Enabling Organizational Strategy through Effective Capital Programming

by

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Abstract

America's infrastructure assets are in a state of decay. There are too many needs with too few funds available for investment. Exacerbating the problem is the continuing decline of government infrastructure appropriations and poor public infrastructure management techniques. This thesis proposes the integration of organizational strategy and capital programming to produce an efficient infrastructure portfolio able to be financially managed by the owner agency.

The strategic capital programming process aims to enable the owner agency to base investment decisions on prior agency performance, long-term agency goals, and realistic analyses of market trends. The iterative process incorporates six core steps: 1) an audit of the agency's past performance, 2) a strategic assessment of the agency's goals and market environment concluding with the development of a corresponding list of potential capital projects, 3) the compilation of a baseline resource profile of the portfolio of projects, 4) an iterative portfolio analysis of the capital projects using schedule, scope, delivery method, and financing as variables, 5) the choice of a capital program that most closely fits agency resource constraints and strategic goals, and 6) program execution, performance tracking, and feedback.

There are three major advantages to implementing a capital programming process that is focused on achieving strategic agency goals through the use of performance analysis and variable project delivery strategies. The process results in an effective and efficient long-term infrastructure investment strategy. Through the use of the process, the agency enables the achievement of their goals rather than hindering them with poor management methods. Finally, the agency can satisfy public demand by becoming more accountable for their investment of funds and strategic decision-making due to increased stakeholder participation and market analysis in the programming process.

This thesis presents a detailed description and analysis of a strategic capital programming model and its applicability to government agencies. A case study of the Massachusetts Port Authority compares the proposed process to capital programming processes currently in use in advanced government agencies. The case study validates the inclusion of agency audit and strategic programming processes in capital programming and establishes the need for a new standard of market- and performance- oriented decision-making incorporating increased communication and feedback within the organization.

Thesis Supervisor: John B. Miller
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Author Biography

Katie J. Adams received her S.B. in Civil Engineering from the Massachusetts Institute of Technology in 1998. She received The Steinburg Prize in Construction Management that same year. Katie's technical concentration in her undergraduate program was Construction Engineering and Management and her humanities concentration was in Anthropological Studies.

Katie is an active member of MIT's Dance Troupe, having served as show coordinator, choreographer, and ballet instructor during her five and a half years at MIT. She performs with the group twice a year. Katie is also an advisor for the Zeta Phi chapter of Alpha Phi International.

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1 Introduction

1.1 Critical State of Infrastructure in the United States

The infrastructure of the United States is in critical condition, needing immediate maintenance, rehabilitation, renewal, and replacement. ASCE's *1998 Report Card for America's Infrastructure* gave America's Infrastructure a cumulative Grade Point Average of D (ASCE 1998), reflecting the poor condition of the country's roads, bridges, mass transit, aviation facilities, schools, drinking and wastewater facilities, dams, solid waste facilities, and hazardous waste disposal sites. Of the nation's $2.5 trillion worth of publicly held infrastructure (Munnell 1990), ASCE estimates the nation's total five-year infrastructure needs at $1.3 trillion (ASCE 1998). Two-thirds of the nation's infrastructure stock is held by cash-strapped state and local governments (Munnell 1990). Fixing these facilities will take more than just additional investments; the problem spreads beyond the physical condition of the infrastructure into management areas such as unknown inventory, unpredictable funding, and administrative priority shifting. As the need for infrastructure investment grows, the available funding at the Federal, State, and Local levels is falling (Miller 1996), creating a chasm into which the nation's infrastructure is slowing being swallowed.

Maintaining the nation's infrastructure, including all transportation facilities, utilities, waste management, and schools, is essential to the continued economic prosperity of the country, as well as to ensure national security. The physical condition of facilities determines the cost of operations and maintenance, which are passed on to the users through direct means such as tolls and user fees, or indirectly through taxes and subsidies. While no proven direct causal link exists between certain infrastructure investments and quality of life (Forkenbrock and Foster 1990), Michael E. Porter links infrastructure to the increased competitive advantage of the region and the nation[1] (Porter 1990).

With very little, if any, revenues currently generated by most infrastructure facilities, the funding available for investments such as maintenance and rehabilitation is limited by the sources of income of the owner of the facility. Since most public infrastructure in the United States is

[1] Discussion on this topic is included in Chapter 2.

owned and operated by the government, the sources of funds are limited to taxes and user fees. The limited funding that is generated by these sources is spread thinly throughout the government to fund all of its programs. This results in a constant budget battle over limited funds and excess needs, a situation that has resulted in a growing deferred maintenance backlog and the consequent poor condition of the nation's infrastructure.

1.2 Finding a Solution to the Problem

In order to reverse the downward trend in infrastructure condition and begin to decrease the backlog of deferred maintenance of those facilities, the entities in charge of the assets need to develop different ways of building, maintaining, prioritizing, and analyzing projects. Government agencies and private companies have begun to reevaluate their strategies of infrastructure delivery to reflect changing views of government responsibilities and the benefits of an effective infrastructure delivery strategy.

Two ways of solving the public funding deficits and increasing the responsibility toward infrastructure investments are various levels of private investment in the public infrastructure industry and the establishment of quasi-public agencies to develop and operate key infrastructure facilities. Procurement of A/E/C contracts in the United States is beginning to change in response to the demand for more infrastructure investment. Governments have also turned to the use of quasi-public agencies to help to shield infrastructure from government budgeting battles and provide for better infrastructure management.

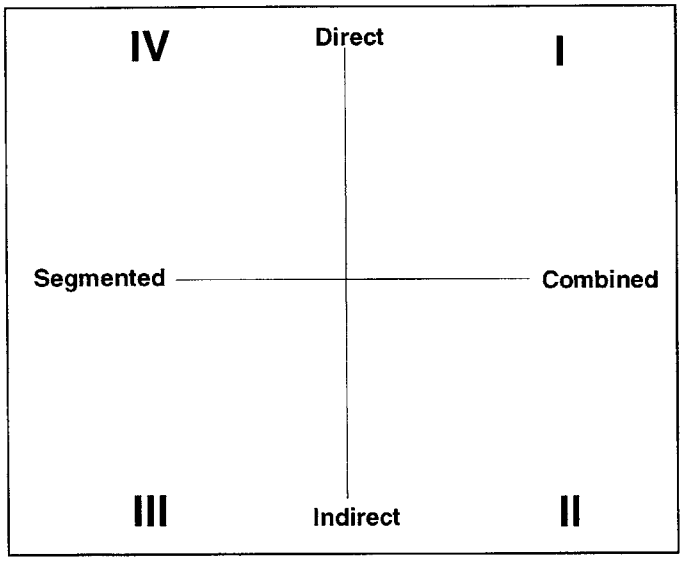

Figure 1-1: Quadrant Framework for Portfolio Analysis

1.2.1 Changing Government Procurement Policies

Figure 1-1 presents a framework for classifying procurement types along the orthogonal axes of project financing and project delivery (Miller 1995). Miller's research, undertaken at the Massachusetts Institute of Technology, has shown that procurement varies according to the source of funding (direct or indirect from the government) and according to the integration of

design, construction, and operations services (segmented or combined). In Figure 1-1, the horizontal axis represents the integration of project delivery and the vertical axis represents the degree of owner-provided funding.

Based on an analysis of 800 infrastructure projects addressed by congress between 1789 and 1972, Miller has determined that the use of the various quadrants for procurement by the government has evolved since the country's foundation (Miller 1995). Between 1789 and 1900, infrastructure was delivered as a system, with design, construction, and possibly operations provided by the same vendor. Funding for projects came through either direct federal funding or indirect funding (Figure 1-2). This multi-quadrant approach was in response to the need for infrastructure in the developing country but the lack of governmental funds. With this dual-track strategy, the government was able to profit from the benefits of infrastructure development without assuming all of the risk involved with the development of projects. Indirect incentives for schools, public buildings, universities, and trans-continental railroads was provided through land grants, checkerboard land sales, and franchises (Miller 1996).

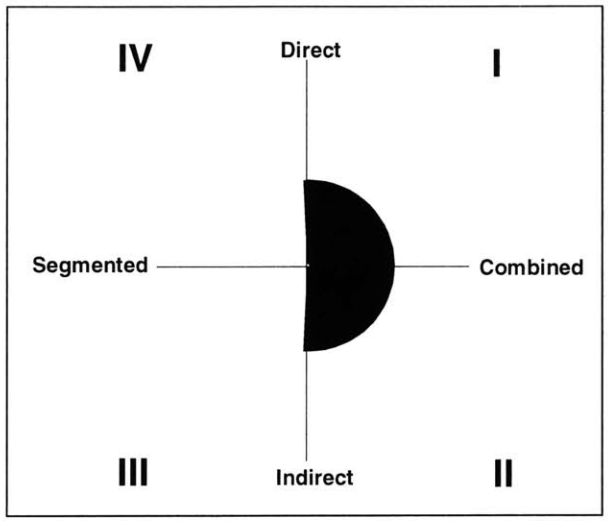

Figure 1-2: Procurement Strategies – 1789-1900

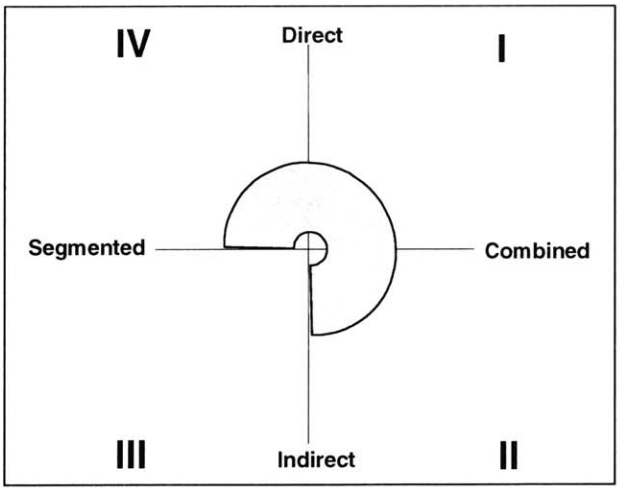

Figure 1-3: Procurement Strategies – 1900-1950

Between 1900 and 1950, the federal government added activity in Quadrant IV to its procurement strategy (Figure 1-3). The segmented design, construction, and operations procurement in Quadrant IV addressed the problems associated with sole-source procurements in Quadrants I and II (Miller 1996) and responded to the growing industry of independent, specialized engineering firms (Miller 1997).

In post-WWII America, the procurement strategy adopted by the federal government has been located almost entirely in Quadrant IV, depicted in Figure 1-4 (Miller 1997). This was the era of the interstate highway system, for which $100 billion of federal money was appropriated for use in Quadrant IV roadway construction. Now that this and other federal infrastructure funds are drying up, procurement policies are beginning to spread back into Quadrants I and II, again in response to infrastructure needs but too little direct resources.

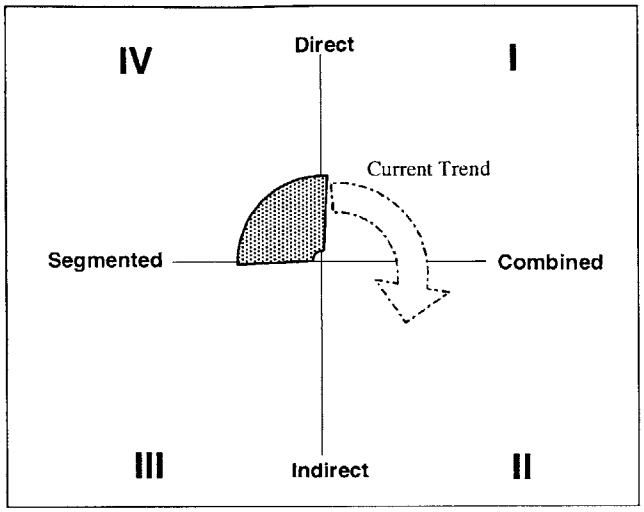

Figure 1-4: Procurement Strategies – 1950 to Present

1.2.2 Role of Quasi-Public Agencies in Infrastructure Management

The use of Quadrant II procurements forces the government to give up control of many of their key infrastructure assets. One way of indirectly funding infrastructure without having the facilities leave the hands of the government is to establish a quasi-public agency to develop, operate, and manage state infrastructure assets.

Quasi-public authorities are governmentally-enabled agencies that are established to build, control, and operate certain public infrastructure assets. Quasi-public authorities are distinguished from state agencies in that the independent authority supports its operations solely through its own operating revenues and investing activities. Typically, legislation authorizes the authority to issue revenue bonds to support its capital programs. Quasi-public agencies do not have the authority to tax, although they may be eligible for federal, state, or local subsidies. Beginning with the Port of London and continuing in the Western Hemisphere with the Port of New York in 1921, important infrastructure assets, most notably linked to national security and regional economic vitality, have been shielded from the vagaries of annual legislative appropriations through the establishment of quasi-public authorities.

The public/private nature of quasi-public agencies creates inherent conflicts in their capital programming strategies. The delivery of efficient, convenient, safe, and smart transportation facilities require significant financial commitments for planning, construction, maintenance, and operations. Agencies must make choices that allow them to support their businesses, calling for projects that are self-supporting and revenue generating. Yet, the jurisdiction of the agencies also calls for them to provide public services that may not fit into this self-supporting model. Agencies must confront the dilemma of how to provide facilities and services that balance public priorities and agency operations while still maintaining a self-sustaining business enterprise.

Quasi-pubic agencies like the Port Authority of New York and New Jersey and the Massachusetts Port Authority are some of the most successful government entities in the field of asset management. This is because they act similar to a private corporation providing infrastructure facilities and services. They are responsible for their own financial strength and their relative independence from the legislature allows them more flexibility for project delivery choices and management practices.

1.3 Research Project

1.3.1 Objective

The objective of this research project is to present a framework for effective capital programming and show how the use of this framework can enable a government agency to determine the most efficient infrastructure development program and use that program to enable its strategic organizational goals to be met.

1.3.2 Scope and Methodology

This thesis presents a process for the integrated practice of capital programming and strategic management for government agencies. A case study of the Massachusetts Port Authority will be used to highlight the differences of the presented schema to processes currently being used in public agencies. The case study will be used to show how the process would enable the Authority to further strengthen its infrastructure base and operations, as well as achieve the economic goals of the region.

The research project began with a financial analysis of the Massachusetts Port Authority, assisted by the decision-support tool CHOICES©. Interviews of managers in the Capital Programs Department, Conley Terminal, Moran Terminal, the Tobin Bridge, the Finance Department, the

Real Estate Development Department, and Sea-Land Shipping Company were conducted to identify the strategic challenges facing the Authority and understand the Authority's current planning procedures. A review was conducted of current business strategic planning techniques that are in use in other industries to determine which of these processes would be applicable and beneficial to public agencies. Finally, the iterative capital portfolio analysis process was expanded to include strategic analysis techniques to develop the initial portfolio and track agency performance.

1.3.3 Results

The results of this study show that a path to organizational strategy and implementation of goals for agencies governing large infrastructure assets is through the marriage of strategic planning and capital programming. A six-step process is proposed to assist agencies to determine their current operational status, set realistic and measurable goals, and formulate a strategy to achieve those goals. Finally, barriers to the implementation of this process are discussed with discussions as to how to overcome those barriers.

2 Capital Programming

2.1 Definitions

Simply put, capital programming is the set of decisions pertaining to what to build, when to build it, and how to get it built. To be effective, these decisions should be based on how to invest resources to produce the greatest future benefits. Examples of capital projects include infrastructure, buildings, and equipment. Capital expenses are any expenses associated with these projects, including design, construction, acquisition, legal fees, and mitigation. Capital programming is undertaken by both public and private entities. This thesis will concentrate on capital programming procedures in public agencies, although the concepts can be applied to planners in private companies as well.

Effective capital programming by government agencies, in terms of finding the right projects, the right schedule, and the right way to build and finance them, assists the Agency in meeting its strategic goals and produces long- and short-term benefits both within and without the agency. These benefits are both economic and social.

2.2 Regional Advantages of Effective Capital Programming

By analyzing a complete set of project alternatives and configurations within the context of a sound decision-making scheme, a public agency will experience short- and long-term cost savings (Miller 1998). These cost savings can stem from decreased capital costs associated with design and/or construction or from decreased operating costs. The integration of operations, facilities management, condition assessment, and alternative analysis into the long-term planning and capital programming procedures results in effective long-term resource allocation for the agency (Miller 1998). The effective resource allocation will increase the agency's "buying power" through project cost savings, the elimination of redundant work, and the elimination of expensive emergency projects.

Effective capital programming should facilitate the use of new technologies and innovative methods in the design, construction, and operations phases of projects (Miller 1998). Decisions are more informed, leading to procurements that foster innovation, are more flexible, and push for both lower facility life cycle costs and opportunities for private investment.

The public experiences different types of benefits from an agency's use of effective capital planning and the resulting infrastructure improvements: regional economic benefits, increased quality of life, and increased regional competitive advantage. Regional economic benefits of infrastructure improvements begin with the creation of local jobs associated with the design and construction of the structures. Construction of new facilities and capital improvements to existing facilities support and attract new and existing A/E/C firms to the region (Miller 1998). The lower transportation costs resulting from infrastructure improvements produce lower prices, higher wages, and higher net incomes for businesses operating in the region (Forkenbrock and Foster 1990).

The rise in regional economic benefits facilitates a rise in the quality of life in the region. Infrastructure improvements resulting from effective capital programming also create increased efficiency and timesavings for users of the facility. New technology can be effectively implemented to contribute to efficiency increases and environmental performance. Additionally, the environmental performance of the infrastructure facilities improves with less air pollution and noise from fewer delays and less congestion (Miller 1997).

The competitive advantage of the region is a region's ability to attract new businesses and sustain existing ones. Lower costs, efficiency increases, and quality of life increases all have positive impacts on the region's competitive advantage. In Michael Porter's book The Competitive Advantage of Nations, he includes infrastructure and conducive government policy as necessary factor conditions for increasing a nation or region's competitive advantage (Porter 1990). Porter asserts that wealth stems from productivity and productivity growth which in turn leads to a higher standard of living. Porter states, "The principal economic goal of a nation is to produce a high and rising standard of living for its citizens. The ability to do so depends not on the amorphous notion of 'competitiveness' but on the productivity with which a nation's resources (labor and capital) are employed." (Porter 1990:6) There are two determinants in competitive success of businesses: lower costs or differentiated products. Governmental agencies can assist the competitive success of their region by lowering the transportation costs in the region, which in turn lowering the operating costs of businesses operating in that region. Sustaining this competitive success requires continuous upgrading of methods and strategies to ensure the continued advantage over other regions (Porter 1990).

2.3 Current State of Capital Programming

Many capital programming processes in the public sector are non-standard and decentralized. Since there is no standard of performance, individual entities very significantly in the effectiveness of their programming processes. Various research efforts are underway to determine the most effective way to choose projects for investment, but there is no general consensus on how this should take place (Hsieh and Liu 1997). Areas in which current practices often fail are projections of construction expense, operating revenues, and operating expenses, which are then coupled with poor projections of usage rates (Miller 1997), project prioritization techniques, evaluation methods (Hsieh and Liu 1997), and lack of knowledge of capital programming techniques. These problems often lead to projects that are built and then do not perform as expected, projects that are deferred when they should be built, or investments that do not give their maximum economic and social return.

3 Capital Programming Process

Figure 3-1 is a proposal for an improved capital programming process emphasizing informed decision-making and agencywide strategy. This process was first proposed by Miller and Fagan in 1999 and is shown here modified to include organizational strategy planning procedures. It is composed of two quadrants: project choice (left side) and project delivery (right side). The tasks within the quadrants are iterative and linked with constant information flow, feedback, and evaluation within and between the quadrants.

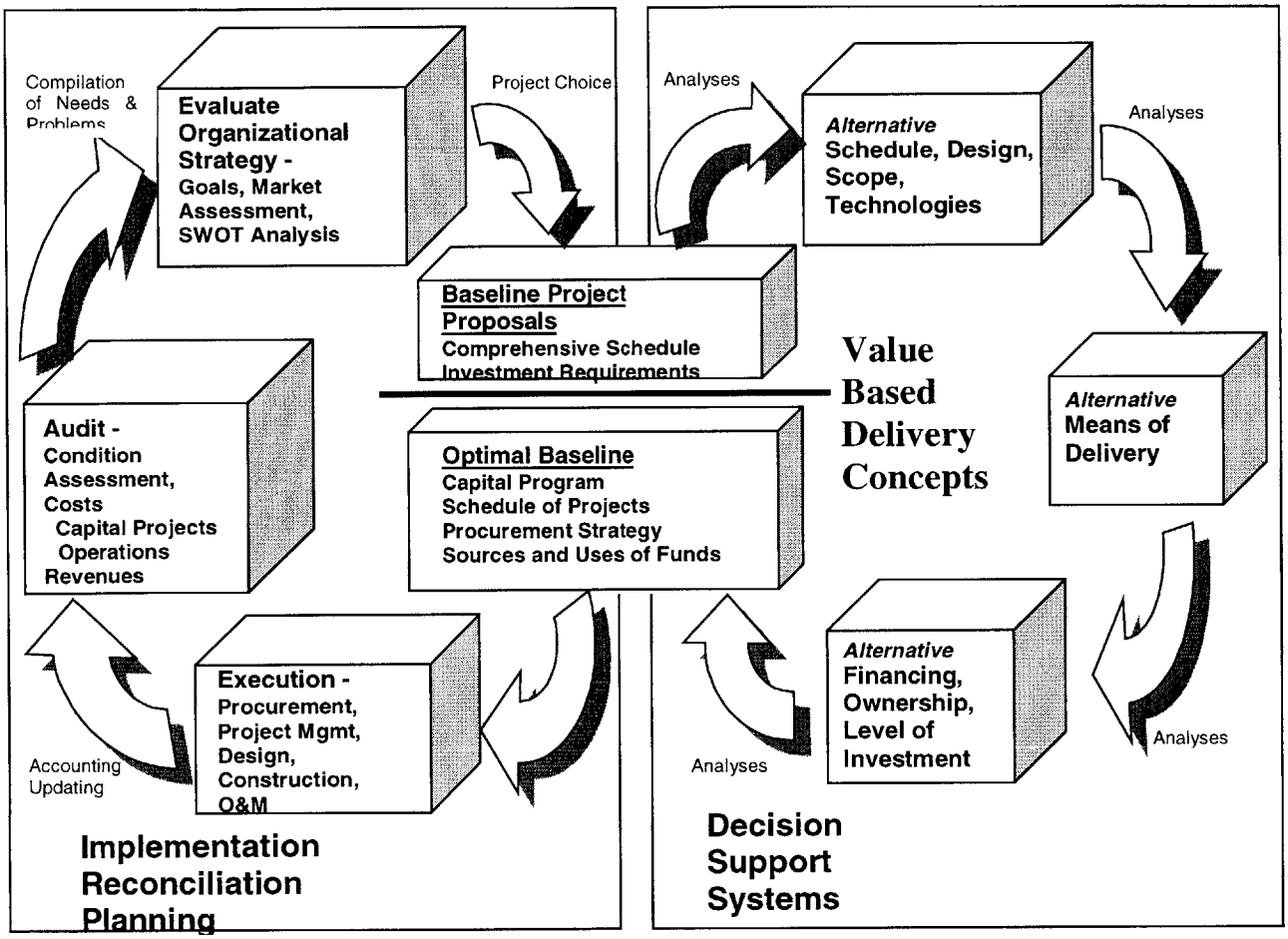

Figure 3-1: Integrated Capital Programming Model

The starting point of the process is an audit of the current condition and performance of all of the facilities for which the owner is responsible. From there, the agency needs to formulate its goals, mission, and strategy for achieving its goals. With these goals in mind, projects are proposed and evaluated using the portfolio analysis technique to achieve an optimal capital program for the agency's needs and constraints. The program is then executed and the process begins again with

an audit of the old and new facilities and the impacts of the previous capital program. The steps are linked in order to provide information flow and feedback for decision-making and consequence analysis.

Before any programming decisions are made, this process forces the agency to look at where it is, where it wants to be, what strategy should be implemented to get there, and how to most effectively implement that strategy. After the most effective strategy is adopted, the resulting program is implemented and the results are forwarded to the agencywide assessment for the beginning of the next cycle.

3.1 Choosing Projects

Project proposals should be based upon two criteria: the current condition and operations of the facilities and the long-term goals and strategies of the agency. These two criteria should not be exclusive but should complement each other in developing proposals for projects that provide the most benefit to the agency in terms of its long-term goals.

The audit and strategic planning processes help the agency determine where they are and where they are going. They provide a context in which to choose the projects that will ultimately be considered for inclusion in the final capital program. Strategic choices must be made as to how to prioritize projects and how to evaluate tradeoffs between different proposals. With a snapshot of the current condition and operating efficiencies of the assets under evaluation, problems can easily be identified and addressed. The strategic planning process looks at the future of the agency and its markets, combined with historical condition and performance assessments of its facilities from the audit, to identify opportunities for increased efficiencies, public benefits, and economic performance of facilities. The problems and opportunities identified in the two processes should be combined to determine the most efficient long-term combination of projects for the achievement of the agency's goals. All of the projects should be pulling the agency in one direction: the achievement of their long-term goals. The combined group of projects represents the agency's strategy to achieve those goals.

From the list of projects derived from the strategic planning process, a baseline of the necessary resources for the group of projects must be produced. The baseline should include all of the necessary capital and operating resources per planning quarter, a comprehensive schedule of work, the revenue that is generated by new projects (or lost from the closing of facilities), and a detailed scope definition of each of the projects. It is this baseline that will be passed on to the portfolio analysis stage of the capital programming process and reproduced and reevaluated with each iteration of the portfolio analysis.

3.2 Portfolio Analysis

3.2.1 Overview

Portfolio analysis is a new field emerging within the infrastructure investment environment (Miller and Evje 1999). Portfolio planning is a long-term evaluation strategy that uses the strengths of certain projects to offset the weaknesses of other projects and create a stronger overall business base. This concept can also apply to areas other than capital programming, such as financing strategies and public relations[2]. For its use in capital programming, iterative variable changes can produce a portfolio that magnifies the strengths of the overall portfolio through applying extra project-produced resources to non-profitable but highly desirable projects while still falling within the agency's resource constraints. In order to use portfolio analysis for capital programming, the agency must have a clear picture of its financial constraints and have already recognized its desired projects. In the proposed process, these activities take place during the agency's audit and strategic planning phases.

The projects proposed in the strategic planning phase of the process comprise the agency's initial portfolio of projects. Portfolio analysis looks at the aggregate benefits and expenses of the system of projects. It combines the financial profiles of all of the projects over time to determine the program's generation and usage of resources from the user's perspective. The portfolio analysis begins with the baseline generated by the initial project configurations. The projects are then assessed to determine the viable configurations of project variables. These configurations are systematically evaluated in the context of the whole portfolio by producing a new portfolio baseline for each configuration of projects and project variables. The projects in the portfolio are

[2] Agencies can obtain capital financing on the strength of their highly performing facilities. These facilities guarantee the debt when poorly-performing facilities could not. In terms of public relations, associating a facility with an agency or other facility that is in the public favor could generate greater usage rates, more public favor for that facility, or greater public acceptance of the facility.

reconfigured until the portfolio profile and baseline is found that most closely suits the agency's resource constraints and strategic initiatives.

3.2.2 Project Delivery Options

The preliminary list of projects generated by the audit and goal assessment needs to be turned into a viable portfolio of projects that can be delivered on time and within the agency's resource constraints. To do this, viable combinations of portfolio variables must be identified for each project. Four project characteristics are considered variables for the portfolio analysis: 1) project scope, 2) financing strategy, 3) delivery method, and 4) project schedule. Each one of these variables has a unique effect on the cash flow of the individual project and on the portfolio collection of projects (Adams and Miller 2000 in press)[3]. The results of the combinations on the portfolio as a whole must be assessed and evaluated to determine the benefits to the agency and the feasibility of the portfolio.

The four variables encourage the innovative use of financing, technology, design and construction techniques to achieve greater results in infrastructure portfolios (Miller 1997). Each variable creates a different cash flow impact in time on both the project and the whole portfolio, allowing the agency to match the portfolio with its resource steams. Certain variables, such as schedule and some financing methods, will not affect the cash flow of the individual project, but will affect the overall configuration of the portfolio cash flow, necessitating the evaluation of the projects on a portfolio level, not a project level.

The decision as to which combinations of variables are viable for each project must be made by the agency for each individual project. Each project has unique constraints that govern how much flexibility is available in reconfiguring the project variables. For example, due to safety and insurance reasons, an agency may want direct control over the design and construction of a project on an active airfield, thereby limiting the delivery method to Design-Bid-Build but leaving open a number of different financing options. Other projects may have no restrictions on the type of delivery method utilized but need to start immediately. Viable project delivery systems can be located anywhere on the quadrant framework presented in Chapter 1. Differences in project scope can represent project size, differing technologies, or differing site usage. Project schedule variations change the rate at which the project begins generating revenues and the rate at

[3] See further discussion in Chapter 10.

which the project consumes agency resources. Constraints on the project variables may arise from legal issues, funding availability, project control, urgency, and configuration benefits.

After the possible configurations of the project have been addressed, the portfolio must be analyzed with each of the combinations. It is not until this analysis has been done and the effects of each variable configuration on the portfolio have been analyzed that final decisions as to project scope, delivery method, schedule, and finance for each project are made. This is a departure from the current industry standard of choosing the delivery method for each project individually, without regard to its effect on the portfolio. The current method locks the agency into one project configuration at the outset of the conceptual design. This configuration is meant to optimize the benefits provided to the agency by the project and procurement (Gordon 1994). In the proposed capital programming process and portfolio analysis, the solid decision of which variable configurations to use for individual projects is not made until all of the options have been explored together. Instead of deciding the procurement type at the beginning of the project's conception, options for project delivery are created which will be evaluated in the portfolio analysis. It is possible that, due to agency, financial, or legislative constraints, the project configurations that have the greatest positive impact on the portfolio are not the variables that optimize the results of an individual project (Adams and Miller 2000 in press).

A thorough portfolio analysis will produce a group of viable portfolios that fit into the resource constraints of the agency. The benefits of these portfolios to the strategic direction of the agency must be compared and, from that, the best choice portfolio for the agency can be determined. From this portfolio, the "optimal baseline" is constructed, consisting of the required investment on the part of the agency and the private sector, the schedule of the projects, the procurement strategy for each project, the sources and uses of the resulting funds, and a detailed scope for each of the comprising projects.

3.3 Execution

The execution of the chosen program includes implementing all of the strategies therein: acquisitions of land and equipment; project design and construction; and operations and maintenance of all the projects. After the execution of the capital program, the results need to be fed back into the system so that the knowledge base to be used in the next year's process is updated and expanded. The feedback loop and information flows are imperative to the effective

implementation of the proposed capital programming method. It is only through the continuous updating of knowledge and modeling criteria that the results of the process improve over time.

3.4 Importance of Decision Support Concept and User Interaction

There are numerous ongoing research projects aimed at computerizing the process of project choice, prioritization, and optimization (Hsieh and Liu 1997). These projects aim to eliminate subjectivity in the process of choosing projects for investment and model the owner's priorities in decision-making software.

These endeavors ignore important aspects of infrastructure development; decisions are not based solely on economics and often the benefits of different projects cannot be directly compared to each other without incorporating compromising and simplifying assumptions. Infrastructure investment is a management decision. The programs do not consider the strategic advantages of project synergy nor the benefits of the experience of the decision-maker. They aim to take the user completely out of the process of project prioritization.

Though other researchers are attempting to eliminate subjectivity in project choice by computerizing prioritization methods (Hsieh and Liu 1997), subjectivity is still inherent in the systems through the choice of priorities and the estimation of benefits and project performance. This weakness, inherent in any prediction of the unknown, is mitigated in the proposed model through the channels for feedback and evaluation.

The process proposed in this thesis values the input of the managers that are familiar with the operations, management, and investment activities of the agency and its various facilities. Key elements in the effectiveness of the process include the healthy debate over the relative benefits of the projects and the creativity of the decision-making group. The portfolio analysis process is a *decision-support tool* aimed at helping decision-makers identify portfolios that represent economically viable project delivery configurations, thus allowing the decision-maker to focus on the strategic aspects of the projects and the portfolio. These viable portfolios are then brought back to the decision-making body to undergo an analysis as to which best fits into the agency's strategic plan. Optimization is not a viable goal in portfolio analysis since the analysis produces a large set of viable portfolios.

4 Massachusetts Port Authority

4.1 Overview of the Massachusetts Port Authority

The Massachusetts Port Authority (Massport) was established as a quasi-public revenue bond authority in 1956 through the Massachusetts Legislature Enabling Act of 1956 (The Enabling Act). It was created to develop and operate Logan International Airport, the public terminals at the Port of Boston, Tobin Memorial Bridge, and the general aviation facilities at L.G. Hanscom Field in Bedford, Massachusetts. Since the provision and care of these infrastructure assets is Massport's main business, any actions taken upon these facilities have major impacts on the financial profile of the agency and the direction of the agency's future. The facilities that Massport runs are integral regional infrastructure links, causing the performance of the facilities to be linked to the economic vitality of the City of Boston and the New England region. In total, Massport's facilities generate $8.6 billion in economic benefits annually, including nearly 29,000 jobs, for Massachusetts and New England (Massport 1996).

Because of Massport's classification as a quasi-public agency, they are statutorily required to be self-sustaining; they generate the funding necessary for operations, maintenance, and capital activities through their own operating and investing activities. This responsibility for financial performance has caused the Authority to jump to the forefront of capital programming practice, using a wide range of financing strategies and portfolio analysis to produce a sustainable infrastructure portfolio. As a self-sustaining business enterprise with much more stability and control over their financial performance from year to year than if they were being appropriated funds by the state, they can exhibit more flexibility in their capital programming than other fully-public agencies.

Massport was chosen for the case study for this project because they have some of the most advanced capital programming and infrastructure management techniques in the public sector. They produce a stable infrastructure and maintain independent financial strength through the use of effective delivery strategies, sound financial analysis, and good estimating techniques. Their projects are based on facility condition and performance, regional economic benefits, and facility strategic planning. Their current programming and planning techniques will be compared and

contrasted with those proposed in this thesis and opportunities for improvement will be expounded.

4.2 Agency Financial Performance

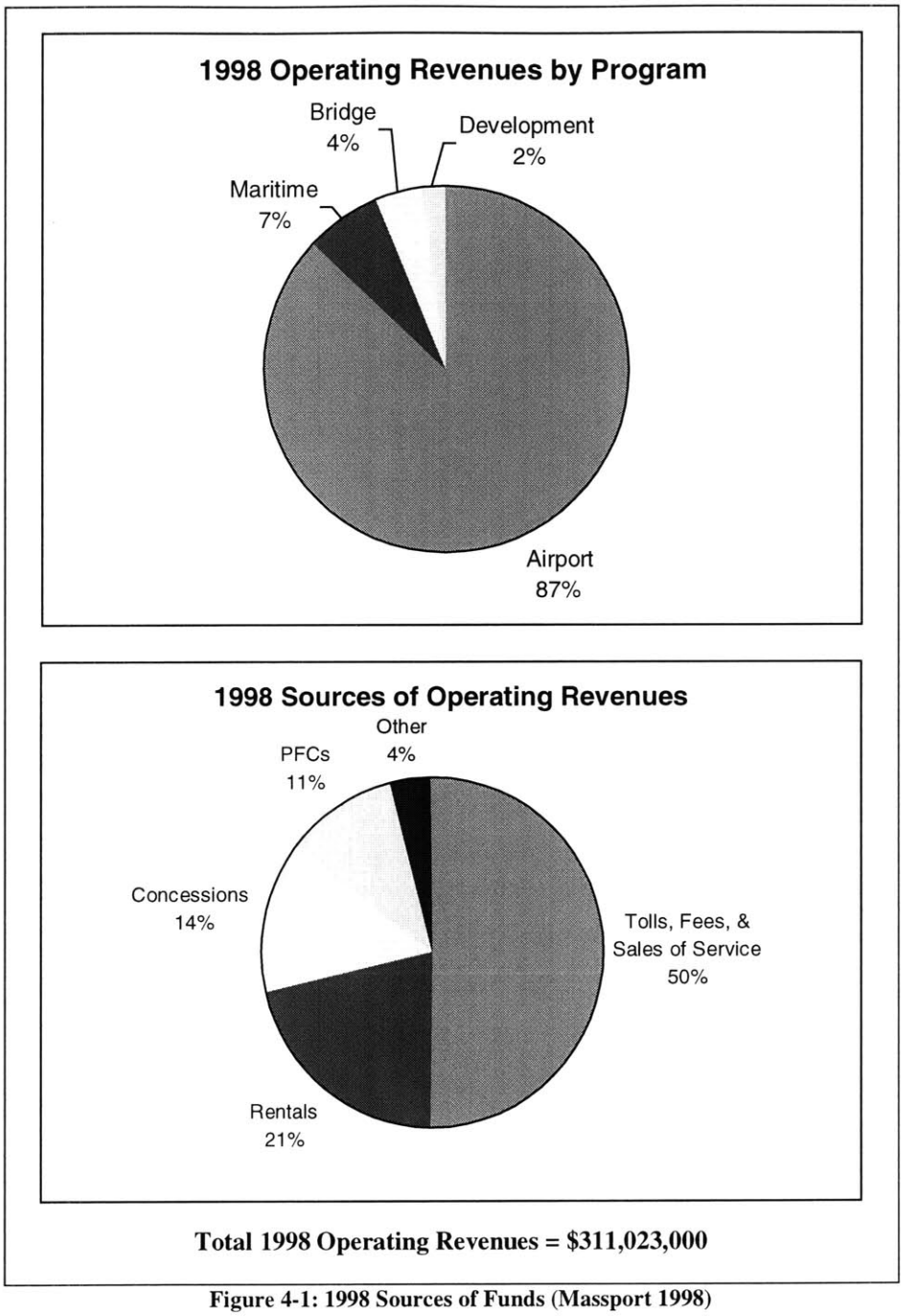

Figure 4-1: 1998 Sources of Funds (Massport 1998)

4.2.1 Revenues

The sources of funds for capital improvements, operations, and related programs at Massport's facilities are generated through the operations of those facilities, through investments of existing funds, and through facility lease payments. These sources are supplemented by construction grants provided by the Federal Government and bonds issued for capital improvements. Every facility owned by Massport generates revenues through a combination of tolls, rental fees, user fees, concessions, and sales of services. In addition, Logan Airport collects funds in the form of Passenger Facility Charges (PFCs) from each airline passenger flying either to or from Logan. The breakdown of 1998 operating revenues by source and by facility is shown in Figure 4-1.

The agencywide operating revenues, including tolls, fees, sales of service, rentals, concessions, PFCs, and other operating revenues, have been increasing at a rate of approximately 9.21% a year since 1975, as calculated in the CHOICES© program[4]. This represents an average increase in revenues of $12,050,000 a year. The standard deviation of this calculation, representing the fluctuation in the operating revenue increases over this period of 24 years, is $8,804,008. This is 73% of the average yearly rise. Tolls, fees, and sales of service increased at a rate of 9.56% over this period while rentals and concessions each increased at a rate of 7.5%. The rate of growth of PFC revenues is dependent on the growth of passengers through Logan and the amount that the Federal Aviation Administration authorizes the agency to charge each passenger.

4.2.2 Expenditures

The 1978 Trust Agreement, which governs the financial operations of the Authority, dictates the use of funds generated by operating and investing activities according to this priority: 1) Operating Expenses 2) Debt Service 3) Payments-In-Lieu-of-Taxes (PILOT), and 4) Capital Projects including new construction, repair, improvements, and maintenance. Throughout its existence, Massport has been required to hold and operate properties with dramatically different net cash flows, requiring excess revenue producing facilities to have always subsidized unrelated facilities.

[4] Average of the percent increase each year for entire data set. These trends do not include Massport's revenues from investing activities, bonds, or grants.

4.2.2.1 Operating Expenses

Figure 4-2 shows the amount of the total operating expenses incurred by each facility in 1998. Massport's operating expenses are grouped into four categories: operations and maintenance (O&M), administration, insurance, and pension.

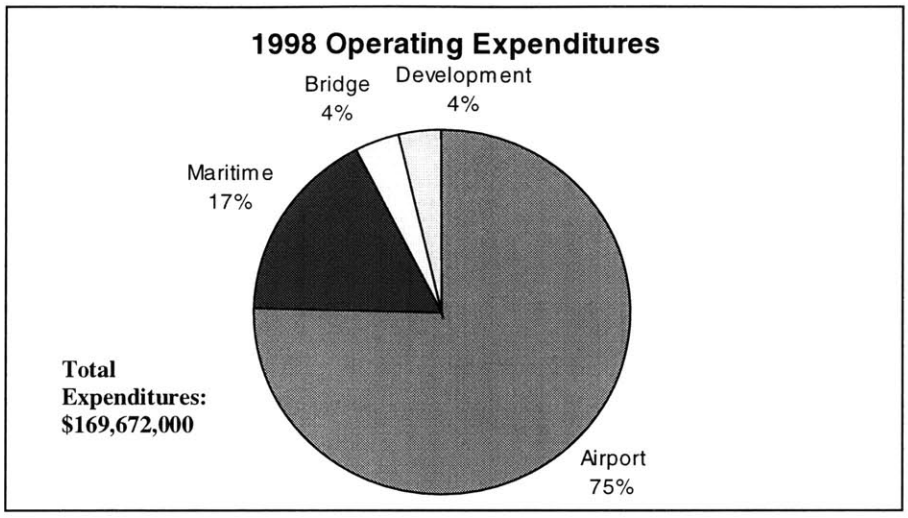

Figure 4-2: 1998 Operating Expenses by Program (Massport 1998)

Up until 1979, Massport was sustaining a growth trend of 23% in their operating expenses per year. This trend was halved in 1980 and since then has been progressing at a 7.24% increase per year, one-third the amount that the Authority was experiencing in 1979. By program, the Authority is experiencing a growth of 9.36% per year in their bridge activities, 10.96% per year at the airport properties, 6.16% per year at the marine terminals, and 18.6% per year in their development properties.

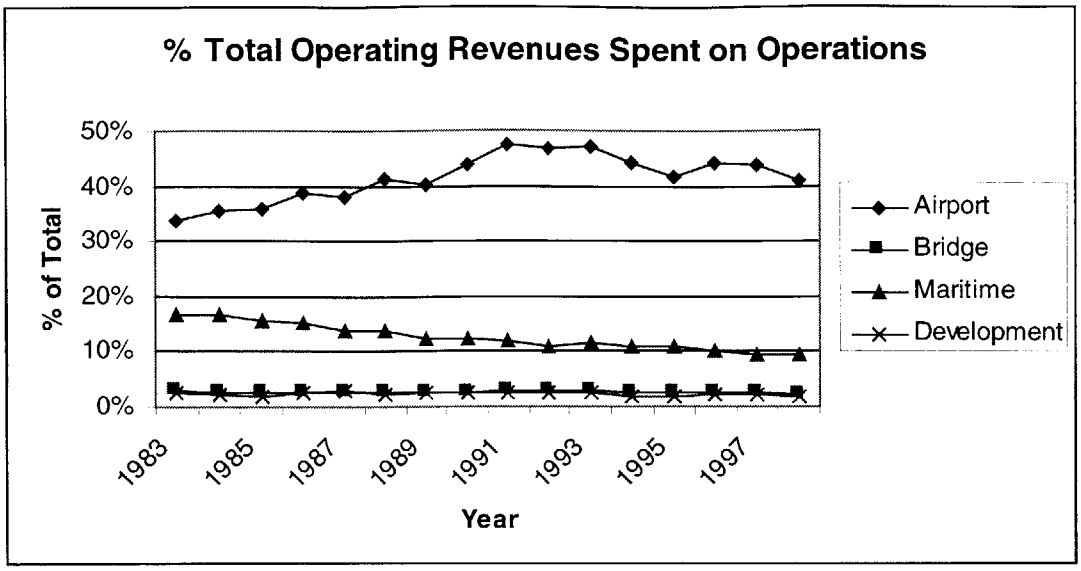

Figure 4-3: Investment of Agency Operating Revenues Per Facility[5]

Figure 4-3 shows the expenditure of operating funds relative to the Agency's total operating revenues. The graph shows that the Tobin Bridge and Development Properties constantly require approximately 2%-3% of the Agency's operating revenues for their O&M, administration, insurance, and pension costs. The relative amount of investment in operations at the maritime facilities has been decreasing each year from a high of 17% in 1983 (the earliest year in which reporting was done separately from development) to a current 1998 investment of 9%. The amount that the Authority spends of their operating revenues on operating the airport properties has grown since 1983 from 34% to 41%, with a peak of 47% in 1991, 1992, and 1993.

Figure 4-4 shows the percent of operating revenues generated by the programs that is spent on the operations of those facilities. This is an indicator of the performance of each of the programs as a conglomerate of the facilities within that program. It shows the degree to which the airport operations, namely parking fees and rental car fees, subsidize the operations of the other facilities. This graph also indicates the impact of the increased roundtrip toll over the Tobin Bridge in 1997. After the toll increase, the bridge is able to support its own operations whereas before the increase it was spending nearly 120% of its toll revenues, the only revenues generated by the bridge, on its operations.

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[5] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

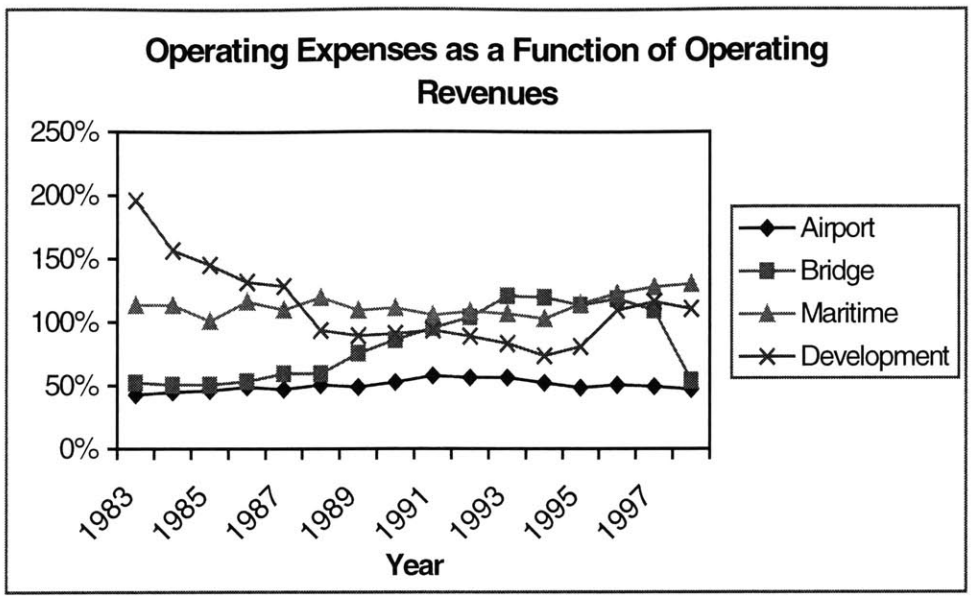

Figure 4-4: Ratio of Operating Expenses to Operating Revenues[6]

In the history of the maritime properties shown here from 1983 to present, the port terminal properties have only once, in 1985, broken even on their operations. Since that time the deficit between their operating revenues and their operating expenses has been increasing, rising to 130% in 13 years. Two factors may help to decrease this deficit in the coming years. One is the consolidation of the two major terminals, Conley Terminal and Moran Terminal, into single cargo terminals. One of the purposes of this consolidation was to increase the operating efficiencies of the terminals. Another factor which may impact the revenue to expense ratio at the port, for better or for worse, is the deregulation of the shipping industry which went into affect on May 1, 1999. The Ocean Shipping Reform Act of 1998 (OSRA) moves the shipping industry from common carriage to contract carriage, allowing shippers to establish direct relationships with ocean carriers. Two scenarios of the deregulation are the push by carriers to lower port fees due to lower profits from increased competition or the ability of Massport to increase port fees due to the carriers' ability to conduct demand pricing and increase their profitability.

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[6] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

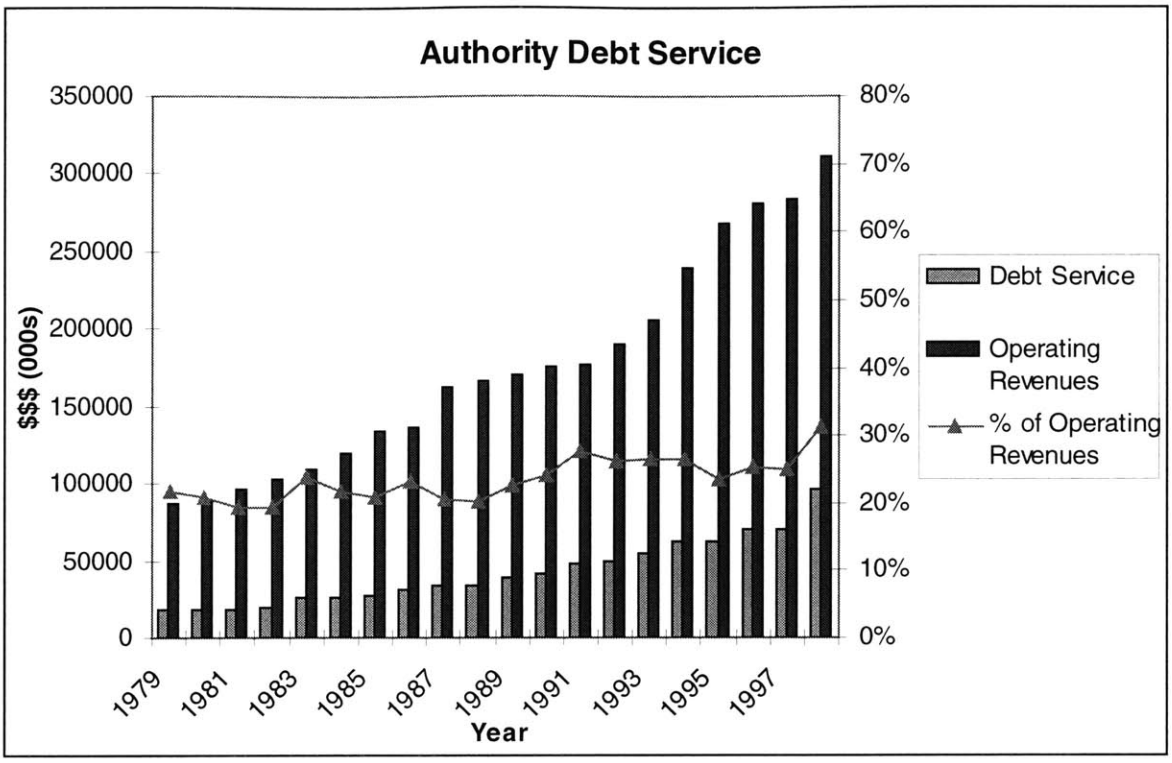

Figure 4-5: Historical Ratio of Debt Service to Operating Revenues[7]

4.2.2.2 Debt Service

Proceeds generated from bond sales are directed immediately to the projects specified in the issuance documents or held in investment funds until those projects are started. The Authority's debt service payments are limited by the Trust Agreement to a maximum of 80% of their operating revenues. Massport's bonds are normally 20-year bonds. They regularly refinance all or part of their older bonds to take advantage of lower interest rates. Also available, though underutilized in the past, are notes and short term debt.

Figure 4-5 shows the historical relationship between debt service and operating revenues. Since 1979, after the major refinancing of all of the Authority's bonds in 1978 out of which the 1978 Trust Agreement arose, the debt service of the agency has been no more than one-third of their operating revenues. This graph shows the untapped debt capacity available to the Authority. Before 1998 the debt service fluctuated between 20% and 25%. The financial plan for the 1998-

[7] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

2003 Capital Program calls for a major shift in this situation, already being reflected in the 1998 ratio debt service to operating revenues of 31%. Massport Director of Finance Betsey Taylor predicts that the debt service will double in the years of the FY98-03 capital program (Taylor 1999)

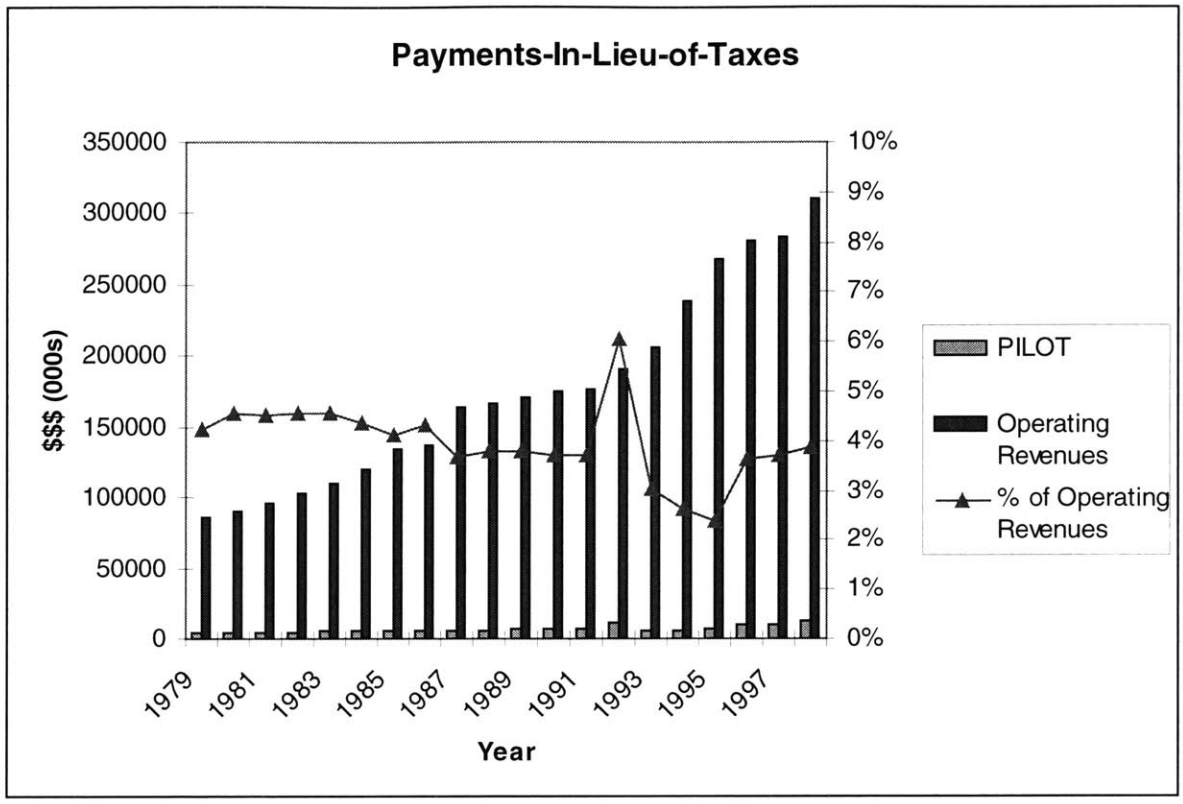

Figure 4-6: Historical PILOT Expenses with respect to Operating Revenues[8]

4.2.2.3 Payments-In-Lieu-of-Taxes (PILOT)

Mitigation programs exist for all of the communities surrounding Massport facilities. These agreements include soundproofing, community improvements, emergency assistance, payments-in-lieu-of-taxes (PILOT), long-term impact goals, and other community assistance. These long-term agreements are negotiated between the affected towns and Massport and often involve substantial financial commitment on the part of the Authority. Despite these agreements, disputes still arise between the communities and Massport regarding new development and the implementation of prior agreements.

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[8] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

As part of Massport's mitigation agreements with its host communities, payments are made to the communities in lieu of taxes. This compensates the host communities since government agencies do not pay taxes. These payments are negotiated with the communities as part of economic and environmental mitigation packages to decrease the negative impacts of Massport's facilities on the communities. PILOT equal on average 4% of the Authority's operating revenues each year. As shown in Figure 4-6, this amount spiked in 1992 to 6% and dropped in 1995 to 2% of the operating revenues. PILOT expenses do not include the amount spent on mitigation projects in the surrounding communities, which are categorized as capital expenses.

4.2.2.4 Capital Expenses

Capital expenses include any expenses that are associated with delivering a capital project, including but not limited to design fees, legal fees, construction, land acquisition, feasibility studies, and term consulting fees. Equipment purchases are also included in Massport's capital plan and budget.

The funds to pay for capital expenses come from four sources: reserve accounts, which are funds set aside after the payment of O&M, debt service, and PILOT; bond proceeds; grants-in-aid-of-construction from the state and Federal government; and private investment. Massport's current 6-year capital program, planning for Fiscal Years (FY) 1998-2003, includes $3.2 billion in funded capital projects. Projects funded from the reserve accounts are termed "pay-as-you-go" projects, or PAYGO. These are either maintenance projects conducted to preserve revenue streams or projects that will generate economic development but will not produce revenue in the near future. The funding for PAYGO projects is expected to drop to $32 million a year, down from $55 million in 1995, due to increases in debt service and PILOT (Massport 1998).

4.2.3 Constraints on Sources and Uses of Funds

Massport likens its financial system to that of a highly regulated private corporation (Massport 1998). In addition to being subjected to intensive Federal and State regulation, they predict that 60% of their revenues are governed by market forces. Logan Airport is a compensatory airport, meaning that compensation for aviation-related costs is limited by Federal case law to an essentially break-even state. Airlines are only responsible for the share of costs attributable to providing for their operations. Revenues that fall under this category, landing fees and terminal rents, make up approximately 26% of Massport's total revenues. These revenues effectively fund airport capital improvements and landing field and terminal operations, but do not adequately maintain support facilities, infrastructure, or utilities at the airport.

Airline Payments per Enplaned Passenger	
Current	**Future (Projected)**
1. John F. Kennedy	1. Miami
2. Denver	2. John F. Kennedy
3. Newark	3. Denver
4. LaGuardia	4. Newark
5. Miami	5. LaGuardia
6. Washington-Dulles	**6. Boston**
7. Washington-National	7. St. Louis
8. Pittsburg	8. Washington-National
9. Boston	9. San Francisco
10. Philadelphia	10. Washington-Dulles
11. Cleveland	11. Cleveland
12. Houston	12. Philadelphia
13. Tampa	13. Pittsburgh
14. Las Vegas	14. Tampa
15. Las Angeles	15. Baltimore-Washington
16. Detroit	16. Seattle-Tacoma
17. San Francisco	17. Orlando
18. Seattle-Tacoma	18. Detroit
19. Baltimore-Washington	19. Houston
20. Orlando	20. Las Vegas
21. Cincinnati	21. Los Angeles
22. Salt Lake City	22. Honolulu
23. Phoenix	23. Dallas
24. St. Louis	24. Cincinnati
25. Dallas	25. Salt Lake City
26. San Diego	26. Phoenix
27. Atlanta	27. San Diego
28. Honolulu	28. Atlanta
Max: $22.50	**Max: $24.00**
Min: $2.50	**Min:$2.75**
Boston: $7.00	**Boston: $12.50**

Table 4-1: Cost per Passenger Comparison

Landing Fees	
Current	**Future (Projected)**
1. LaGuardia	1. LaGuardia
2. John F. Kennedy	2. St. Louis
3. Newark	3. John F. Kennedy
4. Denver	**4. Boston**
5. Cleveland	5. Detroit
6. Detroit	6. Cleveland
7. Boston	7. Newark
8. Orlando	8. Denver
9. Chicago	9. Seattle-Tacoma
10. Los Angeles	10. Orlando
11. Dallas	11. Chicago
12. Washington-National	12. Philadelphia
13. San Francisco	13. Los Angeles
14. Seattle-Tacoma	14. Dallas
15. Miami	15. San Francisco
16. Philadelphia	16. Washington-National
17. Pittsburgh	17. Tampa
18. St. Louis	18. Miami
19. Washington-Dulles	19. Phittsburgh
20. Tampa	20. Washington-Dulles
21. Atlanta	21. Atlanta
Max: $5.25	**Max: $5.25**
Min: $.50	**Min: $.50**
Boston: $2.15	**Boston: $4.00**

Source: (Massport, 1998)

Table 4-2: Landing Fee Comparison

Where discretion in charges is allowed, Massport must still be sensitive to market forces. The financial plan for the FY98-03 Capital Program will result in Logan Airport ranking 6th in the nation in terms of cost per passenger. This is up from its current place at 9th (see Table 4-1). The FY98-03 Capital Program financial plan also calls for an increase in landing fees at Logan (Table 4-2). Airport parking rates and rental car fees, the sources of most of the non-regulated discretionary funds generated by the Authority, are among the highest in the nation (Massport 1998). The ground rents and leases for Massport properties and facilities must be on par with the Boston real estate market in order to attract and maintain tenancy. Because of the sharp competition between East Coast Ports, the fees associated with activities at the port facilities must be competitive at the international level. As a result of these regulations and market forces, the

ability of the Authority to raise revenues through any sort of administrative act is severely limited. Even the doubling of the round trip toll over the Tobin Bridge in 1997 only resulted in a 2% increase in the Authority's overall revenues (Massport 1998).

The use of PFCs, grant funds, and proceeds from bonds are restricted to use on only certain projects in the capital program. PFCs, a major source of funds for airport capital improvements, are currently limited by statute to $3 per passenger[9]. Projects funded by PFCs must be approved by the Federal Aviation Administration (FAA). The designation of a PFC project is highly desirable since it puts no burden on the airlines and does not increase the cost of operating at Logan (Massport 1998). Grant and bond proceeds must be used for the projects that are identified on the application or the issuance documents. The rest of the projects on the capital program must be funded with the revenues generated by parking and rental car fees or through private investment since no facility other than the airport can yet cover its own capital expenses after paying for its operations.

4.2.4 Portfolio Financial Strategy

[9] This amount was raised during the 1999 congressional session to $6 per passenger.

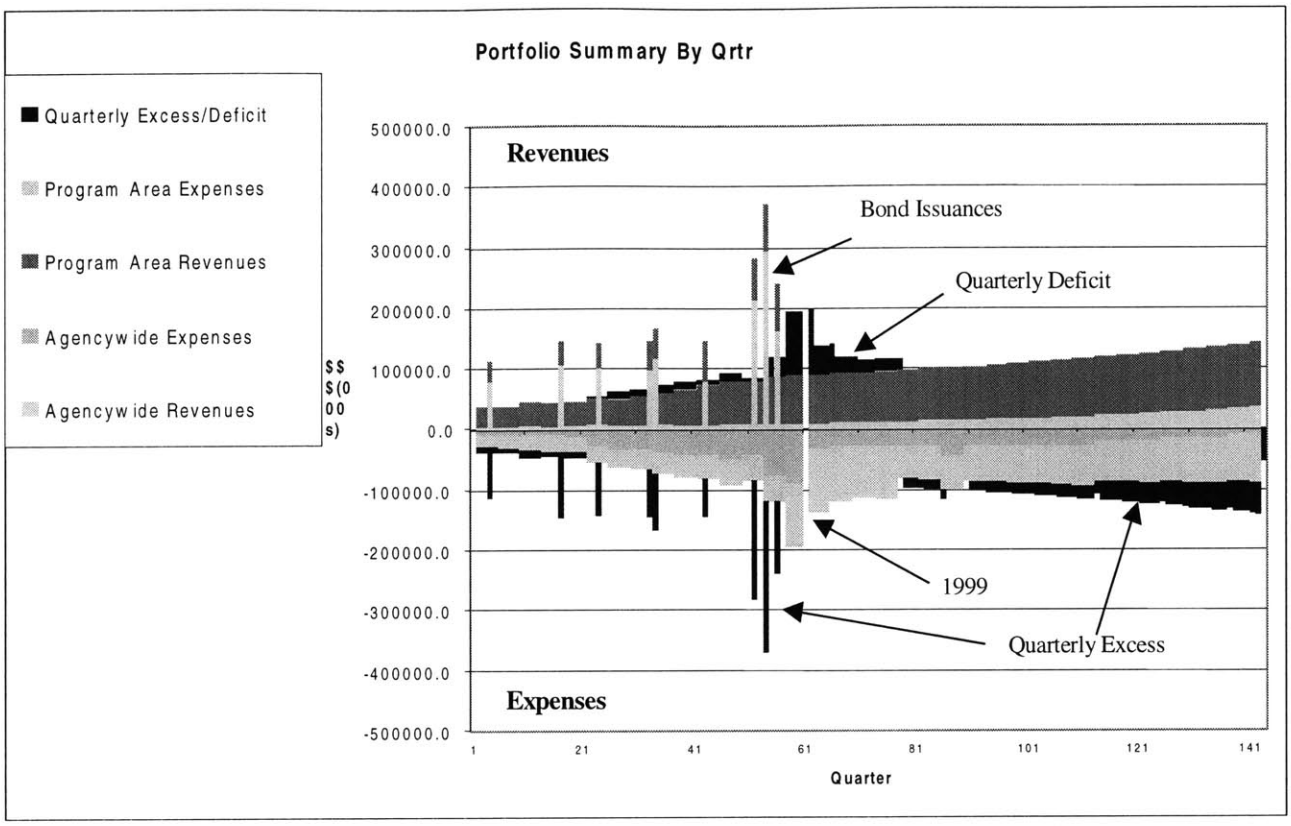

Figure 4-7: Model of Historical Agency Revenues and Expenses (Projection after 1999)

Massport was founded to develop and operate Tobin Memorial Bridge, Logan International Airport, L.G. Hanscom Field, and the public marine terminals at the Port of Boston. Throughout the history of the Authority, one or more of these facilities has run at a deficit, requiring subsidies for operations and capital improvements from other Massport facilities. Unrestricted revenues generated by the facilities are pooled into reserve funds for operations, maintenance, and improvement and extension (capital activities) which are then used by all of the facilities. Figure 4-7[10] shows the quarterly financial performance of the Port Authority from 1985 to the present and then a projection of the revenues and expenses in the future according to past trends, followed by a graph of the historical and projected conglomerate reserve accounts, shown in Figure 4-8.

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[10] Figure 4-7 and those like it throughout this paper were generated by aggregating all of the Authority's program's operating revenues and expenses with the Agency's capital, investment, and intergovernmental revenues and expenses. The source of these figures were Massport's Annual Reports from 1979 to 1998. (Massport 1976; Massport 1977; Massport 1978; Massport 1979; Massport 1980; Massport 1981; Massport 1982; Massport 1983; Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

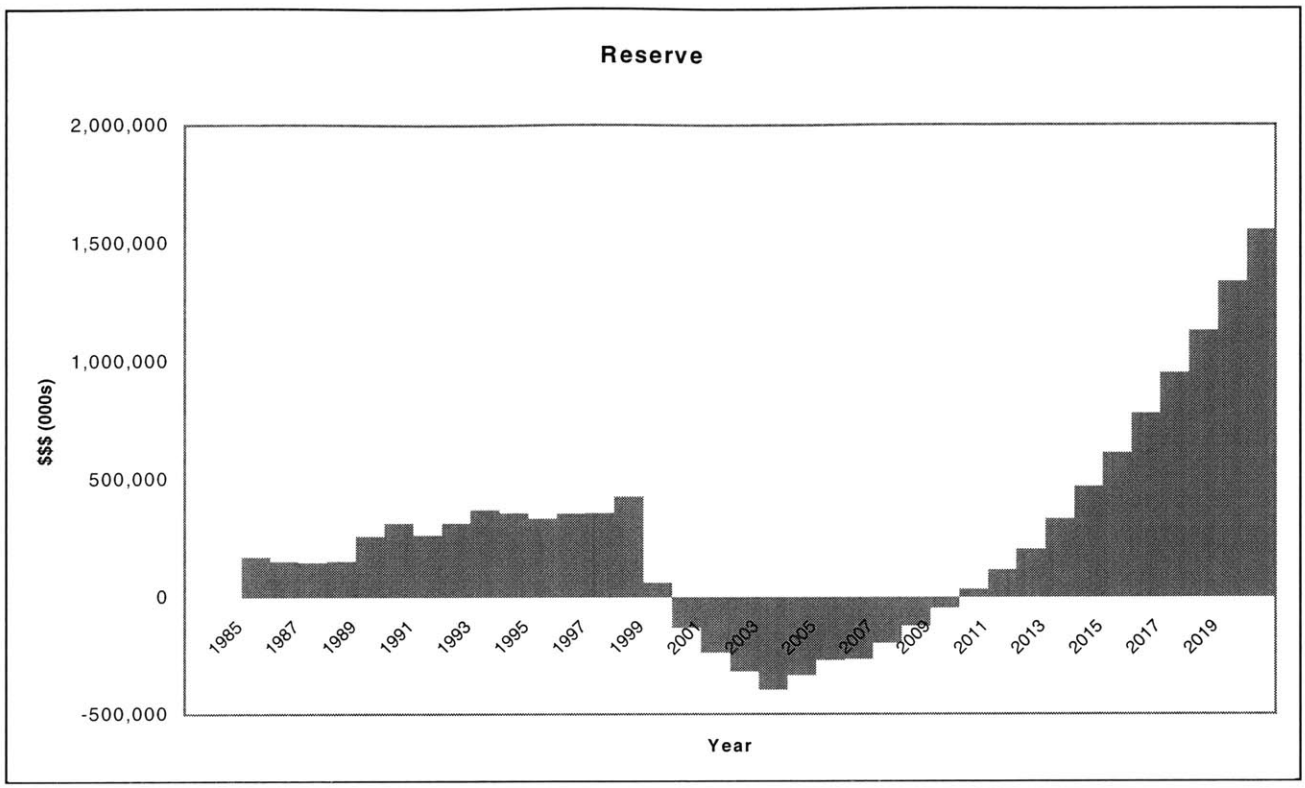

Figure 4-8: Massport Financial Reserve Profile (Projection After 1998)

Figures 4-7 and 4-8 were modeled using the CHOICES© decision-making tool described by Evje (Evje 1997; Miller and Evje 1999). Figure 4-7 models the quarterly revenues and expenses for the agency: the operating cash flows of each of Massport's program areas; the agencywide operating revenues and expenses; the revenues from bonds, construction grants, and investing activities; and the capital expenses incurred by the agency. The operating and investing revenues and expenses are then projected into the future. Any ongoing capital projects, projects that have been started or to which funds have been committed, are modeled along with debt service as known future expenses. The quarterly excess and deficits shown on the graph reflect the mismatch of funds that are received and paid out in that quarter. These graphs assume no further capital expenditures after the FY98-03 program and no further bond revenues after 1998. To generate the reserve graph shown in Figure 4-8, the quarterly excess and deficits are keep as a running total with each quarter producing an excess adding to the total and each quarter running at a deficit subtracting from that total.

Figures 4-7 and 4-8 show the solid financial footing on which Massport is resting. They are projected to be achieving a substantial excess of operating revenues over expenses in the future. The operating deficits and slump in the reserve funds between 2000 and 2009 reflects the

commitment to ongoing capital projects (modeled in Figure 4-8) without including the complementary financial plan and associated bond revenues.

4.2.5 Financial Performance Measures

Massport issues their bonds on the strength of the Authority as a whole, not by the financial performance of an individual facility. Their portfolio financial strategy has been confirmed by the market forces governing bond sales and by their bond rating of AAA on two of their outstanding bonds and AA- on the remaining outstanding bonds. The continuing strength of Massport's bond market is based on the financial strength of the agency and on the condition of their facilities, which are reported annually to the Authority's bank and bondholders. Massport's stability and success can also be measured through the agency's sustained ability to attract and maintain investors, vendors, and private capital.

5 Massachusetts Port Authority Facilities and Programs

The Trust Agreement breaks the Authority's facilities into four program areas: Airport Properties, Bridge Program, Port Properties - Maritime, and Port Properties - Development. Each of Massport's facilities are placed into one of these programs for the purposes of planning, accounting, performance evaluation, and accountability.

Aer Lingus
Air Canada
Air France
Air Nova
Air Tran
Alitalia
America West
American
American Eagle
American Trans Air
British Airways
Business Express
Canadian
Cape Air
Comair
Continental
Delta Airlines
Delta Express
Delta Shuttle
Frontier
Icelandair
KLM
Korean Air
Lufthansa
MetroJet
Midway
Midwest Express
Northwest
Olympic
Qantas
Sebena
Sun Country
Swissair
TAP Air Portugal
TWA
TW Express
United
United Express
US Airways
US Airways Shuttle
US Airways Express
Virgin Atlantic

Table 5-1: Airlines Serving Logan
Source: (Massport 1999)

5.1 Airport Properties

Massport's Airport Properties Program includes the facilities and operations at Logan International Airport in Boston, L.G. Hanscom Field in New Bedford, and Worcester Municipal Airport in Worcester (transferred to Massport by legislation effective January 1, 2000).

5.1.1 Logan International Airport

5.1.1.1 Overview

The 2400 acre Logan International Airport is located in East Boston, Massachusetts. Measured by passenger volume, it is the nation's seventeenth and the world's twenty-fourth busiest airport (Massport 1998). Logan airport is New England's largest transportation center, comprising of five runways, fourteen miles of taxiways, and five passenger terminals housing 84 gates. Forty-two airlines serve Logan's passengers (see Table 5-1). Logan is on an island, surrounded by water to its north, south, and east and by the City of Boston to its west.

Logan Airport saw its first passenger flight on September 8, 1923, when it was named Boston Airport. Its name changed to Commonwealth Airport in 1944. Logan stayed the Commonwealth Airport until 1952 when a petition was filed to the state legislation to change the name to Logan International Airport in honor of World War II General Edward Lawrence Logan.

Four different types of mass transit serve Logan Airport: water taxis, ferries, subway trains, and Logan Express buses. The water shuttles and Logan Express buses are owned and operated by Massport. Currently one in three passengers going from or coming to Logan uses public transportation, ranking Logan near the top in the United States for public transit use at major airports (Massport 1998). Massport's goal is to have 35% of passengers reaching Logan in "something other than a car" by the time the passenger level at the airport reaches 37.5 million (Massport 1998:4). In addition to ground access and landside goals, Logan is looking for ways to improve their airside operations. Logan experiences an average of 100,000 hours of delay each year. It ranks 6th in the nation among the most delay-prone airports (Massport 1998).

The goal of every project at the airport is faster, more convenient, and more on-time air travel (Massport 1998). The challenge is to achieve these goals and increase Logan's efficiency without expanding its borders or compromising environmental performance (Massport 1999). This applies to both the landside and airside programs. Massport is working towards this goal through the Logan Modernization Project, a $1.6 billion public and private investment in the airport. The current Logan Modernization Program is the first major upgrade of the airport's terminals, roadways, and airfield since 1977. Examples of some projects that are included in the Logan Modernization program are

- a new seven story, 3,150 space Central Garage,
- covered walkways attaching the garage to Terminals A & E,
- new cargo facilities with direct access to highways,
- new taxi and limo pools,
- a substantial rehabilitation and expansion of the International Terminal known as the International Gateway Project, including better accommodations for wide-bodied jets and an expanded Federal Inspection Facility,
- a new aircraft fuel distribution system with gateside fueling,
- moving walkways between the new garages and Terminals B & C, and
- a new two tiered roadway system that separates Arrival and Departure road traffic to ease traffic congestion at the terminals (Massport 1998).

Private investments at the airport that are part of the Logan Modernization program include the completed US Air Phase One $35 million Terminal B upgrade, the completed 600 room, $100 million Hilton Hotel, and United Airlines' $45 million expansion of Terminal C (Massport 1998).

Currently under Federal review is a proposal for a new unidirectional runway at Logan. Massport predicts that this runway will reduce normal delays by 23% and reduce delays during Northwest winds by 55%, where Logan is currently limited to one runway (Massport 1998). The runway would permit only over-the-water takeoffs and landings and would divert more flights away from nearby communities and toward flight paths over the Harbor. There is currently significant public controversy surrounding the proposal for the new runway at Logan. Residents of East Boston refer to a 15-year-old court ruling barring any further runway development at Logan. Additionally, the community does not believe Massport's assertions that there will be no negative environmental or sound impacts on the area. The community has experienced significant erosion of trust in the Port Authority stemming from their accusations that the Authority has gone back on their word to the community on this and other occasions.

Massport's mitigation goals for Logan Airport are to reduce noise, congestion, and environmental impact from the airport on East Boston and the surrounding communities. Massport has embarked on the most comprehensive soundproofing program in the country for the communities surrounding Logan: East Boston, South Boston, Winthrop, Revere, and Chelsea. $60 million has already been spent to soundproof 3,800 dwelling units and 34 schools. The soundproofing program has resulted in an average noise reduction of 6.9 decibels in typical rooms and 17.8 decibels in the buildings' preferred rooms (Massport 1998). Massport has committed another $27 million to the program through Fiscal Year 1999. By the end of the program, they will have soundproofed every eligible home in the area. Additionally, Massport is working with the community to determine a waterfront development agenda that "keeps maritime uses alive, and opens the waterfront to the public while providing economically feasible development opportunities needed to drive new building" (Massport 1998:15).

In 1997, Massport reached a major mitigation agreement with the communities surrounding its facilities. In addition to committing to an airport green buffer zone and continued soundproofing, Massport set aside $9.6 million in Payments-In-Lieu-of-Taxes (PILOT) to establish a new East Boston Foundation which will let the community manage some of the mitigation processes. Massport is continuing its development of the Piers Park, a waterfront park in East Boston

established by a Massachusetts legislative act to be built and maintained by the Authority for the use of the residents of East Boston. Massport also renewed its commitment to raising the High Occupancy Vehicle share at the airport from 25% to 35% by the time the passenger volume reaches 37.5 million. The Authority is continually increasing its use of electric vehicles and "clean" buses at the airport.

According to a Boston Globe/MIT study,

> "... a modern Logan Airport able to handle more than double the present traffic is the linchpin of Boston's development boom. The airport serves a growing market and as the region's economy demands more from Logan, Massport must continue its forward progress to make sure Logan is up to the challenge." (Massport 1998:4).

Logan Airport creates $5.3 billion in direct, indirect, and induced economic benefits to the region each year (Massport 1996). Ninety percent of Logan passengers either begin or end their journey in Boston, generating substantial economic benefits for the region but also requiring more infrastructure and service investments than at other hub airports (Massport 1985). Logan supplies more than 16,000 jobs to area residents and pays out more than $860 million in payroll and benefits. That, combined with tax revenues, highway tolls, MBTA fares, public and private tenant expenditures, and tenant income, totals $1.47 billion in direct economic benefits to the region. The direct and indirect economic benefits to the region from Logan total more than $14.5 million per day (Massport 1996).

5.1.1.2 *Facility Performance*

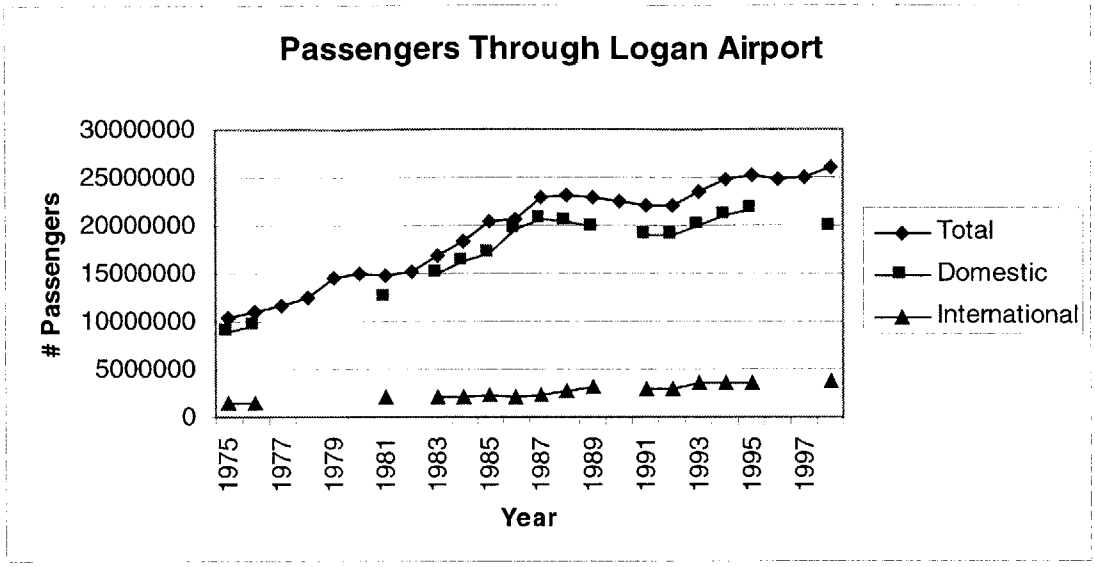

Figure 5-1: Passengers Traveling through Logan[11]

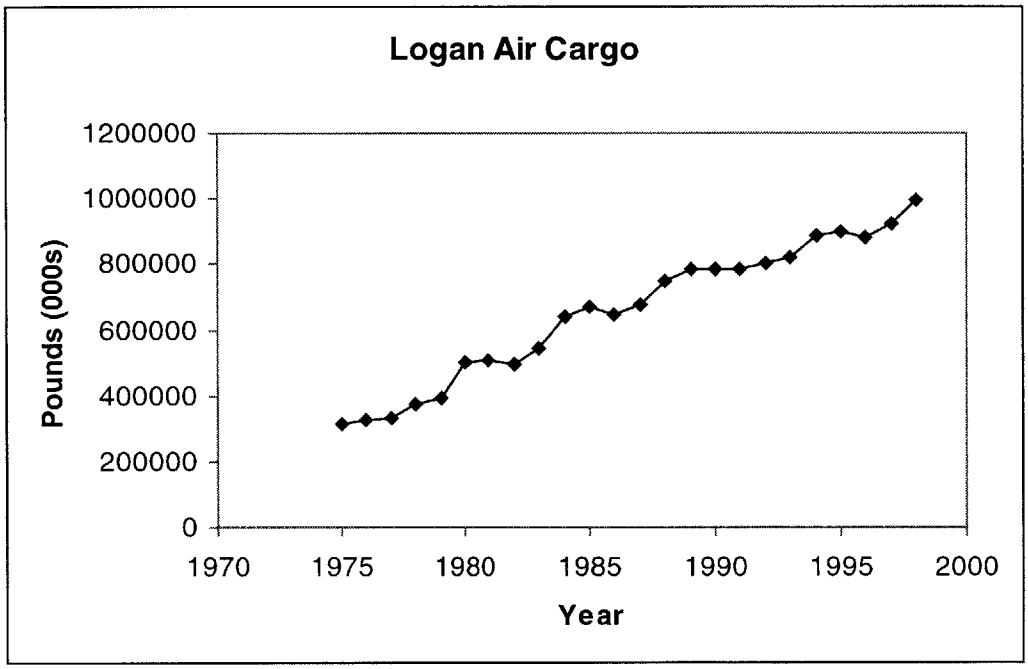

Figure 5-2: Air Cargo Shipped through Logan[12]

[11] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

[12] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

The total number of passengers travelling through Logan Airport has been increasing at an average rate of 3.5% each year, which results in nearly 600,000 new passengers each year (see Figure 5-1). The percentage of the total passengers that are international passengers has historically been approximately 13%, sinking to a low of 10% in the mid-1980s and climbing to between 14% and 15% in the mid-1990s. Logan handles approximately 64% of all New England air travelers, down from nearly 80% in the 1980s (Massport 1999).

The other part of Logan's business comes from cargo carriers. The amount of cargo shipped through Logan has been increasing at an average rate of 5.4% a year, though this has fluctuated throughout recent history as shown in Figure 5-2. This correlates to an average increase of nearly 30 million pounds a year since 1975. It is one of the country's most efficient cargo airports (measured in tons per acre) and ranks eleventh in the value of its imports and exports (Massport 1999). Logan handles and estimated $12.8 billion in imports and $4.5 billion in exports each year (Massport 1999).

5.1.2 L.G. Hanscom Field

5.1.2.1 Overview

Massport owns and operates the general aviation facilities at L.G. Hanscom Field, located 18 miles northwest of Boston. Hanscom Field was founded in 1940 as a permanent base for flight schools and the U.S. Army Air Corps (Massport 1999). The United States Air Force (USAF) subsequently leased the airfield, but military activity ceased in 1974 and Hanscom is now used almost exclusively as a Logan reliever airport for general aviation purposes. The USAF still operates a research and development lab at the airfield. Massport is under obligation to the USAF to keep the airfield in operating condition in the case of a national emergency. Hanscom is the largest general aviation airport in New England with nearly 500 permanently based aircraft and, in terms of operations, is the second busiest airport in New England. The airfield is used primarily for corporate flights, charters, private aircraft, and flight school operations. Hanscom now has one permanently based commercial carrier operating daily flights out of Hanscom.

Hanscom is surrounded by the residential neighborhoods of Lexington, Concord, Lincoln, and Bedford, Massachusetts. There is an ongoing public dispute in the areas surrounding Hanscom Field regarding air and vehicular noise and traffic generated by activities at the airfield. This dispute is growing as the communities surrounding Logan and their associated politicians call for the diversion of more flights to regional airports, including Hanscom.

The first and only commercial airline to operate out of Hanscom is Shuttle America, an airline start-up based in Windsor Locks, Connecticut. The residents and many politicians from the towns surrounding Hanscom have fought to keep commercial air service out of the airfield's operations, citing noise and traffic congestion in the residential towns. The airline flies ten flights a day out of Hanscom Field. The low-cost airline chose to operate out of Hanscom instead of Logan because of its close proximity to Boston, lack of other scheduled airline flights, and free parking (Brelis 1999). Shuttle America has invested $50,000 in modernizing their passenger waiting area and installing security equipment. Shuttle America reports that since the beginning of its operations, 22% of its passengers on flights to or from Hanscom are from the towns surrounding the airfield (Brelis 1999).

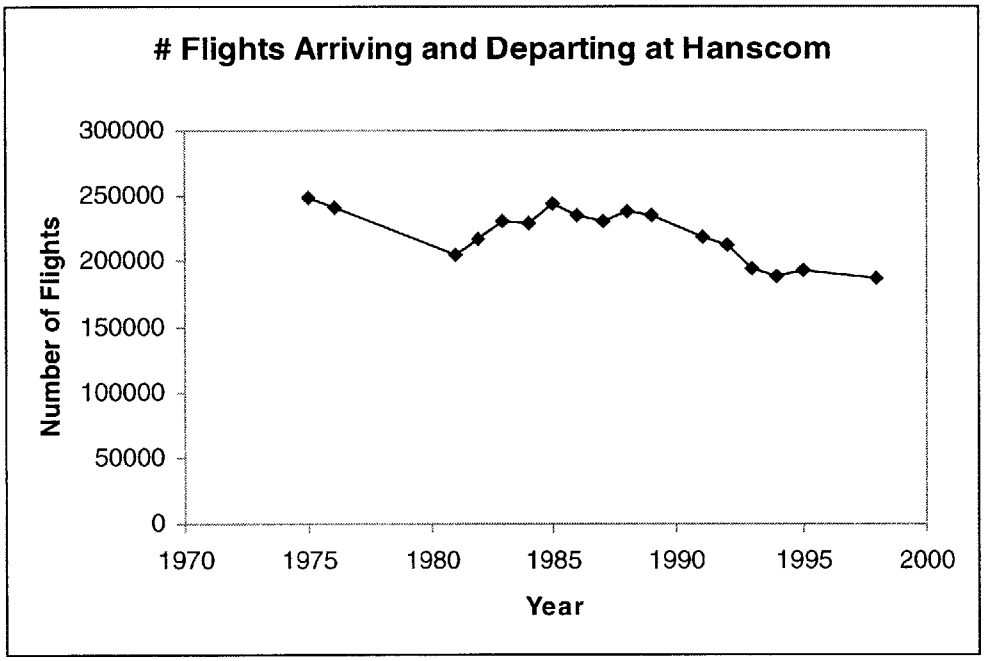

Figure 5-3: Hanscom Airfield Operations[13]

Hanscom's estimated total regional economic impact is over $56 million. Of this, $26 million goes directly into the local economy in the form of jobs and acquired goods and services (Massport 1996). Since the FAA eliminated funding for reliever airports in 1995, Hanscom's airfield conditions have deteriorated due to lack of Authority investment resources. Hanscom has undergone no airfield pavement improvements since that time. The resulting deterioration is

[13] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

being included for rehabilitation in the current capital program. The Authority is considering development options for the Airfield to generate revenues to support the facility. Current proposals under investigation include lodging options and a golf course (Massport 1998).

5.1.2.2 Facility Performance

Hanscom operations reached their peak in 1975 and 1985 with 248,144 and 244,621 flights per year respectively (Figure 5-3). That is 680 takeoffs and landings per day in 1975 compared to the current 511 operations per day in 1998. Since 1985, flights at Hanscom have dropped off at a rate of 2.6% a year, equaling a decline of about 5800 flight operations a year. Operations at Hanscom are mainly private, highlighted by the 1991 and 1992 passengers to flights ratios. Out of 218,000 flight operations in 1991, only 6,595 passengers were carried. This translates to three passengers carried for every 100 takeoffs and landings. The ratio in 1992 was slightly less at 2.89 passengers for every 100 takeoff and landing.

5.1.3 Worcester Municipal Airport

Massport's agreement with Worcester Municipal airport began in 1997. This early agreement was a three-year, $750,000 contract to provide the airport with marketing and technical assistance. The purpose of the contract was to improve both operations and market share at the regional airport. In early 1999, Massachusetts Governor Paul Cellucci proposed that Massport take over operations of the ailing Worcester Municipal Airport. Cellucci proposed the idea so that Massport would use their expertise and relations with major air carriers to buoy the struggling airport. Massport's agreement to operate Worcester Municipal Airport began on January 1, 2000.

There is a substantial air passenger market in the Worcester area, but the airport itself has been underutilized. The April 1999 agreement announced by the Cellucci administration, the City of Worcester, and then Massport Executive Director Peter Blute names Worcester Airport as the weak link in New England's regional transportation plan (Massport 1999). Massport is currently working to make the airport an attractive travel option for travelers from Central Massachusetts (Massport 1997).

5.1.4 Airport Properties' Performance

5.1.4.1 Financial Performance

A consequence of the 1978 Trust Agreement reporting procedures is that the accounting for all of the airport properties (as well as all of the marine and development properties) are lumped in together. This makes the individual performance of the facilities unclear. It can be assumed that the vast majority of the performance indicated here is due to Logan Airport because the scale of its operations dwarfs those of Hanscom Field. Still, a detailed analysis of the sources and uses of funds at Hanscom could provide insight into where investment should take place and the effects of different types of operations on the financial performance of the field.

Figure 5-4 shows the composite historical financial performance of the airport properties with a projection of operating revenues and expenses after 1998. Previously incurred capital expenses are not included in the analysis, but ongoing capital projects at the airport properties are reported between FY99 and FY03, reflecting the degree to which the program is able to support its own capital program. No further capital expenses are included after 2003. Revenues include both PFC revenues and operating revenues in the form of tolls, fees, sales of services, concessions, and rentals. Expenses include O&M, administration, insurance, pension, and PILOT.

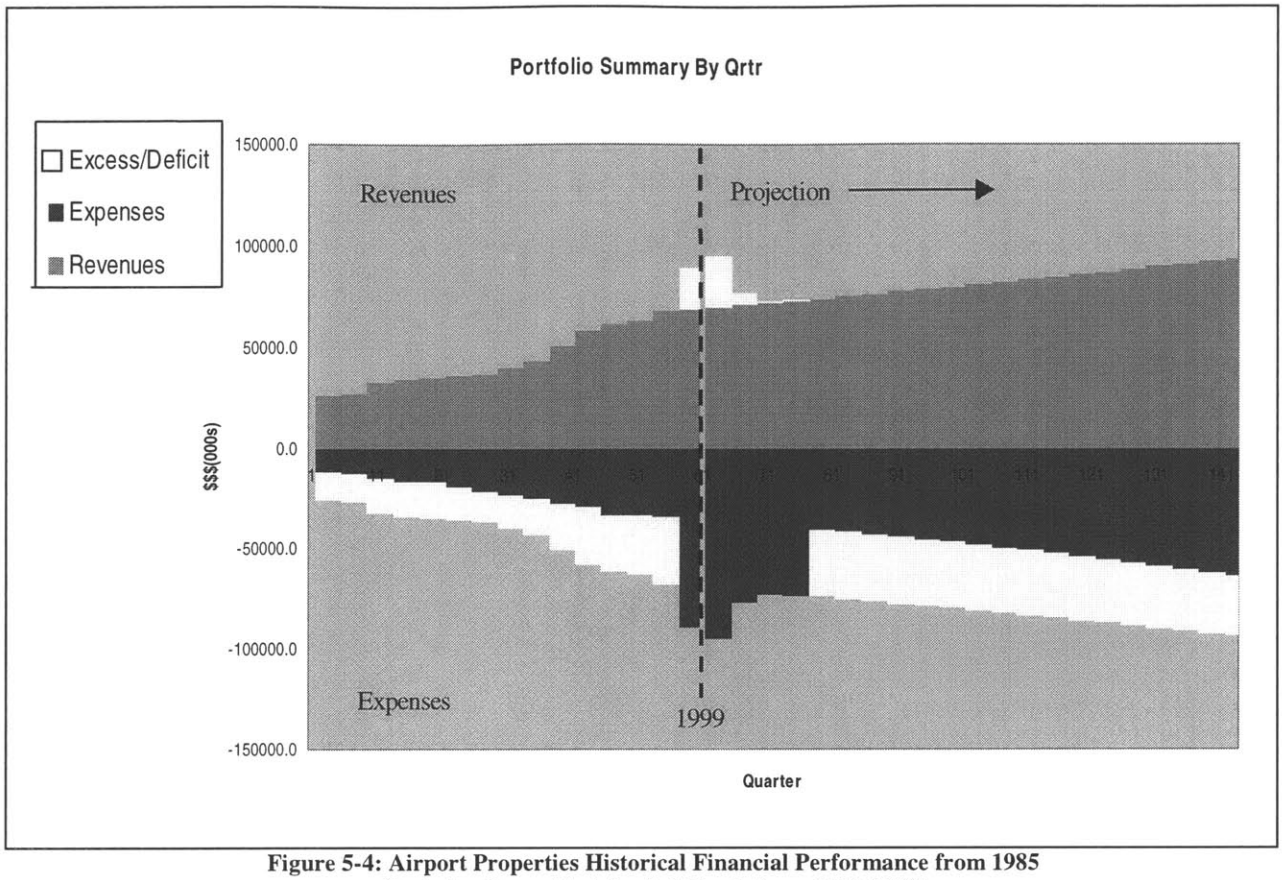

Figure 5-4: Airport Properties Historical Financial Performance from 1985 (Includes Committed Capital Funds from 1999-2003)

5.1.4.1 Analysis

Massport's Airport Properties consistently generate excess revenues over their operating expenses. The excess reflected $132,860,000 in operating profits in 1998. The operating revenues of the airport facilities are experiencing a growth of 6.36% a year. The PFC revenues have been modeled with 2.87% growth. This was calculated from the historical PFC revenues but most likely represents a conservative figure since passenger growth is more than 2.87% and the maximum PFC charge allowed by the FAA has been doubled. The total revenue increase predicted for the future is 5.93% revenue growth per year.

O&M expenses at the airports are experiencing an average growth of 11.85% a year. This is comprised of administrative and insurance expenses rising at rates of 14.95% and 18.56% a year and PILOT expenses unique to the airports increasing at 12.39% a year. The only operating expenses with a growth rate less than the revenue growth rate is pension, with a 3.05% growth rate per year.

The excess revenues generated by operations at Logan Airport are currently used in four ways: subsidizing operations at other facilities; subsidizing the capital improvements at other facilities; paying the debt service on the Authority's bonds; and investing the money for future use and interest revenue generation. Since the airport property revenues are growing at a rate of only 5.93% a year while expenses are growing at 11.85% a year, the expenses are growing faster than the revenues. The airport properties are the major source of excess revenues at Massport. If this excess begins to dry up, as did the excess revenues from the Tobin Bridge in 1992, the Authority's ability to successfully maintain its operations may be severely limited.

It is unknown at this time how the acquisition of the Worcester airport is going to affect the Port Authority's cash flow. The poor performance of this airport, which brought about its takeover by Massport, indicates that it will drain resources away from the reserves being generated by Logan. The amount of burden that will be placed on the Authority, as well as the amount of time before Massport can turn the airport around, are yet to be determined.

5.2 Tobin Bridge

5.2.1 Bridge Program Overview

The Mystic River Bridge Authority (MRBA) was created in 1946 as a revenue bond authority to build, operate, and maintain a bridge crossing of the Mystic River between Boston and Chelsea. The MRBA is another example of a quasi-public authority created for the operation of an infrastructure facility. In 1947, the authority issued $27 million in bonds to build the Mystic River Bridge. The bridge took three years to construct. The facility is 2.4 miles long, which is longer than the Golden Gate Bridge and twice as long as the Brooklyn Bridge, and rises 135 feet above high tide. The bridge connects the Central Artery (I-93 through Boston) to the Northeast Expressway (U.S. Route 1 Northward toward New Hampshire and Maine).

In the early 1950s, the creation of the Massachusetts Port Authority was delayed because the facilities that it was supposed to own and operate – Hanscom Field, Logan Airport, and the public marine terminals – were running at substantial deficits and could not support an issuance of bonds. In 1956, to ensure that Massport's bond obligations could be met and to improve the new authority's cash flow and balance sheet, the Mystic River Bridge Authority was dissolved and the bridge facility was transferred to the newly created Port Authority. The Port Authority issued revenue bonds in that year and paid back the MRBA bonds with the proceeds. In 1966, the name

of the bridge was changed from the Mystic River Bridge to the Tobin Memorial Bridge, in honor of Boston Mayor and Massachusetts Governor Maurice J. Tobin.

The City of Chelsea sits at the foot of the Tobin Bridge and directly across the water from Logan Airport. Massport has supported Chelsea through the years economic development and environmental mitigation programs, including: a parking facility on Massport land to help vitalize the downtown; a new police cruiser every two years; a new vehicle for the fire department every four years; free assistance from Logan by request for fires and snow emergencies; and free blood lead screening for the residents adjacent to Tobin Bridge during painting. In 1998, Massport and Chelsea agreed to an economic development package that guarantees $2.5 million to the city over five years. The agreement addresses Logan's need for additional parking, maintenance facilities, and freight forwarding space by partnering with Chelsea with respect to their long-term economic goals (Massport 1998).

5.2.2 Facility Performance

The financial performance of the Tobin Bridge is governed by two forces: the number of cars crossing the bridge and the cost of maintenance of the bridge. Tobin's only form of revenue is the roundtrip toll that each vehicle pays on its southbound trip into Boston. Compiled from past annual reports, Figure 5-5 reflects the direct relationship between the number of bridge crossings and the revenues generated by the facility. Until 1997, the roundtrip toll was $.50. The tolls were raised to $1.00 per roundtrip in the summer of 1997, the beginning of FY98. In FY98 on the graph, the revenues generated by the bridge double and the amount of revenues directly correlate to the number of vehicles crossing the bridge.

On the other hand, the operating expenses (shown here excluding all PILOT and capital expenses) have no correlation with the number of crossings each year, but rather with the age of the bridge. The advantages of the operating expenses being related to the age of the bridge and not to the traffic volume on the bridge is that the expenses are easier to predict and easier to control. The drop in operating expenses in the past three years verifies the agency's ability to identify and control factors contributing to the operating expenses of the bridge.

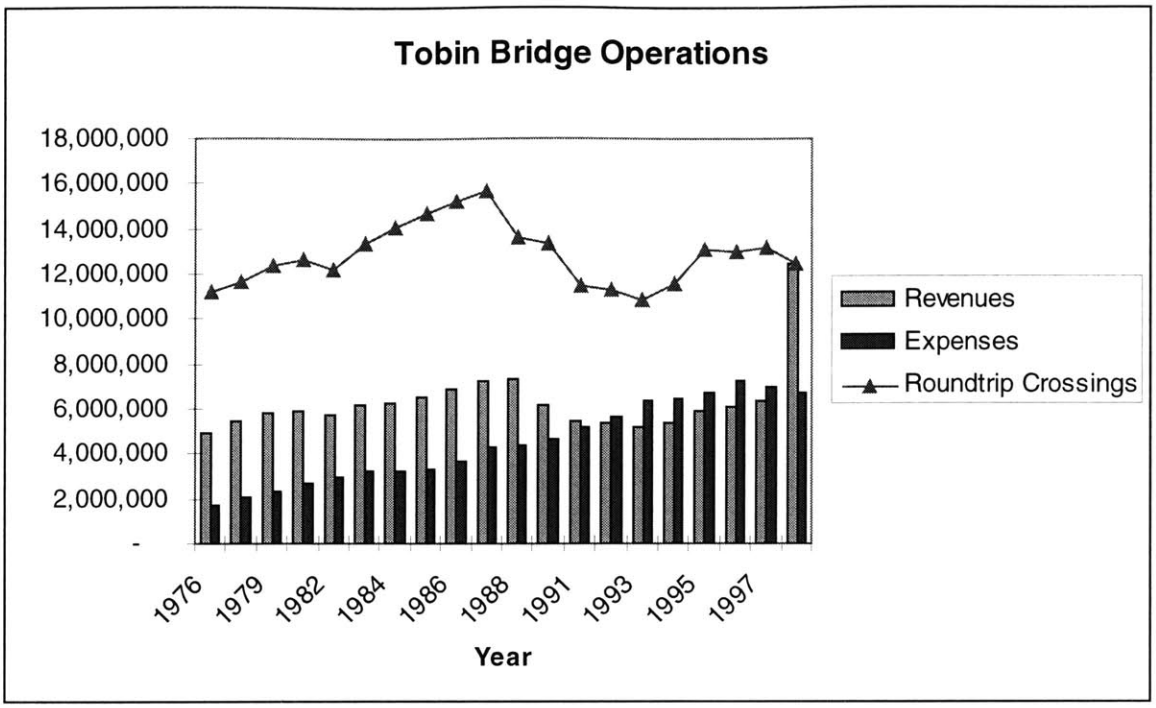

Figure 5-5: Relationship between Vehicle Crossings and Cash Flow on the Tobin Bridge

The first toll increase in 44 years happened in 1997. The cost of the roundtrip across the bridge was raised to $1.00. The Tobin Bridge is the least expensive toll bridge connecting a major city to its suburbs (Table 5-2). Massport is currently installing a new $1.5 million electronic toll collection system on the bridge. This will benefit both commuters and the community by leading to fewer delays, less noise, and less pollution. It allows Tobin to join the regional integrated electronic toll network in place on all toll roads run by the Massachusetts Turnpike Authority. The benefits of joining the integrated traffic network include better overall traffic management, real-time updates of road conditions, and prompt emergency service for breakdowns (Massport 1999).

Bridge	Passenger Car Toll
Tobin Memorial Bridge	**$1.00**
Cross Bay Veterans Memorial Bridge	$1.75
Henry Hudson Bridge	$1.75
Ben Franklin Bridge	$2.00
Betsy Ross Bridge	$2.00
Commodore Barry Bridge	$2.00
Delaware Memorial Bridge	$2.00
Thousand Island Bridge	$2.00
Walt Whitman Bridge	$2.00
Golden Gate Bridge	$3.00
Bronx-Whitestone Bridge	$3.50
Throgs Neck Bridge	$3.50
Triborough Bridge	$3.50
Bayonne Bridge	$4.00
George Washington Bridge	$4.00
Goethals Bridge	$4.00
Outerbridge Crossing	$4.00
Verrazano Narrows Bridge	$7.00

Table 5-2: Urban Toll Bridge Comparison (Massport 1997)

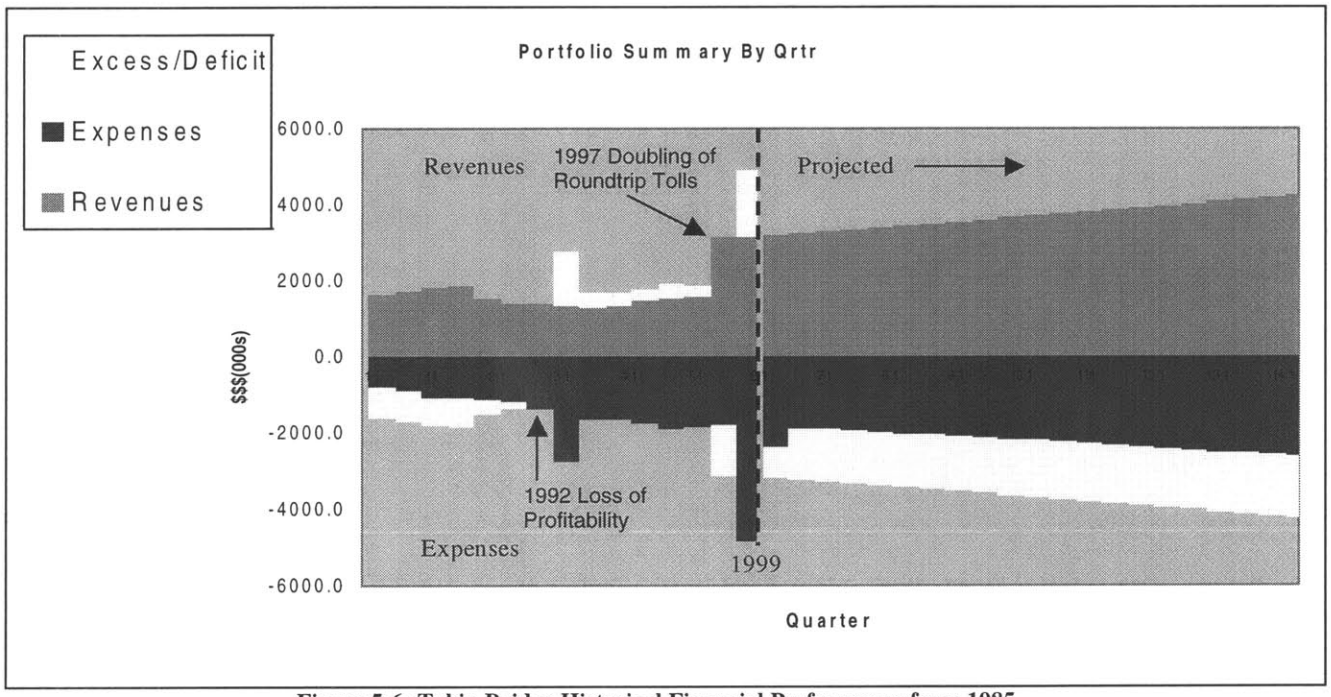

Figure 5-6: Tobin Bridge Historical Financial Performance from 1985 (Includes Committed Capital Funds from 1999-2003)

When the bridge opened in 1950, the roundtrip toll was 30 cents. In 1953 the roundtrip toll for non-commuters was raised to 50 cents. Though the profitability of the bridge helped to fund the early development of the airport and other Massport properties, in the years following 1966, rising operations and maintenance costs, combined with decreased traffic flows from the opening of I-93, Tobin began losing its profitability. In June of 1979 the bridge experienced an additional

drop in revenues that Massport has attributed to the gas shortage and the subsequent emphasis on carpooling (Massport 1978). Figure 5-6[14] shows the historical quarterly financial performance of the Tobin Memorial Bridge. The cash flows show the move from a profit generating facility to a cash drain on the Authority in 1992 and the effects of raising tolls on the Bridge's ability to fund its own operations and capital projects in the future.

5.3 Port Properties – Maritime

There are three major facilities included in Massport's Maritime Port Properties Program: Conley Container Terminal, Moran Terminal/Boston Autoport, and Black Falcon Cruise Terminal. These facilities are supplemented by various smaller port properties used for maritime operations. The Port of Boston's trading partners include Europe, the Mediterranean, the Middle East, North Asia, South Asia, and South America (see Table 5-3). More than 9,000 jobs and $3 billion in economic benefits to the region are attributed to the port each year. The Port of Boston's biggest challenges stem from and the increasing competition from other East Coast ports for vessel calls and the continuously increasing size of cargo vessels requiring the constant expansion and improvement of terminals, equipment, and infrastructure.

5.3.1 Conley Container Terminal

5.3.1.1 Overview

Conley Terminal is located in South Boston next to Castle Island. It is the only container port in New England. Conley Terminal, originally named Castle Island Container Terminal, was constructed for Sea-Land to lease as one of the first container terminals in the country. Sea-Land gave up this lease in 1980 and Massport renovated and improved the terminal into the common use terminal it remains today. The facility has 2000 feet of berth with 4 post-Panamax container cranes and 101 acres of storage. 1200 feet of berth has been dredged to 47 feet and the remaining 800 feet has been dredged to 40 feet. A new 10-lane gate facility was built to facilitate the tracking of incoming and outgoing land transported containers in 1998. In 1998 during the implementation of the Marine Terminal Optimization Program, all of the container ship calls were consolidated to Conley Terminal instead of being split between Moran Terminal and Conley. This was done to increase operating and labor efficiency at the marine terminals, to save

[14] The graph includes no capital expenses prior to 1998 or after 2003, reflecting only those capital projects included in the current program. Capital expenses prior to 1998 are included in Figure 4-7, modeling the agencywide cash flow.

time for incoming container ships because Conley is located closer to the open ocean than Moran with only four miles of Harbor navigation, and to avoid requiring large container ships to clear the Tobin Bridge and Boston Harbor tunnels.

Steamship Line	Trade Area	Frequency	Service
American President Line	Japan, Far East, Europe	weekly	Barge via New York
Atlantic Container Line	UK/Continent, Scandinavia	weekly	Direct
Cho Yang America	Japan, Far East, Europe	weekly	Barge via New York
Columbia Coastal	Feeder	2X weekly	Barge via New York
COSCO	China, SE Asia, Spain, Israel	weekly	Barge via New York
DSR-Senator Line	Mediterranean, Mideast, SE Asia, South America	weekly	Barge via New York
Evergreen America	UK/Continent, Japan, Far East, Mediterranean, India/Subcontinent, Caribbean	weekly	Barge via New York
Hanjin Shipping Co.	Japan, Far East, India/ Subcontinent, UK/Continent, Mediterranean, Mideast, S. America	weekly	Barge via New York
Hapag-Lloyd	UK/Continent, Japan, Far East, Subcontinent	weekly	Direct Barge via New York Feeder via Halifax
Hyundai Shipping	Europe	weekly	Direct
Italia Line	Mediterranean, Levant, Red Sea	weekly	Barge via New York
Ivaran Line	South America	weekly	Barge via New York
Maersk Line	UK/Continent, SCANBALT, Japan, Far East, Subcontinent, Mediterranean, S. America, Australia	weekly	Direct Feeder via Halifax
Mediterranean Shipping Co.	UK/Continent, E./W. Mediterranean, Mideast, Africa, S. America, Australia	weekly	Direct Barge via New York
Mitsui O.S.K. Lines	Japan, Far East	weekly	Barge via New York
NYK Line	Japan, Far East, India/ Subcontinent, UK/Continent	weekly	Feeder via Halifax Barge via New York
OOCL (Orient Overseas Container Line)	UK/Continent	weekly	Direct Barge via
P&O Nedlloyd Ltd.	UK/Continent, India/Subcontinent, Australia	weekly	Direct Feeder via Halifax
Sea-Land	UK/Continent, Mediterranean, Mideast, India/Subcontinent	weekly	Direct Feeder via Halifax
SPM Container Line	Halifax	weekly	Direct
Yang Ming Line	Japan, Far East	weekly	Barge via New York
Zim Container Service	Japan, Far East, Mediterranean, Levant, Red Sea, South America	weekly	Barge via New York Feeder via Halifax

Table 5-3: Steamship Operations at Conley Terminal (Massport 1999)

5.3.1.2 Operations

Container cargo at Conley is served via four different services: direct vessel calls, a barge via the Port of New York, a feeder vessel via the Port of Halifax, and over-the-road carriers (see Table 5-3). Conley received 347 container vessel calls in 1998, down slightly from 352 in 1998.

5.3.2 Moran Terminal/Boston Autoport

Moran Terminal, Massport's original container terminal located immediately under the Tobin Bridge, was leased to Boston Autoport Inc. in 1998 for use as a designated automobile import facility. Boston Autoport is a limited liability corporation consisting of Foreign Auto Servicing and Diversified Automotive, Inc. Boston Autoport Inc. has built an international vehicle distribution hub on the site that is able to process over 150,000 cars annually. The terminal has the capacity to off-load 400 cars an hour. It is the single port of entry into the United States for Volkswagen of America. Boston Autoport currently serves Volkswagen, Audi, and Subaru. The terminal has on-dock rail capabilities, 1000 feet of berth, 60 acres of backland processing and storage space, and 275,000 square feet of indoor vehicle storage space.

5.3.3 Black Falcon Cruise Terminal

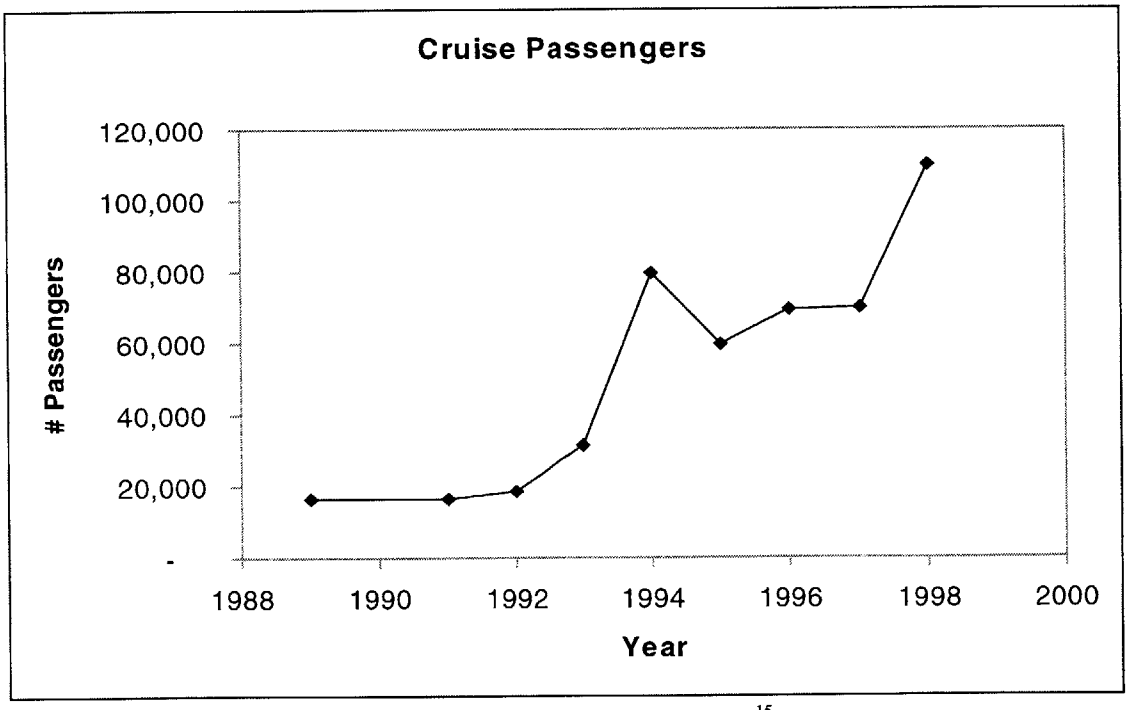

Figure 5-7: Cruise Passenger Growth[15]

[15] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

Black Falcon Cruise Terminal is located across the ship channel from Conley Terminal in the Boston Marine Industrial Park. It opened in May 1986 and in its first year handled 19 ship calls. In 1998, it received 62 ship calls and handled over 109,700 passengers, a growth of over 300% in 12 years (see Figure 5-7). The Black Falcon Cruise Terminal is the homeport for the Norwegian Majesty Cruise Line, which runs weekly cruises between Boston and Bermuda from April to October. Boston is one of the fastest growing cruise markets in the country (Massport 1999). The features of Black Falcon that make it an attractive cruise port include its easy access to Logan Airport and its close proximity to downtown and the historical district.

5.3.4 Other Maritime Properties

In addition to the major terminals, Massport owns the North Jetty, Revere Sugar Refinery, Boston Army Base, Medford Street Terminal, and the soon to be constructed International Cargo Port. North Jetty is a forty acre site located in the Boston Marine Industrial Park with Black Falcon Terminal. North Jetty boasts 800 feet of berth dredged to 40 feet deep and is used for bulk cargo operations. Medford Street Terminal is a 16 acre facility located in Charlestown on the Mystic River. Medford Street Terminal has 12,000 square feet of office/warehouse space and 800 feet of berth that is 33 feet deep. This terminal boasts two on-site rail spurs. The former Revere Sugar Refinery's conversion to a non-container commodity terminal is included in the FY98-03 Capital Program.

5.3.5 Maritime Performance Analysis

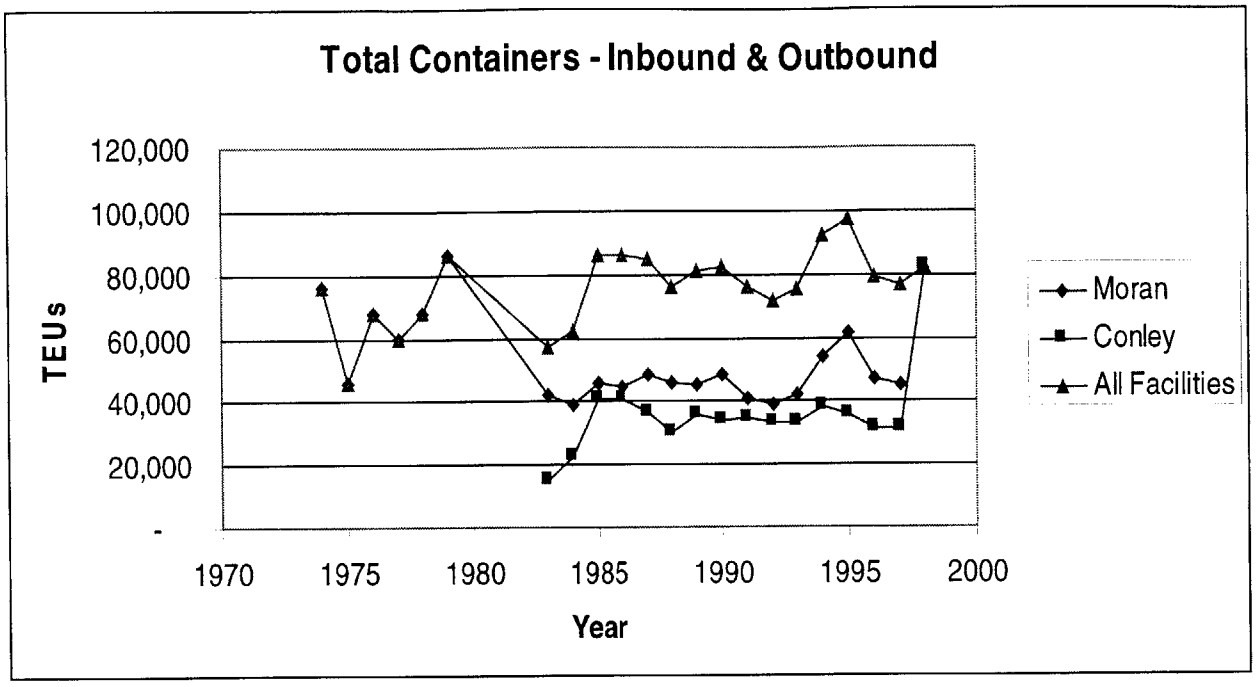

Figure 5-8: Marine Terminal Container Operations

Figure 5-8 shows the total containerized operations through the Port of Boston from 1975 to 1998, measured in the industry standard of twenty-foot equivalent units (TEUs). The graph reflects the conversion of Conley Terminal to a container terminal in 1983 and the consolidation of container operations solely to Conley in 1998. The number of TEUs handled has fluctuated wildly for the past 23 years. The trend has been upwards, but any quantification of the trend is nearly meaningless due to the dispersion of data points. Less than 30% of Boston's container volume is exported (Chrisom 1999; Massport 1999).

The amount of cargo shipped through the container terminals, shown in Figure 5-9, has sustained a much steadier upward trend over the same time period, averaging 3.6% growth per year. This indicates that more cargo was moving through the terminals in the same or fewer number of containers.

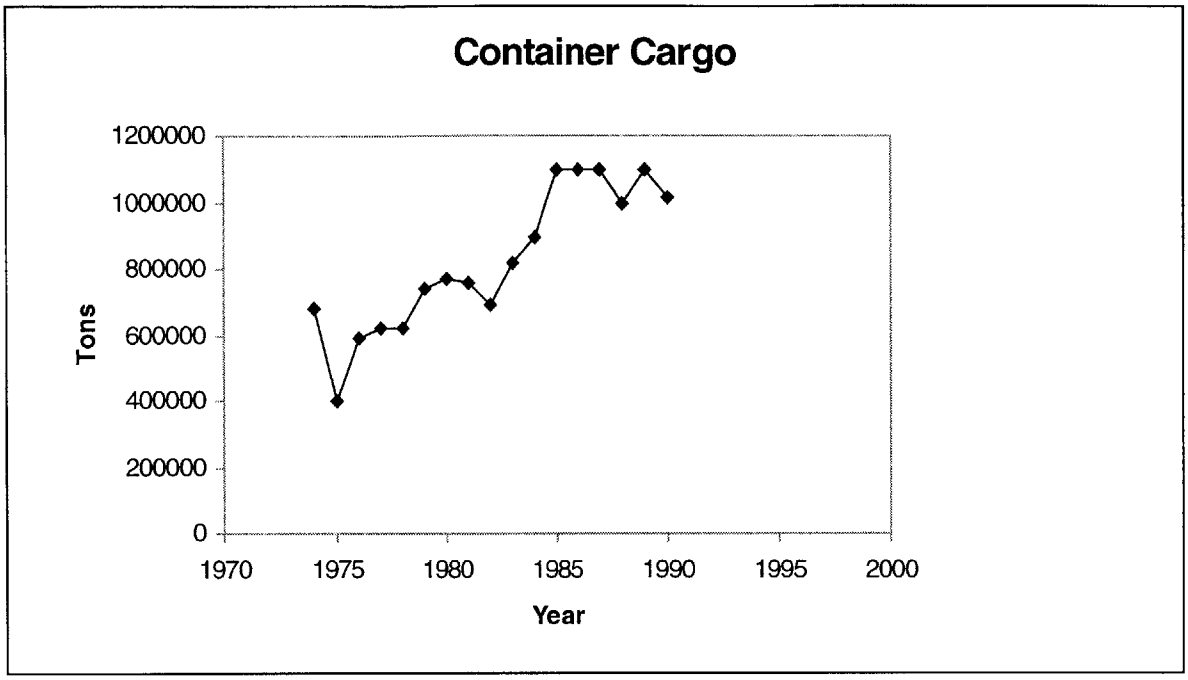

Figure 5-9: Container Tonnage through the Port of Boston[16]

Less than half of all of the waterborne cargo generated in New England is shipped through the Port of Boston (Massport 1976; Massport 1983; Massport 1984). Shippers choose to ship through ports in New York, Canada, and the West Coast instead of shipping through the Port of Boston. Nearly 25 years ago, the cost to ship through Boston via rail was $100 more per container than through ports in New York, Philadelphia, Baltimore, or Norfolk (Massport 1976). This was due to poor rail links and the lack of doublestack access into Boston. While containers were still being handled at Moran Terminal, less than one percent of cargo travelling through Boston traveled to and from dockside on rail. Dockside rail is not available at Conley Terminal as it was at Moran terminal, making today's costs to ship containers via rail even greater. Other challenges that face the port are high fixed labor costs, small size, and the decline of heavy industrial goods in the region. In 1976, Massport recognized that the port "...suffered from the

[16] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

unenviable reputation of being the highest cost port – with few redeeming features – in North America" (Massport 1976:13). The sources of this sustained high cost have been attributed to congestion, delays, & longshoremen overtime. Historically poor waterfront labor/management relationships have resulted in high costs and low productivity consequently driving up both operating and unit costs.

The Port of Boston does have some geographical advantages over other East Coast Ports. It is located a full day closer to major European ports than other East Coast ports in the United States and, conversely, a full day closer to Midwestern markets for inbound cargo than those ports. Cargo transmitted by truck from Boston to Chicago arrives in 24 hours and cargo transmitted by rail from Boston to Chicago arrives in 32 hours. In addition to timesavings, Boston offers the Atlantic Coast's lowest outbound truck rates (Massport 1999). At the end of the current dredging program, Boston Harbor will be deeper than the Ports of New York and Baltimore.

In order to attract business to the marine terminals, Massport must prove to steamship lines that it can operate at competitive costs, profitable cargo can be produced on a continuing basis, and the waterfront labor force is reliable and efficient. Massport has taken steps to increase marketing, reduce rates, and make terminal improvements in order to increase the desirability of the port. Additionally, private investments in a new cargo transfer facility valued at $35 million could add 900 more jobs and provide needed storage space for inbound and outbound cargo. Critical questions facing Massport include how to make the marine terminals more competitive with other East Coast ports, what markets to exploit to generate more business for the port, and what types of capital improvements are needed to make the port more attractive as a business and business partner.

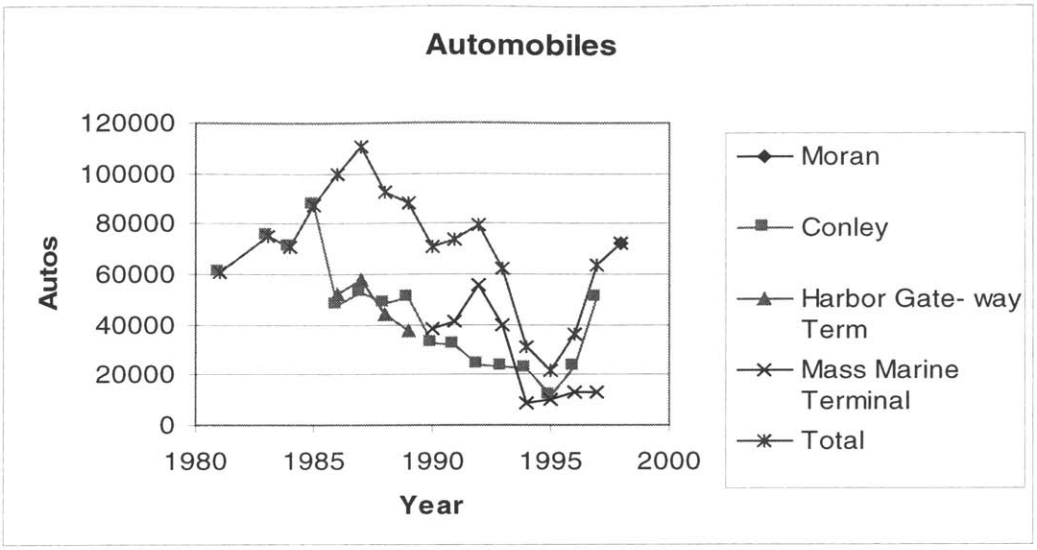

Figure 5-10: Port of Boston Automobile Handling[17]

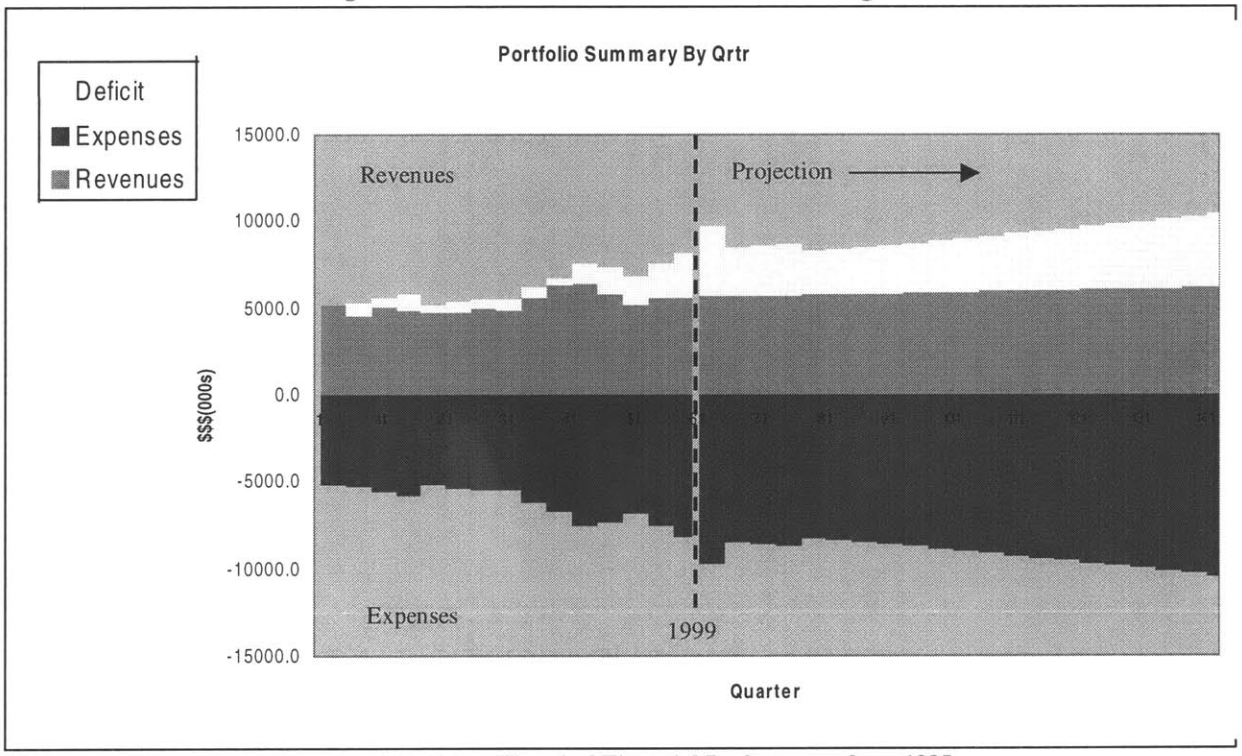

Figure 5-11: Maritime Historical Financial Performance from 1985 (Includes Committed Capital Funds from 1999-2003)

Consolidating the types of cargo handled at the two main marine terminals was an attempt by Massport to control costs and to make the port more attractive to shippers. It has not yet been

[17] (Massport 1984; Massport 1985; Massport 1986; Massport 1987; Massport 1988; Massport 1989; Massport 1990; Massport 1991; Massport 1992; Massport 1993; Massport 1994; Massport 1995; Massport 1996; Massport 1997; Massport 1998)

shown how this consolidation has affected Massport's bottom line finances. The first indication of the success of the consolidation will come with the FY99 Annual Report. Ed Chrisom, Terminal Manager at Conley Terminal, has indicated that it has taken longer than originally planned to achieve the efficiencies expected from the consolidation (Chrisom 1999). The number of automobiles handled at the Port of Boston from 1975 to the present is shown in Figure 5-10. Massport is hoping that the current trend of growth will continue and increase with the benefits of the specialization of Boston Autoport after the steep decline from 1987 to 1995.

As cited in Section 4.2.2.1, the Maritime Program has only once been able to finance its own operations. Throughout the rest of its recent history, before and after Massport took over the operations of the terminals, the port has run at a substantial deficit in its operations and capital improvements. Figure 5-11 shows the financial profile of the Port Properties – Maritime Program[18]. The revenues, growing at a rate of 1.93% per year, and the expenses, growing at a rate of 6.1% per year (see Table 5-4) are creating a widening deficit that requires greater and greater subsidies each year from the other Massport facilities. This raises the question of whether the costs of operating the port are outweighed by the benefits of having a working public cargo port in the region.

Operating Expenses	Growth Trend (1975-1998)
Operations & Maintenance	5.93%
Administration	6.42%
Insurance	8.55%
Pension	-0.22%
PILOT	2.78%
Overall	6.10%

Table 5-4: Port Historical Operating Expenses

5.4 Port Properties – Development

5.4.1 Program Overview

Maritime's Business Development Department (Development) was established as a result of the 1956 Enabling Act, through which Massport gained ownership of properties in both South Boston and East Boston. Massport is the largest single landowner in South Boston. The Authority's Business Development Department is responsible for planning, managing, and leasing all of the

[18] The graph includes no capital expenses prior to 1998 or after 2003, reflecting only those capital projects included in the current program. Capital expenses prior to 1998 are included in Figure 4-7, modeling the agencywide cash flow.

Authority's Port properties that are not used for cargo handling purposes (Massport 1998). These properties have been used and leased since their acquisition with the intent of an eventual encompassing development program in the area. The Department's mission is "to ensure that these properties are used to support maritime-related industries, to contribute to the growth of jobs, commerce and recreational opportunities on Boston Harbor, and to generate revenues necessary to support the operations of the Port of Boston" (Massport 1998:18).

The long-awaited unified development program is now underway with the new Boston Seaport District at Commonwealth Flats development in South Boston. Massport is working in conjunction with the City of Boston to develop the area, which will include the existing World Trade Center and the new Boston Convention Center. In addition, the plan includes a new Seaport Hotel, an hotel/office/residential complex, a new seafood processing plant, a cultural center, and a new $30 million intermodal cargo facility. The development plan calls for expansion of commercial operations at the port as well as public access, office, retail, and light industrial development that will generate revenues to subsidize the port operation. The development program requires substantial inter-agency cooperation with other state and local agencies. The catalysts for the initiation of this development plan were the improved access to the area due to the new Ted Williams Tunnel construction, a resurgence of maritime-related industries in the area, proposals for development of sports arenas, hotels, and the new convention center in the district, and a public demand for better access to and utilization of the waterfront (Massport 1999). Opportunities for parcel development are evaluated according to their potential uses, capacity, economic returns, and area infrastructure needs (Massport 1998).

Massport tries to work closely with the surrounding communities to map out development strategies that benefit both the community and Massport (Massport 1998). The goal of the development program is to "find projects that maximize the potential of [Massport's] holdings in ways that are consistent with its commitments to the community and its own primary mission" (Massport 1998:9). Massport's plan focuses on

- Maintaining maritime-related activities at the port
- Improving access to the waterfront
- Mitigating traffic impacts on the community from the new development
- Acting as a good neighbor to the residents of South Boston
- Facilitating a beneficial mixed-use development of the district

- Advocating responsible in South and East Boston (Massport 1999)

5.4.2 Facilities

In addition to parcels of land throughout South Boston and East Boston, Massport owns three major facilities under their Development Program: the World Trade Center on Commonwealth Pier in South Boston, East Boston Piers Park, and the Fish Pier in South Boston.

5.4.2.1 Commonwealth Pier

Commonwealth Pier in South Boston is the location of Boston's World Trade Center (WTC). The WTC is an exhibition and conference facility located on a former industrial pier. The facility also houses office space. The WTC has been leased to a developer for the operations and capital expansion of the facility. The WTC is expanding onto Massport-owned land during the Seaport District development. This expansion will include a 426-room hotel, a 1200-car parking garage and a 470,000 square foot Class A office building (Massport 1998).

5.4.2.2 East Boston Piers Park

East Boston Piers Park is a 6.5 acre park on the waterfront in East Boston. It opened to the public in 1995. The development of the Piers Park was required of Massport by an act of Massachusetts state legislation. Massport plans on adding to the park in the current capital program by developing an adjacent piece of land. Massport funds all of the operations and maintenance of this park, as well as its associated public sailing program.

5.4.2.3 Boston Fish Pier

The Boston Fish Pier has landing facilities for all fisheries operating out of the Boston Harbor and a two building complex housing Massport offices, restaurants, and fish processing facilities. The fish pier facilities are scheduled for relocation and expansion, including the addition of a new Lobster Terminal, during the Seaport District development.

5.4.3 Performance Analysis

Massport's Development Program was profitable from 1985 to 1995, subsidizing its closely related maritime industry[19] (see Figure 5-12). The current financial trends show that the development properties are increasing their revenues by 11.43% per year while increasing their expenses by only 7.03% each year. By projection, this will result in a decreasing program deficit

[19] The graph includes no capital expenses prior to 1998 or after 2003, reflecting only those capital projects included in the current program. Capital expenses prior to 1998 are included in Figure 4-7, modeling the agencywide cash flow.

each year. Boston has one of the hottest real estate markets in the country and the waterfront properties that Massport owns are well located to generate substantial rental revenues. The development properties that are owned by Massport have the potential to be excellent profit generators into the next century with the Seaport District development raising the attractiveness of the land on which they are situated.

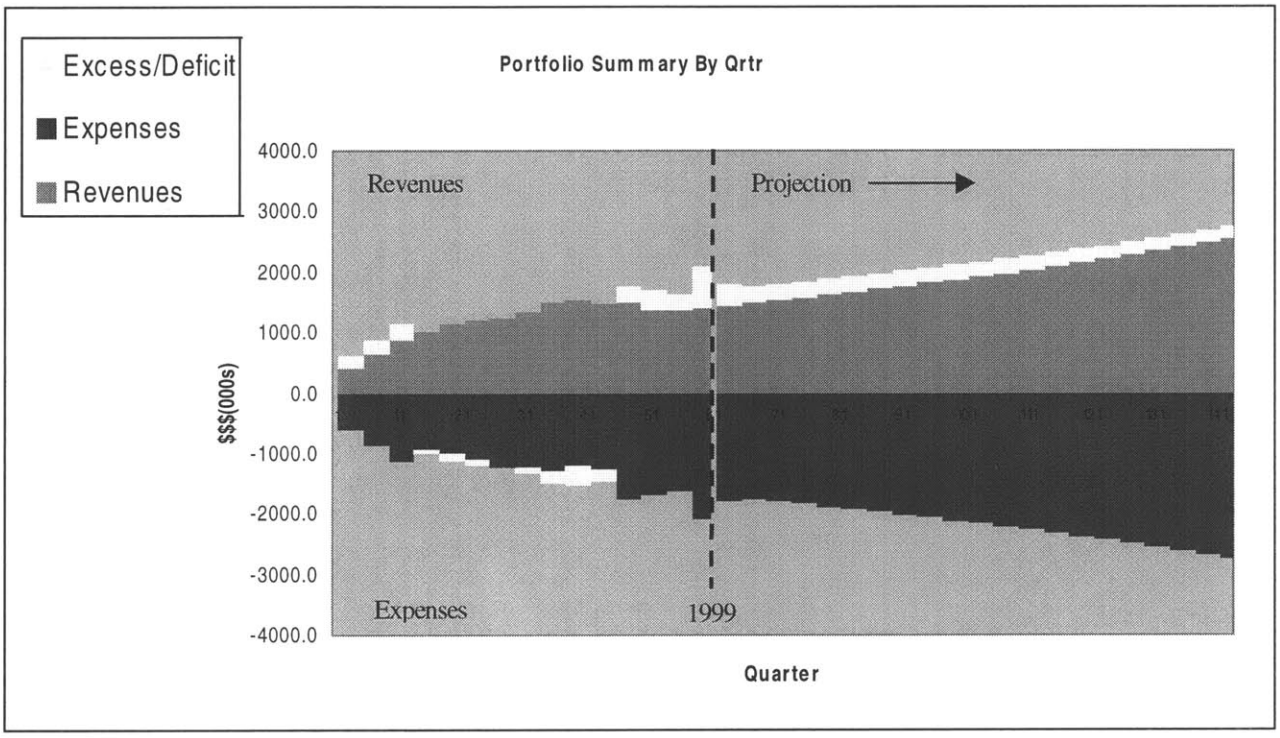

Figure 5-12: Development Historical Financial Performance from 1985 (Includes Committed Capital Funds from 1999-2003)

6 Massport Capital Programming

6.1 Current Capital Program

6.1.1 Overview of FY98-03 Program

Massport's capital programming process results in a six-year comprehensive capital program and accompanying financial plan. The current capital program, active from FY 1998 to FY 2003, will result in $3.2 billion in infrastructure investments in the agency's five programs. The capital investment per year is shown in Figure 6-1 and the breakdown of investment in each program and facility is shown in Figure 6-2.

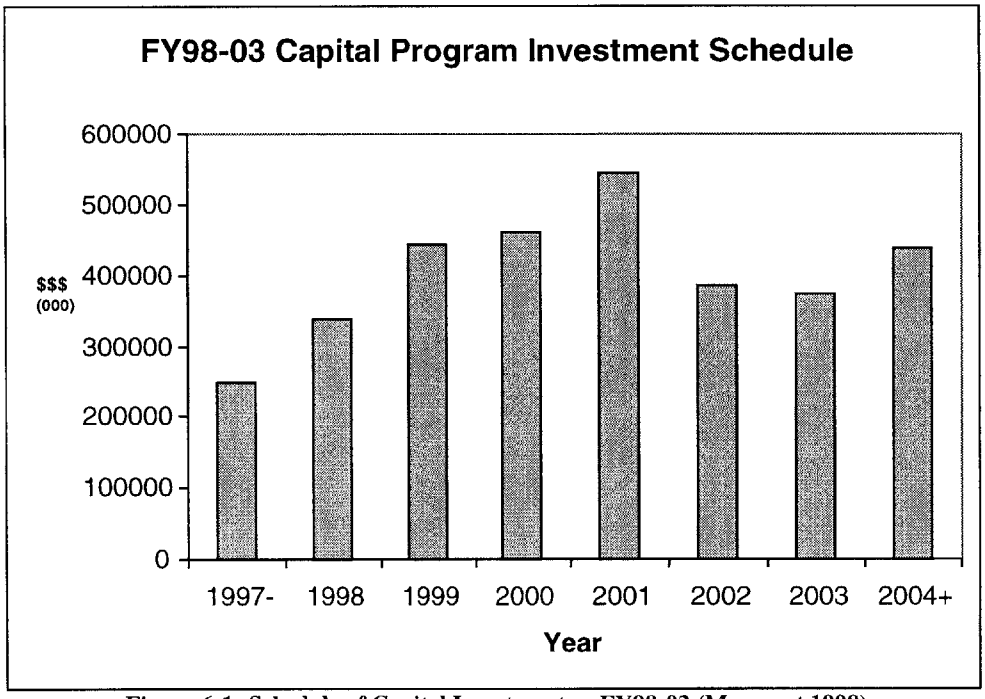

Figure 6-1: Schedule of Capital Investments – FY98-03 (Massport 1998)

6.1.2 Financing Strategy

The FY98-03 Capital Program is accompanied by a detailed financial plan for the successful implementation of the program. The financial plan has three main goals

- "to maximize the total resources available to improve Massport's infrastructure,
- to maintain the strong coverage levels and reserve balances required by the bond market that buys Massport debt, and

- to insure that the cost to shippers and air carriers of using Massport's facilities remain at competitive levels." (Massport 1998:33)

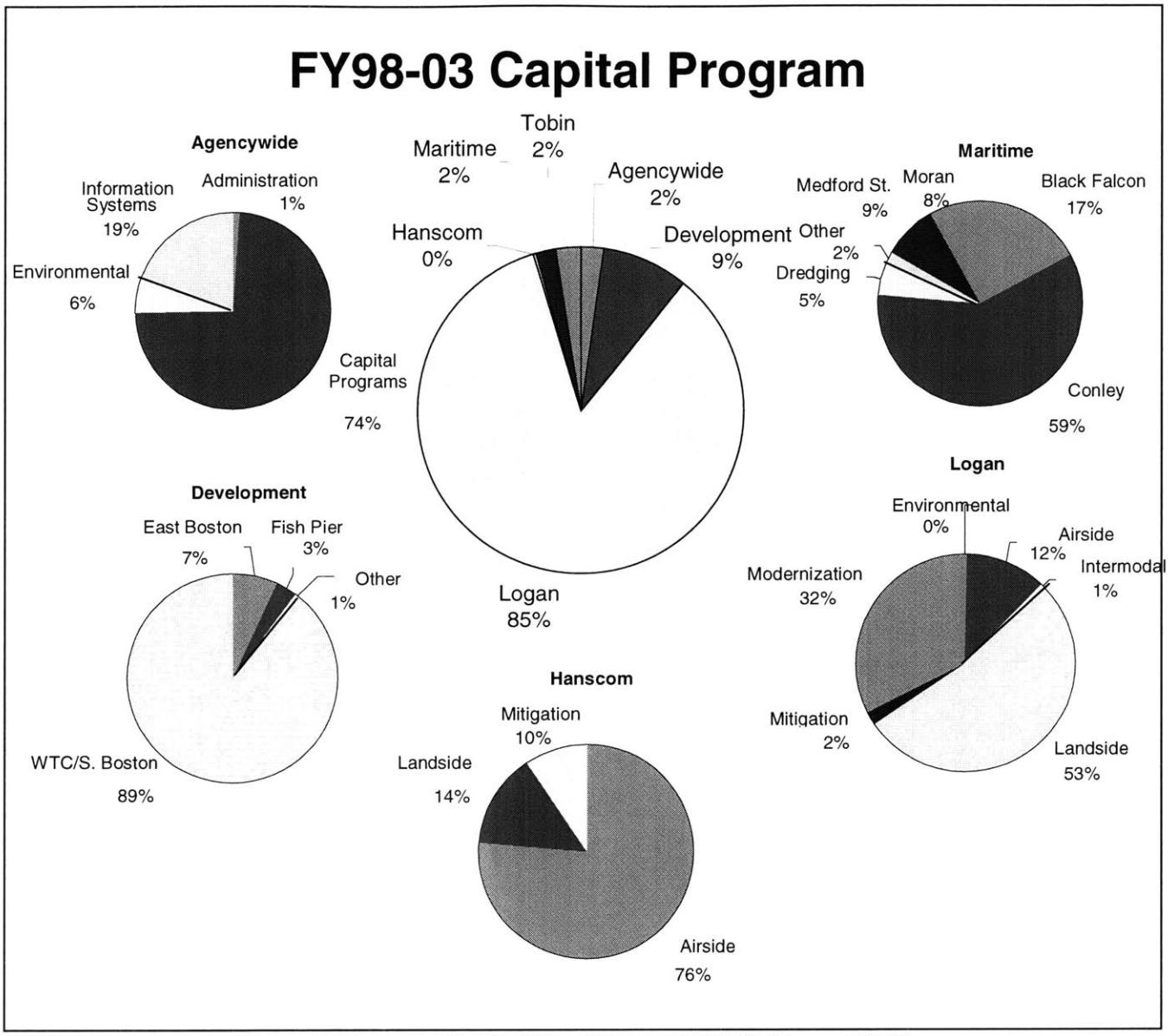

Figure 6-2: Investment by Facility and Program FY98-03 (Massport 1998)

The sources of funding for the FY98-03 Capital Program are outlined in Figure 6-3. The greatest single source of funding is private sector investment in the Authority's facilities, followed closely by funding from the Authority's reserve accounts.

Approximately 40% of the projects included in Massport's current capital program are designated for private funding (Massport 1998). These are tenant-based projects, such as the construction of the new Airport Hilton Hotel and the expansion of Logan's Terminal B by US Air. There are

three funding options for private investment at the Port. The first is direct investment by the private sector. The second is revenue bonds guaranteed by the Authority and through which the Authority carries the market risks. The third is conduit financing, where the Authority issues tax-exempt, special facility bonds that are not backed by the revenues of the Authority but only by the guarantees of the private developer. It was this last scheme that was used to finance the new airline fuel distribution system at Logan. BOSFUEL, a consortium open to all airlines at Logan, used conduit financing to obtain tax-fee bond financing for the distribution system. These bonds are neither backed by Massport's credit nor its general revenues (Massport 1998). The repayment of the bonds will come from the Authority's lease revenues generated by the facility. The facility carries a 40-year lease to BOSFUEL.

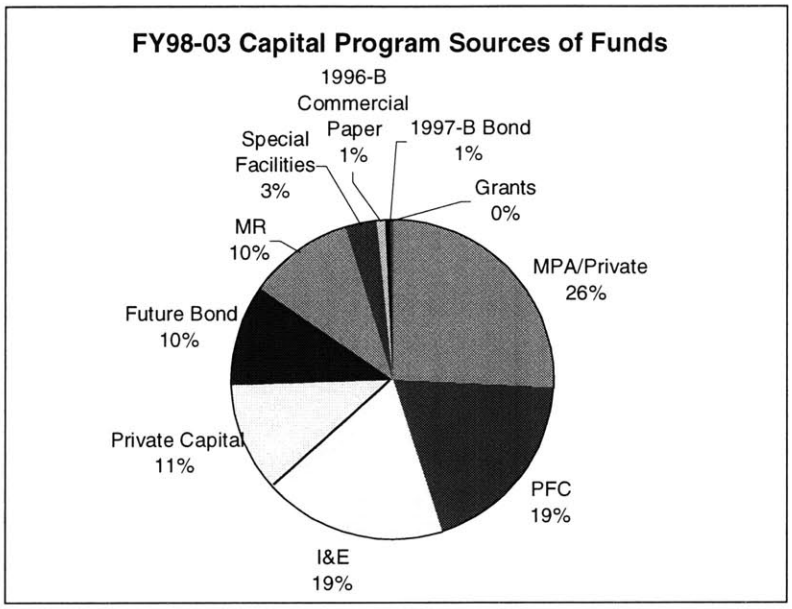

Figure 6-3: Sources of Capital Funds FY 98-03 (Massport 1998)

The remaining 60% of the projects in the capital program are labeled for direct Massport funding. These projects are the projects that most closely support the agency's mission of providing transportation services and regional economic development (Massport 1998). These projects are funded either through reserve funds, bonds, short-term financing, PFCs, or intergovernmental grants. PFC are slated to provide 19% of the funding for the FY98-03 capital program. The use of these funds must be federally approved before their appropriation. Massport is currently approved to use PFCs to fund the International Gateway project, residential soundproofing, elevated walkways, and tiered roadway project (Massport 1998). Grants account for only 0.4% of the Authority's capital financing. This includes the following grants, all of which are subject to FAA funding and application approvals

- $27 million from the FAA for Logan Airfield,

- $0.7 million from the FAA for Hanscom,
- $15 million for soundproofing,
- $10 million for the purchase of "smart" buses for the Airport Intermodal Transit Connector,
- and $1.6 million for the construction of the Regional Transportation Center (RTC) in Woburn, Massachusetts (Massport 1998).

The Authority acknowledges several uncertainties in their financial plan that could affect the execution of the capital program as currently conceived.

- If grant funds are not received, the funding for PAYGO projects will be reduced.
- The aviation program currently depends on continuing levels of Federal funding for aviation and soundproofing grant programs. If the Federal appropriations are diminished, the aviation program will have to be reduced.
- If certain cost-per-passenger thresholds are exceeded, service and passenger traffic may be diminished, thereby reducing operating revenues.
- Airlines may challenge proposed project funding according to the regulations and case laws surrounding compensatory airports. This could result in changes to the program.
- The program is dependent on projections of passenger growth at Logan. If these trends do not materialize, the capital program may need to be restructured.
- Delays in revenue generating projects could cause delays in the projects that depend on their revenue streams (Massport 1998).

6.2 Capital Programming Process

6.2.1 Proposal to Project

6.2.1.1 Project Initiation and Agency Preparation

Massport's programming process aims to intelligently identify and select essential capital projects and efficiently and innovatively deliver those projects (Massport 1999). Capital projects at Massport are initiated by one of five sources: facility managers, program managers, facility condition assessments, Massport's Planning Department, or prior program commitments (Massport 1998). To initiate the process, Program Managers in the Capital Programs Department call for a prioritized list of project proposals and cost estimates from the facility managers at each

of their program's facilities (Donegan 1999). The program manager incorporates into these lists projects associated with condition assessments of the facilities and prior capital commitments, such as mitigation programs. The program manager supplements facility managers' the project cost estimates with historical cost comparisons or unit cost calculations (Donegan 1999; Gordon and Whittaker 1999). More detailed cost estimations may be available from prior feasibility studies or from the Authority's term estimating consultant. The planning department completes the list of proposed projects with suggestions for large development and modernization programs for the agency's facilities (Gordon and Whittaker 1999).

While the list of proposed projects is being researched and compiled, the agency's Finance Department works to identify the funding capacity of the Authority for the six-year planning period (Massport 1998). This includes the available direct funding, the bond capacity of the agency, the available grants, and possible opportunities for private investment. The department also identifies the uncertainties in the financial profile of the agency, as shown in Section 6.1.2, and how sensitive the agency is to those factors.

6.2.1.2 Program Analysis

After the project proposals are obtained from the various sources, the Capital Programs Department begins their analysis of the portfolio of projects. Massport has an iterative process of program proposal and financial viability analysis. To begin, the projects in each program are prioritized according to a numerical ranking system (Gordon and Whittaker 1999). The Finance Department determines the total financial profile of the portfolio and returns to the Capital Programs Department with the results of the analysis in comparison to the agency's available resources. When the program exceeds the projected resource constraints, decisions as to which projects to include in the next cycle are based on safety, efficiency, revenue generating capabilities, operating cost savings, environmental impact, and urgency (Massport 1998). These factors are reflected in the numerical ranking system, but often, managerial decisions have to be made determining the relative merits of various projects (Gordon and Whittaker 1999). Massport commonly defers projects, changes a project's schedule, changes the scope of a project, and, where flexibility is available, considers alternate financing schemes for projects in order to produce a capital program that is financially viable to the agency (Massport 1998).

6.2.1.3 Board Approval and Execution

Once a viable program is obtained from the portfolio analysis phase, the selected program is presented to the Board of Directors for approval. In this process, each Program Manager and

Director of Facilities comes before the Board to justify the projects that were included from their program (Donegan 1999). This approval process is a final check on the program to ensure responsible spending of the Authority's funds. After the approval of the program, the project list is passed on to the Capital Programs Department and executed.

6.2.1.4 Revision Process

The Authority develops a new comprehensive capital program every six years. During execution, this comprehensive program is revised each year according to new developments in financial policies, resource availability, or program progress.

6.2.2 Ancillary Activities

Two of the activities represented on the capital programming process presented in Chapter 3 are performed by Massport but are not considered part of the formal capital programming process, but rather as business, political, and operational processes. Massport tracks performance, operational, and financial statistics and performs an annual condition assessment of their facilities as prescribed in the auditing step of the proposed capital programming process. Of these, the condition assessment is the only centralized process. With the performance measures, each facility tracks its own operations and conducts its own evaluations. These statistics are not tied into the capital programming process unless they are used by the facility manager in his or her project proposals (Gordon and Whittaker 1999).

At the Authority, strategic planning takes place in three distinct circles. The Executive Director sets overall agencywide goals and objectives and determines the target strategic direction of the agency. The planning department proposes large-scale redevelopment projects based on functionality and projected needs. Finally, the facilities and programs each develop their own strategic plans. These three components are then combined in the agency's capital program to produce projects that fit into each facility's strategic direction.

6.2.3 Analysis of Massport's Programming Process

Figure 6-4 shows a schematic representation of Massport's capital programming process and the integrated process recommended in Chapter 3. The figure should highlight many of the differences and similarities between the two processes. The following sections are discussions of the differences between the two processes and some recommendations for improvement of Massport's process.

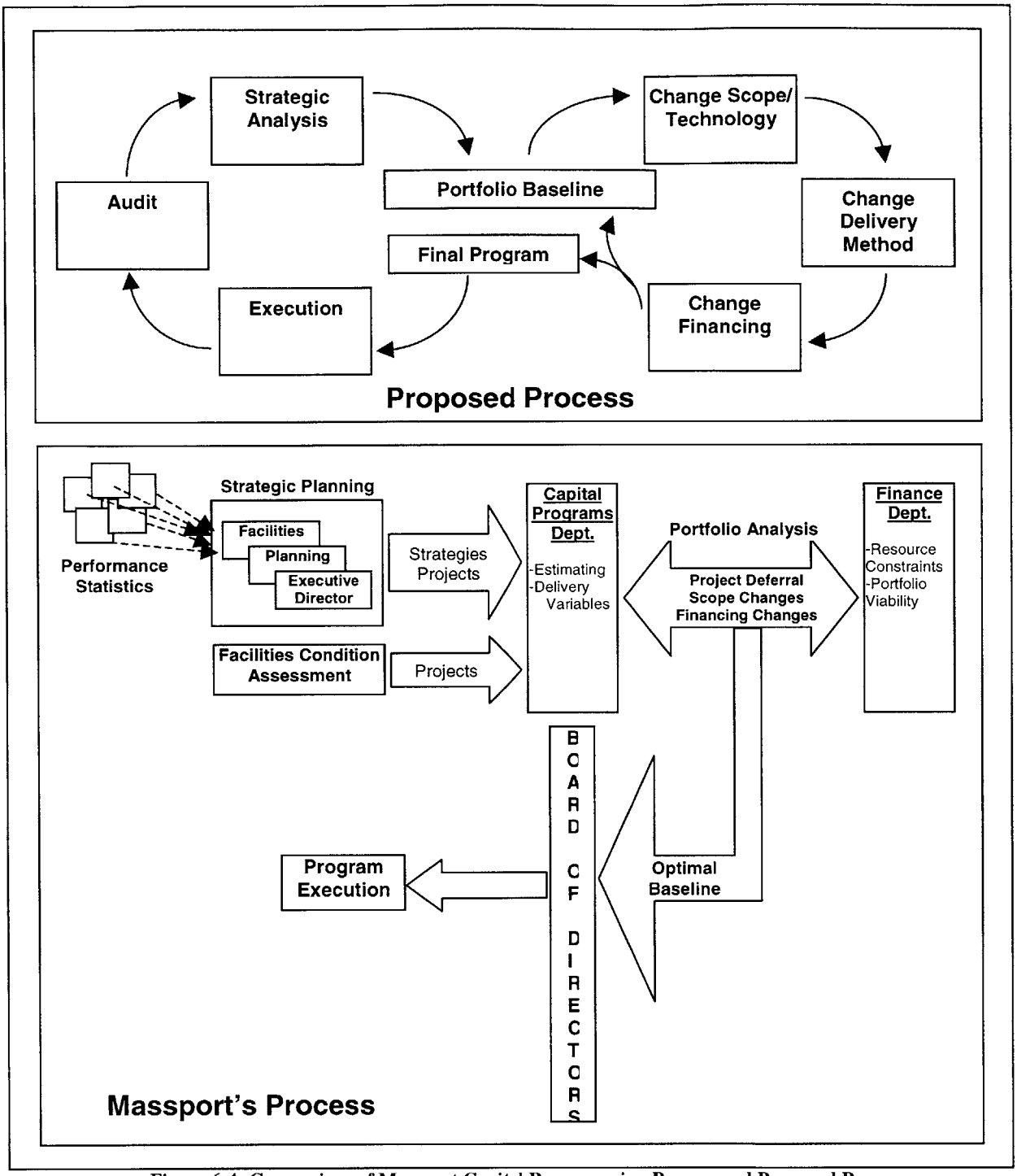

Figure 6-4: Comparison of Massport Capital Programming Process and Proposed Process

6.2.3.1 Segmented Process

The Massachusetts Port Authority conducts all of the steps in the proposed strategic capital planning process, though often diminished in scope, but they are not all recognized as part of the capital programming process, nor all applied directly to it. In order to most effectively utilize agency resources and produce a capital and strategic plan that is implementable and strategically

beneficial, the agency needs to incorporate all current processes into one integrated process. By explicitly linking the two processes, the agency will create a mindset of cooperation and strategy where there are now provincial decisions based on current performance.

6.2.3.2 Missing Links

The biggest difference between the proposed capital programming process and Massport's capital programming process is the lack of direct links and communication between functions. As illustrated in Figure 6-5, the operational and market statistics are only weakly linked to the formation of capital projects or the strategic goal setting process. The condition assessment is linked to the capital programming process but not to the strategic planning phase. The strategic planning stages are not linked together and the execution of the projects is not linked to the performance statistics for the facilities. The lack of these links creates a black hole of information in each of the boxes and results in information not being used effectively throughout the Authority.

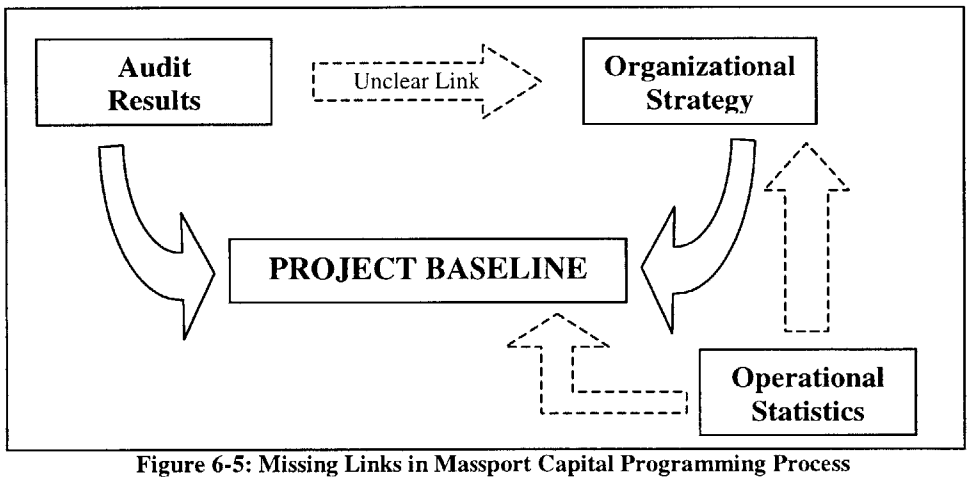

Figure 6-5: Missing Links in Massport Capital Programming Process

6.2.3.3 Search for Integrative Solutions

The portfolio analysis outlined in Chapter 3 and Chapter 10 is a cyclical, cooperative process involving individuals from many different agency departments. In Massport's process, the portfolio is passed back and forth between the Capital Programs Department and the Finance Department. The process values communication but not cooperation. By conducting portfolio analysis procedures together, the agency would experience improvements in the final product. This would lead to an environment more conducive to identifying opportunities and finding solutions to infrastructure development problems. As currently conducted, each department can only identify innovative solutions within its jurisdiction, looking at only half of the possible

solutions. Understanding the others' processes and joining for the analysis may lead to creative joint solutions to the problems of resource constraints and infrastructure needs. The same sorts of arguments can be said for the integration of the Authority's strategic planning processes.

6.2.3.4 Continuity and Purpose

Because Massport's process lacks a link between the execution of the program and the beginning of the planning of the next program, the process is not truly cyclical and does not promote organizational learning. Capital programming becomes an annual process, with the updating of strategic plans happening even less often, instead of them both being continuous. Linking capital performance with future strategic planning will allow a constant push for better agency strategic performance and higher accuracy in project performance and predictability.

7 Agency Audit

7.1 Purpose of Agency Audit

The purpose of performing an audit of the agency's operations, financial performance, and capital projects is to evaluate past actions and performance. It answers the questions of "Where are we now?" and "Were are we going if we do not change our strategy?" (Crane 1989). The audit allows the agency to gather information on their past performance, current problem areas, areas open to improvement, and future performance trends. Kenneth J. Hatten and Stephen R. Rosenthal describe the audit as "analogous to an athlete having a check-up before getting into shape to take on new challenges" (Hatten and Rosenthal 1999:299). The audit supplies information about the agency that is used for the strategy formation in the next phase of the programming process, as well as for the formation of projects based on current deficiencies and operating performance. The audit also supplies the agency with information on opportunities to improve business line competitive advantage and day-to-day operating performance by identifying sources of waste, constraints, reasons for resistance to change, and areas ripe for investment and improvement (Hatten and Rosenthal 1999). The results of the agency's audit should be a prioritized list of needs and problems with highlighted opportunities for improvement outside of these problems.

The agency audit is the primary method of organizational learning in the proposed process. Data and performance are tracked from year to year, showing improvements and declinations and allowing the agency to compare operating and capital delivery method effectiveness. If implemented correctly, results of the audit will not only be used for capital programming but also reverted back to the originating department for its use in updating current models and standards.

7.2 Established Need for an Audit

The need for some form of agencywide performance audit before the beginning of the strategic planning process has been established by researchers in both the fields of capital programming and managerial strategic planning (Crane 1989; Beaulieu 1998; Brouthers and Roozen 1999; Hatten and Rosenthal 1999; Garvin 1999 in press). The concept of a company audit is incorporated into published strategic planning processes in many different forms and names (Fisher 1986; Crane 1989; Betts 1994; Kotler 1994). Each of these processes has the essential

nature of determining where the agency's or company's operations and programs stand before they are evaluated for strategic direction. This need for this audit is precipitated by the lack of data within agencies and whole industries about the condition of facilities and the operation of those facilities (Beaulieu 1998; Garvin 1999 in press). Peter D. Beaulieu illustrates the need by citing the difficulty of effective long-term regional transportation planning within the Central Puget Sound Region due to the lack of assembled and developed information in the freight industry about commodity flows (Beaulieu 1998). In a study by Michael J. Garvin et al, The City of Medford, Massachusetts's lack of a comprehensive inventory of their infrastructure assets and a reliance on an outdated condition assessment of the known infrastructure assets affected the project proposal and cost estimate stages of the capital programming process (Garvin 1999 in press).

7.3 Elements of Strategic Accounting

Traditional accounting methods used in public and private agencies do not provide adequate information to effectively develop and track a strategic plan (Beaulieu 1998; Brouthers and Roozen 1999; Garvin 1999 in press). A system of accounting directed solely at providing information for and about the formulation and implementation of corporate strategy, termed strategic accounting, was first developed by Keith D. Brouthers and Frans A. Roozen in 1999 (Brouthers and Roozen 1999). They criticize financial accounting systems for use in strategic planning on the grounds of

- Reliance nearly solely on financial information
- Reliance only on the past for information
- No information about the industry outside of the corporation
- Predictions about future performance based only on simple financial interpolations
- Lack of centralized, formalized data gathering and dissemination
- Lack of evaluation and feedback systems prohibiting the entity from learning from past failures and successes (Brouthers and Roozen 1999).

In addition to these criticisms, problems in the analysis of Massport data for this project and in Garvin et al's research for the City of Medford show deficiencies arising from the aggregation of financial information that takes place in financial accounting systems, detracting from accountability for financial performance and not providing adequate detail to make performance assessments of individual operations (Garvin 1999 in press).

Brouthers's strategic accounting system aims to report strategic information, not general managerial or financial information. The system is based in both the fields of strategic management and accounting and aims to provide the following benefits to the planning entity, identified as inadequate in traditional accounting systems by the managers involved in their study:

- Qualitative information
- Future-oriented information
- A broader range of information than that presented in current accounting systems
- Reporting on a timely basis
- Information about the implementation of working strategies (Brouthers and Roozen 1999).

Brouthers suggests that the implemented accounting system be centralized within one department in the agency so that the data gathering and dissemination is formalized and assessable (Brouthers and Roozen 1999).

Brouthers's strategic accounting system was developed for private corporation strategic management, making the specific tasks and processes he included are not all directly applicable to public agencies. The two most important concepts embodied in his process though, are very important to any strategic accounting or auditing process: tracking mechanisms for the implementation of current strategies and both "snapshots" of current performance and "movies" of performance over time. This allows the agency to evaluate where they are, where they have been, and where they are going. This idea of looking at current performance in the context of past performance is also advocated by Philip Kotler (Kotler 1994).

The following sections highlight some recommended tasks to be included in the agencywide audit and the agency's strategic accounting process. In each of the cases, auditors should look at both macro-environmental factors and micro-environmental factors that may influence the agency's performance (Kotler 1994). Hatten also states that "sometimes, informed opinions will have to suffice" (Hatten and Rosenthal 1999:301) when hard data is not available or not appropriate.

7.3.1 Asset Inventory

The capital assets owned by public agencies go through considerable changes every year. These changes can be in the form of divestiture, upgrade, acquisition, or functional change. It is important for the agency to have an up-to-date comprehensive list of their assets and the current state of those assets. This inventory should be updated and verified on a continuing basis, at least each time the status of one of the assets changes. Having a knowledge of the current assets, including all underground structures such as mileage and locations of pipes, and the current condition and use of those assets will allow the agency to more thoroughly explore their options during strategic planning and more effectively manage their assets during day-to-day operations.

7.3.2 Condition Assessment

In order to determine the structural needs of the agency's assets, each of the agency's facilities needs to undergo a condition assessment. Garvin et al draw a direct link between the thoroughness and accuracy of the condition assessment and the precision and comprehensiveness of the capital program (Garvin 1999 in press). The condition assessment should be a survey of every facility that is owned by the agency. In cases of highway departments or other agencies with huge quantities of assets, such as hundred of miles of roads or pipes, a survey of a sample of the assets may need to take place. The precondition of knowing the conditions of assets before capital programming has been exemplified in different research and practical applications. Lance A. Neumann's 1980 development of a highway investment programming method for the Wisconsin Department of Transportation included an assessment of existing conditions in order to determine the deficiencies in their highway inventory (Neumann 1980). Garvin et al determined that by not having a current assessment of asset deficiencies, the researchers involved with the capital planning study for the City of Medford were not accurately able to predict the costs of the proposed projects (Garvin 1999 in press). For agencies, an inaccurate prediction of project costs could lead to serious problems with the stability of their capital improvement portfolio.

The completed condition assessment should provide information to determine the current physical needs of the agency's facilities. In addition, the condition assessment will provide a short-term outlook for future needs. Compilation of several years worth of data will allow the agency to determine rates of deterioration for its facilities and evaluate the effectiveness of construction materials and methods for application to future projects.

7.3.3 Operations Audit

7.3.3.1 Financial Performance

The short- and long- term financial performance of each facility's operations needs to be assessed to determine immediate operating deficiencies and long-term trends in performance. The financial graphs for each of Massport's facilities were presented in Chapter 5. The financial analyses include quarter-by-quarter reports of financial performance, the computation of profitability, and trend analyses for revenues, expenses, and profitability. The components of this analysis should be as detailed as possible in order to more effectively show the opportunities for improvement and the past effective strategies. In addition to these analyses, the agency should compute their performance with respect to their financial reserves and sources of new revenues and finance (Fisher 1986). The level of detail in these assessments should be very high in order to make accurate performance evaluations and identify improvement opportunities.

7.3.3.2 Capital Program Performance

In order to determine the effectiveness and efficiency of the past and current capital program, its implementation and subsequent facility operations must be examined. The agency should track

- The performance of the facility or equipment once it is put in place versus the expected performance
- The costs of the project versus the contract price
- The financial impact of the completed project on the operations of the associated facility
- And, the measurable non-economic benefits of the project experienced by the agency versus those that were expected.

Knowing how a capital project performs, both during delivery and during operations, will allow the agency to update their specifications to obtain the best project value, improve their cost, schedule, and performance estimates, determine deficiencies in their benefit assumptions, and track trends in unexpected benefits in anticipation of applying them to future projects. All of these activities will result in lower costs and better value to the agency in their capital and operating activities.

7.3.3.3 Operational Performance

The operations of the facilities need to be tracked through time to determine the efficiency of operations and the operating trends for each facility. Examples of this type of analysis are shown

in Chapter 5 for each of Massport's facilities as rates of cargo, passengers, or other operations per year. Other data that have been recommended for inclusion in the performance analysis:

- Performance statistics such as accident rates on highways (Neumann 1980)
- Volume to capacity ratios (Neumann 1980)
- Customer satisfaction (Hatten and Rosenthal 1999)
- Alignment in operations between the agencies and their business partners (Hatten and Rosenthal 1999)
- Productivity trends (Fisher 1986)
- Service delivery or operational methods (Crane 1989)

Hatten states that in many circumstances, surveys of customers (in the case of public agencies this would be the users of the facilities) can be utilized to determine the real perception of the facilities by their users (Hatten and Rosenthal 1999). The same tactic can be used to determine the alignment between the agency and its business partners and their perceptions of the facility operations.

7.3.4 Inter-departmental Synergies Assessment

Communication and cooperation across departments can create synergies that permeate through the agency, affecting revenue generation, expenditures, public relations, efficiency, etc. The agency can determine whether the different departments are exploiting opportunities for synergy by assessing the amount of communications between departments and the effectiveness and benefits of current inter-departmental cooperation (Crane 1989; Kotler 1994). If the interdepartmental cooperation is not producing the desired synergies, the reasons why the collusion is not efficient and effective must be investigated and passed on to the strategic planning session for solution considerations.

7.3.5 Strategic Implementation Report

The implementation of the agency's current strategic plan should be looked at on a continuing basis to determine its effectiveness and track any deviations from agency strategy. The program implementation and maintenance should be tracked throughout the lifespan of the projects to ensure that the strategy is being enacted effectively by all of the operating and investment departments, as well as to track the results of the implementation. Brouther's manifestation of this need is a Strategic Implementation Report (Brouthers and Roozen 1999). The Strategic Implementation Report consists of three separate reports that are submitted to management every

quarter for businesses not involved in major strategic changes: Strategic Variance Reports, which report activities that differ from the prescribed strategy and why they were undertaken; Strategic Contribution Reports, which measure the contribution of the projects to the agency's goals over their entire lifespan; and Strategic Progress Reports, a primarily financial report detailing upcoming commitments and their predicted impact on the agency (Brouthers and Roozen 1999). Any facility under restructuring should submit the reports more frequently (Brouthers and Roozen 1999). Agencies should take the concept of the three parts of the strategic implementation report suggested by Brouthers and develop their own format for measuring the elements of the implementation about which they are most concerned. This may change throughout the lifecycle of the strategy, so the agency must be continually reassessing its data needs and updating its processes.

7.4 Data Use

The data collected in each of the audit activities must be reported and analyzed by individuals or teams that are familiar with the industry and agency operations (Hutchins 1998). Reporting by individuals directly involved with the operations will allow a complete and enlightened audit that most closely represents the agency's operating and financial strengths and weaknesses. The individuals' knowledge of the industry and operations will allow the agency to accurately examine the performance of the business lines by the analysts' ability to pinpoint inaccurate data or analysis results, identify circumstances that may have unusually affected operations, and identify and recompute unreasonable trend predictions.

Potential Analyses
Financial Performance vs. Capital Expenditures
Capacity Utilization vs. Operating Expenditures
Capacity Utilization vs. Revenues
Safety Performance vs. Capital Expenditures
Fee Structure vs. Profitability
Productivity vs. Revenues
Productivity vs. Expenses

Table 7-1: Cross Comparison Analyses

The data reported through the audit should serve as a context for the analyses, discussions, and decisions that take place in the strategic planning sessions. The data compiled in the agencywide audit will be used to identify ways to improve the day-to-day operating performance of the facilities (Hatten and Rosenthal 1999) and to provide essential information for long-term strategic decision-making. The statistics and trends that are reported during the agency audit should be

cross-compared to determine causal relationships and trends. Examples of these cross comparisons are shown in Table 7-1. This table is by no means a comprehensive listing of possible analyses. The analyses undertaken by each agency should be tailored to the individual agency's needs. Two comparisons that should be undertaken for every agency are analyses of results vs. objectives and results vs. the past (Hatten and Rosenthal 1999). This will allow the agency to determine the effectiveness of its current implementation strategy and operations and how its profitability and operations measure up to past operations, providing a context for performance evaluations.

7.5 Massachusetts Port Authority Audit Activities

7.5.1 Facilities Condition Assessment –The Trust Engineer

The Trust Agreement of 1978 requires that Massport conduct a condition assessment of all of its facilities every year and report the conditions to the State Street Bank & Trust and the Authority's bondholders. The work is contracted out to a consultant for an objective evaluation of the condition of the facilities. The entity to which it is contracted is termed the "Trust Engineer." HNTB Corp. has been conducting the condition assessment for Massport for the past nine or more years with an annual automatic contract renewal (Christopherson 1999).

7.5.1.1 Contract and Services

The current contract for the Trust Engineer is a lump sum yearly fee of approximately $135,000 with a related services sum of $65,000 available by work order. An example of work that falls under the contingent $65,000 is biannual state bridge inspections. For the condition assessment, the Trust Engineer produces three deliverables each year: Detailed Inspection Reports, an Annual Report of Conditions, and Facility Replacement Costs. The consultant has crews on all of Massport's properties on a continual basis. Every single facility that is owned or operated by Massport is inspected each year. In addition to their duties on site, the Trust Engineer performs activities for the Finance Department in preparation for bond issuances and approves all expenditures for contractors on a weekly basis as an independent check on capital expenditures.

7.5.1.2 Detailed Inspection Reports

The Trust Engineer produces detailed inspection reports for every structure that is owned by Massport. It is in these reports that the consultant details the condition of the general construction of the facility, its structural components, and its mechanical and electrical systems. These reports are based entirely on visual inspections of the facilities. If the facility is in extremely poor

condition, an additional, more in-depth assessment is conducted before the contract for repair or replacement is initiated (Christopherson 1999). Each facility is rated on a scale of one to four:

1 - The facility is in need of immediate action.
2 - The facility work can wait for a few months before repair or replacement.
3 - The condition of the facility must be monitored closely.
4 - The facility is in acceptable condition but must be watched for future damage (Christopherson 1999).

In addition to rating the facilities, the reports estimate the cost of the recommended work and state whether the work should be done by a contractor through the bidding process, by Massport maintenance personnel, or by one of Massport's on-call contractors.

In the past, the detailed inspection reports were very cumbersome, making it difficult to sort and prioritize work needs. Because of this they were not used effectively and work that was recommended in the reports was being overlooked (Christopherson 1999). In the past two years, a computer system has been developed to handle all of the inspection reports. This database, developed by HNTB Corp., is sortable by fields and will hold historical condition assessments for easy future review.

7.5.1.3 Annual Report of Conditions

The second type of report that is produced by the Trust Engineer each year is the Annual Report of Conditions. This general executive summary of the detailed inspection reports is submitted to the State Street Bank & Trust, Massport's bondholders, and Massport's insurance handlers. This report is more of a glossy marketing tool than an in-depth condition assessment report (Christopherson 1999).

7.5.1.4 Replacement Cost Report

The Trust Engineer is required to compute the replacement cost of all of Massport's facilities each year. The replacement costs are used for financial purposes and for the calculation of the amount of funds to be set aside into the Maintenance Reserve Fund. Each year, one percent of the current replacement costs of all Massport facilities as calculated by the Trust Engineer are set aside into the Maintenance Reserve Fund, as per the direction of the 1978 Trust Agreement. The money invested in the Maintenance Reserve Fund is used to fund maintenance and small repair projects at all of Massport's facilities.

The formula for the computation of the replacement cost for each facility is

$$Cost_n = (Cost_{n-1})*(1+f)$$

Where,

$$Cost_0 = Cost_{NewConst} - Cost_{Basement}$$

And, f = inflationary rate for that year.

One of the problems with the estimation of the replacement costs of Massport's facilities is that the Trust Agreement requires that the replacement costs include only the costs of the parts of the structures that are above ground (Christopherson 1999). The rational behind this directive is that if a fire were to burn the structure, the foundation would still be there and would not have to be rebuilt. This assumption is now outdated and results in a drastic undervaluation of the replacement costs of the facilities. Massport has a huge investment in underground structures, including utility tunnels, jet fuel facilities, and parking structures. The replacement cost valuation of the new Central Parking facility at its completion in 1998 was millions of dollars less than what the Authority paid for its construction, causing many in the Authority to question the methodology prescribed for the valuation of replacement costs (Christopherson 1999). The revision of this stipulation would have major consequences on the financial structure of the Authority. A higher valuation of the total replacement costs of the facilities would divert more money into the Maintenance Reserve Fund and lower the amount of money available for PAYGO capital projects, which would in turn adversely affect the capital improvement programs of the Bridge and Port facilities that rely on primarily on PAYGO funded development projects.

7.5.2 Financial Modeling

Massport conducts detailed financial modeling in preparation for its capital planning and bond issuances to ensure that the Authority can meet the commitments created by them. This financial analysis primarily looks at the short-term historical performance of the overall Authority. The Authority hires a consultant in San Francisco to assist with modeling the feasibility of its capital program with respect to its financial plan and outlook (Gordon and Whittaker 1999). Each of the facilities closely tracks their own operating revenues and expenses which are then passed on to the Finance Department for use in financial modeling.

7.5.3 Operating Statistics

The number of cars processes at the Autoport, containers handled at Conley, international passengers travelling through Terminal E, and flights leaving from Hanscom are all closely tracked by the programs running those facilities. These sorts of operating statistics are used by the programs to compute revenues and efficiency statistics, as well as by the marketing department to target new business. Growth trends of these statistics may be computed with varying degrees of specificity (Wallace 1998) depending on their use and need. The problem with Massport's collection of statistics like these is that they are not centralized. When people outside of those dealing on a daily basis with the statistics want the information, they need to, first, identify if it is collected and, second, track down the person who is in charge of the statistic. This data is not used directly by the capital programming department in the capital programming process (Gordon and Whittaker 1999), though it may be used by the operating departments to determine their future capital needs. One area where the statistics are used effectively is Logan Airport's capital needs. Logan's programmers use the detailed statistics when determining the size and nature of their proposed airside facilities by computing detailed trends of future passenger and aircraft volumes (Massport 1998).

7.6 Recommended Audit Improvements for Massport

7.6.1 Financial Modeling

Though Massport conducts detailed financial analyses for inclusion in their bond documents and capital programming financial plan, the agency does not compute long-term historical trends in specific operating revenues or expenses for their business lines (Taylor 1999). Betsey Taylor, Massport's Director of Financial Policy, states that they care more about net revenues than about trends in specific revenues and expenses (Taylor 1999). More detail in the financial analyses would highlight opportunities to lower operating expenses, specific areas of poor performance, costs rising at above average rates, and types of contracts and work that produced the most financial benefits to the agency. These results could then be applied to the next programming cycle.

The Finance Department makes assumptions about the trends in available funds for their financial modeling. They assume a four percent general trend in Maintenance Reserve funds and overhead expenses. This accounts for three percent yearly inflation and one percent growth in programs (Taylor 1999). It is impossible to check the accuracy of this assumption because of the

aggregation of revenues and expenses in the Annual Reports. Taylor believes that the agency has relatively fixed operating costs (Taylor 1999). Through my financial analysis documented in Section 4.3.2.1, this is shown to be inaccurate. The operating costs to the Authority have actually been increasing at a rate of 7.24 percent per year, which is 3.24 percent above the Authority's four percent inflation and program growth assumptions.

Modeling their historical financial profile and determining trends in revenues and expenses would allow the agency to more accurately predict their future performance. In addition, they would be able to determine whether the assumptions that had been made in the past were accurate and, if not, update their modeling assumptions for future planning.

7.6.2 Linking Facilities Management and Capital Programming

Massport's Capital Programs Department does not track the performance of most of their capital projects after they have gone into operations (Gordon and Whittaker 1999). The linkage between facilities management and capital programming is missing within the agency. This means that the specifications for future projects are not updated with reports on the performance of past projects. The tracking of lifetime project performance and the direct input of facilities managers in the capital programming analysis could have great impacts on revising the cost structure of both capital projects and operations.

7.6.3 Centralization of Information

As Brouthers suggests in his article on Strategic Accounting, all of the detailed information on financial performance, facility usage statistics, and operating efficiencies should be centralized within the agency for use in inter-departmental cooperation and strategic planning. The data should be easily assessable to support informed decision-making (Brouthers and Roozen 1999). Currently, the bulk of the information compiled about the agency's facilities and operations are kept within the individual departments and outside the department (and possibly within the department also) no one really knows the types of statistics that are tracked or their usage. This was evident during my search for information at the agency and my interviews with Massport operations, finance, and capital program managers.

7.6.4 Comprehensive Inventory

No where does Massport keep a comprehensive inventory of all of its facilities and properties (Christopherson 1999). Each program has knowledge of the facilities over which it has control, but the agency administration has no complete list of the facilities that it owns. This complete

inventory will be essential for the agency to move from a process that leaves the strategy formation entirely up to the facilities to one in which the strategy formation is a coordinated, cooperative effort between the facilities and the administration.

7.6.5 Beware of Stagnancy

One of the traps that Massport has fallen into in the past is that of stagnancy in its audit reporting efforts (Christopherson 1999). This stagnancy arose most notably during the work of the Trust Engineer and the use of the Trust Engineer reports. Until the advent of their computer database, the Trust Engineer consultant grew lax at updating their forms and procedures with the changes in the Agency's asset base. This created problems for those receiving the forms in interpreting the archaic location and condition languages (Christopherson 1999). This stagnancy and satisfaction with the status quo can be eliminated by stronger mandates on procedural changes by the Massport administration and possibly by competing the contract for the Trust Engineer consultant on a more regular basis, allowing competition to increase performance incentives.

There was also a problem with the use of the Detailed Inspection Reports as they became more cumbersome and out-of-date. After the structural failure of elements of Terminal A, which resulted in emergency construction for safety and the need for a replacement Terminal A in the next capital program, people within Massport asked why the problems were not detected earlier and prevented. After the Detailed Inspection Reports were reviewed for Terminal A, it was shown that the problem was identified but the report was overlooked by the programming staff (Christopherson 1999). Though this is a drastic example, complacency with the current conditions and numbness to audit results need to be avoided within the agency in order for the process to be effective.

8 Strategic Analysis

"What is our business? Who is the customer? What is value to the customer? What will our business be? What should our business be?" (Kotler 1994:66)

8.1 Why Long Range Planning?

The questions raised above are the questions that the agency aims to answer during the strategic analysis phase of the programming process. Operating without a long-term strategy is like walking while staring down at your toes: you are not prepared when something shows up in your way. In a speech to port authority officials in February 1999, Phil Connors, Executive Vice President of Maersk Inc., warned, "The leaders in any segment must continue to reinvent their companies to keep pace with the market changes, or risk elimination by competitors with a more effective business model." (Connors 1999:1). Long-range planning allows agencies to develop well thought out strategies for what direction the agency is to head and provides a framework for all operational and investment decision-making within the agency. Long-range planning for governmental agencies incorporates the non-economic factors that are essential to the agencies' success in achieving their regional and agencywide economic goals and to increasing the agencies' accountability for their actions. This sort of planning is missing from most governmental agencies and municipalities even though it represents good business practice and sound common sense.

Gary Hamel and C.K. Prahalad tell their readers that the future resides in changes in technology, lifestyles, regulation, demographics, and politics (Hamel and Prahalad 1994). This is nowhere more true than in public agencies. The foresight required to accurately predict these changes comes from exploring and learning at all levels of the agency (Hamel and Prahalad 1994). Only agencies that are adaptable will fit effectively into the changing environment and leverage the environmental changes to increase the effectiveness of their operations. This adaptability comes from a flexible strategic plan and agency foresight (Kotler 1994).

8.2 Objectives of Strategic Planning

The goal of the strategic planning process should be to find a "viable fit between the organization's objectives, skills, and resources and its changing market opportunities" (Kotler

1994:62). The agency needs to find its strengths, define important niches, assess the future potential of its markets, and devise a way to most effectively manage its portfolio of businesses (Kotler 1994). Hamel and. Prahalad state that in order to succeed in the future, you must either see opportunities that are not seen by other agencies or exploit opportunities that other agencies cannot (Hamel and Prahalad 1994). Strategic analysis is the search for those opportunities and ways to meet the market demands of the future.

As stated above, the object of the strategic planning sessions is to find out how the agency will fare in the future and devise a strategy to take control of its fate. The types of questions that should be considered during the planning session include:

- How attractive are the businesses that the agency is in? (Sadtler 1999)
- Is the agency competitively strong in those businesses? (Sadtler 1999)
- What are the emerging needs of the agency's customers and business partners? (Hatten and Rosenthal 1999)
- What types of performance expectations do the customers and partners hold? (Hatten and Rosenthal 1999)
- Will the agency's resource base be adequate for the future? (Hatten and Rosenthal 1999)
- How did the agency get where it is today - through drifting or through strategic decisions? (Hatten and Rosenthal 1999)
- How do customers perceive the performance of the agency? (Hatten and Rosenthal 1999)
- And most importantly, what options does the agency have?

In order to answer these provoking and difficult questions, the agency will have to examine its audit results, look at changing market conditions, and think long-term and creatively. From these answers will come the direction the agency will follow in their capital program.

8.3 Private Sector Method Applicability to Public Agencies

Using methods designed for strategic planning in private corporations has many advantages for public agencies. The methods will help them to identify opportunities for improvements in their operations and financial profile and improve decision-making techniques. It will help them to become more accountable for their financial situation and their policy decisions. Structural differences between private corporations and public agencies require the public analyst to use caution though when applying private sector strategic planning methods to public agencies.

Examples of these structural differences are given in Sections 8.3.1 through 8.3.4. It is important that the planner remembers the differences between the values, missions, and stakeholders in public and private entities and account for those differences both during the strategic analysis and the goal formulation stages.

8.3.1 Public Good vs. Profit

Most strategic planning tools are based on assessing the current and future profitability of an industry or business and raising its profitability potential. This is appropriate for private sector companies where profit is the driving force behind their actions. Public agencies often act to obtain the most public good, not the most profit. Financial accountability is essential for public agencies, but maximizing profit at the expense of the public conflicts with the agencies' missions and is not a sustainable strategy.

8.3.2 Option Constraints

Part of the results of a private corporation's strategic planning assessment is a recommendation to "build, hold, harvest, or divest" each of the company's businesses[20] (Kotler 1994:72). These options may be severely constrained for public agencies. These agencies may not have the option to harvest or divest their core businesses, no matter how much of a sap on agency resources they represent nor how unattractive the industry. The alternative delivery methods outlined in Chapter 10 offer possible solutions to these constraints, but often with legislative constraints of their own. Private corporations have control over their own strategic actions and have to answer only to their shareholders, who are most likely interested in maximizing profits. Public agencies are subject to public and political criticisms and demands that can limit the flexibility of the agency to perform the "best" strategy.

8.3.3 Role of the Agency

Private companies operate in a competitive environment. Their goal is to get more profit and more market share. The businesses of some public agencies may fit the role of competing with another business, as with ports trying to attract shippers away from other ports, but the agencies' businesses also play other roles in the economies of their region. Public agencies play the role of an enabler for other industries through the provision of infrastructure and other factor conditions for regional competitive advantage (Porter 1990). They may also play the roles of supplier or business partner. This multi-facetted face of public agencies means that the agency not only

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[20] See Section 9.3.1

needs to analyze its businesses according to their competitive advantage but also according to the competitive advantage that they provide to the industries and region that they support[21].

Public agencies also need to define the role that they wish to play in directly supporting the economy of the region. Private companies choose between reinvesting their profits through retained earnings and paying dividends to their shareholders. Public agencies have a similar decision. They decide how much of the revenues generated by their facilities to invest back into the facilities versus invest in programs that support either the social or economic welfare of the region. This policy often shifts with changing political administrations (Taylor 1999).

8.3.4 Multi-Party Interests

In most private sector strategic planning sessions, there are two stakeholders and one goal: management, shareholders, and the highest possible profit. The stakeholders in a public agency's strategic planning process are much more complex. The financial shareholders to which the agency is accountable include the public and the agency's bondholders. The agency is accountable to local communities since construction and infrastructure development often involves the acquisition of land and negative environmental impacts. Businesses that lease facilities or work as strategic partners with the public agency are financially affected by agency policy decisions. Politicians are politically accountable to the public for the actions of the public agencies under their control. Politicians that are not directly involved with agency decision-making take a stand on policy issues to gain political favor with the voters. Each of these stakeholders, plus many others, has a different set of values and different goals for the agency's actions to each of which the agency is accountable.

8.4 Appointing the Strategic Planning Team

Strategic planning sessions should be very open processes in order that everyone understands the final strategy. This understanding helps facilitate the strategy's implementation. There should be a core group of individuals who are responsible for the formation of a strategic plan, but they may wish to include others as consultants or participants during different phases of the process. The important qualifications of a planning team member are that they have a complete knowledge of their specialty area, they are willing to brainstorm and think radically, and they will be willing to learn from and respect others. The agency needs to ensure that the group represents a cross-section of the agency's functions. The group should include those familiar with the program

[21] See Section 8.5.6.4

operations, as well as representatives from the agency's marketing department and administration.

The group needs to solicit the input from those in operations and facilities management of every facility. The upper management needs to be an active participant to show their support for the final product. Representatives from marketing need to be kept informed so that marketing strategies can be aligned with the agency's strategic plan. The managers of each program need to be active participants. In addition, the agency may want to solicit the input, if not the participation, of representatives from the public and the rest of the government. Other governmental agencies may want to be consulted or included if cooperation between agencies would produce strategic benefits for the agencies and the region. Finally, business partners of the agency should be consulted or included.

8.5 Strategic Planning Process

The following sections outline steps in the strategic planning process. Depending on the jurisdiction of the agency undertaking the strategic planning, some of the steps may be omitted or additional steps may be added. This is especially true for agencies not operating revenue-generating facilities such as airports, ports, or transit lines. Highway departments and other agencies without their own revenue generation may want to focus less on competitive analysis and economic performance and focus more on technological innovations, operations, and sociopolitical factors.

8.5.1 Stakeholder Analysis

The first step in the strategic planning sessions is to identify all of the agency's stakeholders and outline their views and values concerning the agency's assets and operations (Kotler 1994). This can be done through soliciting input directly from the stakeholders and from assessing the stakeholder groups' actions and statements in the past. The agency must ensure that all viewpoints have been considered on each strategic point. The list of stakeholder values and concerns must be constantly referred to during the planning process. Kotler suggests the agency strive to satisfy the minimum expectations of each of its stakeholder groups while being careful not to give any one a sense of being treated unfairly with respect to another group (Kotler 1994). This may be nearly impossible for public agencies with their large number of widely diverse stakeholders, but striving for this level of satisfaction may result in some innovative strategies to meet the agency's needs.

8.5.2 Mission Definition

The agency needs to reassess and redefine its mission every planning period to reflect changes in the agency's businesses and priorities (Nelton 1992; Kotler 1994). In defining its mission, the agency should consider five elements: 1) its history, 2) current administration preferences, 3) the market environment, 4) the agency's resources, and 5) the agency's competencies (Kotler 1994). The mission statement should portray the purpose and direction of the agency to those inside and outside the agency. The definition of a mission statement can be very difficult, but it is very important to have one to act as the strategic guide to decision-making.

8.5.3 External Market Analysis

The agency needs to examine the markets in which it has investments to determine the direction of the market and new technologies entering the market. This type of analysis is named an external or market analysis (Fisher 1986; Nelton 1992; Keller 1999). The analysis should focus not only on how other agencies' facilities are operating and performing, but also on trends in the industries supported by the agency's infrastructure facilities and on global economic trends since the transportation industry is sensitive to economic upswings and downturns (Keller 1999).

Fisher's external market analysis recommends the analysts research in three categories: 1) economic, social, and political factors, 2) geographical factors, and 3) market factors (Fisher 1986). Economic, social, and political factors affecting the agency's operations include,

- the availability of outside funding for the agency's capital program or special projects,
- the current construction and labor market or other factors that may affect the cost of program implementation,
- demographic statistics and trends,
- the types and activity level of businesses in the area,
- the political stability in the region,
- the amount of political input into agency operations, and
- current political policies regarding infrastructure development (Fisher 1986)

Geographical factors that could impact the agency's strategic plans include development or regional plans by other agencies or the central government and economic opportunities for strategic investment in local communities. The geography of the region may also provide inherent advantages for the agency's operations or attracting new facility users.

The market factors influencing the agency's performance may include

- Local trends in the industries in which the agency participates or supports,
- National or global trends in the same industries,
- New technologies,
- And customer, client, and partner satisfaction with agency's operations and facilities (Fisher 1986)

8.5.3.1 Porter's Five Forces Model

Porter's Five Forces Model is shown in Figure 8-1 (Porter 1985). This model has become the paradigm competitive analysis in business strategy. It states that the attractiveness of an industry is determined by five forces acting on that industry: the bargaining power of suppliers; the bargaining power of customers; the threat of new entrants; the threat of substitute products; and the rivalry among existing businesses. The agency can focus this analysis on their businesses to determine the attractiveness of their operations in the industry and what can be done to level the imbalances in the forces. The more attractive an industry is, the more profit potential exists in that industry. Sadtler recommends using Porter's model dynamically to determine the trends in the power of the five forces over time (Sadtler 1999). This will give the agency an idea of where the industry is heading so that the agency can react accordingly.

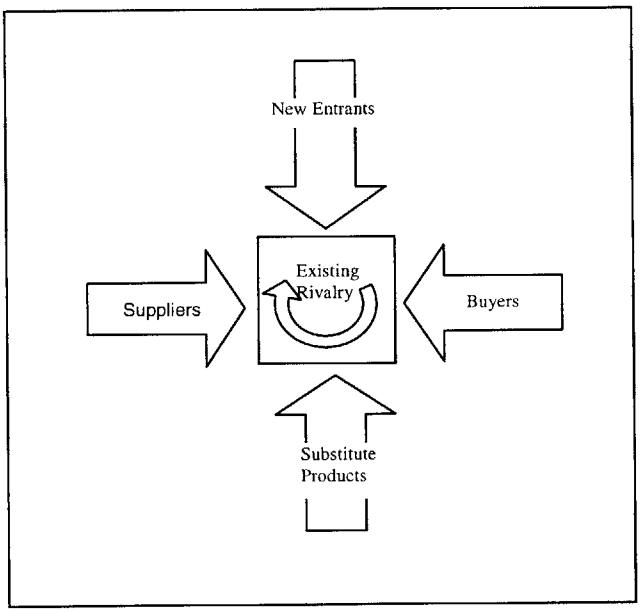

Figure 8-1: Porter's Five Forces Model (Porter 1980)

8.5.4 Competitor Analysis and Competitive Strength Assessment

The agency should examine its competitor's facilities, operations, and performance to determine its competitors' responses to the market environment and the agency's ability to compete in the future (Fisher 1986; Nelton 1992). For each of the agency's markets, the following questions need to be answered:

- Who are the agency's direct competitors (Other agencies or facilities that compete for the same business as the agency)?
- What businesses do the competitors operate in? How vertically or horizontally integrated are they?
- What are the competitors' strengths and weaknesses?
- Are there any trends in their competitive performance? What implications do these have for the agency's operations or performance?
- What factors contribute to their success?
- What advantages does the agency have over its competitors?
- What advantages do the competitors have over the agency's operations? (Fisher 1986)

The agency also needs to undertake an assessment of the competitive strength of the agency and its business lines (Porter 1985; Kotler 1994; Sadtler 1999). In the cases of agencies with no competitive revenue generating businesses, they should conduct an assessment of the competitive advantage of the region in which they operate to how they can increase that advantage (Porter 1990). The agency may chose to utilize the following published models or devise their own assessment of their competitive strength according to their businesses and markets.

8.5.4.1 Porter's Value Chain Analysis

The concept behind Porter's Value Chain Analysis is that an agency or business must be competitive at every stage of its value chain in order to be competitive at the industry level (Porter 1985). The agency's value chain is each step in the process of delivering a facility or service to the public. The analysis involves identifying every step in each facility's or business's value chain and then assessing their performance and competitiveness. In areas of good performance and competitive advantage, the agency must determine if the performance and advantage are sustainable. In areas of poor performance, the agency needs to determine if the performance can be raised or consider options for outsourcing the operations.

8.5.4.2 Sadtler's Resource Analysis

In order to answer the question of the strength of the agency with respect to other entities in the industry, Sadtler recommends analyzing the agency's resources (Sadtler 1999). The resources that are scrutinized should not be only financial. The agency needs to examine their human resources, bond ratings, financial standing, geographic or market resources, etc. Sadtler states

that competitive advantage comes from resources that are hard to replicate and that by themselves create advantages in the marketplace (Sadtler 1999).

8.5.4.3 GE's Multi-Factor Portfolio Model

General Electric is a conglomerate with a varied business portfolio, a model not unlike many public infrastructure agencies. GE has developed a model that evaluates each of their business lines in terms of market attractiveness and business strength (Kotler 1994). The corporation first defines factors contributing to the market attractiveness and business strength in each of their industries. Some factors may be unique to an industry and others may permeate through the entire corporation's analysis. The corporation then assigns a weight to each factor that reflects the importance of that factor to performance. The factors are then rated on a scale of one to five for each of the corporation's businesses and a final weighted score (on a scale of one to five) is computed. GE then bases its strategy for each business on the performance and attractiveness indicated by the scores.

8.5.4.4 Porter's Determinants in National Competitive Advantage

Porter's research has shown that the competitive advantage of a nation or region is determined by four environmental conditions: factor conditions, such as infrastructure and labor; home demand; the existence of related or supporting industries; and the strategy, structure, and rivalry within the target industry (Porter 1990). Agencies should consider how their assets and actions contribute to the increase of competitive advantage of the region in which they operate and identify opportunities for increasing their contribution to this advantage.

8.5.5 Strengths-Weaknesses-Opportunities-Threats (SWOT) Analysis

Considering the results from the agency audit, the market analysis, and the competitor analysis, the agency should be able to identify a set of strengths, weaknesses, opportunities, and threats (SWOT) for its businesses (Fisher 1986; Nelton 1992; Kotler 1994). It is the SWOT analysis that provides the basis for the determination of projects to include in the initial capital program.

8.5.5.1 Strengths & Weaknesses

The strengths and weaknesses of each business line will determine the agency's ability to attend to the opportunities and threats presented by the environment. The strengths and weaknesses should indicate the direction in which the strategy of the agency should head. The agency should look to capitalize on its strength and work to strengthen its weaknesses through its operations and capital activities.

8.5.5.2 Opportunities & Threats

The agency should identify opportunities and threats for each trend or innovation shown in the market and competitor analysis. Kotler defines an opportunity as "an area of need in which a company can perform profitably" (Kotler 1994:80). In order to capitalize on these opportunities, the agency needs to be able to create value for its customers or partners and sustain it over time. Kotler defines a threat as "a challenge posed by an unfavorable trend or development that would lead, in the absence of defensive marketing action, to sales or profit deterioration" (Kotler 1994:81). Threats should be prioritized and addressed according to their potential seriousness to the agency's operations (Kotler 1994).

8.5.6 Goal Formulation

The last step in the strategic planning process before the formation of a strategy is setting of goals for the agency and each of its business lines (Nelton 1992; Kotler 1994). These goals and objectives should be specific, attainable, and based on the information gathered and synthesized in the audit and planning analyses. The goals should address the strengths, weaknesses, opportunities, and threats identified in the SWOT Analysis and be based on the results of the competitive and market analyses. The objectives for each business should be measurable, realistic, and consistent with the overall agency objectives (Kotler 1994).

8.6 Massachusetts Port Authority Strategic Planning Processes

The strategic planning process at Massport happens in three distinct phases that are then tied together during the capital programming process. The agency's Executive Director sets goals and objectives for the whole Authority. The last detailed revision to these objectives took place three to four years ago (Whittaker 1999). Each program, in conjunction with the Capital Programs Department, sets their own strategies for the operations and development of the facilities within that program. Finally, the Planning Department proposes large capital projects, such as the modernization of Logan Airport. The capital programming process ties the facilities' strategies together with the strategies and objectives proposed by the Administration and Planning Department.

In the past year, a Strategic Planning Group has been created within Massport. It is unclear at this time how the group's input will be used in the capital planning process (Whittaker 1999). Bob Whittaker, from the Capital Programs Department, believes that the group is primarily a political

apparition that will work mostly as a liaison with the local communities for the purposes of better public relations (Whittaker 1999).

8.7 Strategic Analysis Recommendations

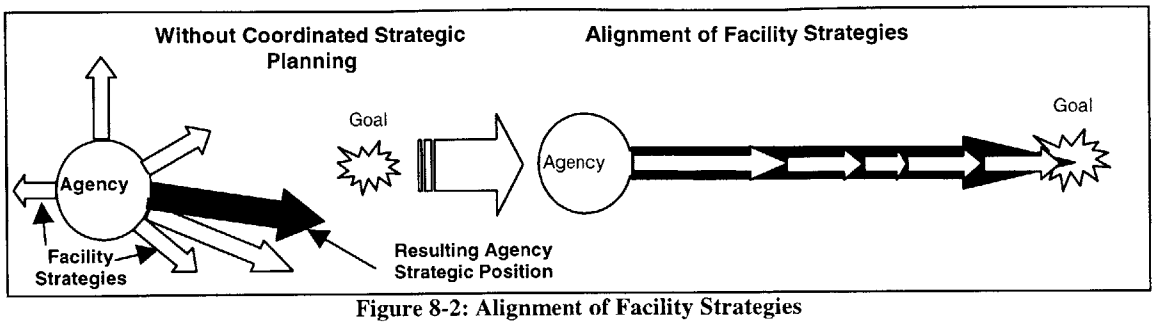

Figure 8-2: Alignment of Facility Strategies

8.7.1 Integrated Strategic Planning Process

Massport needs to integrate their strategic planning process in order to fully explore all of their investment options. In the current scenario, each division has a very limited view of the strategic options available and cannot look at how their strategy decisions will affect the Authority as a whole. The facilities may take very conservative stances on the direction that their business lines should take. The Planning Department may not fully understand the implications of the programs that it proposes. The Executive Director has a better chance of setting realistic and applicable goals if the planning process incorporates personnel from every facility. Brainstorming and discussions with other facilities and agencywide planners will help to explore the most options and determine the best strategy for the facilities. Cooperative planning will ensure that all of the facilities are pulling the agency in the same direction, as illustrated in Figure 8-2.

9 Strategy Formation and Capital Project Initiation

9.1 Strategy Objectives

The strategy for each business should outline how the agency intends to achieve its goals and objectives. The strategy should include a positioning and generic strategy for each business and an agencywide portfolio of capital projects and non-capital programs to meet its goals. In addition, the agency needs to commit funds to the programs in the proposed strategy in order to ensure its implementation. The strategy formation should be based on the results of the agency audit, strategic assessment findings, and newly set goals.

9.2 Brainstorming

The formation of strategy should first begin with a brainstorming session to generate ideas for projects and programs. Examples of questions that should be considered are

- How can the agency improve operations of the different facilities?
- What new or existing technologies can help to achieve the identified goals?
- How can the agency increase client satisfaction?
- What new markets should the agency attract, target, or enter?
- What functions should the agency exit or outsource?
- How can the agency contribute to the regional standard of living?
- How can the agency contribute to the regional economy?
- What opportunities are available for strategic alliances with businesses, other agencies, or local communities?

Porter warns,

> "Complacency and an inward focus often explain why nations lose competitive advantage. Lack of pressure and challenge means that firms fail to look constantly for and interpret new buyer needs, new technologies, and new processes. They lose the stomach to make old competitive advantages obsolete in the process of creating new ones. ... They are deterred by arrogance, lack of rivalry, and an unwillingness to upset the status quo and sacrifice current profits." (Porter 1990:171)

It is important for the participants in the brainstorming session to be intimately familiar with the results of the audit and the strategic analyses. They must be willing to think radically and out-of-the-box. It is important that at this stage that the discussion should be very positively focused and that every idea is seriously considered and explored no matter how impractical it may seem (Fisher 1986). It is from these ideas that real advantages are born.

9.3 Generic Strategies

Based on the results of the competitive and SWOT analyses, the agency should explore the application of the following generic strategies to each of its businesses. These strategies will mold the choice of projects and programs to go into the agency's strategic portfolio.

9.3.1 Build, Hold, Harvest, or Divest?

Private corporations analyze the attractiveness of an industry and their performance in that industry to determine whether they should build, hold, harvest, or divest a certain business line (Kotler 1994; Sadtler 1999). These options may be open to public agencies, but most likely, the public agency is relatively constrained in its use of harvest and divestiture in its core assets and businesses. There are some businesses that the agency will have the flexibility to choose to divest, and that option should be explored if the market, performance, or non-economic benefits of the business are not as expected. The agency may chose to outsource or privatize parts of its value chain or core functions in order to gain better returns and reap the benefits of others' expertise.

When deciding which strategies to use on which facilities, the agency needs to look beyond just the economic performance of the facility. A facility may perform support activities to other facilities, create sociopolitical benefits, or may need modernization to experience its full potential. Sadtler warns that building or divesting a facility without a thorough analysis of all factors may lead to unfavorable and ineffective outcomes (Sadtler 1999).

9.3.2 Low Cost, Differentiation, or Focus?

Porter states that every competitive business needs to employ one and only one of three generic strategies: low cost, differentiation, or focus (Porter 1985). Using a port facility as an example, a low cost strategy would mean that the facility would charge shippers the lowest cost on the coast of operation. A differentiation strategy would mean that the port would have certain characteristics, such as the deepest berths or the best rail access that would attract shippers to that port over others. A focus strategy would mean that the port specialized in a niche market and

focused its competencies on serving that market. Porter considers these three strategies mutually exclusive and urges planners to find the right strategy for each of their businesses (Porter 1980)

9.3.3 Growth Strategy

Agencies that wish to grow within their existing businesses have two options for intensive growth: market-penetration strategy and market-development strategy (Kotler 1994). Market penetration strategy aims to increase the agency's percentage of market share in a particular industry, for example the percentage of the cars imported to the East Coast that the port handles. Market development strategy aims to grow the whole market by targeting new customers or users for the agency's existing facilities. Both of these strategies result in greater usage of facilities and more revenues generated by the facilities.

9.3.4 Strategic Partnerships and Alliances

The last strategy that the agency should consider is the use of strategic partnerships or alliances with other agencies, businesses, or communities to serve markets in which the agency is weak. These alliances may have economic benefits to the agency, may ease future coordination problems, or may assist in improving public relations.

9.4 Project Portfolio and Programs

The agency needs to develop a group of capital and non-capital projects to achieve its goals and implement the strategies of the agency. The non-capital programs should target deficiencies in the agency's operations of facilities, foster customer satisfaction, and support the capital efforts through marketing and community liaison programs.

The capital program developed by the agency should be a group of capital projects for each facility that furthers the facility in the agency's strategic direction. The portfolio should be a multi-year compilation of projects. Each project should be justified according to the audit and strategic analysis of the facility and the progress toward the agency's objectives (Laurent 1997). The projects should try to build today for the markets of tomorrow (Keller 1999). The portfolio should be viewed as a conglomerate, with the strategic direction of the whole group evaluated according to the results expected at the end of the planning period.

9.5 Massport Example – Port of Boston Strategic Plan

The Port of Boston has an eight-point strategic plan for its development and modernization. This plan was instituted to revitalize the shipping industry in Boston, respond to the current changes

taking place in the global shipping industry, and stimulate the regional economy through developing New England's international trade network (Massport 1998).

1) Dredging – The shipping channels at the Port of Boston will be dredged to 45' to attract the largest ships expected in the North Atlantic. This will make the Port of Boston more attractive as a direct call port for deep draft ships from Europe and Asia.
2) Doublestack Rail Clearances – Massport is working with the Commonwealth of Massachusetts to bring doublestack rail into the Port of Boston. Doublestack rail is the most time and cost efficient means of transporting intermodal container cargo. The current lack of doublestack rail contributes to the Port's high costs to shippers. A doublestack rail corridor will make cargo travel from the mid-west to Boston price-competitive with that of other East Coast ports.
3) Marine Terminal Optimization Program (MTOP) – Massport has instituted a program to consolidate their multi-purpose marine terminals into single-cargo terminals. This resulted in the opening of the Boston Autoport at Moran Terminal and the consolidation of all container activity to Conley Terminal. The MTOP will achieve three goals: lowering shippers costs at the Port of Boston and thereby increasing vessel calls, lowering operating cost for the Authority, and taking advantage of expanded cargo opportunities in automobile and bulk cargo shipping.
4) Expanded Carrier Services – Massport is working to take advantage of Asia as New England's primary trading partner by attracting direct call vessels from Asia. Massport is also looking for increasing outbound service to Europe.
5) Labor Relations – The Port of Boston has historically had a rocky relationship with the Longshoremen's Union. Massport is working to improve these relations and decrease the port's operating costs will increasing labor efficiency.
6) Cruise Industry – The cruise industry is the Port of Boston's fastest growing business segment. Massport intends to double their cruise passenger traffic by the year 2000 and attract more homeport cruise lines to the cruise terminal.
7) Automobiles – Boston is looking to capitalize on its wealthy population and easy access to the Midwest to become a hub for automobile import into the United States.
8) Seaport Master Plan – Massport will work with the Boston Redevelopment Authority (BRA) to develop the Seaport district with expanded commercial and public space. This development plan ensures the continuation and expansion of the Port's commercial activities.

9.6 Recommendations

9.6.1 Think Innovative

Massport operates in very mature industries with little market growth and few market opportunities. Massport needs to think innovatively about ways to raise their profits, lower their operating costs, provide benefits to the communities in which they operate, and advance their mature markets into new territories and lifecycle stages. Radical ideas and the commitment of the administration to pursue them are what are needed to improve Massport's performance in their markets and leverage their full potential.

9.6.2 Be Responsive to Facility Users

The business customers and tenants of Massport's facilities have identified their version of the future of their industries through their own strategic planning processes. They have identified the operating trends and new technologies that will shape the future (Connors 1999). They know the status of their operations and the requirements to keep them in operation in the region (McSherry 1999). Massport does not do an adequate job in their capital program of responding to their users needs and future requirements. This is one of the factors to which the Port of Long Beach contributes its success (Keller 1999; Steinke 1999). Massport needs to be less adversarial to its facilities' users and view them as partners trying to find an integrative solution to shared marketplace problems.

9.6.3 Leverage Surrounding Communities

One of Massport's biggest problems is its relationship with its host communities. Instead of viewing projects in the communities as mitigation efforts, Massport should look at them as strategic business development efforts. During the strategic planning process, Massport should identify the concerns and desires of the communities and try to find a mutually beneficial solution to their integrated problems. By acting in good faith to help the economies and environments of the depressed communities surrounding the Port, Tobin, and Logan, Massport may build support for its development program and find new allies in its neighbors.

10 Portfolio Analysis

10.1 Benefits of Portfolio Analysis

Portfolio analysis allows agencies to look at their total investment potential and the portfolio's effect on the financial structure of the agency. The portfolio analysis helps the agency to

determine how to complete all of the projects within its financial ability. It combines the profitable, revenue generating projects with projects that do not support themselves in order to determine the agency's overall funding capabilities. Portfolio planning is particularly helpful to quasi-public agencies because of their need to provide facilities that are not always profitable while still keeping a healthy financial profile (Adams and Miller 2000 in press). They can view the effects of tradeoffs and variable changes while working toward a portfolio that satisfies the objectives defined during their corporate strategic planning. The model lets the decision-makers see the economic effects of their decisions and manipulate the delivery variables to best fit the portfolio to the known resource constraints.

Another benefit of portfolio analysis is that it allows the agency to play "what-if" games with different project configurations, funding levels, and policy issues to determine the incremental benefits of different scenarios without being committed to the decisions. This can be an effective tool for agencies to lobby for policy changes and additional funding.

The portfolio analysis requires the agency to make discrete and transparent decisions about resource constraints and transportation policies, but results in a final infrastructure portfolio that

- Meets the agency's long-term needs
- Allows the agency to pursue their desired strategic direction
- Attracts new resources through private sector involvement in infrastructure provision
- Reduces the costs of transportation services (Miller and Evje 1999).

10.2 Life-Cycle-Cost Analysis

The projects that comprise the portfolio were chosen for their strategic benefits to the agency. This allows the decision-makers in the portfolio analysis stage to evaluate the portfolio in terms of pure economic viability because the non-economic benefits of the projects have already been taken into consideration. Non-economic factors still need to be considered in the choice of viable project configurations and for tradeoff analyses after the best fit portfolios are chosen.

Researchers at the Massachusetts Institute of Technology (MIT) have identified that modeling the portfolio based on the life cycle cash flows of the projects allows the systematic analysis of scenarios and the direct comparison of projects with different variable configurations (Miller 1997). This method of evaluation is necessary since projects cannot be undertaken, no matter

how beneficial to the public, unless the resources are available to fund their design, construction, operations, and maintenance. In the MIT-developed capital programming decision support tool CHOICES©, a cash flow is generated for each project configuration according to its variables and properties. These cash flows are then combined to show the overall portfolio cash flow over time. This process allows the user to view the cash flows of individual projects and their effects on the final aggregate cash flow (Evje 1997; Miller and Evje 1997; Miller and Evje 1999). CHOICES© was used throughout this research project as a means of modeling the financial profile of the Massachusetts Port Authority and its facilities. Most agencies and municipalities do not include maintenance and operation costs in their capital programming analysis, resulting in unforeseen costs to the agency and from that the current deferred maintenance backlog.

Portfolio analysis is based on the linear combination of life-cycle-cash flows (LCC) for all of the projects in the portfolio. There are four stages in the life cycle cost of the project that should be included in the financial analysis: 1) planning and permitting, 2) design, 3) construction, and 4) operations and maintenance (O&M). In addition to the costs, revenues generated by the facility need to be included in the overall cash flow. There are two reasons to include all four project stages in the cost of each of the projects in the portfolio. First, it is necessary to consider the full impact of the project on the financial profile of the agency. Second, consideration of the full life cycle of the project is necessary to be able to compare the costs of projects using different delivery methods with varying degrees of service integration.

Before the portfolio analysis can proceed, a common timeframe for project analysis needs to be determined. Analyzing all of the projects in the portfolio over a common planning period permits linear combinations of cash flows (Brealey 1996). The common timeframe should be long enough to let the projects develop their full economies, but short enough so that the cash flows at the end of the time frame are not insignificant. Miller and Evje recommend a 20-year planning analysis period for life cycle cash flows (Miller and Evje 1999). This period of time allows for a full completion of 15- to 20- year privatization and operations and maintenance contracts. The ability to linearly combine the cash flows per common time increment, i.e. quarter, is essential to the process of offsetting the revenues and expenses of the agency to understand the total effect on the agency's bottom line financial strength.

10.3 Analysis Preparation

The agency's strategic planning process produced a portfolio of projects to meet the agency's organizational goals. In order to turn this portfolio into an implementable capital program, the projects need to be analyzed within the context of the agency's resources. Two steps need to be taken to prepare the projects for evaluation: 1) the compilation of the viable alternative configurations for each project and 2) project prioritization and strategic evaluation of each configuration.

10.3.1 Alternative Project Configurations

For each project in the portfolio, capital planners need to make a list of the viable alternative configurations of project variable that can be implemented in the program. Miller and Evje define viable as "the combination of technical, financial, and environmental feasibility" (Miller and Evje 1999:671). Leaving the definition this broad leaves the agency with the most project choices with which to experiment. The project components that are considered variables for the portfolio analysis are scope/technology, schedule, delivery method, and financing (Adams and Miller 2000 in press). It is not until the whole portfolio analysis has been done and the effects of each variable configuration on the portfolio have been analyzed that final decisions as to project scope, delivery method, schedule, and financing mechanism for each project are made. This is a departure from the current industry standard of choosing the delivery method for each project individually, without regard to its effect on the portfolio. It is possible, due to agency, financial, or legislative constraints, that the project variables that have the greatest positive impact on the portfolio are not the variables that may be the best for the solitary project.

These decisions as to which configurations of variables are viable for a project must be made by the agency for each individual project. For example, due to safety and insurance reasons, an agency may want direct control over the design and construction of a project on an active airfield, thereby limiting the delivery method to Design-Bid-Build but leaving open a number of different financing options. In other cases, such as the development of a hotel or rental car center, the agency only want to deliver it using BOT but may have different options as to the timing of the project. In other cases, multiple delivery methods and financing schemes may be applicable. The choice of viable variables may be constrained by legal issues, funding restrictions, permitting issues, the nature of the project, or a host of other issues. This is why it is necessary to examine each project for its unique attributes. At this stage it is important to be creative, but it is also important to know the limitations of the project.

10.3.2 Project Prioritization

The projects and each of their configurations should be prioritized according to their strategic advantage to the agency. Each project should include a list of the strategic benefits that it confers on the agency so that decision-makers are clear about the tradeoffs involved in different scenarios. The programmers also need to note project configurations that are mutually exclusive or dependant on each other so when scenarios are developed, the portfolio that is implemented is realistic and viable.

10.3.3 Agency Resource Profile

In order to effectively evaluate the portfolio scenarios, the agency has to have an accurate prediction of the resources that will be available over the course of the planning period and the amount of those resources that have already been committed in prior planning sessions. In addition, the flexibility and restrictions of each type of resource should be addressed, as well as volatility of the resources.

10.4 Baseline Calculation

The portfolio baseline has three components: the life cycle cash flow of the portfolio, a list of the schedules and configurations of each project, and a summary of the strategic progress represented by the portfolio. The baseline is only as accurate as the cost, schedule, and benefit estimations made for each project, so care should be taken to ensure accurate project estimating techniques.

10.4.1 Portfolio Cash Flow

To obtain the cash flow of the entire portfolio, the life cycle cash flows of the individual projects are linearly combined. All phases of the project, from planning to operations and maintenance, must be represented (Miller and Evje 1999). Linear combination of cash flows possible because all of the projects are occurring over a common planning period and include the same project phases (Brealey 1996). The project cash flows should include all revenues produced and expenses incurred by a project. The portfolio cash flow should include a computation of the excess or deficit funds over the lifetime of the planning cycle. The baseline should track the different sources and uses of funds over each time increment. Dual representation of the cash flow over time and as a roll-up by fund and project are advantageous for scenario comparisons.

10.4.2 Project Configurations

During the portfolio analysis, it is important to keep track of the current active project configurations. Expanding Miller's analogy of portfolio analysis as a file cabinet (Miller 1998) to

the more complicated situation of a whole agency's capital program illustrates the complexity of scenario analysis and the necessity of tracking the current and past scenario configurations. Miller describes the configuration of a scenario as pulling out the drawers in a file cabinet. In the case of a public agency, each program would have its own file cabinet with each facility having a drawer. Within that drawer would be project folders containing files of viable variable configurations. A file is taken from each folder in each drawer in each file cabinet and analyzed together with the other drawn files in that scenario. They are then placed back into their files and other scenarios are drawn. Even with a computerized decision-support tool like CHOICES© this process becomes complicated very quickly. The agency needs to keep track of its current configuration and the configurations that have been analyzed to avoid repetition and ease bookkeeping.

10.4.3 Strategic Impact

Tracking the benefits generated by the portfolio measures the strategic progress made toward agency goals by the implementation of that portfolio configuration. This measure will aid the decision-makers in their final recommendations to the agency's Board of Directors.

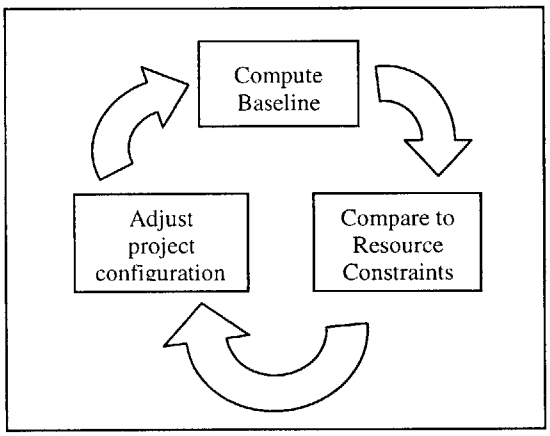

Figure 10-1: Portfolio Analysis

10.5 Scenario Analyses

10.5.1 Process

The portfolio analysis is an iterative process that cycles between computing baseline lifecycle costs, comparing the costs to the agency's resource constraints, and reconfiguring project variables (see Figure 10-1). The process stops when the decision-makers are satisfied that they have found the set of portfolios with the best alignment between the agency's resource constraints and its strategic objectives. During this process there will be a constant tradeoff between project benefits and affordability. To ensure that the decision-makers have analyzed the best options for the agency before they break the cycle, they need to begin their analysis with the portfolio that contains the project configurations placed at the top of the list prioritized in terms of desirability and work their way down. There should be a natural cutoff where the loss of benefits outweighs the advances in affordability.

10.5.2 Variable 1 – Scope/Technology

Often, agencies have many different options for development of a project. The differences may be fundamental, as in the nature of a project, or specific, as in the equipment chosen for operations. Different options for scope and technology can be manifested in all phases of the project, from permitting to design to construction to operations and maintenance. Some examples of project variations that may need to be considered by the agency:

- Options for parcel development, e.g. park vs. parking, hotel vs. performance hall, etc.
- Alternate construction methods
- Alternate operating technologies
- Variations in project scope, e.g. rebuild vs. rehabilitate
- Project deferral beyond the planning horizon or project cancellation

Each difference in scope or technology has different strategic benefits, cash flows, and schedules. Differences in scope or technology can affect the lifespan, expense profile, and revenue generating capabilities of the project, changing project and portfolio cash flow magnitudes and densities (Adams and Miller 2000 in press).

10.5.3 Variable 2 – Schedule

Start date and duration are the two types of project schedule changes that affect the portfolio analysis. Changing the start date of a project will move that project's whole cash flow forward or backwards in the portfolio cash flow. Changes in duration will increase or decrease the magnitudes of quarterly expenses and increase or decrease the density of the cash flow (Adams and Miller 2000 in press).

Changes in project schedules have two implications on the portfolio analysis. They change the cash flow profile of the agency and may change the benefits resulting from individual or groups of projects. The shifting and condensing of cash flows due to schedule changes will affect the payout schedule for the agency in both speed and magnitude and may benefit the agency's cash flow by escalating or delaying the beginning of project revenue generation. It is important that expense requirements resulting from schedule changes coincide with the availability of funds from both inside and outside the agency. A project's benefits to the agency may also be affected by changes in schedule. There may be "windows of opportunity" for the project to have the most strategic impact on the agency, and if the schedule of the project is changed to miss these

windows, the agency will lose some of the project's benefits. In addition, many projects are interdependent and adjusting the schedule of one project could have cascading effects throughout the portfolio on its cash flow or strategic benefits.

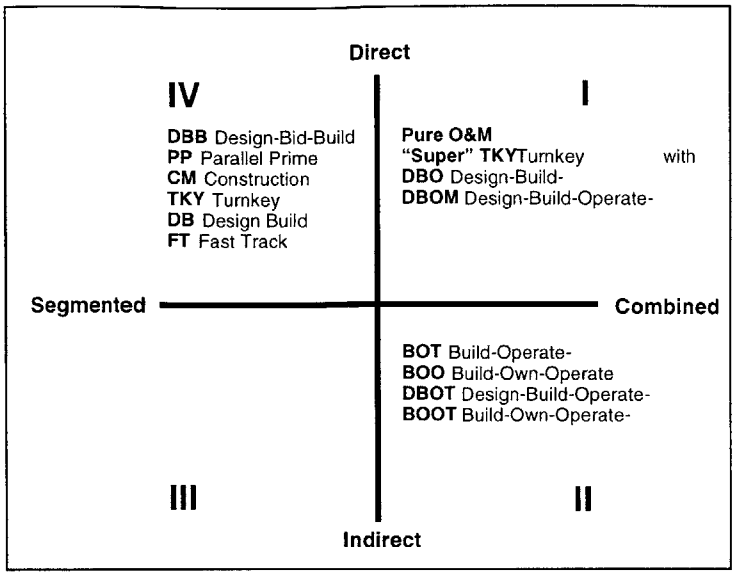

Figure 10-2: Common Delivery Methods (Miller 1996)

10.5.4 Variable 3 – Delivery Method

10.5.4.1 Three Quadrant Strategy

Figure 10-2 shows the common project delivery methods categorized into the four quadrants described in Section 1.2.1. The four quadrants are formed by the orthogonal intersection of integration of delivery and sources of funds. The use of multiple delivery methods is becoming more accepted as experience shows that delivery method choice has a profound effect on the timing and cost of projects, the rate of innovation in the industry, the technological advancement of projects, and the environmental performance of projects (Miller 1998). Sections 9.3.4.2 through 9.3.4.6 describe the characteristics, strengths, and weaknesses of the most common project delivery methods and how they may be used to complement an agency's capital portfolio.

In addition to providing benefits for the agency, the use of a three quadrant procurement strategy provides benefits the to E/P/C industry as a whole. A three quadrant model encourages the development of "better, faster, cleaner, and cheaper" (Miller 1998:6) methods in construction and design. The use of multiple delivery methods and partnering agreements encourages technology transfer and innovation within the industry (Miller 1998). A commitment to the use of delivery methods in the three quadrants will enable and encourage the maturation and specialization of E/P/C firms, leading to better quality products (Miller 1998). New firms will also be encouraged to enter this rising industry due to growing market opportunities. The integration of services will open up existing industries, such as finance and information technologies, to investment in

infrastructure, contributing to cross-market technology transfer (Miller 1998). The use of alternate delivery methods will also produce more value for the public by opening up competition not only on initial construction cost but also on life cycle cost, time, and quality (Miller 1998).

10.5.4.2 Design-Bid-Build (DBB)

Design-Bid-Build (DBB) is a purely segmented approach to construction and is currently the most widely used delivery method for public projects. In this approach, the owner provides planning and financing of all phases of the project. The owner separately contracts for the design and construction of the facility (Miller and Evje 1999). The owner may choose to either contract for or provide O&M services for the facility, separately from the construction. In public project, the designer is selected based on qualifications while the contractor is selected by low bid, theoretically resulting in the best price to the owner (Mulvey 1997). The procurement takes place sequentially, with the design fully complete before the contractor is chosen.

DBB gives the owner direct control over the design and construction of the project. Along with this come huge responsibilities and time commitments. Many owners are now looking to the use of construction managers as owner representatives to take over some of their responsibilities without losing direct control. Though contracted by low bid, DBB may carry hidden project costs. DBB fosters adversarial relationships between the owner, designer, and contractor and often results in litigation. There is a growing trend in owner agencies to use partnering techniques to achieve common project goals and alleviate the adversarial nature of the relationships (Mulvey 1997).

10.5.4.3 Design-Build (DB)

The design-build (DB) delivery is used extensively in the private sector but is prohibited by law in the public sector in eight states (Silver 1999). DB eliminates the owner's responsibility for managing relationships between the designer and the contractor, as well as the lack of pre-construction input by the contractor that are found in DBB projects. In DB, the owner procures the designer and contractor as a single source at the beginning of the project. The owner provides direct financing of the project and procures the operations and maintenance of the facility separately from the design and construction (Miller and Evje 1999). The owner is responsible for all planning and functional design of the facility. DB expedites the construction of the facility because construction can start before the design is 100% complete. Dennis L. Mulvey of McGough Construction states that DB has been used most successfully on projects with repetitive

and clearly defined design needs, demanding schedules, and the need to control cost and risk (Mulvey 1997).

Where the owner had complete control over the design and construction in DBB procurements, in DB projects, the owner loses much of that control (Yates 1995). The owner also loses the checks and balances inherent in DBB by having the designer working for the contractor instead of as an agent of the owner (Yates 1995; Mulvey 1997). This requires more upfront work on the part of the owner to make clear their functional needs and expectations for the project team (Mulvey 1997). The owner also needs to be sure that an acceptable partnering agreement has been made between the designer and contractor (Mulvey 1997). The benefits of the DB approach are a single point of responsibility for the project in the DB team, reduced administrative responsibilities for the owner, and a greater probability of completing the project on time and within budget (Yates 1995). Studies have shown that DB projects exhibit less than half of the median cost growth compared to DBB projects (Eickmann 1999).

10.5.4.4 Design-Build-Operate (DBO)

Design-Build-Operate (DBO) has been used extensively in the wastewater treatment industry. DBO procurements involve choosing a team to design, construct, and operate a facility for a long-term contract. The owner has a direct financial commitment to provide funds to cover the plant's operations and capital improvements (Miller and Evje 1999). Payments to the contractor can be made either through direct payments by the owner or through granted rights to collect charges and fees for the use of the facility (Miller and Evje 1999). The owner is responsible for providing all planning and functional design for the project. DBO projects typically require a 15 to 25 year contract to provide a reasonable return to the contractor (Miller 1997).

DBO projects result in time and money savings for the owner resulting from the cooperation of the designer, contractor, and operator. The owner is more likely to get the best value because the contractor is responsible for the life cycle of the facility. Owners do lose much of the control over the facility after the contract has been let, so the owner must be very specific about performance criteria and conditions at the end of the concession. DBO projects also involve a more complicated procurement based on multiple criteria.

10.5.4.5 Build-Operate-Transfer (BOT)

Build-Operate-Transfer (BOT) or Design-Build-Finance-Operate (DBFO) projects are similar to DBO projects except that the contractor provides all financing for the project, shifting the

performance risk of the facility away from the public owner (Miller and Evje 1999). BOT procurements may be disguised as long-term property leases in many public agencies. In BOT procurements, the owner may be able to obtain ancillary development from the contractor due to the high returns possible on his investment (Miller and Evje 1999). As with DBO projects, BOT projects also require a 15 to 25 year operating contract to provide return high enough for private companies to invest in the project (Miller 1997).

One of the advantages of using DBO or BOT for a project is the seeds for innovation that are inherent in the procurement method (Miller 1997). The integration of services and financial risk undertaken by the contractor push for innovative methods to reduce time and quality and produce a better life cycle cost. BOT arrangements provide a means for the government to procure infrastructure assets without providing scarce agency resources. An agency may have limited opportunities to use BOT procurements because the project must generate enough revenue to support a private firm's investment. The private sector is not likely to invest in an infrastructure project unless it will provide private sector returns, providing an independent check of the government's project performance predictions.

BOT projects are at the center of the debate over the roles of government and the private sector in infrastructure provision. The agency loses control of the infrastructure facility for the duration of the long-term lease. The agency may also be subject to political and legal challenges to its decision.

10.5.4.6 Other Delivery Strategies

The project components of design, construction, short-term finance, long-term finance, operations, and maintenance can be packaged in multiple ways to fit the needs of the agency or project (Miller and Evje 1999). An example is turnkey procurement - DB with the contractor providing short term construction financing. Flexibility in delivery is beginning to be accepted in the construction and related services industries, such as surety and insurance providers. This growing acceptance and availability of services will continually make it easier for agencies to take advantage of alternative delivery methods.

10.5.4.7 Impact on Portfolio Analysis

Each of the alternate delivery methods has an impact on the cost of the project to the agency and the schedule of project completion. These in turn affect the portfolio cash flow as described in Sections 9.3.2 and 9.3.3. The additional benefit of using alternative delivery methods is their

strategic implications to the agency. Alternate delivery methods free agency resources to deliver more projects than they would otherwise be able to fund. They allow agencies to privatize or outsource facilities or functions that are better provided by the private sector. Some warnings about the use of alternate delivery methods should be noted. Projects that are delivered with these methods tend to be very high profile and fraught with political debate. In addition, many states and the Federal Government have laws requiring special permission to be granted before any delivery methods other than DBB are used.

10.5.5 Variable 4 – Financing

The last variable in the portfolio analysis is the source(s) of money used to fund each capital project. The agency has four options for funding: outside funding, user fees/operating revenues, reserves, and bonds. Outside sources include all intergovernmental grants, federal programs, and private funding. These sources are very valuable because they place no financial strain on the agency for the construction of the facility, though the agency may be responsible for the operations of the facility after construction. The drawback of these funding sources is that the agency may lose some of the control over the project due to private development or regulated funding use. Utilizing user fees and operating revenue for financing capital projects increases the cost of facility usage and has the potential to drive away operating revenue sources. The advantage of using these sources is that there is the most accountability and revenue/expense matching per facility. Drawing on the agency's reserves for the financing of capital projects requires close monitoring for sustainability and erosion of the financial strength of the agency. Finally, projects financed with bonds carry a high cost of money and involve a long-term financial commitment for the agency. The agency will have a limited capacity to utilize each of these funding mechanisms for their capital program and must monitor the portfolio's profile with respect to resource availability and agency financial strength.

10.5.6 Output

The output of the portfolio analysis should be a set of portfolios that fit into the agency's resource constraints and produce positive strategic benefits to the agency. The analysts should prioritize the portfolios according to these two dimensions, with one portfolio carrying the recommendation of the group. In addition to the set of viable portfolios, the analysts should produce a set of "what-if" scenarios. These scenarios show what benefits could be produced if certain types of funding were extended by a certain amount or if certain of the agency's procedures or polices were changed. These types of what-if scenarios can be very powerful tools for the addition of funding or the justification for policy changes.

10.6 Evaluating the Optimal Baseline

The prioritized group of portfolios should be presented to the agency's Board of Directors or other governing body by the group of portfolio analysts. The group should present their findings along with their recommendation of which portfolio to adopt. In addition, the group should present the "what-if" scenarios to the Board to see if additional funding or concessions can be obtained.

After the Board has made its decision as to which portfolio to implement, the portfolio must be prepared for execution. The list of projects and their purposes, as well as the results of the entire portfolio, should be circulated so that everyone in the agency can see the result of their effort and the identified direction of the agency. A budget needs to be drawn up for the portfolio implementation and the projects need to be prepared and passed on to the capital programs department for execution.

10.7 Program Execution

The execution of the strategic program is relatively straightforward in comparison to the process of developing the program. Each project needs to be implemented according to its final configuration in the portfolio and the whole program needs to proceed according to schedule. Any discrepancies in the implementation of the program from that prescribed must be reported in a Strategic Variance Report. This report should include a justification of the change and an analysis of the impact of the change on the strategic portfolio. During the execution period, all statistics needed for the audit activities should be compiled and recorded.

10.8 Feedback and Performance Tracking

The full strategic planning process will take place only once every five or so years. Throughout that interim period, the agency needs to be implementing its strategic program, tracking their operational and capital performance, updating their modeling techniques, and preparing for the next strategic planning session. There should also be a yearly revisit to the program to assess the overall agency progress and make revisions to the program as needed. Strategic planning should be a continuous process taking place both in formal sessions and during day-to-day operations at the agency. During the interim period the agency should also gather feedback on the strategic planning process itself so that the process will evolve with the agency. The final interim period process should be a program that keeps everyone in the agency appraised of the progress of the strategic program and the benefits that have been experienced by its

implementation. This type of internal marketing program will help to change the culture of the organization to accept the new process and understand the results that it produces.

10.9 Massachusetts Port Authority Capital Programming

10.9.1 Iterative Portfolio Analysis Process

In Massport's capital programming process, each program manager in the capital programming department submits a prioritized list of projects for each facility (Donegan 1999). The finance department determines the cost of the portfolio and returns to the capital programs department the amount over the agency's resource constraints. The process of submitting projects and calculating the cost of the program with respect to the agency resource constraints continues until the projects match as closely as possible with the resource constraints. Projects that produce revenue and support themselves are always included in the program (Taylor 1999). Programs that require funding from outside of their own resources have a cutoff as to how much money their program is allocated (Taylor 1999).

After the portfolio of projects is established by the capital programs and finance departments, the Program Managers and Director of Facilities for each program go before the Board of Directors to justify their projects' inclusion in the program. The Board approves every project in the program individually since they are personally and politically liable for the actions of the Authority (Donegan 1999).

The capital program for the Authority is revised each year to reflect changes in project status, funding, or priorities. Massport plans on a six-year capital horizon and does not include life-cycle costs in their portfolio analysis.

10.9.2 Use of Alternative Delivery Methods

Massport has a commitment to finding the best delivery strategy for the projects in their capital program (Massport 1999). Massport utilizes project delivery methods found mainly in Quadrants II and IV. The majority of their projects are delivered using DBB or a Quadrant IV variation like Construction Management. Massport does not use DB due to the Massachusetts state law prohibiting its use in public projects. All of Massport's development projects, as well as the Boston Autoport, are delivered using BOT under the auspices of a property or facility lease. This delivery method is required for projects not related to the Authority's core mission according to the Authority's directives. This is a benefit to Massport since the private sector does a far better

job delivering and operating these businesses than Massport ever would. In addition to these four delivery methods, Massport configures its own unique delivery methods for many of their projects by varying the service integration and sources of funds on projects. This is the case with the new airline fuel distribution facility. Massport is overseeing the design and construction of the facility while using money from a consortium of private airlines. The consortium then has a 40 year concession on the facility. The situation is similar to a reverse DB process where the consortium is acting as the owner and Massport is acting as the DB team.

10.10 Recommendations

10.10.1 Delivery Methods as Portfolio Variables

Massport currently locks into a delivery method for each project before the projects are analyzed in the portfolio. They do not consider delivery methods a variable in the capital programming process, even though they acknowledge the time and cost advantages for different delivery methods and understand that there may be more than one delivery method possible for each project (Gordon 1994). By not examining all of the options in the context of the portfolio, they may not be producing the capital program that results in the most effective use of agency resources. Considering alternative delivery methods in the context of the portfolio could result in innovative ways to improve the performance of their facilities and leverage their available resources.

10.10.1.1 Delivery Method Example

Massport has had limited experience with pure DBO. This is an option that the agency should possibly consider in the case of the port in order to reduce its deficits in operations. In their portfolio analysis the agency could determine the effects of leaving the container port terminal under the direct operation of the Authority or changing it to DBO. The DBO concession would allow the port to benefit from the expertise of private port operators while Massport continued or decreased their investment in the port operations. BOT may be an option in the case of Conley Terminal, but Kevin McSherry from Sea-Land has indicated that the returns on the port are not high enough to attract private investors (McSherry 1999).

10.10.2 Life Cycle Cost Evaluation

Massport evaluates projects in their portfolio analysis by the project's design and construction costs only. They do not consider a life cycle cost analysis in the programming process. Costs are

estimated using historical project costs, parametric or unit costs, or by an on-call estimating consultant (Gordon and Whittaker 1999). Project costs are divided by percentages into project phases for the use of the portfolio analysis and resource use projections. Revenues and O&M costs are only considered for the general financial plan associated with the chosen capital program, not for the portfolio analysis (Gordon and Whittaker 1999).

Massport should begin analyzing their portfolio according to life cycle cost in order to ensure that they are implementing the program that creates the most value for the agency. This type of analysis will produce a more accurate assessment of the costs of the projects and give a more accurate prediction of the future agency resource profile.

10.10.3 Approval Process Improvements

At Massport, the approval of the Board of Directors is a final check on the capital programming process. Unfortunately, it leaves the process open to political and personal subjectivity instead of strategic decision-making. Massport should reconsider the process of individual approval of projects and instead involve the Board of Directors in the strategic planning process from the outset. Though the content may be up for discussion, the final portfolio recommendation should be approved as a whole. Until the capital projects are viewed as a strategic program, each contributing to the final goal and linked to one another, the planning process may be thwarted just as it is ending.

10.10.4 Program Stability

The Governor of Massachusetts appoints the Authority's Executive Director and the members of the Board of Directors. Each Board member serves a seven year term with one member's term expires each year. The Board must have a mix of Democrats, Republicans, Independents, and labor and community representatives. The rotating terms were instituted for stability and function so that no state administration can completely control the Authority. The political mix was meant to decrease the effect of political agendas in the Authority's infrastructure policy and add legitimacy to the Authority's operations. Despite these precautions, there can be drastic shifts in priorities with changes in administration (Taylor 1999). Often these changes in administration and policies result in project redesign and the wasting of large amounts of capital money (Taylor 1999).

Instituting a transparent and high-profile strategic planning process that involves all stakeholders in setting goals and priorities for the agency and using those goals and priorities to develop a

capital program should add legitimacy to the capital programming process. Knowing that the program has the backing of major stakeholders and has been assessed with a process that is acknowledged as legitimate and "fair" may help to alleviate some of the mid-program policy shifts. Unfortunately, in a state where infrastructure policy is highly political, the complete eradication of political pressure from the development policy is highly unlikely.

11 Conclusions and Recommendations

11.1 Benefits of Strategic Capital Programming

Strategic capital programming is the combination of strategic business analysis techniques and project portfolio planning to produce the most effective capital program of strategic infrastructure projects. The model presented in this thesis iterates through six steps in a cyclical and self-improving process:

1) Agencywide Audit
2) Strategic Analysis and Project Determination
3) Baseline Development
4) Portfolio Analysis with Schedule, Scope, Delivery Method, and Financing as Variables
5) Choice of Optimal Capital Program
6) Program Execution

The process aims to help the agency determine where it stands in terms of operating efficiency and performance, where it is going with its current strategy, where it wants to go, and how it is going to get there. The goal is to give the agencies more choice and better strategic direction. The advantages of strategic planning versus processes that are currently in use are set forth below:

- The agency analyzes its performance with respect to its market environment.
- The agency audit step results in full picture of facilities' performance and deficiencies.
- The assessment of the agency's strengths, weaknesses, opportunities, and threats is based on facility performance and market research
- The process encourages strategic decision-making based on actual performance and industry outlook in a fully integrative, creative environment.
- There is constant feedback on process and improvements.
- Communication between facilities and levels of management fosters environment for cooperation and program synergy.
- The process incorporates the full range of agency stakeholders.

The capital program that results from the use of integrated strategic planning has the following attributes, setting it apart from its current counterparts:

- It is an effective and efficient long-term infrastructure investment strategy.
- It enables the achievement of the agency's long-term goals.
- It increases accountability to the public for the use of public funds and investment decisions.

11.2 Implementation Issues and Process Use

The existence and maturity of strategic planning processes in governmental agencies varies in scope from none to relatively advanced techniques. No agency that I have encountered in my research efforts fully incorporates a comprehensive strategic agency assessment into their capital programming activities. The implementation of a strategic capital planning process requires a huge change in techniques and attitudes that may encounter resistance during the initial stages. The following sections consider hurdles to implementing the tasks represented by the process.

11.2.1 Funding Horizon

Many government agencies rely on funding allocations from state or federal legislatures for their infrastructure development. This means that there is no guarantee of a consistent or predictable revenue stream from year to year. In this type of environment, it is very difficult to engage in long term planning (Miller 1999). Without strategic planning the effectiveness of infrastructure development in these types of agencies is at the mercy of yearly legislative funding battles.

In cases where funding is constrained, it is extremely important for agencies to identify and prioritize their needs and determine the most effective means of achieving their long-term goals. Agencies in the predicament of living in the shifting sands of government appropriations may want to incorporate the theory of dynamic strategic planning into their strategic capital planning process (de Neufville 1999 in press). This type of planning was developed for environments in which operating factors cannot be predicted with accuracy over long-term planning periods. Dynamic strategic plans are tree-like structures in which the implementation of actions depends on the environmental conditions that actually arise at each decision point (de Neufville 1999 in press). Dynamic strategic planning processes complement the strategic capital planning model presented here. Used alone or in conjunction with dynamic strategic planning, the strategic

capital planning model creates an environment that permits scenario analyses for all funding levels (Garvin 1999 in press) and rewards creative thinking with increased portfolio value.

11.2.2 Administrative Shifting

In the government, any change in administration brings about the changing of policies. Shifting administrative policies have the serious consequences of expensive redesign or cancellation of projects and an upheaval in the planning process. It is these sorts of challenges that deter public entities from devoting resources to implementing strategic planning processes.

Much of the strategic planning process is information gathering and synthesis, something that should be done regardless of the agency's infrastructure policy. This data should be available to the new administration, along with the expert advise of those in planning roles, to help to shape the new strategic program. Portfolio and scenario analysis can be used as tools in developing a new plan. Unfortunately, politics is a fickle environment and policy changes are inevitable. They are more or less destructive depending on the type and management of the agency involved. But in this case, knowledge really is power, and the more knowledge possessed by the planner and passed on to the new administration, the more likely the agency will be able to mitigate the affects of the policy changes.

11.2.3 Project Backlog

Some agencies and municipalities have such a backlog of deferred maintenance that they seem unable to consider strategic infrastructure investment. In this case, the agency should wage a two-pronged attack on their infrastructure needs. They should develop both a backlog investment plan and a strategic infrastructure plan. The two will be interdependent. The strategic capital planning process will assist the agencies in developing objectives and priorities in each of the cases. The audit activities will allow the agency to research their immediate needs and prioritize their deferred maintenance projects. During the strategic planning process, the agency will set measurable and achievable goals and creative strategies based on the realities of the agency's situation. During the portfolio analysis, the agency should run scenario analyses of different funding allocations and priorities to determine the best investment of their funds and the proper distribution of funds between strategic development and backlog projects. It is very important for an agency with too few resources and too many needs to consider all of the alternate delivery methods for project execution. This will leave the agency the most resources for completing their projects. The most important point is that the agency needs to think long term and strategically

about its infrastructure investments. Fighting fires is the most expensive project delivery method and the least efficient use of agency funds.

11.2.4 Legal Issues

The portfolio analysis described in this work takes for granted the use of alternate delivery methods as a project variable. In actually, this is not the case for many public agencies. Legal obstacles and restrictions in many local, state, and federal governments prohibit the use of any delivery methods besides DBB. Though attitudes about alternative delivery methods are changing, the reality is that for many agencies it may be years before their use is permitted. Even without the flexibility of alternate delivery methods, the portfolio analysis process is still important and has been applied effectively using only financing, scope, and schedule as variables (Garvin 1999 in press). The result of the portfolio analysis is still the most effective use of funds for the agency, but is less flexible because of fewer delivery options.

In August 1999, the American Bar Association (ABA) has completed a new draft of the Model Procurement Code (MPC). This draft updates the current 1979 code. The MPC is a document outlining guidelines for the procurement of goods and services. The ABA recommends that states adopt the procurement practices outlined in the MPC. The new MPC guidelines for the procurement of infrastructure facilities and services allow states to utilize delivery methods beyond the traditional DBB allowed by the 1979 code: DB, DBOM, and DBFOM (BOT). The code presents guidelines for the implementation of these procurements, functional design requirements, and Independent Peer Reviews for DBOM and DBFOM projects (ABA 1999). If states adopt these recommended procedures, new opportunities for investment in infrastructure facilities and services will allow agencies to better engage in modern asset management.

11.2.5 Resource Requirements

The initial implementation of the strategic capital planning process will take a massive effort by the agency. The agency will have to devote both manpower and time to ensure proper institution and use of the process.

The first year of implementation will be the most difficult and require the most resources. The agency will have to work to change the culture of the organization to accept the new cooperative thought process and emphasis on decision-making for accountability. There will also be a learning curve as participants determine how to most effectively use the process. The agency will have to devote time and resources to developing administrative and structural and enabling the

physical necessities, such as more computing power and database development. The agency will also have to determine in the first year what data to collect, analyze, and save and historical data will have to be collected and input into the databases.

In subsequent years, the process will require less time and resources. The process will become more accepted in the culture of the organization and the procedures will become entrenched in the system. The process infrastructure will be in place so all that will be needed is the data input of the past year's performance. In addition, the agency will begin to be able to tailor the process to its unique needs. It will learn which analyses are most useful and what data can be discarded. It is this learning and evolution process that makes the feedback mechanisms in the system so important.

There are three ways in which an agency can implement the strategic capital process. They can implement the process in-house, using all agency resources and agency developed procedures. This will require a massive effort on the part of the agency in the first year but will result in the process that is most tailored to the agency's operations. The drawback to an agency designed process is that the developers have most likely never participated in such a process so they may not be aware of the requirements of the system. The agency can hire an outside consultant to help design and implement the process. The advantages of this tactic is that the consultant has expertise in the area of strategic planning and the agency will not have to devote so much manpower to the design of the system. The drawbacks of this system are that the consultant is will probably not be familiar with the peculiarities of the infrastructure market or the workings of government agencies, so the agency is more likely to have to make changes to the analysis methods in subsequent years. This tactic is also likely to cost more than an in-house development. The final tactic for implementation is a process that takes several years and implements a different step each year. This spreads out the resource requirements and makes the changes easier to implement, but results in a process that may never fully get instituted or utilized.

11.2.6 Political Resistance

Political resistance to the institution of the strategic capital planning model will most likely be the biggest hurdle to the program's implementation. Politicians may perceive it as taking the power out of their hands, not as a tool to help institute a more efficient infrastructure program. Because of the nature of politics, the reality of this resistance will never fully be escaped. The best the

agency can hope is that once the policy is institutionalized, a new administration will hesitate to completely disband it.

11.3 Continuing Work in the Field of Strategic Portfolio Analysis

11.3.1 Alternative Delivery Methods

As the use of alternative delivery methods increases, more data will be available to determine its best uses and develop implementation guidelines. Both of these are areas of need since government agencies have very little experience with non-DBB deliveries and, though the MPC paves the way for government use, if little success is found in the first attempts, the use of alternative delivery methods in public work will never permeate the market.

The area currently most in need of further research is that of determining the projects best suited for BOT procurement and better techniques of feasibility analysis for these projects. Exemplified by several high-profile failures of privatized infrastructure projects (Bailey 1996; Reinhardt 1998; 1999), the government has shown a poor record with commitment and performance analysis for attempted BOT projects. David Ashley et al calculate that of the projects that appear financially viable for privatization, for private sector investment, only one in ten is (Ashley, Bauman et al. 1999). By analyzing past successes and failures, researches need to develop better analysis and evaluation techniques for these projects.

11.3.2 Portfolio Analysis Support Tools

As agencies begin implementing a portfolio planning process for their infrastructure development, the need will arise for a standardized decision-support tool to aid the planners in their analysis. Work on this tool has already begun with the development of the decision-support tool CHOICES© being developed at MIT (Miller and Evje 1999). To ready the program for commercialization and ensure its implementation with owner organizations, the following steps need to be incorporated into the development research program:

- Continued automation of program features
- Platform changes that more efficiently handle data
- Continued updating of default cost and schedule models
  - Work should be based on further research of completed construction projects.
  - Possible expansion of cash flow choices to include projects of differing natures, e.g. roads, buildings, bridge, etc.

- Options for user-defined cash flow input
- Development of program compatibility with scheduling and project controls software.
  - Will allow integration of planning and execution activities
  - Opportunities to use actual data from cost and scheduling software to create user-unique planning models

11.3.3 Strategic Infrastructure Accounting System

In order to effectively plan infrastructure development, a strategic infrastructure accounting system needs to be developed that will enable government agencies to track the performance of their facilities, demographic statistics for their region, and industry and market trends affecting their infrastructure facilities. Research pertaining to the best methods to track, analyze, and interpret data to measure the capital, financial, and operational performance of facilities would have wide-ranging practical applications for government agencies. In addition, determining correlations between industry market trends and infrastructure needs and infrastructure performance and regional economic activity would create platforms on which infrastructure investment decisions could ride.

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