8. FINANCIAL PLANNING FOR TRANSIT

8.1 Introduction

For which of you, intending to build a tower, sitteth not down first,

and counteth the cost, whether he have sufficient to finish it?

Lest haply, after he hath laid the foundation, and is not able to finish it,

all that behold it begin to mock him,

Saying, This man began to build, and was not able to finish.

- Luke 14:28-30, Bible (King James Version)

Constructing transportation facilities, purchasing transit vehicles, providing new transit services, or merely maintaining existing services requires a significant financial commitment. Transit capital investments can last a generation or more and require consistent maintenance and reinvestment as well as continual operating subsidies. Prudent management requires that the decision to build new transit facilities, procure equipment, or make operating changes be supported by sound financial planning. Financial planning is the framework for evaluating the feasibility of any proposed transit improvement in the context of operating and maintaining existing levels of service.

Congress affirms the importance of sound financial planning through legislation that governs the federal transit program. Section 3(a)(2)(a) of the Federal Transit Act states that "No grant or loan shall be provided under this section unless the Secretary determines that the applicant has or will have the legal, financial, and technical capacity to carry out the proposed project". Section 5309(e)(4) of The Transportation Equity Act for the 21st Century (TEA-21) states that the Federal Transit Administration (FTA) must evaluate proposed major capital investments to ensure that they are supported by an acceptable degree of local financial commitment.

Responding to this legislation, FTA has been helping transit agencies improve their financial planning for many years. Most recently, FTA published the *Guidance for Transit Financial Plans (2000)*, which defines the content, scope and format of a solid financial plan. The intent of that guidance was to explain what a financial plan is. The intent of this *Section* is to provide a "how to" manual on financial planning methods. This *Section* serves to update the previous *Financial Planning Guide for Transit (1990)* in the context of recent legislative initiatives and planning practice. This section on financial planning focuses specifically on the development and use of financial planning models for ongoing transit capital and service planning.

8.1.1 The Role of the Financial Plan

A solid financial plan facilitates the selection and implementation of new services and projects and the ongoing operation and maintenance of the transit system. The financial plan presents the recent financial history of the transit agency, describes its current financial health, documents projected costs and revenues into the future, and demonstrates the reasonableness of key assumptions underlying these projections. The information in the financial plan helps decision-makers choose the best transit investments from the available alternatives.

The basic structure of the financial plan is consistent throughout the planning and development process. However, several key components become more detailed and the confidence in many estimates and forecasts increases as the project advances through the planning and development process. For example, project cost estimates become more reliable as the project scope is defined in detail and engineering studies are completed. Similarly, funding strategies become more certain as funds are committed. The financial plan is prepared during alternatives analysis and updated during preliminary engineering (PE), final design, and construction, as changes occur to project costs, funding, or external factors that affect agency finances.

While financial planning is a necessity for planning major capital investments, it is also a valuable tool for planning the most basic transit operations. Transit agencies that apply "best practice" planning methods will incorporate continuously updated financial models to help them plan ongoing services, vehicle replacements, maintenance and rehabilitation programs, capital investments, and to plan the funding and financing strategies that are the key to implementing the transit agency's activities. A financial planning model can help ensure the stability of transit agency operations by providing advance warning about potential financial difficulties and can help the agency develop and test realistic strategies to avoid those difficulties.

8.1.2 Organization of this Section

This *Section on Financial Planning for Transit* is designed to go beyond FTA's previous guides to provide a primer on "best practice" methods for developing key financial planning components. Previous guidance has emphasized the role of financial planning in the development and implementation of major transit investments. While this function is still vital, FTA now emphasizes the ongoing use of the financial planning model to inform every aspect of transit agency planning. As such, financial planning for project development is a straightforward extension of the everyday financial planning activities of the transit agency.

The contents of this *Section* follow the basic components of the financial planning model culminating in the use of the financial model for financial analysis in support of transit agency planning. The sections are:

8.2 Contents of a Financial Plan – This chapter specifies the components necessary for a solid transit agency financial plan. The chapter describes how each component of the plan is integrated into detailed capital and operating plans and how these plans combine into an agency cash flow projection. The chapter includes numerous examples to demonstrate the level of detail and format of a "best practice" financial plan and describes in detail, the supporting documentation required to substantiate the financial plan components. The remaining chapters detail the methods used to develop each plan component.

8.3 Capital Cost Estimates – This discusses the use of capital cost estimates in the financial planning process. The chapter offers some guidelines to reduce the risk of cost overruns and the methods for accounting for the uncertainty inherent in any cost estimate.

8.4 Operating and Maintenance Cost Estimates – This section includes a detailed discussion on the development of operating and maintenance cost estimates for proposed projects and existing systems.

8.5 Forecasting Revenues – This section describes the methods used to forecast transit system revenues for the existing system and incremental revenues from proposed projects. Also covered are "best practice" methods for forecasting tax revenues and user fees and the planning assumptions necessary to predict intergovernmental grants, subsidies and formula allocations.

8.6 Financial Analysis – This section describes how transit planners bring together all key financial planning inputs into an integrated financial model. Included in this chapter are discussions of the process of projecting capital funding requirements, operating subsidy requirements, managing debt levels, and performing sensitivity analyses. This chapter presents traditional methods of evaluating financial success and the use of the financial planning model to support the ongoing success of the transit agency.

8.2 Contents of a Financial Plan

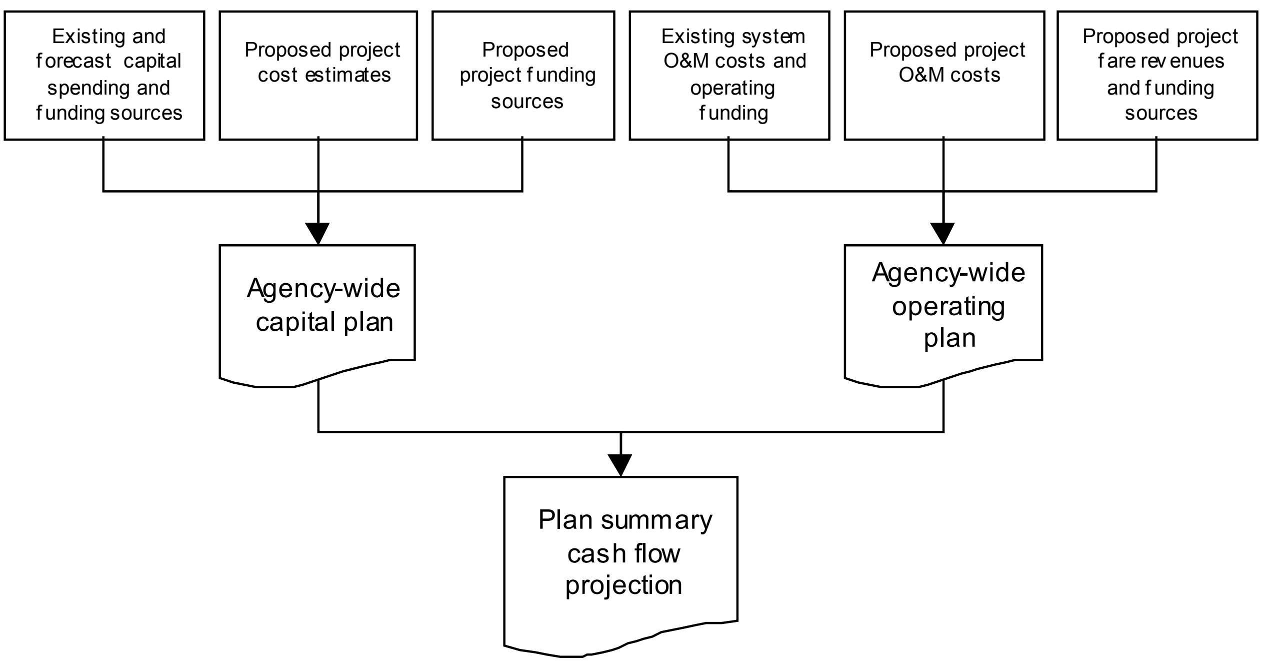
The primary result of a financial plan is an agency-wide 20-year cash flow projection that includes the capital and operating plans for the agency as a whole and for any proposed projects. The 20-year cash flow projection begins with the current year. The remaining content of a financial plan is the information to support all the assumptions and inputs that contribute to the cash flow projection and the financial analysis of agencies assumptions, capital and operating plans and financial strategies.

The 20-year cash flow projection is the summary of several elements of a financial plan that includes:

- Funding sources and revenue forecasts;
- Proposed project capital budget (if the plan is designed to support analysis of a particular project);
- Other planned capital projects; and
- Annual operating and maintenance (O&M) expenses for the proposed project and the existing system.

The plan is constructed by bringing several plan elements together into an integrated financial model. Figure 8-1 summarizes the relationships among the plan components.

Figure 8-1: Components of a Financial Plan



The tables and schedules that constitute the financial plan demonstrate how financial and economic assumptions and project cost estimates have been derived, how the resulting forecasts of capital and operating costs of the proposed project fit into the agency-wide capital and operating plans, whether funds have been committed to the project, how the revenue forecasts are developed, and finally, how capital and operating plans impact projected agency cash flow.

8.2.1 Introduction to the Financial Plan

The financial plan begins with a description of the project sponsor and major funding partners. The introduction includes the following elements:

- a description the current transit system and discusses the project sponsor's and partner's capability to fund the construction and operation of the proposed project;
- a description of the proposed project including an explanation of the purpose and need for the project and how it fulfills the project sponsor's objectives;
- a description of the strategy to provide the local share of project funding; and
- a summary of the projected financial position of the project sponsor and the ability of the sponsor to fund planned capital improvements and continue to operate and maintain the existing transit system.

8.2.2 The Capital Plan

The first component of the financial plan is the capital plan, which documents the transit agency's capital spending plans and funding sources and describes in detail the strategy to fund the construction of the proposed project. The capital plan is composed of two elements: (1) the capital plan for the proposed project and, (2) the agency's 20-year capital plan. The project sponsor first develops the capital plan for the project, and then inserts the project into the agency-wide capital plan. The capital plan documentation confirms the stability, reliability, and availability of all capital funding sources and describes the transit agency's capital spending plans 20 years into the future.

8.2.2.1 Proposed Project Capital Plan

The project capital plan provides a high level of detail regarding the agency's plan to fund the construction of the proposed project. The project capital plan includes the cost estimate and schedule for the proposed project, describes the amount and commitment of non-federal funding sources, describes contingencies for cost increases and federal appropriations shortfalls, and details the debt burden on the project sponsor at a level of detail appropriate to the phase of project development.

The components of the project capital plan change considerably as the project moves from alternatives analysis to signing a full funding grant agreement (FFGA) and construction. As the project moves from preliminary engineering (PE) to final design, capital costs become increasingly detailed as the project scope and precise alignment are finalized, non-federal funding sources are committed, environmental mitigation activities and other cost escalation risk areas are more accurately specified and changes to the original design and cost estimates become apparent. By the time a FFGA is signed, all local funds are committed to the project and cost estimates and schedule are known with a high level of certainty.

Capital Costs and Schedule

A cost estimate and schedule is required at each phase of project development, but the format of the cost estimate changes. In alternatives analysis and PE, project cost estimates and schedules are presented as increasingly detailed unit cost breakdowns of the proposed project. When a project is admitted to final design and seeks to receive a FFGA, the cost estimates are broken into individual contract units that specify the escalated annual cost and schedule for each contract. These cost estimates are updated periodically and tracked as the project is constructed.

Capital cost submissions describe the cost estimation process and segment costs by major cost category (e.g., guideway, facilities, systems, and vehicles). Cost estimates include soft-costs such as PE, final design and construction management as well as set-asides for contingencies. The cost estimate and schedule provide detail to back up the proposed project cost items in the agency-wide capital plan.

The project sponsor documents the current engineering cost estimate for the proposed project, describing each major cost component. A simple project cost estimate is developed in alternatives analysis. This cost estimate, typically including high contingencies to reflect uncertainties in scope and alignment, is used for the financial plan before a project enters PE. During PE, the scope and exact alignment of the project is determined and additional detail added to the cost estimate. As the project moves toward implementation, confidence in the capital cost estimates and schedules increase while cost contingencies decrease. Table 8-1 provides an example cost estimate for a project in PE.

Table 8-1: Detailed Project Cost Estimate in PE, Constant 1999 Dollars (Millions)

Description	*Quantity*	*Cost (Millions of 1999$)*
Construction Costs		
Site Preparation and Restoration		
Utility relocation - meters	3675	$ 13.2
Street restoration - meters	3675	$ 1.9
Traffic signals - #	7	$ 0.6
Structure mod. and underpinnings - #	2	$ 2.9
Environmental mitigations - #	2	$ 0.8
Maintenance facility and yard	1	$ 25.6
Trackway - meters		
At grade - 2 track	690	$ 0.4
Subway - meters		
Cut/cover - 1 track	593	$ 16.7
Cut/cover - 2 track	1230	$ 79.1
Mined tunnel - 1 track	413	$ 16.5
Mined tunnel - 2 track	749	$ 42.5
Ventilation (cut/cover + mined tunnel)	2985	$ 5.5
Stations - number		
At grade	1	$ 2.6
Underground	4	$ 79.5
Trackwork		
Ballasted - meters	690	$ 0.4
Direct fixation - meters	4964	$ 2.8
Special - turnouts, turnback…etc. - #	1	$ 0.6
Traction power supply - meters	5654	$ 4.6
Signaling and train control - meters	5654	$ 7.2
Communications/fire/safety - meters	5654	$ 2.5
Subtotal Construction Costs		**$ 305.8**
Non-Construction Costs		
Right-of-way		
Right-of-way - stations - #	5	$ 4.8
Right-of-way - Maintenance facility - #	1	$ 2.2
New Vehicles - #	8	$ 20.1
Preliminary Engineering		$ 10.0
Final engineering/management		$ 39.8
Subtotal Non-Construction Costs		**$ 76.9**
Contingency		**$ 45.9**
Total		**$ 428.6**

The capital cost estimates are initially produced in constant dollars and escalated to the year-of-expenditure. Costs are typically escalated based on distinct inflation forecasts for, at a minimum, construction costs, right-of-way acquisition, labor costs, and general price inflation to account for the wide variability in the inflation characteristics of certain cost components. Costs in constant dollars are budgeted according to the estimated construction schedule. These costs are then escalated to the year-of-expenditure.[1] Table 8-2 is an example of a cost estimate and schedule for a project in PE.

Table 8-2: Cost Estimate and Schedule, Year-of-Expenditure Dollars (Millions)

*	Cost Category	Millions of 1999$	1999	2000	2001	2002	2003	2004	2005	2006	Total Year-of-Expenditure ($Millions)
1	Inflation (CPI-U)		na	2.34%	2.17%	2.52%	2.63%	2.67%	2.60%	2.48%	
2	Labor Cost Inflation		na	2.53%	2.20%	1.90%	2.03%	2.07%	1.95%	2.15%	
3	Const. Cost Inflation		na	3.55%	2.99%	3.67%	2.22%	1.85%	4.34%	4.77%	
4	Real Estate Inflation		na	2.93%	2.13%	2.96%	1.10%	1.67%	4.27%	4.81%	
2	Preliminary Engineering	$ 10.0	$ 1.0	$ 5.1	$ 4.2						$ 10.3
3	Construction	$ 305.8					$ 83.5	$ 99.6	$ 110.5	$ 67.2	$ 360.8
4	Right-of-Way	$ 7.0				$ 5.1	$ 2.5				$ 7.6
2	Final Engineering/Mgmnt	$ 39.8			$ 6.9	$ 5.6	$ 9.5	$ 9.6	$ 8.2	$ 3.9	$ 43.7
1	Vehicles	$ 20.1						$ 6.1	$ 11.6	$ 5.6	$ 23.3
NA	Contingency	$ 45.9					$ 12.5	$ 14.9	$ 16.6	$ 10.1	$ 54.1
	Total	**$ 428.6**	**$ 1.0**	**$ 5.1**	**$ 11.1**	**$ 10.7**	**$ 108.0**	**$ 130.2**	**$ 146.9**	**$ 86.8**	**$ 499.8**

* These numbers reference the inflation category used to escalate the associated cost category. Inflation assumptions are documented in regional economic forecasts. The source of these inflation assumptions is Standard and Poors DRI, *The US Economy - Winter 2000.*

Cost estimates for projects in final design that are ready to sign a FFGA are broken into contract units. Each of the contract units is a separate contract with a distinct schedule and cost estimate. Each contract is awarded and tracked by the grantee throughout the construction phase. The contracts may contain the project contingency individually or a separate project reserve may be set aside to account for unexpected costs. The initial escalated cost estimate divided into contract units is called the Baseline Project Budget and is developed by the grantee before a FFGA is signed. This estimate may be derived from estimated contract costs escalated to year-of-expenditure or mid-point of construction. An example is provided in Table 8-3.

[1] Year of expenditure cost estimates are derived by multiplying the constant dollar cost estimate for a particular year by the inflation factor calculated for that year. The inflation factor for an expenditure in year t is derived by :

$$i_t = \prod_{n=1}^{t} (1 + i_n)$$

where *i* is the inflation rate in percent for year n.

Table 8-3: Example Baseline Cost Estimate, Escalated Dollars (Millions)

Contract No.	Description	Cost ($Millions) Escalated*
	Preliminary engineering	$ 10.3
	Final engineering and project management	$ 43.8
	Real estate	$ 7.6
	Vehicles	$ 23.3
	Construction Contracts	
1	Maintenance facility and yard	$ 34.7
2	Subway cut/cover	$ 144.1
3	Subway mined tunnel	$ 90.3
4	Trackwork installation	$ 5.1
5	Construct stations	$ 121.2
6	Install traction power system	$ 6.3
7	Signalling system	$ 9.8
8	Communications system	$ 3.4
	Total	$ 499.8

* May be escalated to either year-of-expenditure or mid-point of construction.

The cost estimate changes as bids for each of the contracts come in higher or lower than the baseline and changes to project scope lead to contract amendments. These changes in project costs are tracked on a separate schedule that provides the current budget forecast for the project. *Table 8-4* is an example of the project cost-tracking schedule. As the current budget forecast changes, the project sponsor revises the capital plan to ensure that the grantee maintains a sound financial position. Grantees are subject to financial spot reviews by FTA to ensure they have the capacity to complete the project according to the terms of the FFGA as well as operate and maintain the existing transit system and service levels.

Funding Sources

The project capital plan identifies the proposed sources of funds for constructing the proposed project and details the non-federal share of project costs. The information submitted regarding funding sources provides documentation for FTA to determine the degree of commitment of each funding source and helps ensure that local match requirements are met. As the project advances in the development and implementation process, the level of commitment of non-federal funds increases. To enter PE, a financial plan must identify a "realistic" funding strategy for providing the local share. During PE, the project sponsor is expected to secure committed funds so that the majority of non-federal funds are committed before the project may advance to final design. All non-federal funds must be formally approved and programmed to fund the non-federal share of the proposed project before FTA will recommend or approve a project for a FFGA.

Table 8-4: Project Cost Tracking Schedule, Escalated Dollars (Millions)

No.	Description	***Baseline Budget***	*Contract Award*	*Approved Changes*	*Current Contract*	*Forecasted Changes*	*Contract to be Awarded*	***Current Budget Forecast***	*Expenditures To-Date*
	Preliminary engineering	**$ 10.3**	$ 10.3	$ -	$ 10.3		$ -	**$ 10.3**	$ 10.3
	Final eng. and mgmnt	**$ 43.8**	$ 42.5	$ -	$ 42.5		$ -	**$ 42.5**	$ 5.5
	Real estate	**$ 7.6**	$ 7.8	$ 0.4	$ 8.2		$ -	**$ 8.2**	$ 4.9
	Vehicles	**$ 23.3**	$ 22.5	$ -	$ 22.5		$ -	**$ 22.5**	$ -
Construction Contracts									
1	Maintenance facility	**$ 34.7**	$ 32.4	$ (0.5)	$ 31.9		$ -	**$ 31.9**	$ -
2	Subway cut/cover	**$ 144.1**	$ 148.8	$ -	$ 148.8		$ -	**$ 148.8**	$ 5.2
3	Subway mined tunnel	**$ 90.3**	$ 94.2	$ -	$ 94.2		$ -	**$ 94.2**	$ 1.5
4	Trackwork installation	**$ 5.1**		$ -	$ -		$ 5.1	**$ 5.1**	$ -
5	Construct stations	**$ 121.2**		$ -	$ -	$ (2.5)	$ 121.2	**$ 118.7**	$ -
6	Traction power system	**$ 6.3**		$ -	$ -		$ 6.3	**$ 6.3**	$ -
7	Signalling system	**$ 9.8**		$ -	$ -		$ 9.8	**$ 9.8**	$ -
8	Communications system	**$ 3.4**		$ -	$ -	$ (0.2)	$ 3.4	**$ 3.2**	$ -
	Total	**$ 499.8**	$ 358.5	$ (0.1)	$ 358.4	$ (2.7)	$ 145.7	**$ 501.4**	$ 27.4

The capital plan summarizes the non-federal and federal shares of project costs and references evidence of funding commitment. Evidence of commitment may include legislative documentation, resolutions approving funding, account balances, a bonding prospectus and agency debt covenants, signed joint development agreements or legally binding agreements with state/local agencies committing funds. Table 8-5 presents an example of this type of summary. In the example, the project sponsor would attach legislation or signed local agreements authorizing the dedicated sales tax, MPO commitments for use of Congestion Mitigation Air Quality (CMAQ) funds, the bonding prospectus and evidence of authority to issue debt in the amount planned.

Table 8-5: Sources of Capital Funds, Year-of-Expenditure Dollars (Millions)

Sources of Funds	**Funding Level**	**Funding Share**	**Evidence of Commmitment**
Federal Sources			
Section 5309 New Starts	$ 251.3	50%	NA
CMAQ/STP	$ 20.0	4%	Attach MPO documents committing use of CMAQ or flexible funding.
Other	$ -	0%	
Total Federal Funds	$ 271.3	54%	NA
Non-Federal Sources			
Sales Tax	$ 148.5	30%	Attach Legislation and Revenue Forecast
Bond Proceeds	$ 80.0	16%	Attach Debt Coverage Analysis and Rating
Other Sources	$ -	0%	
Total Non-Federal Funds	$ 228.5	46%	
Total Project Budget	**$ 499.8**	100%	

The accompanying text clearly identifies all local, state, federal and private funding sources, including the name, originating level of government, total dollar amount anticipated, amount currently expended, and the share of total project capital costs in year-of-expenditure dollars. The total dollar amount across funding sources sums to the project's total capital cost.

Funding Source Forecasts

For each funding source, the plan clearly indicates whether the source is an existing source, such as an active local tax from which revenues are currently collected, or a new source requiring legislative approval, referendum, or other governmental action. For existing sources, the plan outlines the conditions of the funding agreement (e.g., funding formula, percent share of total revenues, etc.) and provides at least five years of historical revenue data including the amount available for transit uses. For major funding sources[2], the plan includes 10 years of historical revenue data. For new sources, the plan indicates when legislative approval or public referendum is expected and the date the source would become effective. For all sources, the plan contains a 20-year revenue forecast, documentation of any sunset clauses, and provisions to cover project funding beyond the sunset date.

For all revenue projections, the financial plan uses conservative rates of growth that do not exceed historical experience for that source. Table 8-6 presents an example of a forecast for a dedicated local sales tax.

Borrowing, Debt Levels and Ratings

If the financial plan includes debt, a debt proceeds and service plan is included in the financial plan documentation. This schedule presents outstanding debt levels, the gross amount of each debt issuance, net proceeds from each issuance, bond rating for each issuance, debt service requirements, and interest rates for the past five years and 20 years into the future. This schedule monitors on a yearly basis the most restrictive debt covenant of the agency, such as debt service ratio requirements, outstanding debt ceiling, or limits on debt expenditures during a specific time period. In addition, the most recent bonding prospectus is included as supporting documentation.

Contingencies

Cost contingencies provide reserves against any risks of cost increases in the development of the project. These contingencies are separately identified in the project's financial plan and included in the capital cost estimates. The capital cost documentation includes a description of all the cost escalation risks and identifies the range of potential project costs. As a project moves through the engineering and design process, the likelihood of cost increases, and consequently, the contingency declines. After a FFGA is signed, the project sponsor is responsible for any cost increases and for fulfilling the terms of the FFGA. Reduced service, delayed construction, or reductions in project scope are not acceptable contingency plans.

[2] Defined as sources that contribute more than 25% of agency-wide or New Starts capital or operating funds. The purpose of evaluating ten years of revenue data is to ensure that the forecasts account for a full range of economic conditions.

Table 8-6: Example Funding Source Forecast, Current Dollars (Millions)

Fiscal Year	Retail Sales	Tax Rate	Sales Tax Revenue*	Annual % Chg.
1990	$11,442.0	0.5%	$ 57.2	
1991	$11,918.7	0.5%	$ 59.6	4.2%
1992	$12,441.3	0.5%	$ 62.2	4.4%
1993	$13,027.5	0.5%	$ 65.1	4.7%
1994*	$13,500.0	1.0%	$ 135.0	107.3%
1995	$14,720.0	1.0%	$ 147.2	9.0%
1996	$15,779.8	1.0%	$ 157.8	7.2%
1997	$16,663.5	1.0%	$ 166.6	5.6%
1998	$17,696.6	1.0%	$ 177.0	6.2%
1999	$18,846.9	1.0%	$ 188.5	6.5%
2000	$19,789.3	1.0%	$ 197.9	5.0%
2001	$20,580.8	1.0%	$ 205.3	3.7%
2002	$21,404.1	1.0%	$ 212.6	3.6%
2003	$22,260.2	1.0%	$ 221.0	3.9%
2004	$23,150.7	1.0%	$ 229.9	4.0%
2005	$24,076.7	1.0%	$ 239.2	4.1%
2006	$25,039.7	1.0%	$ 248.8	4.0%
2007	$26,041.3	1.0%	$ 258.5	3.9%
2008	$27,083.0	1.0%	$ 268.7	4.0%
2009	$28,166.3	1.0%	$ 279.5	4.0%
2010	$29,293.0	1.0%	$ 290.8	4.0%
2011	$30,464.7	1.0%	$ 302.8	4.1%
2012	$31,683.3	1.0%	$ 315.3	4.1%
2013	$32,950.6	1.0%	$ 327.9	4.0%
2014	$34,268.6	1.0%	$ 341.0	4.0%
2015	$35,639.4	1.0%	$ 355.0	4.1%
2016	$37,064.9	1.0%	$ 369.6	4.1%
2017	$38,547.5	1.0%	$ 384.4	4.0%
2018	$40,089.4	1.0%	$ 400.0	4.1%
2019	$41,693.0	1.0%	$ 416.2	4.0%

* The tax rate increase of 0.5% approximately doubles the revenue from this source.
** Source: Standard and Poors DRI, *The US Economy - Winter 2000*

<u>Federal Funding Shortfalls</u>

In some cases, project sponsors may assume a higher federal share than is actually provided after the congressional appropriations process. Project sponsors should be prepared to move the full scope of the project forward even if federal funds are less than expected. Evidence of financial capacity to provide additional non-federal funds could be in the form of cash balances, additional debt capacity or commitments of additional funds from new or existing funding sources. Service reductions and deferred maintenance are not acceptable methods of freeing up additional funds.

After a FFGA has established the federal share, federal appropriations may fall short on an annual basis. For instance, the federal commitment to the FFGA funding levels may be satisfied over six years rather than the planned four-year period. The capital plan presents strategies for implementing the project if the annual appropriations are less than planned including short term financing to cover annual funding shortfalls. The capital plan should show adequate cash reserves, construction reserves or debt capacity to complete the full scope of the proposed project if annual appropriations are lower than expected. Service reductions on the existing system, construction delays or reducing the scope or features of the project are not acceptable methods of providing additional funds.

8.2.2.2 Agency-Wide Capital Plan

The components of the project capital plan are summarized and incorporated into the agency-wide capital plan. The agency plan presents capital funding and spending for each individual funding source and each individual capital project for the past five years and planned during the next 20 years. Capital plan documentation includes project names and descriptions, total capital costs and schedules, and proposed federal funding contributions for each existing, proposed, or planned project. Projects included in the long-range plan and transportation improvement program for the metropolitan area are identified. The agency-wide capital plan also includes bus and rail fleet acquisitions, replacement, and major rehabilitation consistent with the fleet management plans prepared by the transit agency.

All capital funding and expenditures are combined into an agency-wide capital plan projection. Agencies with large numbers of transit projects and funding sources may present detailed funding sources or capital projects on a separate schedule (as in Table 8-7) to provide a clearer presentation of the capital funding information. The major funding categories can then be summarized in the agency-wide capital plan projection. Table 8-8 is an example of a 20-year agency capital plan projection.

Table 8-7: Schedule of Capital Funding Sources, Year-of-Expenditure Dollars (Millions)

Fiscal Year	Actual 1994	Actual 1995	Actual 1996	Actual 1997	Actual 1998	Budget 1999	2000	2001	2002	2003	2004	2005	2006
~~Non-Federal Capital Funds~~													
Balance from Operations (see Table 11)	$ (4.6)	$ (1.4)	$ 0.6	$ 5.2	$ 9.4	$ 14.2	$ 11.8	$ 11.5	$ 11.2	$ 10.8	$ 10.1	$ 9.5	$ 12.1
Sales Tax - 50% Capital (see Table 6)	$ 67.5	$ 73.6	$ 78.9	$ 83.3	$ 88.5	$ 94.2	$ 98.9	$ 102.6	$ 106.3	$ 110.5	$ 114.9	$ 119.6	$ 124.4
Net Bond Proceeds	$ -	$ 60.0	$ 105.0	$ 90.0	$ -	$ -	$ -	$ -	$ -	$ 40.0	$ 20.0	$ 20.0	$ -
Investment Income	$ 24.2	$ 13.0	$ 13.4	$ 13.9	$ 13.8	$ 11.0	$ 11.5	$ 12.0	$ 11.9	$ 12.8	$ 14.7	$ 15.7	$ 15.6
Total Non-Federal Sources	**$ 87.1**	**$ 145.2**	**$ 197.9**	**$ 192.5**	**$ 111.7**	**$ 119.4**	**$ 122.2**	**$ 126.1**	**$ 129.5**	**$ 174.1**	**$ 159.8**	**$ 164.8**	**$ 152.0**
~~Federal Funds~~													
Section 5307 - Formula Funds	$ 19.8	$ 22.1	$ 24.2	$ 32.2	$ 34.4	$ 36.8	$ 39.4	$ 41.8	$ 44.3	$ 25.0	$ 25.0	$ 25.0	$ 25.0
Section 5309 - FFGA Attachment 6	$ 67.3	$ 44.0	$ 51.8	$ 48.5	$ 48.5	$ 32.3	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Section 5309 - Bus	$ 10.4	$ 9.9	$ 13.2	$ 13.5	$ 14.0	$ 12.0	$ 10.5	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0
Section 5309 - Rail Modernization	$ -	$ -	$ -	$ -	$ 15.5	$ 16.2	$ 17.5	$ 18.5	$ 19.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0
Section 5309 - Proposed New Start	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1.0**	**$ 2.0**	**$ 8.0**	**$ 51.0**	**$ 66.5**	**$ 74.7**	**$ 48.1**
CMAQ/STP Flexible Funds	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 10.0**	**$ 10.0**	**$ -**	**$ -**
Total Federal Funds	**$ 97.5**	**$ 76.0**	**$ 89.2**	**$ 94.2**	**$ 112.4**	**$ 97.3**	**$ 68.4**	**$ 71.3**	**$ 80.3**	**$ 115.0**	**$ 130.5**	**$ 128.7**	**$ 102.1**

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
~~Non-Federal Capital Funds~~													
Balance from Operations (see Table 11)	$ 6.3	$ 8.0	$ 7.4	$ 6.9	$ 6.5	$ 6.0	$ 5.3	$ 4.5	$ 3.8	$ 3.0	$ 2.0	$ 1.1	$ 0.0
Sales Tax - 50% Capital (see Table 6)	$ 129.2	$ 134.4	$ 139.8	$ 145.4	$ 151.4	$ 157.6	$ 164.0	$ 170.5	$ 177.5	$ 184.8	$ 192.2	$ 200.0	$ 208.1
Net Bond Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Investment Income	$ 15.1	$ 16.3	$ 17.2	$ 17.0	$ 16.8	$ 16.8	$ 16.8	$ 16.6	$ 16.6	$ 16.8	$ 16.9	$ 16.8	$ 16.8
Total Non-Federal Sources	**$ 150.6**	**$ 158.7**	**$ 164.4**	**$ 169.4**	**$ 174.6**	**$ 180.5**	**$ 186.0**	**$ 191.5**	**$ 197.8**	**$ 204.7**	**$ 211.1**	**$ 217.9**	**$ 224.9**
~~Federal Funds~~													
Section 5307 - Formula Funds	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0	$ 25.0
Section 5309 - FFGA Attachment 6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Section 5309 - Bus	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0	$ 9.0
Section 5309 - Rail Modernization	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0	$ 20.0
Section 5309 - Proposed New Start	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
CMAQ/STP Flexible Funds	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total Federal Funds	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**	**$ 54.0**

Table 8-8: Twenty-Year Capital Plan, Year-of-Expenditure Dollars (Millions)

Fiscal Year	**Actual 1994**	**Actual 1995**	**Actual 1996**	**Actual 1997**	**Actual 1998**	**Budget 1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Capital Expenditures													
1 Rail System Phase B	$ 140.0	$ 150.3	$ 186.5	$ 156.0	$ 125.6	$ 72.7	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2 **Proposed New Start (see Table 2)**	$ -	$ -	$ -	$ -	$ -	$ 1.0	$ 5.1	$ 11.1	$ 10.7	$ 108.0	$ 130.2	$ 146.9	$ 86.8
3 Rail System Rehabilitation	$ -	$ -	$ -	$ -	$ 20.2	$ 21.1	$ 26.3	$ 27.8	$ 24.7	$ 26.0	$ 26.4	$ 27.0	$ 27.8
4 Bus Purchases/Overhaul	$ 8.4	$ 9.2	$ 17.4	$ 38.7	$ 28.4	$ 32.3	$ 68.0	$ 69.4	$ 70.7	$ 46.0	$ 34.0	$ 34.7	$ 35.4
5 Other Capital	$ -	$ 12.4	$ 24.2	$ 36.5	$ 32.5	$ 25.0	$ 26.5	$ 32.2	$ 33.2	$ 22.2	$ 22.9	$ 23.6	$ 48.6
Total Capital Expenditures	**$ 148.4**	**$ 171.9**	**$ 228.1**	**$ 231.2**	**$ 206.7**	**$ 152.1**	**$ 125.9**	**$ 140.4**	**$ 139.3**	**$ 202.2**	**$ 213.5**	**$ 232.1**	**$ 198.6**
Debt Service Costs	**$ 39.8**	**$ 44.0**	**$ 51.4**	**$ 57.7**	**$ 57.7**	**$ 57.7**	**$ 57.7**	**$ 57.7**	**$ 57.7**	**$ 60.5**	**$ 61.9**	**$ 63.3**	**$ 63.3**
Capital Funding Sources													
Total Non-Federal Sources (see Table 7)	$ 87.1	$ 145.2	$ 197.9	$ 192.5	$ 111.7	$ 119.4	$ 122.2	$ 126.1	$ 129.5	$ 174.1	$ 159.8	$ 164.8	$ 152.0
Total Federal Funds (see Table 7)	$ 97.5	$ 76.0	$ 89.2	$ 94.2	$ 112.4	$ 97.3	$ 68.4	$ 71.3	$ 80.3	$ 115.0	$ 130.5	$ 128.7	$ 102.1
Total Capital Revenue	**$ 184.6**	**$ 221.2**	**$ 287.1**	**$ 286.7**	**$ 224.1**	**$ 216.8**	**$ 190.6**	**$ 197.4**	**$ 209.7**	**$ 289.1**	**$ 290.3**	**$ 293.5**	**$ 254.1**
Beginning Cash Balance	$ 189.9	$ 186.3	$ 191.6	$ 199.3	$ 197.1	$ 156.9	$ 164.0	$ 171.0	$ 170.4	$ 183.1	$ 209.6	$ 224.5	$ 222.7
Change to Cash Balance	$ (3.6)	$ 5.3	$ 7.6	$ (2.2)	$ (40.2)	$ 7.1	$ 7.1	$ (0.7)	$ 12.8	$ 26.4	$ 14.9	$ (1.8)	$ (7.7)
Closing Cash Balance	**$ 186.3**	**$ 191.6**	**$ 199.3**	**$ 197.1**	**$ 156.9**	**$ 164.0**	**$ 171.0**	**$ 170.4**	**$ 183.1**	**$ 209.6**	**$ 224.5**	**$ 222.7**	**$ 215.0**

Fiscal Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Capital Expenditures													
1 Rail System Phase B	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2 **Proposed New Start**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3 Rail System Rehabilitation	$ 32.0	$ 33.9	$ 36.0	$ 38.1	$ 40.4	$ 42.8	$ 45.4	$ 48.1	$ 51.0	$ 54.1	$ 57.3	$ 60.7	$ 64.4
4 Bus Purchases/Overhaul	$ 36.1	$ 36.8	$ 52.4	$ 52.5	$ 48.0	$ 49.0	$ 49.9	$ 50.9	$ 52.0	$ 53.0	$ 54.1	$ 55.1	$ 56.2
5 Other Capital	$ 55.2	$ 66.0	$ 69.3	$ 72.8	$ 76.4	$ 80.2	$ 84.2	$ 88.4	$ 92.9	$ 97.5	$ 102.4	$ 107.5	$ 112.9
Total Capital Expenditures	**$ 123.3**	**$ 136.7**	**$ 157.7**	**$ 163.4**	**$ 164.8**	**$ 172.0**	**$ 179.6**	**$ 187.5**	**$ 195.8**	**$ 204.6**	**$ 213.8**	**$ 223.4**	**$ 233.5**
Debt Service Costs	**$ 63.3**	**$ 63.3**	**$ 63.3**	**$ 63.3**	**$ 63.3**	**$ 63.3**	**$ 63.3**	**$ 58.0**	**$ 52.8**	**$ 52.8**	**$ 52.8**	**$ 48.6**	**$ 43.5**
Capital Funding Sources													
Total Non-Federal Sources (see Table 7)	$ 150.6	$ 158.7	$ 164.4	$ 169.4	$ 174.6	$ 180.5	$ 186.0	$ 191.5	$ 197.8	$ 204.7	$ 211.1	$ 217.9	$ 224.9
Total Federal Funds (see Table 7)	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0	$ 54.0
Total Capital Revenue	**$ 204.6**	**$ 212.7**	**$ 218.4**	**$ 223.4**	**$ 228.6**	**$ 234.5**	**$ 240.0**	**$ 245.5**	**$ 251.8**	**$ 258.7**	**$ 265.1**	**$ 271.9**	**$ 278.9**
Beginning Cash Balance	$ 215.0	$ 233.1	$ 245.8	$ 243.3	$ 240.0	$ 240.6	$ 239.8	$ 237.0	$ 237.0	$ 240.3	$ 241.6	$ 240.3	$ 240.3
Change to Cash Balance	$ 18.1	$ 12.7	$ (2.5)	$ (3.3)	$ 0.6	$ (0.8)	$ (2.8)	$ 0.0	$ 3.2	$ 1.4	$ (1.4)	$ (0.0)	$ 1.9
Closing Cash Balance	**$ 233.1**	**$ 245.8**	**$ 243.3**	**$ 240.0**	**$ 240.6**	**$ 239.8**	**$ 237.0**	**$ 237.0**	**$ 240.3**	**$ 241.6**	**$ 240.3**	**$ 240.3**	**$ 242.2**

Notes:
1 Funded with FFGA Attachment 6 plus local funds.
2 Proposed to be funded with Section 5309 New Starts, federal CMAQ funds, and local funds.
3 Funded with Section 5309 Rail Modernization and local funds.
4 Funded with Section 5309 Bus and local funds.
5 Funded with Section 5307 Formula grants and local funds.

8.2.3 The Operating Plan

The project sponsor supplies an operating plan to document how the agency intends to fund and operate the proposed project and the existing transit system. The operating plan documents five years of historical data and presents 20 years of projected system operating revenues and operating and maintenance (O&M) costs to demonstrate the capability of the agency to operate and maintain the proposed project while providing existing levels of transit service.

Projections of operating costs, ridership, and fares for the proposed project and existing system are often estimated as part of the alternatives analysis and refined in the DEIS/FEIS. The values reported for ridership and service levels are consistent with the forecasts documented in the MPO's constrained long-range plan. The number of rail vehicles and buses in service, vehicle retirements, acquisitions and overhauls and the associated annual costs are documented in the bus and rail fleet management plans. Information unavailable from any of these sources is generated specifically for the financial plan.

8.2.3.1 Operating Revenues

The operating plan demonstrates the ability to rely on non-federal funding sources to operate and maintain the entire transit system after the proposed project is in revenue service. The operation and maintenance of the proposed project is likely to place additional burden on the agency's local funding sources. Transit agencies usually need to develop new funding sources if they do not have existing sources that provide sufficient extra operating revenues to fund the proposed project.

The operating plan incorporates fare revenue forecasts for the proposed project and the existing transit system. Fare revenue forecasts are based on ridership forecasts and assumptions regarding fare levels.[3] The project sponsor should include a summary of prior fare increases and characterize the fare increase approval process. For simplicity of presentation, the project sponsor may develop the fare revenue forecasts as a separate schedule as shown in Table 8-9.

The plan also provides historical revenue figures and forecasts for all other operating revenue sources and the assumptions used to develop the revenue forecasts. Inflation assumptions are critical to revenue forecasts and are explicitly documented in the financial plan. Often, a source such as a local sales tax that is used for local capital funding may also be used for O&M expenses. In the example provided in this guidance, sales tax revenue is divided equally between capital and operations so that the forecast given in Table 8-6 is adequate to document the revenue forecast. The plan includes documentation proving that the proposed operating funds are committed to their intended purpose.

[3] The MPO's constrained long-range plan contains transit ridership and revenue forecasts. The ridership forecasts used to develop the financial plan need to be consistent with the MPO's forecasts.

Table 8-9: Fare Revenue Forecasts for Proposed Project and Existing System, Current Dollars (Millions)

Fiscal Year	Actual 1994	Actual 1995	Actual 1996	Actual 1997	Actual 1998	Budget 1999	2000	2001	2002	2003	2004	2005	2006
Trips - Existing Bus	38.2	39.3	40.3	40.8	41.9	43.1	39.7	39.4	39.8	39.0	39.7	40.9	39.3
Trips - Existing Rail	4.8	5.0	5.2	5.3	5.6	5.7	14.7	16.1	17.0	19.1	19.4	19.2	21.8
Trips - New Start	-	-	-	-	-	-	-	-	-	-	-	-	0.9
Total Ridership	**43.0**	**44.3**	**45.5**	**46.1**	**47.5**	**48.8**	**54.4**	**55.5**	**56.8**	**58.1**	**59.1**	**60.1**	**62.0**
Annual % Change		**3.0%**	**2.7%**	**1.3%**	**3.0%**	**2.7%**	**11.5%**	**2.0%**	**2.3%**	**2.3%**	**1.7%**	**1.7%**	**3.2%**
Fare Revenues - Existing Bus	$ 30.7	$ 31.6	$ 32.7	$ 34.6	$ 36.1	$ 38.1	$ 32.8	$ 33.7	$ 34.8	$ 33.1	$ 35.0	$ 37.6	$ 37.6
Fare Revenues - Existing Rail	$ 4.8	$ 5.0	$ 5.2	$ 5.6	$ 5.9	$ 6.0	$ 16.2	$ 17.8	$ 18.7	$ 22.0	$ 22.3	$ 22.1	$ 25.1
Fare Revenues - New Start	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.0
Total Fare Revenue	**$ 35.5**	**$ 36.6**	**$ 37.9**	**$ 40.2**	**$ 42.0**	**$ 44.1**	**$ 49.0**	**$ 51.4**	**$ 53.5**	**$ 55.1**	**$ 57.3**	**$ 59.6**	**$ 63.7**
Annual % Change		3.2%	3.4%	6.0%	4.6%	5.1%	11.0%	5.0%	4.0%	3.0%	4.0%	4.0%	6.8%
Average Fare	**$ 0.83**	**$ 0.83**	**$ 0.83**	**$ 0.87**	**$ 0.88**	**$ 0.90**	**$ 0.90**	**$ 0.93**	**$ 0.94**	**$ 0.95**	**$ 0.97**	**$ 0.99**	**$ 1.03**
Annual % Change		**0.2%**	**0.7%**	**4.4%**	**1.5%**	**2.2%**	**0.0%**	**2.8%**	**1.6%**	**0.7%**	**2.2%**	**2.2%**	**3.4%**

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Trips - Existing Bus	38.9	38.5	38.5	39.2	39.6	40.0	40.5	41.0	41.5	42.1	42.7	43.4	44.0
Trips - Existing Rail	22.8	23.7	25.0	25.7	26.6	27.6	28.5	29.5	30.4	31.4	32.3	33.3	34.2
Trips - New Start	**6.3**	**6.5**	**6.7**	**6.9**	**7.1**	**7.3**	**7.5**	**7.8**	**8.0**	**8.2**	**8.5**	**8.7**	**9.0**
Total Ridership	**68.0**	**68.7**	**70.2**	**71.7**	**73.3**	**74.9**	**76.6**	**78.3**	**80.0**	**81.7**	**83.5**	**85.4**	**87.3**
Annual % Change	**9.7%**	**1.0%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**
Fare Revenues - Existing Bus	$ 33.4	$ 37.1	$ 38.3	$ 40.3	$ 38.7	$ 40.5	$ 42.4	$ 44.4	$ 42.8	$ 45.0	$ 47.4	$ 47.8	$ 50.4
Fare Revenues - Existing Rail	$ 28.5	$ 29.7	$ 31.2	$ 32.1	$ 35.9	$ 37.2	$ 38.5	$ 39.8	$ 44.1	$ 45.5	$ 46.9	$ 49.9	$ 51.4
Fare Revenues - New Start	**$ 7.9**	**$ 8.1**	**$ 8.4**	**$ 8.6**	**$ 9.6**	**$ 9.9**	**$ 10.2**	**$ 10.5**	**$ 11.6**	**$ 11.9**	**$ 12.3**	**$ 13.1**	**$ 13.5**
Total Fare Revenue	**$ 69.8**	**$ 74.9**	**$ 77.9**	**$ 81.0**	**$ 84.2**	**$ 87.6**	**$ 91.1**	**$ 94.7**	**$ 98.5**	**$ 102.5**	**$ 106.6**	**$ 110.8**	**$ 115.3**
Annual % Change	**8.8%**	**7.2%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**
Average Fare	**$ 1.03**	**$ 1.09**	**$ 1.11**	**$ 1.13**	**$ 1.15**	**$ 1.17**	**$ 1.19**	**$ 1.21**	**$ 1.23**	**$ 1.25**	**$ 1.28**	**$ 1.30**	**$ 1.32**
Annual % Change	0.0%	5.8%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%

8.2.3.2 Operating Costs

System-wide O&M expenses typically increase after a transit project goes into revenue service requiring additional subsidies to continue operating and maintaining the transit system. FTA needs to determine whether the project sponsor has the financial capacity to fund these additional subsidies without reducing existing service levels. Consequently, the operating plan clearly identifies how existing operations will be affected by the proposed project. Fixed guideway projects often result in significant service realignments. The operating plan details:

- How the project will impact existing operations, revenues and O&M costs;
- How bus routes will be realigned;
- What bus routes will be dropped; and
- What new feeder routes are planned?

presents an example of a schedule of O&M costs for the proposed project and the existing transit system with supporting service statistics.

The accompanying text documents the O&M cost estimation methodology, preferably resource cost build-up, and describes the service plans for the proposed project and existing transit system. The cost estimation documentation provides details regarding operating labor, maintenance labor, fuel, supplies, administration and other relevant cost categories.

Changes in O&M costs have three components: (1) inflation for labor and materials, (2) service/operating changes, and (3) changes in productivity. The plan documents the inflation assumptions, the planned system-wide operating and service characteristics, and productivity assumptions to demonstrate that the agency is not paying for the proposed project's O&M costs through reductions in service or deferred maintenance on the existing system.

8.2.3.3 Agency-Wide Operating Plan

The operating revenues and O&M cost estimates are combined in the agency-wide operating plan. The operating plan demonstrates that adequate additional funds are available to operate and maintain the proposed project and the rest of the transit system. The operating plan calculates the additional subsidy required to operate and maintain the proposed project. The operating plan shows the availability of additional operating revenues to cover the additional expenses. Table 8-11 presents an example of an operating plan. In this example, the transit agency forecasts operating surpluses large enough to easily absorb the subsidy using existing funding sources.

Table 8-10: Operating and Maintenance Expenses, Year-of-Expenditure Dollars (Millions)

Fiscal Year	**Actual 1994**	**Actual 1995**	**Actual 1996**	**Actual 1997**	**Actual 1998**	**Budget 1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Vehicle Revenue Miles (million)													
Bus	25.2	25.5	26.1	26.0	25.4	25.5	27.7	25.8	26.4	24.3	24.7	25.7	24.0
Existing Rail	2.8	2.9	3.0	3.0	3.0	3.0	5.0	5.5	6.0	6.0	6.0	6.0	6.0
Proposed New Start	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Directional Route Miles													
Bus	1885.0	1890.0	1880.0	1850.0	1826.0	1838.0	1658.0	1725.0	1720.0	1750.0	1780.0	1850.0	1720.0
Rail	50.4	50.4	50.4	50.4	50.4	50.4	70.1	70.1	70.1	70.1	70.1	70.1	76.0
Vehicles in Maximum Service													
Bus	584	585	582	573	565	569	513	534	533	542	551	573	533
Rail	60	60	62	68	66	68	96	94	99	100	99	102	125
Operating & Maintenance Expenses													
Existing Bus O&M	$ 97.9	$ 102.4	$ 106.9	$ 110.8	$ 115.5	$ 121.0	$ 121.7	$ 124.3	$ 126.3	$ 131.6	$ 137.8	$ 144.4	$ 145.9
Existing Rail O&M	$ 14.0	$ 14.9	$ 15.9	$ 16.4	$ 16.9	$ 17.4	$ 29.9	$ 34.0	$ 38.3	$ 39.6	$ 40.9	$ 42.3	$ 43.8
Proposed New Start O&M	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3.6**
Total O&M Expenses	**$ 111.9**	**$ 117.3**	**$ 122.8**	**$ 127.2**	**$ 132.4**	**$ 138.4**	**$ 151.6**	**$ 158.3**	**$ 164.6**	**$ 171.2**	**$ 178.8**	**$ 186.7**	**$ 193.4**
Annual % Change		**4.9%**	**4.7%**	**3.6%**	**4.1%**	**4.5%**	**9.5%**	**4.4%**	**4.0%**	**4.0%**	**4.4%**	**4.4%**	**3.6%**

Fiscal Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Vehicle Revenue Miles (million)													
Bus	24.5	25.0	25.5	26.0	26.5	27.1	27.6	28.2	28.7	29.3	29.9	30.5	31.1
Existing Rail	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Proposed New Start	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Directional Route Miles													
Bus	1,754	1,789	1,825	1,862	1,899	1,937	1,976	2,015	2,056	2,097	2,139	2,181	2,225
Rail	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0
Vehicles in Maximum Service													
Bus	543	554	565	576	588	600	612	624	636	649	662	675	689
Rail	125	126	128	130	130	130	130	130	130	130	130	130	130
Operating & Maintenance Expenses													
Existing System - Bus	$ 123.7	$ 129.6	$ 135.8	$ 142.3	$ 149.1	$ 156.2	$ 163.7	$ 171.5	$ 179.6	$ 188.1	$ 197.1	$ 206.4	$ 216.2
Existing System - Rail	$ 67.9	$ 70.2	$ 72.6	$ 75.1	$ 77.6	$ 80.3	$ 83.0	$ 85.8	$ 88.7	$ 91.7	$ 94.9	$ 98.1	$ 101.4
Proposed New Start O&M	**$ 18.9**	**$ 19.5**	**$ 20.2**	**$ 20.9**	**$ 21.6**	**$ 22.3**	**$ 23.1**	**$ 23.8**	**$ 24.6**	**$ 25.5**	**$ 26.4**	**$ 27.2**	**$ 28.2**
Total O&M Expenses	**$ 210.4**	**$ 219.3**	**$ 228.6**	**$ 238.2**	**$ 248.3**	**$ 258.8**	**$ 269.7**	**$ 281.1**	**$ 293.0**	**$ 305.4**	**$ 318.3**	**$ 331.7**	**$ 345.8**
Annual % Change	**8.8%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**	**4.2%**

Fiscal Year	Actual 1994	Actual 1995	Actual 1996	Actual 1997	Actual 1998	Budget 1999	2000	2001	2002	2003	2004	2005	2006
Operating Revenue													
Existing System Fares (see Table 9)	$ 35.5	$ 36.6	$ 37.9	$ 40.2	$ 42.0	$ 44.1	$ 49.0	$ 51.4	$ 53.5	$ 55.1	$ 57.3	$ 59.6	$ 62.6
Proposed New Start Fares (see Table 9)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.0
Other Operating Revenue	$ 4.3	$ 5.7	$ 6.6	$ 8.9	$ 11.3	$ 14.2	$ 15.4	$ 15.7	$ 16.0	$ 16.3	$ 16.7	$ 17.0	$ 17.3
Total System Revenue	**$ 39.8**	**$ 42.3**	**$ 44.5**	**$ 49.1**	**$ 53.3**	**$ 58.3**	**$ 64.4**	**$ 67.2**	**$ 69.5**	**$ 71.5**	**$ 74.0**	**$ 76.6**	**$ 81.0**
Sales Tax - 50 % (see Table 6)	**$ 67.5**	**$ 73.6**	**$ 78.9**	**$ 83.3**	**$ 88.5**	**$ 94.2**	**$ 98.9**	**$ 102.6**	**$ 106.3**	**$ 110.5**	**$ 114.9**	**$ 119.6**	**$ 124.4**
Total Operating Revenues	**$ 107.3**	**$ 115.9**	**$ 123.4**	**$ 132.4**	**$ 141.8**	**$ 152.6**	**$ 163.3**	**$ 169.8**	**$ 175.8**	**$ 181.9**	**$ 188.9**	**$ 196.2**	**$ 205.4**
Annual % Change		8.0%	6.4%	7.3%	7.1%	7.6%	7.1%	4.0%	3.6%	3.5%	3.8%	3.9%	4.7%
Operating & Maintenance Expenses													
Existing System O&M (see Table 10)	$ 111.9	$ 117.3	$ 122.8	$ 127.2	$ 132.4	$ 138.4	$ 151.6	$ 158.3	$ 164.6	$ 171.2	$ 178.8	$ 186.7	$ 189.7
New Start O&M (see Table 10)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.6
Total O&M Expenses	**$ 111.9**	**$ 117.3**	**$ 122.8**	**$ 127.2**	**$ 132.4**	**$ 138.4**	**$ 151.6**	**$ 158.3**	**$ 164.6**	**$ 171.2**	**$ 178.8**	**$ 186.7**	**$ 193.4**
Balance from Existing Operations	$ (4.6)	$ (1.4)	$ 0.6	$ 5.2	$ 9.4	$ 14.2	$ 11.8	$ 11.5	$ 11.2	$ 10.8	$ 10.1	$ 9.5	$ 14.7
New Start Subsidy Requirement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.6
Balance from Operations	**$ (4.6)**	**$ (1.4)**	**$ 0.6**	**$ 5.2**	**$ 9.4**	**$ 14.2**	**$ 11.8**	**$ 11.5**	**$ 11.2**	**$ 10.8**	**$ 10.1**	**$ 9.5**	**$ 12.1**
Operating Ratio	**35.6%**	**36.1%**	**36.2%**	**38.6%**	**40.3%**	**42.2%**	**42.5%**	**42.4%**	**42.2%**	**41.7%**	**41.4%**	**41.0%**	**41.9%**

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Operating Revenue													
Existing System Fares (see Table 9)	$ 62.0	$ 66.7	$ 69.5	$ 72.4	$ 74.6	$ 77.7	$ 80.9	$ 84.3	$ 86.9	$ 90.5	$ 94.3	$ 97.7	$ 101.8
Proposed New Start Fares (see Table 9)	$ 7.9	$ 8.1	$ 8.4	$ 8.6	$ 9.6	$ 9.9	$ 10.2	$ 10.5	$ 11.6	$ 11.9	$ 12.3	$ 13.1	$ 13.5
Other Operating Revenue	$ 17.7	$ 18.0	$ 18.4	$ 18.8	$ 19.1	$ 19.5	$ 19.9	$ 20.3	$ 20.7	$ 21.1	$ 21.6	$ 22.0	$ 22.4
Total System Revenue	**$ 87.5**	**$ 92.9**	**$ 96.3**	**$ 99.7**	**$ 103.4**	**$ 107.1**	**$ 111.0**	**$ 115.1**	**$ 119.2**	**$ 123.6**	**$ 128.1**	**$ 132.8**	**$ 137.7**
Sales Tax - 50% (see Table 6)	**$ 129.2**	**$ 134.4**	**$ 139.8**	**$ 145.4**	**$ 151.4**	**$ 157.6**	**$ 164.0**	**$ 170.5**	**$ 177.5**	**$ 184.8**	**$ 192.2**	**$ 200.0**	**$ 208.1**
Total Operating Revenues	**216.76**	**227.28**	**236.03**	**245.15**	**254.75**	**264.75**	**274.97**	**285.56**	**296.73**	**308.42**	**320.31**	**332.83**	**345.78**
Annual % Change	5.5%	4.9%	3.8%	3.9%	3.9%	3.9%	3.9%	3.8%	3.9%	3.9%	3.9%	3.9%	3.9%
Operating & Maintenance Expenses													
Existing System O&M (see Table 10)	$ 191.6	$ 199.8	$ 208.4	$ 217.4	$ 226.7	$ 236.5	$ 246.7	$ 257.3	$ 268.3	$ 279.9	$ 291.9	$ 304.5	$ 317.6
New Start O&M (see Table 10)	$ 18.9	$ 19.5	$ 20.2	$ 20.9	$ 21.6	$ 22.3	$ 23.1	$ 23.8	$ 24.6	$ 25.5	$ 26.4	$ 27.2	$ 28.2
Total O&M Expenses	**$ 210.4**	**$ 219.3**	**$ 228.6**	**$ 238.2**	**$ 248.3**	**$ 258.8**	**$ 269.7**	**$ 281.1**	**$ 293.0**	**$ 305.4**	**$ 318.3**	**$ 331.7**	**$ 345.8**
Balance from Existing Operations	$ 17.3	$ 19.3	$ 19.2	$ 19.2	$ 18.4	$ 18.4	$ 18.1	$ 17.8	$ 16.8	$ 16.6	$ 16.1	$ 15.2	$ 14.7
New Start Subsidy Requirement	$ 11.0	$ 11.4	$ 11.8	$ 12.2	$ 12.0	$ 12.4	$ 12.9	$ 13.4	$ 13.1	$ 13.5	$ 14.1	$ 14.1	$ 14.7
Balance from Operations	**$ 6.3**	**$ 8.0**	**$ 7.4**	**$ 6.9**	**$ 6.5**	**$ 6.0**	**$ 5.3**	**$ 4.5**	**$ 3.8**	**$ 3.0**	**$ 2.0**	**$ 1.1**	**$ 0.0**
Operating Ratio	**41.6%**	**42.4%**	**42.1%**	**41.9%**	**41.6%**	**41.4%**	**41.2%**	**40.9%**	**40.7%**	**40.5%**	**40.3%**	**40.0%**	**39.8%**

8.2.4 The Cash Flow Analysis

The overall objective of preparing a financial plan is to demonstrate that the agency has the financial resources to successfully construct the proposed project while adequately operating, maintaining, and recapitalizing the existing and planned transit system. The cash flow statement combines the results of the capital plan and the operating plan to summarize the year-by-year financial condition of the project sponsor throughout the 20-year analysis period.

Cash flow analysis is a valuable tool for project planning. Its application permits project sponsors to develop and test funding strategies, test alternative assumptions, and conduct risk analysis as part of the agency's continuing financial planning activities. The cash flow statement includes at least five prior years of actual costs and revenues to provide a clear picture of the historical financial position of the agency and to substantiate the growth rates assumed in future years. Table 8-12 is an example of a 20-year cash flow summary.

The example is not meant to mandate how a transit agency accounts for agency cash flow. The agency in the example carries a large cash balance that is available for operating shortfalls as well as capital projects while operating surpluses can be used for capital expenditures. This is not legally possible for some agencies that must maintain separate funds for operations and capital. In the example, the primary non-federal funding source is the sales tax, which is divided equally between operating and capital expenses. Some transit agencies have the freedom to use dedicated funding sources for any transit activity while others are restricted to using them for a particular purpose or to allocate them between purposes based on a formula. The agency's financial plan identifies and reflects all of the restrictions and covenants that determine how funds are allocated and used.

The cash flow statements are structured in a way that reflects the agency's restrictions on operating and capital funds. Many agencies have restrictions on the use of cash balances such as debt retirement, contractual obligations, lease deposits, uninsured losses or reserve accounts for specific projects. If an agency is subject to any of these restrictions, balances in these restricted accounts are identified in the cash flow statement and not included as "available" cash.

8.2.4.1 Financial Evaluation

The cash flow projection demonstrates that the agency has adequate resources to complete the project as planned and continue to operate the existing transit service. Evidence of this financial capacity could be cash balances or debt service ratios. In general, cash balances should be sufficient to fund at least three months of operations. In the example cash flow projection, the transit agency maintains a working capital fund adequate to fund about one year of operations. The bond market typically requires gross debt service ratios to exceed 150 percent, which means that revenues pledged to cover debt service must exceed 150 percent of annual debt service. Many transit agencies are subject to more stringent debt ratio requirements.

The cash flow projection is often evaluated to determine the sensitivity of an agency's financial health to changes in the assumptions underlying the financial plan. If small changes in the financial planning or economic assumptions, such as economic growth, transit ridership or interest rates, result in financial difficulties for the agency, the financial capacity of the agency may be questionable.

Fiscal Year	Actual 1994	Actual 1995	Actual 1996	Actual 1997	Actual 1998	Budget 1999	2000	2001	2002	2003	2004	2005	2006
Operating													
Operating Revenue (see Table 11)	$ 107.3	$ 115.9	$ 123.4	$ 132.4	$ 141.8	$ 152.6	$ 163.3	$ 169.8	$ 175.8	$ 181.9	$ 188.9	$ 196.2	$ 205.4
O & M Expenses (see Table 10)	$ 111.9	$ 117.3	$ 122.8	$ 127.2	$ 132.4	$ 138.4	$ 151.6	$ 158.3	$ 164.6	$ 171.2	$ 178.8	$ 186.7	$ 193.4
Balance from Operations	**$ (4.6)**	**$ (1.4)**	**$ 0.6**	**$ 5.2**	**$ 9.4**	**$ 14.2**	**$ 11.8**	**$ 11.5**	**$ 11.2**	**$ 10.8**	**$ 10.1**	**$ 9.5**	**$ 12.1**
Capital													
Capital Revenue (see Table 8)	$ 189.2	$ 222.6	$ 286.5	$ 281.5	$ 214.7	$ 202.6	$ 178.8	$ 185.9	$ 198.5	$ 278.3	$ 280.1	$ 284.0	$ 242.1
Capital Expenditures (see Table 8)	$ 148.4	$ 171.9	$ 228.1	$ 231.2	$ 206.7	$ 152.1	$ 125.9	$ 140.4	$ 139.3	$ 202.2	$ 213.5	$ 232.1	$ 198.6
Debt Service Costs (see Table 8)	$ 39.8	$ 44.0	$ 51.4	$ 57.7	$ 57.7	$ 57.7	$ 57.7	$ 57.7	$ 57.7	$ 60.5	$ 61.9	$ 63.3	$ 63.3
Change in Capital Funds	**$ 1.0**	**$ 6.7**	**$ 7.1**	**$ (7.4)**	**$ (49.6)**	**$ (7.2)**	**$ (4.7)**	**$ (12.2)**	**$ 1.5**	**$ 15.7**	**$ 4.7**	**$ (11.3)**	**$ (19.7)**
Cash Balance													
Beginning Cash Balance	$ 189.9	$ 186.3	$ 191.6	$ 199.3	$ 197.1	$ 156.9	$ 164.0	$ 171.0	$ 170.4	$ 183.1	$ 209.6	$ 224.5	$ 222.7
Change to Cash Balance	$ (3.6)	$ 5.3	$ 7.6	$ (2.2)	$ (40.2)	$ 7.1	$ 7.1	$ (0.7)	$ 12.8	$ 26.4	$ 14.9	$ (1.8)	$ (7.7)
Closing Cash Balance	**$ 186.3**	**$ 191.6**	**$ 199.3**	**$ 197.1**	**$ 156.9**	**$ 164.0**	**$ 171.0**	**$ 170.4**	**$ 183.1**	**$ 209.6**	**$ 224.5**	**$ 222.7**	**$ 215.0**

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Operating													
Operating Revenue (see Table 11)	$ 216.8	$ 227.3	$ 236.0	$ 245.2	$ 254.7	$ 264.8	$ 275.0	$ 285.6	$ 296.7	$ 308.4	$ 320.3	$ 332.8	$ 345.8
O & M Expenses (see Table 10)	$ 210.4	$ 219.3	$ 228.6	$ 238.2	$ 248.3	$ 258.8	$ 269.7	$ 281.1	$ 293.0	$ 305.4	$ 318.3	$ 331.7	$ 345.8
Balance from Operations	**$ 6.3**	**$ 8.0**	**$ 7.4**	**$ 6.9**	**$ 6.5**	**$ 6.0**	**$ 5.3**	**$ 4.5**	**$ 3.8**	**$ 3.0**	**$ 2.0**	**$ 1.1**	**$ 0.0**
Capital													
Capital Revenue (see Table 8)	$ 198.3	$ 204.7	$ 211.0	$ 216.4	$ 222.2	$ 228.5	$ 234.7	$ 241.1	$ 248.1	$ 255.6	$ 263.1	$ 270.8	$ 278.9
Capital Expenditures (see Table 8)	$ 123.3	$ 136.7	$ 157.7	$ 163.4	$ 164.8	$ 172.0	$ 179.6	$ 187.5	$ 195.8	$ 204.6	$ 213.8	$ 223.4	$ 233.5
Debt Service Costs (see Table 8)	$ 63.3	$ 63.3	$ 63.3	$ 63.3	$ 63.3	$ 63.3	$ 63.3	$ 58.0	$ 52.8	$ 52.8	$ 52.8	$ 48.6	$ 43.5
Change in Capital Funds	**$ 11.8**	**$ 4.7**	**$ (9.9)**	**$ (10.2)**	**$ (5.9)**	**$ (6.8)**	**$ (8.1)**	**$ (4.4)**	**$ (0.5)**	**$ (1.7)**	**$ (3.4)**	**$ (1.1)**	**$ 1.9**
Cash Balance													
Beginning Cash Balance	$ 215.0	$ 233.1	$ 245.8	$ 243.3	$ 240.0	$ 240.6	$ 239.8	$ 237.0	$ 237.0	$ 240.3	$ 241.6	$ 240.3	$ 240.3
Change to Cash Balance	$ 18.1	$ 12.7	$ (2.5)	$ (3.3)	$ 0.6	$ (0.8)	$ (2.8)	$ 0.0	$ 3.2	$ 1.4	$ (1.4)	$ (0.0)	$ 1.9
Closing Cash Balance	**$ 233.1**	**$ 245.8**	**$ 243.3**	**$ 240.0**	**$ 240.6**	**$ 239.8**	**$ 237.0**	**$ 237.0**	**$ 240.3**	**$ 241.6**	**$ 240.3**	**$ 240.3**	**$ 242.2**

8.3 Capital Cost Estimates

This section describes the major cost inputs to the financial planning process. One of the initial and perhaps most important activities in the development of a financial plan is the estimation of capital and operating costs of the proposed project and existing system. These estimates determine the funding requirements to build new projects as well as the ongoing funding requirements to operate and maintain proposed projects in the context of the existing transit system. Forecasting costs takes on great importance since: 1) it provides the target for securing funding commitments; 2) any significant mistake could harm the ability of the project sponsor to implement the project or other planned projects; and 3) cost overruns can force major reductions in service on the existing system.

Transit agencies generally rely on engineering consultants to provide cost estimates for major capital projects. Therefore, this section emphasizes the use of cost estimates in the financial planning process rather than the development of capital cost estimates themselves.

The transportation industry's history of underestimation of capital costs has diminished the credibility of planning efforts across the country. Large cost increases late in the planning process have resulted in loss of funding, delayed construction for proposed projects as well as other planned initiatives, and a loss of public trust in the development and implementation of highway and transit improvements. While there may be incentives to use the lowest reputable cost estimates in developing capital improvement programs, it is not a prudent approach to transportation planning. Careful, conservative estimation of project costs must be a priority in the development of transportation capital improvement programs.

In addition to the development of construction cost estimates, the ongoing rehabilitation of capital equipment is a hallmark of good planning. Depending on the useful life of key assets and the performance of regular maintenance, most elements of a transit system will require periodic rehabilitation and replacement. The experience of rail systems built in the 1970's, where delayed capital rehabilitation resulted in degraded service and required the expenditure of billions of dollars, emphasizes the need to plan for capital rehabilitation. Capital rehabilitation projects involve large expenditures that are vital to the continued efficient operation of transit systems and must be programmed into the agency-wide capital plan.

8.3.1 Project Development and Capital Costing

The actual estimation of capital costs involves different techniques depending on the type of cost under consideration and the phase of project development. Prudent financial planning requires that all potential projects with a reasonable chance of implementation in the foreseeable future be evaluated to determine their financial feasibility and to identify future funding needs. Transit agencies may want to incorporate projects in their financial planning activities that have not been the subject of any significant engineering work if they have a reasonable expectation that those projects will be implemented during the relevant planning horizon. The financial plan will certainly contain all transit related projects found in the MPO's long-range plan. In addition, the rehabilitation and replacement of existing and planned facilities and vehicles must be scheduled based on their useful lives.

8.3.1.1 Rehabilitation and Replacement

The rehabilitation and replacement (R&R) of capital resources is needed for several reasons. First, capital resources wear out. Stations, maintenance facilities, track-way, signal systems, propulsion systems, and vehicles all have distinct useful lives. These assets must be re-capitalized before deterioration leads to service disruptions. Second, technological obsolescence due to the availability of parts or technological advances may spur the replacement of various systems. Old rail cars may become increasingly difficult to maintain and require replacement or agencies may wish to implement communications based train control, automatic train stop, or passenger information systems to improve system reliability and safety. Third, changes in operating or safety policies may require new capital investment. One example is station or vehicle enhancements to assure compliance with the American's with Disabilities Act (ADA).

Prudent capital planning requires an inventory of the agency's assets and an evaluation of the expected useful life of each major component. An R&R cycle is assumed for each of the major assets and annual costs are projected at least 20 years into the future. Agencies planning major capital investments need to incorporate the R&R of those assets in the later years of the capital plan in addition to the ongoing R&R of the existing asset base.[4]

In most cases, the capital costs for R&R will vary markedly from one year to the next due to different cycles and widely varying costs for the numerous components. Agencies typically establish reserve accounts, sometimes called sinking funds, to provide the funds for sudden increases in capital spending. Occasionally, agencies smooth out the R&R cost swings by using a multi-year rolling average as the annual cost estimate.

8.3.1.2 Major Capital Investments

Estimating the construction costs of major capital investments requires a different approach than estimating rehabilitation and replacement costs. The phase of project development as well as the type of investment determines the appropriate level of effort and detail for the cost estimation efforts. While planners may have a rough idea of the costs of various projects, the first substantial cost estimation effort is undertaken during alternatives analysis.

[4] The Government Accounting Standards Board (GASB) Statement No. 34 mandates that all government entities are required to report all capital assets, including infrastructure, and related depreciation expenses in government financial statements. For agencies with more than $100 million in annual revenues, prospective reporting (new assets) of infrastructure assets was required as of June 15, 2001. For agencies with between $10 and $100 million in annual revenue, prospective reporting was required as of June 15, 2002. Agencies with less than $10 million in annual revenues must apply prospective reporting after June 15, 2003. Retroactive reporting (pre-existing assets) is required four years after the prospective reporting deadlines.

The level of effort expended during alternatives analysis must be adequate to ensure that the evaluation of the relative costs and benefits of the alternatives is not skewed by any cost estimation errors. Clearly, the level of effort and detail of the engineering and costing efforts will depend on the type and complexity of the proposed project. A commuter rail project on existing tracks without any tunnels or bridges can get by with much less effort than a proposed subway project through a central business district because of the uncertainties inherent in tunnel construction in difficult environments. During preliminary engineering, cost estimates must be refined to a level of confidence that allows the grantee to line up funding for the project without exposing themselves to an unreasonable risk of any significant cost increase. Standard industry practice has been to define the level of engineering effort in PE to be a certain percentage of the total design activity (i.e. 30%). However, the level of effort required in PE cannot be defined by a percentage. Grantees must expend whatever level of effort is required to get accurate cost estimates in preliminary engineering. In final design, construction drawings are finalized and bid documents prepared. Cost estimates should not change appreciably in final design or during construction.

8.3.2 Overview of Capital Cost Estimation Methods

The intent of this section is not to provide a methodology for project sponsors to estimate the cost of proposed projects, which is provided in Chapter 3. Rather, the intent is to describe how cost estimates generated in planning studies and during project development are used in the transit agency’s financial planning activities. Hopefully, by understanding the proper use of cost estimates in financial planning, project sponsors may also demand better information regarding the potential uncertainties surrounding cost estimates for major capital investments.

During project planning, two levels of engineering effort are used to build capital cost estimates, one for “typical” facilities and another for “special” situations. A “typical cross-section” is defined for the portion of a project that can be analyzed at an aggregate level. Detailed unit costs are applied to the quantities in the typical sections to estimate capital costs per linear foot. A similar approach is used for stations by type (at-grade, elevated, subway, or terminal). Plan and profile drawings are prepared and quantities computed for each alternative. Segment costs are computed to estimate the capital costs for each segment, exclusive of system-wide elements and add-on items.

Certain costs cannot be estimated using the typical segment approach. Special conditions such as major structures (bridges, tunnels) or uncertain alignments in areas with major existing structures or uncertain terrain or soil conditions represent major areas of cost uncertainty and are subject to a more detailed engineering effort. Additional drawings, quantities and unit costs are developed for these special segments and cost estimates derived exclusive of system-wide elements and add-ons.

System-wide elements include vehicles, electrification, signalization and train control systems. The quantities and characteristics of these elements are determined by the service standards defined for the system. The costs of these items are estimated by multiplying the associated unit costs by system-wide quantities. Add-ons refer to contingency allowances, engineering, insurance, and management services. The cost of these items is typically expressed as a percentage of the other estimated capital costs.[5]

Items that are not functionally part of the project, but that are necessitated by the project must be included in the cost estimates. Some examples of this type of project cost include environmental mitigation such as noise barriers and creation of new wetlands, as well as beautification projects, utility relocation, and rebuilding streetscapes torn up by project construction. All these items must be identified and included in cost estimates at the very beginning of the planning process. To the extent that the costs associated with these items is unknown, a reasonable attempt must be made to make an educated guess regarding what types of auxiliary project elements will be required.

8.3.3 Dealing with Financial Risk to the Cost Estimates

Financial risk is generally defined as the likelihood of financial losses due to uncertainty. Implementing major transportation projects is subject to risks that need to be accounted for in the financial plan. The financial plan accounts for risks that costs and revenues may both deviate from the most careful projections. This section addresses the financial risks to the cost estimates and how the financial plan can minimize those risks. Financial risk to revenue forecasts will be addressed in section 8.5.

The sources of financial risk related to project cost estimates include the following:

- uncertainty in the inflation assumptions;
- changes in project design standards;
- changes in project scope (or omitting key project elements);
- changes in the project schedule;
- uncertainty in the unit cost assumptions; and
- unforeseen construction problems.

The numerous areas of uncertainty highlight the potential for significant cost estimation problems. Any systematic bias toward underestimating the potential of these risks to increase costs can have a compounding effect that amplifies the size of the potential cost overrun.

[5] *Financial Planning Guide for Transit*, UMTA, April 1990, p. 66.

A common misconception is that the contingency line item in the cost estimate mitigates all of these areas of financial risk. The contingency set aside in a cost estimate should account for unforeseen construction problems and, perhaps, the uncertainty in unit cost estimates. It does not address the full range of uncertainties driving financial risk in the project.

Complicating the effort to account for and express the level of financial risk in a cost estimate is the desire to attach a single price tag to major capital investments. In reality, there is a wide range of potential costs for most projects. Project planning studies need to identify the full range of potential costs and evaluate the likelihood of the various estimates. Consider a project that has a range of cost estimates from $300 million to $1 billion with a best guess of $500 million. In addition to evaluating a $500 million project, the project sponsor needs to consider the implications of building a potential $1 billion project. What is the likelihood of the project costing $1 billion? Would it still be feasible? Would the scope need to be reduced? Would the project need to be delayed? Would it still be the preferred alternative? These questions should be the basis for evaluating the financial feasibility of any major capital investment.

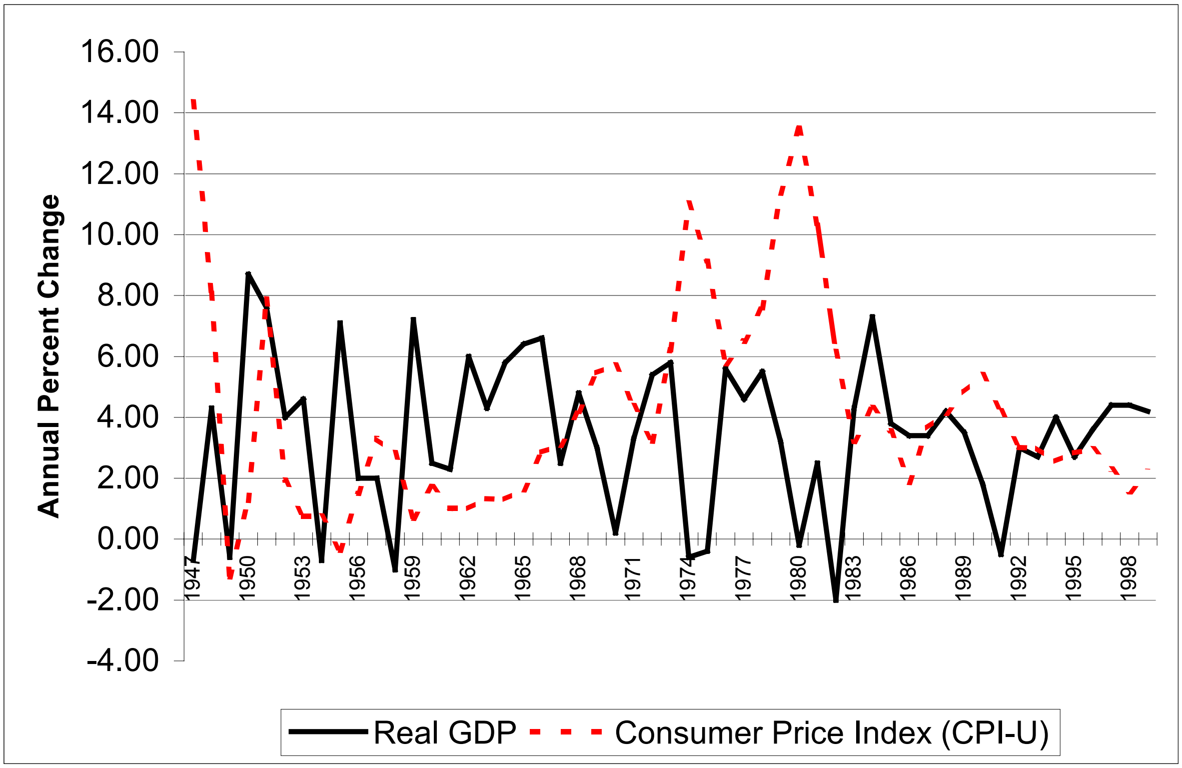
8.3.3.1 Inflation Risk

The financial plan documents the cash flow requirements to fund construction of the proposed project. A major step in the development of the cash flow requirements is the conversion of constant dollar cost estimates to year of expenditure dollars. This conversion requires a series of assumptions regarding inflation expectations between the base year of the constant dollar engineering cost estimate and the last year of construction. Construction costs can also be quite volatile year-to-year creating the potential for significant risk of actual costs deviating from earlier estimates.

Defensible inflation forecasts are available from many sources. Agencies typically use long-range forecasts from professional economic forecasting firms or forecasts developed by local universities. Forecasts of construction cost and building cost inflation are usually available from these same sources. The inflation associated with construction costs are more volatile than general price inflation and have the potential to escalate very rapidly if labor or material shortages occur. Agencies should use forecasts specific to their own regional economy since regional differences in economic performance can be large.

Economic forecasting, especially when looking beyond one or two years, is highly uncertain. These forecasts really provide alternative scenarios, each with a varying likelihood of occurring. The only thing that is certain about economic forecasts is that the forecasts will be wrong. Economic models can identify various relationships, but random events and circumstances ensure that reality will deviate from expectations to some degree. Figure 8-2 displays the US economy's consumer price inflation and growth in real GDP since 1947. The average annual rate of inflation over this period was 4.2% with some years as high as 14.4 % and others as low as –1.2 %.

Figure 8-2: Annual Percent Change in CPI-U and "Real" GDP



Source: Bureau of Labor Statistics

Effectively dealing with uncertainty means that the financial plan is based on conservative economic assumptions that are consistent throughout the analysis. By consistent, we mean that the same inflation assumptions are applied to the cost side as to the revenue side.

From the perspective of cost estimates, conservative inflation assumptions would mean that inflation assumptions used in the analysis are higher than expected. However, higher inflation might be associated with an optimistic higher growth economic scenario. Faster economic growth may well be associated with higher construction costs due to labor and material shortages.

8.3.3.2 Scope and Design Risk

Two common and related causes of cost increases during project development are scope changes and design changes. Scope changes may include changing the project length or number of stations along a transit line. Design changes result from changes in the specific design elements of the project.

Uncertainty about specific design elements is a critical source of risk to project cost estimates. Significant design changes occur on an all too regular basis requiring additional funding or reductions in the project scope to maintain financial feasibility. Design changes are often driven by technical factors surrounding a variety of design alternatives. Only after some amount of engineering work will the definitive design choice be made. Sometimes, design choices are driven by political considerations, financial constraints, or the need to minimize or mitigate environmental impacts.

As an example, consider a segment of a rail transit project with three possible design options to deal with grade crossings: full grade separation, grade separation at key crossings, and upgraded crossing protection. Upgraded crossing protection is the cheapest option, but may be unsightly, disruptive to traffic, and more dangerous. Providing grade separation at key crossings seeks to improve safety and reduce disruption at the most critical points at some added expense. The full grade separation option is very expensive, but provides the best transit operating characteristics, is the safest, and least disruptive to traffic. The costs could range from $75 million for crossing protection upgrades to $100 million for key crossing separation to $150 million for full grade separation. The choice of design will depend on political considerations regarding the affected corridor and the amount of funding available. Technical considerations may also drive the design choice if site conditions prevent certain construction activities or if utility relocation problems preclude some grade crossing separations.

The temptation for a planner is to assume the cheapest option. The lowest possible cost estimate makes the project more politically appealing, easier to fit into long range plans and TIP's, and more popular with the public. This would be imprudent and misleading since there is a real possibility that the segment could be 100% more expensive. Using the lowest cost estimate would be a critical mistake. Cost increases later in project development breed distrust among voters, strain local resources and can cause political support for projects to evaporate. There are many examples of projects that have been brought to the beginning of construction only to collapse under cost overruns. Opponents of transportation projects, both transit and highways have been using the dismal cost estimation record to date to argue against critical projects. If citizens and political leaders believe that costs generated in corridor planning are likely to double by the time construction starts, many will be unwilling to support planned projects.

A prudent approach is to estimate the expected value of the segment cost by assigning probabilities to each design option. The intent is to develop segment cost estimates where there is a 50 percent chance of exceeding the cost estimate and a 50 percent chance falling below the cost estimate. If every segment cost estimate is developed this way, cost overruns on one segment will be balanced by lower costs on other segments. In addition, the foundation for developing cost ranges is readily available.

In the example, consider the following calculation where the probability of crossing protection upgrades is 10 percent, 50 percent for the key crossing separation approach, and 40 percent for the full separation option. The expected value of the cost for this segment is as follows:

$$E(C_i) = P[cp] \times C_{cp} + P[kc] \times C_{kc} + P[gs] \times C_{gs}$$
$$= 10\% \times \$75{,}000{,}000 + 50\% \times \$100{,}000{,}000 + 40\% \times \$150{,}000{,}000$$
$$= \$117{,}500{,}000$$

where

C_i	is the capital cost of segment i
cp	indicates crossing protection upgrades
kc	indicates key crossing separation
gs	indicates full grade separation
P	is an probability operator
E	is an expected value operator

In this example, the cost estimate for this segment is $117.5 million, but could cost as much as $150 million (a significant probability) or as little as $75 million (which is unlikely). It is crucial for financial planning to understand both the probability of achieving a particular outcome and the likelihood of the other possibilities. The critical factor in developing these estimates is the probabilities assigned to each design or scope option. As projects move toward implementation, some design options are rejected and the probabilities of choosing particular options change. As this information becomes available, cost estimates must be refined to reflect current realities.

8.3.3.3 Construction Risk

Uncertainty regarding unit costs and unforeseen construction problems may be termed construction risk. Within the construction risk category, unit cost estimates are generally the most certain. Engineers know what a ton of ballast costs, how much a rail tie or a mile of 136 lb. rail costs. These costs are relatively easy to obtain and change only slightly year to year. The main source of construction risk is related to unforeseen construction problems that in turn cause scheduling delays compounding the cost overrun.

Many examples of project cost overruns have been caused by construction difficulties associated with right-of-way acquisition, utility relocation, and unforeseen soil problems. Right-of-way cost increases can stem from the erratic nature of the real estate market with rapidly increasing prices under certain market conditions. Some rail projects are planned with minimal need for right of way such as a surface street light rail line, but small changes in design or alignment can necessitate the acquisition of expensive property parcels. In older cities, the utility maps may be incorrect leading to surprise relocations of sewer and water lines or other infrastructure. Poor soil conditions can also require large expenditures for stabilization.

Potential construction cost risk can be minimized by focusing extensive engineering effort on areas with the most uncertainty, testing for utility locations, taking numerous soil samples, etc. However, the level of engineering effort needs to match the level of project development and prudent decisions need to be made about focusing engineering effort on the areas of highest risk.

In corridor planning, cost estimates should begin with the early development of rough capital cost estimates for each alternative. These cost estimates are developed within a cost structure where each project segment and broad cost category is defined and carried through the project planning and development process. At the earliest possible stage, the areas of greatest construction risk and their likely locations should be identified including:

- right-of-ray;
- tunnels and elevated structures;
- bridges;
- utility relocations;
- environmental mitigation; and
- any other area where construction difficulties could significantly affect the final cost.

Cost ranges should be applied to each project segment based on the amount of uncertainty involved. For each segment, a best case cost estimate and a worst-case cost estimate should be prepared. For instance, if the segment in question is a tunnel, the range of potential construction costs needs to be estimated including a cost estimate that considers the conditions that would produce the highest conceivable cost, a "median" or "expected" cost estimate, and the cost that would result if no problems arise.

The variation in the potential construction cost due to random or unexpected factors is handled by contingency. Contingency is based on construction risk. This is the construction budget line item that is set aside for unexpected or incidental project costs. Construction cost contingency is traditionally applied as a fixed percentage of the various cost categories with varying percentages depending on the category. For instance, right-of-way acquisition may have one contingency percentage, while construction may have another, while vehicles may have another still. This practice is meant to capture the underlying risk of various cost categories.

8.3.3.4 Schedule Slippage

Aggressive scheduling of the initiation of project construction is common in transit planning. Grantees with proposed projects in alternatives analysis and preliminary engineering occasionally present financial plans that assume construction beginning as soon as two or three years in the future. As projects move through the project development process, the planned construction date frequently becomes later and later. Fairly typical is a 10 to 15-year process between initial planning study and the initiation of revenue service. For instance, St. Louis Metrolink planning began in 1981, the Draft Environmental Impact Statement (DEIS) finished in 1984, the FEIS was completed in 1987, construction began in 1990, and the initial segment completed in 1994. That project, which is typical, took 13 years from the beginning of project planning to initiation of revenue service.

Unrealistic assumptions about project scheduling can cause undue apparent cost escalation. If cost estimates are presented in constant dollars, every year will result in higher costs as the inflation experienced in the past year is reflected in new project costs. FTA suggests that project sponsors present capital cost estimates in year of expenditure dollars to avoid the appearance of continual cost increases that are not real. In addition, any schedule slippage appears as a cost increase, even if the constant dollar cost estimate remains the same. For this reason, conservative assumptions about planning, design, and construction schedules will pay off later in terms of fewer apparent cost increases and the potential for lower costs if the project sponsor actually beats the assumed schedule.

8.3.4 Cash Flow Requirements

The financial analysis of a proposed transit project requires an estimate of the funding stream needed to implement the project. The key inputs to this analysis are the cost estimate in as much detail as is available, a reasonable schedule for initiating construction, the length of the construction period, the distribution of costs over the construction period, and forecasts of the relevant inflation rates between the base year of the cost estimate and the end of the construction period.

Once a project begins construction, the schedule is quite well defined by the engineering work and contracts that govern construction. Financial plans that include proposed major capital investments must take the proposed schedules and costs and project the cash flow needs of the project sponsor to meet the schedule.

8.4 Operating and Maintenance Cost Estimates

This section briefly summarizes the process of estimating operating and maintenance (O&M) costs for both the existing system and the proposed project and describes how O&M costs are incorporated into the financial plan. Many transit agencies utilize detailed O&M cost models for budgeting purposes that can be readily extended to project O&M costs over the longer periods of time covered by the financial plan. Transit agencies can utilize a variety of methods for projecting O&M costs depending on the specific circumstances of the agency and the nature of the projects that are included in the financial plan.

8.4.1 Service Planning

Any acceptable O&M cost estimation methodology links costs to transit service levels. Regardless of the level of disaggregation, acceptable O&M cost models depend on assumptions about a set of service level indicators to calculate operating and maintenance costs. Expectations about the level of service in future transit operations is likely to be the most important driver of future O&M costs. Possible future operating scenarios could be the continuation of current services and service policies, major service redesign, and/or include the implementation of major capital investments.

Key level of service variables useful for projecting O&M costs are:

- number, type, and age of vehicles;
- platform hours;
- vehicle hours;
- vehicle miles;
- annual passengers;
- number of maintenance facilities/yards;
- number and type of stations;
- number of park and ride lots and spaces; and
- route miles.

These service variables can be accounted for by mode and time of day (at least peak/off peak). The service level variables are then combined with productivity factors or unit costs and summed to estimate operating and maintenance expenses. Clearly, the estimation of the service levels that are planned in the future is just as important as knowing the unit costs and productivity factors.

Estimates of these service variables draw on a number of sources including transit network representations and ridership forecasts from travel demand models, service plans, capital improvement programs, and rail and bus fleet management plans. At a minimum, the assumptions in the financial plan must be consistent with the assumptions used to derive regional travel demand estimates both for system planning and project planning.

8.4.2 O&M Cost Estimation Methodologies

Several O&M cost estimation methodologies are available depending on the data availability and the required specificity of the outputs. There is a trade-off between model specificity and the time and effort required to produce the results so special care must be taken to employ the methods that are adequate to the needs of the financial plan. For annual budgeting that requires a great deal of precision, the most detailed costing methods are usually appropriate. For long-range forecasts of up to 20 years, the uncertainly in the level of service forecasts can become more important than the errors inherent in a more aggregate approach. For long range forecasting, detailed O&M cost models may even provide a false sense of certainty when in fact they may turn out to be quite inaccurate.

All else being equal, the more disaggregate the O&M cost model, the more accurate the results. In addition, highly disaggregate cost models are far more useful for evaluating potential changes in the operating environment and circumstances of the transit agency. For some limited applications, simpler methods with less detail can give useful results and require much less effort and model maintenance. It is possible to forecast operating costs for a stable and steadily growing system using fairly aggregate cost models and still produce reasonably accurate forecasts. However, the introduction of new modes and major investments in vehicles and facilities generally require more detailed analysis.

8.4.2.1 Cost Allocation Models

An aggregate cost model that has been commonly applied in the past is the cost-allocation approach. Cost allocation models assign each line item of O&M costs from recent budgets to one of several service level variables. The costs assigned to each variable are summed and divided by the annual total for that service variable to produce a set of aggregate unit costs. The aggregate unit costs are applied to expected future service levels to estimate future O&M costs. Cost allocation models typically take the form:

$$C_t = c_{vm}(vehicle\_miles) + c_{vh}(vehicle\_hours) + c_{pv}(peak\_vehicles)$$

where C_t is total O&M cost and the c_x are unit costs associated with the various service factors. The benefit of this model is the ease with which it can be constructed and calibrated. The problem with this approach stems from the highly aggregate nature of the resulting model. Any changes in the service conditions on which the model was calibrated will create errors in future cost estimates. With a model that is highly aggregated, nearly any significant change can produce large errors. For instance, changes in the fuel economy of buses would be obscured by this model since all maintenance, fuel, and other mileage related costs are aggregated into the unit cost on vehicle miles.

Another example could be the change in the average speed of buses due to a busway project. Increased speeds can have multiple and complex effects on operating and maintenance costs, both in terms of fuel economy and, most importantly, in labor and capital productivity. Increasing bus speeds reduces the labor and capital requirements to provide a given service level since fewer buses and drivers can offer the same level of service. All productivity factors are combined in the unit costs on vehicle hours in the cost allocation model so that the impact of a change in one of those factors cannot be reflected in the aggregate model.

8.4.2.2 Regression Analysis

Regression analysis is an aggregate approach to forecasting costs that is technically similar to the cost allocation approach described below. This method uses a time series of data on total O&M costs and variables that influence those costs such as vehicle hours, wage rates, route miles, etc. and uses the information to estimate the causal relationship between the cost drivers and total O&M costs. A time-series regression analysis could look like the following example:

$$c_t = a + b_1(vehicle\_miles_t) + b_2(route\_miles_t) + b_3(average\_wage_t) + \varepsilon$$

where

c	is O&M cost
a	is the estimated regression constant
b_1, b_2, b_3	are parameters to be estimated
t	indexes the year
ε	is the residual or error term.

Specialized statistical software[6] is usually employed to perform regression analysis using as much historical data as is available. Various combinations of variables are tested to find the model that "fits" the data the best. Then a forecast of future service levels is prepared based on service plans. The estimated causal relationships between service levels and costs are assumed to stay the same in the future, allowing the analyst to forecast total O&M costs based on expected future values for the service levels chosen for the particular regression model.

The analyst could use this method to produce more detailed information by preparing separate regression equations for each mode. This added level of detail would account for planned changes in the relative service levels of each mode. This method will still be inappropriate if other major changes, such as major new vehicle purchases, capital rehabilitation projects, or new labor agreements, have the effect of changing the past observed relationships between service levels and O&M costs. The regression analysis method is generally best when the agency is stable and changes little from year to year.

The simplest form of the regression analysis method is trend analysis. Trend analysis does not attempt to break down O&M costs by components or unit costs, but simply observes past O&M cost growth and assumes continued growth in the future. Often, a trend analysis separates the impact of inflation from "real" growth in O&M costs and forecasts these impacts individually. This method

[6] EVIEW, LIMDEP, SPSS, and SAS are a few of the packages available for performing regression analysis and many other types of statistical analyses.

requires no statistical software to perform, but it remains a regression analysis of the form:

$$c_t = b(c_{t-1}) + \varepsilon$$

where c_t is total O&M costs (in real terms[7]) in year t and b is the growth factor estimated from historical data. If expenses have been observed to grow at 3 percent per year, b would equal about 1.03. The equation above states that O&M costs is year t equal the previous year's O&M cost plus 3 percent. This approach is only useful for projecting very stable future operating scenarios. If service levels are growing or any new projects are planned, this approach is too simplistic to be useful.

8.4.2.3 Resource Build-Up Models

The class of models referred to as "resource build-up" or "causal factors" models are a disaggregate method that allows the evaluation of O&M costs in great detail. Cost projections are made by estimating actual quantities of items required to provide the projected service levels, such as labor, fuel, and tires, and multiplying these quantities by productivity ratios and unit costs. At the most detailed level, a resource build-up model is akin to preparing an operating budget for the years that the projections are made. Resource build-up models provide the most accurate and defensible cost estimates and are preferred by the FTA for project and transit agency planning. The method is time-consuming and data-intensive and requires a reliable source of detailed cost and productivity information as well as reliable projection of service levels.

A resource build-up model represents O&M costs in a series of equations of the form:

$$c_{it} = service\_units \times (resources / service\_unit) \times resource\_unit\_cost$$

where c_{it} is the O&M cost for category *i* in year *t*. Service units could include vehicle miles, vehicle hours, peak vehicles, yards, stations, garages, track or route miles, and passengers. Productivity measures are expressed as the number of a particular resource needed to provide one unit of service. These productivity measures are given by measures such as "number of mechanics per vehicle mile" or "gallons of fuel per vehicle mile". The unit cost is expressed in terms such as "annual wage per mechanic" or "average cost per gallon of fuel".

When forecasting costs for existing services, resource build-up models can be very accurately calibrated to existing service levels, productivity levels, and unit costs experienced by the transit agency. New modes require some "borrowing" of productivity and unit cost data from similar projects in other areas and some extrapolation of costs based on the existing system. When cost data is used from other agencies, it is important that the O&M cost model make use of data from

[7] adjusted to remove the impact of inflation.

agencies that can be reasonably expected to experience similar expenses. For instance, the "borrowing" of productivity measures must account for site-specific factors that impact productivity, such as weather, age of the system, technical specifications and service levels. Resource unit costs such as wage rates and fuel costs vary depending on location and must be adjusted accordingly.

Productivity Ratios

Productivity ratios are critical to the resource build-up approach. These ratios describe the how labor and materials vary with service levels. The financial planner must recognize that operating conditions and vehicle types have a major impact on productivity ratios. Average speed can be a critical factor in forecasting changes in productivity rates over time. If future congestion levels slow down bus routes by 10 percent, the productivity of the bus operator and the vehicle itself declines by 10 percent because to maintain the same level of service with slower speeds requires additional buses and drivers. In addition to the need for more drivers and equipment, fuel consumption rates also change with average speed. Different vehicle types also have different productivity ratios. Productivity ratios change as vehicles and infrastructure age and require more maintenance to maintain a constant level of service. The preferred approach for resource build-up models is to model each vehicle type separately so that these differences can be explicitly accounted for in the projections. If vehicles are combined into a "composite" vehicle type, the productivity ratios associated with that vehicle must change with projected changes in the mix of vehicles in the fleet.

In the short run, productivity ratios can take three forms: continuously variable, step-wise variable, and fixed. The marginal cost of a continuously variable item is directly related to the level of service and remains the same over the range of service levels. Continuously variable productivity ratios include fuel use, electric power, and mileage-based maintenance among others.

Some items vary in steps rather than continuously with the level of service. The marginal cost function of these variables looks like a staircase. A good example of a step-wise variable is building maintenance. Regardless of the level of service, the maintenance expenses of a particular building remain largely the same. However, at some level of service an additional building is required and additional maintenance expenses are incurred, which produces a "step" up in building maintenance expenses. These step-wise productivity ratios change with specific increments of service, such as the peak vehicle requirement, where the specific increment is determined by the number of additional peak vehicles that would require an additional maintenance facility.

Fixed costs are those items that have a marginal cost of zero over the expected range of service variables. Some administrative functions, such as the general manager's office, personnel, and legal services, may fall within this category.

In the long run, almost all costs are likely to be continuously variable. The reason is that service expansion necessarily creates additional responsibilities for existing staff. Leaving staff levels constant in the face of service expansion means that less attention is paid to prior responsibilities. This will cause some additional costs, through lower efficiency, to be incurred by the transit agency. Costs incurred may only become apparent in the long term. For instance, multiple service expansions in the future will undoubtedly cause higher staffing. The cost of these new staff positions can be partially attributed to the first service expansion, even though staffing did not expand until later. Finally, service expansions can cause long-term escalation in salaries net of inflation to account for the additional productivity demanded by the higher levels of service. Cumulatively, these impacts mean that nearly all productivity ratios should be treated as continuously variable in the long run.

Unit Costs

Unit costs are generally derived from well-established experience of the transit agency and comparable figures from other transit agencies when required. However, operating conditions can have a major impact on unit costs, particularly in the areas of labor. One of the most important categories of unit costs is operator wages and benefits. These items usually constitute 50 percent or more of total operating costs and are difficult to model accurately. If the type of service, composition of the workforce (full-time, part-time, over-time, and extra-board operators) and the peak to base ratio of the service in the future is similar to the calibration period, then the labor cost projections can be fairly accurate. However, any changes in these factors can be a major source of error in the O&M cost projections. The O&M cost model should account for expected changes in the factors such as peak to base ratios and the labor agreements that affect the unit cost of labor inputs.

Uncertainty in future unit costs cannot be eliminated, but a solid O&M cost model will make assumptions about operating practices and labor agreements explicit. A solid financial plan will include a sensitivity analysis on all factors that are subject to significant uncertainty to understand the range of possible outcomes or each possible course of action given a clear set of assumptions.

8.4.3 Existing System Operating and Maintenance Costs

Funding decisions and the FTA's project rating and evaluation process rely on detailed financial information on proposed projects separate from the existing transit systems. In addition, FTA must evaluate the financial capability of the transit agency to continue to operate and maintain the existing system. For this reason, the financial plan must treat the existing system separately from any proposed major projects. O&M costs for any proposed major project must be developed and presented separately from the O&M costs of the existing transit network.

The operating characteristics of the existing system may change significantly as a result of a major capital investment. Bus service may be rearranged into feeder service. Headways might be shortened or different types of buses used for new or existing routes. All these changes must be documented and the impact on operating costs for the transit system estimated.

For the existing system, the resource build-up approach is the preferred method of forecasting O&M costs. The resource build-up approach can be supported by actual experience and existing plans and policies that dictate future services. Most of the components of resource build-up O&M cost models can be based on the standard cost and service factors tracked and reported by transit agencies for the National Transit Database. Existing labor and capital productivity can be expressed in terms of past operations and related to observable service levels. Projections about future expenses should be quite accurate in the immediate future for O&M costs associated with the existing system and expansions of that system that match the existing transit technology. Long term changes in productivity, unit costs, and service levels are very difficult to predict and quantify, but the resource build-up approach ensures that assumptions regarding these long-term changes are made explicit rather than hidden within the components of an aggregate cost model.

8.4.4 Project Operating and Maintenance Costs

Transit agencies planning major projects must prepare O&M cost estimates for the proposed project distinct from the existing transit system or other planned projects. FTA has long required that all major capital project planning use the resource build-up approach for the estimation of O&M costs because it offers the most detailed and accurate means of projecting O&M costs. The resource build-up approach has the benefit of making assumptions regarding productivity, staffing and unit costs explicit and comparable to the experience of other transit agencies.

O&M cost estimates for the proposed expansion of existing modes can rely on existing cost, productivity, and service data from the existing system. However, introduction of new modes requires that the experience of the existing agency be combined with the experience of similar operations at peer transit agencies. Cost data from other agencies must be appropriate to the proposed project and differences in agency operations clearly understood. If a project is proposed in the northeast, O&M costs should not be derived from projects in the southwest that do not have the freeze/thaw cycle that tends to increase maintenance of way expenses. Similarly, the age of the system and degree of deferred maintenance has an impact on the O&M costs of transit systems. The degree of outsourcing also impacts the labor productivity figures derived by transit agencies. Judgment is required in deciding which systems or mix of systems on which to base the O&M cost model and it is vital that these issues and the rationale for using specific peer agency data are documented before they are used in the financial model.

8.5 Forecasting Revenues

"Financial forecasting appears to be a science

that makes astrology look respectable."

Burton Malkiel, *A Random Walk Down Wall Street,* (1985), p.152.

This section describes the projection of revenues and the use of revenue forecasts in the development of the financial plan. Transit agency revenues can be grouped into seven major revenue categories, each with a different policy environment requiring different methods for projecting future revenues. These are:

1. operating revenues (fares and other);
2. dedicated tax and user fee revenues;
3. federal formula funds;
4. state and local appropriations;
5. capital grants;
6. borrowing; and
7. other sources.

Forecasting revenues for some sources is a highly structured statistical exercise, while others require only "reasonable" assumptions. Some revenue sources enter long-range plans temporarily, only to be replaced by other sources, or failing that, result in the cancellation of projects. The closer to actual construction, the more certain and committed the revenue source must be. In the long term, the financial plan is just that, a plan. The plan is not to be confused with certainty at one extreme nor a wish list at the other. The financial plan is a ***reasonable and defensible expectation*** of the future revenues and expenses of the transit agency.

8.5.1 Forecasting Operating Revenues

Operating revenues are revenues collected by the transit agency as a result of being the owner and operator of a transit system. The largest operating revenue category, by far, is fare revenues. However, numerous other operating revenue sources can be observed at various transit agencies, though these sources are generally a small proportion of total revenues. These other operating revenues include parking, advertising, concessions, and contract services.

8.5.1.1 Fare Revenues

The fare revenue projection is used to estimate the amount of revenue the transit agency will collect from user fees. Fare revenues are projected based on ridership forecasts and assumptions about fare levels for the existing and proposed system, and the structure of the fare system.

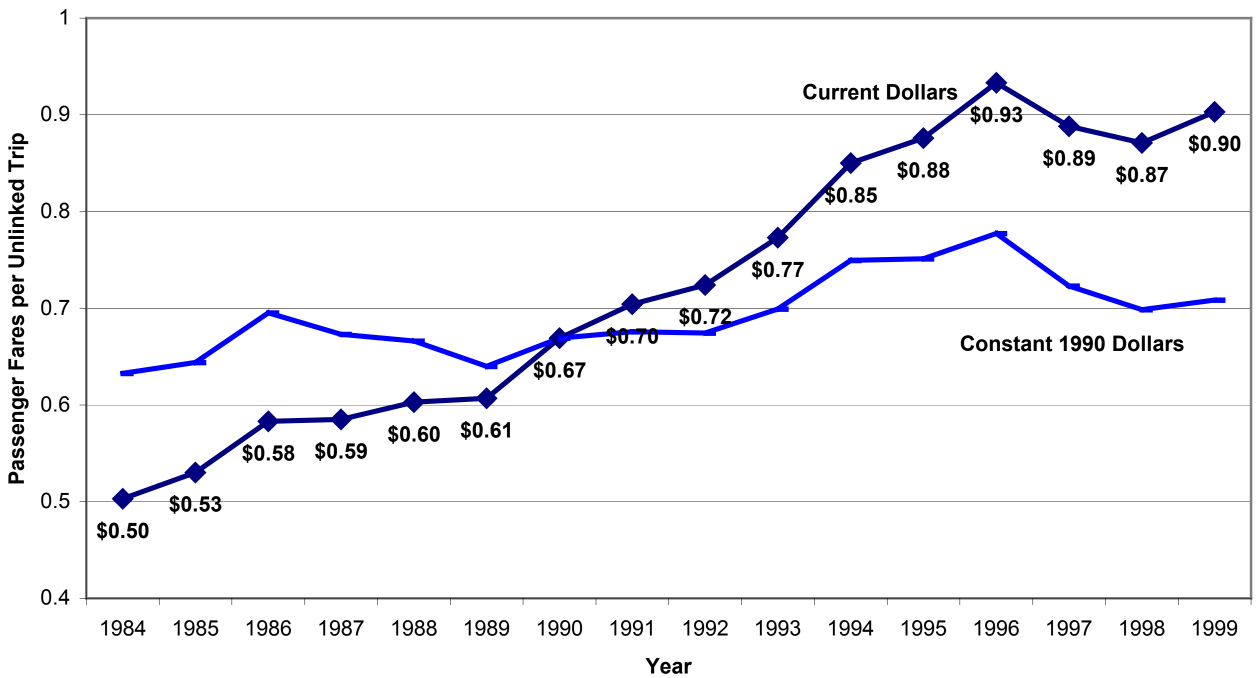
Fare Policy

Assumptions about future fare levels and the structure of the fare system are critical to forecasting operating revenues. Traditionally, fares are assumed to increase with the adopted inflation forecast. This assumption is quite likely a good one. Nationwide, increases in base fares have exceeded inflation by a solid margin. Between 1984 and 1999, APTA estimates that base fares have increased 91 percent compared to 60 percent for the Consumer Price Index for urban consumers (CPI-U).

APTA calculates fare revenues per unlinked trip that account for the impact of discounts and better reflect the actual fare structure than base fares. Average fare revenue per unlinked trip increased 80 percent between 1984 and 1999 implying that, on average, the fare structure of APTA members has been moving toward the increased use of fare discounting. Still, growth in fare revenues per unlinked trip exceeds the rate of inflation over much of the past two decades. Figure 8-3 shows that fare revenues per unlinked trip have increased in real terms (adjusted for inflation) with two multi-year periods of declining fares in real terms.

Transit agencies do not generally increase fares every year. Fares may go many years before finally moving in one large adjustment to a new level to compensate for inflation. If the financial plan assumes annual increases to keep pace with inflation, fare revenues will be overestimated. The financial plan should project fare increases at increments that reflect the historic time lag between fare increases for the transit agency in question. For long range financial planning and in the absence of any other plans to the contrary, assuming a constant fare structure and periodic fare increase to keep pace with inflation is likely to be a good assumption.

Figure 8-3: Growth in Fare Revenue per Unlinked Trip, 1984-1999



Source: APTA for fare data, Bureau of Labor Statistics for CPI-U.
Note: Figures based on unweighted sample of 300 APTA members.

The degree of detail applied to the revenue forecasting exercise depends on the nature and scope of the change under consideration. Evaluating a change of fare policy, either fare structure, fare levels, or both requires a fairly detailed analysis of the revenue impacts. If the financial plan is supporting the introduction of a new transit capital investment under an existing fare structure, the forecasting of fare revenues can be quite simple.

Evaluating a change in the fare structure or the short run impacts of a fare increase should be supported by a thorough evaluation of the following:

- change in the proposed fare structure;
- the nature of the target market segments;
- special subsidies for specific groups (elderly, students, handicapped, etc.);
- peak period fares or premium priced services;
- transfer policies;
- pricing of multiple use fare instruments;

- the price sensitivity of riders in each target market segment; and
- ridership for each of the target market segments.

The fare structure defines the target market segments and specifies the relative fare level paid by each group. Cash fares are established for each fare category (e.g. express, peak, off-peak, elderly, etc.) Then a fairly detailed analysis of travel demand is required for each target market segment.

Travel Demand Estimates

Travel demand must be forecast for the existing and proposed system to derive fare revenue forecasts. Ridership is based on fare policy, service levels, and regional demographic changes. Fare policy and service levels are frequently developed through an iterative process accounting for the expected ridership and revenue impacts and subject to local political and financial considerations.

The regional travel demand model is not run for every year in the forecast period because data on population and employment is not available annually. The regional travel demand model is generally run for some base year, the opening years of any major capital investments, and for a forecast year, typically 20 to 25 years in the future. In some cases, forecasts for 5 or 10-year increments are available. Most regional travel demand models assume riders pay the full cash fare and almost always assume that fares are constant in inflation adjusted terms.

If the agency is interested in long range planning or project level evaluation within an existing fare policy, the financial plan will generally use the output of the regional travel demand model, or the network model used in project planning, to get point estimates of system-wide and project level ridership. Regional network models generally are disaggregated by market sector (usually income or auto ownership is the stratification) so that ridership estimates are available by market sector. The agency then may “fill in the blanks” between the available estimates through trend analysis (interpolation).

If the agency is planning to change the fare structure or level, the transit agency must typically apply a separate model to prepare annual ridership estimates that are sensitive to the projected fare policy changes. Elasticity models are normally used to estimate ridership changes resulting from changes in fare policy. Elasticity models require previous (or current period) ridership and fare policy information to forecast future conditions, unlike network models that “build up” ridership forecasts based on population, employment, land use, and the relative cost of transportation. Elasticity models should be disaggregated by time of day (peak, off-peak), income strata, and mode (bus and rail) if possible, since evidence suggests that fare elasticities are significantly different between these distinct transit markets. Ideally, elasticity estimates will be determined using data from the specific region where they are being applied. A detailed discussion and guide to using fare elasticity models to forecast transit ridership can be found in the APTA report, *Fare Elasticity and Its Application to Forecasting Travel Demand (1991).*

Preparing Fare Revenue Forecasts

After fare policy assumptions and annual travel demand estimates are complete, fare revenues forecasts may be prepared. The first step is to project fare revenue based on assumed fare policies and travel demand estimates, preferably disaggregated by travel market (user groups and time periods) to achieve the most accurate forecasts. Gross fare revenue is found by summing across market segments.

Complicating matters is the fact that travel demand models use the actual cash fare to describe the price of a trip rather than the actual revenue per trip. Monthly, weekly or daily passes, student or senior citizen discounts, special promotions, and fare evasion will make the average revenue per trip significantly lower than the cash fare. To account for this effect, the fare revenue forecasts should be multiplied by a "discount factor" calculated from existing revenue and ridership data.

It is possible to develop an average system-wide discount factor that converts the cash fare into average fare paid per rider by dividing existing fare revenues by the revenue that would be generated if all passengers paid full fare for their route. Fare revenue forecasts are calculated by multiplying the projected ridership by the cash fare assumption and multiplying again by the discount factor. This factor can be applied to other alternatives and proposed projects to generate revenue forecasts.

An average discount factor applied across all transit markets could distort fare revenues to the extent that new projects or future services serve travel markets different from base year conditions. If the population is aging, senior citizen discounts may be relatively more important. Low-income travelers making non-work trips tend to use cash fares more frequently than other market sectors. If this market sector becomes more or less important relative to other markets, the average discount factor may introduce added distortions.

For the best results, the financial planner would estimate a set of discount factors for each distinct market sector in the travel demand forecast and explicitly account for changes in the type of trips attracted to future services. These discount factors would be applied to the fare revenue forecasts for each market sector, then summed to calculate fare revenues. The disaggregate method generally requires on board surveys that include detailed fare payment and demographic information.

The operating financial plan should document the base fare, the average fare paid per rider (accounting for the discount factor), and the ridership forecast. Annual fare revenue forecasts are shown as the product of average fare and ridership within the financial plan. Documentation of the methods and procedures used to estimate ridership, average fares, the fare discount factor and the level of disaggregation should be referenced and available.

8.5.1.2 Other Operating Revenues

Other operating revenues, including parking, advertising, concessions and contract services, are generally a small portion of most operating budgets. For example, the New York MTA collects about 2.5 percent of all revenue from non-fare operating revenues. MARTA in Atlanta receives about 1.25 percent of all revenue from non-fare operating revenues. Some of these revenues are generally sensitive to passenger loads, such as parking and some advertising and concessions, while others such as contract services and external vehicle advertising, may be unresponsive to passenger volumes.

Vehicle advertising revenues can be extrapolated from past experience or, in the case of introduction of a new mode, comparable transit agency data may be used. Station advertising can be extrapolated from past experience or peer transit agencies with adjustments for the strength of the local outdoor advertising market. Concession revenues can be estimated from past experience or from peer transit agencies with adjustments for passenger volumes at the concession facilities. Forecasts of contract service revenues should only be based on past agency experience.

Other operating revenues are generally a consistently growing, yet small amount of revenue. The financial plan should break out each revenue category and forecast growth separately for each if significant revenues are anticipated from one of these sources in the future. However, if these revenues are expected to remain generally trivial amounts, they may be aggregated into a single category and inflated based on historical growth patterns.

8.5.2 Forecasting Tax and User Fee Revenues

Dedicated taxes and user fees are an increasingly common way to fund transit operations and projects. Examples include general sales taxes, property taxes, targeted taxes (gas tax, rental car tax, hotel tax, etc.), vehicle license fees, and tolls. These types of funding sources can provide a great deal of revenue that can be stable and grow with regional population and economic activity. The transit agency can have a good deal of confidence in yearly funding levels in comparison to depending on annual appropriations from state or local governments. In general, the broader the tax, the more dependable and predictable the revenue stream. General sales taxes are the most stable and dependable widely used tax revenue source.

Dedicated taxes and user fees are usually major revenue generators for the agencies that have them. These revenues can support pay-as-you-go financing for major projects, serve as collateral for bonds issued to fund major projects, and provide a large percentage of the operating budget of many transit agencies. The importance of these revenues to the financial structure and health of many transit agencies demands a detailed and defensible forecast of future revenues.

Tax and user fee forecasts are generally produced using trend analysis or regression analysis. Trend analysis is easy to understand and apply, requires little data beyond historical revenue figures, and is relatively accurate for short range forecasting. Trend analysis is performed by calculating past revenue growth rates, preparing some assumptions about likely future revenue growth based on past experience, and using these growth assumptions to estimate future revenues.

Multiple regression models are more complex but produce better long range forecasts and provide a much deeper understanding of the factors that drive revenue growth. Regression analysis is a statistical technique that allows the analyst to estimate the sensitivity of various revenue streams to regional economic conditions or other factors that influence revenues. Financial analysts not already familiar with multivariate regression techniques are directed to other guidance[8] or a good econometrics textbook.[9] ***The Technical Addendum to this chapter provides a detailed example of the development of a regression model and forecasts for retail sales.***

The regression based forecasting process consists of the following steps:

1. Collect historical data on regional economic indicators and revenues;
2. Develop or purchase long term economic forecasts for the region to serve as the base assumptions for revenue forecasts;
3. Estimate the relationship between some of the economic indicators and the tax base of the revenue source using statistical techniques (multiple regression analysis) and historical economic and revenue data; and
4. Calculate the resulting tax revenue for each year in the analysis period using the estimated statistical relationships and the forecasted regional economic indicators.

[8] Such as *Transportation Revenue Forecasting Guide*, US Department of Transportation, 1987 or *State Revenue Forecasting and Estimation Practices*, Federation of Tax Administrators, March 1993.

[9] Such as Frank, Howard A., *Budgetary Forecasting in Local Government: New Tools and Techniques*, Quorem Books, 1993 or Newbold, P. and Bos, T., *Introductory Business and Economic Forecasting*, Southwestern Publishing Co., 1994.

While not prohibiting the use of trend analysis for financial planning, the US Department of Transportation has long cautioned against using trend analysis in long range forecasts in transportation plans.

> "Because trend analysis is unable to objectively account for changes in trends and ultimately in turning points, its usefulness (accuracy) deteriorates with the length of the forecast….While this criticism actually applies to all forecasting techniques, it particularly applies to straight line extrapolations. The forecaster then is advised to be extremely careful in applying this technique to any long term forecast." Page 5-8 in *Transportation Revenue Forecasting Guide, FHWA/UMTA, US Department of Transportation, 1987.*

In choosing a forecasting method, the financial analyst should consider the importance of the funding source to the financial success of the agency and the importance of forecast accuracy to supporting the financial plan. If the revenue source is not a critical element of the financial plan or if even the most pessimistic assumptions regarding revenue trends still produce revenue forecasts that easily exceed planned expenditures, trend analysis may be sufficient.

In cases where a tax or user fee is a critical element of the long term health of the transit agency and the success of the transit agency's financial plan hinges on realizing continued growth in that revenue source, regression analysis is the preferred method for forecasting these revenues. Regression analysis allows the forecaster to understand the factors that drive revenue growth and can use this information to inform the financial planning process.

In the past, some areas have experienced wide variations in their revenues from sales taxes. Understanding the impact of economic conditions on local tax and user fee revenues can provide advance information about the expected change in revenues in the short term and help agencies plan accordingly. For instance, some transit agencies rely on taxes linked to visitor travel (such as hotel taxes or car rental surcharges). If trend analysis is used to forecast these revenues, the financial analyst will most likely not have a good idea about how much revenues would decline if visitor travel declined suddenly due to economic or other factors. A regression model would allow the financial analyst to anticipate the magnitude of the expected revenue decline much more rapidly and accurately because the causal link between visitor travel and tax revenues would be known.

Regardless of the method used, there is a good deal of inherent uncertainty in any forecasting exercise. The economic forecasts that serve as the drivers of the tax revenue forecasts are uncertain. The statistical relationships between tax revenues and economic indicators are uncertain. Future policy changes, such as changes to the tax rate or tax base, can also cause actual revenues to deviate from expectations. The financial plan should include a detailed sensitivity analysis to understand the impact of the range of economic and policy scenarios on the expected revenue stream.

8.5.3 Economic Forecasts

Economic indicators are external to the transit operator, but affect service needs and revenues. Forecasts of economic conditions are used for planning future service levels, for generating travel demand forecasts, for preparing revenue forecasts, and for estimating certain future costs. Useful economic indicators include interest rates, inflation rates, employment and population growth and their spatial distribution, income growth, and certain types of economic activity. Service levels and travel demand forecasts depend on the level and distribution of population and employment. Labor costs depend on service levels and inflation forecasts. Debt service costs depend on interest rate forecasts. Tax and user fee revenues depend on some or all of these economic variables.

Economic forecasts come from a variety of sources. They may be purchased from economic forecasting firms, or obtained from economists at local universities or government agencies. Any reputable, unbiased source is acceptable.

Regardless of the source chosen, transit agencies should follow three basic principles in their use of economic forecasts:

1. Identify the source for all forecasts;
2. Use the same economic forecasts in all areas of transit planning; and
3. Develop a range of internally consistent economic scenarios.

The benefit of using a complete set of economic forecasts from a single source is that all of the data will be consistent. A set of economic forecasts will be based on a single economic forecasting model and all the economic indicators will at least be related to each other in ways that make theoretical sense. Higher inflation means that interest rates will be higher, labor costs may rise faster with low unemployment, while rapid employment growth usually accompanies rapid population growth. Using a consistent set of economic indicators ensures that forecasts based on different indicators are economically coherent.

The transit agency must also ensure that all areas of transit planning make use of the same set of forecasts. If the service plans use different economic forecasts than the regional travel demand forecasts, decisions could be made based on contradictory information. The transit financial plan must be based on the same information used to develop ridership forecasts and service plans. These forecasts should be consistent with the forecasts used in the metropolitan planning process to prepare the long-range transportation plan.

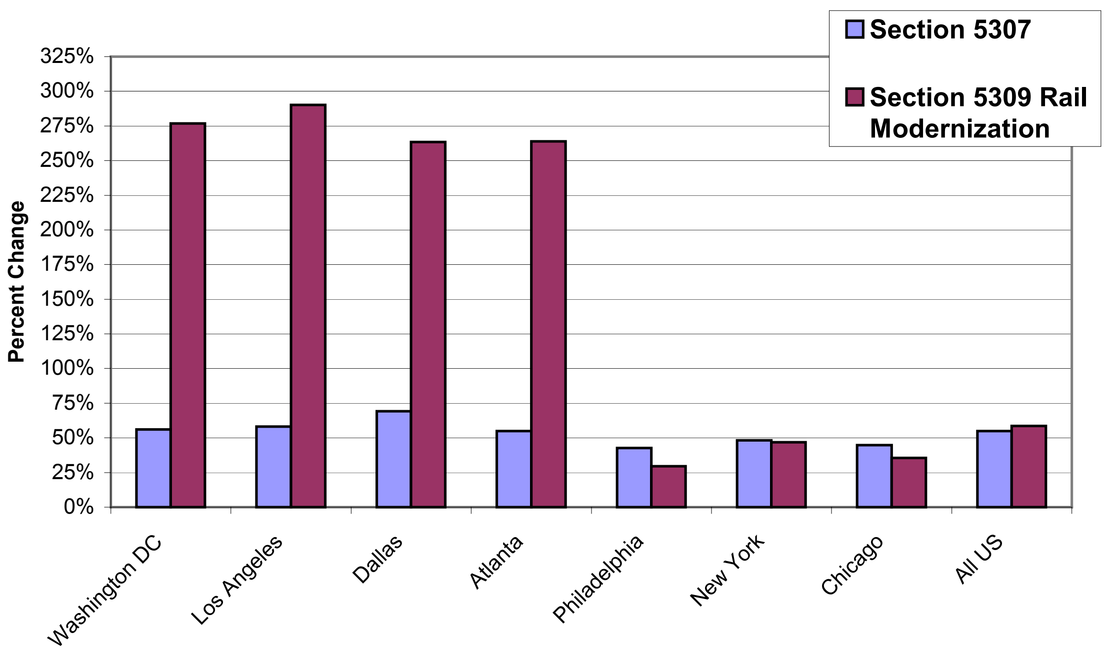
Economic forecasting firms and universities will usually provide a set of economic scenarios to represent a range of possibilities. These scenarios almost always include a high growth and a low growth scenario. These alternative scenarios should be the basis on which sensitivity analysis is performed with respect to economic conditions. These scenarios are superior to simply altering economic indicators on an ad hoc basis since they present coherent sets of economic information with a firm theoretical foundation.

8.5.4 Projecting Federal Formula Fund Revenues

Federal formula funds provide a significant amount funding for the capital maintenance and project funding needs of transit agencies. Depending on the transit agency, federal formula funds can provide more than half the total capital budget. Projecting the revenues from federal formula programs can go a long way toward nailing down the revenue forecasts for the transit agency. Since these funds are subject to annual appropriations and not directly tied to economic conditions, the methods used to forecast revenues from these sources is much more ad hoc.

Moreover, the revenues from the formula programs cannot be projected only by projecting the future size of the federal program. The recipient must also ascertain the relative standing of the region compared to other regions around the country. Figure 8-4 displays the change in transit formula funding for a selection of metropolitan areas and total formula program growth between 1996 and 2001. The characteristics of the metropolitan area and the transit system have a major impact on the growth in federal formula funding to specific regions.

Figure 8-4: Total Growth in Formula Funding Allocations for Selected Metropolitan Areas (1996-2001)



The following sections describe the funding programs and the methods used to develop funding assumptions for the future. The focus is federal programs for urbanized areas, though transit agencies in non-urbanized areas could apply the principles contained here to develop funding assumptions for the Section 5311 Non-Urbanized Area Formula program.

8.5.4.1 Section 5307 Urbanized Area Formula Program

The Section 5307 Urbanized Area Formula Program makes Federal resources available to urbanized areas and to Governors for transit capital and operating assistance in urbanized areas[10] and for transportation related planning. Eligible purposes include planning, engineering design and evaluation of transit projects and other technical transportation-related studies; capital investments in bus and bus-related activities such as replacement of buses, overhaul of buses, rebuilding of buses, crime prevention and security equipment and construction of maintenance and passenger facilities; and capital investments in new and existing fixed guideway systems including rolling stock, overhaul and rebuilding of vehicles, track, signals, communications, and computer hardware and software. All preventive maintenance and some Americans with Disabilities Act complementary paratransit service costs are considered capital costs.[11]

The preferred method for estimating future revenues from federal formula allocations would begin with the agency's past formula allocation and related growth. An estimate of the future growth of the federal transit program should be prepared based on growth trends of past funding levels. The formula used to distribute funds should be assumed to remain constant.

The funding is not distributed evenly among transit agencies as shown in Figure 8-4. Dallas increased its Section 5307 apportionments by 70 percent between 1996 and 2001, while Philadelphia's allocation increased less than 45 percent. The Section 5307 formula program is based primarily on fixed guideway vehicle revenue and route miles, bus revenue vehicle miles, population, and population times density. The growth of a given metropolitan area's transit service levels, population and population density relative to all other metropolitan areas of a certain size, largely determines the magnitude of the allocation of Section 5307 formula funds. For example, Dallas, with a rapidly growing transit system and region, received a growing share of the Section 5307 formula program while Philadelphia, with a slowly growing transit system and region, lost ground. The development of reasonable forecasts for future Section 5307 formula allocations requires some idea of the relative growth of a given region and its transit system relative to the national average.

Generally speaking, transit agencies in rapidly growing cities with rapidly growing transit systems will find that their formula funding grows slightly faster than the projected growth in the federal program, while slower growing metropolitan areas with large, established transit systems may find that their formula funding grows slower than the projected growth in the federal program.

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[10] An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the U.S. Department of Commerce, Bureau of the Census. Areas with a population of more than 200,000, may not use Section 5307 funds for operating expenses.

[11] In addition to Section 5307, the ELDERLY AND PERSONS WITH DISABILITIES program (Section 5310) provides formula funding to States for the purpose of assisting private nonprofit groups in meeting the transportation needs of the elderly and persons with disabilities when the transportation service provided is unavailable, insufficient, or inappropriate to meeting these needs. Funds are apportioned based on each State's share of population for these groups of people.

8.5.4.2 Section 5309 Fixed Guideway Modernization

A "fixed guideway" refers to any transit service that uses exclusive or controlled rights-of-way or rails, entirely or in part. The term includes heavy rail, commuter rail, light rail, monorail, trolleybus, aerial tramway, inclined plane, cable car, automated guideway transit, ferryboats, that portion of motor bus service operated on exclusive or controlled rights-of-way, and high-occupancy-vehicle (HOV) lanes.

Eligible purposes for Section 5309 Fixed Guideway Modernization funds are capital projects to modernize or improve existing fixed guideway systems, including purchase and rehabilitation of rolling stock, track, line equipment, structures, signals and communications, power equipment and substations, passenger stations and terminals, security equipment and systems, maintenance facilities and equipment, operational support equipment including computer hardware and software, system extensions, and preventive maintenance.

These funds are allocated by a statutory formula to urbanized areas with rail systems that have been in revenue service for at least seven years. The formula is based on the revenue vehicle miles and route miles of the fixed guideway transit system that have been in operation for at least seven years.

Transit agencies that have built large transit systems and extensions to existing systems in the last seven years will continue to take an increasing percentage of future rail modernization funding as the recently build sections reach seven years of age. The larger the recent investments that an agency makes relative to the size of the previously existing system, the greater the annual percent growth in formula allocations from Section 5309 Fixed Guideway Modernization, which is clearly evident in Figure 8-4.

Los Angeles, Dallas, Washington DC, and Atlanta all had very large gains in Section 5309 Fixed Guideway Modernization allocations while Philadelphia and New York were below the national average.[12] These allocations result from the relative size of the transit systems and the relative growth in service. New York Metropolitan Transit Authority (NY MTA) operates over 1,600 fixed guideway route miles compared to 103 for the Washington Metropolitan Area Transit Authority (WMATA). A 10-mile extension would increase NY MTA's system by just over 0.5 percent while the same 10-mile extension would increase WMATA's system by nearly 10 percent.

8.5.4.3 Incorporate Formula Funds into the Financial Plan

Traditionally, financial plans have assumed that federal formula funds grow at the rate of inflation. Under TEA-21, the funding levels for all major transportation programs were "guaranteed", providing a level of certainty in the annual funding stream that had previously been lacking. Federal program

[12] The figures for the high growth areas exceed the average by a large amount due to the small size of their transit systems relative to New York. The magnitude of the New York system and their resulting formula allocation for Section5309 Rail Mod is so large that it dominates the "All US" growth figures.

funding levels throughout TEA-21 exceeded the rate of inflation. Funding levels for authorization periods after TEA-21 are usually assumed to continue growing at the rate of inflation.

Every Metropolitan Planning Organization (MPO) prepares a Transportation Improvement Program (TIP) and a Long-Range Transportation Plan. The TIP describes the funding levels, sources and construction schedules for projects to be constructed over the next three to five years. The Long Range Transportation Plan describes the proposed projects and assumed funding levels from all sources over the next 20 years. The TIP and Long Range Plan are reviewed by FHWA and FTA to ensure that they are "fiscally constrained", which means that they are based on reasonable assumptions for all project costs, schedules and funding sources including federal formula funds. The financial plan for the transit agency should assume the same formula funding levels as those found in the local MPO's TIP and Long Range Plan.

8.5.5 Assumptions for Federal Grants

Capital grants are provided to fund some percentage of a planned project. The federal government provides capital grants in the form of Full Funding Grant Agreements (FFGAs) through the Section 5309 New Starts program. The Section 5309 Bus program provides capital grants for bus purchases and other bus related projects. Sometimes, state or local governments provide capital grants as lump sum appropriations to fund some share of planned transit projects. State and local governments rarely have dedicated grant programs, though there are exceptions. Consequently, state and local grants are generally secured as separate appropriations.

8.5.5.1 Section 5309 New Starts

This program provides funds for construction of new fixed guideway systems or extensions to existing fixed guideway systems. Eligible purposes are light rail, rapid rail (heavy rail), commuter rail, monorail, automated fixed guideway system (such as a "people mover"), ferries, busway/high occupancy vehicle (HOV) facilities, or an extension of any of these. Projects become candidates for funding under this program by successfully completing the appropriate steps in the major capital investment planning and project development process.

Major new fixed guideway projects or extensions to existing systems financed with New Starts funds, typically receive these funds through a FFGA that defines the scope of the project and specifies the total multi-year federal commitment[13] to fund the project. Funding allocation recommendations are made in a report to Congress called the *Annual Report on New Starts*.

Funding Amount

Theoretically, an agency planning a rail project could assume that 80 percent of the capital cost of the project will be funded by the federal government through

[13] subject to annual appropriations.

the Section 5309 New Starts program. Project sponsors are generally required to fund at least 20 percent of the project cost with non-federal funds. However, very few project sponsors receive a FFGA for 80 percent of the cost of a project. Proposed New Starts funding averages about 50 percent of total project costs with state, local, or other federal funding comprising the other half (see Table 8-13). Various proposals to legislate a maximum share of between 50 and 60 percent have been put forward.

Table 8-13: Funding Shares by Source for New Starts Projects, FY 2001

Phase	Federal 5309	Other Federal	Total Federal	State	Local	Total Non-Federal	Total ($M YOE)
Pre Eng.	**50.6%**	**3.8%**	**54.4%**	**17.3%**	**28.3%**	**45.6%**	**$21,715**
Final Design	**62.0%**	**15.6%**	**77.5%**	**12.7%**	**9.8%**	**22.5%**	**$2,762**
All Projects	51.9%	5.1%	57.0%	16.8%	26.3%	43.0%	$24,477

Current trends suggest continued pressure to reduce the share of project costs borne by the Section 5309 New Starts program so that more projects can be supported within federal resource constraints. Realistic financial planning will acknowledge these federal financial pressures and plan accordingly. Project sponsors should not generally assume 80 percent New Starts funding.

Payout Schedule

Even if a FFGA is signed specifying the funding amounts to be provided by the Section 5309 New Starts program, Congress does not always provide appropriations exactly according to the schedule set forth in the FFGA. To date, Congress has always provided the total federal share specified in the FFGA, but often does not provide those funds as planned by the project sponsor and set out in Attachment 6 (payout schedule) of the FFGA (see Table 8-14).

Table 8-14 clearly shows that funds do not always flow according to the payout schedule of a negotiated FFGA. Transit agencies need to expect and plan for deviations in the annual funding stream. Financial planners should note that several of these projects have a final FFGA payment year of FY 2002, yet do not receive the amount of the final payment. In particular, the Los Angeles North Hollywood extension was completed and operating during 2001, yet has about $40 million remaining to be paid in FY 2003 and beyond.

Table 8-14: Scheduled FFGA Payout vs. Actual Appropriations, FY 2002

Project	FY 2002 Proposed Budget	Final FFGA Payment Year	Final FY02 Approp-riations	Difference from FFGA Payout Schedule
BART Extension to the SFO Airport	80,610,000	FY 2006	75,673,790	(4,936,210)
Los Angeles- North Hollywood	49,686,469	FY 2002	9,289,557	(40,396,912)
Sacramento- LRT Extension	328,810	FY 2002*	328,000	(810)
San Diego-Mission Valley East LRT Extension	65,000,000	FY 2005	60,000,000	(5,000,000)
San Jose Tasman West LRT Project	113,336	FY 2002*	113,336	0
Denver- Southeast Corridor LRT	71,800,000	FY 2008	55,000,000	(16,800,000)
Denver- Southwest Corridor LRT	192,492	FY 2002*	192,492	0
Ft. Lauderdale-Tri-Rail Commuter Rail Upgrade	84,829,566	FY 2002	27,000,000	(57,829,566)
Atlanta- North Springs	25,072,274	FY 2003	25,000,000	(72,274)
Chicago- Douglas Branch Reconstruction	35,000,000	FY 2006	32,750,000	(2,250,000)
Boston- S. Boston Piers Transitway	11,203,169	FY 2002*	10,631,245	(571,924)
Washington, DC/MD- Largo Extension	60,000,000	FY 2005	55,000,000	(5,000,000)
Minneapolis- Hiawatha Corridor LRT	50,000,000	FY 2005	50,000,000	0
St. Louis- Metrolink St. Clair Extension	31,088,422	FY 2002	28,000,000	(3,088,422)
Hudson-Bergen MOS-1	151,327,655	FY 2003	141,000,000	(10,327,655)
Hudson-Bergen LRT MOS-2	0	FY 2008	0	0
Newark Rail Link (MOS-1)	20,000,000	FY 2004	20,000,000	0
Portland-Interstate MAX LRT Extension	80,085,904	FY 2005	64,000,000	(16,085,904)
Pittsburgh- Stage II LRT Reconstruction	20,000,000	FY 2004	18,000,000	(2,000,000)
San Juan- Tren Urbano	50,159,703	FY 2004	40,000,000	(10,159,703)
Memphis- Medical Center Extension	20,000,000	FY 2003	19,170,000	(830,000)
Dallas- North Central LRT Extension	71,200,000	FY 2004	70,000,000	(1,200,000)
Houston- Regional Bus Plan	95,459	FY 2002*	0	(95,459)
Salt Lake City- CBD to University LRT	15,000,000	FY 2003	14,000,000	(1,000,000)
Salt Lake City-South LRT	718,006	FY 2002*	0	(718,006)
Seattle- Central Link LRT-MOS-1	0	FY 2006	0	0
Total	**$993,511,265**		**$815,148,420**	**($178,362,845)**

Delays in receiving anticipated funding can cause delays during construction, cost overruns, and financial uncertainty for the project sponsor. For this reason, a solid financial plan will specify how the project sponsor will move the project forward even if federal funding is delayed. Short-term borrowing is one mechanism for smoothing out the funding stream. Other options include a locally funded construction reserve large enough to handle delays in receiving federal funds.

Many project sponsors worry that demonstrating they have adequate financial resources to fund a proposed project, even when federal funds are less than anticipated, may signal that they do not "need" the federal funding to construct the proposed project. Some grantees worry that this demonstration of strong financial position will ultimately result in lower federal funding for their projects. However, TEA-21 requires FTA to evaluate the financial capacity and capability of project sponsors to minimize risks to the completion and operation of federally funded projects. The determination of financial capacity and capability often depends on the ability of the project sponsor to demonstrate access to resources in excess of those required to fund planned construction costs.

Incorporate New Starts Grants into the Financial Plan

Section 5309 New Starts funding for a planned project should enter the financial plan according to three basic elements which are initially defined in alternatives analysis: the planned funding sources; the amount required from each source; and the anticipated project construction schedule. Early in project planning, these items may be uncertain, but cost estimates, implementation schedules, and the rough outline of the funding strategy will be complete at the end of alternatives analysis since this information is required before a project can be included in a regional Long Range Transportation Plan.[14]

The assumed Section 5309 New Starts funding (as well as other sources) should be included in the financial plan in the manner in which it is anticipated to be available. Often, only a rough idea of the funding amount is known early in the planning process. In this case, the percentage of total project costs anticipated to be borne by Section 5309 New Starts funding is calculated and applied to the annual construction expenses developed during capital cost estimation as shown in Table 8-15.

[14] Inclusion in the regional Long Range Plan prepared by the Metropolitan Planning Organization is required before FTA will approve any potential New Starts project to enter PE.

Table 8-15: Example Funding Schedule and Amount by Source

FISCAL YEAR	FEDERAL		LOCAL (26%)	TOTAL
	New Starts FFGA (50%)	CMAQ (24%)		
FY 00	$40,000,000	$19,200,000	$20,800,000	$80,000,000
FY 01	$55,000,000	$26,400,000	$28,600,000	$110,000,000
FY 02	$60,000,000	$28,800,000	$31,200,000	$120,000,000
FY 03	$65,000,000	$31,200,000	$33,800,000	$130,000,000
FY 04	$72,500,000	$34,800,000	$37,700,000	$145,000,000
FY 05	$67,500,000	$32,400,000	$35,100,000	$135,000,000
FY 06	$60,000,000	$28,800,000	$31,200,000	$120,000,000
FY 07	$45,000,000	$21,600,000	$23,400,000	$90,000,000
FY 08	$35,000,000	$16,800,000	$18,200,000	$70,000,000
TOTAL	**$500,000,000**	**$240,000,000**	**$260,000,000**	**$1,000,000,000**

As details about each funding source become known and precise amounts are committed, the annual funding stream from each source is adjusted. For instance, the CMAQ funding might be available in a constant annual payment of $30 million between FY 01 and FY 07. The demands for funding from the other sources must be balanced to reflect what is known about available CMAQ funding.

When an FFGA is signed, these funding amounts are set in the agreement. The Section 5309 New Starts payout should be included in the financial plan precisely as stated in the FFGA. As annual appropriations come in, the financial plan is updated to reflect actual receipts and funding amounts form other sources adjusted to maintain the project schedule.

8.5.5.2 Section 5309 Bus and Bus Related

Eligible project expenses for Section 5309 Bus funds include acquisition of buses for fleet and service expansion, construction of bus maintenance and administrative facilities, transfer facilities, bus malls, transportation centers, intermodal terminals, park-and-ride stations, acquisition of replacement vehicles, bus rebuilds, bus preventive maintenance, passenger amenities such as passenger shelters and bus stop signs, accessory and miscellaneous equipment such as mobile radio units, supervisory vehicles, fareboxes, computers, shop and garage equipment, and costs incurred in arranging innovative financing for eligible projects. Congress has allocated most of the Section 5309 Bus funds to specific states, localities, and transit agencies.

Incorporate Other Federal Grants into the Financial Plan

Section 5309 Bus funding is allocated to specific projects or to states for "statewide bus and bus facilities" in the annual FTA appropriation. Project sponsors have three years to obligate the Section 5309 Bus allocation or the funds revert to the federal government. Like other federal transportation programs, these funds require a minimum 20 percent local match. Transit agencies should include Section 5309 Bus funding in their financial plan if they have specified a project that can reasonably be expected to receive such funds and the transit agency has identified the source of the local match required to receive the Section 5309 Bus funds. The financial plan incorporates the federal funding and specifies the source and amount for the local match on an annual basis according to the project implementation schedule.

8.5.6 State and Local Appropriations

The large sums of money needed to fund major transit investments can make securing appropriated funds very difficult due to intense competition for limited resources. However, many projects have been constructed using non-federal capital grants for a significant share of project costs. For operating revenue, transit agencies without dedicated funding sources beyond fares and other operating revenues usually need to seek annual appropriations from state or local governments.

8.5.6.1 State and Local Capital Grants

Many transportation projects are paid for using state or local appropriations rather than dedicated funding sources. Sometimes, states or local governments have transportation improvement funds, transportation trust funds, or other entities set up to provide local funding for projects on a discretionary basis. These funds are usually appropriated for specific projects through the state or local political process. Generally, the project must be included in a state or local budget that directs spending from various transportation funds. These funds must be legislatively approved or included in an approved capital improvement program before they can be considered committed to a specific project.

Good examples of state and local appropriated funding sources include the Maryland Transportation Trust Fund, which has been used to fund the local share of numerous transportation projects in Maryland, including the WMATA Largo Extension, the Maryland Mass Transit Administration’s Central Light Rail Double Track Project, and numerous others. Another example of this type of funding source is California’s Traffic Congestion Relief program funded from a sales tax on gasoline. The law that enabled this program was enacted in July 2000, and will sunset in July 2006. The funding source was established because of large budget surpluses for the State of California, which enabled additional transportation investments. The San Fernando Valley BRT and San Diego Mission Valley East LRT are two of the many projects proposed to be funded through this source.

Incorporate Non-Federal Grants into the Financial Plan

The financial plan identifies all state and local appropriations and incorporates them into the financial plan according to the anticipated annual funding amounts. Specific project funding is a line item in the capital plan. During planning and early project development, these funds are usually un-committed.

Every state and local government is different and funds transportation projects in a different way. The financial plan accounts for these local funding realities. Financial plans should include both committed and planned funds as long as the funds can "reasonably" be expected to be available and committed in the years for which they are required. If the state or local funding for the proposed project is not committed, the source should be identified and a strategy to secure the funding described. If the state or local capital grant is committed, evidence and details of the commitment agreement must be referenced and should be included as an attachment to the financial plan.

8.5.6.2 State and Local Operating Assistance

Most all transit agencies receive state or local assistance to cover operating expenses. Sometimes that assistance is from a dedicated tax as described in section 8.5.2. In many cases, the state or local assistance is provided on an annual basis through a direct appropriation. The New Jersey Transit Corporation, the Massachusetts Bay Transportation Authority in Boston, and WMATA in Washington DC among many others, depend on state or local appropriations to cover annual operating deficits (sometimes including debt service). Often the funding burdens are distributed by statutory formulas to the jurisdictions that benefit from the transit service. The funding jurisdictions typically have representatives that serve on the regional transit governing board giving them significant influence over how the transit system is operated.

Depending on the institutional arrangements, local funding formulas can ensure operating funding stability for transit systems. While dedicated taxes or user fees usually provide a higher level of funding stability, this is not universally true. Many states and localities provide consistent funding levels using annual appropriations. However, absent specific guarantees, local funding levels can fall victim to the budget pressures of state or local governments.

Incorporate Local Operating Assistance into the Financial Plan

Operating assistance provided by state or local governments is a line item under operating revenues determined by the specific relationship established between the local funding partners and the transit agency. The financial plan should document the history of state and local operating assistance levels and track the annual growth in funding to support the assumptions about future levels of operating assistance. Generally speaking, operating assistance should not be assumed to grow faster than historical experience unless an agreement to increase operating assistance has been completed. In addition, if one funding source is assumed to take a significantly higher proportion of total operating expenses in future years, the soundness of the financial plan may be questionable.

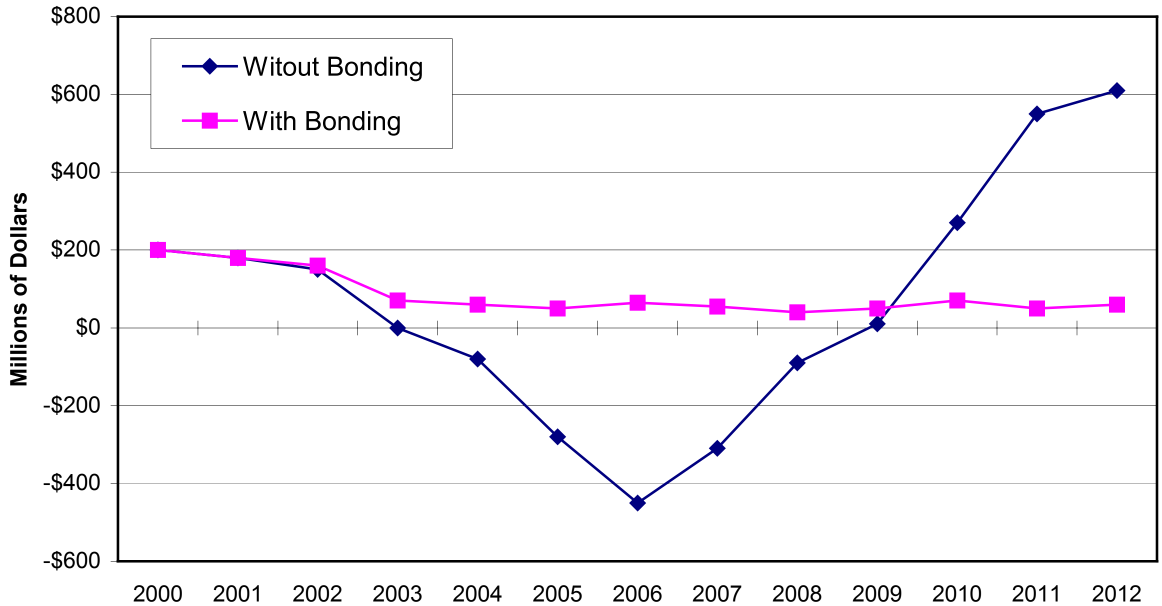
8.5.7 Borrowing and Debt Financing

"You can pay me now, or pay me later."

Television advertisement for FRAM Oil Filters, 1971

A transit system with insufficient cash flow to cover the cost of capital projects as well as operating and maintenance expenses must generally incur debt to advance its capital program on a reasonable schedule (see Figure 8-5). Assuming that the transit agency is capable of paying the debt service after paying for all operating and maintenance expenses, the agency must determine the level and form of debt that is most appropriate. Generally, the transit agency should maximize the net present value of the financing arrangement within the budgetary constraints imposed on the transit agency. The methods used to evaluate financing strategies are discussed in Section 8.6.

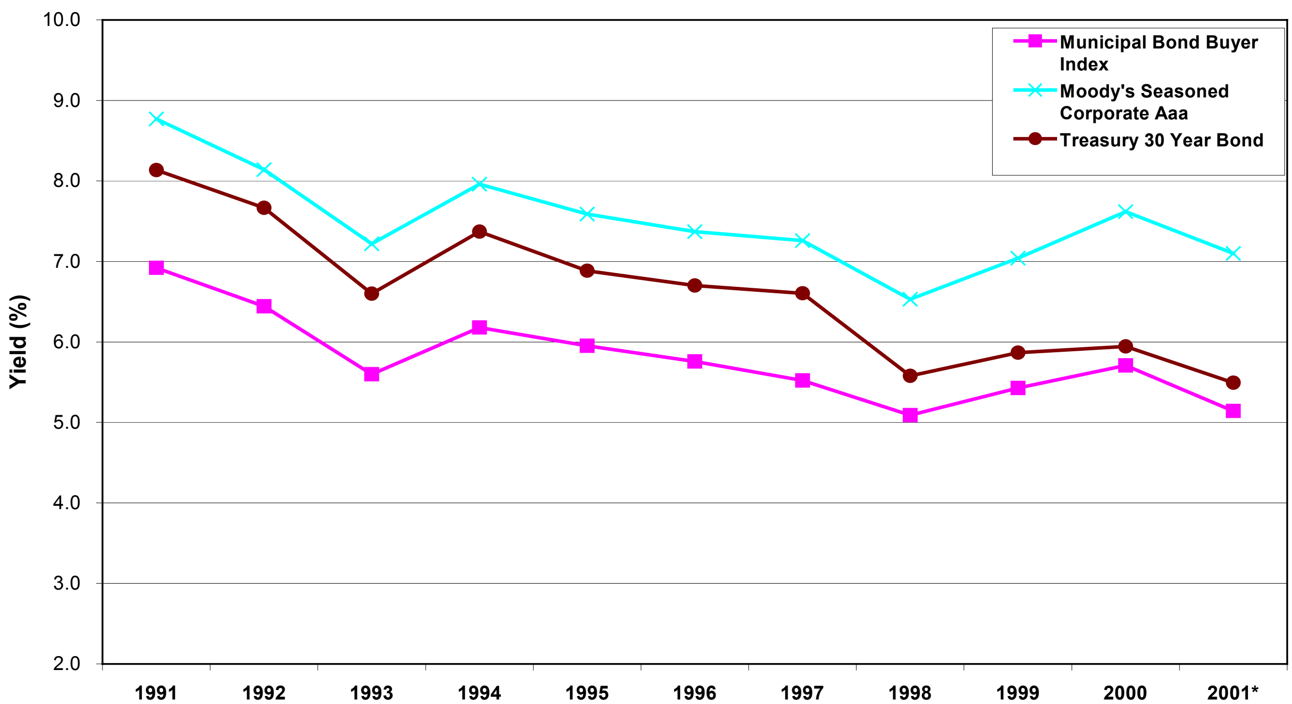
Figure 8-5: Comparison of Ending Cash Balances, With/Without Bonding



As demands for transportation improvements have grown, the use of debt financing has also increased to fund additional projects. Debt financing can be used to advance projects that otherwise would take much longer to construct using pay as you go funding. For agencies with dependable and growing existing revenue sources that would experience deficits only during construction of proposed major capital investments, debt financing may be the solution to funding needed capital projects. If an agency expects operating deficits after completion of the proposed project (s), the bond market will generally demand high interest costs or the agency may be unable to market the bonds at all.

Tax-free municipal bonds are usually preferred mechanisms for municipal finance since the yields are lower than almost any other debt instrument (see Figure 8-6) presuming the bonds are rated investment grade. In some instances, vendor financing or leasing arrangements may offer terms advantageous to the transit agency. The TIFIA program offers another potential source of credit that may be used for major capital investments and can be competitive with some investment grade municipal debt (see Section 8.5.7.2).

Figure 8-6: Annual Percentage Yields on Selected Securities, 1991-2001



** 2001 figures calculated as of 12/01/01*
Source: Federal Reserve Board of Governors

8.5.7.1 Tax Free Municipal Bonds[15]

The tax-exempt bond market has become a major funding source for transportation investments. The amount of debt issued fluctuates by multiple billions of dollars based on market conditions and investment needs, but the trend over the last two decades has been of increasing reliance on the municipal bond market to fund the local share of major investments (see Figure 8-7). State and local governments have increasingly utilized the tax-free municipal bond market

[15] Borrowing liberally from the Federal Transit Administration's, *Financial Planning Guide for Transit*, US Department of Transportation, 1990, pp. 100-05

to fund needed projects far in advance of when they could be constructed using the pay-as-you-go approach.

Long-term bond repayment schedules typically require a principal and interest payment in the range of 8 percent to 11 percent of the par (face value) of the bonds issued.[16] The repayment of any bond issue and any outstanding debt must be factored into the transit agency financial plan. Debt service costs may be accounted for as an agency operating expense or as a debt service payment in a separate capital plan. The latter treatment is more common since most debt service has a dedicated funding source outside of the revenues from operations. Investors in the bond market will examine the agency's financial statements and plan in great detail to judge the financial capability of the agency, and consequently, the likelihood of being paid on time.

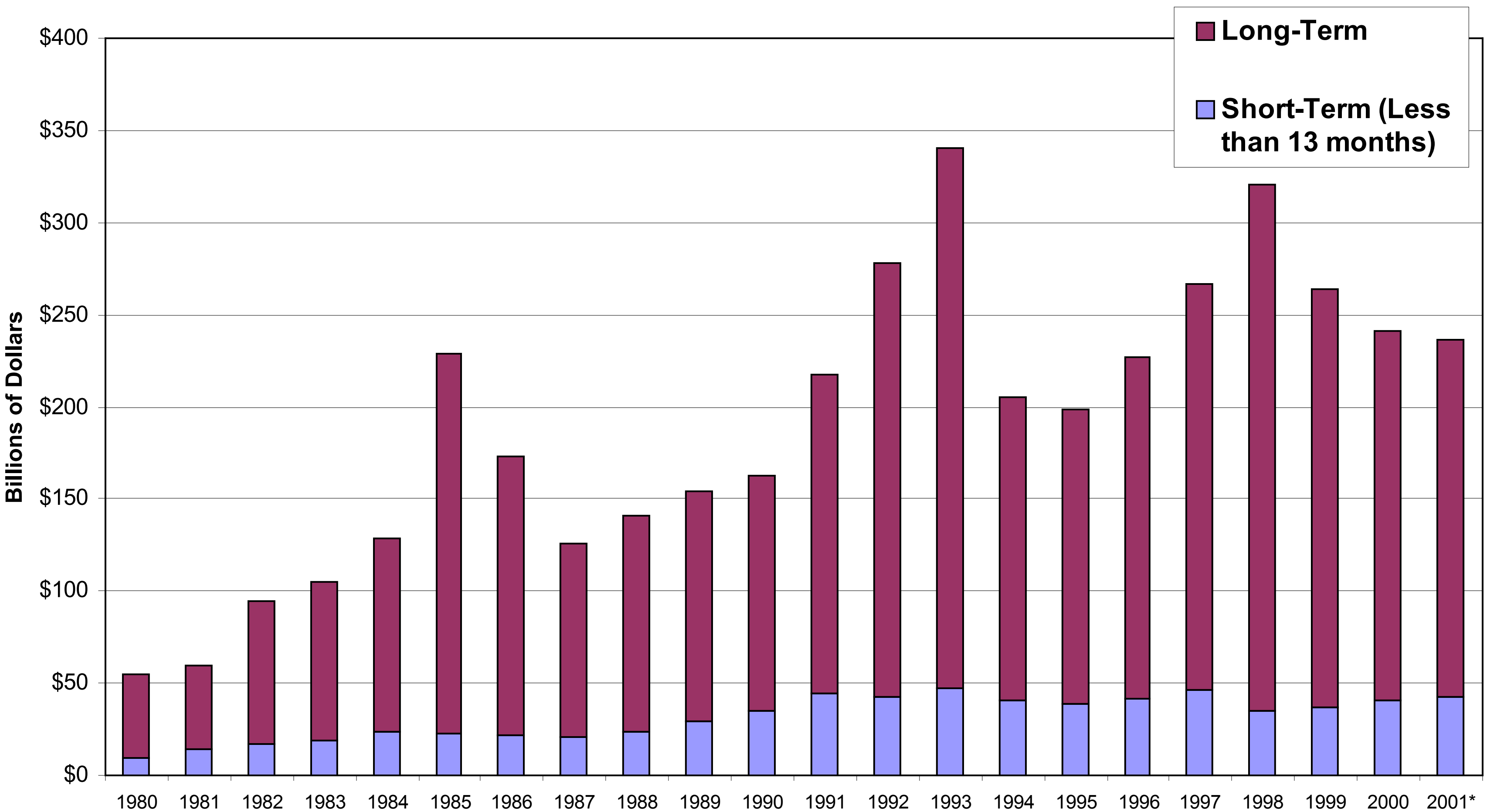
One of the primary factors in the evaluation of any bond issuance is the coverage ratio and the security of the bonds. The coverage ratio is the annual pledged revenues divided by the debt service payment. The coverage ratio measures the ability of the historical, current, and future revenues to meet debt service requirements. Security is the funding source pledged as collateral for repayment of the bonds.

A coverage ratio of 1.0 means that revenues pledged to pay debt service are equal to the debt service payment, which would not be looked at favorably by the bond market because any unexpected adverse occurrence would make the debt service levels too high to pay. The bond market generally requires a debt coverage ratio greater than one by a margin large enough to ensure that there will remain (within tolerable risk levels) enough revenue to pay the debt service regardless of the economic conditions affecting the issuer. Coverage ratios may be based on only those revenues pledged as security for the bonds (a gross coverage ratio), or may include all revenues available to the issuer net of operating expenses (a net coverage ratio).

Historical coverage ratios calculate the measure based on known quantities from previous years. For a new bond issue, prospective coverage ratios must be forecasted into the future. Debt service requirements are quite well known in advance since the terms of the bond are specified at the issuance. Revenue projections must be prepared, either by a respected private forecasting firm, or internally using well documented and state of the practice forecasting methods as described in Section 8.5.2.

[16] Assuming 20-year municipal bond paying 5 percent coupon rate for the low estimate to 9 percent coupon rate at the higher end. Interest rates depend on the market conditions and quality of the bonds.

Figure 8-7: Tax Free Municipal Debt Issuance in the US



** 2001 figures calculated as of 12/01/01*

Selling bonds requires that the seller pledge a stream of revenues for repayment of the bonds. These revenues are the collateral that must provide the bondholder with reasonable certitude that the bonds will be repaid according to the debt service schedule provide at issuance. Whatever revenue source is provided, it must be stable and committed to debt service over the full term of the bonds. Usually, a sales tax, income tax, property tax, fuel tax, or the full faith and credit of the state or federal government are required as collateral for municipal bonds. After the passage of TEA-21, the added stability of the federal funding sources has allowed the development and use of bonds backed by anticipated federal grants, adding a new and important way to service municipal debt. Tax increment financing and farebox revenues have been successfully used as collateral on rare occasions.

Debt issuance limitations may be imposed on bond issuers by state or local governments. Typically, local debt limitations require conservative debt ratios, often 2.0 or greater, to ensure the long-term creditworthiness of local government entities. In many cases, the debt limit is a preset debt level that the issuer is legally required to remain below. Similarly, some bond covenants require that additional bonds maintain both historical and prospective debt ratios, usually 1.5 and 2.0 respectively.

The net coverage ratio, based on all revenues net of expenses, reflects the issuers financial capability more accurately that the gross coverage ratio, which is based only on pledged revenues. The gross coverage ratio ignores non-pledged revenues and the ongoing operating and maintenance expense of the transit system. While technically, only the pledged revenues are relevant to the ability to make debt service payments, a system that cannot cover both operations and maintenance and debt service is not likely to remain financially viable. For this reason, bond rating agencies and potential bondholders will carefully inspect agency financial statements and financial plans to ensure the financial capability of all agency revenues to meet all projected financial obligations.

The different types of municipal bonds are described in the following sections.

General Obligation (GO) Bonds

General obligation securities are bonds backed by the "full faith and credit" of state or local governments. The taxing authority used to service GO bonds is not subject to constitutional or statutory limitations. Consequently, GO bonds are the most secure credit instruments among municipal securities. These bonds tend to receive the highest credit ratings available to a particular municipal agency and, if the agency is credit worthy, can carry exceptionally low yields.

GO bonds often require voter approval in a public referendum. These bonds take two particular forms with different levels of financial security. The most secure type is the unlimited tax (ULT) general obligation bond, which is secured by a tax that is not limited in rate or amount. A less secure GO bond is the limited tax (LT) general obligation bond, which is backed by a specific tax such as a sales tax, fuel tax or an income tax. The limitation on the revenue source securing the bond results in higher risk to the bondholders, lower bond ratings, and higher yields. Limited tax general obligation bonds have been used in numerous cities to fund transportation investments after the successful passage of dedicated transportation taxes.

Revenue Bonds

Revenue bonds help to finance infrastructure projects such as bridges, toll roads, water and sewer facilities, airports, subsidized housing, and occasionally public transit projects. Revenue bonds are generally payable from specific revenue sources related to the operation of the facility being constructed. For instance, toll road and bridge bonds would be paid by the resulting tolls. Revenue bonds are not backed by the full faith and credit of the issuer. Rather, revenue bonds are secured by a specific revenue pledge to assure the adequacy of the revenue source. Since the payment sources are limited, a financial feasibility study that analyzes the projected revenues and operations of the facility to be financed is required to market the bonds.[17]

Since no transit agency collects enough in fare revenue to pay even the operating expenses of the systems, there are generally not enough revenues net of costs to dedicate toward debt service. However, some transit agencies have other revenue sources to fund operations such that fare revenues can be dedicated to pay off revenue bonds. New York MTA was a regular issuer of fare-backed bonds during the 1980's and 1990's.

GANs (or GARVEEs)[18]

Transit agencies can borrow against future Federal-aid funding using Grant Anticipation Notes (GANs), sometimes called Grant Anticipation Revenue Vehicles (GARVEEs). The agency issues bonds secured with a pledge of federal-aid assistance, thus amassing up-front capital, and pays down the bonds over a period of time as the federal funds are received. The agency is not able to make an enforceable pledge of future federal grants since there can be no guarantee that those funds will arrive. The bond market seems to be willing to accept this pledge, assuming that the likelihood of continuing federal grant is very high. GANs are short term notes usually used to initiate construction prior to the receipt of federal grants.

TEA-21 contained certain provisions that enhanced transit agencies' ability to borrow against future federal aid. For example, the additional security of TEA-21 "firewall" provisions (separating transportation funding from appropriations for other domestic purposes) was one factor that helped make it possible for transit agencies to pledge federal aid as the sole source of repayment, without having to encumber other transit revenue sources.

[17] Federal Transit Administration, *Introduction to Public Finance and Public Transit*, US DOT, 1993, p. 54.
[18] Paraphrased from *Innovative Finance Quarterly*, Winter/Spring 2000, Federal Highway Administration, US Department of Transportation, vol. 6, no. 1.

While transit agencies may use the discretionary funds provided through FFGAs to repay debt, these funds are not guaranteed to arrive on schedule because they are subject to annual appropriations. Because discretionary funds provided under an FFGA are project-specific, there is limited ability to shift funds between projects in the event of a shortfall. Thus, the credit risks for a transit GAN backed by a discretionary FFGA may be higher than for a transit GAN backed by formula funding at an equivalent coverage level. A grantee can increase coverage levels by borrowing less than the FFGA amount (essentially providing the coverage required for a good rating opinion) so that even if Congress appropriates significantly less than the budget request, there is likely to be enough funding appropriated to at least cover required debt service.

The Hudson-Bergen Light Rail project in Northern New Jersey explicitly relied on a pledge of future FFGA funding to secure construction financing. The project was supported primarily by a transit GAN, issued against anticipated discretionary funding. As a secondary pledge, the financing was also backed by a pledge from the state's Transportation Trust Fund, in the event that FFGA funds were not forthcoming. New Jersey Transit re-financed the initial debt with new GAN's to allow them to shed the added security of the Transportation Trust Fund. Market conditions allowed both reduced interest costs and additional bonding capacity for the New Jersey Treasury.

Tax-Exempt Commercial Paper

Tax-exempt commercial paper is a mechanism that provides a short-term (maximum maturity of 270 days) tax-free debt instrument to fund working capital for a transit agency. Transit agencies may receive the bulk of their operating subsidies at specific times of the year, which may require them to use short term financing to pay for ongoing operations. The terms available to transit agencies through tax-exempt commercial paper are generally better than could be obtained via a private line of credit from a bank. Usually, liquidity for a tax-exempt commercial paper program is provided through a letter of credit, a revolving credit agreement, or a line of credit.

8.5.7.2 TIFIA

The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) established a new federal credit program under which the U.S. Department of Transportation (DOT) may provide three forms of credit assistance – secured (direct) loans, loan guarantees, and standby lines of credit – for surface transportation projects of national or regional significance. TIFIA credit assistance can be more advantageous than tax fee municipal debt.

One benefit of the TIFIA instrument is that the maximum maturity of all TIFIA credits is 35 years after a project's substantial completion. Municipal bonds usually have a 20-year term. At the end of the 20-year period, new bonds can be issued to pay the old ones, but there are costs associated with this transaction and the associated annual payment is somewhat higher for shorter-term debt instruments. If the interest rates are "close", it is quite possible that the net present value of the financing arrangement under a TIFIA loan could be more advantageous than the municipal bond market.

Another benefit is that the TIFIA credit instrument may be junior (i.e., subordinate) to the project's capital market debt in its priority claim on the project's cash flow. In some circumstances, this feature will allow the borrower to maintain a higher credit rating on senior project debt than would otherwise be possible.

A TIFIA loan, loan guarantee, or line of credit could be a cost saving strategy for funding the local share for some projects. TIFIA is a credit program rather than a grant program so it does not provide incremental funding other than the potential savings associated with TIFIA credit terms compared to the terms available to project sponsors in the tax-free municipal bond market. If an agency's revenue bonds are rated BBB+, the yield in November 2001 was a little under 6 percent. The interest rate floor for TIFIA loans was 5.25 percent[19] at that time. While the interest rate difference is not great, the judicious use of TIFIA loans could reduce interest expenses by significant sums if the financing period is long.

8.5.7.3 Vendor Financing

Vendor financing refers to credit offered to a transit system from an equipment vendor with the potential for advantageous payment terms for equipment or services. Vendor financing is most commonly used for vehicle purchases, but could be used for the purchase of vehicle control systems, fare collection, security or any other major equipment type. Vendor financing is usually either an extended payment schedule, or when the vendor acts as a conduit for financing through a third party. Extended payment schedules imply that the vendor defers sales revenue while third party financing means that a financial institution is providing the credit to the transit agency through the vendor.

At one time, vendor financing was a major part of the purchase decision since numerous vendors competed by offering the most generous (i.e. below market) interest rates. The low rates offered by the vendors reduced the total cost of procuring the various equipment packages and improved the net present value of the financial arrangement. However, domestic vendors complained that below market financing was an unfair trade practice and persuaded Congress in 1986 to prohibit the offering of below market interest rates. Now, the interest rates depend solely on the credit rating of the vendor. The market rates available to private vendors will very likely be higher than the terms available through a municipal bond issuance. The use of vendor financing has declined markedly since 1986.[20]

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[19] Based on the rate for State and Local Government Securities (SLGS) of similar maturity plus five basis points (October 31, 2001).

[20] International vendor financing may offer more advantageous terms. For more information in international vendor financing, see *Introduction to Public Finance and Public Transit*, Federal Transit Administration, US Department of Transportation, 1993.

Today, the primary benefit of vendor financing is the simplicity of the transaction. Equipment features, price, financing arrangements, and payment schedules are all negotiated with a single entity. This financing mechanism is usually applicable only to purchases of vehicles and other equipment so it can only be a relatively small part of the financing strategy for a major investment.

8.5.7.4 Leasing

Leasing provides for the use of an asset without the need to make a large cash payment that most purchase agreements require. A lease is a rental agreement where a lessee (transit agency) agrees to make rental payments to the lessor (owner) in exchange for the use of the asset. Leasing allows the transit agency to reduce current year expenditures on new equipment by spreading the cost over a number of years as specified in the lease. Lease obligations are considered a form of municipal debt and can be tax-exempt if structured properly.

There are two main lease types: operating leases and capital leases. Operating leases are generally short term and cancelable. The risks and rewards of ownership of the leased asset are not transferred to the lessee. The lessor does not generally expect to recover the whole cost of the asset during the lease period which is generally much shorter than the useful life of the asset. Operating leases are generally confined to assets for which an established secondary market exists.

Capital leases are financing arrangements for acquiring assets and are generally non-cancelable financial obligations that are a form of debt. To be a capital lease, a lease agreement must meet one of the following criteria:

- The lease transfers title of the leased asset to the lessee at the end of the lease term. The lessee becomes the owner of the leased asset.
- The lease contains a "bargain purchase option" where the lessee can be expected to purchase the leased asset and become the owner.
- The lease term is at least 75 percent of the useful life of the leased asset.
- The present value of the least payments is at least 90 percent of the market value of the leased asset.[21]

Transit vehicles and specialized building and plant assets used by the transit agency are often accounted for as capital leases. Short term leasing of buses for special events, for instance, would be accounted for as operating leases. Rental of office space for the transit agency could be accounted for as a capital lease or and operating lease depending on the terms of the lease.

[21] Harrison, W.T., and C.T. Horngren, Financial Accounting, Fourth Edition, Prentice Hall: New Jersey, 2001, pp. 383-4.

Leasing Arrangements

There are a variety of leasing arrangements commonly used by transit agencies for structuring capital leases. The two primary options are certificates of participation (or COPs) and sale-leaseback arrangements. The cross-border lease is a complicated form of the sale-leaseback arrangement designed to take advantage of foreign tax laws to improve the lease terms for the lessee. The reader interested in cross-border lease arrangements should refer to *Introduction to Public Finance and Public Transit*, Federal Transit Administration, US Department of Transportation, 1993.

COPs are used to finance equipment purchases by dividing the cost of the asset among many investors. Each investor owns some percentage of the asset and agrees to lease that percentage back to the transit agency. The transit agency uses COPs though a trustee bank that issues the debt and holds title to the equipment on behalf of the investors and administers the lease arrangement with the transit agency. Lease payments made by the transit agency to the trustee bank are "passed though" to the investors as principal and interest payments. COPs generally have 10-year terms, though the terms can be much longer.

The key to a COP arrangement is the marketability of the shares to investors. The interest rates offered on the certificates must be competitive in order to attract investors. The debt is usually structured as tax-exempt, but the lease obligations may not have the same level of security as revenue or GO bonds. Some transit agencies have offered a guaranteed repurchase price for the assets (vehicles normally), which has the effect of guaranteeing the principal amount of the certificates. Financially weak agencies would generally enter into these agreements for buses rather than rail vehicles since there is a more established secondary market for used buses.

Sale-leaseback arrangements are usually used to raise capital by basically selling assets to private investors who then lease the equipment back to the transit agency. The transit agency uses the arrangement to reduce their asset base in exchange for up front capital while still maintaining use of the asset. Sale-leaseback arrangements are much like a secured loan using the equipment itself as collateral.

The tax treatment of sale-leaseback arrangements is complex, but can provide terms competitive with tax-free municipal debt. A sale-leaseback can be structured in two ways:

1. Taxable interest if the lessor uses accelerated depreciation; or
2. Tax-exempt interest if the lessor uses straight-line depreciation.

Tax-free financing cannot be combined with accelerated depreciation. However, if structured properly, sale-leaseback arrangements can offer attractive terms to the lessee. It may be advisable to seek the advice of a tax attorney on structured leasing transactions due to the complex nature of the financial arrangements required to execute a sale-leaseback financing.

The Benefits of Leasing

Leasing has proven to be a valuable financing alternative for state and local governments generally and transit agencies in particular. A variety of benefits have driven the expanded use of lease obligation financing, including:

- leasing allows the agency to spread the cost of equipment and capital assets over many years;
- lease obligation financing can provide advantageous credit terms competitive with other tax free municipal debt;
- the period of the lease can be tied to the useful life of the asset;
- leasing does not usually require voter approval, while municipal bond issuance usually does;
- leasing can provide up to 100 percent of the cost of the equipment;
- leasing preserves liquidity since it does not tie up other working capital or credit lines;
- leasing provides cost certainty for a known period;
- leasing can avoid loan covenants or debt limitations since it is accounted for as an operating expense; and
- with the exception of cross-border transactions, leasing is easy, minimizes administrative expenses, and simplifies tax and accounting procedures, as asset depreciation is the responsibility of the lessor.

Leasing has become a widespread approach to financing equipment and facility procurement by public entities, as it has for private firms. Though leasing can take several forms, they all provide some benefits over bond financing at similar interest rates. The most important advantages over bond financing are the ability to secure financing without voter approval and the ability to leverage existing assets. Transit agencies should note that FTA will not reimburse for more than the depreciated value of a leased asset in a given period. For example, on a ten-year lease of a bus with a twelve-year useful life, FTA will only reimburse 80 percent of $1/12^{th}$ of the asset's value each year rather than 80 percent of the lease payment. This may require the grantee to front-load the lease by several months, which reduces the benefit to the grantee.

8.5.7.5 Incorporate Debt into the Financial Plan

Existing debt is incorporated into the financial plan as stipulated in the debt agreement. Municipal bonds are sold based on a pre-determined payout schedule. The proceeds from the bond issuance vary with the willingness of bond buyers to pay for the right to receive the payments pledged by the issuer. The annual debt service on any existing bond is specified in the debt service schedule. Existing TIFIA loans or credits, vendor financing, or leasing arrangements also have well defined payment schedules, which are included in the financial plan.

Transit agencies with significant debt must provide financial details of their debt program (including lease obligations) within the financial plan. The purpose of the debt analysis is to define the long-term cash requirements of the agency. The ability to cover these long-term recurring obligations will be reflected in the agency's ability to provide consistent level of transit service.

The financial plan should include the following items to allow the close monitoring of the agency's debt load:

- Municipal debt (if any)
    - Outstanding long-term bond debt
    - Statutory debt limitation (if any)
    - Debt service on outstanding bonds
        - Principal
        - Interest
    - Debt issuance and net proceeds
        - Proposed project (if financial plan is supporting project planning)
        - Other capital projects
    - Debt service on New Bonds
        - Principal
        - Interest
- TIFIA debt by project (if any)
    - Outstanding balance
    - Debt service on TIFIA instrument
        - Principal
        - Interest
- Leasehold obligations (if any)
- Other loans or debt financings (if any)
- Financial Ratios
    - Debt service coverage ratio (pledged revenues/annual debt service)

- o Debt service as a percent of revenues
- o Long-term debt as a percent of total assets
- o Operating ratio with debt service (operating revenues/operating expenses)
- o Operating ratio without debt service [(operating revenues – debt service)/operating expenses]

Other long-term obligations that require monitoring are employee benefits for pensions and accrued vacation or other benefit time. These accounts should be treated on an accrual basis to recognize the potential liability. If these liabilities are un-funded, the agency's finances could face severe disruption in the future.

8.5.8 Other Funding Sources

With the declining share of project costs for major transit investments borne by the New Starts program, along with the added flexibility in some of the other federal funding sources, many transit agencies have secured funds from a much wider array of sources than in the past. Since the passage of ISTEA, the Congestion Mitigation Air Quality (CMAQ) program and the Surface Transportation Program (STP) have been available to provide funds for transit investments. A recent trend to extend fixed guideway service to airports has allowed transit projects to use airport passenger facility charges for transit access improvements. Property development and other innovative financing mechanisms have also been used to generate additional funding for transit operations and capital projects. Lastly, direct private sector participation can provide funding in certain cases. This section describes these other sources and provides guidelines for incorporating these revenues into the transit agency financial plan.

8.5.8.1 Flexible Funds[22]

Flexible funds are federal transportation funds that may be used either for transit or highway purposes. The flexible funding provision was first included in the Intermodal Surface Transportation Efficiency Act of 1999 (ISTEA) and continued with the Transportation Equity Act for the 21st Century (TEA-21). A local area can choose to use certain Federal surface transportation funds based on local planning priorities, not on a restrictive definition of program eligibility. Flexible funds include Federal Highway Administration (FHWA) Surface Transportation Program (STP) funds and Congestion Mitigation and Air Quality Improvement Program (CMAQ) and Federal Transit Administration (FTA) Urban Formula Funds. In addition, some transit related projects are eligible to be funded through the FHWA's National Highway System (NHS) program.

Since the enactment of ISTEA, FHWA funds transferred to the FTA have provided a substantial new source of funds for transit projects. When FHWA funds are transferred to FTA they can be used for any eligible expense identified

[22] Section paraphrased from Buffkin, T. and K. Johnson, "Flexible Funding: Trends and Possibilities", FTA, 2001.

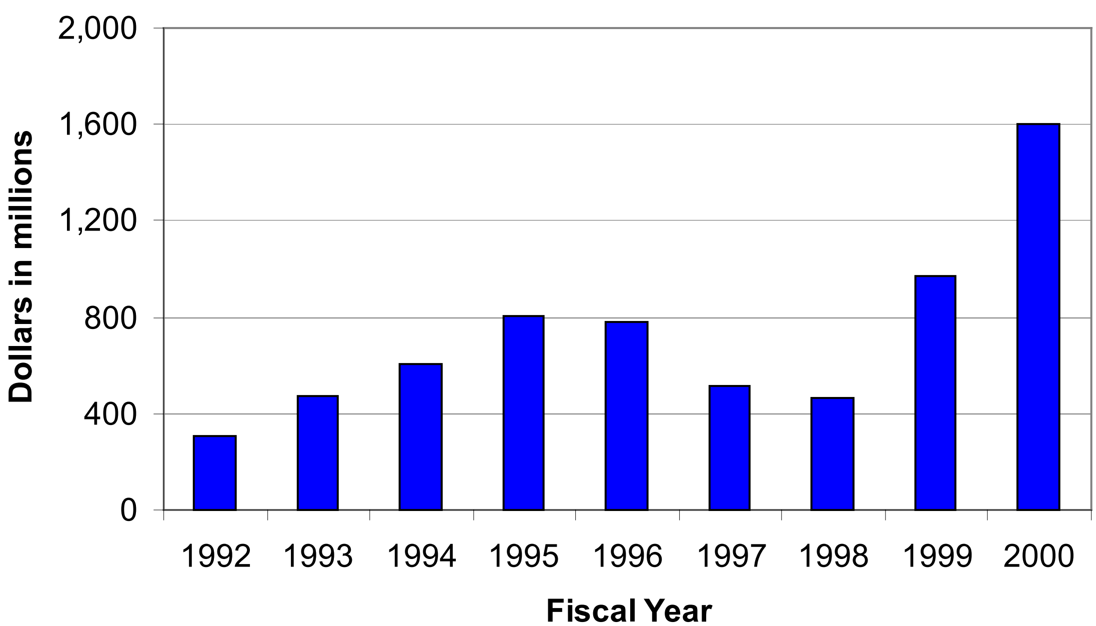
in the FTA program that receives the funds. When FHWA funds are transferred to FTA they are transferred to one of the following three programs:

1. Urbanized Area Formula Program (Section 5307);
2. Non-urbanized Area Formula Program (Section 5311); and
3. Elderly and Persons with Disabilities Program (Section 5310).

Once they are transferred to FTA, the funds are administered as FTA funds and take on all the requirements of the FTA program.

The trends in the use of flexible funding indicate that it is a popular mechanism for funding local transportation priorities. Since the beginning of ISTEA when the flexible funding mechanism was established, local transportation agencies have transferred $6.5 billion from FHWA to FTA, and $20.2 million from FHWA to FTA. After a downturn in the use of flexible fund in FY1997 and FY1998, local transportation agencies have dramatically increased their use of this funding mechanism in recent years. Annual flexible funds transfers to FTA reached the highest level ever at $1.6 billion in FY 2000 (see Figure 8-8).

Figure 8-8: Flexible Funding Transfers for Transit Projects by Year



About 80% of funds transferred have been used for capital projects. The most common type of capital project (about 1/3 of the total) has been for vehicle purchases. Other common capital projects include: major capital investments (New Starts, etc.), station improvements, parking expansion, bicycle racks on buses, and bus stop shelters. Flexible funds have also been used for operations and planning/engineering. The types of operations funded include new or demonstration services, air quality mitigation services, and shuttle services. Flexible funds have been used for planning and engineering of many different types of projects, from Environmental Impact Statements to design of pedestrian malls around stations.

Flexible funds are incorporated into transit agency financial plans like any other federal capital grant. The financial plan must document the agreement between the project sponsor, the MPO and the state department of transportation to initiate and complete the funding transfer. The funding amounts and schedule are negotiated among these various agencies and included as a line item in the transit agency capital plan.

8.5.8.2 Airport Funds

Transit agencies have increasingly partnered with local airport authorities to fund rail transit projects that directly serve airports. Airport revenues from passenger facilities charges (PFCs) are the primary source of funds. Some of the projects recently completed or currently under construction using Airport funds for a portion of their construction costs are:

- AirTrain at Newark International Airport;
- Hiawatha LRT at Minneapolis/St. Paul International Airport;
- BART/Caltrain access to San Francisco International Airport;
- Airport MAX to Portland (OR) International Airport; and
- AirTrain at JFK in New York City.

The difficulty with using funding provided by the airport authority is the restrictions imposed on the projects. PFCs can only be used for funding facilities on airport property or for transit facilities that only serve passengers whose origin or destination is the airport. The Federal Aviation Administration (FAA) must make a determination of eligibility to use airport PFCs for transit projects.

Securing airport funding can be difficult because of the incentive structure of airport revenues. Airports make money on parking revenues. Therefore, every added transit rider means lower airport revenues. Transit access can also use valuable airport space that could be used as parking or curbside taxi space, which is rented and provides the airport authority with additional revenue. In essence, the airport may look at funding transit access as paying millions of dollars for the privilege of reducing airport revenues. On the other hand, airports with significant congestion or that lack space for additional parking may value transit access as a means to bring in more passengers that could not otherwise be accommodated. That said, PFCs are a very large, growing and attractive revenue source that count toward local match required for federal funding.

8.5.8.3 Property Development

Transit agencies can and do generate revenue through the lease, development or sale of property or property rights, otherwise known as the all-encompassing term "joint development". The air rights over a station, yard or terminal, or other real estate procured in the process of constructing a transit project, may be sold or leased to a private developer who agrees to construct a building or collection of buildings. The rent can be a contractually fixed fee or a percentage of the gross lease income produced by the tenants. Joint development projects have included hotels, office space, apartment buildings, homes, and shopping areas.

Joint development near transit stations can also increase transit ridership and operating revenues. When transit agencies weigh development proposals for their property, the additional ridership generated by the uses should be explicitly considered. Even if a proposal for a warehouse was the highest bid for a transit owned parcel near a rail station, apartments may provide the higher total return if significant numbers of additional transit riders result.

Another potential arrangement through which a transit agency could realize benefits from its real estate holdings is to establish a real estate development subsidiary to develop land directly. The subsidiary's profits would then flow to the transit agency as other operating income. The benefits of this approach would be the shorter time to develop the properties as well as the ability to specifically direct the type of development activities that take place on agency-owned land.

Property development projects can provide a one time cash gain or provide a dependable stream of income that helps to offset the operating losses of the transit operation. While these revenues will probably not amount to more than a small percentage of the total operating budget, the revenue can amount to millions of dollars per year, which can be used for a variety of capital or operating needs.

Transit agencies should not assume that property development activities will provide significant funds. The Washington Metropolitan Area Transportation Authority (WMATA) is generally regarded as one of the most aggressive practitioners of transit joint development. WMATA received $6.4 million in joint development revenues for FY 2000 out of a total $684 million budget. While property development revenues provide valuable additional resources for WMATA and, importantly, ensure the type of development that supports the transit system, property development activities bring WMATA less than 1 percent of their system operating expenses. Most other transit agencies are unlikely to generate much more revenue than WMATA.

8.5.8.4 Innovative Finance

"Innovative finance" for transit is a broadly defined term that encompasses a combination of techniques and specially designed mechanisms to supplement traditional financing sources and methods. Most of the programs and tools of innovative finance have been enabled by ISTEA and TEA-21. Many of the financing mechanism already described, such as TIFIA, GANs (GARVEEs), and leasing, are considered “innovative finance”. While these mechanisms are not much more “innovative” than the techniques used by average citizens to buy a house or lease an automobile, their use in the funding of transportation projects, where pay-as-you-go funding is the norm, is relatively innovative.

Traditionally, the government has financed transportation infrastructure primarily through a combination of state and local taxes and fees, and federal grants. These resources typically funded projects on a "pay-as-you-go" basis, meaning that projects were built in phases or increments as funds became available over a period of years. Project funding has been tied closely to Federal and state funding availability. While the pay-as-you-go approach has the benefit of simplicity and avoids interest costs associated with indebtedness, it involves the hidden costs associated with inflation and foregone economic development, especially for projects delayed several years. In addition, delaying projects that provide significant public benefits, reduce emissions or eliminate safety hazards also has obvious negative political and economic effects.

This section only addresses those “innovative” financing techniques not previously discussed. These include the use of State Infrastructure Banks (SIBs) and advance construction.

State Infrastructure Banks (SIBs)

The National Highway System (NHS) Act established the SIB pilot program. A SIB is a state (or multi-state) revolving fund that, much like a private bank, can offer a range of loans and credit assistance enhancement products to public and private sponsors of highway or transit capital projects. Under the initial pilot program, states were authorized to use a portion of their FY 1996 and FY 1997 federal funds as "seed" money, matched with non-federal funds. The 1997 USDOT appropriations act provided $150 million in Federal general revenue funds for SIB capitalization. TEA-21 extended Federal funding for SIBs in four states - California, Florida, Missouri, and Rhode Island - by allowing them to capitalize their banks with funds authorized by TEA-21 through FY 2003. As of October 2001, 32 states have entered into 245 loan agreements with a dollar value of nearly $2.9 billion.

The types of assistance that may be provided by SIBs include loans (which may be at or below market rates), loan guarantees, lines of credit, letters of credit, certificates of participation, debt service reserve funds, bond insurance, and other forms of non-grant assistance. As loans or other credit assistance forms are repaid, a SIBs initial capital is replenished and can be used to support a new cycle of projects.

By obtaining SIB support for a project, the sponsor may be able to attract private, local, and additional state financial resources. Alternatively, SIB capital can be used as collateral to borrow in the bond market or to establish a guaranteed reserve fund. Loan demand, timing of needs, and debt financing considerations are factors to be considered by states in evaluating a leveraged SIB approach.

While the state SIBs authorized by the USDOT under the pilot program began with an initial infusion of federal funds and non-federal matching contributions, states have the opportunity to contribute additional state or local funds beyond the required non-federal match.

Advance Construction

Under advance construction, a grantee may use non-federal funds to advance a federally supported project while preserving its eligibility to receive Federal reimbursements in the future. Advance construction eliminates the need to set aside full obligation authority before starting projects. As a result, a grantee can undertake a greater number of concurrent projects than would otherwise be possible. In addition, advance construction helps facilitate construction of large projects, while maintaining obligation authority for smaller ones. Advance construction allows a grantee to conserve obligation authority and maintain flexibility in its transportation funding program. For transit facilities, a "letter of no prejudice" (LONP) follows similar procedures to advance construction, but also applies to non-construction-related activities (e.g., vehicle procurement).

Partial conversion of advance construction is a somewhat different approach, in which the grantee converts, obligates, and receives reimbursement for only a portion of the federal share of project costs. This removes any requirement to wait until the full amount of obligation authority is available. The grantee can therefore convert an advance-constructed project to a federally funded project in stages, based on cash flow requirements and availability of obligation authority, rather than all at once on a single future date. This flexibility enables a grantee to begin some projects earlier, delivering the benefits to the public sooner.

For example, the Massachusetts Bay Transportation Authority (MBTA) used advance construction authority to fund the Boston Engine Terminal project. The Federal Transit Act requires agencies to resubmit proposals to FTA for advance construction authority with every subsequent transit authorizing legislation (*i.e.*, ISTEA, TEA-21, *etc.)*. In addition, agencies using advance construction must apply each year for federal funds to pay for the project.

The flow of funds under advance construction authority is quite complex. In the case of the MBTA project, the contractor invoices the transit agency. MBTA pays for the local share and submits receipts to FTA for reimbursement of the federal share. Because each year's invoices exceed the total local and federal share, MBTA issues short- term debt to cover the remainder. Twice a year, MBTA issues long- term general obligation bonds to retire this short- term debt. These bonds are not specific to the Boston Engine Terminal project, but are for the entire capital program.

In calculating the federal share of interest expenses, MBTA employs a weighted average. MBTA tracks the progress payments from FTA and ties them to specific bond issues.

MBTA notes several key advantages to advance construction authority over traditional funding methods for large, expensive projects:

- expenses can be incurred immediately;
- construction can be consolidated into one contract; and
- 80% of the bond interest for all expenses incurred above the FTA allocation is reimbursable by FTA.

With advance construction authority, a transit agency can spend the money necessary for a major contract immediately. Thus for projects that exceed an agency's annual FTA capital allocation, a transit agency can build them immediately without having to wait to collect multiple years of allocations and realize the benefits of the project sooner. If MBTA had to wait until it had cash on hand for the $235 million Boston Engine Terminal renovation, the facility would have been out of service for 19 years. Under advance construction authority, the Boston Engine Terminal was rebuilt in 6 years, but the financing is accomplished through 19 years of debt service repayment. After completing the Engine Terminal, MBTA refinanced the bonds at more favorable interest rates, using the proceeds for other capital needs.

Advance construction authority allowed MBTA to consolidate its large construction project into one contract and incur all expenses up-front. Otherwise, multiple small contracts, and therefore numerous procurements, would have been necessary. The single contract saves time and eases project management by eliminating quality control issues related to multiple contracts.

The disadvantages to advance construction are: 1) if FTA funds were discontinued, the agency would be responsible for all project expenses; 2) a portion of future capital grants must be dedicated to paying off the interest for the project. Between FY 2000 and 2013, MBTA must dedicate $16 million in federal capital grants and $4 million of its own revenues to pay the principal and interest on bonds for the Boston Engine Terminal project.[23]

8.5.8.5 Private Sector Participation

Since no US public transit projects actually produce enough revenue to offset their operating costs let alone cover the cost of capital, private sector funding will not usually be forthcoming. The exception is when private firms can benefit from the public investment and may be willing to contribute to the cost of the

[23] Paraphrased from MBTA Advance Construction Authority case study (available on NCHRP sponsored site - http://www.innovativefinance.org/topics/finance_mechanisms/pdfs/tcrp_31_mbta.pdf)

transit project. Two types of situations lend themselves to private sector participation:

1. railroad improvements on lines shared with freight railroads, and
2. property owners near transit stations that benefit from the improvements in accessibility for their properties.

Investments in rail infrastructure to provide capacity for commuter rail on existing freight lines usually produces some benefit for the freight operator, either in terms of higher quality infrastructure, higher capacity, or more operating flexibility, especially during the hours when the commuter rail service is not running. In a few instances, transit agencies have been able to secure private sector contributions from private railroads for capacity expansion and rail upgrades that benefit freight railroads.

Private sector contributions from property owners are another possibility. In cases where property values will clearly increase significantly from direct access to the transit project, property owners may be willing to offer significant amounts of funding. Examples include two recent projects. The Las Vegas monorail project is being partially funded by local property owners through the Las Vegas Monorail Corporation. Another example is the New York Avenue infill station in Washington DC. This project is receiving $25 million in private sector funding through a special assessment district made up of several large property owners within a half-mile of the station.

Private sector funding is incorporated into the financial plan according to the terms of the agreement. The funds are not considered committed until a signed contract between the funding partners is executed. The agreement will stipulate the funding arrangement, which will be incorporated into the financial plan as a line item in the capital budget with supporting documentation.

8.6 Financial Analysis

This section describes the procedures, assumptions, and analytical tools required for developing and analyzing the financial plan. After all the components of the financial plan have been developed, the financial analyst must combine this information into a coherent financial plan. Financial models are prepared to assist in the analysis and development of sound financial strategies.

A financial model attempts to accurately represent the financial position of the transit agency to allow for the systematic evaluation of the potential financial strategies in support of long-term agency goals. The financial model is designed to allow assumptions and inputs to vary in order to support an evaluation of risks to the financial plan, and to determine the sensitivity of the financial condition of the agency to changes in circumstance. The financial model is not the financial plan. It is a tool that assists the financial analyst in evaluating and devising financial strategies that ultimately make up the financial plan.

8.6.1 Analyzing Financial Capacity

The financial model is a valuable tool for evaluating financial strategies. The financial analysis seeks to understand the impact of constructing and operating new projects on the ability of the transit agency to operate and maintain the existing and planned system.

8.6.1.1 Assessment of Financial Condition

The assessment of financial condition considers a variety of factors that may affect the transit agency's ability to construct and operate planned projects as well as the existing transit system. The assessment of financial condition generally looks at historical data to support the findings. The indicators of financial condition fall into three general categories:

1. Economic condition of the region
    a. Appraised value of real property
    b. Building permits issued
    c. Business licenses issued
    d. Development patterns supportive of transit
    e. Population and employment growth
    f. Personal income growth
    g. Bond ratings for regional governments
2. Results of transit operations
    a. Audited financial statements
    b. Ridership growth
    c. O&M cost trends
    d. Capital expenditures
    e. Farebox revenue/recovery ratio trends
    f. Non-fare revenue trends
    g. Working capital
3. Fiscal burden of transit expenditures on the region
    a. Transit subsidy/personal income
    b. Transit subsidy/taxable property value
    c. Long term debt as percent of total assets
    d. Long term debt per capita
    e. Debt service as percent of revenue
    f. Coverage ratios

The indicators of economic condition provide a sense of the economic health of the community and it's ability to support a growing transit system. The transit operation measures track the financial performance of the transit agency. The fiscal burden measures indicate the degree to which transit expenditures in the region are growing or declining relative to available funding sources and the capacity of the region to dedicate additional resources to the transit system.

Securing non-federal funding sources often hinges on the ability of the transit agency to convince local decision-makers and voters to dedicate new sources of funding. This action may involve public referenda or through convincing public officials of the need for additional resources. For this reason, it is important to gauge the public's willingness to approve additional funding for transit projects. These judgments can be made on the basis of the indicators listed above and on the basis of market research.

8.6.1.2 Assessment of Financial Capability

The assessment of financial capability is based on the cash flow analysis which compares current and projected estimates of pledged revenues to planned expenditures. The cash flow analysis is the culmination and combination of all of the components of the financial analysis into a coherent statement of financial position.

The cash flow analysis supports the determination of the transit system's ability to continue to operate and maintain the existing system with the additional costs associated with proposed or planned projects. The cash flow analysis reveals the extent of any predictable revenue shortfalls. The magnitude of the shortfall (if any) will dictate the funding strategies that will be considered. The agency may be able to fund its proposed projects by using "pay-as-you-go" financing, employing a debt instrument, or securing a lease.

The demonstration of financial capability will ensure that the agency can be expected to maintain adequate cash or reserve fund balances while meeting all existing and planned financial obligations over the forecast period. The agency must also meet the minimum required coverage ratios for any debt financing and maintain compliance with any locally or legislatively mandated objectives or limits.

8.6.2 Developing a Financial Model

The financial model is a tool that is helpful in the development of the financial plan. A financial plan can present and combine all the information required using the outputs from other analyses as described in Sections 8.3 through 8.5 without developing a financial model. The financial model is developed as a tool to allow input assumptions to change and to evaluate the impact of those changes on the financial position of the transit agency without having to go through the trouble of recalculating every forecast and cost estimate from scratch.

The financial model is a valuable tool that combines all relevant financial information (the development of which has been detailed in previous sections) into a detailed statement of financial position and links the financial inputs to a series of planning and financial assumptions. Altering various input parameters independently or in combination may expose critical information that was not readily apparent. The ultimate goal of the financial analysis is to develop an affordable and financially feasible strategy for constructing proposed projects while providing for the capital and operating needs of the existing transit system.

The first step in the development of the model is to establish the base modeling assumptions and inputs. This set of inputs should, to the maximum extent possible, contain all the information to support the calculation of the forecasts contained in the model. Year-by-year entry of inputs should be avoided in favor of formula calculations based on modeling inputs and base year information wherever possible. In some cases, such as the development of travel demand forecasts and O&M costs, internal calculation of some forecasts is not possible due to the complexity of the models that produce these forecasts. Special care is required to ensure that internally consistent scenarios are evaluated when external models supply some of the inputs.

The components usually required to populate a financial model include:

- Economic conditions
  - forecasts for various inflation rates (CPI, construction, labor, materials, real estate…etc.)
  - population, employment, and income growth
- Financial information
  - Interest rates
    - real and nominal rates
    - taxable yields
    - tax-exempt yields
    - long term and short term rates
  - Term of each debt issuance
  - Timing of each issuance
  - Issuance costs
  - Debt service reserve requirements
  - Other reserve fund requirements
  - Reinvestment rates
  - Issuance restrictions
- Revenue Forecasts
  - Ridership (growth)
  - Ridership elasticities
  - Fares
  - Federal grants
  - State grants

  - Local grants
  - Tax revenues or user fees
  - Other subsidies
  - Other operating revenues

- Expenses
  - Operations and Maintenance
    - Service levels (vehicles, vehicle miles, vehicle hours, track miles, etc.)
    - Labor
    - Materials
    - Fuel
    - Utilities
    - Replacement and rehabilitation
    - Special programs
    - Administration
    - Other
  - Capital
    - Proposed project
      - Right-of-way
      - Construction
      - System-wide elements
      - Vehicles
      - Shops
      - Stations
    - Other proposed or ongoing projects

- Sensitivity factors
  - Inflation
  - Population, employment and income growth
  - Tax revenues
  - Ridership
  - Grants
  - Service levels/operating costs
  - Capital costs and schedules

Creating a base table for all assumptions in the financial model instead of entering values on a year-by-year basis minimizes the amount of work associated with evaluating alternative scenarios with the model. Most importantly, it facilitates the financial evaluation by allowing systematic variations in the assumptions and their financial impacts. The financial model should carefully link parameters and inputs that are interrelated to ensure that the financial scenario presented is reasonable and consistent. For instance, the model should ensure that a rapid economic growth scenario not only corresponds to more rapid ridership and tax revenue growth, but also results in faster labor cost growth and higher costs for constructing major investments.

8.6.2.1 Structure of a Financial Model

To ease understanding and presentation, the financial model should be structured in separate modules. The modules should include focused financial information that can be combined into summary tables and a cash flow statement. Separate tables should be prepared for revenues and funding sources, operating and maintenance costs, capital costs, debt financing, and economic and planning assumptions. The financial model can combine this information in two ways: 1) as individual operating and capital plans which are combined into a cash flow statement, or 2) as individual schedules of sources and uses of funds which are combined into a cash flow statement.

The financial model then links changes in costs and revenues to changes in planning and financial assumptions. Since re-running the travel demand model and most O&M cost models every time a financial scenario is evaluated would be impractical and time consuming, travel demand estimates and O&M costs should be linked to service and economic factors using simple parametric relationships that are as consistent as possible with the relationships (elasticities) in the external models.

An example of a financial planning model for a large transit agency is presented on the following pages.

8.6.2.2 Modeling Assumptions

The financial analyst must be cautious to avoid being overly presumptuous of accuracy in forecasts of future conditions. Very few forecasters would have predicted the exceptionally low inflation and interest rate environment combined with rapid economic growth experienced in the late 1990's or the exceptionally high inflation and interest rates seen in the early 1980's. The responsible analyst will develop a variety of scenarios to represent the range of financial possibilities as well as developing a "best guess" scenario.

Scrupulous documentation of inflation assumptions is critical in the development and analysis of a financial plan. There are significant differences between measures of general price inflation like the Consumer Price Index (CPI) and the measures of inflation that represent the "basket" of inputs used in transit operations or construction. The seriousness of these differences compound over time. To minimize these potential errors, the financial model should accurately reflect the mix of labor, materials, fuel/power, real estate, and equipment used to operate and construct transit systems.

Economic forecasts drive a variety of items that affect the financial health of transit agencies. Ridership levels, service levels, and tax revenues depend on regional population, employment and income growth. These factors help determine major portions of the transit agency's revenue stream and the operating and maintenance costs of the transit system.

Table 8-16: : Example Financial Model - Inflation and Growth Inputs

Input Parameters	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Inflation Assumptions										→
CPI	2.25%	2.25%	2.25%	2.25%	2.25%	2.25%	2.25%	2.25%	2.25%	
Labor	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	
Fuel/Power	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
Materials	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	
Construction	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	
Real estate	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	
Inflation Factors (calculated)										
CPI	1.0225	1.0455	1.0690	1.0931	1.1177	1.1428	1.1685	1.1948	1.2217	
Labor	1.0300	1.0609	1.0927	1.1255	1.1593	1.1941	1.2299	1.2668	1.3048	
Fuel/Power	1.0200	1.0404	1.0612	1.0824	1.1041	1.1262	1.1487	1.1717	1.1951	
Materials	1.0250	1.0506	1.0769	1.1038	1.1314	1.1597	1.1887	1.2184	1.2489	
Construction	1.0400	1.0816	1.1249	1.1699	1.2167	1.2653	1.3159	1.3686	1.4233	
Real estate	1.0500	1.1025	1.1576	1.2155	1.2763	1.3401	1.4071	1.4775	1.5513	
Incremental Funding Growth over/under CPI										
Section 5307 Formula	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Section 5309 Rail Mod	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	
Local funding compact	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Funding Growth Factors (calculated)										
Section 5307 Formula	1.0225	1.0455	1.0690	1.0931	1.1177	1.1428	1.1685	1.1948	1.2217	
Section 5309 Rail Mod	1.0275	1.0558	1.0848	1.1146	1.1453	1.1768	1.2091	1.2424	1.2765	
Local funding compact	1.0225	1.0455	1.0690	1.0931	1.1177	1.1428	1.1685	1.1948	1.2217	
Growth Rates										
Real income growth	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
Real economic growth	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	
Population growth	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	
Employment growth	0.90%	0.90%	0.90%	0.90%	0.90%	0.90%	0.90%	0.90%	0.90%	
Economic Conditions										
Real Personal Income (mil$)	159,120	162,302	165,548	168,859	172,237	175,681	179,195	182,779	186,434	
Population	3,929,250	3,958,719	3,988,410	4,018,323	4,048,460	4,078,824	4,109,415	4,140,236	4,171,287	
Employment	2,361,060	2,382,310	2,403,750	2,425,384	2,447,213	2,469,237	2,491,461	2,513,884	2,536,509	

Table 8-17: O&M Costs and Travel Demand Inputs

Input Parameters	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
O&M Model Inputs										→
Peak buses	1055	1062	1070	1077	1085	1092	1100	1107	1115	
Bus vehicle miles	27,055,617	27,258,534	27,462,973	27,668,945	27,876,462	28,085,536	28,296,177	28,508,398	28,722,211	
Bus garages	5	5	5	5	5	5	5	5	5	
Direct Bus O&M (base yr$)	288,637,668	290,802,450	292,983,468	295,180,844	297,394,701	299,625,161	301,872,350	304,136,392	306,417,415	
% O&M Labor	79.50%	79.50%	79.50%	79.50%	79.50%	79.50%	79.50%	79.50%	79.50%	
% O&M Util/Fuel	10.20%	10.20%	10.20%	10.20%	10.20%	10.20%	10.20%	10.20%	10.20%	
Peak rail vehicles	666	666	666	666	666	666	666	666	666	
Rail veh miles	42,568,210	42,568,210	42,568,210	42,568,210	42,568,210	42,568,210	42,568,210	42,568,210	42,568,210	
Rail track miles	274	274	274	274	274	274	274	274	274	
Rail yards/shops	4	4	4	4	4	4	4	4	4	
Direct Rail O&M (base yr$)	395,489,120	395,489,120	395,489,120	395,489,120	395,489,120	395,489,120	395,489,120	395,489,120	395,489,120	
% O&M Labor	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	
% O&M Util/Fuel	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	
Project vehicles	0	0	0	0	0	0	30	30	30	
Project veh miles	-	-	-	-	-	-	-	-	3,417,885	
Project track miles	-	-	-	-	-	-	-	-	22	
Project yards/shops	-	-	-	-	-	-	-	-	-	
Direct Project O&M (base yr$)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,754,596	
% O&M Labor	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	73.20%	
% O&M Util/Fuel	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	8.10%	
Gen & Admin (base yr$)	$ 54,730,143	$ 54,903,326	$ 55,077,807	$ 55,253,597	$ 55,430,706	$ 55,609,142	$ 55,788,918	$ 55,970,041	$ 58,692,891	
Travel Demand Scenario										
Inputs from Travel Demand Model										
TDM Bus ridership	116,740,014	117,790,674	118,850,790	119,920,447	120,999,731	122,088,728	123,187,527	124,296,215	125,414,881	
TDM Rail Ridership	184,719,476	187,490,269	190,302,623	193,157,162	196,054,519	198,995,337	201,980,267	205,009,971	208,085,121	
TDM Project Ridership									3,600,000	
TDM Employment growth	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%	
Calculations										
Employment elasticity	1.00									
Bus Fare Elasticity	0.40									
Bus fares	$ 1.00	$ 1.00	$ 1.00	$ 1.10	$ 1.10	$ 1.10	$ 1.10	$ 1.10	$ 1.10	
Bus Ridership Scenario	116,392,917	117,094,399	117,803,232	113,821,486	114,559,306	115,304,625	116,057,510	116,818,025	117,586,237	
Employment elasticity	1.00									
Rail Fare Elasticity	0.20									
Rail fares	$ 1.60	$ 1.60	$ 1.60	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	
Rail Ridership Scenario	184,173,508	186,391,779	188,644,958	187,407,081	189,742,217	192,113,808	194,522,397	196,968,533	199,452,777	
Employment elasticity	1.00									
Project Fare Elasticity	0.20									
Proposed Project Fares	$ 1.60	$ 1.60	$ 1.60	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	
Project Ridership Scenario	-	-	-	-	-	-	-	-	3,600,000	

Table 8-18: Financial Model Cost Inputs

System Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Operations and Maintenance										→
Existing Bus O&M - Direct	$ 296,779,415	$ 307,443,168	$ 318,493,916	$ 329,945,817	$ 341,813,553	$ 354,112,345	$ 366,857,974	$ 380,066,804	$ 393,755,802	
Existing Rail O&M - Direct	$ 406,478,774	$ 417,779,230	$ 429,399,405	$ 441,348,470	$ 453,635,867	$ 466,271,309	$ 479,264,791	$ 492,626,600	$ 506,367,320	
New Project O&M - Direct	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,657,224	
Gen & Admin	$ 56,372,047	$ 58,246,938	$ 60,185,007	$ 62,188,410	$ 64,259,380	$ 66,400,224	$ 68,613,332	$ 70,901,173	$ 76,580,910	
Vehicle Costs										
Beginning buses	1,247	1,256	1,265	1,274	1,283	1,292	1,301	1,310	1,319	
Bus retirements	103	104	105	106	106	107	108	109	109	
Bus vehicle purchases	112	113	114	115	115	116	117	118	118	
Year end bus fleet	1,256	1,265	1,274	1,283	1,292	1,301	1,310	1,319	1,328	
Beginning rail vehicles	855	855	855	855	855	855	855	855	855	
Rail vehicle retirements	20	10	60	10	5	10	15	10	10	
Rail vehicle purchases	20	10	60	10	5	10	15	10	10	
Year end rail fleet	855	855	855	855	855	855	855	855	855	
Average bus cost	$ 357,875	$ 365,927	$ 374,161	$ 382,579	$ 391,187	$ 399,989	$ 408,989	$ 418,191	$ 427,600	
Average rail vehicle cost	$ 2,454,000	$ 2,509,215	$ 2,565,672	$ 2,623,400	$ 2,682,426	$ 2,742,781	$ 2,804,494	$ 2,867,595	$ 2,932,116	
Annual bus purchase costs	$ 40,082,000	$ 41,349,772	$ 42,654,303	$ 43,996,604	$ 44,986,527	$ 46,398,713	$ 47,851,673	$ 49,346,526	$ 50,456,823	
Annual rail vehicle purchase costs	$ 49,080,000	$ 25,092,150	$ 153,940,340	$ 26,234,000	$ 13,412,132	$ 27,427,811	$ 42,067,405	$ 28,675,947	$ 29,321,156	
Project vehicle purchases	-	-	-	-	-	-	30	-	-	
Year end vehicle fleet	-	-	-	-	-	-	30	30	30	
Existing System Capital Costs										
Bus facilities	$ 6,500,000	$ 6,760,000	$ 7,030,400	$ 7,311,616	$ 7,604,081	$ 7,908,244	$ 8,224,574	$ 8,553,557	$ 8,895,699	
Rail facilities	$ 23,400,000	$ 24,336,000	$ 25,309,440	$ 26,321,818	$ 27,374,690	$ 28,469,678	$ 29,608,465	$ 30,792,804	$ 32,024,516	
Other facilities										
Capital improvement program								$ 157,911,814	$ 164,228,286	
Major Rehabilitation Project	$ 155,000,000	$ 166,000,000	$ 175,000,000	$ 150,000,000	$ 45,000,000					
Rail Extension										
Proposed Project Capital Costs										
Right-of-way				$ 75,969,141	$ 79,767,598					
Construction				$ 96,470,046	$ 300,986,545	$ 313,026,007	$ 217,031,365	$ 112,856,310		
Vehicles				$ -	$ -	$ -	$ 84,134,809	$ -		
Engineering and Management				$ 79,339,896	$ 68,100,077	$ 56,114,464	$ 43,348,423	$ 29,765,917		
Contingency				$ 50,018,741	$ 90,937,596	$ 68,216,648	$ 47,741,115	$ 25,547,854		
Total Cost (Base year $/YOE$)				$ 301,797,824	$ 539,791,816	$ 437,357,118	$ 392,255,712	$ 168,170,081		

System Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Operating Revenues										→
Existing Bus Ridership	116,392,917	117,094,399	117,803,232	113,821,486	114,559,306	115,304,625	116,057,510	116,818,025	117,586,237	
Existing Rail Ridership	184,173,508	186,391,779	188,644,958	187,407,081	189,742,217	192,113,808	194,522,397	196,968,533	199,452,777	
New Project Ridership	-	-	-	-	-	-	-	-	3,600,000	
Average bus fare	$ 1.00	$ 1.00	$ 1.00	$ 1.10	$ 1.10	$ 1.10	$ 1.10	$ 1.10	$ 1.10	
Bus fare discount factor	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	
Average rail fare	$ 1.60	$ 1.60	$ 1.60	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	$ 1.75	
Rail fare discount factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	
Bus system revenues	$ 77,983,255	$ 78,453,247	$ 78,928,165	$ 83,886,435	$ 84,430,208	$ 84,979,509	$ 85,534,385	$ 86,094,885	$ 86,661,057	
Rail system revenues	$ 250,475,970	$ 253,492,820	$ 256,557,143	$ 278,768,033	$ 282,241,548	$ 285,769,289	$ 289,352,065	$ 292,990,694	$ 296,686,006	
New project revenues	-	-	-	-	-	-	-	-	5,355,000	
Other operating revenues	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	
Dedicated Revenues	Regression: ln(tax base) = a*ln(population) + b*ln(per capita income) + e									
Regression Parameters	a	0.85	estimated							
	b	1.12	estimated							
Tax base forecast (mil$)	59,584	62,166	64,859	67,669	70,601	73,659	76,851	80,180	83,654	
Tax rate	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	
Tax revenue	$ 609,248,919	$ 649,946,229	$ 693,362,084	$ 739,678,082	$ 789,087,949	$ 841,798,353	$ 898,029,768	$ 958,017,393	$ 1,022,012,140	
Federal Funding										
Section 5307	$ 85,123,125	$ 87,038,395	$ 88,996,759	$ 90,999,186	$ 93,046,668	$ 95,140,218	$ 97,280,873	$ 99,469,693	$ 101,707,761	
Section 5309 Bus										
Section 5309 Rail Mod	$ 67,280,700	$ 69,130,919	$ 71,032,020	$ 72,985,400	$ 74,992,499	$ 77,054,792	$ 79,173,799	$ 81,351,079	$ 83,588,233	
Section 5309 New Starts				$ 80,000,000	$ 80,000,000	$ 80,000,000	$ 80,000,000	$ 80,000,000		
Flexible Funds										
State Grants	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Local Grants	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Local funding compact	$ 97,137,500	$ 99,323,094	$ 101,557,863	$ 103,842,915	$ 106,179,381	$ 108,568,417	$ 111,011,206	$ 113,508,958	$ 116,062,910	

Table 8-20: Financial Planning Model - Debt Issuance and Service

Debt Financing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Existing Debt										→
Short Term Obligations										
Long Term Obligations	$3,093,656,000	$2,930,832,000	$2,768,008,000	$2,605,184,000	$2,442,360,000	$2,279,536,000	$2,116,712,000	$1,953,888,000	$1,791,064,000	
Short Term Debt Rate	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	
Long Term Debt Rate	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	
Short Term Principal Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Short Term Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Long Term Principal Payment	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	$ 162,824,000	
Long Term Interest Payment	$ 185,619,360	$ 175,849,920	$ 166,080,480	$ 156,311,040	$ 146,541,600	$ 136,772,160	$ 127,002,720	$ 117,233,280	$ 107,463,840	
Reserve Balance	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	$ 300,000,000	
Debt Retirement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,241,799	
Financing Requirements	$ 154,309,434	$ 123,709,342	$ 237,640,740	$ 268,021,608	$ 372,379,821	$ 230,683,782	$ 174,300,311	$ 59,730,292	$ -	

New Long Term Debt

Bond Rate	6.00%	Market
Term	30	Determined by debt structure
Interest only (yrs)	-	
Issue costs	2.00%	% of principal
Debt service factor	9.33%	Calculated (1 year of P&I)
Timing	1	Month of issuance
Reinvestment rate	5.91%	Rate on State and Local Government Securities (SLGS) from US Dept. of Treasury

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Debt Issuance	$ 156,151,657	$ 174,033,196	$ 139,521,814	$ 268,015,873	$ 302,280,009	$ 419,977,242	$ 260,169,679	$ 196,579,298	$ 67,364,991	
Financing Costs	$ 3,123,033	$ 3,480,664	$ 2,790,436	$ 5,360,317	$ 6,045,600	$ 8,399,545	$ 5,203,394	$ 3,931,586	$ 1,347,300	
Debt Service Reserves	$ 14,574,155	$ 16,243,098	$ 13,022,036	$ 25,014,815	$ 28,212,801	$ 39,197,876	$ 24,282,503	$ 18,347,401	$ 6,287,399	
Net Proceeds	$ 138,454,469	$ 154,309,434	$ 123,709,342	$ 237,640,740	$ 268,021,608	$ 372,379,821	$ 230,683,782	$ 174,300,311	$ 59,730,292	
Principal outstanding	$ -	$ 174,033,196	$ 307,753,904	$ 565,317,943	$ 848,212,256	$1,238,727,802	$ 1,455,436,543	$ 1,599,882,581	$1,608,561,668	
Principal Payment	$ 5,205,055	$ 5,801,107	$ 4,650,727	$ 8,933,862	$ 10,076,000	$ 13,999,241	$ 8,672,323	$ 6,552,643	$ 2,245,500	
Interest Payment	$ -	$ 10,441,992	$ 18,465,234	$ 33,919,077	$ 50,892,735	$ 74,323,668	$ 87,326,193	$ 95,992,955	$ 96,513,700	
Total payment	$ -	$ 16,243,098	$ 28,917,068	$ 53,304,773	$ 80,354,432	$ 117,784,606	$ 139,459,453	$ 154,678,859	$ 157,445,104	
Reserve Balance	$ 14,574,155	$ 16,243,098	$ 29,265,134	$ 54,279,949	$ 82,492,750	$ 121,690,626	$ 145,973,129	$ 164,320,530	$ 170,607,930	

Transit Operations Plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
OPERATING REVENUES										→
Passenger Revenues										
Bus	$ 77,983,255	$ 78,453,247	$ 78,928,165	$ 83,886,435	$ 84,430,208	$ 84,979,509	$ 85,534,385	$ 86,094,885	$ 86,661,057	
Rail	$ 250,475,970	$ 253,492,820	$ 256,557,143	$ 278,768,033	$ 282,241,548	$ 285,769,289	$ 289,352,065	$ 292,990,694	$ 296,686,006	
Project	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,355,000	
Other Operating Revenues	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	
TOTAL TRANSPORTATION REVENUES	$ 345,335,727	$ 348,822,569	$ 352,361,810	$ 379,530,970	$ 383,548,258	$ 387,625,300	$ 391,762,952	$ 395,962,080	$ 405,578,565	
OPERATING EXPENSES										
Direct Operating and Maintenance										
Bus	$ 296,779,415	$ 307,443,168	$ 318,493,916	$ 329,945,817	$ 341,813,553	$ 354,112,345	$ 366,857,974	$ 380,066,804	$ 393,755,802	
Rail	$ 406,478,774	$ 417,779,230	$ 429,399,405	$ 441,348,470	$ 453,635,867	$ 466,271,309	$ 479,264,791	$ 492,626,600	$ 506,367,320	
Project	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,657,224	
TOTAL DIRECT TRANSIT O&M COSTS	$ 703,258,188	$ 725,222,398	$ 747,893,320	$ 771,294,287	$ 795,449,420	$ 820,383,653	$ 846,122,765	$ 872,693,404	$ 940,780,346	
General and Administrative Expenses	$ 56,372,047	$ 58,246,938	$ 60,185,007	$ 62,188,410	$ 64,259,380	$ 66,400,224	$ 68,613,332	$ 70,901,173	$ 76,580,910	
TOTAL TRANSIT O&M COSTS	$ 759,630,236	$ 783,469,336	$ 808,078,327	$ 833,482,698	$ 859,708,800	$ 886,783,878	$ 914,736,097	$ 943,594,577	$ 1,017,361,256	
OPERATING SURPLUS (DEFICIT)	($414,294,509)	($434,646,767)	($455,716,517)	($453,951,728)	($476,160,542)	($499,158,577)	($522,973,145)	($547,632,497)	($611,782,691)	
NON-OPERATING REVENUES										
Sales Tax Revenue	$ 609,248,919	$ 649,946,229	$ 693,362,084	$ 739,678,082	$ 789,087,949	$ 841,798,353	$ 898,029,768	$ 958,017,393	$ 1,022,012,140	
Local Funding Compact	$ 97,137,500	$ 99,323,094	$ 101,557,863	$ 103,842,915	$ 106,179,381	$ 108,568,417	$ 111,011,206	$ 113,508,958	$ 116,062,910	
Interest Earnings	$ 29,473,657	$ 29,913,504	$ 31,035,329	$ 32,877,302	$ 34,920,028	$ 37,624,114	$ 39,459,244	$ 40,956,569	$ 41,754,539	
TOTAL NON-OPERATING REVENUES	$ 735,860,076	$ 779,182,826	$ 825,955,277	$ 876,398,300	$ 930,187,358	$ 987,990,884	$ 1,048,500,218	$ 1,112,482,920	$ 1,179,829,589	
TOTAL AVAILABLE FOR CAPITAL PROJECTS	$ 321,565,567	$ 344,536,059	$ 370,238,759	$ 422,446,572	$ 454,026,816	$ 488,832,306	$ 525,527,073	$ 564,850,423	$ 568,046,898	
OPERATING RATIOS										
Farebox Recovery Ratio	43.2%	42.4%	41.5%	43.5%	42.7%	41.8%	41.0%	40.2%	38.2%	
Gross Operating Ratio	45.5%	44.5%	43.6%	45.5%	44.6%	43.7%	42.8%	42.0%	39.9%	
% of Non-Operating Revenues used for Operations	56.3%	55.8%	55.2%	51.8%	51.2%	50.5%	49.9%	49.2%	51.9%	

Table 8-22: Financial Planning Model - Capital Program

Transit Capital Program	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
Revenues										→
Operating Revenues Available for Capital Projects	$ 321,565,567	$ 344,536,059	$ 370,238,759	$ 422,446,572	$ 454,026,816	$ 488,832,306	$ 525,527,073	$ 564,850,423	$ 568,046,898	
Federal Grants										
Section 5307	$ 85,123,125	$ 87,038,395	$ 88,996,759	$ 90,999,186	$ 93,046,668	$ 95,140,218	$ 97,280,873	$ 99,469,693	$ 101,707,761	
Section 5309 Bus	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Section 5309 Rail Mod	$ 67,280,700	$ 69,130,919	$ 71,032,020	$ 72,985,400	$ 74,992,499	$ 77,054,792	$ 79,173,799	$ 81,351,079	$ 83,588,233	
Section 5309 New Starts	$ -	$ -	$ -	$ 80,000,000	$ 80,000,000	$ 80,000,000	$ 80,000,000	$ 80,000,000	$ -	
Flexible Funds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
TOTAL FEDERAL GRANTS	$ 152,403,825	$ 156,169,315	$ 160,028,779	$ 243,984,586	$ 248,039,167	$ 252,195,010	$ 256,454,672	$ 260,820,771	$ 185,295,994	
State Grants	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Local Grants	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
TOTAL GRANTS	$ 152,403,825	$ 156,169,315	$ 160,028,779	$ 243,984,586	$ 248,039,167	$ 252,195,010	$ 256,454,672	$ 260,820,771	$ 185,295,994	
TOTAL CAPITAL REVENUES	$ 473,969,392	$ 500,705,374	$ 530,267,538	$ 666,431,158	$ 702,065,983	$ 741,027,317	$ 781,981,745	$ 825,671,194	$ 753,342,892	
Expenditures										
Bus System Expenditures										
Vehicles	$ 40,082,000	$ 41,349,772	$ 42,654,303	$ 43,996,604	$ 44,986,527	$ 46,398,713	$ 47,851,673	$ 49,346,526	$ 50,456,823	
Facilities	$ 6,500,000	$ 6,760,000	$ 7,030,400	$ 7,311,616	$ 7,604,081	$ 7,908,244	$ 8,224,574	$ 8,553,557	$ 8,895,699	
Other	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
TOTAL BUS SYSTEM CAPITAL	$ 46,582,000	$ 48,109,772	$ 49,684,703	$ 51,308,220	$ 52,590,608	$ 54,306,957	$ 56,076,246	$ 57,900,083	$ 59,352,522	
Rail System Expenditures										
Vehicles	$ 49,080,000	$ 25,092,150	$ 153,940,340	$ 26,234,000	$ 13,412,132	$ 27,427,811	$ 42,067,405	$ 28,675,947	$ 29,321,156	
Facilities	$ 23,400,000	$ 24,336,000	$ 25,309,440	$ 26,321,818	$ 27,374,690	$ 28,469,678	$ 29,608,465	$ 30,792,804	$ 32,024,516	
Capital Improvement Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 157,911,814	$ 164,228,286	
Major Rehabilitation Project	$ 155,000,000	$ 166,000,000	$ 175,000,000	$ 150,000,000	$ 45,000,000	$ -	$ -	$ -	$ -	
Rail Extension	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
TOTAL RAIL SYSTEM CAPITAL	$ 227,480,000	$ 215,428,150	$ 354,249,780	$ 202,555,817	$ 85,786,823	$ 55,897,489	$ 71,675,870	$ 217,380,565	$ 225,573,958	
Other Facility Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Project Expenses	$ -	$ -	$ -	$ 301,797,824	$ 539,791,816	$ 437,357,118	$ 392,255,712	$ 168,170,081	$ -	
TOTAL CAPITAL EXPENDITURES	$ 274,062,000	$ 263,537,922	$ 403,934,483	$ 555,661,861	$ 678,169,246	$ 547,561,563	$ 520,007,828	$ 443,450,728	$ 284,926,480	
Debt/Cash Management										
Beginning Cash	$ 184,134,092	$ 189,907,559	$ 195,867,334	$ 202,019,582	$ 208,370,674	$ 214,927,200	$ 221,695,969	$ 228,684,024	$ 235,898,644	
Surplus (Deficit)	$ 199,907,392	$ 237,167,451	$ 126,333,055	$ 110,769,297	$ 23,896,736	$ 193,465,753	$ 261,973,917	$ 382,220,466	$ 468,416,412	
Debt Service	$ (348,443,360)	$ (354,917,018)	$ (357,821,548)	$ (372,439,813)	$ (389,720,032)	$ (417,380,766)	$ (429,286,173)	$ (434,736,139)	$ (427,732,944)	
Balance before Financing	$ 35,598,125	$ 72,157,992	$ (35,621,159)	$ (59,650,934)	$ (157,452,621)	$ (8,987,813)	$ 54,383,713	$ 176,168,352	$ 276,582,113	
Reserve Req. (3 months Operations)	$ 189,907,559	$ 195,867,334	$ 202,019,582	$ 208,370,674	$ 214,927,200	$ 221,695,969	$ 228,684,024	$ 235,898,644	$ 254,340,314	
Net Financing Requirement	$ 154,309,434	$ 123,709,342	$ 237,640,740	$ 268,021,608	$ 372,379,821	$ 230,683,782	$ 174,300,311	$ 59,730,292	$ (22,241,799)	

Table 8-23: Financial Planning Model - Summary Results

Summary Results	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Years 10-20
BEGINNING CASH	$ 184,134,092	$ 189,907,559	$ 195,867,334	$ 202,019,582	$ 208,370,674	$ 214,927,200	$ 221,695,969	$ 228,684,024	$ 235,898,644	→
SOURCES OF FUNDS										
Passenger Revenues	$ 328,459,225	$ 331,946,067	$ 335,485,308	$ 362,654,468	$ 366,671,756	$ 370,748,798	$ 374,886,450	$ 379,085,578	$ 388,702,063	
Other Operating Revenues	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	$ 16,876,502	
Sales Tax Revenue	$ 609,248,919	$ 649,946,229	$ 693,362,084	$ 739,678,082	$ 789,087,949	$ 841,798,353	$ 898,029,768	$ 958,017,393	$ 1,022,012,140	
Local Funding Compact	$ 97,137,500	$ 99,323,094	$ 101,557,863	$ 103,842,915	$ 106,179,381	$ 108,568,417	$ 111,011,206	$ 113,508,958	$ 116,062,910	
Interest Earnings	$ 29,473,657	$ 29,913,504	$ 31,035,329	$ 32,877,302	$ 34,920,028	$ 37,624,114	$ 39,459,244	$ 40,956,569	$ 41,754,539	
Total Grants	$ 152,403,825	$ 156,169,315	$ 160,028,779	$ 243,984,586	$ 248,039,167	$ 252,195,010	$ 256,454,672	$ 260,820,771	$ 185,295,994	
Total Funds Available	$ 1,417,733,721	$ 1,474,082,269	$ 1,534,213,199	$ 1,701,933,438	$ 1,770,145,457	$ 1,842,738,394	$ 1,918,413,811	$ 1,997,949,796	$ 2,006,602,792	
USES OF FUNDS										
Operating Expenses										
Transit System O&M	$ 703,258,188	$ 725,222,398	$ 747,893,320	$ 771,294,287	$ 795,449,420	$ 820,383,653	$ 846,122,765	$ 872,693,404	$ 940,780,346	
General and Administrative	$ 56,372,047	$ 58,246,938	$ 60,185,007	$ 62,188,410	$ 64,259,380	$ 66,400,224	$ 68,613,332	$ 70,901,173	$ 76,580,910	
Capital Expenditures										
Bus Vehicles	$ 40,082,000	$ 41,349,772	$ 42,654,303	$ 43,996,604	$ 44,986,527	$ 46,398,713	$ 47,851,673	$ 49,346,526	$ 50,456,823	
Bus Facilities	$ 6,500,000	$ 6,760,000	$ 7,030,400	$ 7,311,616	$ 7,604,081	$ 7,908,244	$ 8,224,574	$ 8,553,557	$ 8,895,699	
Rail Vehicles	$ 49,080,000	$ 25,092,150	$ 153,940,340	$ 26,234,000	$ 13,412,132	$ 27,427,811	$ 42,067,405	$ 28,675,947	$ 29,321,156	
Rail Facilities	$ 23,400,000	$ 24,336,000	$ 25,309,440	$ 26,321,818	$ 27,374,690	$ 28,469,678	$ 29,608,465	$ 30,792,804	$ 32,024,516	
Capital Improvement Program	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 157,911,814	$ 164,228,286	
Major Rehabilitation Project	$ 155,000,000	$ 166,000,000	$ 175,000,000	$ 150,000,000	$ 45,000,000	$ -	$ -	$ -	$ -	
Proposed Project	$ -	$ -	$ -	$ 301,797,824	$ 539,791,816	$ 437,357,118	$ 392,255,712	$ 168,170,081	$ -	
Total Uses of Funds	$ 1,033,692,236	$ 1,047,007,258	$ 1,212,012,810	$ 1,389,144,559	$ 1,537,878,047	$ 1,434,345,441	$ 1,434,743,925	$ 1,387,045,305	$ 1,302,287,736	
FUNDS AVAILABLE BEFORE FINANCING	$ 384,041,485	$ 427,075,010	$ 322,200,389	$ 312,788,879	$ 232,267,411	$ 408,392,953	$ 483,669,886	$ 610,904,491	$ 704,315,056	
DEBT FINANCING										
Total Outstanding Debt	$ 3,093,656,000	$ 3,104,865,196	$ 3,075,761,904	$ 3,170,501,943	$ 3,290,572,256	$ 3,518,263,802	$ 3,572,148,543	$ 3,553,770,581	$ 3,399,625,668	
Short Term Financing Proceeds										
Long Term Financing Proceeds	$ 154,309,434	$ 123,709,342	$ 237,640,740	$ 268,021,608	$ 372,379,821	$ 230,683,782	$ 174,300,311	$ 59,730,292	$ -	
Debt Service Requirements	$ (348,443,360)	$ (354,917,018)	$ (357,821,548)	$ (372,439,813)	$ (389,720,032)	$ (417,380,766)	$ (429,286,173)	$ (434,736,139)	$ (427,732,944)	
Transfer to Debt Reduction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (22,241,799)	
Net Effect of Financing	$ (194,133,926)	$ (231,207,676)	$ (120,180,808)	$ (104,418,204)	$ (17,340,211)	$ (186,696,984)	$ (254,985,862)	$ (375,005,846)	$ (449,974,742)	
ENDING CASH BALANCE	$ 189,907,559	$ 195,867,334	$ 202,019,582	$ 208,370,674	$ 214,927,200	$ 221,695,969	$ 228,684,024	$ 235,898,644	$ 254,340,314	
Debt Ratios										
Minimum Coverage Ratio	1.50									
Pledged Funds (Gross Tax)	$ 609,248,919	$ 649,946,229	$ 693,362,084	$ 739,678,082	$ 789,087,949	$ 841,798,353	$ 898,029,768	$ 958,017,393	$ 1,022,012,140	
Pledged Funds (Net Tax)	$ 444,495,735	$ 470,791,870	$ 499,232,209	$ 633,553,856	$ 667,145,954	$ 703,403,203	$ 742,522,501	$ 784,714,625	$ 711,588,353	
Debt Service Requirements	$ (348,443,360)	$ (354,917,018)	$ (357,821,548)	$ (372,439,813)	$ (389,720,032)	$ (417,380,766)	$ (429,286,173)	$ (434,736,139)	$ (427,732,944)	
Coverage Ratio (Gross Tax)	1.75	1.83	1.94	1.99	2.02	2.02	2.09	2.20	2.39	
Rem. Debt Capacity (Gross)	$ 794,541,649	$ 1,078,893,901	$ 1,437,321,488	$ 1,661,124,802	$ 1,876,677,821	$ 1,979,632,362	$ 2,331,767,059	$ 2,807,228,891	$ 3,490,877,950	
Coverage Ratio (Net Tax)	1.28	1.33	1.40	1.70	1.71	1.69	1.73	1.81	1.66	
Remaining Debt Capacity (Net)	$ (717,324,855)	$ (565,125,767)	$ (344,121,812)	$ 687,270,097	$ 757,670,508	$ 709,641,779	$ 904,746,216	$ 1,216,906,668	$ 642,257,276	

8.6.2.3 Evaluation of Cash Flows

The evaluation of cash flows, whether using the financial model or not, is based on a variety of financial indicators which may be agency specific. The evaluation criteria used to evaluate financial capability could include:

- Ending cash balances;
- Operating and/or capital reserves;
- Net financing requirements;
- Gross or net coverage ratios for debt;
- Farebox recovery ratios;
- Debt ceilings or other debt limitations;
- Cost of capital; and/or
- Other objectives that may be locally mandated.

Any violations of the established financial capability criteria should be calculated and readily apparent from the financial plan or financial model. The transit agency can evaluate its options to address the funding shortfall, additional financing requirements, failure to comply with local mandates or any other violation of established financial criteria.

The first item to check when evaluating financial capability is the annual operating results. The figures in question appear at the bottom of the cash flow statement and represent the agency's ability to cover operating and capital costs and, if applicable, debt service with revenues received during the year in question. If the annual operating results are positive throughout the 20-year planning period and the agency maintains a cash balance sufficient to cover operating and capital requirements, the financial plan demonstrates solid financial capacity to build the proposed project and operate and maintain the existing and planned system. If the annual operating results are negative, different financial strategies must be explored.

The capital costs of major transit projects are usually so great and concentrated in a short period of time, that most transit agencies will need to specify a new funding source or draw additional funds from an existing source to maintain financial viability. The need for additional local funds has intensified as the share of project costs covered by federal Section 5309 New Starts funding declines.

To implement a major transit project, most transit agencies will need to employ one or more of the following strategies:

- issue bonds/other borrowing;
- reduce other costs; and/or
- secure new funding sources.

8.6.2.4 Debt Financing

In addition to securing federal, state or local grants, many transit agencies have entered the municipal bond market for capital to build major transit projects. As detailed in Section 8.5.7, issuing debt (or TIFIA loans, vendor financing, or leasing) spreads the cost of capital improvements over longer periods of time bringing annual capital expenses within the financial capability of the issuing authority. If the financial model projects funding shortfalls only during the construction period with annual operating results becoming positive after completion, debt financing may offer a financially attractive solution to funding the proposed project (see Figure 8-9, Figure 8-10, and Figure 8-11). If operating deficits continue after construction, expenses must be reduced or new funding sources secured to construct and operate the proposed project and the existing transit system.

To illustrate financial capability to implement a major capital investment using debt financing, the transit agency must demonstrate that its bonds (or other debt instrument) will be well received by the financial markets. A solid long range financial plan and model that forecasts debt coverage ratios that meet or exceed those required by the bond markets, under conservative planning assumptions, is generally required to successfully market long-term debt.

Debt issuance limitations may prevent agencies from issuing debt even when the financial markets would favorably receive additional bonds. Sometimes, the legislation that authorizes the creation of a transit agency also limits the ability of the transit agency to issue debt. Typically, the total amount of debt outstanding is limited to a specific amount. Other limits can include limits on the amount of debt as a percentage of certain regional indicators such as assessed property values. Some agencies can have the debt limits changed by governing boards, while others may need voter approval.

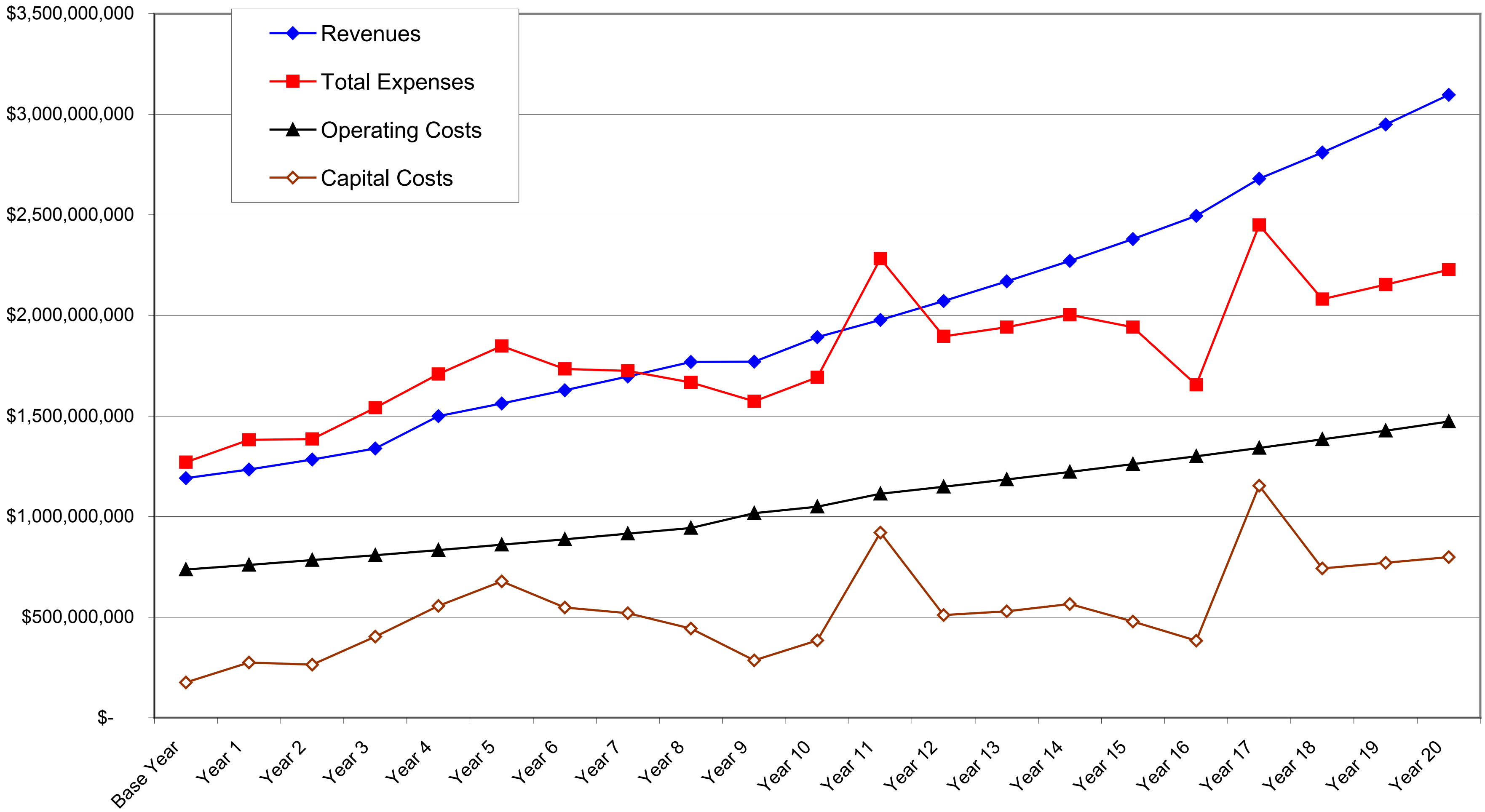


Figure 8-9: Revenues and Expenses without Bonding

Figure 8-10: Revenues and Expenses including Debt

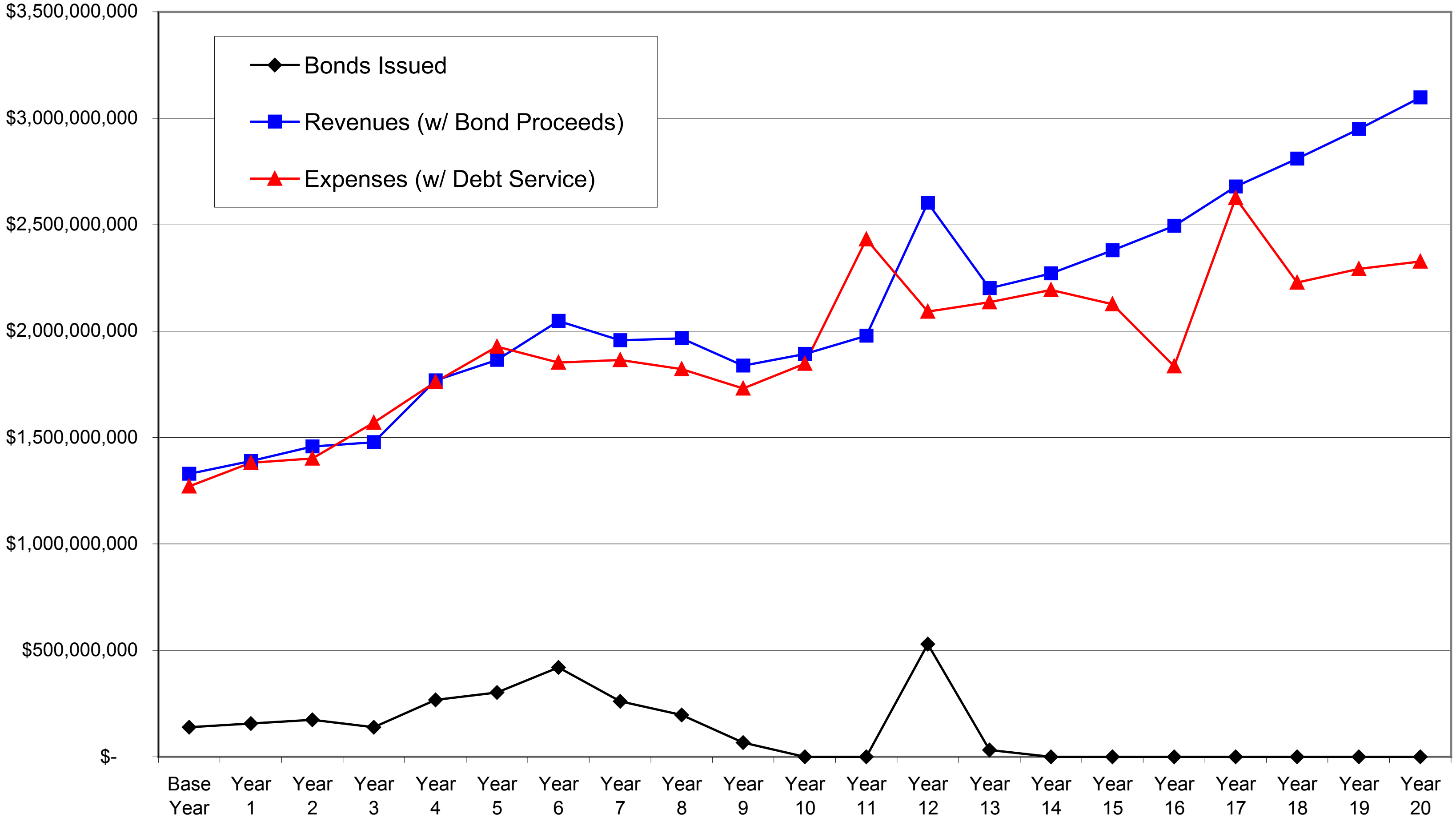
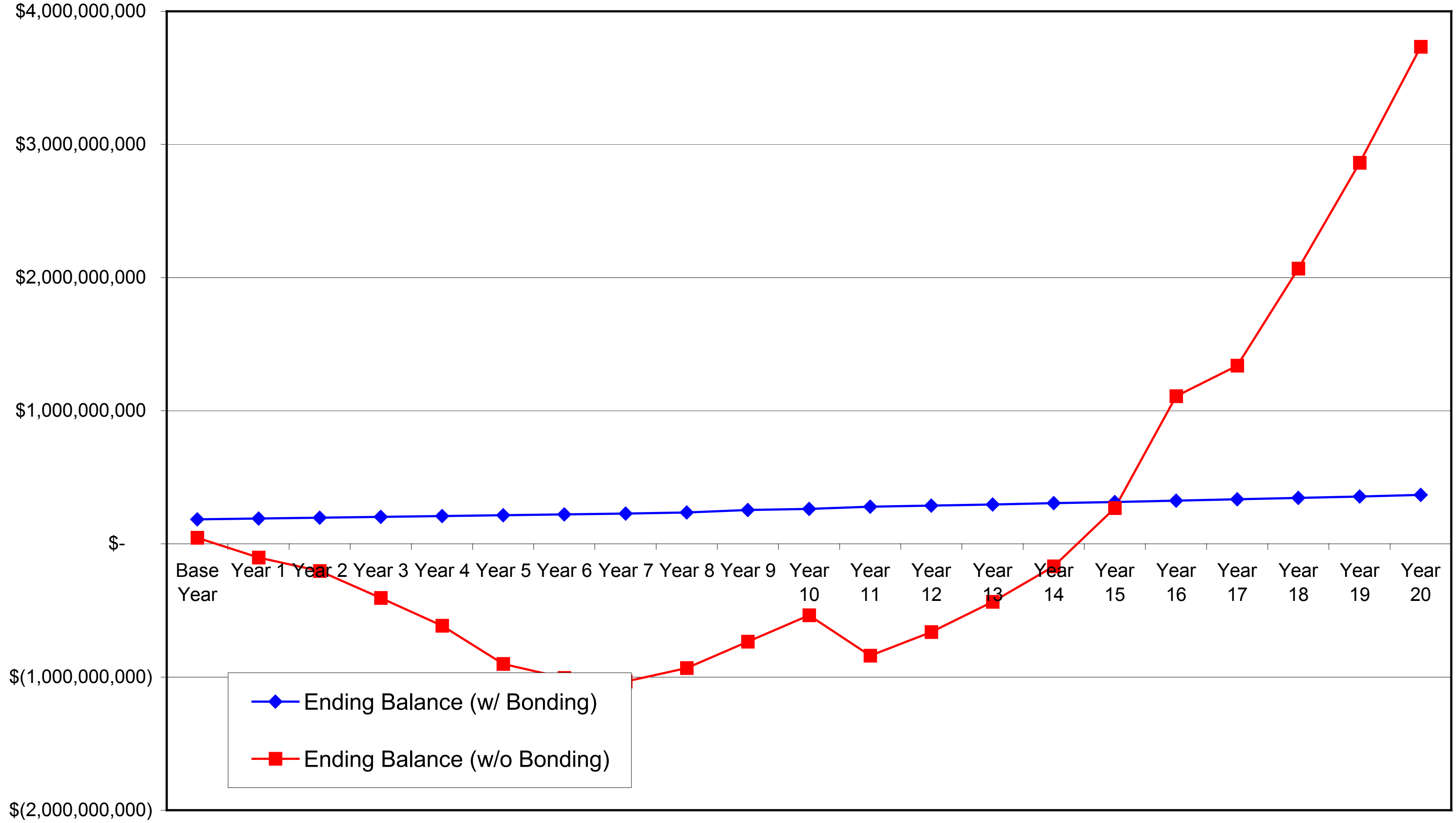


Figure 8-11: Ending Balances - Bonding and Without



8.6.2.5 Identifying Alternative Funding Options

If the transit agency has an insufficient revenue stream to meet its financial requirements, either to cover ongoing pay-as-you-go expenses or to cover debt service, the agency must secure additional resources if its proposed capital investments are to be implemented.

New revenue sources generally require a local political consensus about the need for the proposed investments (or the continuing need for existing transit services). Strong local political support can result in major state or local grants or assist in the passage of local funding referenda.

From a financial perspective, broad based, dedicated taxes (e.g. sales or gas taxes, user fees, property or income taxes) are the most reliable funding sources for major transit investments. While certainly not required, the high cost of most fixed guideway transit systems means that few transit agencies in the US have built major capital investments without access to these types of revenue sources. Also, the detailed records kept regarding the historical bases for these taxes enable detailed and relatively accurate forecasts of future revenues. Financial markets look favorably on these sources as solid security for debt issuance.

If the financial needs are more modest, the transit agency should explore some other revenue sources as detailed in 8.5.8. These can include innovative financing techniques, flexible funds, airport improvement funds, and joint development among others.

Another potential source of revenue is fare increases. However, fare increases of the magnitude required to support major new investments will likely generate significant local opposition.

8.6.2.6 Reducing Costs

Another alternative to predicted financial deficiencies is cost cutting. Strategies to reduce costs can include restructuring the transit agency to reduce labor costs, privatization of key agency functions, rescheduling of project construction activities or rescheduling other planned capital investments.

Reducing needed operations or maintenance activities for the existing transit system is NOT an acceptable method for freeing up additional resources if the agency is seeking federal funding for a proposed major transit investment. The criteria for receiving federal capital grants attempt to ensure that agencies are capable of adequately operating and maintaining existing transit services into the foreseeable future.

If financial deficiencies are identified, the construction period for the proposed project will need to be stretched out over a longer period of time. This method is occasionally necessary but can result in higher construction costs for the project and will delay the generation of transportation benefits provided by the project.

8.6.3 Risk and Sensitivity Analysis

An understanding of the uncertainty surrounding any financial or economic forecast is crucial to a financial analysis. The primary benefit of building an integrated financial model is the ability to test the sensitivity of the agency's financial position to variations in the modeling inputs. While a financial plan might indicate adequate financial capability to implement the proposed capital and operating plan under current assumptions, the financial analyst will want to understand how that financial capability could change under a variety of potential scenarios.

Responsible financial planning requires that transit agencies proceed with a complete understanding of the uncertainties in its financial plan, the problems that may arise, and some idea about the strategy that will need to be employed if its financial capability is threatened.

Unfortunately, uncertainty underlies most inputs to the financial model. The areas most prone to uncertainty can be categorized as:

- risk to project cost estimates and schedules;
- risk to economic conditions; and
- risk to the political environment.

Despite these uncertainties, financial planners must make reasonable, conservative estimates of future economic conditions, rely on well documented and competent cost estimates for capital and operating and maintenance expenses, and have a contingency plan to deal with potentially erratic funding from federal, state, or local funding partners. The financial model should be revisited, worst case assumptions tested, and strategies developed to deal with unanticipated future conditions.

8.6.3.1 Analyzing the Range of Possibilities

Sensitivity analysis is a vital component of responsible financial planning. Sensitivity analysis should be performed on all-important variables separately and in tandem to determine the sensitivity of the financial position of the transit agency with respect to each. Perhaps the most enlightening analysis is the construction of optimistic and pessimistic scenarios to test the range of financial possibilities. Most economic forecasts have a baseline forecast that is considered the most likely with high growth and low growth scenarios presented. Often, a separate "recession" scenario is developed to illustrate a very negative possibility. A final analysis, a stress test, should be performed to gauge the ability of the transit agency to deal with the cumulative effects of compounding unfortunate circumstances. The stress test seeks to answer the question, "How bad could it get?"

The important variables to evaluate in a sensitivity analysis are inflation, interest rates, economic growth, ridership, grant availability, O&M costs, and capital costs. While there is value in testing variations in each variable in isolation, some variables are not isolated from each other. Higher population growth leads to higher ridership growth. Rising inflation leads to higher interest rates. The range of possibilities is defined by developing internally coherent scenarios that represent positive and negative economic possibilities and then testing the impact of variations in key variables that are unrelated to the economic climate.

Table 8-24 provides a possible array of scenarios that can be tested to provide an analytical foundation for the assessment of risk in the financial plan. Clearly a few key scenarios are the most relevant (see **bold** elements in Table 8-24). Lower than expected economic growth combined with lower than expected federal share, extended payout period, and higher than expected construction costs/delays are the key risk factors. The other scenario combinations complete the range of possibilities.

Table 8-24: Possible Sensitivity Analysis Framework

		MAJOR RISK ELEMENTS			
		Inflation	Federal/Local Grants	Federal New Starts Share/Schedule	Capital Costs/Delays
ECONOMIC SCENARIOS	High Growth	High Best Guess Low	Historical Growth Constant or declining	As proposed Lower share Extended payout	Best Guess High cost scenario
	"Best Guess"	**High** Best Guess Low	**Historical Growth** Constant or declining	As proposed **Lower share** **Extended payout**	Best Guess **High cost/Delay scenario**
	Low Growth/ Recession	**High** Best Guess Low	**Historical Growth** Constant or declining	As proposed **Lower share** **Extended payout**	Best Guess **High cost/Delay scenario**

In actual practice, inflation has less impact than may be expected. It tends to affect many elements of the financial plan in offsetting ways. For instance, high cost inflation may be balanced by fare increases that keep pace with inflation and tax revenues that follow inflation upwards. The major exception to this balancing of inflation impacts occurs when agencies have variable rate debt or need to issue significant debt in the future. In the case of debt, an increase in the interest rate from 5 to 10 percent is a 50 percent increase in debt service costs. For agencies relying on a significant amount of debt, inflation can erode the financial capability of the system.

One of the most powerful effects revealed in a sensitivity analysis is the compounding of initially minor problems. A small change in an early year of the plan may not cause immediate financial difficulty, but can lead to diverging trends between revenues and costs in future years. Depending on the statistical relationships, if real economic growth turns out to average 1 percent rather than 2 percent, revenues from a sales tax could be 25 percent lower after 20 years. That could have a severe impact on the financial capability of the transit agency. The lower growth scenario also leads to lower ridership and fare revenues, the effects of which compound over time.

Another key source of funding uncertainty is the federal payout envisioned for proposed New Starts projects. Budget pressures and an increasing number of projects seeking federal funds have placed downward pressure on the federal share provided to new projects. The law still allows 80 percent federal funding, but the average federal New Starts funding share has declined to around 50 percent in recent years. Recent initiatives have indicated that future New Starts funding shares may be limited to 60 percent and below.

Another major source of uncertainty with respect to the federal New Starts payment is the payout schedule. While the federal government has always provided the total amount specified in the FFGA, the payout is often made over a longer period of time than specified in the FFGA. To maintain the planned construction schedule, project sponsors often need to self finance a larger than anticipated proportion of project costs during construction and receive additional payments from the federal government after the project has been completed. The net effect of this is to increase financing expenses for the project sponsor and increase the cash flow burden during peak construction.

While many transportation projects have been constructed on time and within budget, it is no secret that many other projects have been delayed and/or have experienced significant cost overruns during construction. The more complex the project, the more serious the financial risk. A major problem is that financial planners are not generally in the position to assess the likelihood of a cost overrun. The financial planner needs to rely on cost numbers produced during the engineering and design process. Financial planners need to insist that cost estimates be accompanied by some analysis that describes the risks and the construction cost implications of those risks.

Project cost estimates should be reported as ranges with a “best guess”, an upper estimate that assumes the worst, and a lower estimate that assumes the best. Cost estimates reported as a range provide the analytical basis for testing the impact of a cost overrun on the financial capability of the transit agency.

Transit agencies should carefully weigh the risks of embarking on construction projects that could not be completed if costs were to rise to the upper bound estimate.

8.6.3.2 Performing the Stress Test ("How Bad Could it Get?")

The "Stress Test" is an enlightening exercise to define the conditions under which the financial plan for the transit agency becomes unviable. The stress test assumes that all of the bad things that could happen actually do. The financial analyst attempts to mitigate the financial impact through means at the agency's disposal. If the financial capability to implement the proposed project cannot be salvaged using strategies available to the transit agency, specific actions should be identified that would need to be implemented under the worst case scenario.

The stress test will generally combine all negative possibilities. For example, most stress test scenarios would combine the low growth/recession scenario with high inflation, constant or declining nominal growth in federal formula funding, 50 percent or less New Starts funding paid over two to three more years than planned, and the upper bound cost estimate. The initial result may be a financially debilitated agency.

The strategy to deal with the stress test case might include additional bonding, delay or cancellation of other capital projects, delay of the proposed project, or redesign/reduced scope of the proposed project. If all of these actions cannot make the transit agency financially capable of implementing the proposed project, alternative strategies need to be identified. Options might include raising the debt limit, raising fares, or securing additional funding sources. Reducing the required operating and maintenance expenses through reduced service or deferred maintenance on the existing transit system are not acceptable strategies. Local decision-makers should be aware of the results of the stress test so that local decisions to proceed with major projects can be made with an understanding of the risks involved.

8.6.4 Update the Financial Plan

All transit agencies should maintain a current long-range financial plan to assist in the development of new services and projects and identify future funding needs before potential problems become acute. The need for a periodically updated financial plan increases during the planning of major capital projects. The financial plan supports the development of funding strategies at every stage of project planning including supporting the federal funding application process and the issuance of debt on financial markets.

At a minimum, the financial plan is updated every year as new budget information becomes available. Actual financial results replace forecasts from the previous year. Forecasting equations are re-estimated with another year of data and the resulting forecasts updated. Any policy changes or changes to any cost drivers or revenues are made to reflect current reality.

In addition, any event that has a material impact on current or future financial results should engender a revision in the financial plan. Events such as increases in the debt ceiling, passage or loss of funding referenda, a labor strike, changes in the schedule or cost estimates of proposed projects or other such events should be reflected in the current long range financial plan.

8.7 Concluding Remarks

This section on financial planning for transit agencies has sought to describe the role of financial planning in the context of transit planning, project development and implementation. This section is not simply a guide to developing plans to satisfy federal requirements, but a guide for best practice financial planning for any transit agency. The descriptions of the procedures and methods involved in the development and presentation of financial plans and information should be useful to any transit agency interested in financial planning. Transit agency managers, planners, local decision-makers, financial institutions, and federal transportation funding partners will all benefit from financial plans and analysis created in accordance with the practices described in this chapter.

Technical Addendum: Principles and Best Practices for Regression Analysis

High quality revenue forecasting models use time series regression analysis to estimate the relationship between "explanatory" variables and a "dependent" variable. The explanatory variables can be nearly any economic indicator or other factor that could impact the dependent variable, but should be selected from the economic indicators provided by the economic forecast for the region. The dependent variable is the item for which a forecast is being prepared, in this case, the tax base of the dedicated transit tax or user fee. Specialized software such as Eviews, LIMDEP, SAS, and SPSS among others is used to prepare a regression analysis and forecasts, though even a spreadsheet such as Microsoft Excel has some limited regression functions.

A regression analysis begins by collecting relevant sets of data on the dependent variable and a series of potential independent variables. Tax revenue forecasts involve the construction of a data series on the tax base and a set of explanatory variables that will be tested for predictive power.

Model Design and Specification

Model design begins with the definition of the dependent variable. If the financial analyst is interested in forecasting revenues from an existing local sales tax, the analyst must construct the retail sales variable by dividing tax revenues by the tax rate for each year to construct the tax base. The tax base is the dependent variable because the tax rate is a policy variable that tends to change periodically. If the financial plan contains a referendum to increase the tax rate, the easiest way to forecast the revenue stream is to multiply the new tax rate by the forecasted tax base.

The explanatory variables are chosen based on knowledge of simple economic relationships and experience. Explanatory variables are generally chosen from the set of variable provided by the economic forecast to ensure that long-range forecasts of the explanatory variables are available. If the financial analyst is forecasting retail sales, the set of explanatory variables must include those things that influence demand for taxable items. These variables will generally include population and income as the primary drivers of retail sales, though other factors such as employment, wages, and interest rates, among others could be tested for their explanatory power.

The regression equation for retail sales could be expressed as:

$$retail\_sales = \alpha + \beta_1(population) + \beta_2(per\_capita\_income) + \varepsilon$$

Where α is the regression constant, β's are parameters to be estimated, and ε is the error term.

If the financial analyst is interested in car registration fee revenues, the explanatory variables may include average car prices, population, auto ownership rates, and income.

Various other variables are tested and the regression statistics evaluated to identify the functional form that "fits the data" better than any other. The test statistic that measures goodness of fit is R^2, also called the coefficient of determination. This test statistic expresses the percentage of the variation in the dependent variable that is explained by the explanatory variables. The closer R^2 is to 1.0, the better the explanatory variables are at "explaining" the **past** variation in the dependent variable.

The development of good forecasting equations is a process of trial and error and requires experience to identify the preferred regression equation. While high a R^2 is a plus when evaluating a regression analysis, it does not in itself indicate that the best model specification has been found. Regression models must also be inspected to ensure that all the variables included in the model are statistically significant and have the expected sign and reasonable magnitude. A regression equation with a high R^2 that exhibits unexplainable statistical relationships among the variables, is flawed and can produce biased results. The section at the end of this addendum details some of the basic principles of developing regression-based forecasts and highlights best practices in these areas.

Preparing the Forecast

After developing and testing a good regression model that produces accurate forecasts of the dependent variable, the actual tax revenue forecast may be constructed. The number of steps required to accomplish this depends on the construction of the model and how the variables were transformed, but will generally involve the following steps:

1. Make sure forecasts of the explanatory variables are entered into the statistical software program. Most statistical software will include a forecasting routine that allows the user to enter this data directly. The

regional economic forecast should provide this information. In rare cases where the statistical software lacks this capability, the analyst may need to use a spreadsheet to construct the forecasting model.

2. Prepare the dependent variable forecast for the analysis period. The result is a forecast of the tax base in constant dollars, likely expressed as a logarithm.

3. Exponentiate the series to convert the dependent variable from a natural log to its original state.

4. Apply the inflation forecasts to convert the constant (real) dollar tax base forecast to nominal (current) dollars.

5. Multiply the inflated tax base forecast by the expected tax rate to generate the tax revenue forecast.

Developing a set of forecasting equations in the manner described here allows the easy update for future years. As new data for the current period becomes available, the data can be updated, the equations re-estimated, and new forecasts prepared using the most current data. These revenue forecasts are entered into the financial plan as revenue source line items by year.

Example Regression Application

The following example retail sales examples were developed with national data from the Bureau of Labor Statistics, the Bureau of Economic Analysis and the Census Bureau. The data was scaled by 1/50th to reflect an average US State.

Regression techniques can be used to estimate a simple trend line as well as estimate statistical relationships between key variables. The trend line estimation is simple and is a useful place to start when developing a forecasting model.

Before beginning any forecasting exercise, the data should be transformed in several ways to maximize the usefulness of the data in a regression equation. The initial data transformations are:

- from nominal to real dollars (see Principle 1 in next section);
- from total income to income per capita (see Principle 2 in next section); and
- logarithmic transformations of all likely dependent and independent variables (see Principle 3 in next section).

The data for the example regression application is given in Table 8-25.

Table 8-25: Data for Regression Analysis of Retail Sales

YEAR	Retail Sales	Population	Employment	Personal Income	CPI	Real Retail Sales	Real Personal Income	Real Per Capital Income
1983	23,403	4,686,140	1,803,040	58,938	99.6	23,497.2	59,174.7	12,627.6
1984	25,738	4,726,960	1,888,160	65,496	103.9	24,772.2	63,037.5	13,335.7
1985	27,501	4,769,320	1,947,740	70,300	107.6	25,558.1	65,334.6	13,698.9
1986	28,993	4,813,020	1,986,880	74,248	109.6	26,453.2	67,744.5	14,075.3
1987	30,826	4,856,080	2,039,160	79,250	113.6	27,135.5	69,762.3	14,366.0
1988	33,124	4,900,420	2,104,180	85,442	118.3	28,000.0	72,224.9	14,738.5
1989	35,179	4,946,840	2,157,680	91,996	124.0	28,370.5	74,190.3	14,997.5
1990	36,892	4,962,860	2,188,060	98,064	130.7	28,226.6	75,029.8	15,118.3
1991	37,119	5,039,100	2,164,980	101,708	136.2	27,253.1	74,675.5	14,819.2
1992	39,032	5,111,710	2,172,020	107,808	140.3	27,820.2	76,841.1	15,032.3
1993	41,642	5,181,370	2,214,260	112,200	144.5	28,818.2	77,647.1	14,985.8
1994	44,964	5,246,360	2,283,260	117,760	148.2	30,340.1	79,460.2	15,145.8
1995	47,180	5,309,440	2,343,820	124,018	152.4	30,958.2	81,376.6	15,326.8
1996	50,047	5,371,640	2,392,160	130,948	156.9	31,897.6	83,459.5	15,537.1
1997	52,211	5,436,380	2,453,800	138,740	160.5	32,530.4	86,442.4	15,900.7
1998	54,912	5,500,800	2,517,300	148,520	163.0	33,688.3	91,116.6	16,564.2
1999	59,899	5,563,910	2,578,320	155,730	166.6	35,953.5	93,475.4	16,800.3
2000	64,641	5,628,440	2,634,400	168,132	172.2	37,538.3	97,637.6	17,347.2
2001	69,771	5,695,940	2,638,440	173,706	177.1	39,396.4	98,083.6	17,219.9

A regression fits a line that best represents all the data by minimizing the sum of squared residuals (the vertical distance between the linear trend line and the actual data) through method called least squares estimation. Estimating a trend line using regression is accomplished by simply including a constant term and a trend variable as regressors. The trend variable used in the example is the year. The regression equation used to estimate the trend in retail sales is:

$$Log(retail\_sales) = \alpha + \beta(year) + \varepsilon$$

where α is the constant term, β is the coefficient on the trend variable, and ε is the error term.

The regression output is given in Exhibit 8-1. The results suggest that trend alone explains almost 93 percent ($R^2 = .927$) of the variation in retail sales. Both the constant term and the trend variable are highly significant at the 99 percent level and the Durbin-Watson (D-W) statistic indicates that the regression residuals are autocorrelated (see Principle 7 in the next section). Figure 8-12 confirms that the regression residuals display a noticeable pattern and could benefit from applying some autocorrelation correction techniques.

A nice feature of regressions that use logarithmic transformations is that the coefficient estimates can be interpreted as percent changes or “elasticities”. In the trend regression, the coefficient estimate for year is 0.024 or 2.4 percent. The trend line for retail sales is estimated to increase 2.4 percent annually.

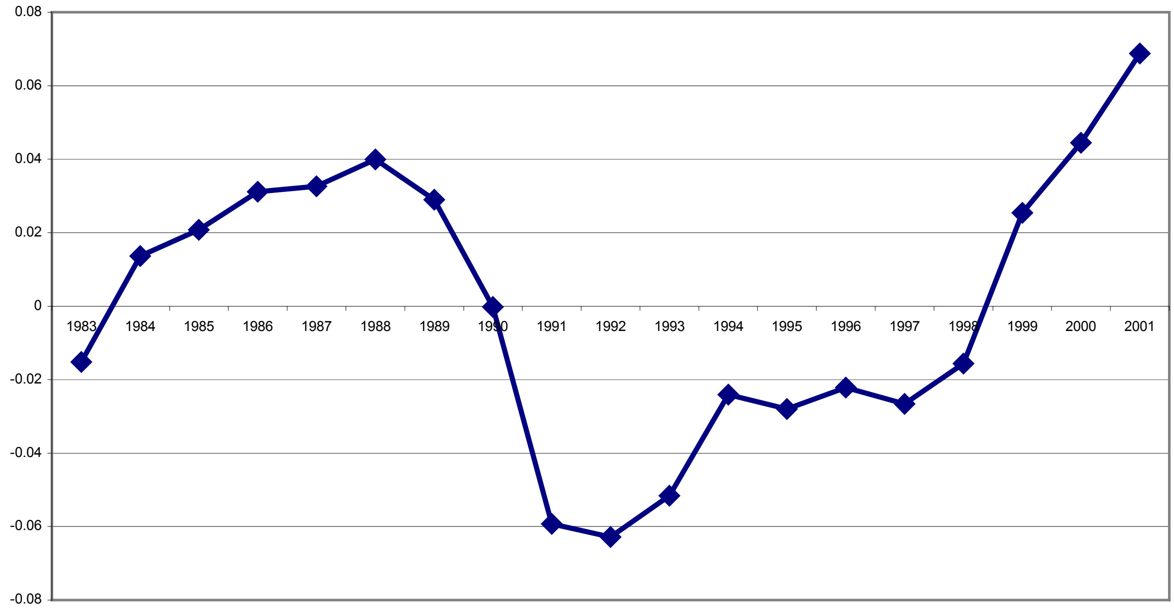
Exhibit 8-1: Regression Estimate for Trend in Real Retail Sales

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Log(RetSal) Mean=   10.29626918 , S.D.=   .1404632916     |
| Model size: Observations =      19, Parameters =   2, Deg.Fr.=     17 |
| Residuals:  Sum of squares= .2557718290E-01, Std.Dev.=         .03879 |
| Fit:        R-squared=  .927980, Adjusted R-squared =          .92374 |
| Model test: F[  1,     17] =  219.04,    Prob value =          .00000 |
| Diagnostic: Log-L =     35.8399, Restricted(b=0) Log-L =      10.8472 |
|             LogAmemiyaPrCrt.=   -6.399, Akaike Info. Crt.=     -3.562 |
| Autocorrel: Durbin-Watson Statistic =    .36060,   Rho =       .81970 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant -37.60204780      3.2363497      -11.619   .0000
 YEAR      .02404533985     .16246674E-02   14.800   .0000  1992.0000
```

Predicted Values (* => observation was not in estimating sample.)

Observation	Observed Y	Predicted Y	Residual	95% Lower Bound	95% Upper Bound
1	10.065	10.08	-0.0152	9.9904	10.1693
2	10.117	10.104	0.0136	10.016	10.1922
3	10.149	10.128	0.0208	10.041	10.2153
4	10.183	10.152	0.0311	10.066	10.2384
5	10.209	10.176	0.0326	10.09	10.2617
6	10.24	10.2	0.0399	10.115	10.2852
7	10.253	10.224	0.029	10.14	10.3087
8	10.248	10.248	-0.0002	10.164	10.3324
9	10.213	10.272	-0.0593	10.188	10.3563
10	10.234	10.296	-0.0628	10.212	10.3802
11	10.269	10.32	-0.0516	10.236	10.4043
12	10.32	10.344	-0.0241	10.26	10.4286
13	10.34	10.368	-0.028	10.284	10.453
14	10.37	10.392	-0.0222	10.307	10.4775
15	10.39	10.416	-0.0266	10.331	10.5022
16	10.425	10.441	-0.0156	10.354	10.527
17	10.49	10.465	0.0254	10.377	10.5519
18	10.533	10.489	0.0445	10.4	10.577
19	10.581	10.513	0.0688	10.423	10.6021

Figure 8-12: Regression Residuals - Trend of Log(RetailSales)



Once an acceptable regression equation has been estimated, the revenue forecast can be prepared. The forecast is prepared by substituting the forecast year independent variables into the regression equation and adjusting the constant term by the final regression residual. The constant term is adjusted to ensure that the forecast is based on the last actual observed value for the dependent variable rather than the forecast value. This is accomplished by adding the final residual (0.0688) to the regression constant (-37.6). If the constant were not adjusted in this way, the first year of the forecast would be based on the predicted value for 2001 rather than the actual known value. The preparation of the revenue forecast is detailed in the following table.

Table 8-26: Trend Forecast of Retail Sales Tax Revenue

Year	Log (Retail Sales)	Real Retail Sales ($mil)	CPI	Retail Sales ($mil)	% Subject to Tax	Tax Rate (%)	Tax Revenue ($mil)
1983	10.0646	23,496	99.6	23,402	42.3	4.5	445.46
1984	10.1175	24,773	103.9	25,739	42.2	4.5	488.78
1985	10.1487	25,558	107.6	27,500	42.3	4.5	523.47
1986	10.1831	26,452	109.6	28,992	41.5	4.5	541.42
1987	10.2086	27,136	113.6	30,826	42.2	4.5	585.39
1988	10.24	28,001	118.3	33,125	42.5	4.5	633.52
1989	10.2531	28,370	124.0	35,179	41.1	4.5	650.64
1990	10.248	28,226	130.7	36,891	41.9	4.5	695.59
1991	10.2129	27,252	136.2	37,118	42.0	4.5	701.53
1992	10.2335	27,820	140.3	39,031	42.1	4.5	739.44
1993	10.2688	28,819	144.5	41,644	41.9	4.5	785.20
1994	10.3202	30,339	148.2	44,963	41.7	4.5	843.73
1995	10.3404	30,958	152.4	47,181	41.7	4.5	886.12
1996	10.3703	31,898	156.9	50,048	41.7	4.5	939.14
1997	10.3899	32,529	160.5	52,210	41.7	4.5	978.84
1998	10.4249	33,688	163.0	54,912	41.6	4.5	1,028.59
1999	10.49	35,954	166.6	59,900	41.6	4.5	1,121.04
2000	10.5331	37,538	172.2	64,640	41.6	4.5	1,208.69
2001	10.5814	39,395	177.1	69,769	41.5	4.5	1,303.44
2002	10.6055	40,357	181.9	73,424	41.5	4.5	1,371.19
2003	10.6296	41,339	186.3	77,020	41.5	4.5	1,438.35
2004	10.6536	42,345	190.7	80,748	41.5	5.5	1,843.06
2005	[illegible]	43,376	195.1	84,611	41.5	5.5	1,931.25
2006	[illegible]	44,431	199.4	88,615	41.5	5.5	2,022.64
2007	[illegible]	[illegible]	203.8	92,764	41.5	5.5	2,117.33
2008	[illegible]	[illegible]	208.2	97,061	41.5	5.5	2,215.43
2009	10.7738	[illegible]	[illegible]	101,514	41.5	5.5	2,317.05
2010	10.7979	[illegible]	[illegible]	[illegible]	41.5	5.5	2,422.31
2011	10.8219	50,108	[illegible]	[illegible]	41.5	5.5	2,531.31
2012	10.8460	51,327	[illegible]	[illegible]	[illegible]	5.5	2,644.19
2013	10.8700	52,576	230.1	[illegible]	[illegible]	5.5	2,761.07
2014	10.8941	53,856	234.5	[illegible]	[illegible]	[illegible]	2,882.06
2015	10.9181	55,167	238.8	131,755	[illegible]	[illegible]	3,007.31
2016	10.9422	56,509	243.2	137,435	41.5	[illegible]	3,136.95
2017	10.9662	57,884	247.6	143,313	41.5	[illegible]	3,271.12
2018	10.9902	59,293	252.0	149,396	41.5	5.5	3,409.96
2019	11.0143	60,736	256.3	155,690	41.5	5.5	3,553.62
2020	11.0383	62,214	260.7	162,202	41.5	5.5	3,702.26

Forecast Period

Regression Parameters

Intercept = (37.6020)
Coefficient = 0.0240
Last Residual = 0.0688

Forecast Equations

Retail sales = exp((Intercept + Last residual) + (coefficient * year))*(CPI / 100)
Tax Revenue = (Retail sales) * (% subject to tax) * (Tax rate)

While regression models can be used to estimate simple trend lines like the previous example, the major strength of multiple regression models is the ability to quantify causal relationships. For retail sales, the most likely causal variables are population, employment, and income (see Principle 4 in the following section).

Once the primary causal variables of interest are identified, an initial regression model can be quickly specified and tested. The following example regression includes a constant term, log of population, log of income, and log of employment as explanatory variables for retail sales. This specification performs fairly well, explaining over 96 percent (R^2 = .964) of the variation in retail sales.

Exhibit 8-2: Example Regression Model Output for Real Retail Sales

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Log(RetSal) Mean=   10.29626918 , S.D.=   .1404632916     |
| Model size: Observations =      19, Parameters =   4, Deg.Fr.=     15 |
| Residuals:  Sum of squares= .1282863927E-01, Std.Dev.=         .02924 |
| Fit:        R-squared=  .963877, Adjusted R-squared =          .95665 |
| Model test: F[  3,     15] =  133.42,    Prob value =          .00000 |
| Diagnostic: Log-L =     42.3951, Restricted(b=0) Log-L =      10.8472 |
|             LogAmemiyaPrCrt.=   -6.873, Akaike Info. Crt.=     -4.042 |
| Autocorrel: Durbin-Watson Statistic =    .59419,   Rho =       .70291 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  -1.649975403      6.9794061        -.236   .8163
 Log(pop)   .2956528846      .60211573         .491   .6305    15.451594
 Log(inc)   1.092841303      .60837137        1.796   .0926    11.257811
 Log(emp)  -.3369919360      .78879657        -.427   .6753    14.614784
```

Unfortunately, the coefficient estimates suggest problems with this regression. The negative coefficient on the employment variable is clearly wrong, since more employment will result in more, not less, retail sales. In addition, the coefficient on the population variable is too low. Recall that a regression with logarithmic transformations of all the variables allows the coefficient estimates to be interpreted as elasticities. Therefore, the coefficient on population suggests that a 1 percent increase in population would cause a 0.29 percent increase in retail sales. A more sensible value would be much closer to 1. The cause of this problem is multicollinearity between the causal variables (see Principle 2 in the next section). The following table is the correlation matrix for all the potential causal variables in the example.

Table 8-27: Correlation Matrix for Causal Variables

	POP	EMPLOY	INC	INCPC
POP	1.00	0.98566	0.98427	0.95002
EMPLOY	0.98566	1.00	0.99571	0.98394
INC	0.98427	0.99571	1.00	0.9891
INCPC	0.95002	0.98394	0.9891	1.00

All the variables are highly correlated with each other, with correlation coefficients that exceed 95 percent in all cases. It is unlikely that these variables can be combined in the same regression without causing problems with multicollinearity. This is a critical problem for the model since multicollinearity causes the coefficient estimates and t-statistics to be unstable. To fix this problem, the regression should be re-estimated with a single causal variable. The following three regression outputs display the results for the retail sales regression using population, employment and real income as single regressors along with a constant term.

Exhibit 8-3: Example Single Variable Regression Outputs

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = log(Retsal) Mean=   10.29626918 , S.D.=   .1404632916     |
| Model size: Observations =      19, Parameters =   2, Deg.Fr.=     17 |
| Residuals:  Sum of squares= .2272403867E-01, Std.Dev.=         .03656 |
| Fit:        R-squared=  .936014, Adjusted R-squared =          .93225 |
| Model test: F[  1,     17] =  248.68,    Prob value =          .00000 |
| Diagnostic: Log-L =     36.9635, Restricted(b=0) Log-L =      10.8472 |
|             LogAmemiyaPrCrt.=   -6.517, Akaike Info. Crt.=     -3.680 |
| Autocorrel: Durbin-Watson Statistic =    .43612,   Rho =       .78194 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  -23.28240372      2.1293400      -10.934   .0000
 Log(pop)    2.173152690      .13780607      15.770   .0000   15.451594
```

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = log(Retsal) Mean=   10.29626918 , S.D.=   .1404632916     |
| Model size: Observations =      19, Parameters =   2, Deg.Fr.=     17 |
| Residuals:  Sum of squares= .1618160697E-01, Std.Dev.=         .03085 |
| Fit:        R-squared=  .954436, Adjusted R-squared =          .95176 |
| Model test: F[  1,     17] =  356.10,    Prob value =          .00000 |
| Diagnostic: Log-L =     40.1892, Restricted(b=0) Log-L =      10.8472 |
|             LogAmemiyaPrCrt.=   -6.857, Akaike Info. Crt.=     -4.020 |
| Autocorrel: Durbin-Watson Statistic =    .38191,   Rho =       .80904 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  -7.534325645      .94491320       -7.974   .0000
 Log(emp)   1.220038179      .64652798E-01   18.871   .0000   14.614784
```

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = log(Retsal) Mean=   10.29626918 , S.D.=   .1404632916     |
| Model size: Observations =      19, Parameters =   2, Deg.Fr.=     17 |
| Residuals:  Sum of squares= .1312234897E-01, Std.Dev.=         .02778 |
| Fit:        R-squared=  .963050, Adjusted R-squared =          .96088 |
| Model test: F[  1,     17] =  443.08,    Prob value =          .00000 |
| Diagnostic: Log-L =     42.1800, Restricted(b=0) Log-L =      10.8472 |
|             LogAmemiyaPrCrt.=   -7.067, Akaike Info. Crt.=     -4.229 |
| Autocorrel: Durbin-Watson Statistic =    .53525,   Rho =       .73238 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  -.4734111606      .51167513        -.925   .3678
 Log(inc)   .9566407220      .45447151E-01   21.050   .0000    11.257811
```

Each regression performs quite well, but real income appears to perform slightly better than the other variables based on the R^2 value. In addition, the Durbin-Watson statistic indicates less serial correlation of the error terms when income is the regressor. However, the answer here is not as clear as it may first appear. A solid argument can be made for using employment since the data is usually tracked more carefully and frequently than either population or income. State employment offices and the US Bureau of Labor Statistics track employment figures carefully and updated employment figures are generally available before population or income estimates. The quality and timeliness of updated data and forecasts is vital to the usefulness of the regression model, so employment could be the best choice in this example.

The Durbin-Watson statistic indicates serial correlation of the error terms, so some corrective action may be justified to derive better estimates (see Principle 6 in the next section). Most econometric software packages can correct for serial correlation automatically. Below is the output for the employment regression including the corrective first order autoregressive term AR(1). The AR(1) term is significant at the 99 percent level and the resulting Durbin-Watson statistic of 1.29 indicates that we cannot reject the null hypothesis of no first order autocorrelation at the 95 percent level.[24] The inclusion of the autoregressive term has improved the model.

Exhibit 8-4: Example Autoregressive Model Output

```
+---------------------------------------------+
| AR(1) Model:     e(t) = rho * e(t-1) + u(t) |
| Initial value of rho       =         .80904 |
| Iter=  6, SS=       .006, Log-L=  48.822249 |
| Final value of Rho    =              .89010 |
| Durbin-Watson:   e(t) =              .21980 |
| Std. Deviation:  e(t) =              .04124 |
| Std. Deviation:  u(t) =              .01880 |
| Durbin-Watson:   u(t) =             1.29353 |
| Autocorrelation: u(t) =              .35324 |
| N[0,1] used for significance levels         |
+---------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  -8.525992053      1.9607706      -4.348   .0000
 Log(emp)   1.289517644      .13423099       9.607   .0000   14.614784
 RHO        .8900993672      .10742520       8.286   .0000
```

The resulting regression suggests that retail sales is quite sensitive to changes in employment. A 1.0 percent increase in employment is estimated to cause a 1.29 percent increase in retail sales. Generating a forecast from a model with an autoregressive term is similar to the trend example. The suggested forecasting equation can be written as:

$$\text{Retail sales} = \exp((\text{Intercept} + \text{Last residual}) + (\text{Coefficient} * \text{Employment})) * \text{CPI} / 100$$

The key issue in developing out of sample forecasts from autoregressive models is whether and how to include the autoregressive term. Since there is no actual data from which to calculate a forecasting error, there would seem to be no basis for including it in the forecasting equation. This guidance generally suggests ignoring the autoregressive term in out of sample forecasts. However, various techniques have been developed for using the autoregressive term in out of sample forecasts, but whether employing these terms is preferable to simply using the forecasting equation above, is unclear.[25] This topic is complex and beyond the scope of this guidance, so the

[24] The confidence interval for the Durbin-Watson statistic can be found in almost any statistics textbook or the manual that comes with most econometric software packages.
[25] Greene, William H., *Econometric Forecasting*, 1990.

reader is referred to a good econometric textbook if more information is desired. Nevertheless, the use of the autoregressive term in the model provides superior estimates for the coefficients for the constant term and employment, so the use of these coefficients from the autoregressive model should be used to generate the out of sample forecast.

An example forecast is presented below. The results highlight the benefits of using a regression model with causal variables. Since retail sales is causally related to employment in the model, information about the growth in employment in the near term allows the forecast for retail sales to adjust accordingly. The simple trend analysis provides no quantitative basis for adjusting the forecast.

In the example in Table 8-28, employment growth in 2002 was assumed to be zero to reflect the slowing economy, then continue its past trend in future years. The regression based forecast for 2002 is about $33 million less under this scenario than the forecast that simply extrapolates past trends. The cumulative difference in the forecasts is about $1.2 billion over the forecast period. The much larger differences over the long term reflect the importance of incorporating updated information as quickly as possible. Forecasting errors in early years compound over time and become much larger as the length of the forecast increases.

Table 8-28: Sales Tax Revenue Forecast - Regression with Causal Variables

Year	Log (Employ)	Log (Retail Sales)	Real Retail Sales ($mil)	CPI	Retail Sales ($mil)	% Subject to Tax	Tax Rate (%)	Tax Revenue ($mil)
1983	14.4050	10.0646	23,496	99.6	23,402	42.3	4.5	445.46
1984	14.4511	10.1175	24,773	103.9	25,739	42.2	4.5	488.78
1985	14.4822	10.1487	25,558	107.6	27,500	42.3	4.5	523.47
1986	14.5021	10.1831	26,452	109.6	28,992	41.5	4.5	541.42
1987	14.5280	10.2086	27,136	113.6	30,826	42.2	4.5	585.39
1988	14.5594	10.24	28,001	118.3	33,125	42.5	4.5	633.52
1989	14.5845	10.2531	28,370	124.0	35,179	41.1	4.5	650.64
1990	14.5985	10.248	28,226	130.7	36,891	41.9	4.5	695.59
1991	14.5879	10.2129	27,252	136.2	37,118	42.0	4.5	701.53
1992	14.5912	10.2335	27,820	140.3	39,031	42.1	4.5	739.44
1993	14.6104	10.2688	28,819	144.5	41,644	41.9	4.5	785.20
1994	14.6411	10.3202	30,339	148.2	44,963	41.7	4.5	843.73
1995	14.6673	10.3404	30,958	152.4	47,181	41.7	4.5	886.12
1996	14.6877	10.3703	31,898	156.9	50,048	41.7	4.5	939.14
1997	14.7131	10.3899	32,529	160.5	52,210	41.7	4.5	978.84
1998	14.7387	10.4249	33,688	163.0	54,912	41.6	4.5	1,028.59
1999	14.7626	10.49	35,954	166.6	59,900	41.6	4.5	1,121.04
2000	14.7842	10.5331	37,538	172.2	64,640	41.6	4.5	1,208.69
2001	14.7857	10.5814	39,395	177.1	69,769	41.5	4.5	1,303.44
2002	14.7857	10.5814	39,396	181.9	71,676	41.5	4.5	1,338.55
2003	14.7985	10.5979	40,052	186.3	74,622	41.5	4.5	1,393.56
2004	14.8125	[illegible]	40,780	190.7	77,762	41.5	5.5	1,774.92
2005	14.8322	[illegible]	41,833	195.1	81,601	41.5	5.5	1,862.54
2006	14.8520	[illegible]	42,913	199.4	85,586	41.5	5.5	1,953.50
2007	14.8718	[illegible]	[illegible]	203.8	89,723	41.5	5.5	2,047.92
2008	14.8915	[illegible]	[illegible]	208.2	94,016	41.5	5.5	2,145.91
2009	14.9113	10.7434	[illegible]	[illegible]	98,470	41.5	5.5	2,247.59
2010	14.9311	10.7689	[illegible]	[illegible]	[illegible]	41.5	5.5	2,353.09
2011	14.9508	10.7944	48,746	[illegible]	[illegible]	41.5	5.5	2,462.55
2012	14.9706	10.8199	50,005	[illegible]	[illegible]	[illegible]	5.5	2,576.08
2013	14.9904	10.8454	51,296	230.1	[illegible]	[illegible]	[illegible]	2,693.84
2014	15.0102	10.8709	52,621	234.5	[illegible]	[illegible]	[illegible]	2,815.96
2015	15.0299	10.8964	53,979	238.8	128,920	[illegible]	[illegible]	2,942.60
2016	15.0497	10.9218	55,373	243.2	134,672	[illegible]	5.5	3,073.89
2017	15.0695	10.9473	56,803	247.6	140,635	41.5	5.5	3,210.00
2018	15.0892	10.9728	58,270	252.0	146,817	41.5	5.5	3,351.10
2019	15.1090	10.9983	59,774	256.3	153,224	41.5	5.5	3,497.33
2020	15.1288	11.0238	61,317	260.7	159,864	41.5	5.5	3,648.89

Forecast Period

<u>Regression Parameters</u>

Intercept	(8.52599)
Employment Coefficient	1.28952
Last Residual	0.04100

<u>Forecast Equation</u>

Retail sales = exp((Intercept + Last residual) + (Coefficient * Employment)) * CPI / 100

Tax Revenue = (Retail sales) * (% subject to tax) * (Tax rate)

Key Principles for Developing Regression Models

Principle 1: For regression analysis, use real rather than nominal variable constructions.

Generally speaking, all variables in a regression equation should be adjusted for inflation. The reason is that inflation is not a "real" factor. Rather it is purely a monetary scaling of all variables that are expressed in dollar amounts. If a monetary series exhibits a trend, the analyst does not know whether this is the result of actual growth or a purely nominal phenomenon that can be attributed to inflation, unless inflation is removed from the equation by expressing all monetary variables in constant dollars.

If inflation is not removed from the analysis, regression equations tend to have higher than justified R^2. The reason being that the portion of the variation of the dependent variable that is attributable to inflation is known with certainty. That is, that portion of the variation in the explanatory variables that is attributable to inflation is perfectly correlated with the inflation in the dependent variable. The effect of that perfect correlation is to inflate the R^2 statistic. A regression analysis for revenue forecasting should express all forecasts in constant dollars. At the end of the forecasting process, these constant dollar revenue forecasts are inflated based on the inflation rate assumptions from the economic forecast and included in the agency financial plan, which is expressed in inflated dollars.

Principle 2: Fewer variables is better (most of the time).

"…any time series regression containing more than four independent [explanatory] variables results in garbage."

Zvi Griliches, "Comments on Sims," in *Frontiers of Quantitative Economics*, vol.2, 1974, p. 335.

In most cases, a regression equation should have as few explanatory variables as possible. Simplicity in modeling is a virtue. Simple models have more clearly defined statistical relationships among variables and are easier to validate. Simple models are also easier to explain to non-modelers. Most importantly, models with too many variables run the risk of including variables that are correlated with each other. This problem is termed multi-collinearity. One of the assumptions of regression analysis is that all explanatory variables are independent of one another. If they are in fact, correlated, the coefficients on the explanatory variables become unstable and forecasts will be biased.

Before including a set of variables in an equation, the analyst should produce a correlation matrix to test which variables are correlated with each other and by how much. Generally speaking, most variables will display some amount of correlation, but if the correlation coefficient comes close to or exceeds 0.7, the two variables in question should not usually appear in the same equation. The result of a regression analysis when the explanatory variables are correlated can be unsettling. Coefficients can display the wrong sign, the t-statistics on the explanatory variables can be impossibly large, removing or adding a variable to the regression can make all the coefficients change dramatically. These impacts can make forecasts based on a multi-collinear regression unstable and theoretically unsound.

The most common method of dealing with this problem is to drop explanatory variables from the regression equation. This works well, as long as the regression equation still performs well and the model is fully specified. If the model is degraded, the other option is to transform some of the variables to remove the source of the collinearity. One common example of this approach is to transform an income variable to per capita income so that it can be used in an equation with population. By dividing income by population to get a per capita income value, one source of the collinearity with population is removed. This approach only works in specific cases where the source of the collinearity is clearly identifiable.

Principle 3: Use logarithmic transformations.

To ease the interpretation of results, economists often transform all their data series' in a regression equation using natural logs. The usual revenue forecasting equation is a non-linear regression of the form:

$$y = \alpha \prod_k X_k^{\beta_k} e^{\varepsilon}$$

where

y	is the dependent variable
X	is a vector of k independent variables
α	is the regression constant
β	are parameters to be estimated
ε	is the error term

When natural logs are applied to both sides of this equation, the result is:

$$\ln y = \ln \alpha + \sum_k \beta_k \ln X_k + \varepsilon$$

which is linear in its components. This model is called the log-linear model since it is a non-linear regression that is linear in log form. In this specification, the coefficients are interpretable as elasticities:

$$\frac{\partial \ln y}{\partial \ln X_k} = \beta_k$$

which can be interpreted to mean the percent change in the dependent variable *y* given a percent change in the explanatory variable *X*. This is the definition of an elasticity.

A good test of a regression model forecasting retail sales from population and income would be to estimate the log-linear form of the regression model and ensure that the coefficients on population and income are in the neighborhood of 1. A coefficient of 1.0 for population means that a 1 percent increase in population leads to a 1 percent increase in retail sales, which is expected. A coefficient of 1.0 for per capita income means that a 1 percent increase in average income leads to a 1 percent increase in retail sales, which is also expected. The analyst will expect some deviation from 1.0 for population due to the reality that population growth may occur among groups that consume more or less than average. A similar explanation can be offered for average income where people's propensity to consume taxable items from income growth may be more or less than the sample average.

A side note to logarithmic transformations is that they reduce the variance for each of the variables in the model. The effect of this is to raise the R^2 statistic in the final regression model. This benefit is illusory because to get usable forecasts, the analyst must exponentiate the model results to generate forecasts in actual dollars. This reintroduces the wider variances and the final forecasts are not any better than they would be if they were prepared without the log transformation.

Other non-linear functional forms can be checked, but they will generally not be suitable for revenue forecasting where the relationships are often consistent and stable under the assumptions of the linear model. A good econometrics textbook should be consulted for suggestions about functional form. In addition, some econometric software packages will have a variety of non-linear regression specifications built into them.

Principle 4: The model should make theoretical sense.

Regression models that are used to forecast demand, such as the retail sales example, should have a sound theoretical basis behind the functional form. This means applying the basic principles of economics to the development of the functional form. For instance, demand is a function of the number of consumers, their income and the price of the product. This suggests that a model to forecasts new car sales (for a registration fee revenue forecast) would include population, income per capita, and the average price of a new car to conform to what economists believe about the structure of demand.

Once a model is defined that makes economic sense and performs well, the coefficients that are estimated should also make sense. The magnitude of the impact of a change in an explanatory variable should be reasonable and the coefficients must have the correct sign. If either of these problems arises, the most likely problem is multi-collinearity (see Principle 2). Other potential problems can be poor data or mistakes made when constructing the data series.

Many models should be estimated without a regression constant. The regression constant indicates the level of the dependent variable if the explanatory variables were zero. The dependent variable in many tax revenue forecasting models would be zero if, for instance, population and income were zero. The regression equation should be tested without the constant to attempt to find a specification that performs well without it. If a constant term is required to achieve adequate fit with the data, the likely problem is a non-linearity in the modeling relationships that occurs well outside the available data set. Non-linear regressions can be estimated, but in many cases, a constant term will need to be included despite theoretical misgivings. The modeler should ensure that if a constant term is included, it is statistically significant at the 95 percent level.

Principle 5: Test lagged variable specifications.

Sometimes, financial reactions to economic indicators are delayed. The most common instance of delayed reaction is related to investment, whether business investment or real estate, in response to changes in interest rates. The delayed reaction is most evident if quarterly data are available, but yearly data can also display lagged reactions. Lagged variable specifications should be tested for a variety of different periods by using the prior period value of the explanatory variables in the regression.

Often, the best explanatory variable in a time series regression is the lagged dependent variable. The rationale for this type of regression is that the best predictor of future conditions is often current conditions. Cyclical impacts can be modeled by using more than one lagged dependent variable. The following regression model was developed to forecast construction activity (*const)*, as a tax base for development fees:

$$\ln(const) = \alpha + \beta_1 \ln(prime\_rate_{-1}) + \beta_2 \ln(const_{-1}) + \beta_3 \ln(const_{-2}) + \varepsilon$$

Where $_{-1}$ indicates the prior period value and $_{-2}$ indicates a value from two periods earlier. This model postulates that construction activity depends on the prime interest rate from the prior period, construction activity in the two previous periods, and a constant term. This model was found to explain 95 percent of past variation in construction activity in one metropolitan area.

Principle 6: Account for serial correlation.

One of the assumptions of multiple regression analysis is that the error terms of the regression equations are uncorrelated with each other through time. If this assumption is violated, the model is said to display serial correlation of the disturbances. In simple terms, the error terms display an observable pattern, and are therefore, not random.

The Durbin-Watson (DW) statistic, which is calculated automatically in the regression routine of all statistical software packages, is used to detect the existence of serial correlation. The rule of thumb is that when error terms are uncorrelated with each other, the DW statistic equals 2. The analyst should consult the table of critical values for the DW statistic for the relevant confidence interval given the specific regression model in question.

Time series forecasting models often violate this assumption. Modelers account for this problem by including an "autoregressive" form of the error term as follows:

$$\varepsilon_t = \rho\varepsilon_{t-1} + u_t$$

This formulation states that the error term is a function of the error term from the previous period plus a random component. This is called a first-order autoregressive term. A class of models called ARIMA (autoregressive integrated moving average) models combine several auto regressive and moving average terms to generate models that rely on no explanatory variables except constructions of the dependent variable itself and the error terms of the regression. These models are a rather complex form of trend analysis.

Principle 7: Test for structural stability.

Structural change in the relationships estimated in a regression model can be the source of bias in the forecasting process. Two common tests of structural instability are the Chow breakpoint test and the Chow forecast test. These tests are performed by splitting the data at some year T and performing tests on the structural change between these two periods.

In the Chow breakpoint test, separate regressions are estimated using all data before year T and after year T. The hypothesis that the coefficients are equal in both time periods is tested using a F-test. There is no hard and fast rule for choosing T except to choose years where the analyst suspects some change in the economic relationships may have occurred, such as recessions or periods of economic instability. Often, the midpoint of the time series is chosen in case there is a consistent structural change that is occurring over the entire period. Some statistical software packages can perform the Chow breakpoint test automatically.

The Chow forecast test is similar to the Chow breakpoint test. The data before year T is used to prepare a forecast for the years after year T. An F-test is used to test the hypothesis that the forecast values are equal to the actual values. The test compares the prediction errors to the variance that is expected if the null hypothesis were true. Failure to reject the null hypothesis (the forecast errors are zero) suggests that the model shows no evidence of structural instability over the forecast period.

An example of structural instability in revenue forecasting can be seen in certain forecasts of retail sales used to estimate sales tax revenue. Sales taxes are generally levied on only a subset of goods and services. Most services, such as medical care or legal services, are untaxed. If the percentage of income spent on taxable items is changing over time, this effect can introduce structural instability into sales tax revenue forecasts. The best way to deal with structural instability is to include a variable that accounts for the effect. In this case, the percent of personal income spent on goods (as opposed to services), can be calculated from economic data and most detailed economic forecasts. Including the percent of personal income spent on goods as an explanatory variable generally removes the structural instability from sales tax forecasting models.

Another source of structural instability might be long-run changes in the age distribution of regional population, which can affect sales and income tax revenues. Changes in vehicle ownership rates can affect forecasts of licensing or registration fees. All revenue sources can be impacted by shifts in the regional economic base. Forecasts are improved when these trends are identified and incorporated into the financial forecasts.