GENERAL PLANNING CONSULTANT

TECHNICAL MEMORANDUM 88.5.3

LODESTAR: TECHNICAL DOCUMENTATION

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CHAPTER 1. MODULE 1: MANAGEMENT POLICY

1.1 INTRODUCTION

LODESTAR (The Los Angeles Development and Evaluation System for Transit Alternatives and Resources) was developed by the General Planning Consultant for the Southern California Rapid Transit District (SCRTD) as a planning and management tool. The program consists of a series of spreadsheets developed on Microsoft MULTIPLAN, Version 3.0. It runs on an IBM PC or compatible computer.

LODESTAR contains recent information on projected SCRTD costs and revenues. Capital and operating costs are provided for heavy rail, light rail, and bus systems under consideration for construction or operation by the SCRTD. Three heavy rail operable segments, four light rail lines, one busway, and the long-established SCRTD bus system are included in the program which represents possible construction scenarios through the Year 2000. The program includes revenues available to the District from Federal, state, and local sources. LODESTAR produces an annual cash flow analysis by comparing projected annual costs and revenues.

LODESTAR allows the user to modify basic assumptions such as project definition, project implementation schedule, economic variables (consumer price index, etc.), and various revenue projections, and to assess the impacts of these changes on cash flow. Numerous scenarios can be run quickly, providing the user with detailed information regarding the SCRTD's complex, multi-year transit development and operations program.

This document includes technical documentation of each component of LODESTAR. Each Module is described in detail. The discussion includes all input elements to the Module, a summary of all pertinent calculations performed on the data, and all output elements of the Module. All key variables and inter-relationships are defined. The text includes sample outputs of each Module so that the user is able to follow the documentation.

1.2 MANAGEMENT POLICY

The Management Policy Module establishes the basic parameters of the transit systems analyzed by LODESTAR. These parameters are:

1. The menu of transit networks that LODESTAR can analyze;

2. User-selected networks, implementation dates, and duration of construction activity;

3. Schedule of operating costs and farebox revenues.

Before running LODESTAR, the user chooses the transit networks and implementation dates to be analyzed. Once that choice is made, Module 1 automatically creates a management project schedule which provides

information on operational transit systems, year of construction completion, and anticipated start of revenue service.

Virtually all inputs to the Management Policy Module are external to LODESTAR. These inputs are described below under Supporting Models. Outputs of this module are used by the Farebox Revenue Module, Operating Cost Module, and Capital Cost Module. Figure 1.1 is a printout of Module 1.

1.3 SUPPORTING MODELS

Supporting models are data sets and schedules which have been entered into Module 1. There are five such data sets and schedules. Their values may be changed if the underlying assumptions change, but normally they run automatically. These data sets are:

1. Defined transit networks, each consisting of a set of projects;

2. Implementation schedules of selected networks (the year a network begins revenue operations);

3. Duration of construction activity for each project;

4. Heavy rail, light rail and bus operating costs for two horizon years for each defined network;

5. Heavy rail, light rail and bus farebox revenues for two horizon years for each defined network.

1.3.1 Transit Networks

Potential capital projects include all projects which could be built within the time span under consideration (e.g., 20 years, 30 years). A capital project may be a transit line or line segment, provided that the completed project is operable and capable of generating revenues. The Metro Rail heavy rail line is divided into three minimum operable segments: MOS-1; MOS-2; and MOS-3. The Long Beach-Los Angeles and Norwalk-El Segundo light rail lines are under construction as is MOS-1.

A defined transit network consists of a set of transit projects which can be implemented and which, in concert with the existing all bus system, can be analyzed for projections of ridership, farebox revenues, and operating costs for preselected years. Management policy determines which networks are implemented and when they become operational.

Fourteen defined transit networks are given. Each defined network has a unique Identification Number (ID). One primary goal of Module 1 is to offer the user a range of choice in considering alternative networks and schedules. Therefore, more transit networks are defined than are actually used in any one analysis.

FIGURE 1.1

MODULE1: MANAGEMENT POLICY ALIGNMENT 6 ; MOS-2

THE FOLLOWING NETWORKS ARE AVAILABLE FOR CASH FLOW ANALYSIS

MODULE 1: MANAGEMENT POLICY

NETWORK I.D.	NETWORK DESCRIPTION	SIMULATION DATES SIM-1	SIM-2	OPERATING COSTS (DEC 85 DOLLARS) BUS SIM-1	BUS SIM-2	METRO SIM-1	METRO SIM-2	LRT SIM-1	LRT SIM-2	REVENUE PROJECTIONS (DEC 85 DOLLARS) BUS SIM-1	BUS SIM-2	METRO SIM-1	METRO SIM-2	LRT SIM-1	LRT SIM-2
1	ALL BUS SYSTEM	1985	1990	504.90	517.31	0.00	0.00	0.00	0.00	218.94	242.30	0.00	0.00	0.00	0.00
2	LB-LA	1990	2000	502.91	508.99	0.00	0.00	14.40	20.05	242.30	281.20	0.00	0.00	11.50	12.72
3	LB-LA MOS-1	1990	2000	491.15	524.39	12.03	15.40	14.40	20.05	262.77	285.73	3.57	4.34	11.50	12.72
4	LB-LA MOS-1 CENTEX	1990	2000	504.90	527.58	12.03	15.40	15.46	30.94	268.41	287.59	3.50	4.24	17.34	18.77
5	LB-LA MOS-1 MOS-2	1990	2000	481.62	536.43	21.56	27.80	14.40	20.05	249.06	317.53	32.73	44.03	14.27	15.93
6	LB-LA MOS-1 CENTEX MOS-2	1990	2000	455.54	525.54	21.56	27.80	15.46	30.94	249.06	317.53	32.73	44.03	18.49	23.46
7		2001	2010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8		2001	2010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	LB-LA MOS-1 CENTEX MOS-2 MOS-3	1990	2000	448.13	515.99	31.40	40.20	15.46	30.94	232.98	295.87	48.91	65.69	18.49	23.46
10	LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4	1990	2000	448.13	515.99	31.40	40.20	15.46	30.94	232.98	295.87	48.91	65.69	18.49	23.46
11	LB-LA MOS-1 CENTEX MOS-2 LRTC1	1990	2000	451.14	516.56	21.56	27.80	22.29	42.97	243.59	310.51	32.73	44.03	23.96	30.48
12	LB-LA MOS-1 CENTEX MOS-2 LRTC2	1990	2000	451.14	516.56	21.56	27.80	22.29	42.97	243.59	310.51	32.73	44.03	23.96	30.48
13	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1	1990	2000	441.20	503.96	31.40	40.20	22.29	42.97	227.41	288.85	48.91	65.69	23.96	30.48
14	LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1	1990	2000	441.20	503.96	31.40	40.20	22.29	42.97	227.41	288.85	48.91	65.69	23.96	30.48
15	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 LRTC2	1990	2000	435.84	494.33	31.40	40.20	27.75	52.60	221.94	281.83	48.91	65.69	29.43	37.50
16	LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1 LRTC2	1990	2000	435.84	494.33	31.40	40.20	27.75	52.60	221.94	281.83	48.91	65.69	29.43	37.50

MENT POLICY ALIGN 4 MOS-2

THE FOLLOWING NETWORKS HAVE BEEN IDENTIFIED FOR USE IN THE CURRENT ANALYSIS

NW ID	SCHED IMPLEMENTATION	NETWORK DESCRIPTION	SIMULATION DATES SIM-1	SIM-2	OPERATING COSTS (DEC 1985 DOLLARS) BUS SIM-1	BUS SIM-2	METRO SIM-1	METRO SIM-2	LRT SIM-1	LRT SIM-2	REVENUE PROJECTIONS (DEC 1985 DOLLARS) BUS SIM-1	BUS SIM-2	METRO SIM-1	METRO SIM-2	LRT SIM-1	LRT SIM-2
1	1984 FISCAL YEAR	ALL BUS SYSTEM	1985	1990	504.50	517.31	0.00	0.00	0.00	0.00	218.94	242.30	0.00	0.00	0.00	0.00
2	1991 FISCAL YEAR	LB-LA	1990	2000	502.91	508.99	0.00	0.00	14.40	20.05	242.30	281.20	0.00	0.00	11.50	12.72
3	1993 FISCAL YEAR	LB-LA MOS-1	1990	2000	491.15	524.39	12.03	15.40	14.40	20.05	262.77	285.73	3.57	4.34	11.50	12.72
4	1993 FISCAL YEAR	LB-LA MOS-1 CENTEX	1990	2000	504.90	527.58	12.03	15.40	15.46	30.94	268.41	287.59	3.50	4.24	17.34	18.77
6	1996 FISCAL YEAR	LB-LA MOS-1 CENTEX MOS-2	1990	2000	455.54	525.54	21.56	27.80	15.46	30.94	249.06	317.53	32.73	44.03	18.49	23.46
11	1993 FISCAL YEAR	LB-LA MOS-1 CENTEX MOS-2 LRTC1	1990	2000	451.14	516.56	21.56	27.80	22.29	42.97	243.59	310.51	32.73	44.03	23.96	30.48
13	2000 FISCAL YEAR	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1	1990	2000	441.20	503.96	31.40	40.20	22.29	42.97	227.41	288.85	48.91	65.69	23.96	30.48
15	2000 FISCAL YEAR	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 LRTC2	1990	2000	435.84	494.33	31.40	40.20	27.75	52.60	221.94	281.83	48.91	65.69	29.43	37.50

THE NETWORKS IDENTIFIED ABOVE FOR ANALYSIS DEFINE IMPLEMENTATION DATES FOR THE FOLLOWING SPECIFIED TRANSPORTATION IMPROVEMENTS.

HEAVY RAIL DESC	NETWORK DESIGNATION	IMPLEMENTATION REVENUE SERVICE	CONSTR COMPLT	DUR	LIGHT RAIL DESC	NETWORK DESIGNATION	IMPLEMENTATION REVENUE SERVICE	CONSTR COMPLT	DUR	BUSWAY DESC	NETWORK DESIGNATION	IMPLEMENTATION REVENUE SERVICE	CONSTR COMPLT	DUR
MOS-1	3	1993	1993	7	LB-LA	2	1991	1991	6	HARBOR	-	-	-	3
MOS-2	6	1996	1996	8	CENTURY EXT.	4	1993	1993	6					
MOS-3	13	2000	2000	5	LRTC1	11	1993	1993	5					
MOS-4	-	-	-	5	LRTC3	-	-	-	4					
EAST LA METRO	-	-	-	5	LRTC4	-	-	-	3					
NORWALK METRO	-	-	-	5	LRTC2	15	2000	2000	5					
SANTA MONICA	-	-	-	5	LRTC5	-	-	-	3					

NETWORK I.D. FISCAL YEAR

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NETWORK 1	I	+	+	+	+	I	+	+																		
NETWORK 2				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 3				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 4				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 6				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 11				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 13				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								
NETWORK 15				+	+	I	+	+	+	+	+	+	+	+	+	I	+	+								

When a new project becomes operational, the newly defined network naturally supersedes the previous network. The new cost and revenue projections, therefore, include the previous system plus the new capital improvements. Only a relatively small number of transit networks are technically feasible. For example, because of the location for the yard-shop complex, MOS-1 must be implemented before any other heavy rail segment. The LB-LA light rail line will be the first rail facility in operation. Thus, any network selected for analysis must include MOS-1 and LB-LA.

Other transit networks can be defined, but they must be feasible and operable. Moreover, it is a major undertaking to develop the requisite data for each newly defined network. Regional trip tables exist for only a few years - currently 1985, 1990, 2000, and 2010. These are the only available horizon years for a defined network. For any new network, Urban Transportation Planning System (UTPS) simulations must be run for the trip-table years which bracket the implementation date. For example, if a network is to be implemented in 1992, and serve as the regional network through 1996, UTPS simulations must be run for 1990 and 2000. Costs and revenues can then be interpolated for 1992 through 1996. Using another example, if the 1997 defined network prevails through 2001, the two horizon years will be 1990 and 2000. For such a network, interpolations would be made for 1997 through 2000, with extrapolation to 2001.

Every defined network must have two horizon or simulation years, unless it exists for one year only, and that year is one of the four trip-table years. Interpolation and extrapolation are made on a straight-line basis. Currently, extrapolation is programmed for two years at each end of the time span.

1.3.2 Implementation Schedule

The implementation schedule for each of the transit segments or projects identified is input to the model. As each new project becomes operational, a new transit network is defined and its two simulation years are determined. Simulation years are selected to bracket the anticipated network implementation date.

The user may change the implementation schedule. However, UTPS simulations are performed for only two of the four trip-table years defined. Thus, the project operational date is limited to not more than two years earlier than the early simulation date nor more than two years later than the later simulation date. However, this limitation is not severely restrictive because the implementation date may span a fifteen-year period.

1.3.3 Construction Duration

The duration of construction activity defines the time span over which funds are expended on a given project. The year in which construction is completed then defines the time frame of activity. The distribution of annual construction expenses in constant dollars and a table of cost

escalation factors enable the calculation of current (escalated) dollar costs.

The user may vary the construction duration period and the year of completion to test various management strategies and the impact on cash flow.

1.3.4 Operating Costs

Currently, bus operating costs are provided by the District via a computer program which runs in association with UTPS simulations. The trip-table for a simulation year is assumed, and all trips are divided among the several transit options available for the defined network undergoing analysis. The bus operating cost model calculates the cost of operating the bus system necessary to serve its assigned trips.

Bus operating costs are found for the two horizon years for each defined network input into the Management Policy Module.

A brief description of an Urban Transportation Planning System (UTPS) simulation run follows:

1. A trip table is prepared by generating the trip demand of the several traffic zones and distributing these trips geographically;

2. The relative proportion of trips by each mode is determined by an appropriate modal split model;

3. Trips are assigned to the transit network components assumed in the defined network;

4. Each simulation produces data such as vehicle miles of travel, vehicle hours of operation, linked passenger trips, and peak vehicle requirements.

The bus operating cost model uses data such as vehicle hours of bus service, vehicle miles of bus travel, and peak to base vehicle ratios to provide an estimate of operating costs for buses.

Operating costs for Metro Rail are provided by SCRTD staff. A cost model is used for this purpose. The model is based on local wage rates and labor conditions, the experience of other agencies operating rail transit and an assumed operating schedule which defines miles and hours of operation. Operating costs for the light rail lines are derived from data supplied by the Los Angeles County Transportation Commission (LACTC).

1.3.5 Fare Box Revenues

Bus and rail farebox revenue estimates are derived directly from UTPS simulations run in conjunction with a Fare model developed by SCRTD staff.

The fare model employs the fare policy of SCRTD to calculate revenues based on the transit trip production projected in the UTPS simulations.

Farebox revenue estimates are made for two horizon years for each defined network. These projections are input to the Management Policy Module.

1.4 INPUT SUMMARY

All input to the Management Policy Module are generated external to LODESTAR. Input data consists of two categories.

1. Network description
2. Operating cost and revenue projections

1.4.1 Network Descriptions

The description of a network consists of a list of projects it includes. The user may change this description by re-entering the new list and by adjusting the project column in the right of the spread sheet. A 1 in the project column means the project is included in the network corresponding to the row while a "0" means the project is not included.

The networks chosen for cash flow analysis are entered by each network's ID number. Each added network indicates a new project has been completed and added to the previously defined network. The sequence of selected networks must be technically feasible. The year of scheduled implementation of revenue service, the year in which construction will be completed, and the duration of construction activity are selected by the user in accordance with management policy and technical feasibility.

1.4.2 Operating Cost and Revenue Projections

Operating costs and farebox revenue projections for each of two simulation years for the heavy rail, light rail, and bus transit systems are entered for each of the available networks. Note that these data may not be available for some networks.

1.4.3 Calculations

Changes in the list of available transit projects implies major revisions to the proposed regional transit system. However, projects may move up or down in priority such that network buildup sequences not anticipated at this time may become reasonable alternatives in the near future. The procedure for adjustments in this instance is described above. Similarly, the only changes made to operating cost and revenue projections will be the result of revisions or updates to models external to LODESTAR.

Changes normally made in Module 1 consist of the choice of defined networks included in the current cash flow analysis, and/or the scheduled implementation year for any defined network.

Module 1 calculations consist entirely of table look-up procedures which permit the transfer of information from the "networks available" table to the "networks identified" table. LODESTAR automatically transfers network descriptions, simulation dates, operating costs, and revenue projections according to network ID number. Network designations and implementation years for specific improvement projects are updated automatically to agree with any change in defined networks.

1.5 OUTPUT SUMMARY

Networks defined for analysis in Module 1 are output to the Farebox Revenues, Operating Costs, and Capital Costs Modules. These outputs are primarily descriptive in character, and are used for column headings.

Farebox revenues are output to Module 3. Operating costs are output to Module 7. The principal function of these two modules is to interpolate revenues and costs for the years between the two simulation years.

Module 1 provides a schematic diagram of the implementation schedule for the networks chosen for LODESTAR analysis. For each defined network, the schematic identifies the year the network begins operating and highlights the years during which it is expected to generate revenues.

CHAPTER 2. MODULE 2: ECONOMIC AND DEMOGRAPHIC PROJECTIONS

Economic and demographic projections made in Module 2 provide data used in the conventional funding, operating cost, capital cost and other modules.

Most assumptions are based on those made by:

- The California Department of Transportation (CALTRANS)
- The State of California Department of Finance (DOF)
- The California Energy Commission (CEC)
- The Southern California Association of Governments (SCAG)

In general, calculations are made from a 1984 base year. Some price and income indices use 1967 as the base year. In both cases the index for the base year is 100. Some indices use 1986 as a base year because much cost data is in FY 1986 dollars.

Figure 2.1 is a printout of Module 2. The commentary follows the figure sequentially and corresponds to line-by-line calculations in the model.

2.1 INPUT - CURRENT INPUT DATA, ASSUMPTIONS, AND CALCULATIONS

2.1.1 Population

Population forecasts drive a number of key revenue sources, especially taxable sales, fuel sales, and operating revenues which fund the Transportation Development Act Account (TDA), the Transportation Planning and Development Account (TP&D), the Proposition Five Account (Prop 5), and other accounts.

Los Angeles County population projections are based on the latest projections available from SCAG. Similarly, California population projections are the latest available from DOF. U.S. population projections for 1985, 2000, and 2010 are from the June 28, 1984, U.S. Bureau of the Census Report.

SCAG, DOF, and U.S. Census forecasts are used to project populations through 2010. Forecasts are available only for "calibration years." Projections for intervening years are interpolated from a logistic curve developed by SCRTD.

U.S. Census population projections are based on calendar years. SCRTD forecasts costs and revenues by fiscal year. To make Census projections useful to the SCRTD, it is necessary to convert populations from calendar

FIGURE 2.1

MODULE 2 ECONOMIC/DEMOGRAPHIC PROJECTIONS

MODULE 2: ECONOMIC/DEMOGRAPHIC PROJECTIONS

	FISCAL YEAR		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	INPUT																		
	POPULATION																		
--->SCAG	L.A. CO. POPULATION, CY	000s	7975	8137	8332	8487	8592	8665	8736	8805	8874	8942	9008	9073	9137	9201	9262	9323	9383
--->SCAG	L.A. CO. POPULATION, FY	000s	7921	8029	8246	8418	8556	8629	8700	8771	8840	8908	8975	9041	9106	9169	9232	9293	9353
--->SCAG	L.A. CO. POPULATION GROWTH RATE	%		1.35	2.72	2.09	1.64	0.85	0.83	0.81	0.79	0.77	0.75	0.73	0.72	0.70	0.68	0.66	0.65
--->DOF	CA. POPULATION, CY	000s	25919	26384	27038	27704	28236	28670	29100	29526	29949	30370	30788	31202	31612	32018	32420	32817	33214
--->DOF	CA. POPULATION, FY	000s	25556	26079	26688	27388	28019	28453	28886	29313	29738	30161	30580	30996	31408	31816	32220	32620	33015
--->DOF	CA. POPULATION GROWTH RATE	%		2.05	2.34	2.62	2.30	1.55	1.52	1.48	1.45	1.42	1.39	1.36	1.33	1.30	1.27	1.24	1.21
--->USBOC	U.S. POPULATION, CY	000s	236409	238631	240822	242980	245105	247197	249256	251280	253271	255228	257150	259037	260890	262708	264492	266241	267955
--->USBOC	U.S. POPULATION, FY	000s	234313	237520	239727	241901	244043	246151	248227	250268	252276	254250	256189	258094	259964	261799	263600	265367	267098
--->USBOC	U.S. POPULATION GROWTH RATE	%		0.94	0.92	0.90	0.87	0.85	0.83	0.81	0.79	0.77	0.75	0.73	0.72	0.70	0.68	0.66	0.64
--->DOF	OTHER PROP 5 CO. POPULATION, FY	000s	9411	9729	9943	10089	10274	10378	10520	10660	10799	10936	11072	11205	11337	11467	11595	11721	11845
--->DOF	OTHER PROP 5 CO. POP GRWTH RATE	%		3.37	2.21	1.47	1.44	1.40	1.37	1.33	1.30	1.27	1.24	1.21	1.18	1.15	1.12	1.09	1.06
	PRICE INDICES																		
--->CAL	U.S. CPI-U	FY1986=100	91.92	96.10	100.00	103.56	107.71	112.01	116.49	121.15	126.00	131.04	136.28	141.73	147.40	153.30	159.43	165.81	172.44
--->CAL	U.S. CPI-U GROWTH RATE	%		4.5	4.1	3.6	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
--->CAL	U.S. CPI-U	1967=100	299.30	312.90	325.60	337.20	350.69	364.72	379.30	394.48	410.26	426.67	443.73	461.48	479.94	499.14	519.10	539.87	561.46
--->CAL	CA. HWY CONSTRUCTION INDEX	FY1986=100	96.47	99.90	100.00	104.00	108.16	112.49	116.99	121.67	126.53	131.59	136.86	142.33	148.02	153.95	160.10	166.51	173.17
--->CAL	CA. HCI GROWTH RATE	%	3.87	3.55	0.10	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	REAL PERSONAL INCOME/CAPITA																		
--->SCAG	L.A. REAL PERSNL INCOME/CAPITA	$,1967	4764	4810	4856	5002	5092	5189	5298	5420	5629	5710	5801	5894	5989	6084	6182	6281	6381
--->SCAG	L.A. REAL PERSNL INCM/CAP GRWTH	%		2.10%	2.00%	3.00%	1.80%	1.90%	2.10%	2.30%	3.70%	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%
--->CAL	CA. REAL PERSNL INCOME/CAPITA	$,1967	4460	4505	4550	4595	4682	4776	4881	4998	5188	5276	5366	5457	5550	5645	5740	5838	5937
--->CAL	CA. REAL PERSNL INCM/CAP GRWTH	%		1.00%	1.00%	1.00%	1.90%	2.00%	2.20%	2.40%	3.80%	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%
--->CAL	CA. PERSNL INCOME/CAP GRWTH	%		5.59%	5.10%	4.60%	5.38%	6.08%	6.29%	6.50%	7.95%	5.77%	5.77%	5.77%	5.77%	5.77%	5.77%	5.77%	5.77%
	TAXABLE SALES COEFFICIENTS																		
--->SCAG	L.A. TXBL SALES/PERSNL INCM			0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259	0.5259
--->FTB	L.A. TS/PI (SAFE ESTIMATE)			0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994	0.4994
--->SCAG	CA. TXBL SALES/PERSNL INCM			0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435	0.5435
				0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170	0.5170
	GASOLINE PRICES																		
--->CAL	CA. GASOLINE REAL PRICE	$/GAL,FY67	0.38	0.36	0.32	0.27	0.28	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
--->CAL	CA. GASOLINE PRICE	$/GAL,1	1.14	1.13	1.04	0.92	0.97	1.00	1.04	1.08	1.13	1.18	1.23	1.28	1.33	1.38	1.43	1.49	1.55
--->CAL	CA. GAS REAL PRICE GRWTH RATE	%		-5.94	-11.42	-14.15	1.06	-0.57	-0.49	0.51	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VEHICLE MILES TRAVELED																		
--->CAL	CA. LDV VMT/Capita Index	FY84=100	100	100.70	101.40	102.11	103.47	104.92	106.54	108.33	111.21	112.53	113.87	115.23	116.60	117.98	119.39	120.81	122.25
--->CAL	CA. LDV VMT/CAPITA GRWTH RATE	%		0.70%	0.70%	0.70%	1.33%	1.40%	1.54%	1.68%	2.66%	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%
--->CAL	CA. Commercial Fleet Index	FY85=100	96.6	100	102.2	104	105.9	108.10	109.90	111.70	113.32	114.93	116.53	118.11	119.68	121.24	122.78	124.30	125.80
--->SCAG	CA. COM'L FLT INDEX GRWTH RATE	%		3.52%	2.20%	1.76%	1.83%	2.08%	1.67%	1.64%	1.45%	1.42%	1.39%	1.36%	1.33%	1.30%	1.27%	1.24%	1.21%
	FUEL DEMAND																		
--->CAL	CA. NEW LDV FUEL EFFICIENCY	MPG	23.70	22.29	19.75	16.95	17.13	17.04	16.95	17.04	17.14	17.14	17.14	17.14	17.14	17.14	17.14	17.14	17.14
--->CAL	CA. NEW LDV FUEL EFFCY GR RATE	%		-5.94	-11.42	-14.15	1.06	-0.57	-0.49	0.51	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
--->CEC	CA. AVG LDV FUEL EFFICIENCY	MPG	16.40	16.75	16.96	16.96	16.97	16.98	16.98	16.98	16.99	17.01	17.02	17.03	17.03	17.04	17.05	17.06	17.06
--->CEC	CA. AVG LDV FUEL EFFCY GR RATE	%		2.16	1.23	0.00	0.08	0.03	-0.01	0.03	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04
--->CAL	CA. LDV FUEL DEMAND	MIL GALS	10920	11220	11520	12080	12310	12420	12550	12660	12770	12880	12990	13100	13210	13320	13430	13540	13650
--->CAL	CA. TRUCK FUEL DEMAND	MIL GALS	1839	1904	1946	1980	2016	2058	2092	2126	2157	2188	2218	2249	2278	2308	2337	2366	2395
	U.S. GASOLINE ADJUSTMENT FACTOR			0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	U.S. DIESEL ADJUSTMENT FACTOR			1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	OPERATING REVENUES																		
--->SCAG	CA. OPERATING REVENUES	$MIL,I	774.9	826.7	880.4	935.6	995.5	1051.4	1110.0	1171.5	1236.0	1303.7	1374.7	1449.2	1527.2	1608.9	1694.5	1784.2	1879.0
--->SCAG	CA. REAL OPERATING REVENUES	%		6.68	6.49	6.28	6.40	5.61	5.58	5.54	5.51	5.49	5.45	5.41	5.38	5.35	5.32	5.29	5.26
	OUTPUT																		
	L.A. CO TXBL TRANS (SAFE EST)	$BIL,I		61	66	69	75	80	86	92	100	107	114	121	129	137	146	156	165
	CA. TAXABLE TRANSACTIONS	$BIL,I		200	216	225	233	252	271	293	319	345	371	398	426	457	489	524	561
	SCRTD/L.A.CO SUBSIDY SHARE			0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375	0.864375
	CA. GASOLINE SALES	MIL GALS	10920	11220	11520	12080	12310	12420	12550	12660	12770	12880	12990	13100	13210	13320	13430	13540	13650
	CA. DIESEL SALES	MIL GALS	1839	1904	1946	1980	2016	2058	2092	2126	2157	2188	2218	2249	2278	2308	2337	2366	2395
	U.S. GASOLINE SALES	MIL GALS		100145	101409	104561	105074	105297	105690	105925	106164	106405	106650	106899	107152	107411	107676	107946	108224
	U.S. DIESEL SALES	MIL GALS		22540	22729	22733	22827	23144	23373	23602	23791	23977	24160	24340	24516	24689	24859	25025	25189
	CA. GASOLINE PRICE	$,I		1.13	1.04	0.92	0.97	1.00	1.04	1.08	1.13	1.18	1.23	1.28	1.33	1.38	1.43	1.49	1.55
	PROP 5 CO POP/CA POP COEFF			0.6850	0.6848	0.6783	0.6719	0.6692	0.6666	0.6640	0.6615	0.6591	0.6566	0.6542	0.6519	0.6496	0.6473	0.6451	0.6430
	CA. OPERATING REVENUES	$MIL,I		827	880	936	995	1051	1110	1172	1236	1304	1375	1449	1527	1609	1695	1784	1878
	L.A.CO POP/CA.POP COEFF			0.3078	0.3090	0.3074	0.3054	0.3033	0.3012	0.2992	0.2973	0.2954	0.2935	0.2917	0.2899	0.2882	0.2865	0.2849	0.2833
	LA CO POP/OTHR PROP5 CO POP COEF			0.4521	0.4559	0.4569	0.4564	0.4550	0.4537	0.4524	0.4511	0.4498	0.4486	0.4474	0.4463	0.4452	0.4441	0.4430	0.4420
	TP&D SALES TAX CAP GROWTH RATE	%		6.68	6.49	6.28	6.40	5.61	5.58	5.54	5.51	5.48	5.45	5.41	5.38	5.35	5.32	5.29	5.26
	SCRTD/LA CO-PROP A SHARE			0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631	0.85631

to fiscal years. The fiscal year population is the average of the current and previous calendar year. Conversely, calendar year populations are the average of the current and subsequent fiscal year. Thus, the fiscal year population is measured as of January 1 and the calendar year population as of July 1.

Although SCAG uses fiscal year data for financial planning, previous calendar year projections must be used for certain components of these forecasts. These data are referred to as "lagged from the previous calendar year." For example, the FY 1985 estimate of gasoline sales is taken from the FY 1984 data.

Population data for the nine Proposition 5 counties are included to allow the calculation of projected Guideway Fund shares. The details of this capability are discussed in the Conventional Funding Module (Module 5) documentation.

o **Los Angeles County Population**

Fiscal year population projections for Los Angeles County 1984-2010 inclusive, are from SCAG. These data must be updated annually as available. The model calculates calendar year population projections by averaging current and subsequent fiscal years and then calculates annual LA County population growth rates for each calendar year from 1985-2010, inclusive.

o **California Population**

California population projections for calendar years 1984-2010, inclusive, are from DOF. These data must be updated annually as available. The model averages current and previous calendar years to calculate fiscal year populations. The model calculates calendar year annual California population growth rates as for LA County, above.

o **U.S. Population**

U.S. population projections for calendar years 1984-2010, inclusive, are from the U.S. Census. These data must be updated annually, as available. The model calculates fiscal year populations as for California, above. The model calculates calendar year annual U.S. population growth rates as for California, above.

o **Proposition 5**

As of 1985, nine counties have adopted Proposition 5: Alameda, Contra Costa, Los Angeles, Orange, Sacramento, San Diego, San Francisco, San Mateo, and Santa Clara. If others elect to participate in the future, the model must be revised accordingly. The 1984 fiscal year population for Proposition 5 counties other than Los Angeles County are from DOF. These data must be updated as available. The model projects the population of the other counties for fiscal years 1985-2010 by successive application of the annual California growth rate.

2.1.2 Price Indices

Various agencies which develop transportation improvement programs use different Consumer Price Index (CPI) projections. Projections are made by:

- The Southern California Association of Governments (SCAG)
- The California Department of Transportation (CALTRANS)
- The Southern California Rapid Transit District (SCRTD)

For FY 1986-1990, the differences between CPI growth rates projected by the four agencies are not significant. It would be equally valid to use any in Module 2. After 1990, conflicts arise between agencies which forecast revenues and agencies which forecast capital expenditures. For revenues, the need to be conservative demands the use of low CPI growth rate forecasts. For costs, the opposite is true. SCAG, which forecasts revenues, projects CPI growth rates of 3% to 4% after FY 1990. CALTRANS and LACTC, which forecast both revenues and costs, project 4.5% to 5% growth rates after FY 1990.

The UCLA Business Forecast for June, 1988 suggests that the National CPI for next decade should be in the range of 3.6% to 4.5%. Accordingly, it was decided to adopt 4.0% for this study inasmuch as forecasts of revenues and costs are made.

The model calculates the CPI for each year from a 1986 base of 100 by multiplying by 1 plus the assumed growth rate.

The 1967 CPI is calculated from a FY 1984 base of 299.13 for Los Angeles-Long Beach. CPIs in 1967 dollars are calculated for 1985 and subsequent years using CPI growth rates as above. CPI's adjusted for Los Angeles-Long Beach are used for historical data. However, in forecasting, national projections are used.

Heavy Construction Index (HCI) growth rates for FY 1986-2000 are those used by SCRTD. The rates are derived from quarterly reports published in the Engineering News Record as adjusted for Los Angeles. The model calculates the HCI for each year from a 1986 base of 100.

2.1.3 Real Personal Income Per Capita

Real personal income per capita and population projections are used to project both tax and operating revenues.

CALTRANS projects annual California real personal income per capita for each calendar year 1984-1996. For 1997-2010, SCAG assumes an annual growth rate of 1.4%. Using those projections, SCAG developed an econometric model which estimates Los Angeles County real personal income. All income projections appear in constant 1967 dollars.

The model calculates California real personal income per capita growth rates prior to 1997 on the basis of the CALTRANS data.

The model calculates California personal income per capita growth rates for 1985-2010 in current dollars by first multiplying real personal income by the 1967 based CPI factor.

A model developed by SCAG is used to forecast Los Angeles Real Personal Income based on the California Real Personal Income Forecast. A problem with all personal income data is that updates have not been available for several years. However, new data are expected in summer 1988.

2.1.4 Taxable Sales

The model projects California and Los Angeles County taxable sales using SCAG methodology based on annual observations beginning in 1972:

- The ratio of taxable sales to real personal income for each geographical entity within SCAG is determined; and
- The mean and standard deviations of that ratio are calculated.

Statistically, actual measured values are higher than their expected values about half the time and lower about half time. To be conservative, taxable sales must be forecast low more frequently than high. A forecast can be structured to meet that requirement by reducing the average ratio by some number of standard deviations. The number of standard deviations in the reduction is a function of the acceptable risk factor.

In this model, to make the observed ratio higher than the forecast at least 90% of the time and lower only 10% of the time, the average is reduced by 1.28 standard deviations of the ratio. The number 1.28 is the normal deviate for which 10% of a normal distribution falls under the left tail of the curve. The observed thirteen-year average ratio of Los Angeles taxable sales to real personal income is 0.5259. That value is assumed for 1985-2010, inclusive. The standard deviation of the ratio is 0.0207.

The safe ratio of Los Angeles taxable sales to real personal income is calculated by dividing 1.28 standard deviations by the square root of the

horizon length in years (n) and then subtracting this result from the observed ratio.

The value of n varies to correspond to short, medium, and long term planning horizons: n is 1 for the first year projected: 4 for years two through five inclusive; and 20 for the remaining forecast period. These calculations should be updated as data is available.

2.1.5 Gasoline Prices

Gasoline prices, vehicle miles traveled, and fuel demand are required to provide some estimates of spillover tax collections due to the high price of motor fuel. However, fuel prices are low such that there are no spillover fuel taxes available and revenues for transit guideway projects derived from that source are expected to be zero for several years. Moreover, if fuel prices rise substantially in the future, new legislation may change or even eliminate the spillover fuel tax. The gasoline and diesel fuel demand in gallons per year, is used to estimate the California 9 cent per gallon tax revenues generated annually. The estimating procedure developed by the California Energy Commission and CALTRANS are used in LODESTAR to provide estimates of motor fuel consumption.

2.1.6 Operating Revenues

Operating revenue projections are needed to develop allocation formulas to project local shares of certain funds. Module 2 uses SCAG projections. The statewide revenue base for transit systems operating in California was $642.7 million in 1984. This amount is expected to increase as a function of statewide transit ridership increase (assume equal to percent growth in California population) and the growth in the average cost per ride statewide (assume equal to percent growth in the Consumer Price Index.)

2.2 OUTPUT - INFORMATION TO BE USED IN OTHER MODULES

2.2.1 Taxable Transactions

A forecast of the dollar amount of taxable sales in Los Angeles County is based on a formula structured to yield a forecast with 90% confidence that actual sales will be at least this high. Los Angeles real personal income per capita for the previous calendar year is multiplied by the Los Angeles County population and the U.S. CPI for the current year. The safe ratio of taxable sales to personal income is applied to the result. The result is expressed in billions of dollars.

California taxable transactions are determined by multiplying California real personal income per capita by the forecast of California population for the previous calendar year. The ratio of California taxable sales to personal income is applied, and the result is inflated by the U.S. CPI. The result is expressed in billion of dollars.

There are two subsidy share percentages calculated by LACTC to determine SCRTD's share of transit related funds allocated to Los Angeles County.

The first percentage is SCRTD's share of Federal Section 9 funds and State TDA and STA funds. This share comes to 0.864375 and is based on the following: 50% on revenue vehicle miles; 25% on passenger boardings; and 25% on linked passenger trips. The average of FY82 and FY83 data were used to determine the FY86 and FY87 apportionment.

The second percentage is SCRTD's share of the Proposition A monies accumulated in Los Angeles County. This share comes out to 0.856310 and is based on the following: 50% on fare units calculated by dividing fare box revenues by the cash base fare and 50% on revenue vehicle miles. The average of FY82 and FY83 data were used to determine the FY86 and FY87 apportionment. Both these subsidy share percentages are revised every few years.

2.2.2 Fuel Gasoline Sales

Fuel sale forecasts are presented in the Module for California gasoline and diesel fuel sales and for the California gasoline price.

2.2.3 Coefficients/Growth Rates

The ratio of the sum of Proposition 5 County Populations to the State of California population is calculated. The ratio of Los Angeles County population to the State of California population is calculated. The ratio of Los Angeles County population to all Proposition 5 Counties is calculated. Each of these ratios is used to calculate Los Angeles County's share of various revenue streams.

The procedure described below calculates the Transportation Planning and Development tax growth rate. Any given year's rate is based on the smaller of the U.S. CPI or the California personal income per capita growth rate.

If the U.S. CPI is smaller than the California per capita growth rate, then the TP&D sales tax growth rate is calculated from the California population growth rate and the U.S. CPI.

If the California personal income per capita growth rate is smaller than the U.S. CPI, then the TP&D sales tax growth rate is calculated from the California population growth rate and the California personal income per capita growth rate.

CHAPTER 3. MODULE 3: FAREBOX REVENUE PROJECTIONS

Module 3, the Fare Box Revenue Projections Module, forecasts revenues for the transit system as a whole and for bus, heavy rail, and light rail modes individually, for each year modeled.

Data are automatically entered from Module 1 for two simulation years for each selected network description. The model generates a forecast, interpolated from the two simulation years, for each intervening year. The interpolation is performed for each network description and transit mode.

The model calculates annual revenues anticipated from the implementation schedule selected in Module 1. Revenue flows for a given network description are automatically entered only for the years that network is in operation, not before implementation of that network or after the implementation of a new network.

Revenue projections are calculated in 1986 dollars for a base fare of $1.00. Projections are then inflated by the appropriate Consumer Price Index for each year, and later used in the Conventional Funding and Operations Cash Flow Manager Modules. A printout of Module 3 is shown in Figure 3.1

3.1 MODULE INPUT

3.1.1 Price Indices

The United States Consumer Price Index (CPI) and associated growth rate for each year of the planning horizon are automatically entered from Module 2. A CPI of 100 is assumed for 1986, the base year.

3.1.2 UTPS Simulations

UTPS simulation data are automatically entered from Module 1 for two years which bracket each system's scheduled implementation date. For example, if MOS-3 is scheduled for 1999, simulations are entered for 1990 and 2000. Simulation results include fare box revenue projections for the modal components of each system.

The following data are automatically entered from Module 1:

- Network Description and Implementation Schedule
- Simulation years for each network description
- Bus revenues for each simulation
- Metro Rail revenues for each simulation
- Light Rail revenues for each simulation

FIGURE 3.1

MODULE 3: FARE BOX REVENUE PROJECTIONS

			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
MODULE 3	FARE BOX REVENUE PROJECTIONS																		
	ALIGN 6 MOS-2		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	----------		------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
	INPUT FROM MODULE 2																		
--->CAL	U.S. CPI-U	FY1986=100	91.92	96.10	100.00	103.56	107.71	112.01	116.49	121.15	126.00	131.04	136.28	141.73	147.40	153.30	159.43	165.81	172.44
--->CAL	U.S. CPI-U GROWTH RATE	%		4.54	4.06	3.56	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

INPUT FROM UTPS REVENUE MODEL

			SIMULATION DATES SIM-1	SIM-2	BUS SIM-1	BUS SIM-2	METRORAIL SIM-1	METRORAIL SIM-2	LIGHTRAIL SIM-1	LIGHTRAIL SIM-2
1984	ALL BUS SYSTEM	1986 $MIL	1985	1990	218.94	232.71	0.00	0.00	0.00	0.00
1991	LB-LA	1986 $MIL	1990	2000	232.71	270.07	0.00	0.00	11.50	12.72
1993	LB-LA MOS-1	1986 $MIL	1990	2000	262.77	285.73	3.57	4.34	11.50	12.72
1993	LB-LA MOS-1 CENTE1	1986 $MIL	1990	2000	268.41	297.59	3.50	4.24	17.34	18.77
1996	LB-LA MOS-1 CENTE1 MOS-2 HARBOR	1986 $MIL	1990	2000	283.20	321.24	41.16	54.95	18.48	23.39
1998	LB-LA MOS-1 CENTE1 MOS-2 MOS-3 HARBOR	1986 $MIL	1990	2000	232.89	295.94	43.91	65.69	18.48	23.39
1998	LB-LA MOS-1 CENTE1 MOS-2 MOS-3 LRTC1 HARBOR	1986 $MIL	1990	2000	227.42	288.89	43.91	65.69	23.96	30.45
2000	LB-LA MOS-1 CENTE1 MOS-2 MOS-3 MOS-4 LRTC1 LRTC2 HARBOR	1986 $MIL	1990	2000	221.94	281.83	43.91	65.69	29.43	37.50

1984	NETWORK (BUS)	1986 $MIL	216.19	218.94	221.69	224.45	227.20	229.96	232.71	235.45	238.22								
1991	NETWORK (BUS)	1986 $MIL					225.24	228.97	232.71	236.45	240.18	243.92	247.65	251.39	255.13	258.86	262.60	266.33	270.07
1993	NETWORK (BUS)	1986 $MIL					258.18	260.47	262.77	265.07	267.36	269.66	271.95	274.25	276.55	278.84	281.14	283.43	285.73
1993	NETWORK (BUS)	1986 $MIL					264.57	266.49	268.41	270.33	272.25	274.16	276.08	278.00	279.92	281.84	283.75	285.67	287.59
1996	NETWORK (BUS)	1986 $MIL					239.59	246.40	253.20	260.00	266.81	273.61	280.42	287.22	294.02	300.83	307.63	314.44	321.24
1998	NETWORK (BUS)	1986 $MIL					229.29	226.58	232.89	239.19	245.50	251.81	258.11	264.42	270.72	277.03	283.33	289.64	295.94
1998	NETWORK (BUS)	1986 $MIL					215.12	221.27	227.41	233.56	239.71	245.86	252.00	258.15	264.30	270.44	276.59	282.74	288.88
2000	NETWORK (BUS)	1986 $MIL					209.96	215.95	221.94	227.93	233.92	239.91	245.90	251.89	257.87	263.86	269.85	275.84	281.83
	FARE BOX REVENUES (BUS)	1986 $MIL		218.94	221.69	224.45	227.20	229.96	232.71	236.45	240.18	274.16	276.08	278.00	294.02	360.83	276.59	282.74	281.83

1984	NETWORK (HEAVY RAIL)	1986 $MIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
1991	NETWORK (HEAVY RAIL)	1986 $MIL					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	NETWORK (HEAVY RAIL)	1986 $MIL					3.42	3.49	3.57	3.65	3.72	3.80	3.88	3.96	4.03	4.11	4.19	4.26	4.34
1993	NETWORK (HEAVY RAIL)	1986 $MIL					3.35	3.43	3.50	3.57	3.65	3.72	3.80	3.87	3.94	4.02	4.09	4.17	4.24
1996	NETWORK (HEAVY RAIL)	1986 $MIL					38.40	39.78	41.16	42.54	43.92	45.30	46.68	48.05	49.43	50.81	52.19	53.57	54.95
1998	NETWORK (HEAVY RAIL)	1986 $MIL					45.55	47.23	48.91	50.59	52.27	53.94	55.62	57.30	58.98	60.66	62.33	64.01	65.69
1998	NETWORK (HEAVY RAIL)	1986 $MIL					45.55	47.23	48.91	50.59	52.27	53.94	55.62	57.30	58.98	60.66	62.33	64.01	65.69
2000	NETWORK (HEAVY RAIL)	1986 $MIL					45.55	47.23	48.91	50.59	52.27	53.94	55.62	57.30	58.98	60.66	62.33	64.01	65.69
	FARE BOX REVENUES (HEAVY RAIL)	1986 $MIL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.72	3.80	3.87	49.43	50.81	62.33	64.01	65.69
1993	START-UP ADJUSTMENTS (MOS-1)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.55	1.28	0.00	0.00	0.00	0.00	0.00	0.00
1996	START-UP ADJUSTMENTS (MOS-2)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.48	15.44	0.00	0.00	0.00
1998	START-UP ADJUSTMENTS (MOS-3)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ADJUSTED REVENUES (HEAVY RAIL)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	2.52	3.87	18.96	35.37	62.33	64.01	65.69

1984	NETWORK (LIGHT RAIL)	1986 $MIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
1991	NETWORK (LIGHT RAIL)	1986 $MIL					11.26	11.38	11.50	11.62	11.74	11.87	11.99	12.11	12.23	12.35	12.48	12.60	12.72
1993	NETWORK (LIGHT RAIL)	1986 $MIL					11.26	11.38	11.50	11.62	11.74	11.87	11.99	12.11	12.23	12.35	12.48	12.60	12.72
1993	NETWORK (LIGHT RAIL)	1986 $MIL					17.05	17.20	17.34	17.48	17.63	17.77	17.91	18.06	18.20	18.34	18.48	18.63	18.77
1996	NETWORK (LIGHT RAIL)	1986 $MIL					17.50	17.99	18.48	18.97	19.46	19.95	20.44	20.94	21.43	21.92	22.41	22.90	23.39
1998	NETWORK (LIGHT RAIL)	1986 $MIL					17.50	17.99	18.48	18.97	19.46	19.95	20.44	20.94	21.43	21.92	22.41	22.90	23.39
1998	NETWORK (LIGHT RAIL)	1986 $MIL					22.86	23.31	23.96	24.60	25.25	25.90	26.55	27.20	27.85	28.50	29.15	29.80	30.45
2000	NETWORK (LIGHT RAIL)	1986 $MIL					27.82	28.62	29.43	30.24	31.04	31.85	32.66	33.47	34.27	35.08	35.89	36.69	37.50
	FARE BOX REVENUES (LIGHT RAIL)	1986 $MIL		0.00	0.00	0.00	0.00	0.00	0.00	11.62	11.74	17.77	17.91	18.06	21.43	21.92	29.15	29.80	37.50
1991	START-UP ADJUSTMENTS (LA-LB)			0.00	0.00	0.00	0.00	0.00	0.00	7.79	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	START-UP ADJUSTMENTS (CENTE1)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.96	1.95	0.00	0.00	0.00	0.00	0.00	0.00
1996	START-UP ADJUSTMENTS (LACTC1)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	START-UP ADJUSTMENTS (LACTC2)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.73
	ADJUSTED REVENUES (LIGHT RAIL)			0.00	0.00	0.00	0.00	0.00	0.00	3.84	7.87	13.81	15.96	18.06	21.43	21.92	29.15	29.80	32.77

FARE BOX REVENUES

	FARE BOX REVENUES (BUS)	I $MIL		126.10	196.14	190.81	193.20	257.58	271.09	286.46	302.63	359.26	374.25	394.02	433.40	461.16	440.97	468.80	485.99
	FARE BOX REVENUES (HEAVY RAIL)	I $MIL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	3.43	5.49	27.94	54.22	99.38	106.14	113.28
	FARE BOX REVENUES (LIGHT RAIL)	I $MIL		0.00	0.00	0.00	0.00	0.00	0.00	4.65	9.91	18.10	21.75	25.59	31.58	33.60	46.47	49.40	56.51
	FARE BOX REVENUES (ALL MODES)	I $MIL		126.10	196.14	190.81	193.20	257.58	271.09	291.11	312.54	378.91	401.42	425.09	492.92	548.98	586.82	624.34	655.79

3.2 CALCULATIONS

3.2.1 Bus Revenues

Bus revenues are simulated for the two bracket years, then interpolated for each intervening year. Additionally, revenues are linearly projected for two years before the beginning and after the end of the simulation. For example, if simulations are run for 1990 and 2000, revenue projections are calculated for each year from 1988 through 2002.

Revenue projections are interpolated assuming that revenues grow linearly between simulation years:

1) Calculate the slope. The slope is the difference in fare box revenues for the two simulation years divided by the difference in years between the two simulation years.

2) Beginning with the first simulation year, add the fare box revenue and the slope to estimate the fare box revenue for the next fiscal year. Continue this procedure until fare box revenues are calculated for two years beyond the second simulation year.

3) Extrapolation to the two years prior to the first simulation year is accomplished by subtracting the slope.

After the above calculations are completed for all possible system configurations, the revenues for a given year are determined by table look-up. Yearly revenues correspond to the system configuration in effect that year.

3.2.2 Heavy and Light Rail Revenues

The procedure for both heavy and light rail revenue projections is exactly as described above for bus revenues.

3.3 MODULE OUTPUT

Module 3 output consists of annual estimates of bus, heavy rail, light rail, and combined mode fare box revenues adjusted for inflation. All revenues calculated in the simulations are in constant 1986 dollars. The revenue estimates are derived from patronage estimates, the fare policy of the district, and a base fare of $1.00 per passenger. Thus, if the base fare changes, the revenue estimate may be updated by adjustments for the new base fare and an appropriate elasticity factor in Module 10, the Operations Cash Flow Manager.

The new base fare is determined either by District policy or by inflating the base fare by the inflation rate. Current District policy on base fares is detailed in Module 10.

After these calculations are completed for each mode and all years in the planning horizon, individual modal revenues are summed to find combined revenues. Inflated revenue projection data are used in the Operations Cash Flow Manager Module and are calculated according to the following rule:

- Revenue estimates for 1985 through 1988 are based on historical data and are not adjusted for escalation of base fare.

- Revenue estimates for 1989 and beyond are adjusted for escalation.

CHAPTER 4. MODULE 4: PROJECT COST ESTIMATES

The overall program for an up-to-date rapid transit system serving the Los Angeles area consists of 14 projects made up of 6 heavy rail segments, 7 light rail lines, and one busway. Possible construction scenarios in which all 14 projects are completed extend through the Year 2010. Construction estimates of 7 of the projects (3 HRT and 4 LRT) covering some 81 system miles total more than $4.8 billion in constant 1986 dollars.

An important element of a cash flow analysis is an estimate of capital expenditures on an annual basis in terms of inflated dollars. Such a projection of capital costs is provided by Module 9.

The purpose of Module 4 is to provide an estimate of project cost in terms of 1986 dollars for portions of projects or total projects when such estimates are not otherwise available.

A project such as Metro Rail ordinarily is constructed in segments, because the very high cost dictates that financing can be accomplished only over a 15- to 20-year time frame. If the bulk of financing is on a pay-as-you-go basis, then construction is carried out over the same 15- to 20- year time frame. However, a major stipulation is that completed segments of the system must be operable to the extent that effective service is provided and revenues are generated. The sequence of steps in developing project cost estimates for planning purposes is outlined as follows:

- Divide the project into several constructible segments;
- Determine a set of construction categories into which all phases of the construction process may be assigned;
- Develop a cost factor for each construction category independently for heavy rail, and light rail;
- Determine the system characteristics for the group of constructible segments identified as an operable segment;
- Calculate the construction cost estimate for an operable segment by summing the products of cost factors and system characteristics over all construction categories.

A printout of Module 4 is shown in Figure 4.1. The 21 construction categories and associated cost factors are included in Figure 4.1 for heavy rail construction.

FIGURE 4.1

MODULE4 PROJECT COST ESTIMATE

MODULE 4: PROJECT COST ESTIMATE

CANDIDATE ALIGNMENT 4

ITEM	COST FACTORS (FY86,$M) UNIT	HRT	LRT	BSWAY
SUBWAY TUNNEL	/MI	34.85		
AERIAL CONSTRUCTION	/MI	16.90	16.61	12.84
SUBWAY CUT-COVER	/MI	68.64		
TRACKWORK	/MI	2.33	1.40	0.00
TRAIN CONTROL	/MI	2.63	0.00	0.00
COMMUNICATIONS	/MI	1.26	0.92	0.00
TRACTION POWER	/MI	2.37	1.94	0.00
SUB STA MISC	/STA	6.03	1.02	0.00
ROLLING STOCK	EACH	1.20	1.06	0.16
SUBWAY STATION	EACH	36.00	14.06	0.00
AERIAL STATION	EACH	9.00	9.94	0.00
SUB STA D/U	EACH	75.00		
SUB STA X-OVER	EACH	41.40		
AER STA TOVER	EACH	11.00		
SUB POCKET	EACH	3.00		
SUB TAIL TRACK	EACH	13.00		
PORTAL	EACH	2.00		
CONTROL/YARDS&SHOP	EACH	34.90	2.12	0.00
R/W SUBWAY	/MI	4.09	9.50	0.00
R/W AERIAL	/MI	5.63	13.18	0.00
AER STA MISC	/STA	4.59		

ITEMS	SYSTEM CHARACTERISTICS MOS-1	MOS-2	MOS-3	MOS-4	EAST LA	NORWALK	ST MONICA	LB-LA	CENTURY	VALLEY	PASADENA	COASTAL	TORRANCE	HUNTING	HARBOR
(HRT=1 LRT=2 BSWY=3)	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
MILES OF SUBWAY	4.4	2.3	3.9	2.2				0.0	0.0						
MILES OF AERIAL	0.0	3.4	2.2	0.0				0.0	0.0						
MILES OF CUT-COVER	0.0	1.1	0.9	0.0				0.0	0.0						
TOTAL MILES	4.4	6.8	7.0	2.2				0.0	0.0						
# OF SUBWAY STATIONS	5	2	2	0				0	0						
# SUB STA D/U	0	1	0	0				0	0						
# SUB STA X-OVER	0	1	0	1				0	0						
# AERIAL STATIONS	0	4	2	0				0	0						
# AER STA X-OVER	0	0	1	0				0	0						
TOTAL STATIONS	5	8	5	1				0	0						
SUB POCKET	0	1	0	0				0	0						
SUB TAIL TRACK	0	0	1	1				0	0						
PORTAL	0	0	0	0				0	0						
CONTROL/YARD&SHOP	1	0	0	0				0	0						
ROLLING STOCK	27	41	31	14				0	0						

ITEMS	CONSTRUCTION ESTIMATE (FY86,$M) MOS-1	MOS-2	MOS-3	MOS-4	EAST LA	NORWALK	ST MONICA	LB-LA	CENTURY	VALLEY	PASADENA	COASTAL	TORRANCE	HUNTING	HARBOR
FACILITIES															
GUIDEWAYS	177	215	239	78	0	0	0	0	0	0	0	0	0	0	0
STATIONS-SUBWAY	270	168	74	45	0	0	0	0	0	0	0	0	0	0	0
STATIONS-AERIAL	0	36	29	0	0	0	0	0	0	0	0	0	0	0	0
POCKET-TAIL-PORTAL	0	3	10	10	0	0	0	0	0	0	0	0	0	0	0
CONTROL/YARDS&SHOP	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL FACILITIES	481	442	352	133	0	0	0	0	0	0	0	0	0	0	0
SYSTEMS															
TRACKWORK	16	14	16	5	0	0	0	0	0	0	0	0	0	0	0
TRAIN CONTROL	19	18	15	5	0	0	0	0	0	0	0	0	0	0	0
COMMUNICATIONS	13	9	8	2	0	0	0	0	0	0	0	0	0	0	0
TRACTION POWER	10	16	13	4	0	0	0	0	0	0	0	0	0	0	0
SUB STA MISC	8	24	11	5	0	0	0	0	0	0	0	0	0	0	0
AER STA MISC	3	18	13	0	0	0	0	0	0	0	0	0	0	0	0
VEHICLE PASSENGE	44	49	36	16	0	0	0	0	0	0	0	0	0	0	0
VEHICLE AUX	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISC EQUIP															
TOTAL SYSTEMS	116	151	111	38	0	0	0	0	0	0	0	0	0	0	0
CAPITAL COST	597	593	463	170	0	0	0	0	0	0	0	0	0	0	0
CONT(15%FAC+10%SYS)	91	81	64	24	0	0	0	0	0	0	0	0	0	0	0
DCM(13%FAC+10%SYS)	165	73	57	21	0	0	0	0	0	0	0	0	0	0	0
PCM	47	50	42	42	0	0	0	0	0	0	0	0	0	0	0
AGENCY(5%FAC&SYS)	128	30	23	9	0	0	0	0	0	0	0	0	0	0	0
INSURANCE(7.5%FAC&SY	47	44	35	13	0	0	0	0	0	0	0	0	0	0	0
TOTAL COST $86.M	1085	872	685	279	0	0	0	0	0	0	0	0	0	0	0

4.1 CONSTRUCTION ESTIMATE ELEMENTS

4.1.1 Constructible Segments

The heavy rail project is divided into several constructible segments. The rationale, methodology, and criteria for this step are beyond the scope of this report. Such data are input manually to LODESTAR.

4.1.2 Construction Categories

A list of 21 construction categories is used in this analysis. The list includes the miles of subway, aerial, and cut-and-cover construction, the miles of trackwork, the number of various station types, and the presence or absence of various special features such as cross-overs, tail track, and pocket track. The list is developed external to LODESTAR and is included in Figure 4.1.

4.1.3 Cost Factors

Estimates of total project cost are prepared by Transit System Development (TSD), a Division of SCRTD. Cost factors for items such as trackwork are calculated as the weighted average, in dollars per mile, of the estimates of alternatives as provided by TSD. The estimates are external to LODESTAR. The cost factors are presented in terms of 1986 dollars.

4.1.4 System Characteristics

Each of the proposed heavy rail construction projects is described by 15 system characteristics as listed in Figure 4.1. In general, these characteristics are measurable or countable depending on the design parameters and are not truly estimates. As an example, it is known that Project MOS-1 consists of 4.4 miles of subway and 5 subway stations.

Direct estimation of each characteristic is necessary for each project. All information on system characteristics is external to LODESTAR and all data are entered manually in appropriate units.

4.2 CONSTRUCTION COST ESTIMATE

A construction estimate for a given project is obtained by multiplying the cost factor by the system characteristic for each construction category and summing all products formed. The system characteristics of HRT, LRT, and Busway project types must be multiplied by the HRT, LRT, and Busway cost factors, respectively.

Each construction category is classified as a facility or as a system component. The distinction is important in instances when percentages added on for items such as design, construction management, insurance, and contingencies are different for each classification. The facility or system classifications for all construction categories are shown on Figure 4.1.

4.2.1 Facilities Estimates

Guideway costs include the per mile costs of subway, aerial, and cut-and-cover construction for a given project. Cost factors are multiplied by the length, in miles, of each guideway type and the products summed to yield guideway costs. The cost of pocket track, tail track, and portal guideway requirements are included in this estimate.

Station costs include the costs of all subway, aerial, and special station construction for a given project. Cost factors are multiplied by the number of each station type and the products summed. Cross-over costs are included in station costs.

Central control facilities and yard and shop facilities are part of several heavy and light rail projects but there is no more than one control facility on a given project. A project cost estimate for these facilities is equal to the cost factor for each project type.

The total cost of facilities is the sum of the facility cost elements described above.

4.2.2 Systems Estimate

Track work, train control, communications systems, and traction power are provided over each mile of heavy and light rail projects. Cost is the product of the cost factor and total project length.

Fare collection systems, fans and air handling equipment, elevators and escalators, and graphics are required at all stations on heavy and light rail projects. The cost of these systems is the product of the cost factor and the number of stations included in the project.

Each project requires a certain number of passenger vehicles (rolling stock) to become operational. The number depends on factors such as cars per train, headway spacing, and length of trip. Cost is the product of the vehicle cost factor and the number of passenger vehicles required for the project.

Several projects require an auxiliary vehicle, which includes a crane for specific maintenance activities. A cost of $1 million is entered manually for each project requiring auxiliary vehicles.

The total cost of systems is the sum of the system cost elements described above.

Capital cost for a specific project is defined as the sum of the total facilities cost and the total systems cost.

4.3 ANCILLARY COST ESTIMATES

A contingency allowance is necessary in the event of unforeseen design changes and problems, higher-than-expected bid prices, and unforeseen

construction problems. In preliminary cost estimating, the contingency percentage is high. In Module 4, the percentage is selected as 15% of capital costs.

As the design proceeds for specific locations, more detailed cost estimates are available and general cost factors are no longer used. The need for a high contingency percentage decreases. For example, in the final phases of the design of MOS-1, the contingency percentage decreased to about 8.6%.

All construction projects go through a sequence of planning, preliminary design, and final design stages which yield a set of detailed plans and specifications on which bids are received. The construction process must be monitored to ensure compliance with plans and specifications and to determine periodic contractor payments for progress.

Generally, the costs of design and construction management are estimated as a percentage of the capital cost estimate. In Module 4, this percentage is selected as 20 percent.

The cost of acquiring right-of-way is a function of the facilities component of a project. In general, facilities take up space so that costs are incurred for right-of-way. In Module 4, right-of-way cost factors are calculated as the weighted average of right-of-way costs included in the project estimates by TSD. The cost factor is expressed in dollars per mile of project length. Thus, the cost of right-of-way is the product of the cost factor and total project length.

The sponsoring agency, SCRTD in this instance, incurs costs for contract negotiation and management, for monitoring progress, for collecting revenues and paying bills, and for a variety of expenses associated with administering a multibillion-dollar project over several years. Agency costs are estimated as 14 percent of capital costs.

Insurance is a necessary expense in any undertaking. Every venture has an element of risk and protection against liability is a common expense. Worker's compensation is an important element of insurance cost. Generally, insurance costs are close to 7.5% of capital costs.

The total cost of a project is the sum of the components of facilities costs, the components of systems costs, and the components of ancillary costs. All cost estimates calculated in Module 4 are in terms of constant 1986 dollars.

4.4 MODULE OUTPUT

The output of Module 4 consists of estimates of total construction costs for the projects included in the proposed transit system. All costs are in constant 1986 dollars. These data are used in Module 9, where annual cost estimates are prepared based on assumed project durations and scheduled dates of project implementation. Whenever detailed cost

estimates are prepared for a given project they are used in lieu of the procedure described in this chapter.

CHAPTER 5. MODULE 5: CONVENTIONAL FUNDING PROJECTIONS

Revenues from various public transit programs are available to SCRTD. Programs which provide transit funding to Los Angeles County include one county, three state, and two federal programs. The purpose of Module 5 is to quantify the cash flow projections to SCRTD as a result of these programs. The legislation establishing these programs has been enacted over several years. Inasmuch as there is no comprehensive, integrated program, the flow of transit funding is somewhat complex.

5.1 OVERVIEW OF TRANSIT FUNDING PROGRAMS AND TAXES

The following revenue sources support transit programs:

LOS ANGELES COUNTY 1/2 PERCENT SALES TAX

Proposition A - Transit Program

STATE OF CALIFORNIA 6 CENT SALES TAX

Transportation Development Act
(TDA - Transit Program)

State Transit Assistance
(STA - Transit Program)

STATE OF CALIFORNIA 9 CENT FUEL TAX

Guideway Fund

FEDERAL 1 CENT FUEL TAX & GENERAL FUND

Section 3 - Transit Program

Section 9 - Transit Program

5.1.1 Los Angeles County Sales Tax: Proposition A

The Proposition A Los Angeles County 0.5% Retail Sales Tax was approved by the voters in 1980. Net receipts to LACTC are 98.36 percent of gross tax revenues. The State Board of Equalization earns 1.64 percent of gross for administering the tax program. Net receipts are distributed as follows:

- 25% "local return" distributed on the basis of population to the 83 cities within the tax district.
- 40% LACTC Discretionary fund for transit systems.
- 35% capital funding for county rail development.

The Prop A discretionary fund is available for both bus and rail operations and capital. The rail development fund is technically available for rail capital or operations, but LACTC policy is to reserve the 35% share for rail capital only.

Prior to FY 1986, 75% of Prop A funds were used to fund the fare reduction program mandated by Proposition A.

5.1.2 California Sales Tax - Historical Perspective

The 1971 California Legislature enacted the Transportation Development Act, which was intended to provide the equivalent of a 5% sales tax on motor vehicle fuels for mass transit. To accomplish that intention, TDA extended the state sales tax to gasoline, reduced the state percentage share of the sales tax, and allowed for an increase in the local government share of the sales tax for transit (equivalent to the state's reduction.)

In 1971, 1/4% of retail sales closely approximated a 5% tax on fuel sales. Because the equivalent of 5% of fuel sales is administratively difficult to estimate, the Legislature chose to fund TDA with 1/4% of all retail sales. Thus, TDA resulted in the dedication of the state's then 5% sales tax on motor fuels as follows:

- 3-3/4% to the state
- 1% to the cities and counties
- 1/4% to local mass transit

Because the extension of the sales tax to gasoline was equivalent to an additional 1/4% sales tax on all taxable sales, the Legislature's expansion of the sales tax base kept total state sales tax revenues for non-transit purposes at their existing level. Thus, existing programs maintained their funding while a new, dedicated funding source for local transit was created.

The 1/4% sales tax has become a critical funding source for local transit operators. However, it is somewhat volatile due to its dependence on general taxable sales and the relative health of the California economy, but is expected to be a growing transit revenue source in the future.

TDA also included a second funding mechanism through the "spillover" formula. The formula provided that if revenues from the new 3-3/4% sales tax on all taxable sales, including gasoline, produced more revenue than that from the old 4% rate on all taxable sales, excluding gasoline, then the difference (spillover) would accrue to the Transportation Planning and Development Account.

Viewed another way, the Act provided that when sales tax revenues from gasoline increased faster than that of other taxable items, the additional sales tax revenue from gasoline would be spent for transit activities rather than general state activities.

The spillover formula soon took on great importance as world oil shortages drove fuel prices up much faster than retail prices in general. Sharply rising fuel prices in turn caused sharply increased fuel tax revenues. The TDA Fund failed to capture those increased fuel taxes because of provisions in subsequent legislation which also raised the overall sales tax to 6%.

In 1979, the spillover formula was adjusted to reflect the total 6% sales tax rate. SB 620 provided that $110 million annually in spillover revenues, adjusted for increases in population and consumer prices, be deposited in the Transportation Planning and Development (TP&D) Account for transit activities. By 1984, the spillover revenue base increased to $162 million. However, oil prices continued to drop such that motor fuel prices at the pump fell well below the level required to generate any spillover revenues for transit. These revenue sources are projected at zero levels for future years.

5.1.3 Transportation Development Act

Exactly 1/4 cent of the 6 cent California Sales Tax is allocated for mass transit to each county in direct proportion to sales tax receipts. Net county allocations are distributed to the 14 county transit operators in Los Angeles County according to a regional subsidy formula. The formula distributes 50% based on unlinked passenger trips. LACTC funds certain capital needs and allocates the balance to operating expenses.

Note that state revenue projections depend on total projected volume of state taxable sales. Therefore, state sales tax revenues may not increase at the same rate as the L.A. County sales tax, which depends only on county taxable sales.

5.1.4 California $0.09 per Gallon Gasoline Tax

Of the $0.09 per gallon California gasoline tax, $0.0439 is returned to local jurisdictions for city and county road maintenance. The remaining $0.0461 from the $0.09 fuel tax is distributed to the State Highway Account (SHA). A constitutional amendment known as Proposition 5 was approved by the voters in 1974. Prop 5 allows counties to use a portion of state gasoline excise taxes for transit guideway construction if county voters also approve a subsequent local referendum on the question. Currently, nine counties have approved guideway usage of gas tax revenues. The amount eligible for guideway usage is determined through budgetary action on specific project proposals. Any county which adopts Proposition 5 may use a portion of its SHA revenues for the Mass Transit Guideway Fund if all basic highway needs are met first.

5.1.5 Federal Revenue Sources

Sections 3 and 9 of the U.S. Surface Transportation Assistance Act of 1982 are funded by a $0.01-per gallon federal gasoline tax and by general

federal revenues. Section 3 comprises about 29% of Federal transit funds. Section 3 is distributed annually according to guidelines established by the Public Transportation Act. Section 9 is about 63% of the federal program. Of that amount, 88% is distributed to urbanized areas. Los Angeles County receives 82% of the amount allocated by regional formula to the Southern California region. The U.S. Surface Transportation Assistance Act of 1987 (H.R.2) extended these provisions and authorized $870 million for Metro Rail in Los Angeles.

For Southern California, SCAG receives Section 9 funds for the Los Angeles-Long Beach urbanized area. SCAG distributes the Los Angeles County share to LACTC, which distributes operating assistance to fourteen municipal operators by the regional subsidy formula discussed above. Section 9 capital assistance revenue may be used for rail or bus capital projects at the discretion of LACTC. Recently, these funds have been reserved for bus capital projects.

5.2 MODULE INPUT

Figure 5.1 is a printout of the Module 5 format.

The primary function of Module 5 is to forecast operating and capital funds available to the SCRTD. A major component of this forecast is the economic and demographic information generated by Module 2.

The following data sets are automatically entered from Module 2:

- Safe Estimates of L.A. County Taxable Transactions
- California Taxable Transactions
- SCRTD/L.A. County - Subsidy Share
- California Gasoline Sales
- U.S. Gasoline Sales
- U.S. Diesel Sales
- California Gasoline Prices
- California Operating Revenues
- Proposition 5 County Populations/California Population Coefficients
- L.A. County Population/California Population Coefficients
- L.A. County Population/Other Proposition 5 County Populations Coefficients
- Transportation Planning and Development Tax Growth Rates
- SCRTD/L.A. County Proposition A Share

Please refer to Chapter 2 for a description of each of the above data sets.

FIGURE 5.1

MODULE 5 CONVENTIONAL FUNDING PROJECTIONS

MODULE 5: CONVENTIONAL FUNDING PROJECTIONS

FISCAL YEAR		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
INPUT FROM MODULES 2 & 3																		
--->MOD 2 L.A. CO TXBL TRANS (SAFE EST)	$BIL,I		61	66	69	75	80	96	92	100	107	114	121	129	137	146	156	165
--->MOD 2 CA. TAXABLE TRANSACTIONS	$BIL,I		200	216	225	233	252	271	293	319	346	371	398	426	457	489	524	561
--->MOD 2 SCRTD/L.A.CO SUBSIDY SHARE			0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864	0.864
--->MOD 2 CA. GASOLINE SALES	MIL GALS	10920	11220	11520	12080	12310	12420	12550	12660	12770	12980	12990	13100	13210	13320	13430	13540	13650
--->MOD 2 CA. DIESEL SALES	MIL GALS	1839	1904	1946	1980	2016	2058	2092	2126	2157	2188	2218	2249	2278	2308	2337	2366	2395
--->MOD 2 U.S. GASOLINE SALES	MIL GALS		100145	101409	104561	105074	105297	105690	105925	106164	106405	106650	106899	107152	107411	107676	107946	108224
--->MOD 2 U.S. DIESEL SALES	MIL GALS		22540	22720	22733	22827	23144	23373	23602	23791	23977	24160	24340	24516	24689	24859	25025	25189
--->MOD 2 CA. GASOLINE PRICE	$,I		1.13	1.04	0.92	0.97	1.00	1.04	1.08	1.13	1.18	1.23	1.28	1.33	1.38	1.43	1.48	1.53
--->MOD 2 PROP 5 CO POP/CA POP COEFF			0.6850	0.6848	0.6783	0.6719	0.6692	0.6666	0.6640	0.6615	0.6591	0.6566	0.6542	0.6519	0.6496	0.6473	0.6451	0.6430
--->MOD 2 CA. OPERATING REVENUES	$MIL,I		827	880	936	995	1051	1110	1172	1236	1304	1375	1449	1527	1609	1695	1784	1878
--->MOD 2 L.A.CO POP/CA.POP COEFF			0.3078	0.3090	0.3074	0.3054	0.3033	0.3012	0.2992	0.2973	0.2954	0.2935	0.2917	0.2899	0.2882	0.2865	0.2849	0.2833
--->MOD 2 LA CO POP/OTHR PROPS CO POP COEF			0.4521	0.4559	0.4567	0.4564	0.4550	0.4537	0.4524	0.4511	0.4498	0.4486	0.4474	0.4463	0.4452	0.4441	0.4430	0.4420
--->MOD 2 TP&D SALES TAX CAP GROWTH RATE	%		6.68	6.49	6.29	6.40	5.61	5.58	5.54	5.51	5.48	5.45	5.41	5.38	5.35	5.32	5.29	5.26
--->MOD 2 SCRTD/LA CO-PROP A SHARE			0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856	0.856
--->MOD 3 FARE BOX REVENUES (ALL MODES)	I $MIL		126.1	196.1	190.8	193.2	257.5	271.1	291.1	312.5	378.9	401.4	425.1	492.9	549.0	586.9	624.3	655.8
CA. GASOLINE SALES TAX	$MIL,I		623	615	578	577	609	636	668	705	742	778	816	856	897	941	987	1035
CA. TDA FUNDS	$MIL,I		500	539	562	582	629	679	733	797	864	927	994	1065	1142	1223	1310	1402
FUEL TAX SPILLOVER	$MIL,I		123	75	16	0	0	0	0	0	0	0	0	0	0	0	0	0
TP&D SALES TAX CAP	$MIL,I	162	173	184	196	208	220	232	245	258	273	287	303	319	336	354	373	393
TP&D SALES TAX REVENUE	$MIL,I		123	75	16	0	0	0	0	0	0	0	0	0	0	0	0	0
CA. GENERAL FUND SPILLOVER	$MIL,I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIFIED TRANSP FUND	$MIL,I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UTF TO TP&D	$MIL,I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UTF TO STATE HWY ACCT	$MIL,I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TP&D INCOME	$MIL,I		123	75	16	0	0	0	0	0	0	0	0	0	0	0	0	0
TP&D TO CA TRANSP BUDGET	$MIL,I		49	30	6	0	0	0	0	0	0	0	0	0	0	0	0	0
TP&D TO GUIDEWAY FUND	$MIL,I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHA FUEL TAXES	$MIL,I		605	621	648	660	667	675	682	688	695	701	708	714	720	727	733	740
ARTICLE 19 FUNDS PROP 5 CNT	$MIL,I		414	425	440	444	447	450	453	455	458	460	463	465	468	471	473	476
PROP A FUNDS ($I,M)	$MIL,I		282.0	304.1	316.9	346.8	371.9	397.8	426.3	460.4	495.2	527.2	561.2	597.3	635.6	676.3	719.3	765.1
25% LOCAL RETURN	$MIL,I		70.5	76.0	79.2	86.7	93.0	99.5	106.6	115.1	123.8	131.8	140.3	149.3	158.9	169.1	179.8	191.3
40% LACTC DISCRET	$MIL,I		211.5	121.6	126.3	138.7	148.8	159.1	170.5	184.1	198.1	210.9	224.5	238.9	254.2	270.5	287.7	306.0
35% RAIL PROGRAM	$MIL,I		0.0	106.4	110.9	121.4	130.2	139.2	149.2	161.1	173.3	184.5	196.4	209.1	222.5	236.7	251.8	267.8
TDA ARTICLE 4 FUNDS:LA CNTY	$MIL,I		142.3	153.5	160.0	175.1	187.7	200.8	215.2	232.4	250.0	266.2	283.3	301.5	320.9	341.4	363.1	386.2
STA FUNDS	$MIL,I		73.6	45.2	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70% ALLOCATION BY POP	$MIL,I		14.9	9.2	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30% ALLOC BY REVENUES	$MIL,I		8.3	5.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LACTC RAIL SET ASIDE	$MIL,I		6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REMAINING STA ALLOC	$MIL,I		17.2	8.2	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUIDEWAY FUND	$MIL,I		103.6	106.3	109.9	110.9	111.7	112.5	113.2	113.8	114.5	115.1	115.7	116.4	117.0	117.6	118.3	118.9
50% ALLOC BY POP TO LACTC DISC	$MIL,I		23.4	24.2	25.1	25.3	25.4	25.5	25.6	25.7	25.7	25.8	25.9	26.0	26.0	26.1	26.2	26.3
50% ALLOC TO CTC DISCRET FUND	$MIL,I		51.8	53.1	55.0	55.5	55.8	56.2	56.6	56.9	57.2	57.5	57.9	58.2	58.5	58.8	59.1	59.5
SECTION 9&18 FORMULA GRANT	$MIL,I		2450.0	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5	2082.5
SECTION 9 (OPERATING CAP)	$MIL,I		55.1	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
SECTION 9:LA CNTY SHARE	$MIL,I		119.2	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4	101.4
METRORAIL SET ASIDE	$MIL,I		20.0	20.0	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SECT 9 (OPERATIONS)	$MIL,I		55.1	55.0	55.9	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
SECT 9 (CAPITAL)	$MIL,I		44.1	26.4	30.8	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4	46.4
SECT 3 FUNDS (1 CENT FUEL TAX)	$MIL,I		1120.0	1120.0	1272.9	1279.0	1284.4	1290.6	1295.3	1299.5	1303.8	1308.1	1312.4	1316.7	1321.0	1325.3	1329.7	1334.1
OUTPUT																		
RTD OPERATING SUBSIDIES																		
<--- 10 PROPA 40% DISC	$MIL,I		142.6	85.5	115.0	107.5	106.0	110.0	117.9	127.3	137.0	145.8	155.2	165.2	175.8	187.1	199.0	211.6
<--- 10 TDA ARTICLE 4 FUNDS:RTD	$MIL,I		122.5	152.3	140.1	159.7	147.7	153.1	164.1	177.2	190.6	203.0	216.0	229.9	244.7	260.3	276.9	294.5
<--- 10 STA REMAINING ALLOCATION	$MIL,I		14.9	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 SECTION 9:OPERATING	$MIL,I		49.1	51.4	54.4	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8
OTHER REVENUES																		
<--- 10 AUX REV/LOCAL OPR CONTRIBUTIONS	$MIL,I		4.6	4.8	5.8	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.5	4.7	4.9	5.1	5.3	5.5
<--- 10 NON TRANSIT REVENUES	$MIL,I		16.4	17.1	9.7	9.6	10.0	10.5	11.0	11.4	11.9	12.3	12.8	13.3	13.9	14.4	15.0	15.6
CAPITAL FUNDING (CONV.FUNDS)																		
<--- 10 OTHER LOCAL CAPITAL FUNDS	$MIL,I		0.0	1.2	6.8	8.6	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 STA METRORAIL SET ASIDE	$MIL,I		6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 SECT 9 METRORAIL SET ASIDE	$MIL,I		20.0	20.0	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 SECT 9:REMAINING FOR CAPITAL	$MIL,I		38.2	22.8	35.2	41.1	45.3	41.6	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1
<--- 10 BENEFIT ASSESSMENT DISTRICT	$MIL,I		0.0	0.9	7.6	10.9	15.5	38.5	42.7	12.2	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 PROPA 35% (diverted for bonds)	$MIL,I		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<--- 10 PROPA 25% LOCAL RETURN TO L.A.	$MIL,I		27.5	29.6	30.9	33.8	36.3	38.8	41.6	44.9	48.3	51.4	54.7	58.2	62.0	65.9	70.1	74.6
<--- 10 GDWY 50% POP FORMULA LACTC DISCR	$MIL,I		23.4	24.2	25.1	25.3	25.4	25.5	25.6	25.7	25.7	25.8	25.9	26.0	26.0	26.1	26.2	26.3
<--- 10 GDWY 50% CTC DISCR	$MIL,I		51.8	53.1	55.0	55.5	55.8	56.2	56.6	56.9	57.2	57.5	57.9	58.2	58.5	58.8	59.1	59.5
<--- 10 SECT 3 TO LA (UZA W/POP>1M ONLY)	$MIL,I		114.3	114.8	130.5	131.1	131.7	132.3	132.8	133.2	133.6	134.1	134.5	135.0	135.4	135.8	136.3	136.7
<--- 10 SECT 3 TO LA (SEC 9&18 FORMULA)	$MIL,I		46.9	46.0	53.3	53.5	53.8	54.0	54.2	54.4	54.6	54.8	54.9	55.1	55.3	55.5	55.7	55.8

5.3 MODULE CALCULATIONS

5.3.1 LA County Local Taxes: Proposition A

In Los Angeles, local funding is very important to local transit. Proposition A funds provide for a portion of Metro Rail funds, all of light rail construction funds, significant operating subsidies and transit projects throughout Los Angeles County. The amount of Proposition A funds available is calculated by taking 98.36% (100% less 1.64% administrative expense) of the 1/2 cent County sales tax times the safe estimate of LA County taxable transactions. The Prop A tax base is smaller than the TDA tax base because non-Los Angeles County residents do not pay the 1/2 cent county sales tax on purchases delivered outside of L.A. County. Thus, the amount of Prop A funds is multiplied by 0.94 to account for the smaller tax base. The result is expressed in millions of dollars.

Prop A funds are divided into three categories: local return to cities in Los Angeles County amounts to 25% of Prop A funds; the LACTC discretionary fund amount to 40% of Prop A funds; and capital funds made available for rail transit programs in Los Angeles County amount to 35% of Prop A funds.

5.3.2 California State Revenues

The following discussion refers to state taxes. These calculations are used to estimate expected revenues which will fund TDA and the Guideway programs.

The California gasoline sales tax receipts are equivalent to a 5% state sales tax on gasoline. Consistent with SCAG policy, calculations are based on lagged calendar years. Lagged current gas sales prices are calculated and multiplied by 0.05 to yield gasoline sales tax revenues.

Transportation Development Act (TDA) funds are calculated by multiplying the 0.25% tax rate by California taxable transactions. If the equivalent 5% gasoline sales tax is greater than the TDA Fund, the difference is the "spillover fund." If the equivalent 5% tax on gasoline is less than 0.25% of retail sales, the spillover is 0. The spillover is expected to be 0 over the next several years.

The State Highway Account (SHA) is credited with $0.0461 per gallon of the $0.09 per gallon California State gasoline and diesel fuel tax. An annual estimate is obtained by multiplying $0.0461 by the projected gallonage total of gasoline and diesel fuels.

The amount of Article 19 funds allocated to the Proposition 5 counties is calculated by multiplying SHA Fuel Taxes by the ratio of the sum of Proposition 5 County populations to the California population.

Article 4 Funds of the Transportation Development Act (TDA) are derived from the 1/4 cent portion of the California Six Cent Sales Tax. The funds are calculated by multiplying the 0.25% retail sales tax rate by the safe

estimate of LA County taxable transactions. The result is multiplied by 0.9335, which is the proportion of tax dollars available for operator subsidies, capital expenditures, and discretionary expenses. The operators of 14 regional transit systems in Los Angeles County receive 100% of TDA Article 4 funds. Distribution is based on a statutory formula as described earlier.

The Guideway Fund receives funds from two sources: the guideway allocation from the Transportation Planning and Development (TP&D) account and 25% of Article 19 funds for Proposition 5 counties. LACTC is allocated a portion of 50% of the Guideway Fund on the basis of population. The population ratio used is that of LA County population to the total population of all Proposition 5 counties. However, grants to LACTC have been suspended in view of the $400 million contribution to Metro Rail from the Guideway Fund.

The California Transportation Commission (CTC) is allocated the other half of the Guideway Fund and exercises its discretionary powers in expending the monies.

5.3.3 Federal Revenues: Federal Transit Assistance Act

The Federal Transit Assistance Act provided $2,450 million for Section 9 and 18 Formula Grant Programs in 1985. In addition, the Federal Transit Assistance Act earmarked $1,120 million for the Section 3 discretionary program. The following sections provide some details relative to the calculation of Los Angeles County's share of these Federal assistance programs.

A portion of the Section 9 & 18 formula grant is to be expended in urbanized areas with populations of more than 200,000. In 1986, the portion was 88.43% of the total. The Fixed Guideway Fund is allocated 33.29% of this amount while the Bus Fund is allocated the remaining 66.71%. Los Angeles County is eligible to earn a fixed percentage of both the Guideway and Bus Fund as spelled out in the legislation.

Projected funding levels of the various section grants must be determined to estimate Los Angeles County's share of these funds. The magnitude of Section 9 and 18 formula grants was $2,450 million for Fiscal Year 1985. From 1986 on, the default value of the grant is assumed to be 85% of the 1985 grant, or $2,082.5 million. Los Angeles County's share of Section 9 and 18 formula grants is the sum of the four component Los Angeles County shares calculated in accordance with the legislation. For fiscal years 1985 and 1986, the Los Angeles County Section 9 share was the sum of the Fixed Guideway Basic and Incentive program shares, the Bus Fund allocated to urbanized areas over 1,000,000 population and the Bus Fund Incentive program. For Fiscal Year 1987 and thereafter, Los Angeles County's share is calculated by multiplying the expected fiscal year formula grant by the ratio of Los Angeles County's 1985 share to Section 9 & 18 grants for 1985. However, in all instances where SCRTD has updated information on Section 9 grants these new data are entered into the model and supersede default values calculated by the model.

A portion of Los Angeles County's share of Section 9 funds is allocated to operations. The allocation is taken as the smaller of two quantities: the Section 9 operating cap versus the Section 9 LA share less the Metro Rail set aside. The Metro Rail set aside amounts to $90.6 million for MOS-1. No further Section 9 funds will be allocated to Metro Rail. A second portion of Los Angeles County's share of Section 9 funds is allocated to capital. The allocation is the amount remaining of Section 9 LA County Share funds after deductions for the Metro Rail Set Aside and the allocation to operations.

Section 3 funds are authorized at the discretion of Congress. The funds are derived from a one-cent-per-gallon fuel tax. For fiscal years 1985 and 1986, the Section 3 Fund was $1,120 million. For fiscal years 1987 and thereafter, Section 3 Funds are estimated by multiplying $0.01 times the total U.S. gallonage sales of gasoline and diesel fuels. This calculation is based on the continuation of the one-cent-per gallon fuel tax by the Congress.

5.4 MODULE OUTPUT

The output of Module 5 is a list of operating and capital subsidies derived through various local, state, and federal funding programs. The purpose of Module 5 is to quantify each funding source in terms of dollars available to SCRTD each fiscal year. This information is transferred to Modules 10 and 11, the Operating and Capital Cash Flow Managers.

5.4.1 SCRTD Operating Subsidies

The operating subsidies which have been identified and quantified are presented. In each case, the amount is that accruing to SCRTD.

5.4.1.1 Local Funding

Proposition A funds are derived from the local one-half percent sales tax. Discretionary funds for LACTC amount to 40% of Prop. A funds. Generally, these funds are used for operating assistance to transit operators. The Commission uses 5% of this fund for discretionary programs throughout the County. The remaining 95% are distributed for operations by a two part formula.

In FY 1986, 85% was distributed to operators by the LACTC formula such that SCRTD received about 85.6 percent of the amount distributed. The remaining 10 percent is distributed to operators through an earned bonus plan. Again, SCRTD is eligible for about 85.6 percent of the bonus monies through the formula but expects to earn only 75 percent of their share of the bonus monies. Any operator bonus monies not earned in any one year are carried over to the following year's bonus pool.

In FY 1988 and thereafter, 80% will be distributed by formula to transit operators and 15% will be placed in the bonus pool. Each year, SCRTD is eligible to earn 85.631% of the bonus pool monies multiplied by the earned

percentage bonus. The earned percentage is based on the extent to which an operator achieves service goals set by LACTC with respect to cost per vehicle service hour, operating revenues over operating cost ratio, subsidy per unlinked passenger, and unlinked passengers per vehicle service hour. In FY 1987, SCRTD earned 75% of the bonus monies and expects to earn 60% for FY 1988 and beyond.

Auxiliary revenues are income streams projected by SCRTD stemming from advertising. Non-transit revenues are income streams projected by SCRTD stemming from interest bearing accounts.

5.4.1.2 State Funding

The full amount of Transportation Development Act (TDA) funds are distributed regionally. The share coming to SCRTD is used to satisfy certain capital and debt service expenses. The balance is used for operating expenses. Eligible debt service relates to annual payments for retirement of Equipment Trust Certificate used to purchase buses. Capital expenses relative to SCRTD bus operations are eligible as well. The amount of TDA Article 4 funds available to SCRTD is equal to the TDA funds for Los Angeles County multiplied by 0.864375, the subsidy share.

5.4.1.3 Federal Funding

Section 9 operating assistance funds for Los Angeles County are distributed according to the subsidy share just as for TDA Article 4 funds.

5.4.2 SCRTD Capital Subsidies

The capital subsidies accruing to SCRTD which have been identified and quantified are presented.

5.4.2.1 Local Funding

The local return portion of Proposition A funds is 25% of the net funds. The local return is distributed among 83 cities on the basis of population. The City of Los Angeles receives about 39% of the local return monies and will contribute to Metro Rail construction from this source. The distribution of these funds is based on population.

Proposition A funds set aside for capital funding of rail systems amount to 35% of the net funds. LACTC administers these funds which are used to finance a portion of Metro Rail, all light rail lines, and debt service related to bond issuance.

Benefit assessments are fees on property in a specified area. Fee proceeds are used to pay part or all of the cost of specific capital improvements made within and specifically benefiting the area. A government entity with appropriate authority may levy the assessment. Capital improvements are financed with bonds secured by the assessments.

Benefit assessments have been used nationwide to finance a variety of public improvement projects. Property owners near such improvements often receive special benefits and are asked to share in project costs. Other area beneficiaries include office building tenants, hotel operators, and store retailers. The extent of a Benefit Assessment District's boundaries are determined by some maximum walking distance from Metro Rail stations. A one-half mile walking distance is used for stations within the Central Business District while a one-third mile walking distance is used for other station locations. Total assessments for the Metro Rail segment designated as MOS-1 will not exceed the amount needed to pay for or to finance $130.3 million in capital construction costs.

Other local capital funds are income streams projected by SCRTD from other governmental units or other sources.

5.4.2.2 State Funding

The Los Angeles County Transportation Commission plans to deposit funds into a capital rail account from their allocation of State Transit Assistance (STA) funds. These deposits probably will end after FY1988 or FY1989. The California Transportation Commission's (CTC) share of the Guideway Fund is available to SCRTD for capital programs. CTC has allocated a total of $400 million for Metro Rail.

5.4.2.3 Federal Funding

The Metro Rail Set Aside from Section 9 was $20 million for fiscal years 1985 and 1986. The set-aside was $15.6 million in FY 1987 and $0 thereafter. The total Section 9 funds for Metro Rail will be limited to $90.6 million already committed to MOS-1. No additional Section 9 funds for Metro Rail are anticipated. Section 9 funds distributed to Los Angeles County for bus capital programs are allocated to SCRTD according to the subsidy share just as for TDA funds.

The amount of Section 3 funds available to Los Angeles County is limited to Congressional Authorizations for Metro Rail. The Congress Authorized about $401.7 million for Metro Rail in the 1982 Surface Transportation Act and an additional $870 million in the Surface Transportation Act of 1987. The next Authorization Bill is scheduled for 1992. The step subsequent to Authorization is an annual appropriation for Metro Rail in keeping with the specifications of the Authorization legislation.

5.5 SUMMARY

This chapter provides a summary of the operating and capital grants and subsidies accruing to SCRTD for the construction of Metro Rail, bus capital expenditures, and transit operating expenses.

CHAPTER 6. MODULE 7: OPERATING COST PROJECTIONS

Module 7, the Operating Cost Projection Module, forecasts operating costs for each year for all modes combined and for bus, heavy rail, and light rail modes individually. In addition, Module 7 projects the number of bus replacements required each fiscal year in accordance with SCRTD bus replacement policy.

Data are entered from Module 1 for each of two simulation years for each selected system configuration. Operating costs are calculated the same as for fare box revenues in Module 3. Sequentially, these calculations are:

1. Generate a forecast for each year by interpolation between the two simulation years.

2. Calculate the anticipated annual operating cost for each mode according to the system implementation schedule.

3. Inflate operating cost projections by the appropriate Consumer Price Index for each year.

Inflated operating cost projection data are used later in the Operations Cash Flow Manager Module. Bus replacement figures are used in Module 9 to calculate capital requirements for new buses. A printout of Module 7 is shown in Figure 6.1.

6.1 MODULE INPUT

6.1.1 Price Indices

The United States Consumer Price Index (CPI) and associated growth rates are entered for each year in the planning horizon from Module 2. A CPI of 100 is assumed for 1986, the base year.

6.1.2 UTPS Simulations

For a given system configuration, Module 1 contains data from UTPS simulations for two years, including operating cost projections for each transit mode. The following data from Module 1 are automatically entered into Module 7:

- System configuration and implementation schedule
- Simulation years for each system configuration
- Bus operating costs for each simulation
- Metro Rail operating costs for each simulation
- Light rail operating costs for each simulation

MODULE 7 OPERATING COST PROJECTIONS
ALIGN 5 MOS-2

FIGURE 6.1
MODULE 7: OPERATING COST PROJECTIONS

FISCAL YEAR			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
INPUT FROM MODULE 2																			
--->CAL	U.S. CPI-U	FY1986=100	91.92	96.10	100.00	103.56	107.71	112.01	116.49	121.15	126.00	131.04	136.28	141.73	147.40	153.30	159.43	165.81	172.44
--->CAL	U.S. CPI-U GROWTH RATE	%		4.54	4.06	3.56	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
INPUT FROM MODULE 1								SIMULATION DATES			BUS		METRORAIL		LIGHTRAIL		FLEET SIZE (PVR)		
								SIM-1	SIM-2		SIM-1	SIM-2	SIM-1	SIM-2	SIM-1	SIM-2	SIM-1	SIM-2	
1984	ALL BUS SYSTEM					1984	$MIL	1985	1990		504.50	517.31	0.00	0.00	0.00	0.00	2270	2328	
1991	LB-LA					1984	$MIL	1990	2000		502.91	508.99	0.00	0.00	14.40	20.05	2263	2290	
1993	LB-LA MOS-1					1984	$MIL	1990	2000		491.15	524.39	12.03	15.40	14.40	20.05	2210	2360	
1993	LB-LA MOS-1 CENTEX					1984	$MIL	1990	2000		503.90	527.58	12.03	15.40	15.46	30.94	2272	2374	
1996	LB-LA MOS-1 CENTEX MOS-2 HARBOR					1984	$MIL	1990	2000		453.91	515.06	25.62	32.80	15.46	30.94	2043	2318	
1998	LB-LA MOS-1 CENTEX MOS-2 MOS-3 HARBOR					1984	$MIL	1990	2000		448.13	515.99	31.40	40.20	15.46	30.94	2017	2322	
1998	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 HARBOR					1984	$MIL	1990	2000		441.30	503.96	31.40	40.20	22.29	42.97	1986	2268	
2000	LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1 LRTC2 HARBOR					1984	$MIL	1990	2000		435.34	494.33	31.40	40.20	27.75	52.60	1961	2224	
1984	NETWORK (BUS)	1984 $MIL	429.30	442.60	459.00	473.00	501.69	502.30	502.91	503.52	504.13								
1991	NETWORK (BUS)	1984 $MIL					501.69	502.30	502.91	503.52	504.13	504.73	505.34	505.95	506.56	507.17	507.77	508.38	508.99
1993	NETWORK (BUS)	1984 $MIL					484.50	487.83	491.15	494.47	497.80	501.12	504.45	507.77	511.09	514.42	517.74	521.07	524.39
1993	NETWORK (BUS)	1984 $MIL					500.26	502.63	504.90	507.17	509.44	511.70	513.97	516.24	518.51	520.78	523.04	525.31	527.58
1996	NETWORK (BUS)	1984 $MIL					441.68	447.80	453.91	460.03	466.14	472.26	478.37	484.49	490.60	496.72	502.83	508.95	515.06
1998	NETWORK (BUS)	1984 $MIL					434.55	441.34	448.13	454.91	461.70	468.49	475.27	482.06	488.84	495.63	502.42	509.20	515.99
1998	NETWORK (BUS)	1984 $MIL					428.76	435.03	441.30	447.56	453.83	460.10	466.36	472.63	478.89	485.16	491.43	497.69	503.96
2000	NETWORK (BUS)	1984 $MIL					424.14	429.99	435.84	441.69	447.53	453.38	459.23	465.08	470.93	476.78	482.63	488.48	494.33
	OPERATING COSTS (BUS)	1984 $MIL		442.60	459.00	473.00	501.69	502.30	502.91	503.52	504.13	511.70	513.97	516.24	490.60	496.72	491.43	497.69	494.33
1984	NETWORK (HEAVY RAIL)	1984 $MIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
1991	NETWORK (HEAVY RAIL)	1984 $MIL					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	NETWORK (HEAVY RAIL)	1984 $MIL					11.36	11.69	12.03	12.37	12.70	13.04	13.38	13.72	14.05	14.39	14.73	15.06	15.40
1993	NETWORK (HEAVY RAIL)	1984 $MIL					11.36	11.69	12.03	12.37	12.70	13.04	13.38	13.72	14.05	14.39	14.73	15.06	15.40
1996	NETWORK (HEAVY RAIL)	1984 $MIL					24.19	24.91	25.62	26.34	27.06	27.78	28.49	29.21	29.93	30.65	31.36	32.08	32.80
1998	NETWORK (HEAVY RAIL)	1984 $MIL					29.55	30.52	31.40	32.28	33.16	34.04	34.92	35.80	36.68	37.56	38.44	39.32	40.20
1998	NETWORK (HEAVY RAIL)	1984 $MIL					29.55	30.52	31.40	32.28	33.16	34.04	34.92	35.80	36.68	37.56	38.44	39.32	40.20
2000	NETWORK (HEAVY RAIL)	1984 $MIL					29.55	30.52	31.40	32.28	33.16	34.04	34.92	35.80	36.68	37.56	38.44	39.32	40.20
	OPERATING COSTS (HEAVY RAIL)	1984 $MIL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.04	13.38	13.72	29.93	30.65	38.44	39.32	40.20
1984	NETWORK (LIGHT RAIL)	1984 $MIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
1991	NETWORK (LIGHT RAIL)	1984 $MIL					13.27	13.84	14.40	14.96	15.53	16.10	16.66	17.23	17.79	18.36	18.92	19.49	20.05
1993	NETWORK (LIGHT RAIL)	1984 $MIL					13.27	13.84	14.40	14.96	15.53	16.10	16.66	17.23	17.79	18.36	18.92	19.49	20.05
1993	NETWORK (LIGHT RAIL)	1984 $MIL					12.36	13.91	15.46	17.01	18.56	20.10	21.65	23.20	24.75	26.30	27.84	29.39	30.94
1996	NETWORK (LIGHT RAIL)	1984 $MIL					12.36	13.91	15.46	17.01	18.56	20.10	21.65	23.20	24.75	26.30	27.84	29.39	30.94
1998	NETWORK (LIGHT RAIL)	1984 $MIL					12.36	13.91	15.46	17.01	18.56	20.10	21.65	23.20	24.75	26.30	27.84	29.39	30.94
1998	NETWORK (LIGHT RAIL)	1984 $MIL					18.15	20.22	22.29	24.36	26.43	28.49	30.56	32.63	34.70	36.77	38.83	40.90	42.97
2000	NETWORK (LIGHT RAIL)	1984 $MIL					22.78	25.27	27.75	30.24	32.72	35.21	37.69	40.18	42.66	45.15	47.63	50.12	52.60
	OPERATING COSTS (LIGHT RAIL)	1984 $MIL		0.00	0.00	0.00	0.00	0.00	0.00	14.96	15.53	20.10	21.65	23.20	24.75	26.30	38.83	40.90	52.60
	BUS REPLACEMENT PROGRAM																		
1984	NETWORK (BUS REQUIREMENTS)	PVR		2169	2189	2094	2293	2305	2316	2328	2340	2351							
1991	NETWORK (BUS REQUIREMENTS)	PVR						2258	2260	2263	2266	2268	2271	2274	2276	2279	2282	2285	2287	2290
1993	NETWORK (BUS REQUIREMENTS)	PVR						2180	2195	2210	2225	2240	2255	2270	2285	2300	2315	2330	2345	2360
1993	NETWORK (BUS REQUIREMENTS)	PVR						2252	2262	2272	2282	2292	2303	2313	2323	2333	2343	2354	2364	2374
1996	NETWORK (BUS REQUIREMENTS)	PVR						1988	2016	2043	2071	2098	2126	2153	2181	2208	2236	2263	2291	2318
1998	NETWORK (BUS REQUIREMENTS)	PVR						1956	1987	2017	2048	2078	2109	2139	2170	2200	2231	2261	2292	2322
1998	NETWORK (BUS REQUIREMENTS)	PVR						1930	1958	1986	2014	2042	2071	2099	2127	2155	2183	2212	2240	2268
2000	NETWORK (BUS REQUIREMENTS)	PVR						1908	1935	1961	1987	2014	2040	2066	2093	2119	2145	2171	2198	2224
	BUS REQUIREMENTS (PVR)	PVR		2169	2189	2094	2293	2305	2316	2328	2266	2258	2303	2313	2323	2308	2236	2212	2240	2224
	ACTIVE FLEET SIZE REQUIRED	BUSES		2651	2686	2570	2752	2766	2780	2794	2719	2722	2763	2775	2788	2650	2683	2654	2688	2669
	CHANGE IN ACTIVE FLEET SIZE	BUSES			35	-116	182	14	14	14	-75	3	41	12	13	-138	33	-29	34	-19
	1/12 OF FLEET SIZE PREVIOUS YR	BUSES			221	224	214	229	231	232	233	227	227	230	231	232	221	224	221	224
	THEORETICAL REPLACEMENT REQ	BUSES			274	126	414	262	264	265	177	248	287	261	264	114	272	213	274	224
	EXCESS VEHICLES	BUSES			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<--- 9	VEHICLE REPLACEMENTS	BUSES			30	0	265	427	222	232	216	192	185	177	170	163	157	213	274	224
	OPERATING COSTS																		
<--- 10	OPERATING COSTS (BUS)	I $MIL			425.34	495.76	490.48	510.11	517.60	585.86	610.03	635.20	670.54	700.45	731.68	723.15	761.45	783.48	825.21	852.42
<--- 10	OPERATING COSTS (HEAVY RAIL)	I $MIL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.09	18.23	19.44	44.12	46.98	61.29	65.20	69.32
<--- 10	OPERATING COSTS (LIGHT RAIL)	I $MIL			0.00	0.00	0.00	0.00	0.00	0.00	18.13	19.57	26.34	29.51	32.88	36.48	40.31	61.91	67.82	90.70
<--- 10	OPERATING COSTS (ALL MODES)	I $MIL			425.34	495.76	490.48	510.11	517.60	585.86	628.16	654.77	713.97	748.19	784.00	803.75	848.75	906.68	958.23	1012.44

6.2 CALCULATIONS

6.2.1. Bus Operating Costs

Bus operating costs are given for two simulation years only. Projections are interpolated for intervening years using the identical procedure described for bus revenues in Module 3. Operating cost projections are interpolated assuming that operating costs grow linearly between simulation years:

1) Calculate the slope. The slope is the difference in operating costs for the two simulation years divided by the difference in years between the two simulation years.

2) Beginning with the first simulation year, add the operating cost and the slope to estimate the operating cost for the next fiscal year. Continue this procedure until operating costs are calculated for two years beyond the second simulation year.

3) Extrapolation to the two years prior to the first simulation year is accomplished by subtracting the slope.

Annual operating costs corresponding to the current system configuration are determined by table look-up.

6.2.2 Heavy and Light Rail Operating Costs

The procedure for both heavy and light rail operating cost projections is exactly as described above for bus operating costs.

6.2.3 Bus Replacement Program

The SCRTD publishes annually a Short Range Transportation Plan (SRTP) which provides historical data, the current fiscal year program, and a proposed program for the next five years. A document published as part of this SRTP includes the SCRTD's bus replacement program for the next 12 years. The anticipated life of a bus is 12 years. The implication implicit in this fact is that the entire bus fleet needs to be replaced over a 12 year period. SCRTD has developed a comprehensive bus replacement program and data from this program are entered into Module 7.

6.3 MODULE OUTPUT

6.3.1 Operating Costs

Module 7 output includes annual estimates of bus, heavy rail, light rail, and combined mode operating costs adjusted for inflation. Simulated operating costs are in constant 1986 dollars.

For each year, operating cost projections for each mode are inflated by the price index for that year. Combined mode operating costs are determined by summation. Inflated operating cost projections are used in the Operations Cash Flow Manager (Module 10).

6.3.2 Vehicle Replacements

Module 7 output includes the projected number of buses that should be purchased each year to account for scheduled replacement and system growth in ridership. The number of buses to be purchased is determined by the SCRTD bus replacement strategy.

The number of vehicle replacements each year is used in the Capital Costs Module 9 to estimate annual capital requirements for new buses.

CHAPTER 7. MODULE 9: CAPITAL COST PROJECTIONS

A key element of a cash flow analysis is an estimate of annual, inflated capital expenditures for each year of the planning period. Module 9 provides projections for five categories of capital costs: heavy rail construction; light rail construction; bus acquisition and replacement; buildings, equipment, and land in support of bus transit; and other capital items.

Data are entered automatically from Module 1 for network descriptions, implementation schedules, and project durations. Total project cost estimates are entered from Module 4 or directly into Module 9. The number of new buses to be acquired annually is entered from Module 7.

All capital costs are calculated in 1986 dollars. The reference to 1986 dollars refers to FY 1986 constant dollars inasmuch as all cost estimates are in December, 1985 dollars. Projections are inflated by the appropriate construction price index for each year and later used in Module 11, the Capital Cash Flow Manager. A printout of Module 9 is shown in Figure 7.1.

7.1 MODULE INPUT

The network descriptions for networks that have been identified for use in the current analysis are entered automatically from Module 1. The year in which each proposed project is scheduled to become operable is entered from Module 1. The project implementation schedule actually consists of three schedules: first, for the heavy rail projects; second, for the light rail projects; and third, for the busway project. The construction time ranges from a minimum of four years for several projects to a maximum of eight years for MOS-2, the second heavy rail segment. Project durations are entered from Module 1 in two schedules: first, for the heavy rail projects; and, second, for the light rail projects.

The California Heavy Construction Index (HCI) and associated growth rate are entered automatically from Module 2 for each year of the planning period. A HCI of 100 is assumed for 1986, the base year. The HCI will be used to inflate construction costs for heavy rail and light rail construction.

The Consumer Price Index (CPI) and associated growth rate are entered automatically from Module 2 for each year of the planning period. A CPI of 100 is assumed for 1986, the base year. The CPI will be used to inflate the costs of buses, equipment, and other capital items.

7.1.6 Project Cost Estimate

Project cost estimates in constant 1986 dollars are entered automatically from Module 4 for any projects that have a current cost estimate prepared in Module 4. Most often, detailed cost estimates are available from the sponsoring agency in 1986 constant dollars. SCRTD has prepared such

FIGURE 7.1

MODULE 9: CAPITAL COSTS

MODULE9 CAPITAL COST DISTRIBUTION
ALIGN 6 MOS-2
INPUT FROM MGMT MODULE

1984	ALL BUS SYSTEM MOS-3 TO N. HOLLYWOOD ALIGN 4
1991	LB-LA
1993	LB-LA MOS-1
1993	LB-LA MOS-1 CENTEX
1996	LB-LA MOS-1 CENTEX MOS-2 HARBOR
1998	LB-LA MOS-1 CENTEX MOS-2 MOS-3 HARBOR
1998	LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 HARBOR
2000	LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1 LRTC2 HARBOR

EST $,$$	PROJ DESC	DURATION IN YEARS	COST ESTIMATE DISTRIBUTED YEAPLY							COST DISTRIBUTION TABLE 1	2	3	4	5	6	7	8
722.4	(MIN MOSI)																
1085.1	MOS-1 (WILSHIRE/ALVARADO)	7	100.9	209.1	229.0	207.2	163.9	120.4	58.6	100.0	59.3	35.1	22.9	16.1	12.0	9.3	7.5
886.0	MOS-2	7	82.4	167.5	186.9	169.2	133.8	98.3	47.8		40.7	43.9	36.4	27.0	23.1	18.9	15.4
944.0	MOS-3	7	87.8	178.4	199.2	180.3	142.5	104.8	51.0			21.0	27.6	26.7	24.2	21.1	18.4
0.0	MOS-4	5	0.0	0.0	0.0	0.0	0.0						13.2	18.9	19.7	19.1	17.9
0.0	EAST LA METRO	5												9.3	14.2	15.1	15.2
0.0	NORWALK METRO	5													6.8	11.1	12.3
0.0	SANTA MONICA METRO	5														5.4	8.9
674.4	LONG BEACH-LOS ANGELES	6	69.0	58.2	206.3	243.4	88.9	13.6									4.3
267.6	NORWALK-EL SEGUNDO	6	23.6	27.0	38.6	49.0	70.0	55.6									
335.0	LRTC1	5	53.9	97.2	89.4	62.3	31.2										
0.0	LRTC3	4															
0.0	LRTC4	3															
412.0	LRTC2	4	94.3	150.0	113.3	54.4											
0.0	LRTC5	3															
0.0	HARBOR BUSWAY	3	0.0	0.0	0.0												

INPUT FROM ECO/DEMO MODULE

--->CAL	U.S. CPI-U	FY1986=100	91.92	96.10	100.00	103.56	107.71	112.01	116.49	121.15	126.00	131.04	136.28	141.73	147.40	153.30	159.43	165.81	172.44
--->CAL	U.S. CPI-U GROWTH RATE	%		4.5429355	4.0588047	3.562653a	4	4	4	4	4	4	4	4	4	4	4	4	4
--->CAL	CA. HWY CONSTRUCTION INDEX	FY1986=100	96.47	99.90	100.00	104.00	108.16	112.4°	116.99	121.67	126.53	131.59	136.86	142.33	148.02	153.95	160.10	166.51	173.17
--->CAL	CA. HCI GROWTH RATE	%	3.87133	3.6	0.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
				1.00	1.00	1.04	1.08	1.12	1.17	1.22	1.27	1.32	1.37	1.42	1.48	1.54	1.60	1.67	1.73

INPUT FROM OPER COST MODULE

	VEHICLE REPLACEMENTS	BUSES		30	0	265	427	222	232	216	192	185	177	170	163	157	213	274	224
	COSTS/VEHICLE	$86,THOUS		165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6	165.6

EST $I,M	PROJECT DESCRIPTION	CONSTR COMPLETE		FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
1255.6	MOS-1 (WILSHIRE/ALVARADO)	1993		0.0	0.0	105.0	221.8	257.5	242.5	199.3	152.4	77.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1108.7	MOS-2	1995	MOD10-->	0.0	0.0	0.0	0.0	92.7	195.9	227.4	214.1	176.1	134.6	68.1	0.0	0.0	0.0	0.0	0.0
1277.9	MOS-3A	1997	MOD10-->	0.0	0.0	0.0	0.0	0.0	0.0	106.9	225.8	262.1	246.8	202.9	155.1	78.5	0.0	0.0	0.0
0.0	MOS-3B	2000	MOD10-->	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	EAST LA METRO	-		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	NORWALK METRO	-		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	SANTA MONICA METRO	-		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
826.7	LONG BEACH-LOS ANGELES	1991		0.0	60.0	58.9	200.7	311.5	174.3	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
343.7	NORWALK-EL SEGUNDO	1993		0.0	0.0	2.0	15.0	37.3	51.9	62.6	93.8	78.2	2.9	0.0	0.0	0.0	0.0	0.0	0.0
491.8	LRTC1	1998	MOD10-->	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.8	138.3	132.4	97.5	49.9	0.0	0.0
0.0	LRTC3	-	MOD10-->	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	LRTC4	-		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
668.2	LRTC2	2000	MOD10-->	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145.2	240.1	188.7	94.2
0.0	LRTC5	-		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	HARBOR BUSWAY	1996		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BUS ACQUI AND REPL	86 $MIL		5.0	0.0	43.9	70.7	36.8	38.4	35.8	31.8	30.6	29.3	28.2	27.0	26.0	35.3	45.3	37.0
	BUILDINGS	86 $MIL		22.9	16.4	10.3	13.9	9.6	1.7	1.7	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	SUPPORT EQUIPMENT	86 $MIL		17.5	15.0	10.0	12.0	9.0	4.9	3.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	LAND	86 $MIL		0.0	25.6	0.5	7.0	7.1	1.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OTHER CAPITAL ITEMS	86 $MIL		1.0	1.1	1.8	4.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	CAPITAL COSTS																		
<--- 10	BUS ACQUI (FEDERAL SHARE)	I $MIL		0.0	0.0	28.0	18.3	32.6	35.5	34.7	32.0	32.1	32.0	31.9	31.8	31.9	45.0	60.1	51.1
<--- 10	BUS ACQUI (LOCAL + DEBT)	I $MIL		5.5	7.0	30.0	19.7	16.7	15.5	13.4	13.1	13.5	13.8	11.1	12.9	8.0	11.3	15.0	12.8
<--- 10	METRORAIL CAPITAL	I $MIL		0.0	0.0	105.0	221.8	350.2	438.4	533.6	592.3	515.3	381.4	271.0	155.1	78.5	0.0	0.0	0.0
<--- 10	LIGHT RAIL CAPITAL	I $MIL		0.0	60.0	60.9	215.7	349.8	225.2	83.9	93.8	78.2	76.7	138.3	132.4	242.7	290.0	188.7	94.2
<--- 10	BUILDINGS/EQUIP/LAND	I $MIL		40.4	57.0	20.8	32.9	25.7	7.6	7.9	8.2	8.5	8.8	9.2	9.6	9.9	10.3	10.8	11.2
<--- 10	OTHER CAPITAL ITEMS	I $MIL		1.0	1.1	1.8	4.0	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3
<--- 10	BUSWAY CAPITAL	I $MIL		0	0	0	0	0	0	0	0	0	4.804E-05	6.248E-05	3.109E-05	0	0	0	0

estimates for the second and third operable segments of Metro Rail. LACTC has made available order-of-magnitude estimates for two proposed light rail lines. Projects such as MOS-1, the Long Beach to Los Angeles LRT, and the Norwalk to El Segundo LRT are under construction and annual escalated cost estimates are available from the sponsoring agency for each of these projects. In every instance that such up-to-date information on costs are available, the data are entered directly into Module 9 and are not input from Module 4. Currently, no cost estimates are entered from Module 4.

The number of buses which are to be acquired or replaced is entered automatically from Module 7 for each year of the planning period.

7.2 INTERMEDIATE CALCULATIONS

7.2.1 Cost Distribution Table

The Cost Distribution Table is not calculated, but entered manually. The tabular values represent the percentage of a project which is completed during each of the periods required to complete the project. Figure 7.1 shows that for a three year project, about 35.1%, 43.9%, and 21.0% are completed in the first, second, and third years of construction, respectively. Completion percentages are given for project lengths ranging from one to eight years. These percentages were developed several years ago as part of the TRACS program used by SCRTD.

7.2.2 Timing Tables

Two timing tables are set up in the Module but not printed. They are used in distributing the construction costs over the duration of the project.

Timing Table 1 is constructed in the following manner. Each column of the table corresponds directly with the fiscal year which can vary from 1985 to 2010. Each row of the table corresponds to one of the construction projects. Tabular values are set equal to "1" if that project is under construction during that year and to "0" otherwise.

As an example, consider the LRTC1 line in Figure 7.1. It is scheduled to go into operation in 1998 and has a construction duration of four years. Thus, the LRTC1 must be under construction during 1995, 1996, 1997, and 1998 to be ready for service in 1998. In timing table 1, the tabular values for the LRTC1 row would be "1" for these four column years and 0 for all other columns.

Timing Table 2 is set up in the same row-column format as Timing Table 1. For each project, tabular values represent the year of construction in the duration span. In the example above for LRTC1, 1995 is the first year of construction, 1996 the second, 1997 the third, and 1998 the fourth and last year of construction. Tabular values for all other years are "0".

7.3 CALCULATIONS

7.3.1 Cost Estimate Distribution

These calculations result in the table of Figure 7.1 entitled "Cost Estimate Distributed Yearly." Each row is one of the projects and each column represents the first, second,...to n:th year of construction activity, where n is project duration.

The duration of a project is the column number to be used in the Cost Distribution Table discussed in 7.2.1 above. The percentages in the column are multiplied, each in turn, by the total project cost to yield the distributed yearly costs found in the project rows of the Cost Estimate Distributed Yearly Table. All other tabular values are left blank.

7.3.2 Project Costs Distributed

The tabular costs in the Cost Estimate Distributed Yearly Table must be adjusted for inflation and assigned to the year of planned occurrence. This is accomplished by constructing the Project Costs Distributed Table consisting of one row for each of the projects and one column for each fiscal year from 1985 through 2010.

For every project-year cell in this table, the Module consults Timing Table 1 to determine if the project is undergoing construction in that year or not. If not, a dash is entered in the cell. If so, the Module consults Timing Table 2 to determine which year of construction activity is underway for that project. The year of construction activity underway is the column number for reference to the Cost Estimate Distributed Yearly Table. The cost estimate located in the project-construction year cell is multiplied by the Highway Construction Index for the fiscal year in question and the result entered in the Project Costs Distributed Table. This procedure is followed for each cell in the 15 x 26 array defined for this table.

7.3.3 Buildings, Land, Support Equipment

Each year, the District invests capital for nonrail facilities. Buildings, land and support equipment are needed for bus-related facilities and office space. Maintenance, garage, and other facilities are required at various District locations to provide for smooth, efficient, and cost effective operation of the bus transit program operated by the District.

Annual estimates of capital expenditures for these items are provided by the District. These estimates are given in escalated dollars through 1993 and in 1986 dollars beyond 1993.

7.3.4 Other Capital Items

Each year, the District purchases a wide variety of equipment which costs less than $100,000 per item. The list of equipment includes such items as trucks, hoists, pumps, etc. which must be replaced quickly but generally are not held in inventory. The District provides estimates of such equipment purchases under the category of Other Capital Items.

7.3.5 Bus Acquisition and Replacement

Bus acquisition for fiscal years 1985 through 1988 and the financing arrangements for their purchase already have been committed to by the District and relevant data are entered manually. Module 9 calculates cost data for 1989 and beyond. Vehicle costs in constant 1986 dollars are supplied by the District. Cost data through 1988 represent average costs for a mixed fleet of buses including conventional and propane powered vehicles.

Bus Acquisition Costs are calculated by multiplying the annual costs of bus acquisitions and replacements by the CPI factor for the year in question. Current sources for the funds are a Federal grant program, Equipment Trust Certificates financed through Transportation Development Act (TDA) monies, and TDA receipts.

Federal grant programs for bus purchases provide up to 80 percent of capital costs. In general, such funds are made available under Section 9 of the Urban Mass Transit Administration program. Bus Acquisition (Federal Share) costs appearing in the output section are 80 percent of Bus Acquisition Costs for fiscal years 1988 and beyond. In fiscal year 1987, a larger portion of bus capital costs are financed locally than in later years. SCRTD provides estimates of the Federal share.

Equipment Trust Certificates (ETC) are financial instruments used by the District to finance the District's share of 20 percent of Bus Acquisition Costs or more in those years when Federal funds fall short of bus purchase requirements.

Equipment Trust Certificates have been used by the SCRTD to purchase buses since about 1980. The District has an existing debt service payment schedule for certificates issued to date. Three ETC series have been issued in 1980, 1984, and 1986 for a total of $72.2 million at interest rates ranging from 3.5% to 9.1%. The ETC debt service payment schedule is entered directly into Module 9. At the beginning of FY 1989, the outstanding ETC debt balance will be about $44.9 million.

7.4 MODULE OUTPUT

7.4.1 Metro Rail Capital Costs

Capital costs for heavy rail transit construction are summed for each project under construction in a given year. Heavy rail transit projects

are represented by the first 7 rows of the Project Costs Distributed Table. Costs are in terms of inflated dollars.

7.4.2 Light Rail Transit

Capital costs for light rail transit construction are summed for each project under construction in a given year. Light rail transit projects are represented by rows 8 through 14 of the Project Costs Distributed Table. Costs are in terms of inflated dollars.

7.4.3 Buildings, Equipment, Land

Capital cost estimates for buildings, equipment, and land are summed for a given year and transferred directly to the output section up through FY2000. All these costs are output in inflated dollars. The SCRTD has estimated these costs through FY 2000.

7.4.4 Other Capital Items

Capital cost estimates for other capital items are transferred directly to the output section through FY 2000. All these costs are output in inflated dollars.

7.4.5 Bus Costs - Federal Share

The estimated Federal shares of bus capital costs are included in the output section in terms of inflated dollars. The Federal share is about 80 percent of bus capital costs.

7.4.6 Bus Costs - ETC Debt Service

The remaining portion of bus capital costs are financed through the issuance of Equipment Trust Certificates or by direct cash payment from TDA receipts. The annual estimate of debt service payments by the District for principal and interest on these certificates is included in the output section.

7.4.7 Summary

Six capital cost categories are calculated for fiscal years 1985 through 2010 and stored in Module 9. These data are transferred to Module 10, the Operations Cash Flow Manager, or to Module 11, the Capital Cash Flow Manager, as required. In general, only the Metro Rail and light rail transit capital costs are transferred to Module 11.

CHAPTER 8. MODULE 11: CAPITAL CASH FLOW MANAGER

The Capital Cash Flow Manager provides a summary of capital costs for Metro Rail and the light rail corridors and for all sources of capital construction funds accruing to SCRTD and LACTC for regional rail construction. Changes in construction time tables, capital costs, escalation rates, and other factors related to costs are made in other modules and input to Module 11 when it is loaded.

Changes in Module 11 are related to the amount of funds available from a particular source and the timing of the receipt of the funds. Rail construction funds are available from several sources: UMTA Section 3 and Section 9 grants; Benefit Assessment Districts; State of California Guideway Fund; the City of Los Angeles; and LACTC. In addition, Module 11 includes a bonding component which assists in balancing the capital program, if possible, in the cash flow analysis structure of the module.

A printout of Module 11 is shown in Figure 8.1.

8.1 MODULE INPUT

Module 11 receives input directly from Module 9 and indirectly from Modules 1 and 2. Any programmatic changes in the network implementation schedule and project duration are made in Module 1. Escalation rates may be adjusted in Module 2. Module 9 reads these changes, accepts cost update inputs, and produces a set of annual, escalated construction costs for each year of duration for those projects included in the network descriptions. These capital cost data for Metro Rail operable segments and light rail transit lines are entered directly into Module 11.

8.2 USES OF RAIL SYSTEM FUNDS

Rail system funds are used to provide for the construction of Metro Rail and several light rail lines, a rail system capital reserve, an operating reserve, debt service on bonds, and payments to the so-called SB1995/1845 escrow account.

8.2.1 Metro Rail

The Locally Preferred Alternative (LPA) is divided into three minimum operable segments: MOS-1; MOS-2; and MOS-3. MOS-1 is under construction at an escalated cost of $1,250 million. Costs entered for MOS-1 represent the best estimate of SCRTD for annual expenditures for construction and equipment procurement contracts, design and construction management fees, agency fees, and insurance costs. The costs extending from FY 1988 to FY 1993 include a contingency reserve in excess of $112 million which is allocated over the six year period directly with the percentage of remaining costs. As revised figures for MOS-1 become available, they may be entered directly into Module 11.

METRO RAIL ALIGNMENT 6 MOS-2
LPA AND MERGED LIGHT RAIL LINES
ACCELERATED RECEIPT OF CTC AND CITY FUNDS
PRESENT METRO RAIL BOND LIMITATIONS APPLY

UMTA MOS-2 PARTICIPATION = 60.1%

REGIONAL TRANSIT FINANCIAL PLAN
SOURCES AND USES OF FUNDS FOR RAIL SYSTEM CAPITAL PROGRAM

FIGURE 8.1

MODULE 11: CAPITAL CASH FLOW MANAGER

SOURCES OF RAIL SYSTEM FUNDS	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTALS	
LACTC																	
PROCEEDS FROM BONDS-phase 1		37.4	337.7	100.0	89.5	70.2										634.8	
PROCEEDS FROM BONDS-phase 2					0.0	0.0	0.0	0.0	0.0							0.0	
PROCEEDS FROM BONDS-phase 3										0.0	0.0	100.0	325.0	310.0		735.0	
STATE TRANSIT ASSISTANCE	28.0	12.6	13.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.1	
SALES TAX RECEIPTS (35% PROP A) 1.0	67.4	81.9	118.2	125.2	133.0	140.9	150.1	159.6	169.8	180.4	191.7	203.4	215.7	228.7	242.6	2368.6	
INVESTMENT INCOME (5.50% 7.80%)	0.0	0.0	16.0	22.5	23.1	14.1	11.3	10.9	10.9	13.0	15.1	15.7	13.4	11.9	13.4	190.8	
TOTAL COMMISSION FUNDS	95.4	91.9	485.4	253.7	245.5	225.2	161.1	170.4	180.7	193.4	206.9	319.1	554.1	550.6	256.0	3989.3	
(UTILIZATION COEFF.:PROP A PROGRAM)	N/A	2.74	3.42	3.09	2.84	2.64	2.33	2.43	2.64	2.80	2.98	2.77	2.10	1.75	1.71		
UMTA																	
SECTION 3 FUNDS MOS-1	132.4	11.4	98.4	141.1	124.6	71.1	21.1	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	605.3	48%
SECTION 3 FUNDS MOS-2	0.0	0.0	0.0	55.7	117.7	125.7	128.7	105.8	80.9	40.9	0.0	0.0	0.0	0.0	0.0	666.3	60%
SECTION 3 FUNDS MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.2	146.2	189.7	159.8	131.4	100.4	50.3	827.4	58%
																2099.0	55%
SECTION 9 FUNDS MOS-1	15.8	8.3	14.5	20.7	13.2	10.2	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.6	7%
SECTION 9 FUNDS MOS-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
SECTION 9 FUNDS MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
																90.6	2%
STATE OF CALIFORNIA																	
GUIDEWAY FUNDS MOS-1	58.0	10.9	48.1	33.8	31.9	22.9	7.5	0.0								213.1	17%
GUIDEWAY FUNDS MOS-2	0.0	0.0	0.0	12.4	26.3	30.5	29.7	23.6	18.0	9.1	0.0	0.0	0.0	0.0	0.0	149.6	13%
GUIDEWAY FUNDS MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	7.6	8.8	8.3	6.8	3.1	0.0	38.3	3%
																400.0	11%
SCRTD																	
BENEFIT ASSESS. BONDS MOS-1	0.0	0.0	18.5	30.5	38.5	27.7	15.1	0.0								130.3	10%
BENEFIT ASSESS. BONDS MOS-2	0.0	0.0	0.0	0.0	0.0	0.0	25.0	31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	5%
BENEFIT ASSESS. BONDS MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	19.0	0.0	0.0	34.0	0%
																220.3	6%
CITY OF LOS ANGELES																	
LOCAL ASSISTANCE MOS-1	0.0	10.0	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	3%
LOCAL ASSISTANCE MOS-2	0.0	0.0	0.0	0.0	11.0	11.0	10.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	2%
LOCAL ASSISTANCE MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
																69.0	2%
PROPOSED SPECIAL FUNDING FOR MOS-2																	
CITY PROPOSED - MOS-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LACTC LOAN (MOS-3 REAUTHORIZATION)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ADV ROW ($4.4M);CITY OF LA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
																0.0	
UNIVERSAL CITY ROADWORK (SOURCE:FAUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL OTHER FUNDS	206.2	40.5	191.5	306.2	368.2	310.0	238.5	169.0	171.7	203.8	178.5	193.1	157.2	103.5	50.8	2879.9	
TOTAL ALL SOURCES	301.6	132.5	676.9	559.9	613.7	535.2	399.7	339.4	352.4	397.2	385.3	502.2	711.3	654.1	306.8	6868.2	
USES OF RAIL SYSTEM FUNDS	IMPLEMENTATION SCHEDULE																
RAIL TRANSIT SYSTEM PROJECTS																	
METRORAIL(MOS-1)	FY 1993	257.2	66.0	197.5	283.3	250.2	142.9	42.3	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1249.9	
METRORAIL(MOS-2)	FY 1996	0.0	0.0	0.0	92.7	195.9	227.4	214.1	176.1	134.6	68.1	0.0	0.0	0.0	0.0	0.0	1108.9	
METRORAIL(MOS-3)	FY 2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.1	253.9	294.8	277.6	228.2	174.5	88.3	1437.5	
LONG BEACH PROJECT	FY 1991	60.0	58.9	200.7	311.5	174.3	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	826.7	
CENTER PROJECT	FY 1993	0.0	2.0	15.0	37.3	51.9	62.6	93.9	78.2	2.9	0.0	0.0	0.0	0.0	0.0	0.0	343.7	
LRTC PROJECTS(MERGED) FY1998	FY 2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.8	294.8	383.3	294.1	148.1	1200.2	
LRTC PROJECT (OTHER)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ROADWORK AT UNIVERSAL CITY		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RAIL SYSTEM CAPITAL RESERVE		0.0	6.6	13.2	17.8	7.0	-7.6	-11.4	-7.0	6.8	6.7	-2.7	-1.7	-4.9	-5.4	-8.6	9.8	
ASSOCIATED LRT CONST COSTS		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GENERAL RESERVE RAIL OPS COST		0.0	0.0	5.6	5.9	6.3	6.7	7.0	7.5	8.0	8.5	9.0	9.6	10.2	10.8	11.4	106.4	
DEBT SERVICE LACTC BONDS-phase 1		0.0	11.2	34.5	40.5	40.8	53.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	766.0	
DEBT SERVICE LACTC BONDS-phase 2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DEBT SERVICE LACTC BONDS-phase 3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	33.3	66.2	77.5	191.0	
SB 1995 ESCROW		0.0	0.0	13.2	15.1	20.3	13.0	8.1	-17.4	-17.4	-17.4	-17.4	0.0	0.0	0.0	0.0	0.0	
ADDITIONS TO CASH		-15.6	-12.2	197.2	-244.2	-139.0	15.6	-18.7	27.0	33.0	13.0	-42.6	-151.5	-8.1	49.6	-74.4	-370.9	
TOTAL ALL USES		301.6	132.5	676.9	559.9	613.7	535.2	399.7	339.4	352.4	397.2	385.3	502.2	711.3	654.1	306.8	6868.2	
BEGINNING BALANCES (SALES TAX)		257.6	242.0	229.8	427.0	182.8	43.8	59.4	40.7	67.7	100.7	113.7	71.1	-80.4	-88.5	-39.0		
ADDITIONS TO CASH		-15.6	-12.2	197.2	-244.2	-139.0	15.6	-18.7	27.0	33.0	13.0	-42.6	-151.5	-8.1	49.6	-74.4		
ENDING CASH BALANCE (EXCLUDING RESERVES)		242.0	229.8	427.0	182.8	43.8	59.4	40.7	67.7	100.7	113.7	71.1	-80.4	-88.5	-39.0	-113.3		
RAIL SYSTEM CAPITAL RESERVES			6.6	19.8	37.6	44.6	37.0	25.6	18.7	25.5	32.2	29.5	27.8	22.9	17.4	8.8		
GENERAL RESERVES			0.0	5.6	11.5	17.8	24.4	31.5	39.0	47.0	55.4	64.5	74.0	84.2	95.0	106.4		
ENDING CASH BALANCES		242.0	236.4	452.3	231.9	106.2	120.9	97.8	125.3	173.1	201.3	165.0	21.4	18.5	73.5	1.9		

Costs in December, 1985, constant dollars for MOS-2 and MOS-3 are entered into Module 9 for distribution over time and for cost escalation. Constant dollar cost estimates are available from the District for a variety of operable segment/alignment configurations. The user must enter cost revisions for MOS-2 and MOS-3 in Module 9. These costs cannot be adjusted in Module 11 because they are entered from an external Module. MULTIPLAN permits changes only in the originating module.

8.2.2 Light Rail

LACTC provides annual, escalated cost estimates for the Long Beach to Los Angeles and Norwalk to El Segundo Light Rail lines. These lines are both under construction although design work on the Norwalk to El Segundo line has not been finalized as yet. These cost data are entered directly into the output section of Module 9.

Constant dollar cost estimates for two other light rail corridors are entered into Module 9 for distribution over time and for escalation. These two corridors are merged for cost purposes and appear in Module 11 as LRTC Projects (Merged). However, the costs are entered separately in Module 11, under the directions of a Macro, beginning with Column 48 of the spread sheet. The formulas in the cells representing costs of the "Merged" and "Other" LRTC projects may be adjusted when it is desirable to separate the costs.

The row headed Associated LRT Construction Costs refers to rail yard work to be accomplished in conjunction with the Long Beach to Los Angeles Light Rail line. In some Module 11 scenarios, the Associated LRT costs are zeroed and the costs transferred to the Long Beach-Los Angeles cost row.

8.2.3 Reserves

LACTC, in association with the City of Los Angeles, is required to maintain a rail system capital reserve account under terms of the Full Funding Contract with UMTA for MOS-1. The reserve is to be set up at the start of each fiscal year in an amount equal to 10% of the construction and equipment procurement contracts for the coming year. The reserve is intended to finance unanticipated conditions which may result in added expenditures for revised designs and alternative construction techniques. It is not intended as cost overrun protection.

LACTC, as a matter of Commission Policy, maintains a Rail Operations reserve. The Operations reserve grows each year by 5% of the Prop A rail constructions fund receipts for the year. The fund is to be used to provide operating grants for the new rail systems as they enter revenue service.

8.2.4 Debt Service

LACTC is empowered to issue sales tax revenue bonds to help finance rail construction in Los Angeles County. The sale of such bonds requires

annual interest and capital payments to the Bond Trustees. LACTC has issued several series of bonds totalling about $707 million which will require annual debt service payments of about $64.4 million. These payments are made directly from the Prop A rail construction fund receipts each year.

8.2.5 SB1995/1845 Escrow Account

The provisions of Senate Bills 1995 and 1845, both signed into law over the past two years, are designed to assure the construction of Metro Rail to specific locations in the San Fernando Valley with a terminus in North Hollywood.

The Bills require that, beginning with FY 1988, a certain sum of money be spent on Metro Rail construction in the Valley or at least be placed in an interest bearing escrow account. The required sum of money is equivalent to 15% of the non-Federal share of all Metro Rail costs for the previous fiscal year. This will amount to over $70 million in the escrow account for the MOS-1 portion of Metro Rail. Additional deposits of $100 million to $150 million may be required depending on the design and extent of MOS-2.

8.2.6 Roadwork at Universal City

Construction of Metro Rail at Universal City includes a subway station. Improvements to highways in the vicinity, including construction of a six-lane bridge across the Hollywood Freeway, are needed if bus and passenger car traffic are to function efficiently and safely in the area. A 1,500 space parking garage is included in the station development plan. The majority of costs associated with additional roadwork at Universal City are included in the Metro Rail cost estimate for operable segments which include Universal City. Consequently, this row is included if it is desired to separate all or part of the roadwork costs from the transit costs.

8.3 SOURCES OF RAIL SYSTEM FUNDS

Rail system funds are derived from several sources, many of which are devoted exclusively to Metro Rail rather than to regional rail construction. The summary which follows will detail exclusive Metro Rail sources and conclude with Proposition A funds, the principal regional source.

8.3.1 UMTA Section 3 and Section 9 Funds

UMTA Section 3 Discretionary grants for Metro Rail are authorized by Congress to be followed by appropriations as funds are available. As of August, 1986, a total of $401.6 million has been granted or appropriated for MOS-1 of Metro Rail. The Surface Transportation Act of 1987 authorized an additional $870 million for Metro Rail of which $203.7 million are for MOS-1 and $666.3 million are for MOS-2, the second segment of the Locally Preferred Alternative.

The Final Environmental Impact Statement of 1983 included Federal Section 3 involvement of $2,099 million in Metro Rail. Thus far, a total of $1,271.6 million has been authorized. It is anticipated that the UMTA Section 3 Discretionary Grant Program will continue and that additional funding will be available for MOS-3 upon passage of the Surface Transportation Act of 1992.

A portion of UMTA Section 9 Block Grant capital funding is set aside for Metro Rail and the balance used for bus capital programs. A total of $90.6 million is allocated for MOS-1 construction but no further Section 9 funds for Metro Rail are anticipated. It is the consensus that Section 9 capital grants be reserved for the bus capital program.

8.3.2 State of California Guideway Fund

The California Transportation Commission (CTC) has administrative control of the Guideway Fund and exercises discretionary power in disbursing the funds. The CTC has committed $400 million to Metro Rail with $213.1 million allocated to MOS-1 and $186.9 million available for MOS-2. The SCRTD may apply to the CTC for additional Metro Rail funding if the CORE study LPA is enhanced or lengthened in comparison to that defined in the 1983 FEIS.

8.3.3 Benefit Assessment Districts

Benefit Assessment Districts are a value capture technique designed to recover a portion of value added to property and its utility as a result of proximity to a Metro Rail station. The assessment will be set at a rate per eligible square foot designed to provide debt service over a 20-year period for a bond issue in support of Metro Rail construction. The Benefit Assessment Districts associated with the stations of MOS-1 are expected to support bond proceeds of $130.3 million for the MOS-1 construction program. The benefit assessment program for MOS-2 stations is in the organization process. Early estimates indicate it may be possible to service a bond issue with proceeds of $56 million for Metro Rail construction.

8.3.4 City of Los Angeles

The local return portion of Proposition A funds is 25% of the sales tax receipts. The City of Los Angeles receives 39% of the local return monies which are distributed to all Los Angeles County cities on the basis of population. The City has committed $34 million to MOS-1 and at least $35 million for MOS-2 from its share of local return funds.

8.3.5 Proposed Special Funding: MOS-2

In order for several proposed operable segments for various candidate alignments to be implemented, it will be necessary to identify additional funding resources to narrow the gap between available and required funds.

It is up to the user to identify these sources and enter the data relative to anticipated annual receipts of funds.

8.3.6 Los Angeles County Transportation Commission

The Los Angeles County Transportation Commission derives the bulk of its funds for the rail program from Proposition A sales tax receipts. The rail program receives 35% of Proposition A funds. The capital funds may be augmented in any given year by interest earned on short-term deposits and the debt service reserve account. These funds may be applied to rail construction cash payments for either heavy or light rail construction. Funds derived from the State Transit Assistance program probably end in FY 1989.

However, LACTC is authorized to issue bonds for rail construction programs. The Proposition A rail program is the source of debt service payments for interest and principal. LACTC has issued some $707 million in bonds which generated about $675 million in proceeds. A maximum of $100 million of bond proceeds can be applied to Metro Rail. In general, the Commission uses current income to fund its commitment to Metro Rail while bond proceeds and current income are used to fund the light rail program.

8.4 CALCULATIONS

8.4.1 Uses of Rail System Funds

The annual, escalated cost estimates for heavy and light rail projects are read in directly from Module 9.

The rail system capital reserve account is maintained at 10% of the fiscal year expenditure estimates for Metro Rail. Actually the reserve is based on the estimate for construction and equipment procurement contracts for the fiscal year. This data is known only for MOS-1. Total expenditures are used for MOS-2 and MOS-3. This has very little impact on cash flow calculations. For a given year, the capital reserve requirement is calculated as 10% of the current fiscal year Metro Rail expenditures minus 10% of the previous fiscal year Metro Rail expenditures. Thus, the reserve deposit for a given year could be negative which indicates that Metro Rail expenditures have decreased. The capital reserve account balance is zero at the end of Metro Rail construction.

The Reserve account for rail operations is calculated as 5% of the Proposition A rail program receipts for a given year. The deposit to the reserve account is made at the beginning of the next fiscal year. This account accumulates and will amount to well over $100 million by 2000.

8.4.1.1 SB 1995 Escrow Account

The annual deposit to the SB 1995 escrow account is calculated as follows:

- For a given fiscal year, determine the sum of Metro Rail expenditures.
- From this sum, subtract the total Federal contribution to Metro Rail for that fiscal year such that the balance is the local contribution.
- The escrow deposit during the subsequent fiscal year is 15% of the current fiscal year local contribution.

The escrow account continues to accumulate funds until such time as Metro Rail construction begins in the San Fernando Valley as defined in the legislation. At this point, the escrow deposits cease and withdrawals are made from the escrow account to help finance Valley construction. The user may assume a withdrawal sequence as appropriate. The model used in Module 11 assumes an annual withdrawal equivalent to a fixed percentage of the local share for the operable segment which includes Valley construction. The procedure is summarized:

- For each operable segment (MOS-1, MOS-2, and MOS-3), the annual local share is computed.
- For MOS-1 and MOS-2, the 15% escrow deposit is calculated. These data are stored in a working table included in Module 11.
- If MOS-2 includes Valley construction, escrow deposits are made only during MOS-1 construction and the drawdown made during MOS-2 construction.
- If MOS-3 includes Valley construction, escrow deposits are made during both MOS-1 and MOS-2 construction and the drawdown made during MOS-3 construction.
- The exact nature of the drawdown procedure is a policy decision. The model in Module 11 employs the same technique to draw down the escrow fund as is used to build it up. The fixed percentage of the local share is selected by trial and error. The minimum percentage must be that which zeroes the escrow account by the end of Valley construction. Increasing this percentage

speeds up the drawdown which may have a positive impact on the cash flow picture.

8.4.1.2 Debt Service for Bonds

Debt service for bonds issued by LACTC are shown in three phases. Phase 1 bonds refer to the $707 million authorized by LACTC according to the conditions of the Official Statement of 1986. The debt service payments for Phase 1 bonds are from data supplied by LACTC.

Phase 2 bonds are those proposed for issuance from 1990 to 1994 and Phase 3 from 1995 to 1999. The amount of bond proceeds in any one of these years is entered by the user and the model calculates the required issue size and the annual debt service requirements. The user may adjust the dividend rate paid to bond owners, the investment rate earned on the sinking fund, the cost of issue percentage and the life of the issue. The bonding model in Module 11 assumes that only interest payments are made during the Phase years (1990 to 1994 for Phase 2 and 1995 to 1999 for Phase 3) and that principal payments to the sinking fund do not start until 1995 for Phase 2 and 2000 for Phase 3. If the deferral of principal concept is not used it is a relatively simple matter to reprogram the Module to account for the change.

The primary formula used in the bonding model is for the calculation of annual debt service. All other formulas are simple arithmetic and used for bookkeeping purposes. The following symbols will prove useful in the derivation:

DR	=	The dividend rate paid to bond owners.
IR	=	The investment rate earned by the sinking fund.
IC	=	The issue cost rate.
BP	=	The bond proceeds.
BA	=	The bond amount.
DS	=	The annual debt service.
n	=	The bond life in years.

A bonding requirement is that the equivalent of one year's debt service must be placed in an escrow account which earns interest and which will be the last debt service payment as each issue matures. Thus, the basic formula for the bond amount is the sum of bond proceeds, the issue cost, and the escrow deposit:

$$BA = BP + IC * BA + DS$$

This expression may be rewritten:

$$BA = \frac{BP + DS}{(1 - IC)}$$

The expression for annual debt service is the sum of interest payments to bond owners and the annual sinking fund payment for the retirement of principal:

$$DS = DR * BA + BA*(IR/((1 + IR)^n - 1))$$

The above expression for bond amount (BA) may be substituted in the expression for debt service (DS). After some algebraic manipulation and rearrangement of terms, the following expression for debt service is developed:

$$DS = \frac{BP*[\ DR + IR/((1 + IR)^n - 1)]}{[1 - IC - DR - IR/((\ 1 + IR)^n - 1)]}$$

The debt service is entered in a working table for each year of the 5 year phase. The total debt service for each phase is transferred to the cash flow in the debt service rows of the model. Only the bond proceeds and the debt service appear in the cash flow. The bond issue costs and the escrow deposit are represented by the difference between bond amount and bond proceeds.

8.4.2 Sources of Rail System Funds

The distribution of funds from the various sources is calculated as follows:

- For a given Metro Rail operable segment, the current dollar cost is determined for each year.
- The contribution from a source is divided by the total project cost to determine the project share.
- The annual contribution from a source is determined by multiplying the project share by the annual project expenditure.

The user may wish to vary this approach for cash flow purposes. In some instances, the contributor may wish to distribute their contribution more uniformly over time. The City of Los Angles, for example, may want to adjust their contribution in keeping with other budgetary decisions. Benefit Assessment District funds are derived from bond issues. Thus, the timing of the contribution depends on when bonds can be sold. The SCRTD has agreed to delay receipt of assessment fees until Metro Rail is very close to service implementation. Thus, bond sales may be delayed until that time or bonds may be issued earlier with capitalized interest provisions.

UMTA Section 3 and 9 funds are appropriated in a given year but are credited to the grantee as construction progresses. In other words, the funds must be earned by work performed prior to receipt of the funds.

The size of the contribution and the schedule for its receipt are the subject of negotiations for the full funding contract. The user must

program any schedule agreed to or enter the amounts manually. In Module 11, the scheduled receipts of funds from Benefit Assessment Districts, the City of Los Angeles, and Special MOS-2 funding are entered manually.

Total UMTA Section 3 and Section 9 funds for MOS-1 are assumed fixed. The annual amounts will change as a function of actual costs and use of the $112 million contingency fund. However, these are not items for user manipulation as part of the planning process. As MOS-1 construction proceeds, cost observations are made and the data updated. The same situation applies to other rail components. As design progresses, refined cost estimates are available, they are entered into the model, and source funds related to these costs are recalculated.

Investment income is calculated as two components. The first is long-term interest earned on the bond escrow deposits at a rate which may be adjusted by the user. The current default value is 7.8% annually.

The second component is short-term interest earned on the cash on hand. The cash on hand balance is calculated as the average ending cash balance of the two previous fiscal years. The interest is credited in the current fiscal year at an interest rate which may be adjusted by the user. The current default value for short-term interest is 5.5% annually.

Bond proceeds for phases 2 and 3 are entered by the user in accordance with a decision rule presented below. The utilization coefficient or bond coverage factor is calculated by dividing the Proposition A sales tax receipts for rail programs by the total debt service for a given fiscal year. Current policy is to maintain the utilization coefficient at or above the minimum value of 1.15.

8.4.3 Summary Statistics

Total Commission Funds available for rail systems are the sum of bond proceeds, State Transit Assistance, Proposition A rail receipts and earned interest income. Total Other Funds are the sum of funds derived from sources such as UMTA Sections 3 and 9, State Guideway Fund, Benefit Assessment Districts, City of Los Angeles, and proposed Special Funding programs. The Total All Sources is the sum of Total Commission Funds and Total Other Funds.

The Total All Sources number is transferred to the Total All Uses row. Additions To Cash represents the difference between Total All Uses and the sum of all uses listed above the Additions to Cash row.

The beginning cash balance is transferred from the ending cash balance (excluding reserves) of the previous fiscal year. The sum of the beginning cash balance and additions to cash yields the ending cash balance (excluding reserves). In this balance, reserves constitute an expense and are excluded from the balance. In reality, reserves are on deposit. The Rail System Capital Reserves represent the accumulated amount in reserve at any one time. As construction continues, this reserve begins to decrease and eventually reaches zero when construction

ends. The General Reserves represent the cumulative total of reserves for rail operations.

The sum of ending cash balance (excluding reserves) and the two reserve funds yield the ending cash balance, the very last line of the example of Module 11 shown in Figure 8.1.

8.4.4 Decision Rule For Bonding

The cash flow model represented in Module 11 is interactive with respect to the bonding component. The user examines the ending cash balance (excluding reserves) and enters sufficient bond proceeds to keep this balance at or slightly above zero. At the other extreme, the user examines the ending cash balance (including reserves) and enters sufficient bond proceeds to keep this balance above zero at some predetermined level. The latter case results in a lower level of bond proceeds and hence, lower debt service. In this series of cash flows, the attempt is made to maintain an ending cash balance (including reserves) of about $20 million. Simultaneously, the coverage ratio must be at least 1.15 each fiscal year. Otherwise, the funding scenario under analysis may not be feasible. In the interest of reproducibility of results, Bond Proceeds are entered in increments of $5 million such that the ending cash balance is $20 million plus or minus $2.5 million.

However, another factor is involved which must be considered in the bonding strategy. In the enabling legislation which permitted LACTC to issue bonds for rail construction, a provision is included which states that no more than $100 million in bonds may be applied to Metro Rail construction. This provision carries with it two implications:

1) All bonds issued in Phases 2 and 3 are strictly in support of light rail construction.

2) LACTC annual payments for debt service and Metro Rail contributions must come from current cash income.

Thus, three new items of data are calculated. The first is called available debt service for any given year. It is calculated from the Proposition A rail fund by subtracting the LACTC Metro Rail contribution and 1.15 times the debt service requirement. The second item is the bonding capacity which is calculated as 9.4822 times the available debt service. The bonding capacity factor of 9.4822 is designed to yield the bond proceeds based on a 25-year life and 8% interest. The third item represents LACTC's cash position. All cash receipts, excluding bond proceeds, are adjusted by subtracting debt service expenses and Metro Rail contributions. It is desirable to have a positive cash position each fiscal year.

The bonding strategy may be summarized as follows:

- Screen display: Set up three windows which are horizontally linked. The first window is 12 rows deep and displays Rows 7 through 18. The second window is 3 rows deep and displays Rows 87 through 89. The third window is 3 rows deep and displays Rows 155 through 157.

- Position the cursor on Row 11 at the left end and move to the right one column at a time. Observe Row 87 (ending cash balance) and when this balance is less than $17.5 million, bond proceeds are necessary. The initial estimate of bond proceeds is the amount needed to raise the ending cash balance to a positive $20 million.

- Check Row 156 which shows the bonding capacity for that year. Bonds may be issued up to but not in excess of the capacity.

- Enter Bond Proceeds in increments of $5 million until the ending balance is within $2.5 million of $20 million. Make sure the bonding capacity is not exceeded (Row 156) and the coverage ratio (Row 18) is at least 1.15. Continue this procedure until a financial plan is developed. In 1995, the cursor must be moved to Row 12 for Phase 3 bonding.

- If the bonding strategy does not produce a feasible plan, then changes in either uses of funds or sources of funds may be needed to produce a workable financial plan.

8.5 MODULE OUTPUT

Basically, the output of Module 11 is a financial operating plan which shows how the uses and sources of funding are matched up to produce a feasible plan if such is possible for the scenario under analysis.

The output consists of the regional financial model as shown in Figure 8.1. A companion set of output is Figure 8.2 which shows the contribution of each funding partner for each year of Metro Rail activity for the three proposed operable segments: MOS-1; MOS-2; and MOS-3. Thus, Figure 8.1 shows a regional financial plan while Figure 8.2 shows a Metro Rail financial plan.

Portions of the Module 11 output shown in Figure 8.2 are used by Module 10 to provide a summary of SCRTD's operating and capital cash flows.

FIGURE 8.2

METRO RAIL FUNDING PARTICIPATION LEVELS

METRO RAIL FUNDING PLAN ; PARTNERS' LEVELS OF PARTICIPATION
METRO RAIL ALIGNMENT & MOS-2
LPA AND MERGED LIGHT RAIL LINES
PRESENT METRO RAIL BOND LIMITATIONS APPLY

FUNDING PARTNER	FISCAL YEAR															TOTALS	
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	$	%
SOURCES OF MOS-1 FUNDS																	
STATE OF CALIFORNIA	58.0	10.9	48.1	33.8	31.9	22.9	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	213.1	17.0%
BENEFIT ASSESSMENT DISTRICT	0.0	0.0	18.5	30.5	38.5	27.7	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.3	10.4%
CITY OF LOS ANGELES	0.0	10.0	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	2.7%
UMTA SECTION 9 FUNDS	15.8	8.3	14.5	20.7	18.2	10.2	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.6	7.2%
UMTA SECTION 3 FUNDS	132.4	11.4	98.4	141.1	17.6	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	401.7	32.1%
LOAN REPAID UPON MOS-2 AUTHORIZATION	0.0	0.0	0.0	0.0	107.0	70.5	20.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	203.6	16.3%
LACTC FUNDING	51.0	25.4	6.0	45.2	37.0	10.9	-3.9	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	176.6	14.1%
	257.2	66.0	197.5	283.3	250.2	142.3	42.3	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1249.9	100%
SOURCES OF MOS-2 FUNDS																	
STATE OF CALIFORNIA	0.0	0.0	0.0	12.4	26.3	30.5	28.7	23.6	18.0	9.1	0.0	0.0	0.0	0.0	0.0	148.6	13.4%
BENEFIT ASSESSMENT DISTRICT	0.0	0.0	0.0	0.0	0.0	0.0	25.0	31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	5.1%
CITY OF LOS ANGELES AND ADV ROW ($4.4M)	0.0	0.0	0.0	0.0	11.0	11.0	10.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	3.2%
UMTA SECTION 9 FUNDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
UMTA SECTION 3 FUNDS	0.0	0.0	0.0	55.7	117.7	136.7	128.7	105.3	80.9	40.9	0.0	0.0	0.0	0.0	0.0	666.3	60.1%
LOAN REPAID WITH MOS-3 AUTHORIZATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
UNIVERSAL CITY ROADWORK-FAUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
LACTC FUNDING	0.0	0.0	0.0	24.6	40.9	49.3	21.8	12.7	35.7	18.1	0.0	0.0	0.0	0.0	0.0	203.0	18.3%
	0.0	0.0	0.0	92.7	195.9	227.4	214.1	176.1	174.6	68.1	0.0	0.0	0.0	0.0	0.0	1108.9	100%
SOURCES OF MOS-3 FUNDS																	
STATE OF CALIFORNIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	7.6	8.8	8.3	6.8	3.1	0.0	38.3	2.7%
BENEFIT ASSESSMENT DISTRICT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	19.0	0.0	0.0	34.0	2.4%
CITY OF LOS ANGELES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
UMTA SECTION 9 FUNDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
UMTA SECTION 3 FUNDS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.2	146.5	169.7	159.8	131.4	100.4	50.8	827.4	57.6%
LACTC FUNDING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.4	100.2	116.3	94.5	71.0	71.0	37.5	537.8	37.4%
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.1	253.9	294.8	277.6	228.2	174.5	88.3	1437.5	100%
SOURCES OF METRORAIL FUNDS																	
STATE OF CALIFORNIA	58.0	10.9	48.1	46.2	58.2	53.4	36.2	23.6	21.6	15.7	8.8	8.3	6.8	3.1	0.0	400.0	10.5%
BENEFIT ASSESSMENT DISTRICT	0.0	0.0	18.5	30.5	38.5	27.7	40.1	31.0	0.0	0.0	0.0	15.0	19.0	0.0	0.0	220.3	5.8%
CITY OF LOS ANGELES AND ADV ROW ($4.4M)	0.0	10.0	12.0	12.0	11.0	11.0	10.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.0	1.8%
UMTA SECTION 9 FUNDS	15.8	8.3	14.5	20.7	18.2	10.2	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.6	2.4%
UMTA SECTION 3 FUNDS	132.4	11.4	98.4	196.8	242.3	207.8	149.8	111.0	150.0	187.1	169.7	159.8	131.4	100.4	50.8	2099.0	55.3%
LOAN REPAID WITH MOS-3 AUTHORIZATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
UNIVERSAL CITY ROADWORK-FAUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
LACTC FUNDING	51.0	25.4	6.0	69.8	77.9	60.2	17.9	17.7	83.1	118.2	116.3	94.5	71.0	71.0	37.5	917.4	24.2%
	257.2	66.0	197.5	376.0	446.1	370.2	256.4	186.7	254.7	322.0	294.8	277.6	228.2	174.5	88.3	3796.3	100%
UMTA SECTION 3 GRANTS																	
SEC 3 GRANTS MOS-1	132.4	15.2	97.6	139.9	123.6	70.5	20.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	605.3	
SEC 3 GRANTS MOS-2	0.0	0.0	0.0	96.3	190.0	190.0	190.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	666.3	
SEC 3 GRANTS MOS-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	190.0	190.0	190.0	190.0	67.4	0.0	0.0	0.0	827.4	
															SUM=	2099	
AVAILABLE DEBT SERVICE					8.49	26.88	70.82	67.86	12.67	-11.87	1.35	34.87	60.27	39.64	54.95		
BONDING CAPACITY (FACTOR=9.4822)					80.46	254.84	671.51	643.48	120.11	0.00	12.83	330.60	571.52	375.88	521.06		
LACTC CASH POSITION(INCOME-DEBT SERV-MRCONT)					31.3	41.4	78.9	88.3	33.2	10.8	26.1	51.2	55.4	39.0	76.6		
LACTC CONTRIBUTION TO METRO RAIL(CUM)	51.0	76.4	82.4	152.2	230.1	290.3	308.2	325.9	408.9	527.2	643.4	737.9	808.9	879.9	917.4		
LACTC ELIGIBLE METRO RAIL FUNDS(CUM)	48.2	163.4	228.3	294.4	357.4	413.7	469.8	528.4	590.3	657.4	730.0	806.7	884.8	965.3	1051.5		

CHAPTER 9. MODULE 10: OPERATIONS CASH FLOW MANAGER

The Operations Cash Flow Manager considers projections of costs, revenues, grants, and subsidies accruing to SCRTD for the operations and maintenance of all the bus, heavy rail, and light rail lines for which it will be responsible and calculates annual cash flow for each year in the planning period. In addition, the capital program for the bus system is presented along with a summary of the Metro Rail capital program which is input from Module 11.

The cash flow for operations is balanced by adjusting the base fare. All fare box revenue estimates are calculated with a base fare of $1.00 within the framework of the Urban Transportation Planning System package. For a given year, farebox revenues are adjusted by changing the base fare and simultaneously applying an elasticity model to account for ridership changes resulting from the fare change.

Data stored and calculated in Modules 2, 3, 5, 7, 9, and 11 are input to Module 10 and organized into two sections:

- Section A: Operating Costs, Revenues, and Grants
- Section B: Capital Costs and Grants

Three sets of balances are maintained in developing the cash flow for overall construction and operation of the selected networks:

- Annual and cumulative cash flow for operations;
- Annual and cumulative cash flow for capital;
- Annual and cumulative cash flow for operations and capital combined.

The details of the model are described below. Refer to Figure 9.1 for a printout of Module 10.

9.1 MODULE INPUT

9.1.1 Price Indices

The United States Consumer Price Index (CPI) and associated growth rates are entered for each year in the planning horizon from Module 2. A CPI of 100 is assumed for FY1986, the base year.

9.1.2 Fare Box Revenues

Estimated fare box revenues by year for all modes are input from Module 3. The data for 1985 through 1988 are historical data. The data from 1989

FIGURE 9.1

MODULE 10: OPERATIONS CASH FLOW MANAGER

SCRTD FINANCIAL OPERATING PLAN

MODULE 10 ALIGNMENT 4 MOS-2	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
A. OPERATING COSTS AND REVENUES																	
I. OPERATING COSTS																	
METRO OPERATING COSTS		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1	18.2	19.4	44.1	47.0	50.0	53.2	69.3
LIGHT RAIL OPERATING COSTS		0.0	0.0	0.0	0.0	0.0	0.0	18.1	19.6	26.3	29.5	32.9	36.5	40.3	44.4	48.7	90.7
BUS OPERATING COSTS		461.4	495.8	490.5	510.1	517.6	523.0	544.6	567.1	598.6	625.3	653.2	685.6	679.8	715.7	753.4	761.0
TOTAL OPERATING COSTS		461.4	495.8	490.5	510.1	517.6	523.0	562.7	586.6	642.1	673.1	705.5	726.2	767.1	810.1	855.3	921.0
II. OPERATING REVENUES																	
FARE BOX REVENUES		126.1	196.1	190.8	193.2	234.4	232.0	241.5	251.3	284.0	291.5	299.1	335.9	362.0	389.9	400.2	391.6
AUX REV/LOCAL OPR CONTRIBUTIONS		3.8	4.8	5.8	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.5	4.7	4.9	5.1	5.3	5.5
NON TRANSIT REVENUES		11.7	17.1	9.7	9.5	10.0	10.5	11.0	11.4	11.8	12.2	12.8	13.3	13.9	14.4	15.0	15.6
TOTAL OPERATING REVENUES		141.6	218.1	206.3	206.2	248.0	246.2	256.3	266.7	300.0	308.2	316.4	353.8	380.8	408.4	420.5	412.7
REVENUES LESS OPERATING COSTS	0.0	-319.8	-277.7	-284.2	-303.9	-269.6	-276.8	-306.4	-319.9	-342.0	-364.8	-389.1	-372.4	-386.3	-401.7	-434.8	-508.3
FARE BOX RATIO		0.31	0.44	0.42	0.40	0.48	0.47	0.46	0.45	0.47	0.46	0.45	0.49	0.50	0.50	0.49	0.45
BASE FARE POLICY I,$		0.50	0.85	0.85	0.85	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
ELASTICITY INDEX (BASE $1.00,FY86)						0.986	0.957	0.929	0.901	0.873	0.846	0.820	0.794	0.768	0.743	0.719	0.696
III. OPERATING GRANTS																	
LOCAL AND STATE CONTRACTS		3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
STA REMAINING ALLOC		14.9	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TDA FUNDS REMAIN FOR OPERATIONS		109.3	152.3	106.1	126.5	116.4	124.5	147.5	162.3	174.9	186.6	202.0	213.7	232.9	239.9	237.5	266.2
SECTION 9 OPER		49.1	51.4	54.4	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8
PROP A 40% DISCR		143.0	85.5	115.0	107.5	106.0	110.0	117.9	127.3	137.0	145.3	155.2	165.2	175.8	187.1	199.0	211.6
TOTAL OPERATING GRANTS		319.8	295.7	275.4	280.7	269.2	291.3	312.2	336.4	358.7	378.2	404.0	425.7	455.5	473.8	483.3	524.6
$$$$$$$$$$ OPERATIONS FUND BALANCE	12.0	0.0	17.9	-9.8	-23.1	-0.4	14.5	5.9	16.5	16.6	14.4	14.9	53.4	69.2	72.1	48.4	16.3
$$$$$$$$$$ CUMULATIVE BALANCE	12.0	12.0	29.9	21.2	-2.0	-2.3	12.2	18.1	34.6	51.2	65.6	80.5	133.8	203.0	275.1	323.6	339.8
B. CAPITAL COSTS AND FUNDING																	
IV. CAPITAL COSTS																	
METRO RAIL CAPITAL		0.0	257.2	66.0	197.5	376.0	446.1	370.2	256.4	186.7	254.7	322.0	294.8	277.6	228.2	174.5	88.3
BUS ACQUISITION (FED SHARE MAX)		0.0	0.0	29.6	20.9	32.6	35.5	33.8	32.0	32.1	32.0	31.9	31.8	31.9	31.8	31.5	31.1
BUS ACQUI (LOCAL + DEBT SERVICE)		5.5	7.0	30.0	19.7	16.7	15.6	13.4	13.1	13.5	13.8	11.1	12.9	8.0	16.2	35.1	23.8
BUILDINGS/SUPPORT EQUIPMENT/LAND		40.4	57.0	56.3	47.6	65.3	7.6	7.9	8.2	8.5	8.3	9.2	9.6	9.9	10.3	10.8	11.2
OTHER CAPITAL ITEMS		1.0	1.1	1.8	4.0	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3
TOTAL CAPITAL COSTS	0.0	46.9	322.3	183.7	289.7	492.1	506.3	426.9	311.4	242.5	311.2	376.2	351.1	329.4	288.7	254.0	156.7
FAUS FUNDING(UNIV CITY ROADWORK)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LACTC FUNDS (MR)		0.0	51.0	25.4	6.0	69.8	77.9	60.2	17.9	17.7	83.1	118.2	116.3	94.5	71.0	71.0	37.5
TDA CAPITAL GRANT(BUSES)		13.1	0.0	34.1	33.2	31.3	18.7	16.6	14.9	15.8	16.4	14.1	16.2	11.8	20.4	39.4	28.3
LOCAL FUNDS AND ETC(BUSES)		1.5	23.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENEFIT ASSESSMENT DISTRICT(MR)		0.0	0.0	0.0	18.5	30.5	38.5	27.7	40.1	31.0	0.0	0.0	0.0	15.0	19.0	0.0	0.0
CITY OF LOS ANGELES(MR)		0.0	0.0	10.0	12.0	12.0	11.0	11.0	10.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUIDEWAY FUND(MR)		0.0	58.0	10.9	48.1	46.2	58.2	53.4	36.2	23.6	21.6	15.7	8.8	8.3	6.8	3.1	0.0
UMTA SECTION 9(MR)	0.0	0.0	15.8	8.3	14.5	20.7	18.2	10.2	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UMTA SECTION 9(BUSES)	179.3	38.2	22.8	35.2	41.1	45.3	41.6	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1
UMTA SECTION 3(MR)		0.0	132.4	11.4	98.4	196.8	242.3	207.8	149.8	111.0	130.0	187.1	169.7	159.8	131.4	100.4	50.8
TOTAL CAPITAL GRANTS	179.3	52.8	303.5	144.3	271.9	452.5	506.3	426.9	311.4	242.5	311.2	376.2	351.1	329.4	288.7	254.0	156.7
$$$$$$$$$$ CAPITAL FUND BALANCE	179.3	5.9	-18.8	-39.4	-17.9	-39.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$$$$$$$$$$ CUMULATIVE BALANCE	179.3	185.1	166.3	126.9	109.0	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4
$$$$$$$$$$ OPERATIONS & CAPITAL BALANCE	191.3	5.8	-0.9	-48.2	-41.0	-40.0	14.5	5.9	16.5	16.6	14.4	14.9	53.4	69.2	72.1	48.4	16.3
$$$$$$$$$$ CUMULATIVE BALANCE-ALL FUNDS	191.3	197.1	196.3	148.1	107.1	67.1	81.6	87.5	104.0	120.6	135.0	149.9	203.3	272.5	344.6	393.0	409.3

and beyond are adjusted for escalation and are derived from UTPS simulations.

9.1.3 Operating Subsides: Bus/Rail

Several operating subsides and non-transit revenues are input directly from Module 5. These include estimates of the following sources:

- o Proposition A 40% Discretionary Funds
- o TDA Article 4 Funds (For Operations and Capital)
- o STA Remaining Allocation (No funds are projected after 1986 from this source)
- o UMTA Section 9 Operating Grants
- o Auxiliary and other Non-Transit Revenues

9.1.4 Capital Grants: Bus Systems

Funds available for bus capital programs are entered directly from Module 5. These funds include:

- o Other Local Funds
- o UMTA Section 9 for bus capital

Capital grant and subsidy data for Metro Rail construction are entered from Module 11.

9.1.5 Operating Costs

Estimated operating and maintenance costs by year are input directly from Module 7 for each operating mode: Metro Rail; light rail; and buses. Operating costs are escalated in Module 7. However, the bus operating costs through FY 1989 are based on historical data and SCRTD budget estimates.

9.1.6 Bus System Capital Costs

Projected bus system capital costs by year are input directly from Module 9. Capital costs for buses are presented in four categories:

- o Bus Acquisition-Federal Share. UMTA Section 9 Capital grants provide up to 80% of bus system capital costs.
- o Bus Acquisition-Local Share. Local funding sources, particularly TDA, provide local matching funds for bus purchases and debt service payments for existing Equipment Trust Certificates.

- o Buildings/Equipment/Land. SCRTD is engaged in an ongoing program of providing facilities at strategic locations throughout Los Angeles County to ensure efficient reliable bus service.

- o Other Capital Items. These include a variety of relatively low-cost capital items.

9.1.7 Metro Rail Capital

Estimated annual expenses for construction of Metro Rail are input from Module 11. The sources of funds for Metro rail are input from Module 11 as well. The annual contributions of each funding partner on an annual basis are entered to provide a summary of all SCRTD operating and capital fund expenditures and income sources.

9.2 CALCULATIONS

9.2.1 Total Operating Costs

Total Operating Costs are the sum of heavy rail, light rail, and bus operating and maintenance costs input from Module 7 in terms of escalated dollars.

9.2.2 Fare Box Revenues

The Fare Box Revenues for all modes as input from Module 3 are calculated by applying SCRTD's fare policy with a base fare of $1.00 to the ridership estimates of the UTPS simulations on network configurations. The fare box revenue estimate for a given year is the real dollar fare box revenue in terms of FY 1986 dollars. The fare box revenue is converted to current dollars by multiplying by the appropriate escalation factor for each year. This has the effect of increasing the base fare each year by the estimated annual consumer price index growth rate. Inasmuch as the base fare in 1986 is $1.00, the base fare in any year beyond 1986 is the escalation index with a base of 1 in 1986.

The fare charged in any future year, however, very likely will be different from the base fare for that year. Thus, the revenue must be modified to account for this fare differential. This is done with an Elasticity Index.

9.2.3 Elasticity Index

Elasticity is expressed as the ratio of the percent change in trips to the percent change in fare:

$$E = \frac{\%\ \text{Change in Trips}}{\%\ \text{Change in Fare}}$$

This is an example of the demand-price curve in which the sales (demand) for a particular product or service decreases as the price increases. The

demand for competitive products is said to be elastic (elasticity > -1.0) because a small percentage increase in price results in a higher percentage decrease in sales and an overall drop in revenues. On the other hand, non-competitive products are said to have an inelastic (elasticity <-1.0) demand because an increase in price results in a smaller percentage decrease in demand and an overall increase in revenues.

Transit is an example of a service with an inelastic demand function. Most transit agencies have historical data on price-ridership changes such that they have a good estimate of the elasticity for their operation. SCRTD has developed an elasticity of -0.25. The relationship for SCRTD is written as follows:

$$\frac{TRIPS(F) - TRIPS(B)}{TRIPS(B)} = -0.25 \frac{FARE(F) - FARE(B)}{FARE(B)}$$

where F refers to future values of trips and fares while B refers to base values of trips and fares. The following relationship is well known:

$$REV = TRIPS * FARE$$

where REV is the annual revenue. This may be rewritten as:

$$TRIPS = REV/FARE$$

and substituted in the SCRTD Elasticity model above:

$$\frac{REV(F)/FARE(F) - REV(B)/FARE(B)}{REV(B)/FARE(B)} = -0.25 \frac{FARE(F) - FARE(B)}{FARE(B)}$$

After some algebraic manipulation, the expression is reduced to:

$$\frac{FARE(B)}{FARE(F)} * \frac{REV(F)}{REV(B)} = 1 - 0.25 \frac{FARE(F) - FARE(B)}{FARE(B)}$$

This expression is solved for the Future to Base Revenue ratio which is referred to as the elasticity index.

$$\frac{REV(F)}{REV(B)} = \frac{FARE(F)}{FARE(B)} * \left(1 - 0.25 \frac{FARE(F) - FARE(B)}{FARE(B)} \right)$$

For example, the escalation factor for 1990 is 1.1649. Call this FARE(B). The actual fare in 1990 probably will be $1.10, the fare for FY 1989. Substitution of these fares in the above expression yields an elasticity index of 0.957. The Fare Box Revenue is estimated for 1990 by multiplying the Module 7 value by 0.957.

9.2.4 Total Operating Revenues

Total operating revenues are the sum of fare box revenues, auxiliary revenue, and non-transit revenues for each year.

9.2.5 Fare Box Ratio

The Fare Box Ratio is the ratio of total revenues to total operating costs.

9.2.6 Total Operating Grants

Total operating grants are the sum of grants received by SCRTD for operations and maintenance activities. These are 3 primary sources of operating grants:

- o TDA Funds for Operations
- o UMTA Section 9 for Operations
- o Proposition A 40% Discretionary Funds

9.2.7 Capital Costs and Funding

These data on capital costs and funding sources are input directly from other modules and transferred to the table shown on Figure 9.1. Total capital costs and total capital grants are calculated through summation.

9.3 CASH FLOW BALANCES

Module 10 is the final operating module and does not produce data for other modules. Module 10 provides a summary of all expense and income streams accruing to SCRTD. The module also provides annual and cumulative totals for all funds related to operations, capital, and the combination of operations and capital.

In general, the capital side of the equation is balanced. The Metro Rail program is balanced upon input from Module 11. The bus capital program may be balanced with the funds available from UMTA Section 9, TDA Capital Grants, and other local funds such as Equipment Trust Certificates.

The operations and maintenance side of the equation sometimes runs at a deficit. SCRTD in the past has acted to balance the budget by some combinations of the following 3 options:

- o Reduce service by cutting lines or increasing headways.
- o Reduce costs by invoking measures designed to save operations dollars.
- o Increase fares.

The principal measure used in Module 10 is adjustment of the fares. Fare box revenues are calculated using SCRTD fare policy and a base fare of $1.00 for FY 1986. SCRTD's fare policy is included in Figure 9.1. The

fare was $0.50 in 1985 and $0.85 in 1986, 1987, and 1988. The fare was raised to $1.10 for FY 1989. The fare beyond 1989 must be adjusted by the user in an effort to balance the cash flow.

9.3.1 Operating Fund Balances

The operating fund balance represents the net funds available from operations. The fund balance is the sum of revenues and grants minus operating costs for each fiscal year. The cumulative operating fund balance is a running total of operating fund balances from year to year.

9.3.2 Capital Fund Balances

The capital fund balance represents the net funds available from the capital program of the District. The fund balance is equal to total capital grants minus total capital expenses for each fiscal year. The cumulative capital fund balance is the running total of capital fund balances from year to year.

9.3.3 SCRTD Balance: All Funds

The combined operations and capital balances represent the net funds available to SCRTD each fiscal year after accounting for all income and cost streams for operations and capital. The combined balance is the sum of the operating fund balance and the capital fund balance for each fiscal year. The cumulative balance of all operating and capital funds is a running total of operations and capital balances from year to year.

CHAPTER 10. SUMMARY AND APPLICATIONS

10.1 LODESTAR USER'S MANUAL

The LODESTAR User's Manual includes an overview of the LODESTAR cash flow modeling system. A description of each of the 9 functioning modules is included. The Manual includes a set of instructions for using MULTIPLAN on a PC. However, the main thrust of the Manual is on the set of procedures and instructions for using LODESTAR. Finally, several potential management uses of LODESTAR are discussed. Please refer to Technical Memorandum 88.5.2 for this Manual.

10.2 LODESTAR TECHNICAL DOCUMENTATION

This Technical Memorandum includes documentation of each working component of LODESTAR. Each module is described in detail. The discussion includes all input elements to the Module, a summary of all pertinent calculations performed on the data, and all output elements of the Module.

The source of all input data is identified either as external to LODESTAR or as output from another Module. All variables and inter-relationships are defined. The text includes sample outputs of each Module so that the user is able to follow the documentation.

10.3 APPLICATIONS

One of the major features of LODESTAR is the ability to change input data rapidly, to run other Modules as necessitated by the changes, and to assess the impact of the changes on cash flow. In reality, data changes fall into one of two categories:

- Real changes over which the user has no control. Actual data values may be used rather than forecast values. The actual amount of Proposition A funds collected in FY 1986, for example, may be substituted for the forecast figure. A revised set of forecast figures may be published by an agency. For example, the current LODESTAR incorporates the fourth set of Consumer Price Indices since formulation of the model began. An agency such as LACTC may revise their policies relative to funding mechanisms or the allocation percentages dedicated to various purposes.

- Changes which the user makes to test various funding scenarios. Many of these changes fall into the "what if" category; for example, "What happens to cash flow if federal funds are cut in half or are doubled?" Other changes of this type include the year of implementation of a project,

the duration of a project, capital cost distributions, cost streams, income streams, etc.

Another application is sensitivity analyses. It may be possible for certain variables or forecasts to determine optimistic, most likely, and pessimistic values and then to measure the impact on cash flow. If the impact is minor, use of the most likely values will not introduce appreciable error. If the impact is significant, greater effort should be expended in refining the value to be used in the analysis.

Obviously, the user of LODESTAR will generate scenarios for testing in accordance with cost and funding assumptions of interest. LODESTAR should prove to be an effective management tool.