 - The number of segments at LOS D that stay in that range from 2010-2040 is 2.
 - The number of segments at LOS D that decline to LOS E from 2010-2040 is 4.
 - The number of segments at LOS E that stay at that level from 2010-2040 is 3.
 - The number of segments at LOS E that decline to LOS F from 2010-2040 is 8.
 - The number of segments at LOS F that remain at that level is 10; LOS F can increasingly worsen as it is the bottom end of the traffic service quality scale.
- Overall, traffic volumes generally increase incrementally and more roadway segments operate at a lower level of traffic service. The limited number of added lane-miles to the roadway system is insufficient to offset the increase in travel demand, though modest.
- The majority of locations with LOS E or F are located in the San Juan TMA. This indicates the need to develop plans for transportation-demand management, alternative travel-mode choices, and hybrid transportation solutions like the PR-22 dynamically tolled lanes with BRT service on the west side of the San Juan TMA.

Figure 5.24
TRAFFIC VOLUME CHECKPOINTS

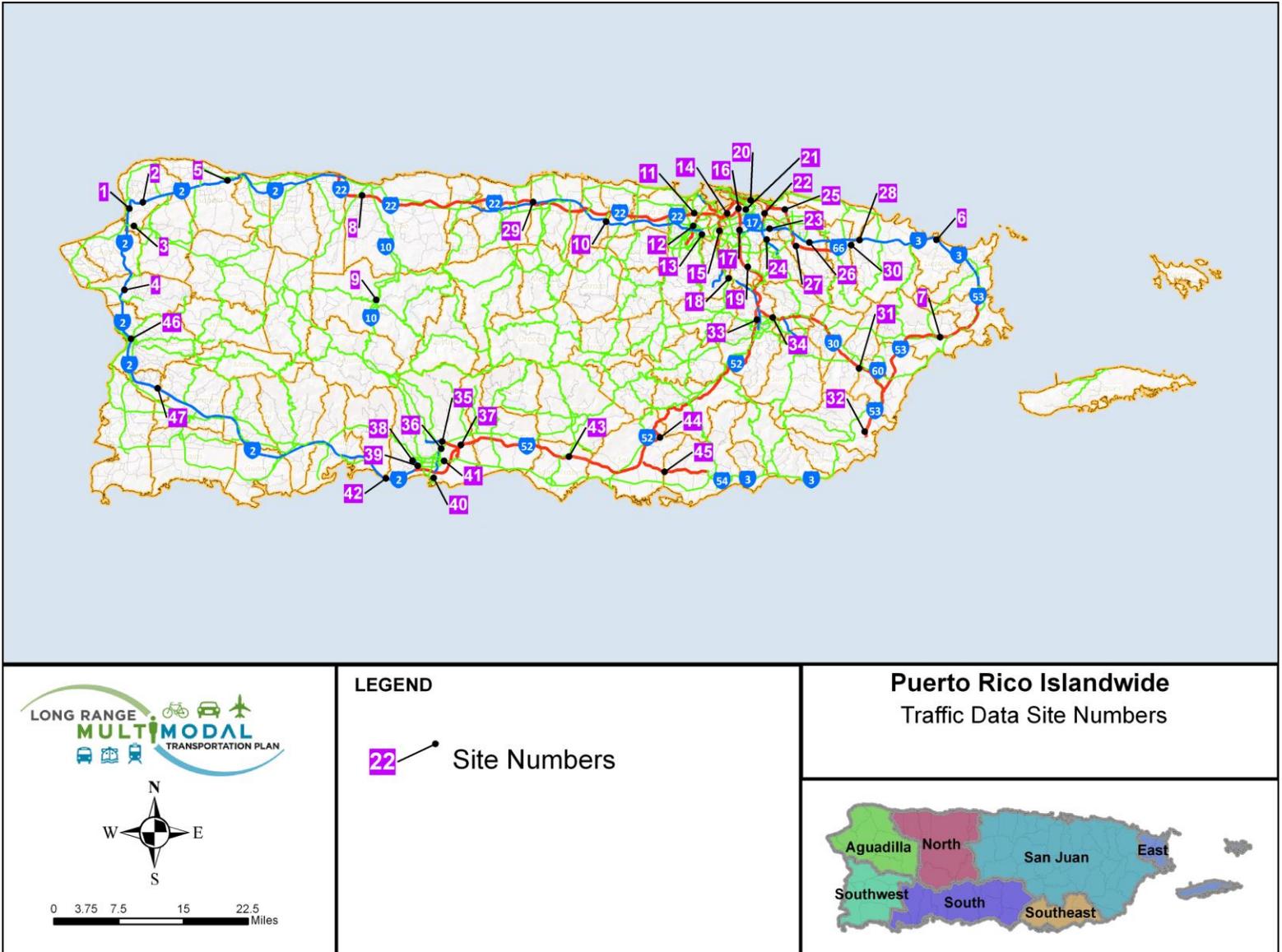


Table 5.9
TRAFFIC VOLUME CHANGES AT SELECTED LOCATIONS 2010 AND 2040

Site No.	Roadway	Location	2010 Daily Traffic	2010 Level of Service	2040 Daily Traffic	2040 Level of Service	Traffic Change 2010-2040	Percent Traffic Change 2010-2040
1	PR-2	North of PR-2R (Calle San Carlos)	30,800	C	33,200	C	2,400	7.8%
2	PR-2	East of PR-443	30,000	B	32,700	C	2,700	9.0%
3	PR-111	West of PR-443	27,200	C	35,000	D	7,800	28.7%
4	PR-2	North of PR-110 (Añasco)	40,900	E	42,900	F	2,000	4.9%
5	PR-2	North of PR-113 (Quebradillas)	30,900	B	32,600	B	1,700	5.5%
6	PR-3	East of PR-992	31,800	C	37,200	C	5,400	17.0%
7	PR-53	West of PR-973	31,800	B	35,400	C	3,600	11.3%
8	PR-22	East of PR-10 (Arecibo)	53,500	D	56,100	D	2,600	4.9%
9	PR-10	North of PR-5516 (Adjuntas)	2,500	A	4,400	A	1,900	76.0%
10	PR-2	East of PR-165 (Toa Baja)	21,900	F	22,700	F	800	3.7%
11	PR-22	West of PR-5 (Bayamon)	113,600	F	114,500	F	900	0.8%
12	PR-5	South of PR-6 (Bayamon)	97,600	F	99,300	F	1,700	1.7%
13	PR-177	At Rio Bayamon	47,600	D	44,100	D	-3,500	-7.4%
14	PR-2	North of PR-22 (San Juan)	102,300	E	108,700	F	6,400	6.3%
15	PR-20	South of PR-22 (San Juan)	104,300	F	113,700	F	9,400	9.0%
16	PR-22	South of PR-1 (San Juan)	165,300	F	173,500	F	8,200	5.0%
17	PR-18	South of PR-17 (San Juan)	159,300	E	168,600	F	9,300	5.8%
18	PR-1	South of PR-173	48,300	F	51,000	F	2,700	5.6%
19	PR-52	South of Ave. Montehiedra	83,200	E	87,600	F	4,400	5.3%
20	PR-26	West of PR-187	139,100	E	143,200	F	4,100	2.9%
21	PR-1	South of Martin Peña Channel	50,700	E	57,000	F	6,300	12.4%
22	PR-17	South of PR-26 (San Juan)	34,800	B	40,800	B	6,000	17.2%
23	PR-3	East of PR-181 (San Juan)	83,600	F	85,500	F	1,900	2.3%
24	PR-181	North of PR-876	39,600	E	40,800	E	1,200	3.0%
25	PR-26	East of PR-17 (Carolina)	109,800	E	110,200	F	400	0.4%
26	PR-3	West of PR-853	86,400	F	100,000	F	13,600	15.7%
27	PR-66	East of PR-853	33,700	E	42,300	F	8,600	25.5%
28	PR-3	East of PR-187	57,400	F	49,200	D	-8,200	-14.3%
29	PR-22	West of PR-37 (Vega Baja)	41,500	D	46,400	E	4,900	11.8%
30	PR-66	East of PR-187 (Caguas)	0	-	30,400	C	30,400	N/A
31	PR-30	Southeast of PR-52 (Caguas)	68,900	D	73,700	E	4,800	7.0%
32	PR-53	South of PR-906	30,800	B	43,300	C	12,500	40.6%
33	PR-52	South of PR-30	96,300	E	100,100	E	3,800	3.9%
34	PR-30	Southeast of PR-52	98,600	F	105,200	F	6,600	6.7%
35	PR-10	West of PR-14	32,800	C	37,900	C	5,100	15.5%
36	PR-14	South of PR-14	19,800	E	20,200	E	400	2.0%

Site No.	Roadway	Location	2010 Daily Traffic	2010 Level of Service	2040 Daily Traffic	2040 Level of Service	Traffic Change 2010-2040	Percent Traffic Change 2010-2040
37	PR-52	North of PR-10	78,900	F	81,900	F	3,000	3.8%
38	PR-9	North of PR-2	8,200	B	19,200	D	11,000	134.1%
39	PR-2	East of PR-2R	19,400	C	24,400	D	5,000	25.8%
40	PR-12	South of PR-52	26,300	D	28,300	E	2,000	7.6%
41	PR-1	West of PR-52	58,000	C	57,300	C	-700	-1.2%
42	PR-2	Between PR-385 and PR-127	40,900	F	62,600	D	21,700	53.1%
43	PR-52	East of PR-153	43,000	C	46,600	C	3,600	8.4%
44	PR-53	East of PR-753	26,200	B	27,800	B	1,600	6.1%
45	PR-52	North of PR-712	24,900	B	28,300	B	3,400	13.7%
46	PR-2	Rio Vaguez Bridge (Mayagüez)	34,900	D	42,900	E	8,000	22.9%
47	PR-2	Between PR-330 and PR-245 (Lavadero)	36,900	C	52,500	D	15,600	42.3%
		TOTAL of All Checkpoints	2,644,200		2,891,200		247,000	9.3%

NOTE: Level of Service is for the worst period of the day.

Table 5.10 compares the traffic assignment and LOS results and supporting model output documentation between:

- The 2010 Base Year (the reference year for the travel-demand model calibration).
- The 2040 Existing plus Committed (E+C) Project Condition (which includes projects in the 2013-2017 CIP plus projects developed between the 2010 base year and the start of the CIP, and reflects the 2040 demographics).
- The 2040 Cost-Feasible Plan Condition (which includes the E+C and the 2018-2040 cost-feasible projects).

This comparison reveals shifts in the measures of effectiveness due to changes in travel demand and in the transportation network.

The results of the performance measure comparison between the 2010 Base Year and the 2040 E+C Project condition leads to several observations:

- Person trips and vehicle trips increased 11.2 percent and 11.3 percent, respectively. Vehicle miles of travel increased 11.3 percent and vehicle hours of **travel 3 percent**, yielding a decline in average system speed of 3.4 percent.
- These types of changes mean that traffic took advantage of new roadway capacity and new travel links, with longer trip lengths in some instances, yielding a slightly lower system travel speed. This indicates that the extent of capacity improvements did not keep pace with increases in travel demand.

Table 5.10
ISLANDWIDE COMPARISON 2040 EXISTING PLUS COMMITTED NETWORK WITH COST-FEASIBLE PLAN

Measures of Effectiveness	2010 Base Year	2040 E+C	2040 Cost-Feasible Plan	Percent Change 2010 Base to 2040 E+C	Percent Change 2040 E+C to 2040 Cost-Feasible Plan
SYSTEM PERFORMANCE					
Average network speed	23.0	22.2	22.3	-3.4%	0.5%
Total transit passengers per route mile	20.6	23.8	24.2	15.5%	1.7%
% non-motorized trips	6.0	5.9	5.9	-1.7%	0.0%
% transit trips	2.4	2.4	2.5	0.0%	4.2%
Average highway trip cost	\$1.69	\$1.70	\$1.70	0.6%	0.0%
Average transit trip cost	\$0.99	\$1.00	\$1.00	1.0%	0.0%
% Population within 0.5-mile walk to transit	35.4	35.4	35.4	0.0%	0.0%
% Employment within 0.5-mile walk to transit	57.4	57.5	57.5	0.2%	0.0%
Vehicles hours of delay	383,553	516,406	504,296	34.6%	-2.3%
Vehicle hours of travel/1000 vehicle miles of	43.5	45.0	44.7	3.5%	-0.6%
VMT above capacity	1,422,348	2,092,128	2,023,677	47.1%	-3.3%
Speed on limited access roads and expressways	29.5	29.0	29.1	-1.7%	0.3%
Gallons of fuel consumed	3,055,119	3,413,452	3,423,232	11.7%	0.3%
SYSTEM USAGE					
Vehicle miles of travel	54,862,038	61,066,076	61,256,726	11.3%	0.3%
Vehicle hours of travel	2,383,552	2,747,146	2,740,931	15.3%	-0.2%
Average network speed	23.0	22.2	22.3	-3.4%	0.5%
Person trips	6,072,018	6,752,972	6,753,068	11.2%	0.0%
Vehicular Trips	5,890,399	6,592,518	6,592,383	11.9%	0.0%

- The vehicle miles of travel that occur on road segments that are over capacity and the vehicle hours of delay both increased significantly, by 47.1 percent and 34.6 percent, respectively. There are also slightly more hours of travel per 1,000 miles of travel, which is a negative shift.
- Average speed on expressways and toll roads decreased slightly, as did the overall system speed, reflecting capacity improvements that were made.
- Fuel consumption increased 11.7 percent, in proportion to an increase in vehicle miles of travel.
- Average trip cost for the highway mode and transit mode were unchanged.
- The percent of transit trips did not change. Non-motorized trips showed a small percentage decline.
- A significant increase in total transit passengers per route mile of 15.5 percent was seen.
- The percent of population and the percent of employment within easy access of transit were essentially unchanged.

The results of the performance measure comparison between the 2040 E+C Project Condition and the 2040 Cost-Feasible Plan Condition lead to several additional observations:

- For essentially the same number of daily person trips and vehicular trips as the 2040 E+C Condition, the average network speed increased by a small increment, while vehicle miles of travel edged up slightly and vehicle hours of travel declined slightly.
- These types of small changes mean that traffic took advantage of new roadway capacity and new travel links, with longer trip lengths in some instances. Because of the limited number of projects, there was not a large change in these parameters from the 2040 E+C Condition.
- The vehicle miles of travel that occur on road segments that are over capacity and the vehicle hours of delay both decreased noticeably, by 3.3 percent and 2.3 percent, respectively. There are also slightly fewer hours of travel per 1,000 miles of travel, which is a positive shift.
- Average speed on expressways and toll roads increased slightly as did the overall system speed, reflecting the effect of capacity improvements.
- Fuel consumption increased slightly, and in proportion to an increase in vehicle miles of travel.
- Average trip cost for the highway mode edged up slightly, with no change for the transit mode.
- The percent of transit trips and non-motorized trips did not change.
- A slight increase in total transit passengers per route mile was seen.
- The percent of population and the percent of employment within easy access of transit both were unchanged.

Overall, there was a small improvement on the highway travel side in terms of reduced delay and in vehicle miles of travel under congested conditions, reflecting the beneficial impact of recommended highway projects. This improvement involved slightly higher vehicle miles of travel as traffic redistributed to take advantage of new network capacity. There was essentially no change in parameters related to transit as no meaningful transit projects came on line.

5.7.4 Conclusions

The results of the 2040 Cost Feasible Plan Condition versus the 2040 E+C Project Condition indicate that improvements in network performance can be achieved, but that the level of investment in transportation system capacity improvements must be much greater to achieve more significant progress in reducing congestion and in providing alternative mode choices for travel decisions. Unfortunately, the level of funds available precluded a more comprehensive approach to addressing network improvement needs across all the modes.

Because of the level of funds available for investment in relation to the costs of candidate projects and other funding constraints, and since transit projects could not be recommended at this time due to insufficient capital funds, no commitment on operating funding sources, or both, the regional LRTP plans endeavored to identify prudent and productive projects as noted earlier in this section.

Going forward, the key to a transportation investment program that is more responsive to identified needs is to develop expanded or new sources of funding, as discussed in Chapter 7. Accomplishing this objective would enable the capture of many opportunities for the development of multimodal corridors; strategic corridor improvements benefiting freight, tourism, and general traffic; alternative travel choices; and a more interconnected transportation network.

Chapter 6

FINANCIAL RESOURCES

6.1 Overview of Puerto Rico Transportation Finance

The purpose of this chapter is to present background on how transportation in Puerto Rico is funded, discuss the sources of transportation funding, explain the basis for forecasting transportation revenues to 2040, and summarize the forecasts of transportation revenue sources and the uses to which those revenues will be put. This chapter also introduces the requirement that this transportation plan covering 2013-2040 must be cost-feasible, that is, the expenditures on transportation operations and improvements must be constrained to the level of revenues that can reasonably be expected to accrue.

6.1.1 Transportation Financing Responsibilities

Two agencies are responsible for the construction and maintenance of transportation infrastructure in Puerto Rico at the islandwide level, both under the Department of Transportation and Public Works (PR DTPW): the Puerto Rico Highways and Transportation Authority (PRHTA) handles planning, design and development of all highways, expressways, and toll freeways as well as major reconstructions and even some major transit systems, while the Public Works Directorate (PWD) repairs and maintains all highways on the island, except the toll freeways and expressways. The work of these bodies is complemented by other projects developed by municipalities and private parties, in some cases as part of new developments.

The contrast between these two entities is distinct, with PRHTA having several sources of dedicated funds and the PWD being dependent on annual appropriations from the Legislature. Since almost all of the investment in Puerto Rico's transportation system is by the PRHTA, the resources of this public corporation are the main focus of this financial analysis.

PRHTA is responsible for the construction of the highways in Puerto Rico and, in the case of the toll roads and expressways; it is responsible for both construction and maintenance. PRHTA has several sources of revenue and the ability to issue bonds against those sources. In addition to highway-building responsibilities, PRHTA is implementing intelligent transportation system (ITS) technologies and traffic control on the expressways of San Juan and proposing ITS for other areas such as Aguadilla as well as funding numerous other transportation initiatives. Further, PRHTA is a multimodal agency, with direct responsibilities in metropolitan planning and the development and operation of major transit systems, including the Tren Urbano regional metro and Metrobús (a privately operated bus system). During the past years, PRHTA has also supported the operation of some AMA (Metropolitan Bus Authority) routes and part of AMA's handicapped (paratransit) bus service.

PRHTA is the designated recipient (DR) of both Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) funding for Puerto Rico and is a grantee of both federal agencies including for some sections under FTA funds (Sections 5303, 5310, and 5311). As the DR for the FTA funds (Sections 5307, 5316, and 5317), the PRHTA distributes all these funds throughout Puerto Rico through federal planning and programming regulations. Those municipalities and agencies that receive funds directly from FTA through the Metropolitan Planning Organization (MPO) planning process are responsible for complying with all the applicable FTA program regulations.

Several PRHTA offices respond directly to the Secretary of Transportation and Public Works and assist the Secretary in all functions and responsibilities, including acting as operating arm and support of the MPO for all of Puerto Rico's urbanized and metropolitan areas. The MPO plays a vital and continuous

role identifying projects that can improve all aspects of the transportation system (road, transit projects, freight, etc.).

6.1.2 Historic Background

The previously approved 2031 and 2032 Long Range Transportation Plans (LRTP) for Puerto Rico's two transportation management areas (TMA) and five transportation planning regions (TPR) were based on future year funding expectations and strategies of the time. The resulting islandwide financial forecast was the basis for the cost-feasible plans documented in the regional LRTPs approved between January 2011 and May 2012, including the one for this region. Major changes in general economic conditions, however, have resulted in a significant downward adjustment of the transportation revenue outlook.

Particularly during the Fiscal Year (FY) 2005-2010 period, the local and global economic situation worsened, affecting PRHTA's funding capacity to the degree that PRHTA's outstanding bonds were severely downgraded and bonding markets became inaccessible to the agency. Furthermore, and partly because of said changes, the PRHTA suffered a serious budgetary situation. In an agreement with the Government Development Bank (GDB), interim financing was provided. This approach was reflected in the LRTPs approved over the FY2011-2012 period. This prior budgetary situation further shapes the financial strategy to be applied in the 2040 LRTPs.

The declining effectiveness of the fuel-based tax revenues, coupled with the global economic downturn, affected PRHTA's funding capacity, resulting in a reduction of revenue at a time when investment and operational costs continued to rise, particularly during the FY2005-2009 period. Major agency revenue sources were adversely impacted, including toll receipts and gasoline taxes, resulting in a drop of \$21.5 million in PRHTA total revenues from FY2007 to FY2009.

After FY2005, energy costs started to rise following many years of crude oil price stability, when the average price of crude oil (West Texas Intermediate (WTI)) rose over \$50 per barrel. These higher costs affected PRHTA revenues as vehicle miles traveled (VMT) declined, yet transit consumption and farebox revenues increased.

The economic recession had a larger negative impact on the Commonwealth than it did in the continental U.S. In Puerto Rico, it started almost two years before the U.S. recession in the second semester of FY2006, according to the National Bureau of Economic Research, resulting in a decline of 7.1 percent in real gross national product (GNP) in the FY2005-FY2009 period. By comparison, the U.S. economy grew by 5 percent in the same period. By June 2009, Puerto Rico experienced a loss of 159,000 jobs, a 20 percent decline in manufacturing employment, a 5.5 percent increase in the unemployment rate, a 45 percent drop in car and light truck sales, and a 40 percent fall in cement sales.

The U.S. economy started to recover in the first quarter of FY2010 and the Puerto Rican economy recovery soon followed in the second quarter of FY2010. In addition, the Government of Puerto Rico proactively undertook measures to reduce the fiscal deficit and stimulate the economy with local and federal resources, such as the economic stimulus in the American Recovery and Reinvestment Act (ARRA) funds of \$7 billion that were expended throughout the Commonwealth.

Nevertheless, the low 12 percent population growth over the past 20 years and an out-migration, primarily to the U.S., adversely affected the Commonwealth's economic recovery. In the 15-month period from April 2010 to July 2011, a net 35,469 residents moved out of Puerto Rico. This population loss has translated into lower earnings, less consumption and spending, less demand for cars, lower annual VMT, less gasoline consumption, and lower PRHTA revenues.

In March 2013, PRHTA issued the 2013-2017 Investment Program, including updated financial projections for this period and an updated Construction Improvement Program (CIP). The financial

projections in these documents reflect a sharply different approach to funding of PRHTA operations and transportation improvements over the prior forecasts. They take a much more conservative approach to debt management and capital investments. Consequently, the financial forecasts for the 2040 L RTPs, incorporated the FY2013-2017 financial statement and its budgetary assumptions, using those as a starting point for continuing forecasts to 2040. The result of this approach is sharply reduced spending on transportation and less availability of funds for capital investments.

The following sections of this chapter describe existing and potential sources of funding, current expenditures on transportation, and finally, projections of anticipated revenues and expenditures through 2040. These sections provide financial planning analyses that were conducted to support the 2040 L RTP recommendations. The objectives of this effort are to:

- Analyze past PRHTA revenue forecasts.
- Project PRHTA existing funding sources over the 2040 L RTP period, taking into account economic and demographic factors expected to influence the PRHTA's revenue sources.
- Identify funding gaps between projected revenues and needs.
- Identify potential alternative revenue options for future consideration to close identified gaps, including the introduction of new revenue sources.

6.2 Islandwide Revenue Sources

PRHTA revenue sources consist of two categories: revenues that are pledged for bonding purposes (Pledged Revenues) and revenues that are not pledged (Non-Pledged Revenues). The former consist primarily of a combination of fuel-tax revenues, license fees, toll revenues, and interest earnings, which are pledged to outstanding bonds, whereas the latter consist of federal grants, local appropriations, fines, and impact fees.

Under 2012 estimates, Pledged Revenues make up around 32 percent of total PRHTA revenues, whereas Non-Pledged Revenues make up 27 percent, making the former the dominant funding source. From another perspective, revenues primarily tied to motor fuel consumption, or gas taxes, consisting of the Pledged Revenues (gas tax, petroleum-related taxes), and Non-Pledged Revenues (FHWA and FTA funds), were expected to make up over half of the total 2012 revenues, not including financing.

The key point from these two related observations is that PRHTA's majority revenue sources are tied to local highway usage and local and national motor fuel consumption, both of which show declining growth and/or absolute declines. PRHTA gasoline tax revenues, therefore, were negatively impacted by the significant gasoline price increases from 2006 through 2009, which reduced consumption of gasoline and, thus, gasoline tax revenues. Oil prices are, however, expected to increase in the following years through 2035, affecting both the retail gasoline market and tax collection capacity.⁴

In Puerto Rico, for instance, the average gasoline price increased by 18.14 percent or 47.7 cents per gallon in FY 2011 compared with the FY2010 average price. Prices continued to rise in FY2012 by 15.90 percent or 48.1 cents per gallon, compared with the same period the previous year. In response to gasoline price increases, gasoline consumption dropped 6.8 percent between 2007 and 2011 and is expected to continue dropping. The estimated gasoline consumption for FY2012 was 1,043 million gallons, 2.52 percent below FY2011 gasoline consumption. The drop in gasoline consumption reduced

⁴U.S. Department of Energy, Annual Energy Outlook 2012, June 2012. In the reference case, the average real price of crude oil in 2035 is estimated to reach \$145 per barrel in 2010 dollars, p.24.

PRHTA gasoline tax revenues by 2.55 percent or \$4.43 million in FY2011, and it is estimated to drop another 3.22 percent or \$5.5million in FY2012.⁵

Identified revenues are itemized in Table 6.1, shown in Figure 6.1, and then briefly described.

⁵Much of this discussion is based on work by Dr. Jorge F. Freyre in "Long-term PRHTA Revenue Projections and Alternatives to Increase Funding Resources, (June 30, 2012)," Jorge F. Freyre, Ph.D., President, Applied Research, Inc.

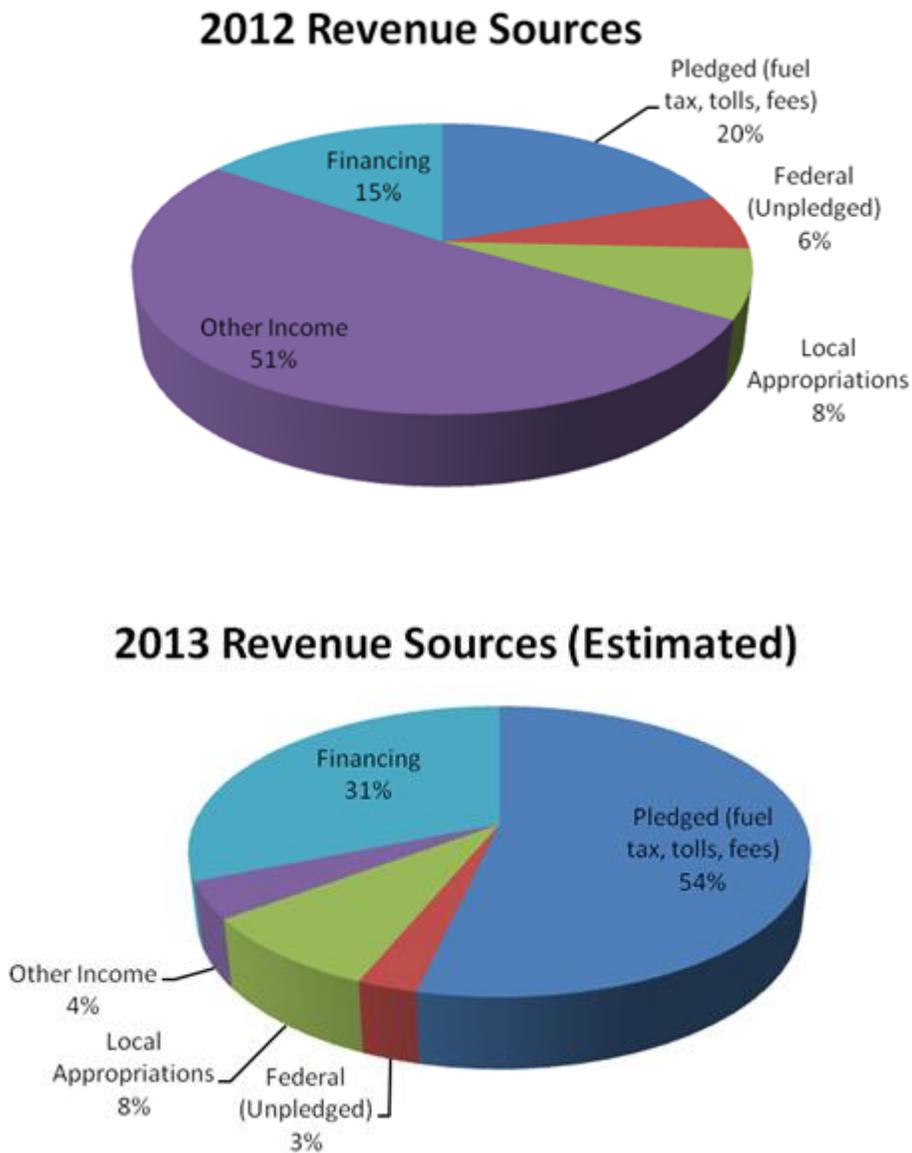
Table 6.1
PRHTA REVENUE SOURCES AND SHARES - 2013 ESTIMATES (\$1,000s)

Revenue Source	2013 Estimated (in \$ Thousands)	Percentage of Total Sources
<u>Pledged Revenues</u>		
Gasoline Tax Revenue	165,930	12
Diesel Oil Taxes	9,500	1
Motor Vehicle License Fees	33,000	2
Toll Revenues	97,420	7
Investment Income 68 Resolution	2,435	0
Total Pledged Revenues - Res. 1968	308,285	22
Petroleum Tax Revenue	92,920	7
Corridor of the East Revenue	26,490	2
Investment Income 98 Resolution (Includes SIB)	11,497	1
Total Pledged Revenues - Res. 1998	130,907	10
Subtotal Pledged Revenues	439,192	32
<u>Non-Pledged Revenues</u>		
Federal Aid - FHWA & Earmarked Projects (Net of Penalties)	230,222	17
Federal Aid-FTA (Sections 5307 & 5309)	19,342	1
ARRA Funds - FHWA	5,582	0
ARRA Funds - FTA	-	0
GARVEE Bonds Federal Aid	12,034	1
Total Federal Funds	267,179	19
Local Appropriations	69,853	5
Total Federal and Local Funds	337,032	24
Transit Revenues	8,894	1
Concession Revenues	-	0
Impact Fee	1,933	0
Interest Earned, Electronic Toll Fines & Other Income	22,799	2
Total Other Income	33,626	3
Subtotal Non-Pledged Revenues	370,658	27
Total Resources	809,850	59
Bond Issues	-	
Financing Fed. Const. Projects - 20 Percent Matching	57,555	4
Financing	507,419	37
GRAND TOTAL	1,374,824	

Source: Based on "Based on PRHTA CIP for 2013-2017.

Figure 6.1 shows the sources of revenue in 2012, which include a large one-time payment from the PR-22/PR-5 concession agreement. The estimated revenue sources show a more representative view of revenue sources, though they do vary over the 2013-2017 five-year period.

Figure 6.1
2012 AND 2013 REVENUE SOURCES



6.3 Pledged Revenue Sources

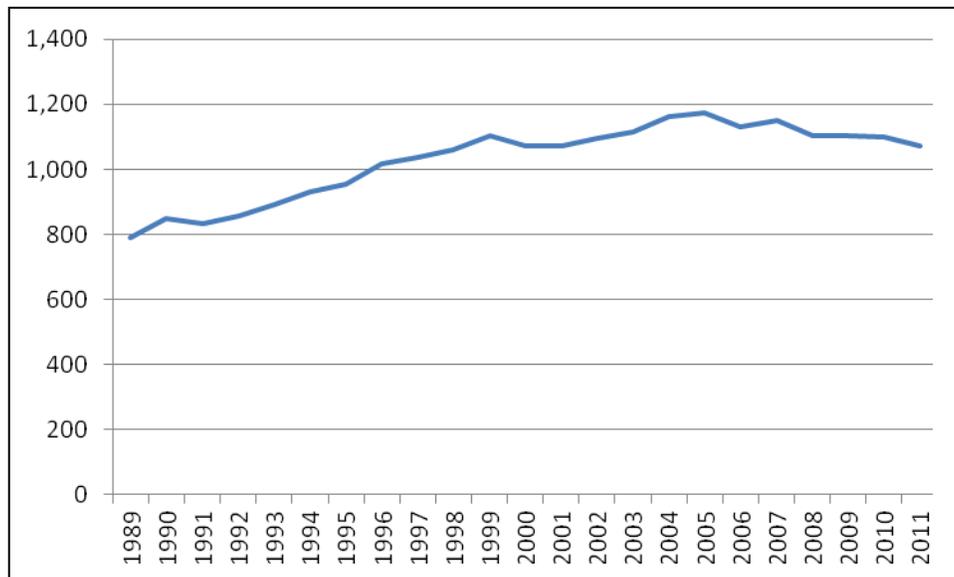
Pledged revenues include gasoline taxes, diesel oil taxes, license fees, tolls, petroleum taxes, and investment income. Each of these sources is discussed in greater detail in this section.

6.3.1 Gasoline Tax Revenues

Gasoline tax revenues are PRHTA's single largest revenue source, estimated at 12 percent of total revenues and over a third of Pledged Revenues in 2013. Gasoline taxes are derived from a \$0.16 fixed charge per gallon measured at 60-degree Fahrenheit on all gasoline sales.

In the last decade, 2001 to 2011, PRHTA gasoline taxes have barely grown, and have actually declined since 2007. Key factors that contributed to this trend were the enactment of Act No.80 of March 15, 2004, which changed the tax calculation of gas at 60-degree Fahrenheit, followed by the great recession and severe energy crisis, reducing gasoline consumption, as depicted in Figure 6.2 below. The continued increase in gasoline prices through 2012, estimated at 18 percent in FY2011 and 17 percent in FY2012, was the main contributor to a decline in gasoline tax revenues for PRHTA in the last years.

Figure 6.2
GASOLINE CONSUMPTION IN PUERTO RICO (1989-2011)



Source: *Econometric Modeling Project, Interamerican University, April 2012.*

This trend reflects a similar tendency throughout the U.S., which is driven by several factors:

- First, the federal gas tax rate has remained at \$0.184 per gallon, since the 1990s, effectively halving the value of this funding source.
- Second, during the recession, VMT declined nationally between 2007 and 2009.⁶ This trend persists as total VMT fell 1.2 percent from the 2010 level, to its lowest level since 2003.⁷

⁶Upward Trend in Vehicle-Miles Resumed During 2009.

- Third, there appears to be growing evidence that younger people in the continental U.S. are less likely to drive and own cars than they have in the past, preferring either to share them, rent them (where examples such as Zipcars are available), take transit, ride bikes, walk instead, or live where their commutes are very short.⁸ This trend has not yet clearly manifested itself in Puerto Rico, however.
- Fourth, more fuel efficient cars, including hybrids, are making up a larger portion of the national fleet as consumers seek such cars due to spikes in gas prices and as hybrids have gained market acceptance. For the same number of VMT, more fuel-efficient cars will generate lower gasoline tax revenues. This is due in part to U.S. Environmental Protection Agency's (EPA) Corporate Average Fuel Economy (CAFE) Standards that impose higher levels of vehicle miles per gallon performance, which further adversely affects fuel-tax revenues over time.

First enacted by Congress in 1975, the purpose of CAFE standards was to reduce energy consumption by increasing the fuel economy of light duty vehicles (LDV). The introduction of CAFE standards for LDVs resulted in an increase in fuel economy from 19.9 miles per gallon (mpg) in 1978 to 26.2 mpg in 1987. Over the two decades that followed, despite improvements in LDV technology, fuel economy fell to between 24 and 26 mpg as sales of light-duty trucks increased from 20 percent of new LDV sales in 1980 to almost 55 percent in 2004. The subsequent rise in fuel prices and reduction in sales of light-duty trucks, coupled with tighter CAFE standards for light-duty trucks starting with make year (MY) 2008, led to a rise in LDV fuel economy to 29.2 mpg in 2010.

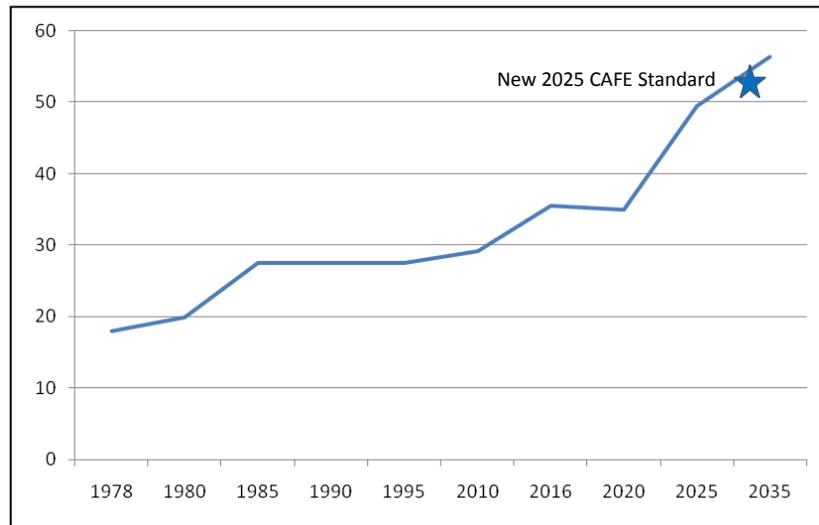
The National Highway Traffic Safety Administration (NHTSA) introduced attribute-based CAFE standards for MY 2011 LDVs in 2009 and, together with the U.S. EPA, in 2010 announced CAFE and green house gas (GHG) emissions standards for MY 2012 to MY 2016, raising average fuel efficiency to the equivalent of 35.5 mpg by 2016. Following other more stringent proposals, the Obama Administration finalized in August 28, 2012, the goal to increase fuel economy to the equivalent of 54.5 mpg for cars and light-duty trucks by MY 2025, a decade earlier than expected, as shown in Figure 6.3.

A Time Series Analysis," Peg Young, Ph.D., Research and Innovative Technology Administration, Bureau of Transportation Statistics, April 2010. http://www.bts.gov/publications/bts_transportation_trends_in_focus/2010_04_01/html/entire.html

⁷"Motor Vehicle Travel Demand Continues Long-Term Trend in 2011", State Smart Transportation Initiative, University of Wisconsin, February 20, 2012, <http://www.ssti.us/2012/02/motor-vehicle-travel-demand-continues-long-term-downward-trend-in-2011/>

⁸"Why Don't Young Americans Buy Cars?" *The Atlantic*, March 25, 2012, <http://www.theatlantic.com/business/archive/2012/03/why-dont-young-americans-buy-cars/255001/>

Figure 6.3
CAFE STANDARDS TREND (1978-2035)

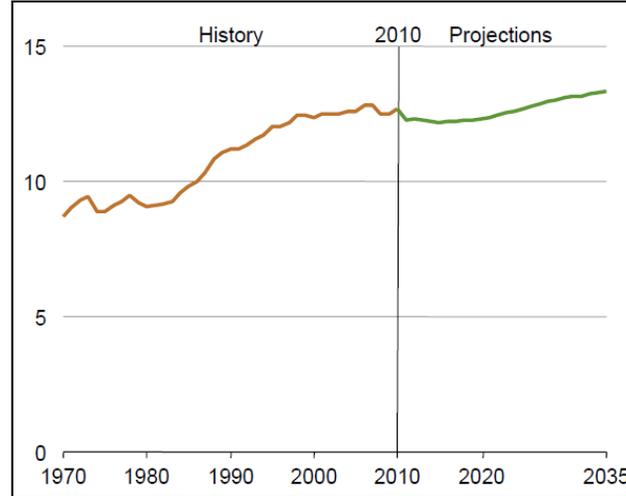


Source: U.S. Energy Information Administration | Annual Energy Outlook 2012

The impact of higher fuel efficiency standards directly affects lower levels of gasoline consumption. Therefore, CAFE standards provide a key guide for the development of fuel consumption forecast estimates, based on the combination of fuel efficiency and population growth. Implications of higher CAFE standards forecasting include:

- **Lower motor gasoline tax revenues:** As gasoline consumption decreases, excise taxes levied on gasoline sales also decrease.
- **Change in vehicle fleet mix:** As vehicle attributes, such as horsepower and weight, change to meet more stringent fuel economy standards, some consumers switch to alternative fuel-powered vehicles, reducing gasoline consumption even further. Currently, there are approximately 230 million LDVs on the road in the U.S., projected to increase to 276 million in 2035. Although gasoline-only vehicles will retain the largest market share of new vehicle sales, accounting for 84 percent of LDV delivered energy consumption in 2035, sales of vehicles that do not rely solely on a gasoline internal combustion engine for both motive and accessory power (including those that use diesel, alternative fuels, and/or hybrid electric systems) will play an increasingly substantial role in meeting the higher fuel economy standards.
- **VMT:** Among the several demographic forces that play a role in moderating the growth in VMT per licensed driver; consumers' perception of a lower fuel cost per mile induces more VMT. In general, increased travel is supported by rising incomes, declining costs of driving per mile, and demographic changes such as women entering the workforce, population growth, and lower unemployment rate. For instance, VMT grew at an average annual rate of 1.1 percent from 1970 to 2007, from about 8,700 miles per driver in 1970 to 12,800 miles per driver in 2007. Between 2007 and 2010, VMT per licensed driver declined to around 12,700 miles because of a rise in the cost of driving per mile and the economic downturn. VMT per licensed driver is expected to grow by an average of 0.2 percent per year, to 13,350 miles per driver in 2035. Faster growth in income than in fuel prices suggests that travel demand will likely rise by reducing the percentage of income spent on fuel, as Figure 6.4 indicates.

Figure 6.4
VEHICLE MILES TRAVELED PER LICENSED DRIVER, 1970-2035 (THOUSAND MILES)



Source: U.S. Energy Information Administration | Annual Energy Outlook 2012

Gas tax revenue is forecast to decline at 1.64 percent annually until 2032. Over the 2033-2040 period, the rate of gas tax revenue decline is projected to moderate at 0.82 percent annually. This is similar to the motor fuel consumption forecasts of the Department of Energy in its “Annual Energy Outlook 2012,” which predicts motor fuel consumption to decrease by 0.6 percent per year, 2010-2035.⁹

6.3.2 Diesel Oil Tax Revenues

Diesel oil tax revenues make up 1 percent of PRHTA revenues in 2013. Diesel oil taxes are derived from a \$0.04 fixed charge per gallon at 60-degree Fahrenheit on all diesel sales. The source of these revenues is primarily the diesel used in the Commonwealth’s power plants. Unfortunately for PRHTA, this is a declining source of revenue, as these plants are shifting to cheaper natural gas. This tax revenue is forecast to decline at 1.64 percent annually until 2032. Over the 2033-2040 period, the rate of revenue decline is projected to moderate at 0.82 percent annually.

6.3.3 License Fees

License fees consist of fees paid for motor vehicle and other related licenses. The fee paid to the PRHTA is \$15 per license.

Since its inception in FY1984, license fees have remained a relatively minor source of revenues for PRHTA, around 2 percent of the total. License fees are projected to have a growth rate to 2020 of 0.7 percent per year, and 0.35 percent thereafter.

6.3.4 Toll Revenues

Toll revenues make up the second largest revenue source, at 7 percent in 2013. They consist of revenues from major Commonwealth toll roads, including: PR-52, PR-53, PR-20, and PR-66. PR-22 and PR-5 revenues are not included as they are part of a long-term concession agreement.

Toll revenues have exhibited significant fluctuations in the last decade, increasing significantly until 2007 and then declining after that. Main factors associated with the decline in toll revenues are:

⁹“Annual Energy Outlook 2012” U.S. Energy Information Administration, June 2012, at: www.eia.gov/forecasts/aeo, p. 135.

- Increase in gasoline prices that reduced motor vehicle use as previously discussed.
- Conversion of tolled general purpose lanes into electronic tolling lanes (Autoexpreso) that reduced PRHTA toll revenues by \$0.05 per transaction since July 2007 as an incentive to highway users to move out from conventional cash-in-hand payment.

This revenue is forecast to grow at 3.54 percent annually until 2032 and at 1.77 percent thereafter, reflecting reduced vehicle usage.

6.3.5 Petroleum Tax Revenues

Petroleum tax revenues are an additional petroleum tax levied on crude oil and derived products, making up an additional 7 percent of revenues. As such, this tax is subject to fluctuations in petroleum consumption. The revenue from this source in future years is forecast to mirror those of the gas and diesel taxes.

6.3.6 Investment Income

Borrowing consists of earnings on the debt service reserve funds associated with PRHTA's "1968" and "1998" bond resolutions. The earnings amount to less than 1 percent of total revenues. This revenue source is not projected to grow during the planning period.

6.4 Non-Pledged Revenue Sources

Non-pledged revenues consist of FHWA funds; FTA funds; ARRA funds – FHWA; ARRA funds – FTA; grant anticipated revenue vehicle (GARVEE) funds; local appropriations; interest, toll fines and other income; impact and other fees. These revenues are primarily various types of grants, dominated by the FHWA funds and local appropriations.

Based on known information, all these sources are expected to not grow and remain at existing levels for forecasting purposes, except for License Fees, and Interest, Electronic Toll Fines and Other Income categories which are forecast to grow at 0.2 percent annually to 2032, and 0.1 percent thereafter.

6.4.1 FHWA Revenues

The FHWA administers discretionary programs through its various offices. These discretionary programs represent special funding categories where FHWA solicits for candidates and selects projects for funding, based on applications received. Each program has its own eligibility and selection criteria that are established by law, by regulation, or administratively.

FHWA revenues are almost all derived from the national gas tax, whose rate has stayed the same since the 1990s, effectively reducing this revenue source by around half in real terms since then, independent from the shift towards more fuel-efficient cars and potential fewer drivers.

The U.S. Congress has failed to agree on any gas tax increases in the last several years, including the most recent Moving Ahead for Progress in the 21st Century (MAP-21) legislation so that the FHWA's Highway Trust Fund, which is funded by these gasoline taxes and funds almost all FHWA programs, is now being partially funded through general fund appropriations.

6.4.2 FTA Revenues

FTA provides financial assistance to develop new transit systems and improve, maintain, and operate existing systems. The FTA oversees grants to state and local transit providers, primarily through its ten regional offices. These grantees are responsible for managing their programs in accordance with federal

requirements, and the FTA is responsible for ensuring that grantees follow federal mandates, along with statutory and administrative requirements.

FTA revenues are partially derived from the Highway Trust Fund and general fund appropriations. While transit funding has found increased support in Washington, D.C., even prior to the Obama Administration, FTA is essentially dependent on the same uncertain revenue sources on which FHWA revenues are dependent.

6.4.3 ARRA Funds - FHWA

These funds come from the 2009 ARRA or “stimulus package” legislation designated for FHWA projects. Most all of the ARRA funds for Puerto Rico and the many states have been fully committed and most of them have been spent.

6.4.4 ARRA Funds - FTA

These funds come from the 2009 ARRA or “stimulus package” legislation designated for FTA projects. Similarly, most all of the ARRA funds for Puerto Rico and many states have been fully committed and most of them have been spent.

6.4.5 GARVEE Funds

These consist of funds from the Commonwealth’s GARVEE program, a program that issues bonds in anticipation of future federal grant receipts.

6.4.6 Local Appropriations

Local appropriations consist of the Commonwealth’s appropriations to PRHTA from its general revenue sources. Due to fiscal constraints, no funds are expected from this source in the 2040 LRTPs.

6.4.7 Transit Revenues

Transit revenues consist of revenues from the Commonwealth’s public transit providers.

6.4.8 Concession Revenues

Concession revenues comprise payments from concession agreements; at this time, that has consisted of a one-time payment of concession monies from the PR-22 and PR-5 concessions.

6.4.9 Impact Fees

Impact fees are levied on specified properties along certain PRHTA roadway corridors. This source is highly dependent on the activity of the real estate development market.

6.4.10 Interest Earned, Electronic Toll Fines, and Other Income

This revenue category includes other non-bond reserve fund interest, toll fines, and revenue sources.

6.4.11 Bond Issues

Bond issues consist of bond proceeds from bonds issued by PRHTA.

6.4.12 Financing Federal Construction Projects

This category covers the local share of federal construction projects which are expected to be financed.

6.4.13 Financing

PRHTA receives financing from the GDB on an interim basis to fund its operations. It is expected that this financing source will continue, although its use cannot be specifically forecast.

6.5 Potential Revenue Enhancement Alternatives

For informational purposes, potential revenue enhancement alternatives are described in the following sections, 6.5.1 through 6.5.5. After careful review, however, none of the discussed cost efficiencies and new or revised revenue sources meets the “reasonably expected” test. As a result, the financial forecasts to 2040 do not reflect any of the revenue enhancements discussed in these sections, nor any debt reduction or cost-efficiency actions.

6.5.1 Cost Management Strategies

New funding sources require the enactment of new legislation. Some of these measures could include adopting innovative funding alternatives, establishing more robust collection enforcement efforts, allowing for local appropriations from the Local Stimulus Plan Act (Law No. 9 of 2009). Examples of financing alternatives under consideration are amendments to the traffic fine law and direct transfer of traffic and “Weight and Dimension Program” (for trucks) violation fines to PRHTA.

In an effort to provide users with a well-maintained road system, while reducing the deficit, PRHTA was one of the pioneer agencies in Puerto Rico engaging in a public-private partnership (PPP). As passed in Act 29, known as the PPP Act, of June 8, 2009, private participation is encouraged in the development, finance, construction, operations, and maintenance of infrastructure in Puerto Rico. On June 21, 2011, PRHTA signed a concession agreement with Autopistas Metropolitanas de Puerto Rico (Metropistas), a Goldman Sachs Infrastructure-Abertis Partners infrastructure consortium, to transfer the operation and maintenance of PR-22 and PR-5 highways. The transfer took effect on September 22, 2011, for a 40-year period. The agreement entitled PRHTA to an initial allocation of \$1,080 million to reduce debt and debt service, plus the commitment of \$356 million in investments through the life of the concession period, with an immediate investment of \$56 million in the first three years of the concession.

Expense reduction initiatives may involve the restructuring of internal business practices, such as the implementation of advanced technological resources, outsourcing of non-essential services, or reorganizing processes and procedures with the aim of maximizing operational efficiencies.

6.5.2 Conventional Funding Sources

The decline in revenue sources over time, coupled with the rising costs of maintaining and expanding the transportation system, is compelling transportation agencies nationwide to reexamine opportunities to raise more revenue from existing sources and develop new funding sources or strategies. They are also focusing on more cost-efficient delivery of projects to assist in reducing the stress on funding sources. In assessing the opportunity of increasing PRHTA revenues, the agency faces several structural problems:

- Revenues are based on fixed fees or taxes that apply to consumed units instead of the prices of those units; therefore, revenues from excise taxes and fees do not adjust by inflation rates over time, but drop when prices increase because consumption is inversely related to pricing.
- Four of the five PRHTA revenue sources require legislation to be amended (gasoline price tax, petroleum tax, license fees, and diesel oil tax).
- PRHTA’s reliance on the GDB for interim financing.

The Commonwealth has not raised the tax rates, which are fundamental to PRHTA’s revenues, since 1998. In the past, PRHTA advisors suggested that any increases in fees and taxes should be implemented by small amounts recurrently (4 to 5 years) for optimal financial planning and recommended new

regulations be enacted on the following three revenue sources, the gasoline price tax, petroleum tax, and license fees.¹⁰ These are discussed below.

6.5.2.1 Gasoline Tax

The gasoline tax was implemented in 1966 at \$0.06/gallon. Since 1971, this revenue source was increased twice to reach today's level of \$0.16/gallon by 1976. Consequently, the gasoline tax revenue represented 93.9 percent of the PRHTA revenues in 1976, while only an estimated 32.8 percent in FY2011.

Justification of the increase is based on how long these taxes have not been increased. Since 1976, the construction price index increased by 223.3 percent and the consumer price index by 184.3 percent, while the gasoline tax remained constant. Adjusting the current gasoline tax based on these two indexes, the gasoline tax in FY2010 was equivalent to \$0.04896 per gallon as per the 1976 construction price index, or \$0.0568 per gallon as per the 1976 consumption price index.

In addition, gasoline tax revenues were reduced by the enactment of Law No. 80 of March 15, 2004, which changed the conditions of volume measure from room temperature to 60-degree Fahrenheit, reducing the fees to approximately \$0.1583 per gallon equivalent due to gasoline volume change.

To increase gasoline tax revenues, it was recommended to resume the consumption measurement unit, based on volume of gallons at room temperature, since this law was passed to resolve a tax issue with the liquid gas, totally independent to the gasoline and other products derived from petroleum.

Also, two scenarios for gasoline tax increase were proposed:¹¹

- \$0.04 per gallon increment in 2018 followed by \$0.005 per gallon annual increase from 2018 onward.
- \$0.08 per gallon increment in 2018 followed by \$0.01 per gallon annual increase from 2018 onward.

The immediate effect of the proposed increment would be to generate between \$50.3 million and \$100.4 million in FY 2018 for the \$0.04 per gallon and the \$0.08 per gallon increases, respectively. The progressive increment after FY 2018 would increase PHRTA revenues between \$99.8 million and \$198.1 million in FY2032, respectively.

6.5.2.2 License Fees

The license fee regulations were enacted in 1982, with \$15 per license to be assigned to a special fund administered by the PRHTA, starting in 1984. The passage of this law was intended to prevent the adoption of a \$0.0378 per gallon increase in the gasoline tax proposed by the government at the time, led by Governor Romero Barceló. This fixed fee depends on the number of vehicles, independent of the vehicle price or inflation. Since this fee was adopted, it has never been increased.

The recommendation of increasing this fee is based on the fact that other license payments have been increased in the past, such as \$35 for ACAA insurance, a \$99 increase for mandatory insurance as well as a substantial increment in license fees of luxury cars in 2005 to reduce the government's "structural deficit." To reduce opposition to the adoption of the policy, it was proposed to justify the increment in the license fee by assigning the proceeds to a fund that would ultimately benefit vehicle owners, such as an extraordinary program to repair highways.

¹⁰Much of this discussion is based on work by Dr. Jorge F. Freyre in "Long-term PRHTA Revenue Projections and Alternatives to Increase Funding Resources, (June 30, 2012)," Jorge F. Freyre, Ph.D., President, Applied Research, Inc.

¹¹*Ibid.*, p.25-27.

The two proposed scenarios for this revenue source recommended an increment of \$10 and \$20 on top of the already \$15 license fee, under the premise of an 0.70 percent annual growth of vehicles in Puerto Rico after 2016, less than half the vehicle growth rate forecasted by IHS Global Insight for the U.S.¹² The first scenario, increasing license fees to \$25, would generate a 66 percent increase in license fee revenues in FY2018, to \$58.32 million, with a modest annual growth to reach \$64.31 million in FY2032. The second scenario, increasing license fees to \$35, showed a 133 percent growth in FY2018 to \$81.65 million in license fee revenues, growing annually to reach \$90.03 million in FY2032.

6.5.2.3 Petroleum Tax

The rate of the petroleum tax fluctuates between \$3 per barrel and \$6 per barrel, measured at 60-degree Fahrenheit, and it is inversely related to the price of crude oil. For instance, when the price of crude oil is \$16 per barrel or less, the tax rate reaches the maximum of \$6 per barrel. As the price of crude oil increases, the petroleum tax rate decreases to reach a minimum of \$3 per barrel when the price of crude oil is \$28 per barrel. The enactment of Law No.80 of March 15, 2004, changing the tax base of all petroleum product taxes to volumes measured at 60-degree Fahrenheit, further reduced the petroleum tax rate to \$2.9882 per barrel, measured at room temperature. Finally, if the current regulations do not change, petroleum tax proceeds cannot exceed \$120 million annually, even if consumption exceeds 40 million barrels in a yearly period.

Today's \$3 per barrel petroleum tax is half the tax in FY1999 and it has not been adjusted since 2005. Previous LRTPs have discussed this fact, observing that, because this tax has been twice today's value in the past, it was strong evidence to support the approval of an increment in the petroleum tax.¹³ In this regard, two scenarios were previously proposed for this increase under the premise that tax increments would be 100 percent assigned to the PRHTA:

- \$4 per barrel in 2018.
- \$6 per barrel in 2018.

As a result, the immediate increment in FY2018 would be between \$39.1 million and \$107.3 million, based on a petroleum tax of \$4 per barrel and \$6 per barrel, respectively. The fact that gasoline consumption is expected to decrease in the future will diminish the revenues from the petroleum tax increment assuming all increments in petroleum tax in their entirety to the PRHTA. Projected revenues for FY 2032 will be \$32.4 million and \$86.57 million, based on the tax increment of \$4/barrel and \$6/barrel, respectively.

6.5.2.4 Other Revenue Sources

The other two revenue sources are toll revenues and diesel oil tax:

- **Toll Revenues:** These are also a fixed amount directly related to the number of transactions and unrelated to inflation. Toll fees were last revised in September 2005, the first time after 10 years of stability. The private agreement for PR-22 and PR-5 contemplates a toll increase based on the U.S. Consumer Price Index plus 1.5 percent; this was previously suggested as a precedent indicating that the only way to maintain the value of tolls is through periodic fee increments.¹⁴

¹²*Ibid.*, p.27-29.

¹³*Ibid.*, p.37-38.

¹⁴*Ibid.*, pp 4 and 39.

Another proposed alternative to increase toll revenues was the elimination of the \$0.05 discount granted to users of electronic tolling lanes (Autoexpreso). Due to the acceptance of the system, the incentive seems no longer necessary.¹⁵

A third potential strategy to increase toll revenues is to eliminate untolled trips that can be made on some of the toll corridors. The toll roads have a mix of directional and bi-directional toll plazas, but most interchange ramps are untolled. A significant number of short- and medium-length trips can be made without paying a proportional toll. Eliminating this leakage would require tolling stations on ramps. These could be all electronic with license plate photo-identification and billing of users without transponders. There are also issues with customers who do not have transponders due to cost, or lack of banking/credit/debit accounts. Selective introduction of ramp tolling at key locations might be another option.

- **Diesel Oil Tax:** The diesel oil tax is currently at \$0.08 per gallon at 60-degree Fahrenheit and divided in equal parts between the PRHTA and the Metropolitan Bus Authority (PRMBA). This tax represents minimal revenue to PRHTA and it will continue to drop due to the adoption of natural gas. Due to the reduced magnitude of this revenue source, no recommendations were made to impose future increments.¹⁶

6.5.3 MAP-21 and Innovative Finance

Moving Ahead for Progress in the 21st Century (MAP-21) was signed into law by President Obama on July 6, 2012, the first long-term highway authorization enacted since 2005. It provides for over \$105 billion for FY2013 and FY2014 programs, which is approximately the same annual funding level of the previous transportation bill, SAFETEA-LU. While this legislation did not have major policy changes, it did increase the funding for US DOT's Transportation Infrastructure Finance and Innovation Act (TIFIA) of 1998, an innovative finance program intended for large capital projects, including highways, transit systems, and some seaport intermodal facilities, among others. This program helped to fund part of Tren Urbano at the beginning of the last decade.

The TIFIA program will be able to fund six to eight more capacity projects, or a total of approximately \$10 billion of projects in 2014. While this is a loan program and the repayment requirements are very rigorous, TIFIA's terms are very beneficial for large projects and could be one tool that PRHTA can pursue to win additional funding capacity. Furthermore, TIFIA loans can work well with private infrastructure projects.

6.5.4 Public-Private Partnerships

Public-private partnerships, or P3s, have grown in popularity among primarily state transportation agencies throughout the U.S. P3s can be used to monetize existing assets (a brownfield P3) or build new assets (a greenfield one). PR-22, which is both a brownfield and greenfield P3, is one example of such opportunities. Governments pursue P3s to take advantage of unique capabilities of private partners, such as design, construction, operations, or traffic and revenue risk-taking.

¹⁵ *Ibid.*, p. 4, and Aguadilla Forecast (20-Years)" -- "Aguadilla urbanizad Area 2032 Long RangeTransportation Plan", Chapter 6, Puerto Rico Highway and Transportation Authority, Department of Public Works, February 2012, p.80.

¹⁶"Freyre, *op.cit.*, p.15.

As with innovative finance programs such as TIFIA, P3s must have access to revenue sources, such as tolls, fares, property development, or other sources, such as availability payments. The latter are payments from a government provided to the private partner that funds construction, operations, and profits through a long-term payment mechanism, which only pays when the project is “available,” i.e., fully operational.

Not all projects offer these opportunities—i.e., certain road segments do not readily lend themselves to tolling—so that often the universe of potential P3s in a region is limited to the major arteries or development corridors.

6.5.5 Value Capture

Value capture is one type of revenue source that is particularly appropriate for transit facilities, although it also applies to highways. Essentially, through several mechanisms, a value capture strategy allows a public entity to share some of the real estate benefits of the transportation facility on adjacent or nearby property. These mechanisms can include an assessment district, joint development pursuits together with the private party, and/or tax increment financing districts.

Value capture can also encourage development that is considered “sustainable.” It can encourage higher density, for instance, around train stations, which thereby can reduce car usage and encourage bike and pedestrian travel. The challenge about value capture is that its benefits may occur five to twenty years following the completion of the transportation facility. This reflects the typical real estate business cycles and the long periods required to plan and finance major real estate projects.

6.6 Revenue Forecasts

Revenues over the 2018-2040 planning period were forecast based on anticipated changes in funding sources. All dollar amounts discussed in this chapter are in year of expenditure dollars, meaning that inflationary effects have been included as applicable. Over the planning period, approximately \$20.7 billion will be available for the PRHTA transportation program, an average of about \$900 million annually, ranging from \$850 million to \$965 million in specific years. Supporting data are provided in Appendices A and C.

6.6.1 Forecast of Revenue Sources

Table 6.2 summarizes projected revenues across planning phases. Relatively little growth in revenues is expected over time, which is in contrast to a steady historical growth rate of about 4 percent in the cost of transportation projects and operations. Future revenues are mostly not expected to grow in value with an inflation adjustment, and thus have a declining value in current dollars, while the cost of expenditures is expected to increase significantly. This declining real value of revenues in the face of escalating costs is the dilemma that transportation agencies across the country are confronting.

6.6.2 Forecast of Revenue Uses

The forecast of the anticipated uses of the future transportation revenues are shown in Table 6.3. The effect of the low rate of growth in revenue sources is no growth in any capital funding categories over the planning period, and a 3.00 percent growth in major operating categories, with the exception of electronic toll collections with a 2.00 percent growth rate.

The first five revenue uses in Table 6.3 define the PRHTA Highway & Construction Program funding level. The Highway & Construction Program covers the capital costs (including design and right-of-way) of capacity and non-capacity projects that are implemented to maintain the transportation system in a state of good repair and to enhance system capacity. The 0 percent growth rates in effect stipulate that

funding for projects and programs covered by the Highway & Construction Program per the CIP will be frozen at 2017 levels which are the lowest of the 5 Year 2013-2018 CIP financial statement. This point reinforces the conservative fiscal approach being taken in this 2040 plan.

Figure 6.5 shows the share of the different funding sources graphically over the 2013-2040 period. While Figure 6.6 shows the share of the different funding uses graphically over that period. Supporting data are provided in Appendices A and C.

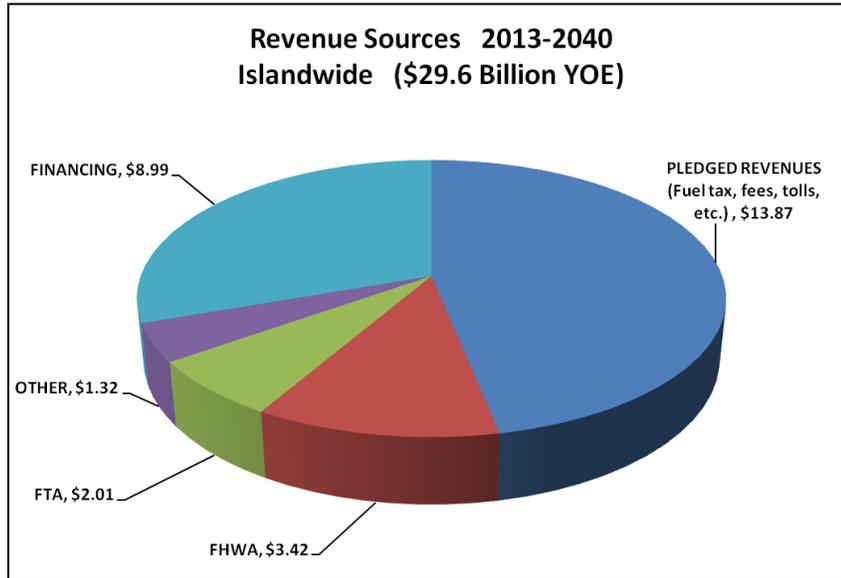
**Table 6.2
FORECAST OF PRHTA REVENUE SOURCES 2013-2040 (\$1,000s, YOY)**

SUMMARY OF TRANSPORTATION REVENUE SOURCES								
ISLANDWIDE \$x1,000s (YOY)								
(Year of Expenditure)	Period						Total	Total
Agency and Funds	2013-2017	2018-2020	2021-2025	2026-2030	2031-2035	2036-2040	2018 - 2040	2013-2040
PRHTA								
PLEDGED REVENUES (Fuel tax, fees, tolls, etc.)	2,293,056	1,429,620	2,413,957	2,483,463	2,583,704	2,662,311	11,573,057	13,866,113
NON-PLEDGED REVENUES								-
FHWA Funds	866,179	333,268	555,447	555,447	555,447	555,447	2,555,057	3,421,236
FTA Funds (5307, 5309) [Tren Urbano]	90,041	53,032	88,387	88,387	88,387	88,387	406,579	496,620
ARRA	11,301	-	-	-	-	-	-	11,301
GARVEE	60,164	36,094	60,157	60,155	60,155	60,155	276,716	336,880
Local	107,057	-	-	-	-	-	-	107,057
Other Income	154,833	91,352	153,049	154,052	155,004	155,575	709,032	863,866
SUBTOTAL	1,289,575	513,747	857,040	858,041	858,993	859,564	3,947,384	5,236,959
FINANCING	3,711,880	612,141	1,114,413	1,182,181	1,208,315	1,159,314	5,276,364	8,988,244
TOTAL - PRHTA	7,294,512	2,555,508	4,385,410	4,523,686	4,651,012	4,681,189	20,796,805	28,091,317
Metropolitan Bus Authority (Transit Services)	115,623	72,186	125,203	131,589	138,302	145,356	612,636	728,258
PORTS AUTHORITY (FTA grant recipient for Ferries)	26,278	16,406	28,455	29,907	31,432	33,036	139,235	165,513
MUNICIPALITIES Outside San Juan Region (FTA funds)	98,243	61,335	106,384	111,810	116,123	123,508	519,160	617,404
TOTAL REVENUE SOURCES	7,534,656	2,705,435	4,645,451	4,796,992	4,936,869	4,983,089	22,067,836	29,602,492

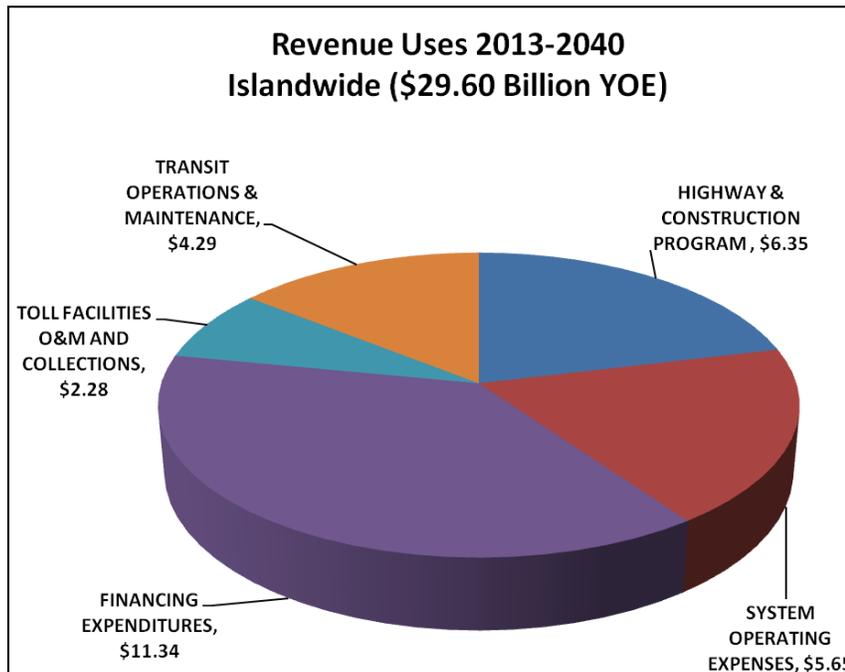
**Table 6.3
FORECAST OF PRHTA REVENUE USES 2013-2040 (\$1,000s, YOY)**

SUMMARY OF TRANSPORTATION REVENUE USES								
ISLANDWIDE								
\$x1,000s (YOY)								
(Year of Expenditure)	Period						Total	Total
Agency and Funds	2013-2017	2018-2020	2021-2025	2026-2030	2031-2035	2036-2040	2018 - 2040	2013-2040
PRHTA								
RIGHT-OF-WAY	104,254	60,844	101,418	101,420	101,408	101,508	466,598	570,160
DESIGN	102,779	60,844	101,418	101,420	101,408	101,508	466,598	568,695
SAFETY	98,228	116,978	195,036	195,035	195,035	195,209	897,293	995,521
BRIDGES	89,732	116,978	195,036	195,035	195,035	195,209	897,293	987,025
STATE PLANNING & RESEARCH (SPR)	1,716	41,002	68,263	68,264	68,263	68,325	314,117	315,833
OTHER (Preservation)	234,905	59,670	99,468	99,469	99,467	99,556	457,630	692,535
CAPACITY	421,625	128,720	214,540	214,539	214,539	214,729	987,067	1,408,692
HIGHWAY & CONSTRUCTION PROGRAM SUBTOTAL (REGIONAL COMPONENT)	1,053,239	585,036	975,179	975,182	975,155	976,044	4,486,596	5,538,461
HIGHWAY & CONSTRUCTION PROGRAM SUBTOTAL (ISLANDWIDE COMPONENT)	827,520	-	-	-	-	-	-	827,520
HIGHWAY & CONSTRUCTION PROGRAM SUBTOTAL	1,880,758	585,036	975,179	975,182	975,155	976,044	4,486,596	6,365,981
OPERATING EXPENSES	868,927	508,789	913,072	1,005,547	1,112,676	1,236,794	4,776,878	5,645,804
FINANCING EXPENDITURES	4,112,537	1,040,034	1,713,762	1,645,856	1,535,662	1,292,134	7,227,448	11,339,986
TOLL FACILITIES O&M AND COLLECTIONS	314,897	200,916	367,162	411,962	462,473	519,457	1,961,970	2,276,867
TRANSIT OPERATIONS	357,536	230,493	432,622	501,527	581,407	674,011	2,420,060	2,777,596
TOTAL - PRHTA	7,534,656	3,150,305	4,385,410	4,523,686	4,651,012	4,681,189	20,796,805	28,091,317
Metropolitan Bus Authority (Transit Services)	115,623	72,186	125,203	131,589	138,302	145,356	612,636	728,258
PORTS AUTHORITY (FTA grant recipient for Ferries)	26,278	16,406	28,455	29,907	31,432	33,036	139,235	165,513
MUNICIPALITIES Outside San Juan Region (FTA funds)	98,243	61,335	106,384	111,810	116,123	123,508	519,160	617,404
TOTAL REVENUE USES	7,774,800	3,300,232	4,645,451	4,796,992	4,936,869	4,983,089	22,067,836	29,602,492

**Figure 6.5
FORECAST OF PRHTA REVENUE SOURCES 2013-2040**



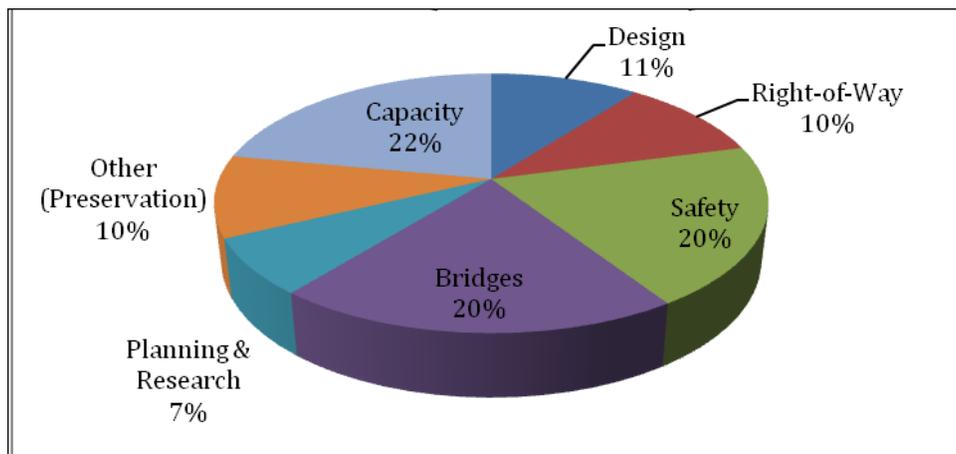
**Figure 6.6
FORECAST OF REVENUE USES 2013-2040**



The administrative and operations category accounts for agency staff in regional offices and the central office who oversee the operations and maintenance of facilities and services, staff involved with system administration, management, planning, design, database systems, accounting and human resource functions, as well as costs for toll collection and maintenance of the toll roads and expressways. Financing relates to the debt service on bonds and other interim financing used to support operations

and project investments. The highway and construction category accounts for the various project-based needs for implementing projects to preserve, modernize and expand the transportation system, including design, right-of-way acquisition, bridge maintenance and replacement, pavement repairs, safety projects, and capacity projects which widen existing roads or add new roadway segments. Approximately \$4.4 billion is available for highway, transit, and bicycle/pedestrian projects over the 2018-2040 planning period, and \$5.5 billion over the 2013-2040 period. Figure 6.7 shows the projected commitment to each of these highway and construction fund investment categories for the 2018-2040 period.

Figure 6.7
USES OF PRHTA CONSTRUCTION AND HIGHWAY PROGRAM FUNDS



Chapter 7

STRATEGIC DIRECTION

This chapter of the Islandwide 2040 Long Range Transportation Plan (LRTP) lays out a set of strategic actions that the Department of Transportation and Public Works and the Puerto Rico Highway and Transportation Authority (DTPW/PRHTA) will pursue through policies, programs, partnerships, and projects to advance the state of the transportation system in Puerto Rico.

The goals and objectives framework for plan development was built around four themes that capture and group the essential focus areas for transportation system management and development (see Chapter 2). Those four themes are:

- **Effectiveness:** improving how well the transportation system provides mobility and accessibility – in short, “doing the right things.”
- **Efficiency:** improving the transportation system so that it works better for users, with less cost to use the system, with better safety and security, and by optimizing the condition and use of assets – in short, “doing things well.”
- **Economy:** managing the transportation system so that it productively contributes to the island economy for both business and societal interests, with a more sustainable funding strategy.
- **Environment:** supporting actions to minimize greenhouse gas and other adverse environmental effects and to advance smarter land uses with more livable communities.

In the sections that follow, each of these themes is described in terms of the goals and objectives framework, the relation between the goals and the eight federal planning factors, background conditions, and finally, strategies and activities supporting each goal and its objectives that the DTPW/PRHTA will advance through this plan.

7.1 Effectiveness

7.1.1 Framework

The framework for the theme of Effectiveness is summarized as follows:

GOAL 1	Improve transportation mobility and access for people and freight.
Objective 1.1	<i>Improve mobility and access for all system users with improved travel choices, connections between major centers, and integration between and within modes.</i>
	Improve connectivity between primary activity centers, including employment, tourism, and dense residential districts.
Objective 1.2	Enhance system integration within and between modes.
Objective 1.3	Increase travel choices for residents, visitors, and workers.
Objective 1.4	Focus investments in areas of highest user benefit.
Objective 1.5	Facilitate access for the elderly and transportation disadvantaged persons.

The most relevant federal planning factors are:

Planning Factor	Description
4	Increase accessibility and mobility for people and freight.
6	Enhance transportation system integration and connectivity, across and between modes, for people and freight.

7.1.2 Background

The transportation system can be defined by the extent of accessibility and mobility it provides, and the quality of its connectivity. Accessibility refers to the reach or coverage of the system, being able to get from one place to another, which may be convenient on the highway if one has a car, but more limited for the transit mode. Mobility refers to the quality or speed of transportation on the network. Chronic congestion on expressways diminishes mobility, as do lengthy waits to connect between bus routes. Finally, connectivity relates to how one can move between services in one mode or between modes. For example, when one returns a rental car to the airport, there is a shuttle for the trip to the airport terminal.

A key approach to improving the transportation network is to look for ways to make the existing pieces of the system connect to each other, or to connect better or more seamlessly, to fit new pieces of the system into this network so that it becomes more robust, and to provide points where changes between modes are convenient and attractive. Relating this system of nodes and links to major activity centers – large employment concentrations, major shopping centers, large educational complexes, transportation hubs, and tourism districts -- further capitalizes on the concept by tapping into the travel markets of these activity centers.

A related approach is to encourage infill in the vicinity of these nodes to create transit-oriented development and apply the principles of livability discussed under Goal 4 in this chapter. In metropolitan San Juan, many opportunities exist to pursue these concepts, but they can apply on a smaller scale in island municipalities like Humacao, Aguadilla, Ponce, Caguas, Yauco, Bayamón, and many others.

In Puerto Rico, on the freight side, connectivity is simplified because there is no freight rail option. Consequently, freight connections focus on the major highway links and smooth access to airports, seaports, and distribution centers.

By organizing components of the transportation system smartly, the synergies between these components can generate increased transit ridership and stimulate positive effects on land use development around the respective nodes. In the end, a well-conceived and interconnected transportation system, makes the system better than the sum of its parts and starts to optimize the value of the interconnected components. The timing and priority of implementing recommended actions is indicated for each by the codes (S – short range; M – medium range; L - long range).

7.1.3 Strategies

Based on the framework and background for the theme of Effectiveness, the following strategies have been formulated to address system improvement in terms of facilities and connectivity, and to better structure how capital investment decisions are prioritized.

Strategy 1: Enhance system connectivity and integration.

One of the opportunities available is to make strategic improvements that provide better connectivity between and within travel modes.

Key Action Items:

1. Incorporate the role of general traffic, freight movements, transit routes, and pedestrian/bicycle movements in new project concept development. Identify nodes where facilities can interconnect between and within modes, to enhance their connectivity. Advance the development of Complete Streets prototype projects as quickly as possible to provide a basis for broader implementation. (S)
2. In planning future premium transit improvements, especially in the San Juan region, develop a network of major and minor transit hubs where different transit routes and modes will interface as seamlessly as possible. This strategy would represent an expansion of the several transit terminals operated by the Metropolitan Bus Authority and the público system. Most of these nodes should be at key activity centers to optimize their ridership impact. (S, M)
3. In conjunction with travel demand management and congestion management strategies, identify locations for the development of additional park-and-ride lots at existing facilities underutilized during the day or those newly constructed, interfacing with quality premium transit services, such as the new PR-22 Metro Urbano bus rapid transit project. These facilities would complement carpool-matching programs and could include access to tolled facilities for high-occupancy vehicles (three or more occupants); this is the policy on the I-95 Express tolled lanes in Miami. (S, M)
4. Continue promoting the use of transit (adjusting Tren Urbano fares) and working to improve transit use by offering improved (revised Metropolitan Bus Authority routes) and new services (Metro Urbano). As noted under Goal 3, a broad policy for supporting transit development at the municipal and regional levels, in terms of financial and logistics support, would be another positive step. This strategy should extend islandwide, where many municipalities are working with público operators, or are interested in developing a fixed-route transit service or expanding the one they have. (S, M)
5. Integrate non-motorized mode access to and from major transit nodes to encourage multimodal travel and address the “last mile” issue (getting between the trip destination and the transit stop or station) in maximizing transit usage. (S, M)
6. Incorporate the needs of transportation disadvantaged persons, including the elderly, handicapped, low-income persons, and others into all of the agency’s project planning and design activities. (S)

Strategy 2: Pursue strategic multimodal investment decisions.

The intent of this strategy is to improve the process through which projects are selected so that they are targeted to most important needs, yielding substantial benefits. By evaluating projects against goals and objectives, quantitatively and qualitatively, the selection process is more transparent and justifiable. There are always tradeoffs in the decision-making process, but objectivity is a desirable feature.

Key Action Items:

1. Enhance the project selection and prioritization process to incorporate performance measurement and monitoring characteristics to capitalize on databases developed, and to better integrate the decision-making framework across goals, objectives, and measures, tying system improvement to stated priorities. Coordinate with the Metropolitan Planning Organization (MPO) to develop a consistent approach between processes. (S)

2. Improve the project prioritization process so that transportation projects represent strategic investment choices: (S, M)
 - a. Look at entire corridors and the impact of a specific improvement in terms of overall benefit of project, and not just moving a problem downstream.
 - b. On urban highways, identify bottlenecks and examine the benefit and possible disadvantages (such as revealing a new bottleneck downstream) of any corrective improvements.
 - c. Analyze major travel markets and travel patterns and develop strategic linchpin improvements that capture opportunities to shift trips between modes.
 - d. Improve asset management and decision-making databases to better target pavement, bridge, and other maintenance spending.
3. Use a variety of strategies to do more with less, and improve the throughput of primary travel corridors: (S, M)
 - a. Applying congestion management strategies, including travel demand management and alternative modes.
 - b. Applying intelligent systems technology (ITS) to improve facility throughput and incident avoidance.
 - c. Delivering projects as expeditiously as possible.
 - d. Carefully defining projects to add the right performance value and scale the solution to the practical need, perhaps with some cost-saving compromises.
 - e. Focusing on implementing projects of higher value and merit, based on benefit to more users.
 - f. Incorporating strategies to facilitate transit projects in major corridors, avoiding traffic congestion and creating more competitive travel times (as, for example, the “bus on shoulder” priority treatment).
4. Develop mode-specific master plans to guide proposed system components through planning, design, and implementation: (S)
 - a. The PRHTA has initiated work on a comprehensive islandwide bicycle/pedestrian master plan, that will inventory all completed projects, those in planning, and additional projects that would begin to complete a network of connected facilities and routes within regions and perhaps across the island. This plan should be developed in Geographic Information System (GIS) to facilitate documentation and tracking of projects.

The Transportation Alternatives Program (TAP) authorized under Section 1122 of Moving Ahead for Progress in the 21st Century Act (MAP-21) provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities. One of the eligible activities is the “Conversion and use of abandoned railroad corridors for trails for pedestrians, bicyclists, or other non-motorized transportation users”.

As part of the plan for non-motorized modes, the existing sections of the old railway easement around the island, abandoned for many years, to consider reuse as bicycle and pedestrian trails, will be identified. This heritage of historical and cultural value offers great potential for reuse to provide safe and accessible routes for everyday walking or cycling to the workplace and school, developing initiatives for ecotourism and sustainable travel. It also offers the opportunity to promote active lifestyles for all ages, sporting and recreation consistent with new social demands, encouraging the development of local small businesses and stimulate economic revitalization.

The initiative of “Rails-to-trails Conservancy” in the United States, and the “European Greenways Association” promote the transformation of disused railway lines into greenways, to ensure that railway heritage is preserved and maintained, and at the same time generating local

economic opportunities. In addition, these initiatives safeguard the continuity of transport corridors so that, if necessary, the trails could revert to their original use as railway lines.

- b. Develop a comprehensive transit master plan with a focus on the San Juan region, but also with islandwide coverage. Such a plan would utilize the travel demand model to assist in assessing individual corridors and their combined impact. This plan would address major premium transit corridors, interconnecting fixed-route services, inter-regional and regional services, and públicos. It would also address financing strategies for both capital and operating costs as well as policy issues. The plan should take a critical look at staged implementation for major corridors, to develop the most cost-effective mode choice to accelerate implementation, and phased implementation developing the full stage improvements in steps over time to spread out costs to support implementability under funding cost-constraints.
- c. Prepare a detailed freight plan for the island. This plan would clearly document the pattern of interregional freight movements in terms of truck volumes and tonnage patterns, and include cargo movements at the key airports and seaports. The study would refine the definition of key trucking routes beyond the strategic highway network and, with input from the freight and logistics industry, identify key improvements that would enhance the freight network.

5. Formulate as a policy priority, in tandem with transit funding strategies noted in Section 7.3.3 and with Item 4.b above, a transit implementation strategy to develop and deploy transit improvements in these categories: (S, M, L)

- Major San Juan region transit corridor projects.
- San Juan region Metropolitan Bus Authority (MBA) fixed route service refinements to improve headways and schedule reliability, as well as coverage.
- Mobility hubs, where several modes meet to facilitate connectivity. Current examples are the Tren Urbano stations at Sagrado Corazón and Bayamón where Tren Urbano, MBA routes, MetroUrbano or Metrobus routes and some públicos meet at transit stations with park-and-ride lots.
- Transit projects in other regions including the Mayagüez bus rapid transit (BRT), Ponce BRT, and light rail, and fixed route bus systems in Aguadilla, Mayagüez, Ponce, Yauco, and elsewhere.
- Collaborative projects with público operators following models in Carolina and Caguas.

These projects need to be defined with cost economy in mind to facilitate implementation. The approach is to be strategic in implementing projects that will expand the reach of transit and build the network of quality services. If successful, further improvements or higher capacity modes can be considered for implementation. Another strategy is further application of hybrid highway/transit projects such as the PR-22 dynamically tolled lanes with BRT service, which could be applied to additional sections of PR-22 going westward, the PR-52 corridor from San Juan to Caguas, and the PR-52 corridor from Juana Díaz, and others. Currently proposed projects such as the PR-3 East BRT corridor to Carolina should perhaps be reviewed for cost reduction with a solution that relies on fewer overhead structural segments to reduce cost, possibly implementing those sections later once ridership success is achieved.

7.2 Efficiency

7.2.1 Framework

The framework for the theme of Efficiency is summarized as follows:

GOAL 2	Improve transportation system performance.
Objective 2.1	<i>Maintain and operate Puerto Rico's transportation facilities and services proactively for better economy and efficiency, leveraging available capacity, with adequate safety and security.</i>
	Reduce congestion and travel time, through the congestion management process and other similar projects.
Objective 2.2	Optimize use of transportation assets and leverage efficiency of prior investments.
Objective 2.3	Maintain transportation assets in a state of good repair.
Objective 2.4	Improve efficiency in the cost of managing and operation transportation systems.
Objective 2.5	Improve transportation system safety and security, and ability to support emergencies.

The most relevant federal planning factors are:

Planning Factor	Description
2	Increase the safety of the transportation system for motorized and non-motorized users.
3	Increase security of the system for motorized and non-motorized users.
7	Promote efficient system management and operation.
8	Emphasize the preservation of the existing transportation system.

7.2.2 Background

7.2.2.1 Transportation Demand Management

Transportation demand management (TDM) refers to a set of strategies that are focused on influencing individual travel choices relating to the need for a trip, the beginning and/or end points for the trip, how the trip is made, and when the trip is made. The intention of TDM is to help alleviate travel congestion through lower cost means than major capital investments for physical system capacity. In this way, TDM can be pursued on its own, and it can be incorporated as an integral element of a well-conceived Congestion Management Process (CMP). In fact, TDM has been incorporated in the congestion management toolbox in the planning being done for the San Juan and Aguadilla transportation management areas (TMAs). A wide variety of TDM strategies can be employed to affect and manage travel demand in the ways noted above. These include:

- **Ridesharing Programs:** Trip matching, carpooling, vanpooling, and high-occupancy vehicle lanes.
- **Transit Usage:** Improved or new transit services, favorable transit pricing through passes and fares.
- **Alternative Modes:** Encouraging more trips by bicycling and walking, to reduce vehicular trips and to support improved public health.
- **Telework/Telecommute Programs:** Replacing commuting with remote work sites relying on telecommunications.
- **Compressed Work Weeks:** Variable work hours to take commute trips out of the peak hour, or to reduce the number of trips.
- **Parking Management:** Managing parking supply and cost to influence travel choices.
- **Park-and-Ride Facilities:** Built to support increased use of connecting transit services.
- **Congestion Pricing:** Dynamic pricing of toll facilities to discourage peak-period trips.
- **Transit-Oriented Development:** Mixed-use developments at transit nodes to reduce auto-based trips and increase transit and non-motorized travel.

TDM strategies, as noted, are embedded in the CMP planning that has been developed for the San Juan and Aguadilla TMAs. As that process begins to identify specific congestion management projects for implementation, TDM approaches will also be considered. In the meantime, several TDM-related projects have been implemented in Puerto Rico:

- **Transit Usage:** Fares for Tren Urbano were reduced to \$0.75 two years ago, and resulted in increased ridership. AMA transit routes have undergone review to improve their routing and orientation to major travel patterns; Phase 1 of these improvements has been implemented; Phase 2 development is continuing but has been delayed due to the change in governmental administration.
- **Congestion Pricing, Transit Usage, and Park-and-Ride Facilities:** The reversible dynamic-tolled lanes project on PR-22 and a new BRT-style Metro Urbano transit service, connecting from the Bayamón Tren Urbano station and a new park-and-ride lot at PR-165, a distance of about 10 miles.
- **Transit-Oriented Development:** DTPW/PRHTA has sponsored several planning studies of TOD development around Tren Urbano stations, and there is supporting legislation in place. It is hoped that, as real estate market conditions improve, results from this planning will begin to be realized.
- **Alternative Modes:** PRHTA is working on a comprehensive islandwide bicycle and pedestrian plan, is developing a Complete Streets technical manual and identifying its first round of regional Complete Streets projects, has promoted alternative modes through a publicity and educational campaign, and will expand on that with respect to a recent law calling for promotion of alternative transportation and its preventative health benefits.

Many other opportunities exist to expand the application of TDM strategies and it is expected that the next phase of the CMP will be the primary conduit for identification and implementation of the priority projects.

7.2.2.2 Intelligent Transportation Systems

The DTPW and PRHTA are responsible for the development and implementation of ITS in Puerto Rico. Several years ago, the DTPW/PRHTA embarked on a multi-faceted program for ITS development, deployment, and expansion. This initiative has important implications for many other aspects of the island's transportation systems and their operations and management, including safety, security, operational efficiency, traveler communications, and TDM benefiting the highway, transit, and freight movement facilities and operations.

Previously, the PRHTA had implemented ITS technologies with great success, but with a limited scope of services or duration. Examples of this success were the systems implemented during the Regatta 2000 special event that included the use of a temporary Traffic Management Center (TMC) to enhance the mobility and safety of transportation system users in the San Juan Area during the event. Most of the systems previously implemented had a short operational duration, mainly because system development did not follow a systems engineering approach. As a consequence, no permanent staffing was assigned to monitor and operate the systems once the events were concluded, responsibilities were not assigned to the different stakeholders, and no budget was assigned for the maintenance of such systems once the project was completed.

Another important effort carried out in 2005 was the development of the Regional ITS Architecture for the San Juan Metropolitan Area. This initiative was conducted to comply with the federal regulations imposed by the 23 Code of Federal Regulations (CFR) 940 (*Intelligent Transportation System Architecture and Standards*) and set the cornerstone for the implementation of ITS projects in the San Juan Metropolitan Area using Federal Highway Administration (FHWA) funds specifically destined for ITS.

Currently, the PRHTA is taking the necessary steps to implement ITS in different regions throughout Puerto Rico. These steps include the following, among others:

Traffic Control Systems.

As part of the efforts to improve safety on signalized intersections, a comprehensive modernization of the traffic signal control systems has been undertaken during the past couple of years, starting with the PR-2 corridor in the municipalities of Moca, Aguadilla, Aguada, Añasco, Mayagüez, and Hormigueros. These projects have implemented several ITS technologies, such as centralized traffic signal control, closed-circuit television for remote verification of system performance, and microwave radar vehicle detection for data collection. For this project, an Interim TMC was developed to monitor the recently modernized traffic control systems. Future systems will also be integrated with this Interim TMC, until a permanent TMC is developed in the next five years as the ITS is expanded to incorporate other user services, such as incident management.

Another effort underway is the development of the Concept of Operations for the implementation of an adaptive signals control technology for the traffic control systems previously mentioned. Other projects are currently in different development stages to continue with the traffic signal modernization efforts, including the following corridors:

- PR-2 from Hatillo to Isabela.
- PR-3 from Río Grande to Fajardo.
- Rio Mar – including PR-1 PR-25, and PR-35 in San Juan.
- PR-23 (Roosevelt Ave.) in San Juan.
- PR-1 from San Juan to Caguas.

The technologies being implemented as part of these projects will be used in the future to support the implementation of other ITS user services, such as:

- Incident management.
- Traveler services information.
- TDM.
- Maintenance and construction operations.
- Public transportation management.

Systems Development.

The PRHTA recently contracted with a consulting team to help with the development of the ITS Program Plan and the Systems Engineering Analysis for the San Juan Metropolitan Area Incident Management System. The first phase of this program will be to implement incident management and traveler information systems in the PR-18 (San Juan), PR-26 (San Juan – Carolina) and PR-52 (San Juan - Caguas) corridors to mitigate the effects of traffic incidents and to provide travelers with relevant information about the transportation network. For the first phase, it is expected to use ITS technologies such as closed-circuit television surveillance cameras, vehicle detectors, dynamic message signs, and highway advisory radio to monitor the roadways to detect any incidents and activate the corresponding protocols for their management and information dissemination. Planning documents will also be developed to take care of the staffing and budget needs to support and maintain the systems well into the future, as well as to incorporate other stakeholders into the planning process.

Electronic Toll Collection

Since the mid-2000s, the PRHTA has been implementing Autoexpreso, an electronic toll collection (ETC) system on tolled roads around the island in an effort to reduce the delays associated with this activity. More recently, all of the tolls were converted to allow only transactions associated with ETC, eliminating the facilities dedicated to collecting cash at the tolls, with the exception of PR-22. In 2012, the first open road tolls (ORT) were inaugurated, with ORT facilities in both directions of PR-52 at Juana Díaz and in both directions of PR-66 at Río Grande.

Another application of ETC that will be implemented in the near future is for dynamic toll collection in the PR-22 corridor from Toa Baja to Bayamón. This system will be implemented in the BRT and regular vehicle shared reversible lanes so as to maintain an acceptable level of service at all times in those lanes and keep a regular and reliable schedule for the BRT vehicles. The basic concept behind this system is that, as the speeds in the reversible lanes decrease, the cost of using them increases to discourage regular vehicles from using those lanes; once the speeds inside the lanes start to increase, the cost of the tolls decreases. For this system, it is expected that ITS technologies such as vehicle detectors, automatic vehicle identification, and dynamic message signs will be installed. Information gathered with this system can be shared with other PRHTA offices for planning or operational purposes.

Special Events

ITS technologies are being used to manage special events in different regions of Puerto Rico. Two of the most relevant examples include the 2010 Central American Games in Mayagüez and the San Sebastián Street Festivities in San Juan. During these special events, temporary TMCs are assembled to house personnel from different agencies including DTPW/PRHTA, Police, Fire and Transit to coordinate activities associated with the special event. ITS technologies used during these events include closed-

circuit television to monitor traffic conditions along important corridors, dynamic message signs, and highway advisory radio to inform travelers of alternate routes or parking availability. One important goal of the ITS program is to develop a permanent TMC where all these special events can be managed, as well as other components such as incident management and traffic control, with permanent representation of all the stakeholders involved in roadway management.

Given that the PRHTA has taken the necessary steps to implement some of the most important ITS user services addressed mainly toward private vehicles, it is understood that much more has to be done to successfully integrate all of the different transportation modes. One of the most important aspects of ITS is that it can present travelers with information regarding different travel modes so a choice can be made about which mode is best at a particular moment. For the mid- to long-term, the PRHTA plans to integrate information to serve most of the travel modes.

Sharing and Pooling of Resources

One of the most important characteristics of ITS technologies is the capacity to share the resources (ITS components) among stakeholders and derive benefits. For example, through the archived data user service, the data acquired with ITS devices, such as microwave radar vehicle detection, can be shared with other PRHTA Offices (Planning, Design, among other) or other stakeholders, such as the police and universities. This sharing of information can reduce what other stakeholders have to invest to gather already available information. At the same time, the investment saving can be used to complement the information available by gathering other type of information or expanding the coverage area.

Mode Integration

The integration of all transportation modes to ITS is paramount to achieve a successful implementation of ITS in Puerto Rico. Currently, most transit services operate somewhat independently from each other, resulting in reduced ridership on public transportation modes and a higher number of trips on private vehicles. These effects in turn contribute to congestion problems in many parts of the island, specifically in the San Juan Metropolitan Area. The PRHTA plans to implement ITS strategies included in the Public Transportation Management User Service Bundle to integrate information collected from different transportation modes and present this information to the travelers so that, again, they can make an informed decision as to which transportation mode is better at a given moment in time. Some of these strategies include:

- Present real-time information about transit schedules on kiosks, website, and mobile apps.
- Use dynamic message signs on bus stops and train stations to provide travelers with information about expected arrival times.
- Promote electronic (web site, mobile apps, etc.) services toward trip planning.
- Present real-time traffic information, including snapshots or video, about travel times and current traffic condition on highways so travelers know beforehand what to expect.
- Integrate different information systems from the Metropolitan Bus Authority, Tren Urbano, and Metro Urbano into one central system.
- Provide real-time parking information about parking availability, parking reservation services, etc. for parking serving public transportation services.

System Expansion

One of most immediate actions planned for the ITS program is to develop an islandwide ITS architecture. This need will be addressed through the previously mentioned consulting contract. Some of the regions

in Puerto Rico currently have ITS deployments in place so the development of this architecture will help achieve a more coordinated operation of these systems. The expansion of such systems to other areas in Puerto Rico will be better served once the island-wide architecture is developed and approved by the PRHTA and other stakeholders.

Another action that needs to be addressed in the future is the development of other regional architectures to incorporate the different needs these regions may have. These include the needs of rural areas, such as road weather monitoring systems and the needs of recently created regional public transportation services.

Coordination of Emergency Response

ITS technologies provide the necessary tools for the integration of different emergency response agencies. During the Concept of Operations development for the San Juan Metropolitan Area, the needs of and input from different stakeholders will be gathered to better define the requirements for the ITS user services to be incorporated in the ITS Program Plan, including the Emergency Management User Service Bundle; prioritization will be assigned depending on the evaluation scheme agreed upon by the stakeholders.

The Emergency Management User Service Bundle includes the following user services:

- Emergency notification and personal security.
- Emergency vehicle management.
- Disaster response and evacuation.

The PRHTA plans to incorporate the use of ITS technologies to assist emergency response agencies during the management of emergencies, including the use of dynamic message signs and highway advisory radio during emergency evacuations. Also, emergency plans will be included as part of the traffic control signal timing plans to facilitate evacuation through major corridors and the use of preemption in traffic signals to help emergency vehicles pass through signalized intersection with minimal delay will be evaluated.

Commercial Vehicle Operations

Considering that trucks will remain the mode for freight distribution on the island for the foreseeable future, an effort will be made to incorporate the Commercial Vehicle Operations (CVO) User Services Bundle into the ITS Program Plan. This will require private sector participation and input in the planning process. Of special interest is the Freight Mobility User Service, which provides information between drivers and dispatchers to take advantage of real-time traffic information as well as vehicle and load location information. The private sector can use this information to increase productivity. Most of the data needed to provide this information can be easily shared and will be available in the near future, once the implementation of the Incident Management and Traffic Control User Services is completed.

Other technology that will be evaluated for implementation is the weigh-in-motion technology to monitor the compliance of the loads being carried by commercial vehicle operators. This technology will allow the PRHTA to increase the percentage of trucks being sampled for load-limit compliance, while reducing the time needed to measure the weight of the loads, since the trucks do not need to make a full stop for the weight to be measured.

7.2.2.3 Congestion Management Process

The Transportation Equity Act for the 21st Century (TEA-21) established the Congestion Management System, currently evolved to the CMP) as an integral part of the transportation planning process, and

required that all states, including the Commonwealth of Puerto Rico, develop, establish, and implement a CMP in cooperation with their MPO agencies. The purpose of this process is to apply a systematic approach, collaboratively developed and implemented throughout a metropolitan region, which provides for the safe and effective management and operation of new and existing transportation facilities through the use of demand reduction and operational management strategies (as defined by the U.S. Department of Transportation, FHWA, and Federal Transit Administration (FTA), 2007).

Under federal regulations, both the San Juan and Aguadilla TMAs are required to develop and manage a congestion management process. The MPO, working with PRHTA, has embarked on the development of its CMP Plan, as required under federal regulations. The plan development process thus far has defined the congestion management network for the San Juan and Aguadilla regions; established goals, objectives, and measures; developed a set of toolbox strategies to address congestion management; and identified target locations for further analysis. The identified strategies are multimodal and span a spectrum of capacity, throughput efficiency, and alternative mode approaches. The next phase of work should identify specific priority congestion management projects that can be incorporated into the Five-Year State Transportation Improvement Plan (STIP) and the long range transportation plan process. The CMP should prove to be an effective channel for prioritizing high-impact projects into the transportation system, and as a result, contributing to improved air quality, reduced fuel consumption, and more efficient use of transportation assets.

As the San Juan and Aguadilla CMP Plan advances and becomes more mature, opportunities exist to enhance the effort to better manage congestion through application of not only transportation demand and transportation systems management, but also through better integration with ITS strategies as they are deployed and broadened in Puerto Rico. ITS can meaningfully contribute to congestion management by providing a TMC and a data clearinghouse that will:

- Support faster clearing of accidents and incidents.
- Dispatch support to disabled vehicles.
- Reduce the number of crashes.
- Decrease secondary incidents on the principal arterial network.
- Communicate construction and maintenance activities to motorists via the TMC.
- Provide traffic control support to a variety of special events.
- Incrementally improve travel time reliability on trunk corridors.
- Incrementally increase person throughput on the principal network.
- Integrate travel information from all public agencies into a single source.
- Provide traveler information to motorists and transit users.

As discussed, the PRHTA is in the process of developing a plan for ITS deployment and implementation. The San Juan and Aguadilla CMP Plan has been developing statistical benchmarks for evaluating the performance of specific action strategies that are implemented in the target corridors. As those projects are developed, they should be coordinated with the Five-Year STIP and with the long range planning process.

7.2.2.4 Safety and Security

Safety and security are important considerations in the operational oversight of the transportation system. Safety initiatives are geared to reducing the frequency of accidents and providing for reduced risk in using transportation facilities. Security relates to providing a travel environment that is free from personal harm. To these ends, a variety of initiatives and programs is in place to advance these two

important components of transportation across Puerto Rico's transportation providers. Both safety and security are recognized in the LRTP plan, goals, and objectives framework under Objective 2.5.

Safety

Safety initiatives relate to all transportation modes, including transit, highways, and pedestrian/bicycle facilities. Puerto Rico's transportation agencies are active in a variety of safety management systems promulgated under several federal regulations.

The transit services operated by PRHTA, the Tren Urbano rail service, and the Metropolitan Bus Authority bus service, have procedures to address safety requirements within their bus and rail operations. System Safety Program Plans (SSPP) have been prepared for these transit operations, in accordance with the requirements and guidelines set forth by the FTA. The service operators are committed to implementing the SSPP and achieving its safety goals and objectives. The SSPPs address safety in service operations and also cover other critical elements such as emergency procedures, monitoring and audits, and inspections, all to ensure passenger comfort and convenience.

Under the new Moving Ahead for Progress in the 21st Century (MAP-21), the FTA has been granted the authority to establish and enforce a new comprehensive framework to oversee the safety of public transportation relating to both bus and rail transit systems. Going forward, transit agency safety plans will need to include strategies for identifying and minimizing exposure to risks, the presence of a trained safety officer, a staff-training program, and monitoring of performance targets based on measurable performance criteria. The Transit Safety Management and Performance Measurement (Volume 1: Guidebook) published by FTA in May 2011 is an important resource in configuring an existing safety program into a revised and expanded program that conforms to the new requirements.

Puerto Rico has a robust highway safety effort that has been underway for decades. Within the PRHTA, traffic safety is an important agency function. The highway work programs routinely include a variety of programmed projects that address improvement of intersection geometry and traffic controls, reconstruction or realignment of roads to include safety features and upgrading to current design standards, traffic signalization and coordination projects to improve traffic flow, removal of drainage issues, repair of aging guardrails, upgrade of bridges to current standards, and the like.

A primary force in the advancement of traffic safety on the island is the Puerto Rico Traffic Safety Commission (PRTSC). The mission of the PRTSC is to continuously reduce traffic-related fatalities and injuries. This mission is accomplished by developing and supporting a comprehensive, multi-strategy approach that includes enforcement, deterrence, prevention, media and education, training, legislation and regulation, data management, and analysis. Over the years, the PRTSC has made commendable progress in reducing the fatality rate and other measures of highway safety. Its efforts are coordinated with the PRHTA. The PRTSC issues an annual report and plan that track the safety results of its program elements, and charts continuing strategies.

The PRTSC coordinates closely with the PRHTA in the development of safety-related projects of all kinds to identify remedial and improvement projects at high-crash locations across the island, based on the safety history. Projects currently being advanced include geometric and safety improvements at intersections and along corridors, safety upgrades at toll plazas, and "safe route to school" projects for students traveling to and from their schools. These improvements can utilize a variety of elements, including signing, pavement markings, pavement repair, roadside safety devices, lighting, and rumble strips.

The PRTSC has also been working on improvements to the crash reporting system, driver license and vehicle registration databases, and crash report data entry backlogs. The agency uses a set of

performance measures conforming to the National Highway Traffic Safety Administration requirements to track progress across its thirteen program areas covering impaired driving, police support and enforcement, traffic records, community programs, non-occupant safety, driver education, traffic engineering, motorcycle safety, and others. The new MAP-21 legislation establishes national performance goals for federal highway programs, including safety, and emphasizes performance measurement and monitoring. As these criteria evolve, it is likely that the PRTSC performance measures that have been in place for years may need some refinement.

The PRHTA is an active partner in advancing traffic safety, working with the PRTSC. In addition to the specific projects advanced by PRTSC derived from crash history analysis, PRHTA has an ongoing safety program that develops a variety of project types across the island which have a safety focus and safety benefits to the motoring public, pedestrians, and bicyclists. Examples of these efforts include:

- Traffic signal modernization and traffic control system upgrades.
- Guard rail installation or repair.
- Pavement marking replacement.
- Intersection safety improvements (geometry, crosswalks, lighting).
- Rough pavement replacement.
- Replacement or improvement of functionally obsolete bridges.
- Street reconstruction to current design standards.
- Installation of sidewalks as part of roadway projects.
- Identification of candidate Complete Streets projects from each region.
- Development of ITS applications across the island.

The importance of safety has been incorporated into the plan goals and objectives, and the PRHTA investment program includes a large share of projects that will address the improvement of transportation system features that will enhance public safety and security.

Puerto Rico's transportation agencies and service providers have established safety programs that are coordinated with partner agencies, law enforcement, and other entities, focused on the mission of ensuring safe passage through the transportation network. Highway and transit agencies will be revisiting their safety programs to implement the federal MAP-21 guidance on updated performance measures and standards going forward, which should deliver better safety outcomes in the future.

Security

Security programs for transportation facilities are rapidly evolving, many led by the U.S. Department of Homeland Security to address terrorism threats, over and above prior initiatives focused on crime prevention. The FTA Safety and Security Office has advanced requirements in several areas related to transit operations. The DTPW/PRHTA, the Puerto Rico Ports Authority, the Puerto Rico Maritime Transportation Authority, and the Metropolitan Bus Authority, spanning oversight of the Tren Urbano, San Juan bus system, the island ferry system, and the seaports and airports, continue their efforts to integrate these various requirements into their transportation facilities and operations, to conform to the required standards and procedures.

For example, all Tren Urbano stations are protected by specialized security units, such as private police companies and the Tren Urbano police of the Puerto Rico Police Department. The Tren Urbano system design incorporates various emergency response features, including emergency telecommunications systems, track signals and train control systems, closed-circuit television, seismic event detection, fire management systems, station sign messaging, and station and vehicle communications systems. The

Tren Urbano emergency management program incorporates these tools, along with training, emergency exercises and emergency operations procedures, coordinated with partner agencies, to promote the safety of passengers, employees, and emergency response personnel.

The PRHTA has a defined strategic highway network, which comprises those roads that provide defense access, continuity, and emergency management capabilities for moving personnel and equipment in both peace and war. This network includes the trunk corridors defining the basic network as well as connectors that link to individual facilities. It is vital for defense needs, as noted, but also comprises the road network that is essential for the commerce and economic needs of the island's business community, for the daily mobility needs of its residents, and for the convenient travel of tourists to destinations across the island. This network connects all the island's principal municipalities along its coastal perimeter along with three cross-island corridors that link the north and south coasts. The maintenance and enhancement of this strategic roadway system has long been a priority of the PRHTA, which is very appropriate due to the large share of the island's vehicular activity concentrated on the relatively low mileage of this network, and its importance to Puerto Rico's economic and defense security.

The DTPW and PRHTA also coordinate with the Puerto Rico Police Department and others in patrolling the principal roadways for the security and safety of the motoring public. In addition, the further implementation of several ITS functions, including the 511 information system, dynamic sign messaging, and surveillance cameras, will further enhance security as they are deployed.

The continuing deployment of the ITS network across Puerto Rico will enable a variety of new tools and applications, such as dynamic message signs and highway advisory radio as well as signal timing plan adjustments to facilitate evacuation and preemption of traffic signals to expedite passage of emergency vehicles. These will benefit the highway network in terms of incident management and emergency management and evacuations.

The Puerto Rico transportation system plays a critical role in the regional and islandwide economies as mobility of freight and people are essential to Puerto Rico's well-being. Continuing efforts to enhance transportation security are supported by the MPO, and the responsible agencies and their partners are committed to advance security provisions across the transportation network.

7.2.3 Strategies

Based on the framework and background for the theme of Efficiency, the following strategies have been formulated to address system improvement in terms of facilities and connectivity, and in better structuring how capital investment decisions are prioritized.

Strategy 1: Pursue actions to better manage transportation demand.

This strategy is intended to intensify efforts to apply TDM strategies to reduce trips on the network, especially at peak times, to improve traffic operations, and also to contribute to environmental improvement under Goal 4.

Key Action Items:

1. Incorporate changes in programs, funding, project delivery, and performance monitoring that are directed by the new MAP-21 transportation legislation. (S)
2. Expand efforts to coordinate with the PRHTA's non-motorized transportation working group to coordinate needs and programs to encourage implementation of pedestrian and bicycle network improvements. (S)
3. Work to advance the development and implementation of the Complete Streets legislation. (S)

4. Work with the MPO to form and collaborate with a Freight Advisory Committee, as discussed under Goal 3.
5. Take a proactive role with the MPO in the coordination of a San Juan regionwide and islandwide approach to the development of plans for integrated transit services, including públicos, and for non-motorized transportation facilities.
6. Further coordinate the integration of the CMP into the short and long-term transportation planning processes. Assure that the process considers TDM, ITS, and freight components in its toolbox.
7. Advance the implementation of ITS applications in terms of functionalities and multiple modes.
8. Explore strategies to advance TDM, initially with projects developed through the CMP.
9. Support coordination between DTPW/PRHTA, transit agencies, and the MPO in confirming performance measures and monitoring with MAP-21 requirements.
10. Pursue additional actions to reduce or moderate travel demand:
 - a. Promote telecommuting, adjusted work hours, and off-peak travel.
 - b. Support a carpooling match program, and encourage carpooling and vanpooling, with priority corridor or access treatments where possible.
 - c. Continue to incentivize transit usage with new strategic, low-cost services and alternative mode travel.
 - d. Leverage unutilized capacity investment in specific roads and transit facilities to improve return on investment.

Strategy 2: Address ways to improve safety and security initiatives.

Safety and security are separate but related features of transportation system functioning. Under MAP-21, performance measures related to safety will need to be formally incorporated into system reporting; fortunately, the Commonwealth's traffic safety program has employed robust factors for years. The new federal law also heightens requirements for transit safety. Concurrently, ongoing programs to ensure a sufficient degree of security should be reviewed and enhanced as appropriate.

Key Action Items:

1. Continue through the partnership with the Puerto Rico Traffic Safety Commission to advance the work of traffic safety across the island, which has shown commendable results through a well-conceived and multi-pronged approach. Work to bring crash record reporting current to provide timely data for priority analysis and performance.
2. Coordinate with the public transit corporations and services to conform to new MAP-21 requirements relating to safety plan and reporting requirements.
3. Through a commitment of heightened funding for safety improvements, develop a targeted approach to identifying and defining safety improvements for maximum positive impact.
4. Improve coordination with the Puerto Rico Emergency Management Office on the use and management of the highway system for special incident and natural disaster event emergency preparedness and response (for floods, hurricanes, tsunamis, hazardous material incidents, terrorism, and other incidents). Coordinate with the Federal Emergency Management Office and the U.S. Army Corps of Engineers on hurricane-scenario analysis, and revisit storm-surge mapping as it relates to transportation infrastructure risk and response and also as related to the climate change sea level rise analysis under Goal 4.

5. Update hazardous cargo roadway incident response procedures with involved agencies and police authorities. Review prior incident records to identify any patterns in repeat incidents to address contributing factors. (S, M)
6. Review the status of the system response plan with U.S. Department of Homeland Security guidance. (S)
7. Explore implementation of a Road Ranger program on major expressways in urban areas to assist with disabled motorists, road debris, and other minor incidents. These agents can also report other roadway condition risks, accidents, and erratic or risk-causing vehicle activity. In many locales, these may be partially or fully sponsored by private business such as insurance companies. (S)
8. Expand security coordination with the Puerto Rico Emergency Management Office to better integrate evacuation protocols and also coordinate with ITS development and deployment activities. (S, M)

Strategy 3: Advance the development of asset management and investment decision databases and tools.

The shortage of transportation funding compels agencies to do more with less, to better manage the application of timely maintenance to the highway network pavement, bridges, and other features. The same applies to transit systems, where the new MAP-21 law is expanding the application of the “state-of-good-repair” philosophy in the transit arena, and the development of transit safety and condition performance measures. Part of the response to these current and emerging needs from a management perspective is to have information that supports informed assessments about the condition of the transportation infrastructure and informed decisions about investment actions and priorities.

This approach requires the assembly and automation of key infrastructure data, and software programs to perform standard and customized analyses and database queries. The database structure can also support performance measurement and monitoring, provided a framework for doing this has been set up. The intent of this strategy is to advance the development of these tools at the PRHTA. The benefit of more efficient infrastructure asset management, and better investment targeting in terms of timing and action, can easily offset the cost of development and ongoing database management.

Key Action Items:

1. Conduct a review of MAP-21 requirements in relation to current DTPW/PRHTA practices considering asset management and performance measurement and monitoring requirements: (S)
 - a. Review existing digital database systems for road inventory, bridges, pavement, signs, traffic data, and other features, considering the available attributes and how they are or can be collected. Examples include the recent work on bridge rating and scour analysis.
 - b. Assess the design of an updated database system and the level of data collection needed to support it.
 - c. Develop a strategy and master plan for upgrading the database and software to enable the development of this powerful decision-making framework. The integration of GIS mapping capabilities should be considered in this effort. Options could be to develop an outsourcing/turnkey approach to accomplishing this development process.

2. Initiate a process to refine, develop, and implement a performance measurement and monitoring system that responds to basic system performance management as well as MAP-21 requirements. This effort should also be coordinated with the MPO to develop other system performance measures. Desirably, this system would be interfaced with the new capital project, cost and programming database system that is being developed to replace the existing antiquated software package. (S)

7.3 Economy

7.3.1 Framework

The framework for the theme of Economy is summarized as follows:

GOAL 3	Reinforce economic vitality.
	<i>Enhance global and economic competitiveness by facilitating the efficient movement of freight, business and tourism activity.</i>
Objective 3.1	Enhance economic competitiveness by facilitating efficient movement of freight and goods.
Objective 3.2	Generate potential public-private opportunities.
Objective 3.3	Provide strategic network connectivity and capacity across Puerto Rico.

The most relevant federal planning factors are:

Planning Factor	Description
1	Support economic vitality of the metropolitan areas, especially by enabling global competitiveness, productivity, and efficiency.
6	Enhance transportation system integration and connectivity, across and between modes, for people and freight.

7.3.2 Background

7.3.2.1 Financial Sustainability

As the lead agency in Puerto Rico for overseeing and sponsoring multimodal projects across the island, the PRHTA has been challenged in recent years in its ability to develop reliable funding sources that diminish reliance on financing and borrowing and enable the agency to administer and operate the transportation system, to maintain and repair the system in an acceptable state of repair, and to undertake projects to add capacity and reduce congestion in the system. As discussed in Chapter 6, traditional funding sources, especially the gas tax, have not been indexed to inflation and are being diminished by more fuel-efficient vehicles, an issue confronting departments of transportation across the nation. The extended economic recession in Puerto Rico has also contributed to the erosion of traditional funding revenues. These trends are exacerbated by the steady rise of the cost of transportation maintenance and projects at a rate exceeding the consumer price index. The accumulation of debt from financing, both bonding of revenue streams and interim financing requires devoting a large portion of the operating budget to servicing that debt.

PRHTA management is committed to addressing these concerns and is working to formulate a longer-term approach to resolving the funding challenge by reviewing revenue sources for opportunities to increase their yield and concurrently identifying ways to improve the efficiency and effectiveness of expended funds in the administrative, maintenance, and project delivery areas. The results of these assessments are in progress, and will be reflected in future financial statements as the strategies are authorized and implemented. Presently, less reliance is being placed on interim financing, which reduces funds available for transportation investment. The priority is being placed on addressing system maintenance, bridge repair, and safety-related improvements, with less emphasis on capacity projects. As the debt service is diminished, the budget should allow for expansion of strategic capacity projects to be implemented.

Reduction of financing debt, coupled with the other cost-management strategies, will over time allow the agency to arrive at a more sustainable budgeting situation, where the transportation needs of the agency can be better addressed in a more sustainable manner. This objective relates not only to the critical investment needs for maintenance and operations, but also for improving and expanding the transportation system.

The upcoming implementation of performance measures and standards under the new MAP-21 legislation will provide another tool to assess the results of transportation investments on system performance outcomes, helping to better target those investments to achieve desired results in the quality of infrastructure and the way that it operates.

7.3.2.2 Freight

As discussed in Chapter 5, Section 5.6, freight movements touch the lives of businesses and residents throughout Puerto Rico. The efficiency of landside freight movements affects the competitiveness of individual businesses on the island, and along with the capacity and capabilities of the island's seaports and airports, also influences Puerto Rico's broader competitiveness as a transportation distribution center. Freight mobility and connectivity are thus important contributors to the overall economy.

The new federal transportation legislation, MAP-21, includes a number of provisions to improve the condition and performance of the national freight network and support investment in freight-related surface transportation projects. Among these are the creation of a national freight policy, the identification of a national freight network, and the development of a national freight strategic plan in consultation with the states and other stakeholders as well as other detailed initiatives.

Freight's importance is already recognized in the government's economic planning for the island. Various government initiatives have focused on expanding the island's air and sea cargo hubs and the essential land access connections to them.

7.3.3 Strategies

Based on the framework and background for the theme of Economy, the following strategies have been formulated to address system improvement in terms of facilities and connectivity, and in better structuring how capital investment decisions are prioritized.

Strategy 1: Enhance the financial sustainability of transportation system funding.

PRHTA management has recognized the impact of borrowing on the capacity of the agency to advance its transportation programs for state-of-good-repair, modernization, and system expansion across all modes. The most recent financial forecasts for the 2040 regional L RTPs developed by the MPO take a conservative outlook of nearly flat growth in existing funding sources, and reduced reliance on interim

financing strategies, with the intent of beginning to reduce the role of this financing in its budget. This strategy seeks to expand the array of options that can be considered.

Key Action Items:

1. Identify further opportunities for public-private partnerships to jointly fund projects and accelerate their implementation. Continue investigating new “brownfield” or “greenfield” public-private partnerships or concessions to advance new corridors. Consider “value capture” contributions from private land ownerships for interchange locations which support the regional urban form plans and discourage sprawl. (S, M, L)
2. Determine local funding sources and funding level as a match to federal funds for the development and operations of trunk premium transit service corridors, and formulate a funding partnership policy. (S)
3. Consider entry into the FTA New Starts program, as restructured under MAP-21, to gain a share of federal funding for major projects. MAP-21 is simplifying some of its previously quite rigorous analytical requirements, and has merged environmental documentation into the project development stage. Candidate projects should first receive a high-level screening using the new travel demand model to identify top-performing transit corridors in terms of total ridership and estimated construction and operating cost per total riders and per new riders, to justify the meaningful pursuit of these very competitive funds. DTPW/PRHTA should be prepared to comply fully with FTA expectations as to the revised project analysis and documentation. (S, M, L)
4. Review and reposition funding of major transit projects to incorporate changes in FTA’s transit project funding program structure and revised project development and environmental procedures. (S)
5. Work to identify alternative and innovative funding sources, including identification of expanded funding from existing sources including fees, licensing, gas tax, and others. Consider a levy or tax targeted to niche markets - such as car rental, import/export cargos, and others - to augment funds for special purpose projects such as the strategic highway network. Seek opportunities to increase revenues and reduce costs: (S, M)
 - a. Identify ways to reduce waste and inefficiencies from program delivery.
 - b. Examine existing revenue sources, including the gas tax and license fees, for adjustment.
 - c. Identify other revenue sources.
 - d. Remove free trips from toll roads by tolling ramps.
 - e. Consider tolling on present toll-free roads at modest rates on corridors funded locally or do so consistent with emerging federal policy on tolling of interstate highways.
 - f. Carefully define roadway-widening projects and new alignment projects to scale solution to need, looking for ways to build a functional facility that serves all modes, but does not overinvest.
 - g. Consider other applications of the PR-22 dynamically tolled lanes/bus rapid transit project in congested urban corridors.

Strategy 2: Further advance the freight planning process.

Freight movements, both domestic activity between businesses, distribution/warehousing, manufacturing, and customers, as well as those passing through the island’s international portals at the several largest seaports and airports, are the lifeblood of the island economy. Unfortunately, needed

access improvement projects are quite extensive and the major missing segments are found in the smaller regions of the island, where limited financial resource allocations under the LRTP financial planning process preclude their timely implementation. The more efficient these hubs and the supporting highway network are, in terms of travel times and connectivity between these logistics centers, the more attractive the island becomes.

Efforts to position the new port in Ponce as a transshipment center for expanded trade lanes through the improved Panama Canal are also strategic. Thus it is important to work more closely in the future with the freight and distribution industry to identify their transportation issues and needs, and incorporate them into the transportation project prioritization process. In many cases, projects that benefit freight movements will also benefit the general motoring public as well. Freight should also be considered in the CMP analyses in the San Juan and Aguadilla TMAs. Focus on the strategic highway network, as described in this section, will also benefit the entire island's business, the public, and tourists. The updated travel demand model includes a truck-trip purpose analysis, and this tool will be useful in isolating truck trips and developing targeted improvements for freight movements.

Key Action Items:

1. It is recommended that the PRHTA participate in the development of a freight planning initiative through the MPO, wherein freight planning in Puerto Rico would be elevated by the formation of a Freight Advisory Committee that can provide input into industry needs and potential solutions. Like other niche users of the transportation system, the freight industry needs to be a proactive participant in the transportation planning process so that its key needs can be identified and addressed. This process could accomplish a number of worthy objectives: (S)
 - a. Enhance economic development and global competitiveness by improving freight system connectivity.
 - b. Identify the varied freight needs of shippers and distributors within the regions of the island and in primary corridors linking regions.
 - c. Partner with Puerto Rico's regional economic development organizations to advance freight movement needs and solutions.
 - d. Give greater priority and attention to freight in the regional planning process.
 - e. Help inform public investments that could help improve cost efficiency and reliability of goods movements.
 - f. Work to educate the public on the importance of efficient and reliable freight transportation to the economy and end users, and communicate the needs and concerns of shippers, distributors, and other affected stakeholders.
2. Incorporate freight movement considerations into the San Juan and Aguadilla CMP analyses and recommendations. (S)
3. Compile with the MPO a database of freight movements between regions of the island to better understand truck and cargo flows. (S)
4. Refine the definition of a principal freight network as initially developed in the 2040 regional LRTPs prepared by the MPO, to guide prioritization of roadway improvements. (S)

Strategy 3: Pursue targeted development of the Strategic Highway Network.

The strategic highway network is a vital component of the overall transportation system, contributing to general commerce and freight movements, personal travel and commuting, and tourism, making all corners of the island easily accessible. This strategy is intended to support the further development and eventual completion of the network.

1. Develop a network completion strategy, consisting of proposed alignment solutions (upgrade current alignment or develop a new alignment), current cost estimates, review of implementation strategies (standard funding, concession and tolling, etc.) and a tentative prioritization of corridor segments based on traffic, benefits, costs and implementation options. Complete pertinent environmental analyses to inform the alignment selection process. (S, M)
2. Utilize the completed travel demand model to test tolling and alignment scenarios to identify solutions that maximize toll funding vs. other approaches to funding. Also test interchange locations for traffic shifts, considering compatibility with land use plans to avoid sprawl. Consider, however, partnerships with landholders to support construction cost in return for access points. Also consider strategic placement of toll plazas to permit selected subregional free trips to avoid undue impact on localized circulation and relief of the existing arterial corridors. (S)
3. Incorporate Strategy 1 action items from a financing and implementation standpoint. (S, M)
4. Consider isolating the funding of the remaining strategic highway network improvements into an islandwide account separate from the transportation funding allocations to the individual transportation planning regions, to enable more timely application of standard funding resources to the strategic highway network. (S)

7.4 Environment

7.4.1 Framework

The framework for the theme of Environment is summarized as follows:

GOAL 4	Promote environmental sustainability.
	<i>Incorporate responsible environmental stewardship in transportation investments through reduced impacts, smaller carbon footprint, "smart" growth, and more livable communities.</i>
Objective 4.1	Minimize adverse impacts to natural and built environments.
Objective 4.2	Reduce greenhouse gas emissions and energy consumption, and improve air quality.
Objective 4.3	Support integrated transportation and land use planning for more livable communities and reduced travel.
Objective 4.4	Enhance alternate modes and travel demand strategies.

The most relevant federal planning factor is:

Planning Factors	Description
5	Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements, Commonwealth and local planned growth and economic development patterns.

7.4.2 Background

Conservation and protection of the environment have been a long-standing principle of the Puerto Rico Commonwealth. Concern for the environment has been embraced within the broader concept of

sustainability, which is defined by the U.S. Environmental Protection Agency (EPA) as a process that “creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.” Sustainability is focused on managing what we consume, how we consume it, and the byproducts of our consumption, in such a way that resources are preserved, regenerated, renewed, and available to those who follow.

From a review of several transportation agencies, their treatment of sustainability in relation to the transportation planning process encompasses environmental sustainability, social sustainability, and economic sustainability. Within this framework, sustainability can be viewed as including the following facets:

- **Environmental sustainability**
 - Air quality (green house gases)
 - Climate change
 - Environmental management and mitigation
 - Travel demand management
 - Congestion management
- **Social sustainability**
 - Livability: travel choices (transit, bicycles and pedestrians)
 - Transportation and land use linkage
 - Public health

As evidence of the continuing commitment to sustainability in Puerto Rico, the Governor recently issued an Executive Order (OE-2013-017) that calls for the creation of a Sustainability Action Council with responsibility for formulating strategies to reduce reliance on carbon-based energy, advising the Governor on climate change mitigation and response, proposing laws for further protection of environmental resources, identifying ways to create “green” jobs related to new forms of energy and environmental restoration, and supporting the development and implementation of policies and laws, strategies and programs, and communications between academic centers for ongoing technical exchange of sustainability advances. The Council is to comprise a cross-section of membership drawn from academics, environmentalists, economists, businesses that have embraced the concept, technical professionals, and the public. This council on sustainability presents an opportunity for the MPO and PRHTA to provide input and information on an ongoing basis as it relates to the transportation system.

The sections below describe how the activities of the MPO and its transportation partners relate to the important environmental topics that are essential components of a well-rounded transportation planning and transportation system management framework.

7.4.2.1 Air Quality

The responsible agencies and officials in the Commonwealth have committed to policies, specific projects, and a general course of action that promote good development, efficient transportation systems, and protection of the environment. This in turn contributes to improved air quality and creates more sustainable communities. A variety of concerted actions and policies such as pedestrian friendly land uses and improvement of pedestrian facilities, intersection improvements and other low-cost transportation measures, covering of loads on trucks, stabilizing the sides of roadways, paving parking areas, street cleaning and removal of road dust, and restoring roads to good repair can help in this endeavor. The increased emphasis on and implementation of transit improvements is a major

commitment that will bring benefits for many years to come. These and other actions of the responsible agencies and officials will serve to improve the air quality.

The importance of air quality and of addressing the issue of greenhouse gases was recently underscored by the Governor of Puerto Rico, who issued an Executive Order (OE-2013-018) that calls for a study of greenhouse gases in Puerto Rico led by the Energy Affairs Administration, the Environmental Quality Board (EQB), and the Department of Natural Resources and Environment. The study is to provide a profile of the level and sources of greenhouse gases in Puerto Rico, the impact on the environment of these carbon emissions, and strategies to reduce the emissions. This is an opportunity for PRHTA, and the MPO as well, to participate in this effort as the emission of greenhouse gases from the transportation system contributes significantly to the overall mix of gas sources. The PRHTA and the MPO are already involved with transportation planning and management activities that should be an integral part of the study recommendations.

7.4.2.2 Energy Consumption in the Transportation Sector

Puerto Rico has few conventional energy resources, and imported petroleum products are the dominant energy source for the island. According to the U.S. Energy Information Administration, in 2011, 68 percent of Puerto Rico's electricity came from petroleum, 16 percent from natural gas, 15 percent from coal, and 1 percent from hydroelectric power, as shown in Table 7.1.

Table 7.1
PUERTO RICO'S ENERGY CONSUMPTION BY TYPE

Type of Energy Usage (Percent)				
Petroleum	Natural Gas	Coal	Hydro	Other
68	16	15	1	---

Source: US Energy Information Administration, July 2012.

In 2010, Puerto Rico was fifth among U.S. states and territories in installations of solar thermal hot water heaters. Two wind facilities slated to begin operations in 2012 -- the Santa Isabel and Windmar plants -- could supply up to 120 megawatts of capacity. Up to 30 billion kilowatt-hours per year of electricity could potentially be generated by tapping ocean wave energy.

Puerto Rico is offering tax benefits to encourage installation of solar equipment and allows net metering, meaning that residents can sell power from home solar panels to the grid. Also, the Commonwealth has adopted a renewable portfolio standard requiring 20 percent of net electricity sales to come from renewable energy resources by 2035.

About one-third of all energy is consumed by the transportation sector. Though the Commonwealth's attempts at diversification since 2000, by adding natural gas to its energy mix, have proved successful -- with the percent of petroleum usage dropping from 93.6 percent in 2001 to 68 percent in 2012, the island is still highly susceptible to the price fluctuations of international energy markets. The use of alternative technologies to fuel vehicles may reduce reliance on foreign sources whose stability may have great impact on the Puerto Rican economy. While alternative technologies may take years to develop and implement, energy conservation is a "technology" that can be harnessed immediately. In

the transportation sector, conservation is accomplished in a number of ways, and is supported by recommendations in this document.

In particular, increasing the mix of land uses in any given area has the potential to reduce vehicle miles traveled, and even the number of trips taken by individuals to various destinations. Locating mass transit facilities properly and coordinating routes so that public transportation is a safe, efficient, and viable alternative to the private vehicle will conserve energy, as will increasing the number of site-complementary multi-modal options throughout the commonwealth, such as sidewalks or park-and-ride lots. These strategies and technological ones, like using hybrid vehicles or more efficient diesel technologies, have the potential to make Puerto Rico more efficient with regards to its transportation system and underlying energy needs.

7.4.2.3 Climate Change

Climate change issues and their effects on our developed environments are a rapidly emerging consideration in LRTP documents across coastal areas. The relation to transportation is through transportation greenhouse emissions from vehicles using the transportation system. Overall, transportation accounts for 29 percent of all greenhouse gas emissions. The EPA reports that the average car owner releases 4.8 million metric tons of carbon dioxide each year by driving. The total amount of carbon generated by the transportation system is a function of the vehicle mix in the fleet, the fuels used, and the operational efficiency of the system (network travel speed). The federal government has recently approved new Combined Average Fuel Economy (CAFE) standards for new vehicles, which will further reduce emissions. Changing vehicles and their emission rates is reasonably manageable. Changing how well the system moves these vehicles and how people change their needs to consume transportation mobility is more challenging.

There are two dimensions to the transportation reach: mobility and accessibility. Mobility refers to how much ground or distance can be covered rapidly; thus vehicle miles of travel is a positive indicator of this dimension. Automobiles on uncongested freeways greatly expanded urban mobility, encouraging suburbanization. Accessibility, the other dimension, means the ability to reach a desired range of various needs (shopping, services, schools, work, recreation) within a relatively short distance. If such resources, or at least many of them, are available within a short reach, then overall vehicle miles of travel can be reduced. So strategies and policies to adjust personal decisions about place of residence, place of work, and place of other destinations can influence trip lengths and travel mode choices, thus reducing the amount of travel and the environmental consequences of that travel. And if that travel involves more non-motorized travel by walking or bicycling, a collateral benefit that has been demonstrated in the literature is improved personal health and better quality of life.

A recent publication by the FHWA, *Integrating Climate Change Considerations into the Transportation Planning Process: Final Report* (2008) discusses how acknowledgement of climate change concerns can be coordinated with transportation planning processes. Regarding the LRTP process, climate change can be reflected in the plan vision, goals, and objectives; it can be connected to projects that provide benefit in terms of reduced vehicle miles of travel and reduction in greenhouse gas emissions; and it can be monitored in terms of performance measures of programs and projects.

Under Goal 4 of this Islandwide 2040 LRTP—promote environmental sustainability—the four stated objectives address minimizing adverse impacts to the natural and built environments; reducing greenhouse gas emissions and energy consumption, and improve air quality; supporting integrated transportation and land use planning for more livable communities and reduced travel; and enhancing alternative modes and travel demand strategies. All of these objectives interface with climate change concerns. Other plan objectives also connect to climate change as discussed in the FHWA report.

Various projects in the plan relate to reduced vehicle miles traveled and emissions, and the outputs from the travel demand model include a number of useful performance measures that relate to climate change impacts.

In terms of the planning process, the FHWA report notes there are avenues to integrate climate change into the MPO's ongoing activities; these are related to coordination with other agencies, land use planning and integration, and funding linkages. On these fronts, the MPO has opportunities to introduce climate change into its coordination with the island planning and environmental agencies, in its coordination with the Planning Board regarding regional land use planning that is presently underway, and in linking funding decisions in part to climate change considerations.

This impact of transportation activity can be addressed through the following means:

- **Reducing the direct emissions from vehicles:**
 - Improving vehicle miles per gallon via the CAFE standards established by the EPA and USDOT)
 - Improving traffic conditions by reduced congestion and improved signal timing
- **Reducing vehicle miles of travel:**
 - By reducing trip length
 - By increasing vehicle occupancy through higher automobile occupancy (carpooling)
 - By increasing vanpooling
 - By increasing use of transit
 - By decreasing required trip lengths by improved land use decisions
 - By promoting more non-motorized travel by walking and bicycling
 - By eliminating the need for travel (compressed days of work and telecommuting)
 - By promoting the development of walkable, mixed land use activity centers with access to transit for longer distance trips
- **Reducing congestion on major travel corridors:**
 - By improving travel speeds
 - By providing competitive transit service

PRHTA has been active on a number of these fronts with projects that contribute to reduce transportation impacts on the environment, through its development of the **CMP** and through the implementation of other projects that address traffic operations. In addition, PRHTA has been coordinating with various municipalities and regional economic development organizations on potential transit projects as well as trails and greenways projects.

One of the primary concerns of climate change besides air quality is the longer-term effect of rising sea elevations due to increases in atmospheric temperatures and the melting of the arctic icepack. Since 1880, sea levels have risen by 8 inches. Some projections say sea level will rise by a foot by 2040 and by up to two feet by 2060. According to climatologists at Climate Central (www.climatecentral.org), as reported in their peer-reviewed surging seas report, 55 sites across the United States were analyzed to evaluate the level at which the "storm of the century" would normalize, determining that most major storm events would normalize at about four feet above the high tide line. Of the vulnerable populations in the United States, half of those live in Florida and eight of the top ten cities determined to be in Florida. It was found that two counties in South Florida, Broward and Miami-Dade, each have more people living below four feet of elevation than any state other than Louisiana. The recent storm event Sandy, impacting New Jersey and New York, is further demonstration of the devastating impact of such events.

As a result of this concern, the four counties in Southeast Florida entered into the Southeast Florida Regional Climate Change Compact to work cooperatively to address climate and the resulting sea level concerns. These issues are problematic in terms of their solution, but planning and policy development, as reflected in transportation system planning and management, is a proactive approach that was acknowledged by FHWA for its vision. As an example, a recent combination of tropical storm surge and high tides caused considerable damage to the Florida State Route A1A roadway on the Fort Lauderdale beach, triggering an expensive refurbishing project to put the roadway corridor back into operational use. Various reaches of Southeast Florida beaches have experienced recurring issues with beach erosion and beach replenishment. These same issues can confront Puerto Rico's coastal realms.

Advance planning for sea rise and climate change contingencies is a complement to evacuation planning for low-lying coastal areas. A number of low-elevation communities in Puerto Rico coastal areas are susceptible to marginal increases in sea rise over the long term or to combinations of high tide and storm-related water elevation increases and surges. In addition, the Puerto Rico State Agency for Emergency and Disaster Management (PRSAEDM) and partners have recognized the potential for tsunami events within the region and have done advanced planning to support the preparedness and response elements of such events. PRSAEDM coordinates programs addressing disaster preparedness, response, recovery, and mitigation across focus areas including earthquake safety and risk reduction, the National Flood Insurance Program, the National Hurricane Program, Mitigation Grant Program, Assistance Program for Flood Mitigation, and Pre-Disaster Mitigation Program.

The significance of pursuing climate change response strategies was recently authenticated by the Governor of Puerto Rico, who issued an Executive Order (OE-2013-016) that calls for a study of climate change risks in Puerto Rico to be coordinated by the Department of Natural Resources and the Environment. The first step is a scan of the literature and research for available information from various government agencies, university centers, and others involving the academic community, consultants and the like to identify the potential impacts and risks in terms of sea temperature, sea level, rainfall, and other issues. Once this documentation is issued as a foundation report, each government agency is to prepare a response plan for the impacts and vulnerabilities that may confront its infrastructure, and to reflect these outcomes in its capital investment programs.

Supporting this initiative is the issuance of the report "Puerto Rico's State of the Climate: Assessing Puerto Rico's Social-Ecological Vulnerabilities in a Changing Climate" by the Puerto Rico Climate Change Council through the Department of Natural and Environmental Resources. This document was prepared through the efforts of four working groups each focusing on specific vulnerability categories; this will be followed by the Adaptation Strategies document, which will identify issues and strategies, techniques and approaches to guide public policy, planning and development, and to strengthen public awareness.

It is recommended that the PRHTA, as well as the MPO, participate in this effort as transportation infrastructure that may be vulnerable along the coasts and elsewhere is ubiquitous. The PRHTA is already involved with transportation planning and management activities that should be an integral part of the study analyses and recommendations. This process would provide a starting point for further discussion of land use and infrastructure concerns resulting from rising seas and related issues, and could inform certain decisions about how to invest in at-risk roadways, for example. The MPO looks to build on its current collective efforts that relate to climate change, both in terms of the processes that it is involved in, and in the planning documents that are produced.

7.4.2.4 Environmental Management and Mitigation

Another important facet of transportation is the impact of transportation projects on the environment. The prevalence of environmental assets across the island heightens the need to plan projects to avoid or

minimize environmental impacts, and to devise proactive mitigation strategies to compensate properly for needed improvements with unavoidable impacts. As individual projects are developed, they are subjected to the required environmental scrutiny, complying with both federal and Commonwealth laws and regulations. Puerto Rico has traditionally placed high value on its environmental resources and has in place its own robust environmental impact review process that, in tandem with National Environmental Policy Act (NEPA) requirements for environmental assessment of qualifying projects, creates a framework for minimizing environmental harm.

These process tools include agreements between PRHTA and other local and federal agencies, including the Permits Management Office, the Department of Natural Resources and Environment, the Planning Board, the State Historic Preservation Office, the Puerto Rico Culture Institute, and the EQB. Puerto Rico also recently created a Permits Management Office, which is designated to issue construction and development permits, and provides a consolidated clearinghouse for the rules and requirements of other government agencies under a Joint Permit Regulation for Construction Works and Land Uses. For federally funded projects with required environmental documentation, the PRHTA coordinates with the EQB regarding compliance with Commonwealth environmental regulations.

7.4.2.5 Livability

Livability is planning concept that seeks to interconnect decisions about the transportation system with land use planning, environmental protection, and economic development to promote communities where reliance on the auto is greatly diminished, where a variety of mixed uses of sufficient density are highly accessible by walking or bicycling, and where quality of life is enhanced by improving environmental quality. As noted in the publication *Livability in Transportation Guidebook: Planning Approaches that Promote Livability* (FHWA/FTA, 2010), there are a number of allied urban planning initiatives that interface with livability, including smart growth, walkable communities, transit-oriented development, life-long communities, complete streets, and new urbanism. This planning concept has received renewed visibility with the initiation in 2009 of the Interagency Partnership for Sustainable Communities formed between the USDOT, EPA and the Department of Housing and Urban Development (HUD). This partnership has advanced six livability principles that are being reflected in existing and new federal programs across these three agencies, reflecting initiatives through transportation, housing, and the natural and built environments.

The six livability principles are:

- **Provide more transportation choices** to decrease household transportation costs, reduce our dependence on oil, improve air quality, and promote public health.
- **Expand location- and energy-efficient housing choices** for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.
- **Improve economic competitiveness of neighborhoods** by giving people reliable access to employment centers, educational opportunities, services and other basic needs.
- **Target federal funding toward existing communities** – through transit-oriented and land recycling – to revitalize communities, reduce public works costs, and safeguard rural landscapes.
- **Align federal policies and funding** to remove barriers to collaboration, leverage funding and increase the effectiveness of programs to plan for future growth.
- **Enhance the unique characteristics of all communities** by investing in healthy, safe and walkable neighborhoods, whether rural, urban or suburban.

The federal, Commonwealth, and local governments have differing roles and responsibilities in relation to the application of these principles. The PRHTA, working with the MPO and the Planning Board, has,

however, begun to incorporate livability into its processes. Examples include the Complete Streets program, development of a comprehensive bicycle and pedestrian plan, pursuit of new transit projects, the planning by the municipalities of San Juan, Bayamón, Humacao, Mayagüez, and others to create more livable communities supported by a mix of transit, pedestrian, and bicycle facilities.

The framework of vision, goals, and objectives for this plan includes Objective 4.3 which relates to “integrated transportation and land use planning for more livable communities and reduced (automobile) travel.” Several other objectives are also supportive of livability in terms of improved connectivity, enhanced integration between and within modes, increased travel choices, reduced congestion and travel time, leveraging the efficiency of prior infrastructure investments, minimizing adverse environmental impacts, reducing greenhouse gas emissions and energy consumption, and enhancing alternative modes and travel demand strategies. There are many other windows of opportunity for the DTPW/PRHTA to provide leadership in promoting livability and beginning the process through supportive policy and project decisions that advance the application of livability in urban place making, and the PRHTA and its partners are supportive of further planning and implementation of the livability concept.

7.4.2.6 Transportation - Land Use Linkage

The prior discussions of livability and transportation demand management highlight the importance of the transportation and land use linkages. In the new era of reduced transportation funding and rising costs for transportation projects, focusing a portion of transportation project investment on projects that support community development, economic revitalization, and multimodal accessibility can be more effective than conventional roadway capacity projects. When coupled with land use projects that promote affordable housing with mixed land uses and access to transit, the amount of travel needed per person can be reduced and the way in which that travel occurs can be shifted from the auto. This in turn reduces pollution and energy use. More use of active transportation, such as walking and bicycling, also generates benefits to personal health. This type of interaction between transportation and land use enhances quality of life, reduces public infrastructure costs, and makes the transportation system more efficient.

One of the challenges is in taking the first few steps toward livability and sustainability. The existing transportation and land use fabric has evolved over decades and represents the collective result of millions of individual decisions about where employment is located, where people choose to live, where they shop and go to school, and how they choose to travel between these places. Changing the shape and character of this urban landscape likewise will require the first successful steps on prototype projects under improved economic and real estate market conditions. Unfortunately, Puerto Rico has experienced a population decline over the last decade, and continued reporting indicates that the decline has continued. The population forecasts for the island to 2040, as prepared for this LRTP, do forecast an eventual return to a population growth trend, albeit a modest one compared with the past. This will limit to some extent the opportunities for development. There is always, of course, movement in the housing, retail, and employment market places even with a stable population as housing stock ages and younger consumers seek different housing and lifestyle options.

Municipalities across the island are investigating and investing in the revitalization of their traditional town centers, either by renovation of old underutilized buildings or by planning and developing “in-town” projects that offer new development in the city center on vacant and underused land. Some of the several examples across the island include Fajardo, Bayamón, Caguas, San Juan, Humacao, Carolina, Ponce, and Aguadilla. As noted, even in no growth or slow growth situations, submarkets of the population can be looking for these types of live-work-shop-play walkable community lifestyles. Often

such projects can serve as the nucleus for adjacent redevelopment that expands on the success of the initial phase.

From these results, several important conclusions can be drawn:

- Expanded premium transit can have more immediate impact on travel choices and the transportation network, especially if less capital-intensive transit corridor solutions can be defined.
- Concentrations of land use can have profound effects on the transportation–land use equation, providing robust use of transit while addressing concerns relating to energy consumption and vehicle emissions. These require a visionary and persistent application of policies and incentives to capture the market opportunities and can require longer ramp-up periods to achieve. Land use changes are essential, however, to creating more livable communities, even if on smaller scales at more locations.
- As other regions have found, so much of our urban region structure is “locked in” over time by cumulative land use and transportation decisions, so it is difficult to move the vehicle-miles-of-travel needle. Commitments to sustainability and livable communities, however, dictate that efforts to advance these causes be initiated. A successful transit-oriented development around a transit station does make a significant change in transportation performance within its bubble of influence.

The implementation of the Islandwide 2040 L RTP should provide for a range of incremental environmental benefits arising from reduced congestion in the vicinity of capacity projects, which in turn would contribute to reduced greenhouse gas and other pollutant emissions. Increased use of existing transit services and the introduction of new transit services would contribute further. The PRHTA has begun to participate in innovative projects such as the PR-22 Metro Urbano bus rapid transit project which shares the dynamically tolled lane. This project serves as a prototype for further implementation of similar solutions in other congested radial corridors. Reorganization of AMA bus routes to better feed and interface with Tren Urbano is an example of another positive development that will improve synergies within the transit network.

National statistics clearly demonstrate the benefits to air quality and energy conservation which can occur with a coordinated and orchestrated approach. A toolbox of strategies is available to develop a multi-pronged program to reduce the need for vehicular travel through travel demand management. These strategies have been incorporated into the congestion management plans for San Juan and Aguadilla. Federal policies regulating vehicular emissions and CAFE standards provide a national framework for pursuit of these objectives. Coupled with smarter land use programs aimed at curbing sprawl and reducing travel demands as well as greater use of transit, bicycling, and walking, significant changes are beginning to be seen. Enabling laws are in place to permit development of robust transit-oriented development along the Tren Urbano stations although the full effect of these has been deterred by poor real estate market conditions and the effects of the recent recession. As the market rebounds, however, they offer the opportunity to create a more environmentally supportive urban environment, like those developing within Washington, DC and along its radial transit train corridors.

The land use growth patterns in Puerto Rico over the last 20 years have increased work trip commuting on much of the island’s strategic road network, the highways looping around the island’s coastal perimeter, and the toll roads, freeways, expressways, and some arterial segments. The diversion of a share of these commute trips to transit would advance sustainability and provide some congestion relief to corridor motorists. As the price of gasoline escalates, it is considered that citizens will rethink their

transportation budgets and lifestyle decisions about where to live and work, which defines commuting needs. Surveys conducted recently by the MPO provide some insight to that behavioral response.

7.4.2.7 Public Health

Studies nationally have demonstrated the important linkages between the character of transportation and how it is used and the quality of health across the general population. Recent studies have linked reduced obesity rates with those who use public transportation more frequently. The evolution of the transportation system in most urban areas over the past six decades has been dominated by an auto-oriented and auto-dependent culture, related to the low-density suburbanization of the nation's cities.

This pattern of sprawl, which has also affected the regions of Puerto Rico, is denoted by segregation of land uses into separate districts, lower development densities, usually the lack of a true town center, and a road network with indirect connectivity, little redundancy (alternative routes between points), and a lack of pedestrian and bicycle facilities. This evolution pattern has spawned consequences that eventually affect the quality of life and health of citizens. In a lower density land use setting, it is more difficult to serve a community cost-effectively with transit; walking access to needed shopping and medical services may not be practical due to distance and lack of sidewalks, and bicycling is typically more difficult as there is no safe accommodation of bicyclists on the roadways. Basic mobility tends to be auto-dependent and this circumstance has led to a more sedentary and less healthful lifestyle, and diminished accessibility for households with lower auto ownership to needed services and shopping. Thus, public health can be affected by transportation.

The important connections between transportation investments, land use patterns, and quality of life are long recognized in Puerto Rico, and reflected in several laws and executive orders which have been issued in relation to transit-oriented land use, Complete Streets, greenhouse gases, and others. The long recession and recent population decline in Puerto Rico has affected the pursuit of land use strategies that are market-driven. The PRHTA, working with the MPO and the Planning Board, is beginning the process to accomplish initiatives to advance the concept of livability and improvement of public health. This is being done by supporting the use of "active" transportation (walking and bicycling) projects which are multimodal in nature, by the preparation of a comprehensive bicycle and pedestrian plan, and by the identification of the first Complete Streets projects in each region of the island. The goals and objectives for this plan incorporate consideration of factors that can positively support the improvement of public health through transportation.

7.4.3 Strategies

Based on the framework and background for the theme of Environment, the following strategies have been formulated to engage the advancement of livability and environmental stewardship beyond the current programs of DTPW/PRHTA.

Strategy 1: Support initiatives for livability and the transportation-land use linkage.

The DTPW/PRHTA can participate more actively in the process to improve management of demand on the transportation system and quality of life by supporting initiatives that promote livability and better connections between transportation and land use policies.

Key Action Items:

1. Work closely with the MPO to coordinate with the Planning Board and its pending Land Use Plan, to improve land use-transportation planning coordination between involved agencies, and to identify strategies to incentivize "smarter" and more sustainable growth, including redevelop

urban centers, discourage sprawl, and advance the groundwork laid by DTPW/PRHTA for development of transit-oriented development around Tren Urbano stations. (S, M, L)

2. Coordinate with the MPO in its efforts to engage with federal programs such as the HUD/USDOT/EPA livability initiative and the EPA Smart Growth program, among others. (S)
3. Work to carry forward the Complete Streets law by advancing the completion of the technical manual to guide design implementation, identify regional prototype projects for implementation, and identify opportunities for other similar applications in partnership with municipalities and private development. (S)
4. Strategize on ways to incentivize a pilot project for transit oriented development around one of the Tren Urbano stations providing mixed use, denser development that complements surrounding land uses, to serve as a “success story” to encourage other similar projects. (S, M, L)
5. Coordinate this strategy area with other initiatives undertaken by PRHTA, in partnership with the MPO, including congestion management, transit development, non-motorized (bicycle and pedestrian) travel, and travel demand management. (S, M, L)

Strategy 2: Support environmental sustainability.

Key Action Items:

1. Coordinate a program of “green” initiatives, in coordination with the Congestion Management Process and other programs within PRHTA, the Planning Board, the EQB, and others. A variety of strategies could be pursued to reduce environmental impacts and promote sustainability, including energy conservation, travel demand management (carpooling, transit use, non-vehicular travel), transit-oriented development, improved community transit, and others. (S, M)
2. Participate in the processes under the Governor’s recently issued Executive Orders that call for the creation of a Sustainability Action Council; a study of greenhouse gases in Puerto Rico led by the Energy Affairs Administration, the EQB, and the Department of Natural Resources and Environment; and the study of climate change risks in Puerto Rico to be coordinated by the Department of Natural Resources and the Environment. Transportation, along with the allied areas of land use and the environment, is an integral component of these three issue areas, is affected by their consequences, or both, and should be at the table. These three processes are critical opportunities for the PRHTA, and its MPO partner to provide valuable input and information on an ongoing basis from the perspective of the transportation system. (S)
3. With respect to the climate change risk study just discussed, the PRHTA can use this process to define the risks to the transportation system from sea level change, and begin to incorporate consideration of infrastructure decisions in coastal areas relative to maintenance and new construction projects. (S)
4. Continue improving PRHTA environmental processes in coordination with its agency partners to proactively reduce the impact of highways on the natural and built environments, through avoiding impacts in the design, minimizing impacts creatively, and mitigating impacts responsibly. (S, M, L)
5. Work with the MPO, environmental agencies, and advocacy groups to encourage all strategies that would reduce energy consumption by transportation through energy conservation, reduced demand for travel, the “greening” of transportation maintenance and construction projects and programs, and other strategies. Include public outreach programs to encourage public support and adoption of these approaches. Embrace the “Puerto Rico Verde” initiative. (S, M, L)

7.5 Summary of Plan Compliance

This section summarizes how the Islandwide plan has addressed the Title 23 CFR 450.208 and 450.214 requirements that guide the development and content of statewide (Commonwealth) plans. (Other requirements -- 450.206 and 450.210 -- are summarized in Appendix D and Section 3.4, respectively.)

7.5.1.1 Coordination of Planning Process Activities: (Title 23 CFR 450.208)

- **Coordinate planning with the metropolitan planning activities, using reports and information from the MPO where possible.** The development of the Islandwide Transportation Plan has relied heavily on the transportation planning performed in relation to the two TMAs and five transportation planning regions (TPRs) of the MPO, which together comprise the entire geographic area of the Commonwealth. These regional LRTP documents are referenced within the Islandwide Transportation Plan.
- **Coordinate with trade and economic development planning activities and related multistate efforts.** This plan was coordinated with the regional economic development agencies across the island which were members of the Economic Development Advisory Committee that met during the plan development process and were included in email notices of draft documents. In addition, DTPW/PRHTA has coordinated with these agencies in the development of key transportation corridor projects such as the Bayamón-Hatillo Transit Alternatives Study, the PR-52 Caguas Corridor Transit Alternatives Study, and the PR-22 Highway Extension in the North and Aguadilla regions. There is close coordination between DTPW/PRHTA and the Ports Authority operating airports and seaports; from this coordination has come improvements on PR-12 to the Port of the Americas in Ponce, access improvements along PR-2 (Kennedy Expressway) adjacent to the Port of San Juan, and improved freight access to the Luis Muñoz Marín International Airport in San Juan.
- **Consider concerns of Federal land management agencies that have jurisdiction over land within the boundaries of the Commonwealth.** Several federal agencies have jurisdiction over land within the Commonwealth boundaries, including the U.S. Forest Service, the U.S. Fish and Wildlife Service, the Department of Defense, and the National Park Service. These sites include Fort Buchanan in San Juan, the El Yunque National Forest, several National Wildlife Refuges, and several national historic sites in Old San Juan, including the El Morro Castle and the San Cristobal Castle.

The Eastern Federal Lands Highway Division of the FHWA coordinates transportation projects involving these sites; its most recent Active Projects List (December 2012) includes four Puerto Rico projects: (1) Road repairs to Route 100 in the Cabo Rojo National Wildlife Refuge, (2) Repair of a wall on Forest Highway 3 in the El Yunque National Forest, (3) Reconstruction of a section of PR-9938 in El Yunque National Forest, and (4) Bridge replacement at La Chiva Lagoon in the Vieques National Wildlife Refuge. All of these projects were slated to be completed between 2011 and early 2013. These projects have been coordinated with the PRHTA as appropriate, and PRHTA is committed to facilitate coordination on future projects.

In August 2000, PRHTA entered into a “Forest Highway Statewide Agreement” with the US Forest Service and the Eastern Federal Lands Highway Division of the FHWA, to cooperatively address planning, construction and maintenance of forest highways in Puerto Rico. In recent years, PRHTA has cooperated on addressing access and visitor parking issues on the PR-191 road leading to the El Yunque National Forest. At the request of the U.S. Forest Service, an interagency Transportation Assistance Group (TAG) site review of the status of planning and

options for providing alternative transportation at the El Yunque National Forest was conducted during October 15-19, 2007. A summary report was prepared, based on discussions between federal, state, and local government stakeholders. The report summarizes the conditions observed, transportation issues and considerations, and recommendations arising from the meeting. The findings laid out a comprehensive series of next steps. While a final solution strategy has not been arrived at, the PRHTA which participated in the TAG meeting is as engaged as the U.S. Forest Service in addressing improved transportation solutions for this iconic tourist attraction in Puerto Rico.

- **Consider the concerns of local elected and appointed officials with responsibilities for transportation in non-metropolitan areas.** While a few municipalities are classified as rural, all municipalities are assigned to one of the transportation management areas/transportation planning regions, so that all municipalities are included in the development of the islandwide travel demand model and within one of the regional 2040 LRTPs prepared by the MPO. These municipalities have been included in the transportation planning process in terms of meeting notices and invitations, and the other communications channels for the plan, and have, therefore, been afforded opportunities to convey their opinions and concerns during the plan development process.
- **Consider the concerns of Indian Tribal governments that have jurisdiction over land within the boundaries of the Commonwealth.** As there are no specified Indian Tribal governments in Puerto Rico, this item is not applicable.
- **Consider related planning activities being conducted outside of metropolitan planning areas and between states.** As non-metropolitan planning areas have been included within the regional and islandwide transportation planning process, relevant planning activities have been considered. While Puerto Rico is not adjacent to any of the 50 states, it does have periodic dealings with its island neighbors including the Dominican Republic, the U.S. Virgin Islands, and others.
- **Coordinate data collection and analyses with MPOs and public transportation operators to support Commonwealth transportation planning and programming priorities and decisions.** As described in this Islandwide LRTP, DTPW/PRHTA have a unique one-to-one relationship with the single MPO for the island as the seven transportation management areas/transportation planning regions for the island constitute the same area of responsibility for the transportation agency. In addition, PRHTA provides technical staff support to the MPO for its planning functions and the public transportation agencies providing Tren Urbano, MetroUrbano, and MBA transit services are part of the DTPW/PRHTA organizational structure. Consequently, there is a close working relationship between the transportation agency, the MPO, and the transit operators, which extends to database development, sharing and analysis. As a result, the processes of transportation planning and programming priorities and decisions are facilitated significantly

7.5.1.2 Development and Content of the Long Range Transportation Plan: (Title 23 CFR 450.214)

Per 450.214, the Islandwide 2040 LRTP must be developed with:

“...a minimum 20-year forecast period at the time of adoption, that provides for the development and implementation of the multimodal transportation system for the Commonwealth. The long-range Islandwide transportation plan shall consider and include, as applicable, elements and connections

between public transportation, nonmotorized modes, rail, commercial motor vehicle, waterway, and aviation facilities, particularly with respect to intercity travel.”

The plan must also:

- **Include capital, operations and management strategies, investments, procedures, and other measures to ensure the preservation and most efficient use of the transportation system.** The plan addresses capital, operations, and management investments in Chapter 6, which discusses the outlook to 2040 for transportation funding resources and uses islandwide. Funds are identified for continuing non-capacity investments in bridge, safety, and other system preservation and modernization programs to maintain the system in serviceable condition to meet the needs of the traveling public. Chapter 5 also summarizes recommended investments in additional transportation system capacity across the island, based on the results of the individual transportation planning area/region LRTPs. Here in Chapter 7, additional recommended strategies and actions for improvement of the transportation system are described in relation to the four goals and supporting objectives established to guide the oversight and development of transportation in Puerto Rico.
- **Reference other transportation plans, programs, studies, and policies that were relevant to the development of the plan.** The Islandwide LRTP draws from a variety of data sources, policy documents, and prior studies and reports, both published and on websites. The Islandwide plan also relies on data, analyses, and other content in the LRTPs prepared by the MPO for the two TMAs and the five tPRs on the island. These references are cited in Appendix R.
- **Include safety and security elements.** Section 7.4.2.2 of the plan includes a discussion of transportation safety and security activities and programs. Strategy 2 under Section 7.2.3 discusses proposed actions to advance this important component of transportation system management.
- **Be developed in cooperation and consultation with the MPOs and nonmetropolitan officials responsible for transportation, Commonwealth, tribal, and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation.** Plan development was coordinated with the Puerto Rico MPO, and nonmetropolitan areas were included within the transportation planning regions and thus considered in the regional LRTPs prepared by the MPO. There are no tribal entities within Puerto Rico. Further, the plan was coordinated with Commonwealth agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation. Presentations were made of LRTP findings, draft reports were circulated for comment, and the plan development process was coordinated with several of the agencies in terms of data needs and data development and review. In addition, two of these agencies -- the Planning Board and the Environmental Quality Board --are members of the MPO Policy Committee.
- **Include a discussion of potential environmental mitigation activities.** Protection of the environment is a long-standing value of the Commonwealth, and the PRHTA is charged with contributing to environmental preservation through its project development process where widening or new alignments come into play, or where environmental features within existing rights-of-way are affected. Section 7.4.2.4 of the plan includes a discussion of PRHTA environmental mitigation activities. Strategy 2 under Section 7.4.3 discusses proposed actions to advance this important component of transportation system management. PRHTA coordinates closely with its environmental partners at the Commonwealth and federal levels.

- **Have the plan made available for public review to provide citizens, affected public agencies, representatives of public transportation employees, freight shippers, private providers of transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, providers of freight transportation services, and other interested parties with a reasonable opportunity to comment on the plan.** The Islandwide LRTP planning process endeavored to be inclusive in the outreach efforts. As discussed in Chapter 3, the advisory committees and review meetings included representatives from the disabled, the elderly, freight transportation providers, Commonwealth agencies, transit service providers, non-motorized transportation groups, regional economic development agencies, professional planning and traffic engineering societies, and educational facilities. This cross-cutting membership yielded stimulating discussions and valuable insights and inputs into the planning process, which is the intended outcome. These contacts were also used to leverage publicity of project meetings to their user groups.

Chapter 8

IMPLEMENTATION AND PERFORMANCE MEASURES

8.1 Plan Implementation

This plan strives to incorporate strategies that will address a variety of transportation system management and investment priorities, benefiting all users and stakeholders. It considers the current financial limitations of the Puerto Rico Highway and Transportation Authority (PRHTA) finances, which are being addressed, and incorporates emerging trend and tools in the changing landscape of transportation funding and revenues. Despite funding limitations, the plan represents forward progress in improving transportation in Puerto Rico and addresses important actions that can be taken to enhance system management. Opportunities to partner with other agencies and processes to improve policies that influence and shape transportation are also highlighted.

Against this backdrop, the new federal Moving Ahead for Progress in the 21st Century (MAP-21) transportation legislation that became effective on October 1, 2012 introduces significant changes in how federal transportation funds will be managed, though the basic level of funding for projects did not appreciably change. As a 27-month bill, its future into 2015 and beyond is not clear, but it is likely that it would be extended for an additional period, perhaps with some refinements to its provisions and funding levels, including attention to the depletion of the Highway Trust Fund.

Some of the major provisions of MAP-21 include the following:

- **Funding Program Consolidation**
 - Program Reduction: Reduces 87 programs to 30 programs with emphasis on performance and outcomes
 - National Highway Performance Program: Focuses on interstate highways, freeways, and other major highways
 - Surface Transportation Program: Now includes bridges not on the above system
 - Transportation Alternatives: Includes safe routes to school and recreational trails
 - National Freight Movement: Funding incentives for projects that enhance freight movement
 - Highway Safety Improvement Program
 - Congestion Mitigation and Air Quality Program
- **Performance Measures and Management**
 - U.S. Department of Transportation (USDOT) rulemaking followed by state and Metropolitan Planning Organization (MPO) performance target setting
 - Process will require up to three years to fully define
- **National Federal-Aid Highway Goals**
 - Federal planning factors remain unchanged
 - New national goals must be connected to MPO planning and decisions
 - Goals cover safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays
- **Project Delivery Streamlining:** Changes in agency review timelines and projects eligible for the Categorical Exclusion status under the National Environmental Policy Act (NEPA)

- **Expansion of the Transportation Infrastructure Funding Innovation Act (TIFIA)**
- **Federal Transit Agency (FTA) New Starts and Small Starts Project Regulations**
 - Project planning and NEPA processes to be integrated
 - Streamlining and simplification of cost-effectiveness and benefit analysis
 - Further guidance by FTA will be provided

It is prudent for DTPW/PRHTA to embrace the changes brought forward under this federal legislation as they will affect funding programs, strategies in how available federal funding can be applied to system needs, and the management of transportation infrastructure and services, both asset management and performance monitoring. A useful approach is to establish an internal process to manage the progress of the transportation agency in pursuing the proposals and strategies formulated in this plan. This tracking process can provide valuable input into the next iteration of this plan.

8.2 Performance Monitoring

Performance-based management of the transportation network, facilities, and services can be a systematic process integrated into the ongoing planning, maintenance and operations, and capital investment processes of DTPW/PRHTA. System performance analysis enables informed decisions about managing the system assets, and is valuable in assessing progress towards the organizational goals and objectives. This information can be presented on the agency website in a dashboard graphic format to convey this progress to the public and stakeholders.

The monitoring and analysis of performance can be used to inform policy changes, transportation alternative choices, and resource allocation decisions by helping to frame the likely outcomes of options and choices. The following potential performance measures focuses on a core group of measures that have been identified as indicators of the goals and objectives defined for this plan in Chapter 2. These are higher-level performance measures of the transportation system; more detailed indicators of specific infrastructure elements such as bridges, pavement, bus vehicles, and so on can be developed to better manage those assets. This list will require refinement in part due to the definition of several performance measures to be established under MAP-21 by the US Department of Transportation.

Table 8.1
CANDIDATE PERFORMANCE MEASURES

Goal	Performance Element	Performance Measure
EFFECTIVENESS 1. Improve transportation mobility and access for people and freight.	<ul style="list-style-type: none"> • System Connectivity • Investment Decisions 	<ul style="list-style-type: none"> • % of trips involving two transit services or auto/transit connection • Change in TTI Congestion Index
EFFICIENCY 2. Improve transportation system performance.	<ul style="list-style-type: none"> • Manage Travel Demand • Safety and Security • Asset Management 	<ul style="list-style-type: none"> • Vehicle miles of travel per capita and % non-auto trips • Traffic fatality rate • Composite asset condition index
ECONOMY 3. Reinforce economic vitality.	<ul style="list-style-type: none"> • Financial Sustainability • Freight Mobility • Strategic Highway Network 	<ul style="list-style-type: none"> • % of budget available for investment • Travel times between regions • % of network to be upgraded
ENVIRONMENT 4. Improve transportation system performance.	<ul style="list-style-type: none"> • Sustainability • Livability 	<ul style="list-style-type: none"> • Change in greenhouse gas emissions • Change in transit ridership

Again, this is a high-level monitoring framework that captures the ten plan strategies contained for the four goals. There would necessarily be a more detailed list of measures for each component of the system – highway use, highway system condition (bridge, pavement, etc.), transit use, transit system condition, and so on. This performance monitoring framework can be populated with data from conventional data collection sources (traffic counts, transit ridership and operations reports, traffic safety, bridge ratings), from the ITS data repository once it is developed, from the congestion management process, and from the travel demand model, which has a powerful capacity to report a variety of system statistics and performance measures.

8.3 Going Forward

Going forward, the DTPW/PRHTA can continue to advance its role in maintaining, managing, and developing Puerto Rico’s transportation system. As that process continues, other key actions can be advanced, in cooperation and coordination with the MPO, as appropriate, to further plan implementation, to promote the development of policies that can enhance coordination between transportation and land use, to build a foundation for a more multimodal approach to transportation solutions, and to set the stage for the next long range planning cycle. These actions will continue incorporation of strategies for a more sustainable future, both in terms of investment capacity as well as in transportation investments and improvements that address the public’s travel needs in a responsible and environmentally friendly way, for the benefit of today’s users of Puerto Rico’s transportation system, and the generations to follow.