Chapter 2

COST PROXY MODEL BASICS

This section contains an overview of the concepts behind the Cost Proxy Model and is intended for a general audience. The Appendixes give more detailed information and explanations.

2.1 Purpose

The Cost Proxy Model is a co-development effort between Pacific Bell and INDETEC International. The purpose of the model is to determine a Universal Service provider's subsidy funding requirements using cost proxies for basic services. This requires building a cost proxy model that will estimate the cost of providing residential service (1FR, 1MR, Lifeline), and compare those costs with monthly basic service revenue.

In order to develop the model, we needed to answer the following questions:

- What is the cost of providing Universal Service?
- What is a Universal Service provider's subsidy funding requirements?
- What is the cost for Basic Service to every customer?
- Which customer or group of customers are being provided service below costs?
- What is the amount of subsidy that is being provided to this customer or group of customers?

2.2 Background Definitions

In order for the user to understand the model, the following definitions provide the background from which cost of service is developed.

Universal service - the provisioning of affordable telephone service to all customers. The CPM was first implemented in California where **Universal Service** was defined to include the following:

- access to single-party residential local exchange service
- access to interexchange carriers
- ability to place and receive calls
- touch-tone dialing
- free access to emergency services, 911/E911
- access to directory assistance
- lifeline rate for eligible customers
- customer choice of flat or measured rate service
- access to directory listing

- access to operator services
- voice grade connection to public switched telephone network
- access to information services and 800 services
- one-time free blocking for information services and one-time billing adjustments for charges incurred inadvertently, mistakenly, or that were unauthorized
- access to telephone relay service as provided for in PU Code 2881
- access to public policy pay telephone
- free access to customer service for information about ULTS, service activation, service termination, service repair and bill inquiries

The CPM is flexible and can accomodate alternative lists of elements to be included in the definition of Universal Service.

2.3 Engineering Data Assumptions

This section provides the engineering assumptions used to develop the cost of basic service.

- Interoffice is 100% Fiber, Feeder is Fiber (>9kft) Copper (<9kft) mix
- Litespan/DLC (Digital Loop Carrier) systems used when Loop >9,000 ft
- Distribution is dedicated
- SAI (Serving Area Interface) is considered feeder
- Distribution buried plant is engineered at a ratio of 2 lines per household
- Distribution aerial plant is engineered at a ratio of 1.5 lines per household
- Distribution planning is not affected by demographics. If more lines are needed, DAML technology is used
- MOU and Messages per subscriber per month in the BH are based on BellCore models SCIS and/or NCAT
- Costs are based on capacity used and the investment amount is defined specifically by (Density, Terrain, Length of loops, and Switch type)

2.4 Current Model Methodology

This section presents important design elements in the Cost Proxy Model. Detailed descriptions of some of the elements can be found in the Appendixes.

- A "bottoms-up" approach to costs. The model separates costs into their most basic (that is, "smallest") level of detail. This approach provides a solid base for cost projection.
- The model is based on standard economic principles and has a sound financial basis.
  - TSLRIC (Total Service Long Run Incremental Cost) methods
  - Capacity Costs investment drivers
  - Activity Based Cost (ABC) operating expense drivers
- The model is forward looking. It allows us to use history, and project the future.
  - Engineering model and technologies used

  - Capital costs
- The model is meaningful because numbers are expressed in network components such as:
  - Cost per foot of aerial copper
  - Cost per foot of buried copper
  - Cost per line termination
  - Cost per switched minute of use

- Customer information is derived by dividing a state into a grid of 1/100 of a degree latitude and longitude squares. Census data, company data and other demographic data is then summarized at the grid level to approximate the number of customers within the grid.

- Distance is calculated using the latitude and longitude of each grid and the company locations for switches. Distances are first split into feeder and distribution based on ratios developed from actual data. Distances are then converted to route distances based on statistically derived ratios. Distances determine the amount of outside plant facilities needed and the type of loop technology to be used.

- The geographical grid area is analyzed to determine the density, terrain, soil type, water table depth, etc. The values analyzed are those thought to influence costs.

- The values of the simple cost components are adjusted based on each customer's specific characteristics. These characteristics include technology, switch type, density, terrain, soil type, depth to rock, etc.

- Finally, using the grid's distance, the model will develop the Cost Proxy for all customers within the grid.

- Once investment costs are derived, company specific estimates of operating costs per line can also be applied; for example:
  - Cost per bill
  - Average monthly repair costs
  - White page listing costs

- Costs are then collected and attributed to the grid and are compared to revenues to calculate subsidy amounts. Subsidy is the difference between the cost of providing service and the amount of revenue received from the customer for that service

- The grid costs can also be summarized in a number of ways as long as the data is related to a grid; for example,
  - By Central Office
  - By Zip Code

- By Census Block Group
- By political boundaries
- etc..

Chapter 3

Model Structure and Platform

The Cost Proxy Model is designed using SAS® software and Microsoft® Excel. It runs best on a Pentium-based machine using Microsoft® Windows NT or Windows®95. It is based on a modular design using a table-driven database structure. Ongoing maintenance is minimal. The user only verifies that tables are up-to-date and that current raw customer data has been obtained.

3.1 Data Requirements

The Cost Proxy Model is heavily dependent on user input. The user input consists of predefined data tables. The following overviews the specific tables. For a detailed listing of the layout of each table, refer to the CSV (Comma Separated Value) file in the Appendix.

3.1.1 Geographic Data

- **Household file at Grid level. (CENSUS.CSV)** Census level data or some other substitute for Residential lines. This file contains household count information at the grid level.
- **Daytime population file at Grid level. (DAYPOP.CSV)** Census level data or some other substitute for Business lines. This file contains daytime population values at the grid level.
- **State Census Block Group (CBG) file. (ST_CBG.CSV)** State information at grid level that provides the CBG of each grid.
- **State Grid file (ST_GRID.CSV)** State information at grid level that provides the political district, CLLI, distance to CLLI from the center of the grid, and square mile area of each grid.
- **Terrain file (TERRAIN.CSV)** State information that provides the terrain characteristics of each Grid.

3.1.2 Customer/Lookup Data

- **Usage Values file (USAGE.CSV)** Provides the monthly number of messages per service as well as the associated shared switching investment.
- **Wire Center file (WC.CSV)** State information that provides location, owner, tariffed rates, and switch type for each CLLI (wire center) within the state.
- **Operating Exp. Ratios file (OPX_RTO.CSV)** Provides ratios to estimate a company's operating expenses as compared to the statewide average operating expenses.

- **Feeder Route/Air Ratios file (FDR_RTO.CSV)** Converts air feet to estimated route feet in the feeder plant.
- **Density Type file (DENS_TYP.CSV)** Provides the definition of the Density types used in the model.
- **Distance Type file (DIS_TYP.CSV)** Converts air feet to estimated route feet in the distribution plant.
- **Engineering Rules file (ENG_RUL.CSV)** Provides some of the basic engineering rules.
- **Feeder % W/O SAI file (MIS_SAI.CSV)** Provides the ratio of feeder to distribution plant for a given total distance.
- **Surface Classifications file (SURF.CSV)** Provides the indication of which soil types affect installation costs.
- **Factors file (FACTORS.CSV)** Provides conversion factors for census data. These conversions are for Households to Residence lines and Daytime population to Business lines.

3.1.3 Engineering/Cost Data

- **OSP (Outside Plant Specifications) Spec file (OSP_SPC.CSV)** Provides percentage of aerial, buried, and underground cable used for a specific grid based on density. This file also contains some outside plant electronics used by a particular service (that is, 1FR).
- **CO/IO (Central Office/Interoffice) Spec file (SIO_SPC.CSV)** Provides the switching and interoffice investment items consumed by a particular service.
- **Stc Svc (Standard Service) Spec file (STD_SPC.CSV)** Based on the definition of Basic Service, provides the operating expense items to include with a service.
- **A + B Cost file (AB_CST.CSV)** Capitalized cost of outside plant equipment.
- **Outside Plt Adj (Plant Adjustment) file (OSP_FCT.CSV)** Provides an adjustment to the capitalized value of cable plant based on the density value and terrain type.
- **Annual Chg Fctr (Charge Factor) file (ACF.CSV)** Annual charge factor table. Used to convert investments into costs.
- **Operating Exp (Expense) file (OTH_EXP.CSV)** Provides operating expenses at a line level in predefined categories (for example, billing).
- **Cable Size file (CBL_SIZ.CSV)** Given certain density zones, this table provides the average outside plant cable size used.
- **Other Inv (Investment) file (OTH_INV.CSV)** This is a file that contains those investment items driven only by lines (for example, terminal, drop, SAI).
- **Fill Level file (FILLS.CSV)** Provides the going forward actual plant utilization rates.
- **Switch / IO (Interoffice) file (SIO_INV.CSV)** Switch and Interoffice investment by line, message, etc.

Basic System Design

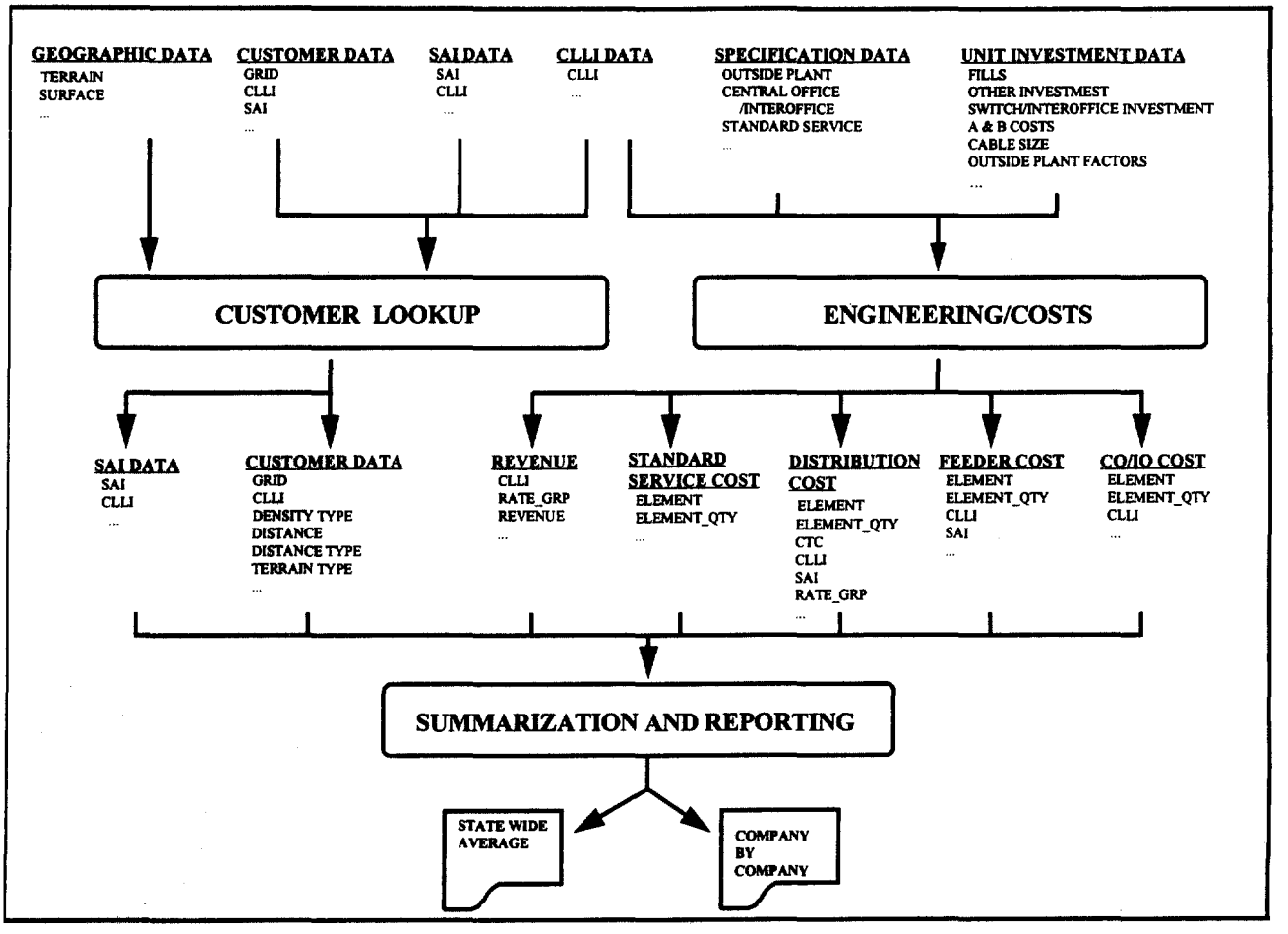


Figure 3-1 - Basic System Flow

3.3 Basic System Description

This section gives a description of the basic Cost Proxy Model system.

3.3.1 Data Input

The user provides all of the information contained in the engineering and lookup tables.

3.3.2 Customer Lookup Engine

Externally generated decode tables are used to convert data values into classification values that trigger program logic. These decodes help trigger the engineering decisions as well as determining the various cost elements to be used for each customer. (For example, the density type table contains 7 to 10 classifications of density that trigger different engineering decisions. A high density area may require different cable sizes than a low density area.)

- ***Customer:*** The lookups for customer provide the terrain type, density type, and the conversion of the distance into a route distance.
- ***SAI:*** The lookups for SAI provide the terrain type, density type, technology type, and the conversion of the distance into a route distance.
- ***CLLI:*** The lookups for CLLI provide the density type and switch usage characteristics.

3.3.3 Engineering/Costs Engine

Costs are unitized at the pertinent dimensional level (density type, terrain type, technology type, switch type, and distance). For example, aerial cable installed cost per foot/per month in a rural central office, in sandy soil, in a low density cell is $0.05. Aerial cable installed cost per foot/per month in an urban central office, in bedrock, in a high density cell is $0.25.

The specification tables identify the cost elements used by the service in each part of the plant (for example, distribution, feeder, etc.). The costs for distribution, feeder, switch, interoffice, and standard services are determined using the specification values and unit cost tables.

3.3.4 Summarization and Reporting Engine

The SAI, customer, and all cost data is joined and summarized into files for reporting purposes. Detail and summary reports can be generated by company, state representative and

senate districts, census block group, density type, terrain type, CLLI, and class of service. This model also generates a statewide average report.

Chapter 4

ONLINE SYSTEM

The online system is built using the SAS® software system. Data is input using Microsoft® Excel through Comma Separated Value (CSV) files. Any questions regarding use of the system can be referred to INDETEC International.

This section explains the processes used to start the system, load the entire model, update data files and bring the system up-to-date, run a sensitivity analysis to see how changes to various tables affect the output results and how to run a report.

4.1 Starting the System

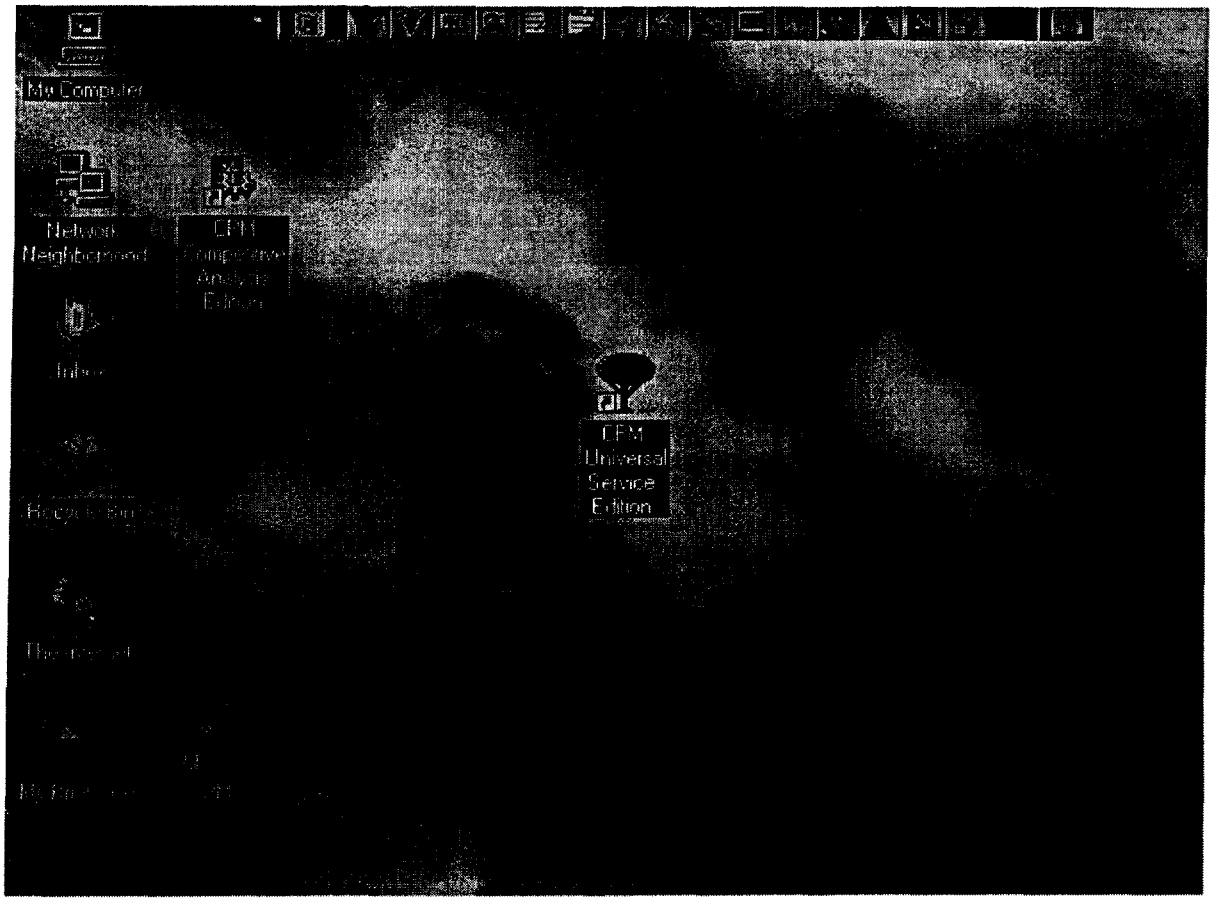


Figure 4-1 - Microsoft ®Windows®95 Screen with Cost Proxy Model Icon

STEP 1. To start the system, double-click on the CPM Universal Service icon.

4.1.1 Cost Proxy Model (CPM): Universal Service Edition Main Menu

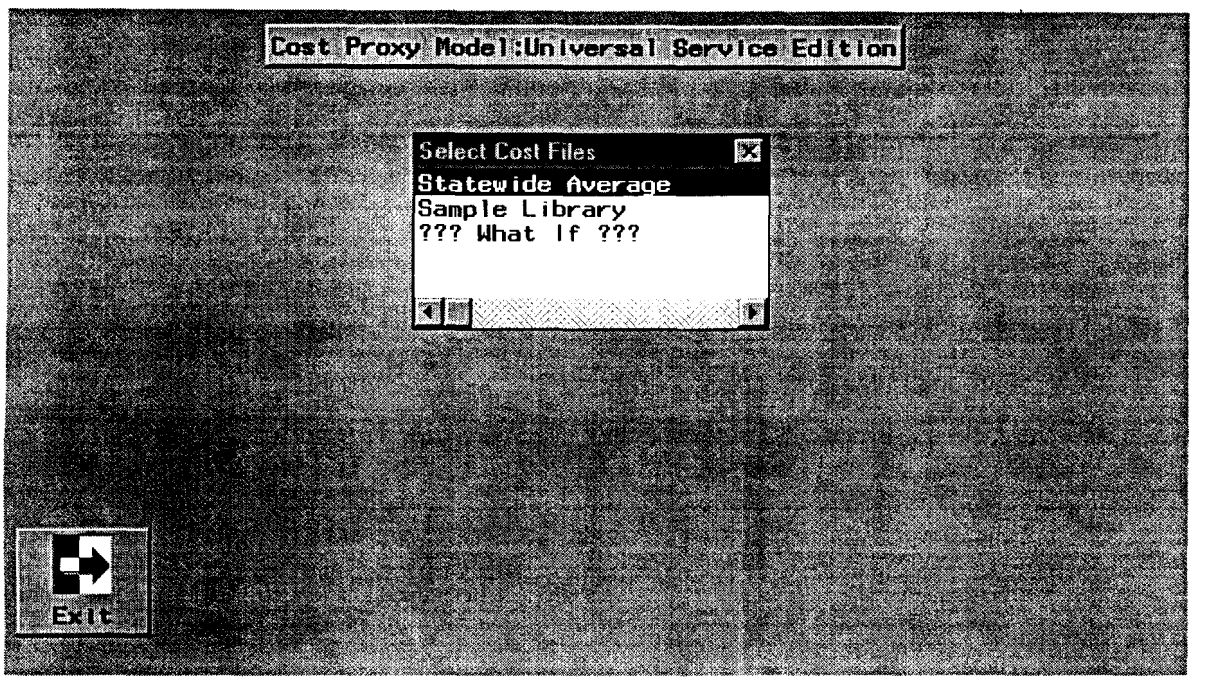


Figure 4-2 - CPM: Universal Service Edition Cost File Menu

STEP 2. Click on the cost files you want to use for your modeling.

- Statewide Average - produces reports based on the statewide average cost characteristics
- Sample Library - Contains Sample data for user to see how all files are set up and how system runs
- ??? What If ??? - allows you to change the cost files and run "What If" scenarios without affecting the Statewide Average values

4.2 Update or Load Data (CSV) Files

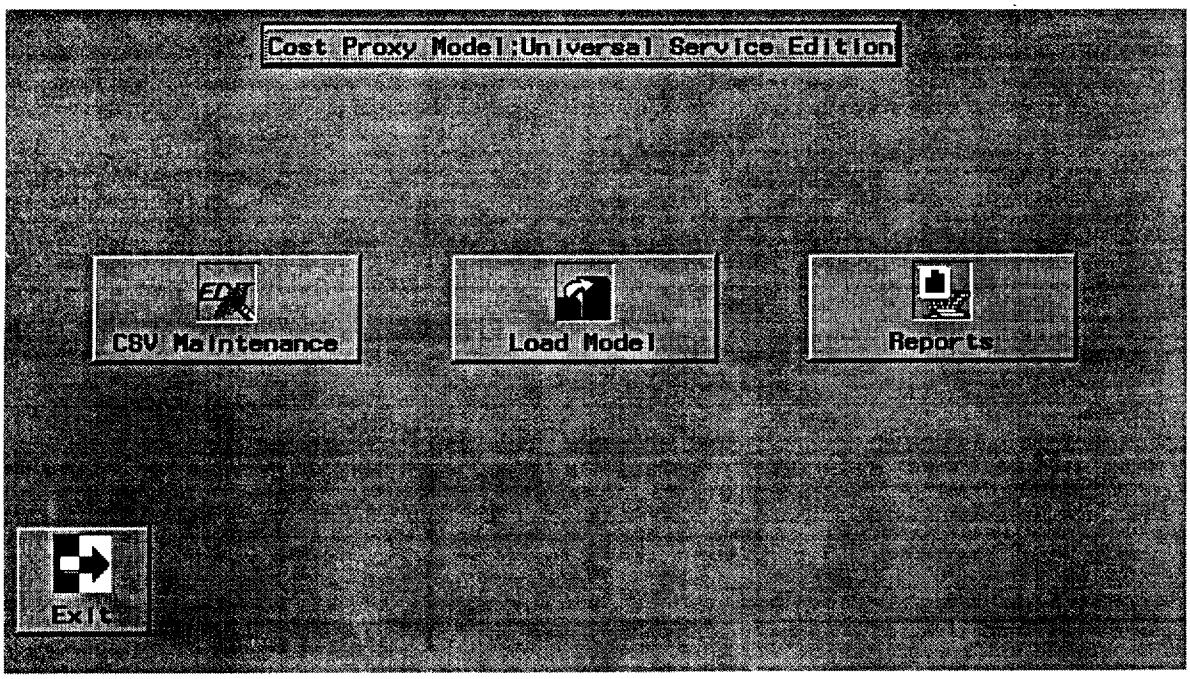


Figure 4-3 - CPM: Universal Service Edition Main Menu

- CSV Maintenance - menu selection allows the user to edit/update the CPM data
- Load Model - menu selection allows the user to Initially load the CPM System or reload based on CSV changes
- Reports - menu selection allows user to produce various types of output.

STEP 1. Click the CSV Maintenance button.

4.2.1 CSV Maintenance Screen

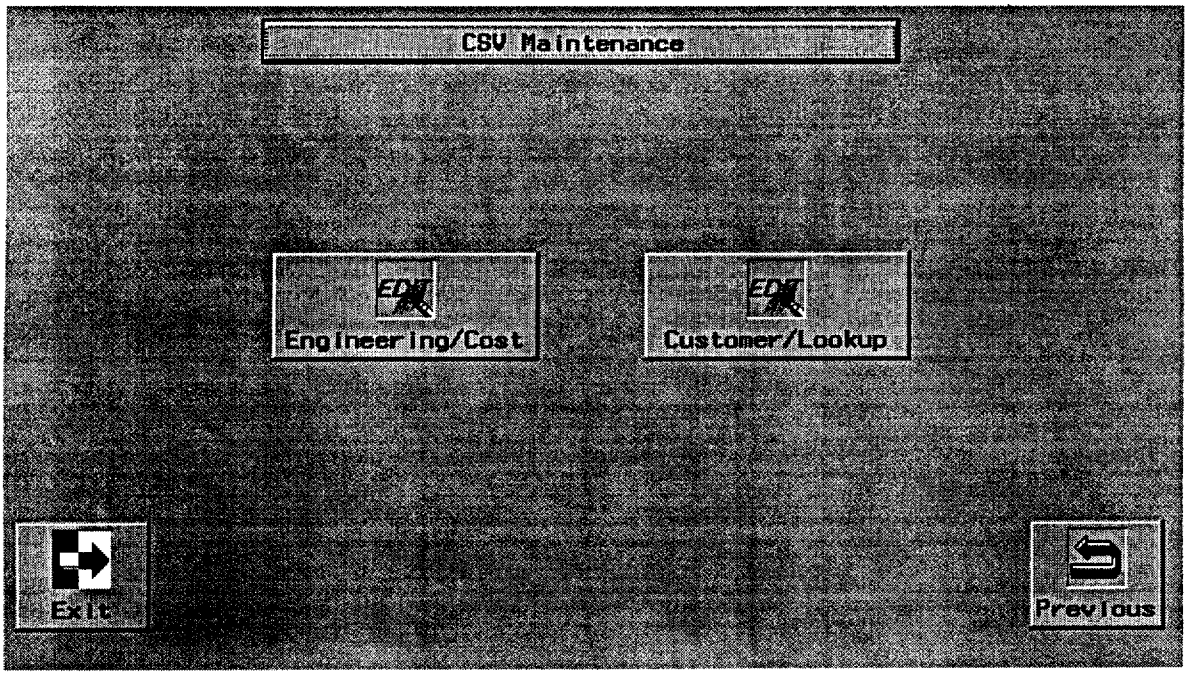


Figure 4-4 - CSV Maintenance Screen

- Engineering/Cost - menu selection will allow user to modify the data referred to in Section 3.1.3
- Customer/Lookup - menu selection will allow user to modify the data referred to in Section 3.1.2 (certain input files are on the screen)

STEP 2. Click the appropriate button to access either the Engineering/Cost or Customer/Lookup selection screen.

4.2.2 CSV Maintenance - Engineering/Cost Screen

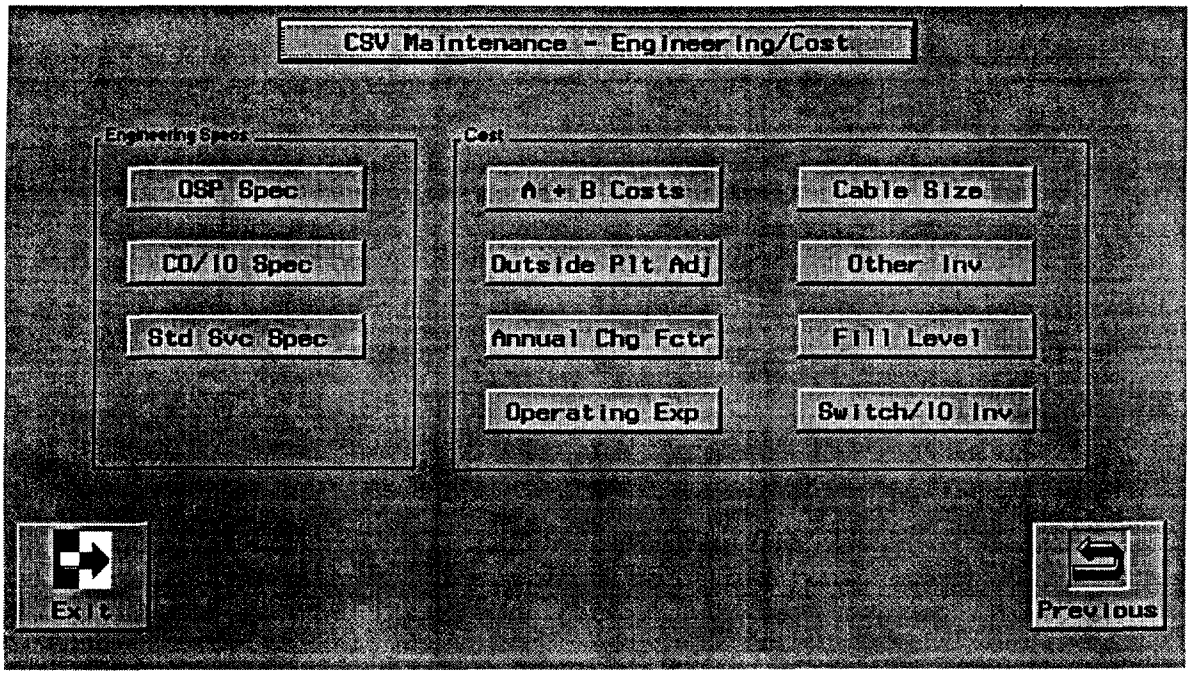


Figure 4-5 - CSV Maintenance Engineering/Cost Screen

- Description of files can be found in Section 3.1.3 or Appendix E

STEP 3. **Click the appropriate button depending upon the changes you want to make. This launches Microsoft® Excel so you can edit the CSV file.**

or

4.2.3 CSV Maintenance - Customer/Lookup Screen

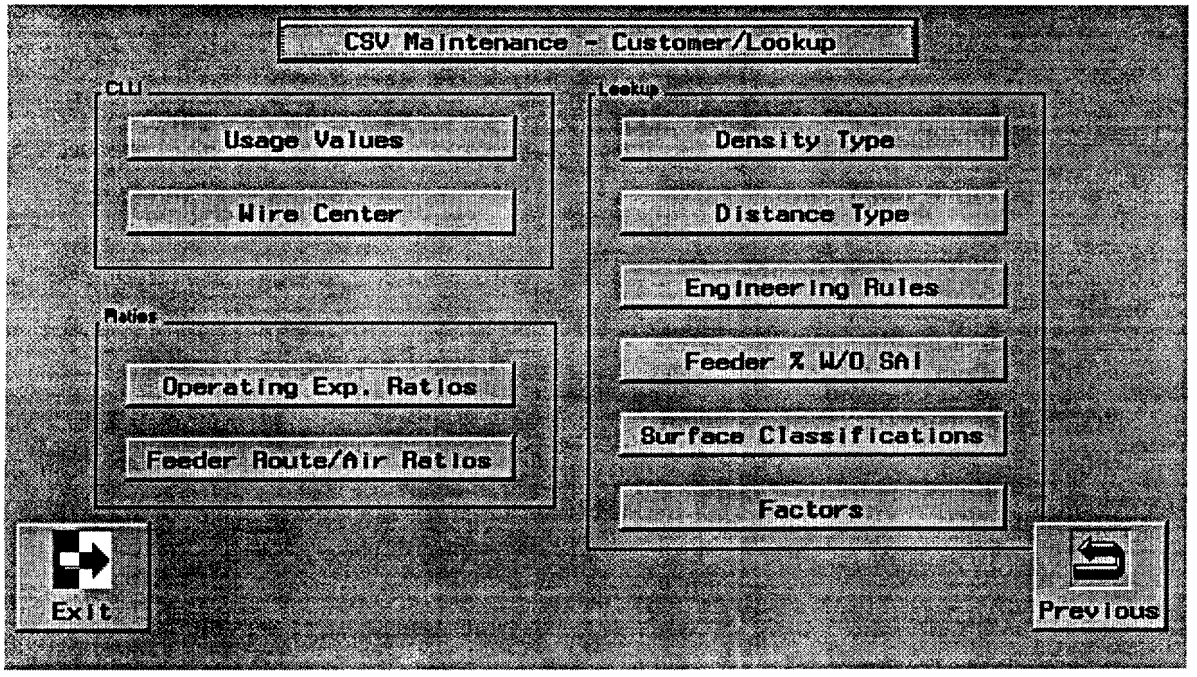
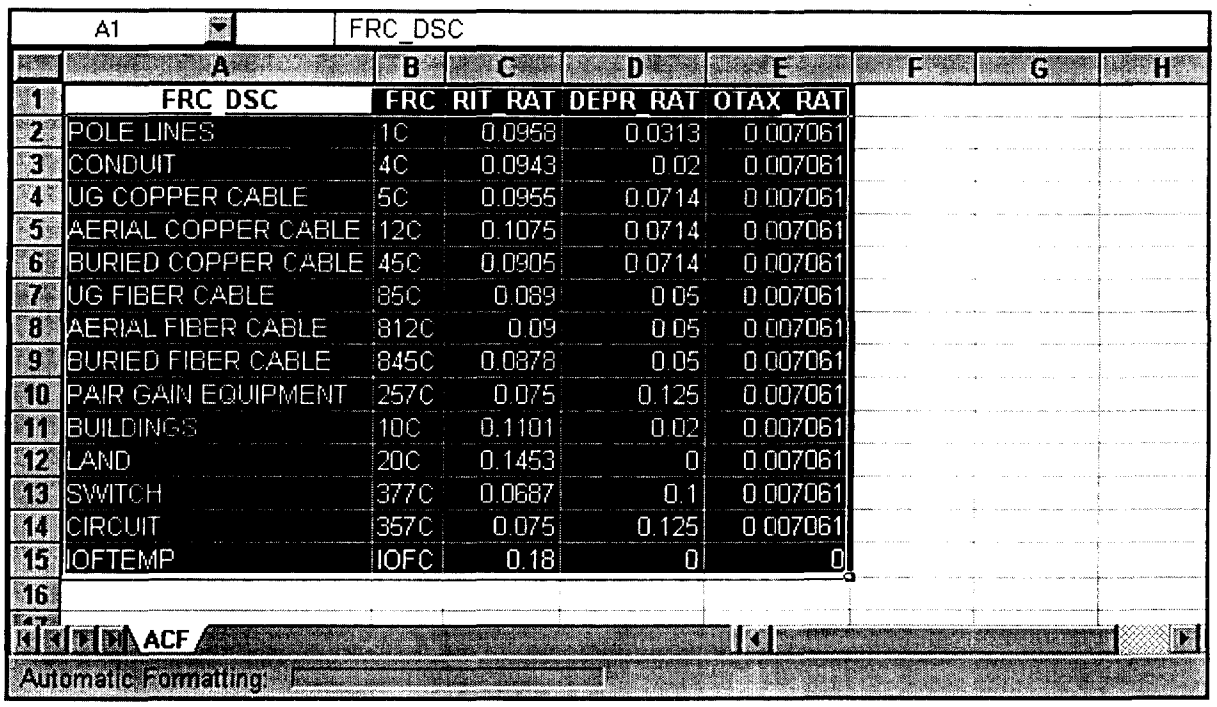


Figure 4-6 - CSV Maintenance - Customer/Lookup Screen

- Description of files can be found in Section 3.12 or Appendix E

STEP 3. **Click the appropriate button depending upon the changes you want to make. This launches Microsoft® Excel so you can edit the CSV file.**

4.2.4 CSV Editing through Microsoft® Excel



A1 FRC_DSC

	A	B	C	D	E	F	G	H
1	FRC_DSC	FRC	RIT_RAT	DEPR_RAT	OTAX_RAT			
2	POLE LINES	1C	0.0958	0.0313	0.007061			
3	CONDUIT	4C	0.0943	0.02	0.007061			
4	UG COPPER CABLE	5C	0.0955	0.0714	0.007061			
5	AERIAL COPPER CABLE	12C	0.1075	0.0714	0.007061			
6	BURIED COPPER CABLE	45C	0.0905	0.0714	0.007061			
7	UG FIBER CABLE	85C	0.089	0.05	0.007061			
8	AERIAL FIBER CABLE	812C	0.09	0.05	0.007061			
9	BURIED FIBER CABLE	845C	0.0878	0.05	0.007061			
10	PAIR GAIN EQUIPMENT	257C	0.075	0.125	0.007061			
11	BUILDINGS	10C	0.1101	0.02	0.007061			
12	LAND	20C	0.1453	0	0.007061			
13	SWITCH	377C	0.0687	0.1	0.007061			
14	CIRCUIT	357C	0.075	0.125	0.007061			
15	IOFTEMP	IOFC	0.18	0	0			
16								

ACF

Automatic Formatting

Figure 4-7 - Sample Excel Editing Screen

STEP 4. Edit the CSV file.

- Do **not** edit or delete the header line
- Descriptions of each CSV are in Appendix E
- Be sure to validate your data - the system does not check for **validity** of data
- Do **not** save file as a Microsoft® Excel worksheet. It **must** be saved in its current (CSV) format.

After you make any changes, exit Excel; this takes you back to CPM.

4.3 Update or Load CPM System

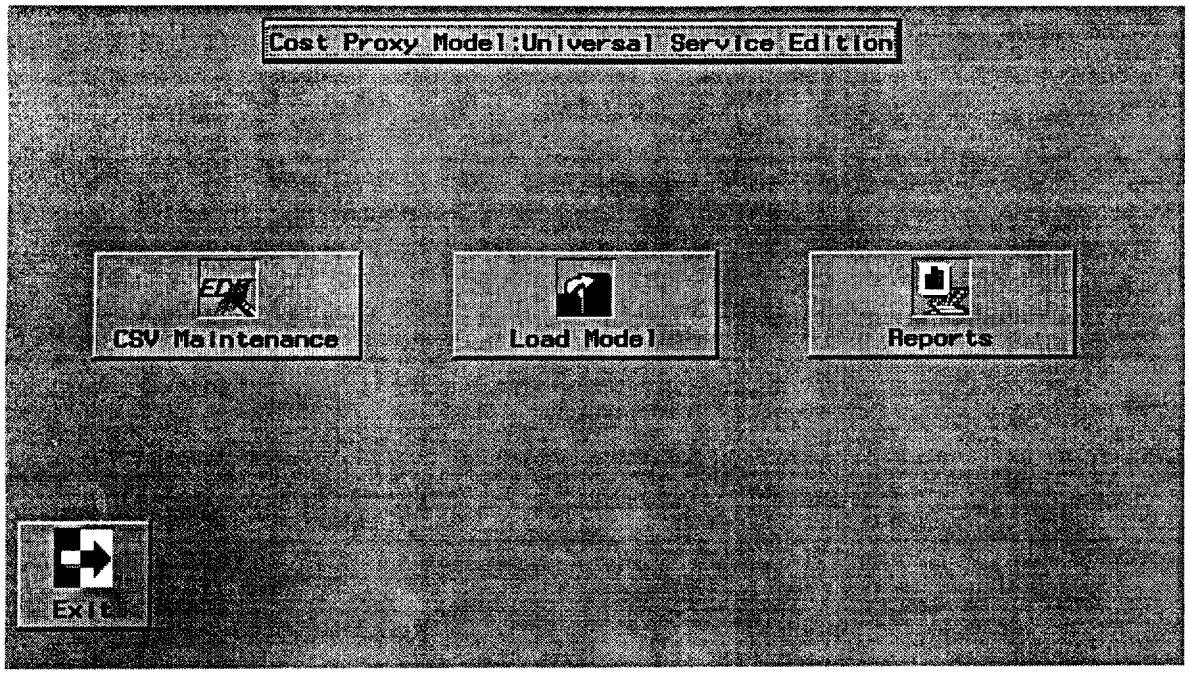


Figure 4-8 - CPM: Universal Service Edition Main Menu

- CSV Maintenance - menu selection allows the user to edit/update the CPM data
- Load Model - menu selection allows the user to Initially load the CPM System or reload based on CSV changes
- Reports - menu selection allows user to produce various types of output.

STEP 1. From the Main Menu, click the Load Model button.

4.3.1 Load Model Screen

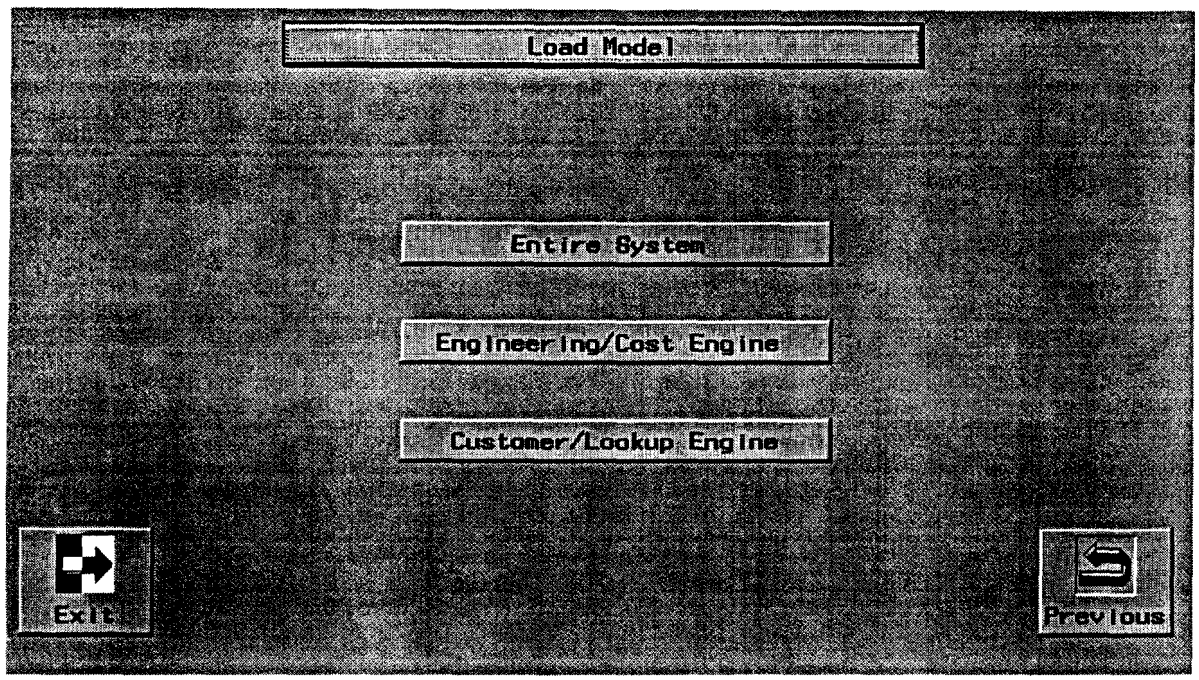


Figure 4-8 - Load Model Screen

STEP 1. Click on the appropriate button depending on which model you want to load.

- The Entire System loads/reloads the entire system.
- The Engineering/Cost Engine reloads the Engineering/Cost system tables based on changes made to the Engineering/Cost CSV files.
- The Customer/Lookup Engine reloads the Customer/Lookup system tables based on changes made to the Customer/Lookup CSV files

Loading the Entire System or the Customer/Lookup Engine takes approximately 1-2 (or more) hours (based on type of machine used) and requires additional system resources.

STEP 2. Return to the Main Menu.

4.4 Run a Detail Report

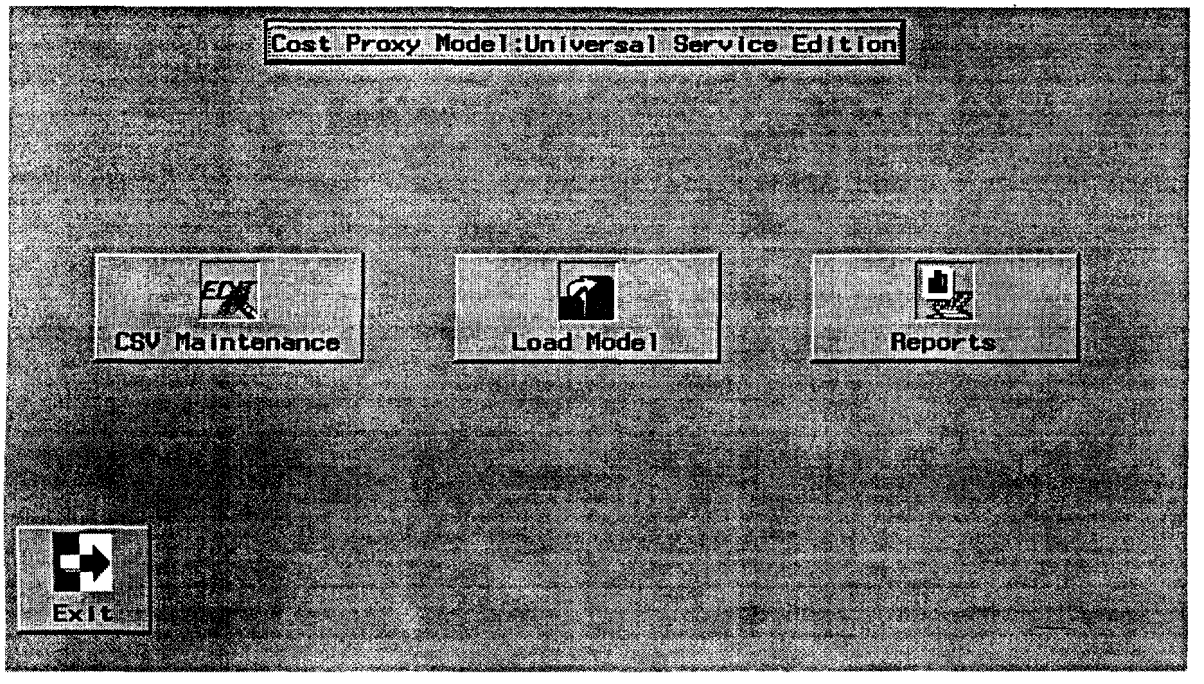


Figure 4-10 - CPM: Universal Service Edition Main Menu

- CSV Maintenance - menu selection allows the user to edit/update the CPM data
- Load Model - menu selection allows the user to Initially load the CPM System or reload based on CSV changes
- Reports - menu selection allows user to produce various types of output.

STEP 1. Click the Reports button.

4.4.1 Report Menu - Company Selection

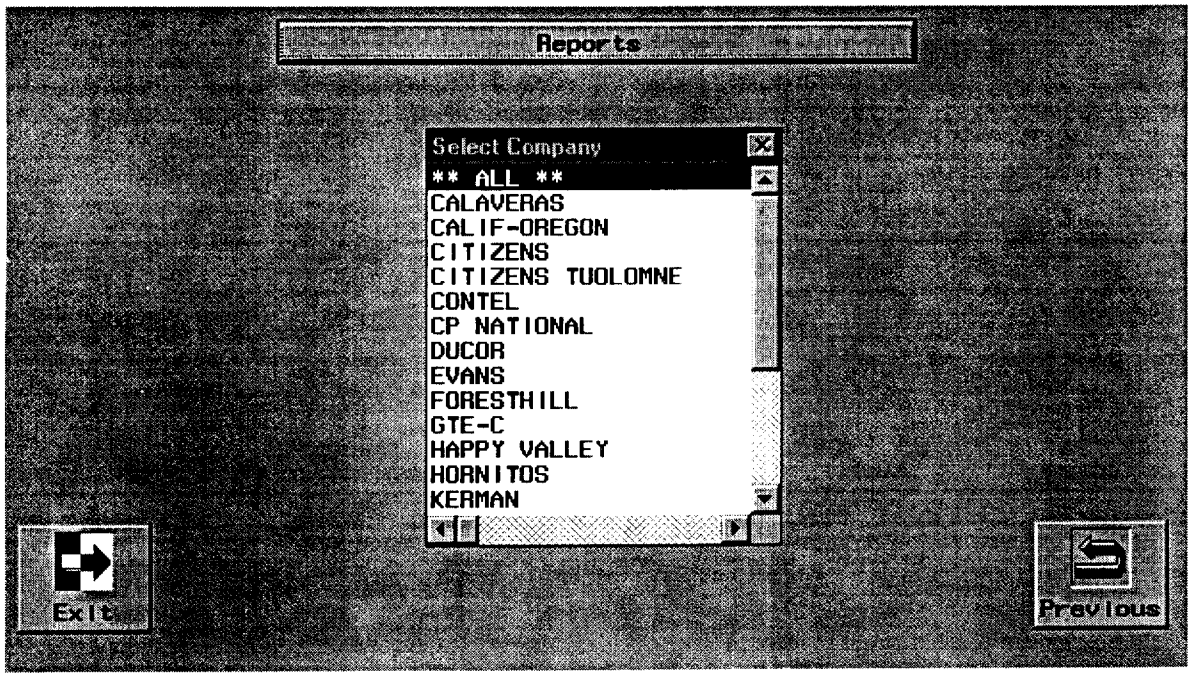


Figure 4-9 - Company Selection Screen

STEP 2. Double-click on the company you want to analyze.

Selecting ALL will use all of the companies' data in developing the reports. Selecting a single company will limit the report to data for just that company.

4.4.2 Reports Menu Screen

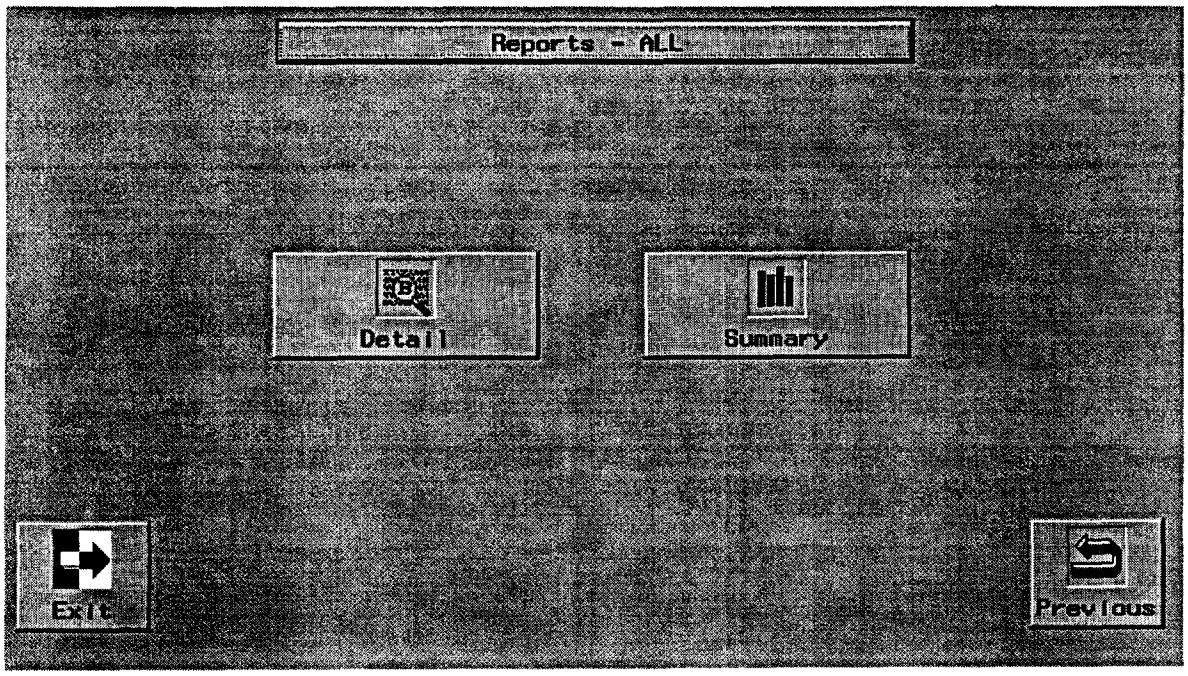


Figure 4-10 - Reports Menu Screen

STEP 3. Click the Detail button.

Produces a report with only detail data for the record in the selected item (for example, a report of 1FR from the COS or Density Zone Z1 from the Density Zones).

4.4.3 Variable Selection

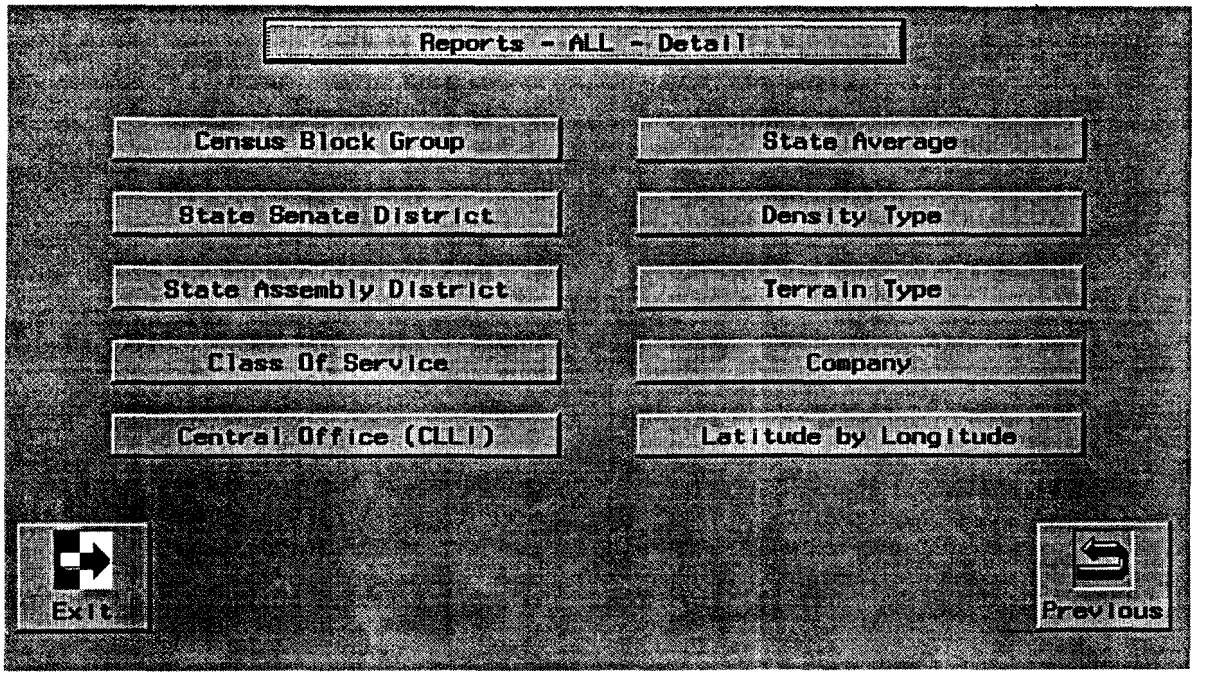


Figure 4-11 - Report Variable Selection Screen

STEP 4. **Click on the button for the desired report variable.**

4.4.4 All Reports Except CBG and Latitude by Longitude

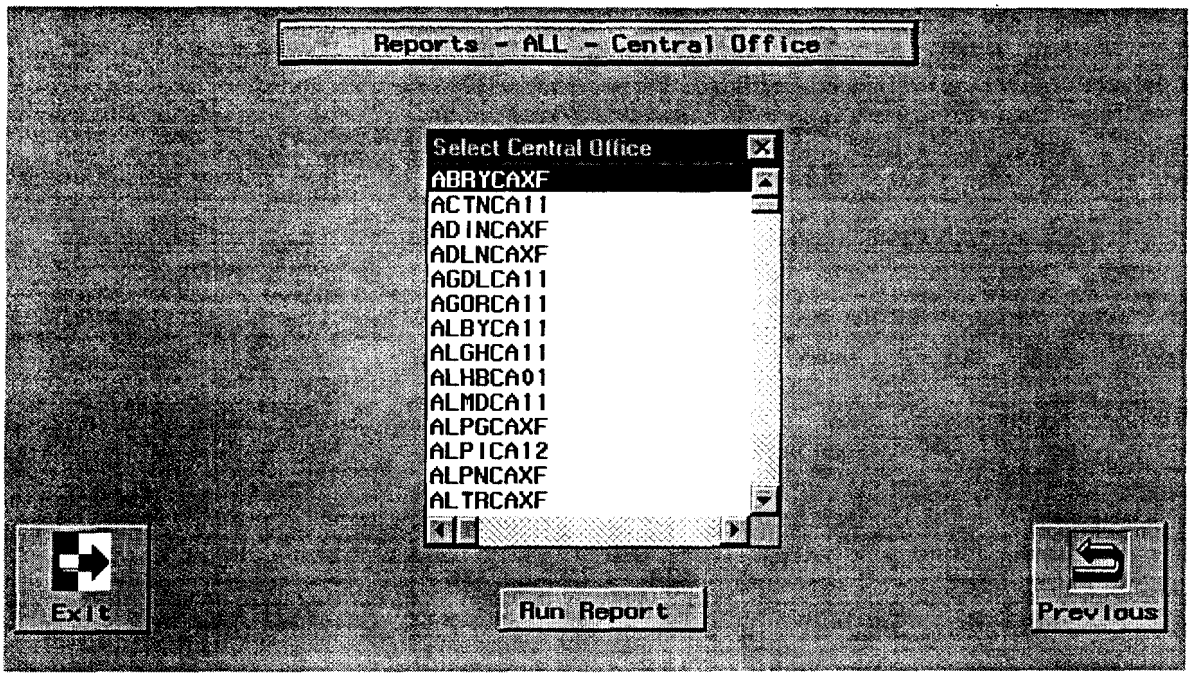


Figure 4-12 - Central Office Selection Screen for Detail Reports

- This is just an example assuming that the user selected the Central Office (CLLI) button on the previous button.

STEP 5. Scroll down to highlight the items for the report

- You can highlight multiple items

STEP 6. Click the Run Report button to generate the report

This screen format is used for all report types (except CBG, and Latitude by Longitude; see the next pages for selections for those).

4.4.5 CBG Reports

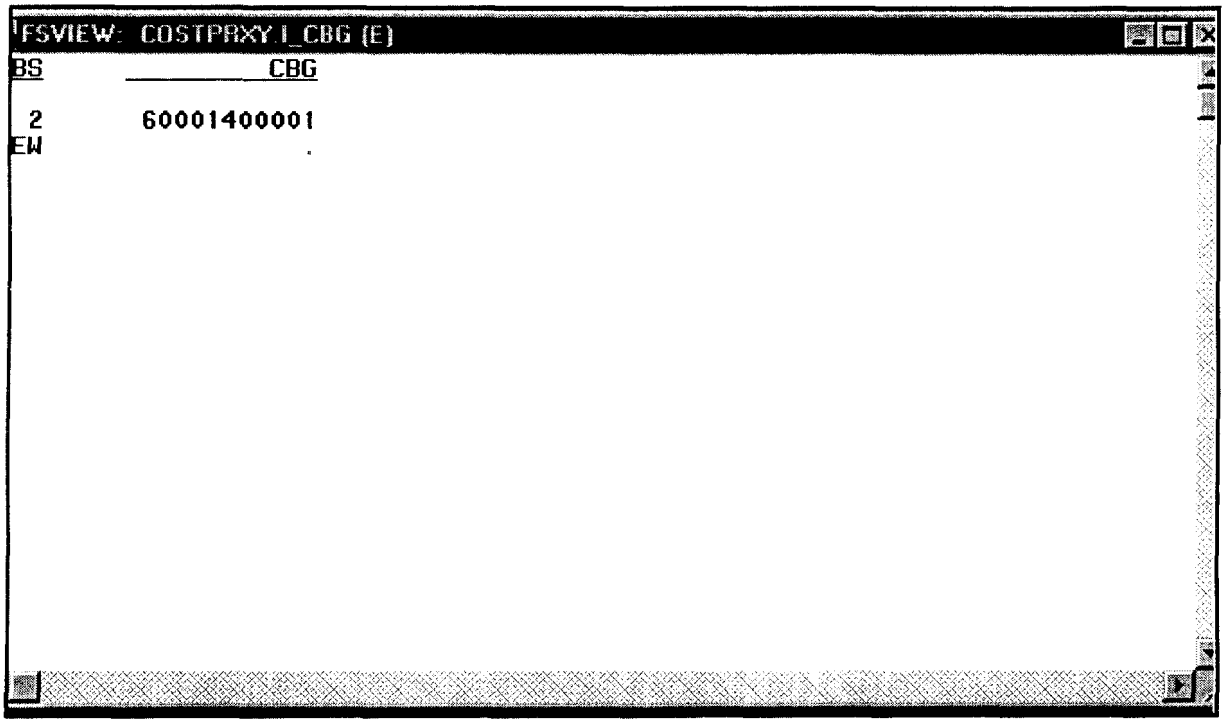


Figure 4-13 - Detail Input Screen for CBG Reports

STEP 5. Type in the appropriate record to report (for example, 60001400001).

- You may enter multiple records to get more than one report at a time.
- To delete values on the input screen:
  1. Click on the Observation number (the value is then highlighted)
  2. Select Edit from the Toolbar
  3. Select Delete
  4. Type the Observation number to delete
  5. Press E

STEP 6. Exit the Data Input screen to generate the report.

4.4.6 Latitude by Longitude Reports

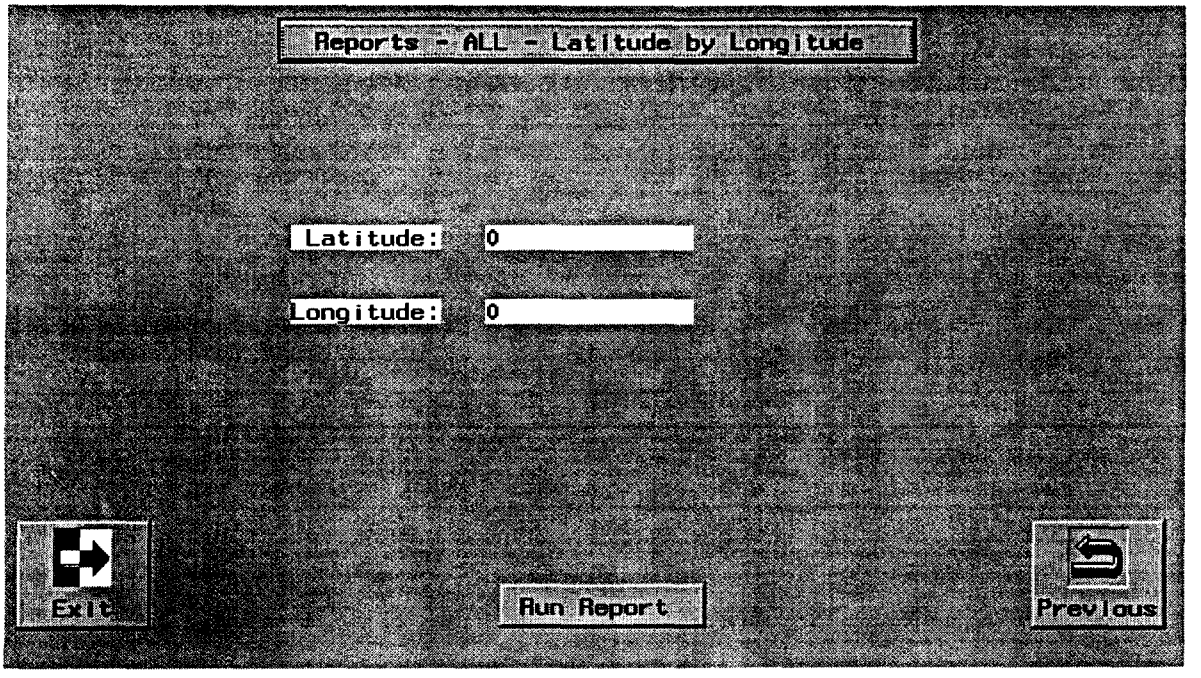


Figure 4-14 - Detail Screen for Latitude by Longitude Reports

STEP 5. **Type in the Latitude and Longitude.**
STEP 6. **Click the Run Reports button to generate the report.**