IEA Implementing Agreement on Communications Technologies for Demand Side Management

User Interface Design for Function and Communication Evaluation and Costing Model

Prepared by Operating Agent
Annex II

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IEA DSM ANNEX II

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**IEA Implementing Agreement on
Communications Technologies for
Demand Side Management**

**User Interface Design for Function and Communication
Evaluation and Costing Model**

Summary

The IEA Communications Model is a software package for the analysis of communications needs and costs for providing DSM and Value Added functions for customers connected to a single primary substation. It provides a tool kit for the viewing, manipulation, and analysis of network and communications data.

This document provides the design of the user interface, describing in detail the features available and how they will be operated by the user.

Contents

1   Introduction

The IEA Communications Model is a software package which can be used to represent the communications needs and DSM functions for customers connected to a single primary substation. It provides a tool kit for the storing, viewing, manipulation, and analysis of the network and communications data. It can deal with a single study presenting the costs and benefits of a single investment in customer functions and communications infrastructure. It can also link several studies together into a roll-out scenario which year-by-year rolls out the communications and DSM functions to more and more of the customers.

This document provides the design of the user interface, describing in detail the features available and how they will be operated by the user. All the major screens are shown and provide sufficient detail for the system to be programmed. The screens are shown here merely as drawings indicating the approximate layout and content. When programmed they will appear slightly different according to the style of the software package used. For example, the scroll bars shown on the tables will not appear if there are too few rows to need them. It is also possible that technical limitations discovered in the course of the software development will necessitate some changes to the design.

2   System features

The features of the system can be summarised as follows:

1)   Set up the fixed data describing the types of substations, the types of customers, the types of communications media, and the types of functions that can be provided.

2)   Create a primary substation and specify the numbers of each type of customer connected to it.

3)   For each primary substation create a set of distribution substations (DSS) of different types connected to it, and populate each with a defined set of customers.

4)   For each customer group on each DSS attach a low level communications medium.

5)   For the network so far created allocate a suitable set of high level communications links and gateways between the low level and the high level communications systems.

6)   For each DSS for each customer group with a particular communications medium allocate a set of functions.

7)   Find the data flows on the proposed communications system required to transfer the data resulting from the allocated functions. Return and modify the communications systems to accommodate the traffic flows as required.

8)   Find the total capital and running costs of the communications systems.

9)   Return and edit the functions or the communications systems and find the resulting costs.

10)   Store a set of studies, each consisting of a primary, a set of substations, a set of customers, a communications system, a set of functions, a cost, and a user-entered financial benefit.

11)   Create a scenario consisting of a set of linked studies to show how the communications and DSM functions available may develop over several years.

12)   Calculate the present value of costs and benefits for the scenario.

Each of these features is described in more detail below.

Version 2 of this design includes the following features which were mentioned in the specification of March 1996 but omitted from the version 1 design.

1)   The generic copies are not limited to one per substation type, page 14.

2)   There are two additional buttons on the Functions allocation screen for easier data entry when the functions are the same for all comms types or for all customer types, page 23.

3)   The customer comms traffic results for phone and CATV are shown broken down by both substation and customer type, pages 29 and 31.

4)   The customer traffic results for the rollout analysis give the results for phone and CATV broken down by both substation and customer type, page 46.

5)   In the fixed data the customer types and customer comms have been merged so that the comms details can be different for the different customer types, page 51.

6)   There are also a number of minor corrections and clarifications of the text which do not affect the original design.

3   The User Interface

The communications model is operated largely by clicking the mouse on command buttons on data entry forms. Whilst much of the data could be entered by hand it is likely that in most cases some form of automatic generation of distribution substations, customers, communications, and functions will be used.

When the system is started the first window shows the copyright and has just the File and Help menus available. The first operation is to open a new or existing file using the file menu.

```
┌─────────────────────────────────────────────────────────────────┐
│ ▬        eaCOMMS - the IEA Comms Model                    ▼ ▲    │
├─────────────────────────────────────────────────────────────────┤
│  File        Global fixed data      Help                         │
├─────────────────────────────────────────────────────────────────┤
│                                                                   │
│                          ea                                       │
│                      technology                                   │
│                                                                   │
│              eaCOMMS - the IEA Comms Model                        │
│                      Version 1.00                                 │
│              Copyright 1996 EA Technology Ltd.                    │
│                                                                   │
│            To continue:                                           │
│              Select File, New    or    File, Open                 │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```
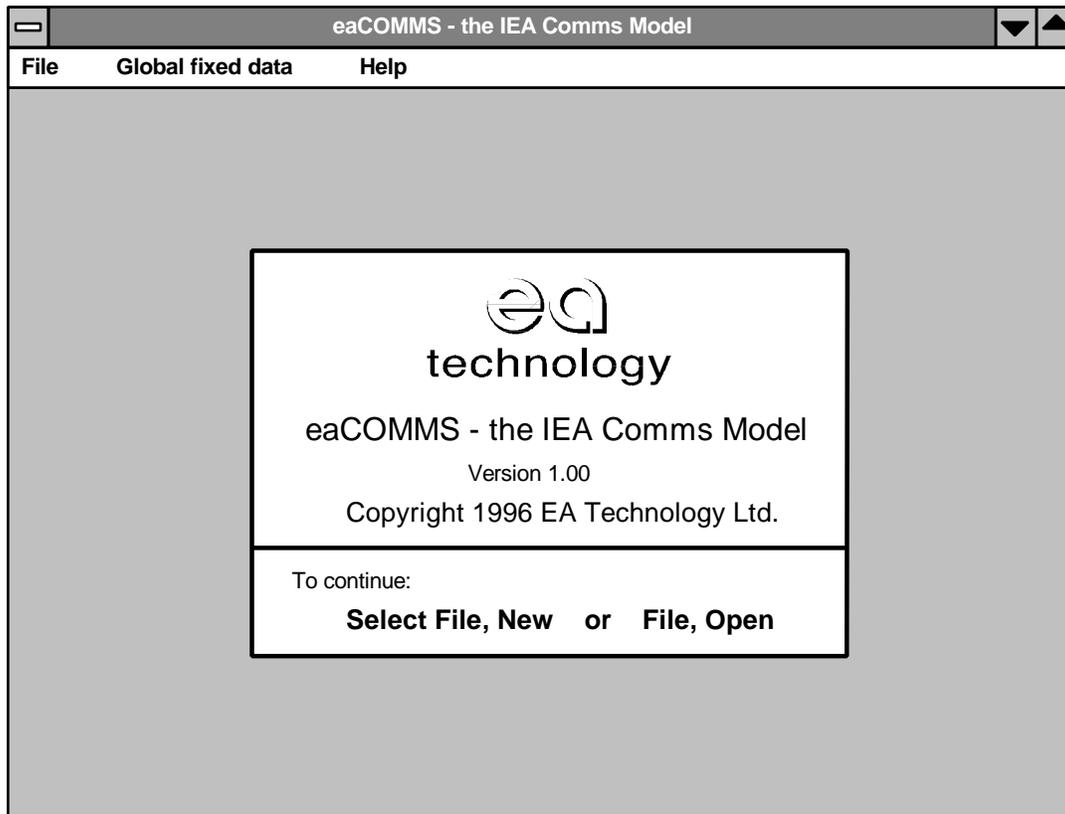
File menu

New   Displays a file-new dialog box and allows the user to give the name of the new database. The dialog box title will be "Enter a name for the new database". On clicking the OK button the system will display the Main menu window for the new file.

Open   Displays a file-open dialog box and allows the user to select an existing database to open.

Exit   To close down the program. The database is compacted automatically if any record deletions have occurred.

Other options   Any other options mentioned below will appear in grey and inactive on the menus at this stage.

Global fixed data menu

The global fixed data menu provides access to the global fixed data and has the following entries.

>   DSS types
>   Customer type and comms
>   Primary comms types
>   Gateway types
>   Function types

If the user selects one of these menu items the system displays a dialog box for the entry or amendment of the chosen data, see page 48. The same sets of types of primary, DSS, etc. are available to all scenarios in the database. .

Help menu

About...   This will display a help about box giving the program version, and details of the system running it.

4   The Databases

For the purposes of discussion the eaCOMMS system is considered to be divided into several databases covering the network and customer data, the communications data, and the customer functions data. These are the sets of data that will be changed by the user to examine the details of different configurations. Another database covers the fixed data which includes the types of primary substation, of distribution substation, of communications media, etc. including where appropriate the capacities and costs of such items.

As the communications data can only be assigned to a previously defined network the databases are not independent, and for example the communications database can be accessed only after a network has been created or selected from the network database. The communications records that are then available for viewing are those relevant to the selected network database. Other communications records created for other networks can be seen only if the appropriate network record is selected first.

The network, communications, and functions databases allow the creation of records by selecting types of substations, of customers, of communications channels, and of functions from the lists held in the fixed data. It is essential therefore that the allowable types of these items are entered before attempting to create the first study. Otherwise the drop down lists of allowable types will be empty and no study can be created.

As soon as the functions data for a study has been created the system analyses the communications traffic required by the given functions and checks for traffic

overloads. Once these overloads have been resolved the results of the cost calculations show the cost for the communications equipment required.

In practice all the "databases" described above are stored together and can be considered as a single interlinked database system. However it is still convenient to talk about them as if they were separate databases.

5   The Network Database

When an eaCOMMS file is opened or created the network database window is displayed with the file name and program name as its title.

The menu bar now contains the following items in addition to those described above.

File, Save   Any unsaved data or results are written to the current file.

File, Save As   The data from this file is copied to a new file with the File - Save As menu selection. The previous file is closed and the new file becomes the active file. The new name is displayed on the window title strip.

Fixed data   The fixed data menu provides access to the fixed data for this scenario and has the following entries

DSS types
Customer type and comms
Primary comms types
Gateway types
Function types

If the user selects one of these menu items the system displays a dialog box for the entry or amendment of the chosen data, see page 48. The same sets of types of primary, DSS, etc. are available to all scenarios in the database.

The network database window has a set of tab cards to display the different sorts of data required and at the right hand side it has a set of command buttons. The heading strip is the same on all the tab cards, and shows that all the cards are part of the same data record.

The heading strip on the tab cards contains the following items:
the scenario name, (a short text string)
the description of this data record, (a longer text string)
the filename of the currently open database file, (read-only)
The filename cannot be edited here since it is selected from the file menu.

The tab card initially displayed is that labelled Summary.

eaCOMMS - Network database - PROJECT1			

File **Fixed data** **Help**

Summary / Typical DSS / Generic copies / Actual DSS

Network Database

Name **scenario 1** Data file: PROJECT1 **Accept**

Description **Big city primary in country 44** **Cancel**

View

Add

Primary substation size, MW **50**

Amend

Customer type	Size kW	% of load	Number	
large domestic	2.5	35	15000	
small domestic	7.0	15	8000	
small commercial	5.0	12	2000	
large commercial	25.0	7	500	

Copy

Amend

Copy

Delete

Print

Number of customers **35400** Primary demand, MW **43.5** Utilisation % **85**

Distribution substn type	Size MW	Number	
small	1.0	0	
medium	4.0	15	
large	8.0	4	
very large	15.0	2	

Auto allocate

Rollout Analysis

Comms Database

Target utilisation of DSS, % **85** Total number of substations **32**

Functions Database

5.1 The database buttons

The database buttons are used as follows.

View   This is used to select and then view a previously saved record from the currently open database file. A new window opens which has a scrolling list of the Name and Description fields from all the records available. The user clicks on one row of the list to select a record and then on the OK button to return to the previous window in which the selected record is then displayed. The network database buttons are re-activated.

Select a record from the database	

Name	Description	
scenario-1	Big city primary in country 44	
scenario-2	As no 1 with more small substations	
scen-2b	As no 2 with all domestic customers	

text box		OK	Cancel

The rows in the selection list are sorted into alphabetical order of Name. If a character is entered into the text box the list scrolls down to the first name that starts with the given character.

If the user clicks on the Cancel button the window closes and the Network data window is re-displayed exactly as it was left.

Add   This is used when a new record is to be defined. Clicking the Add button clears any details already displayed, though that data is not itself deleted from the database. The fields on this and all the other tab cards are activated. The Accept and Cancel buttons are activated. The set of Network database buttons are de-activated and greyed. The menu bar is de-activated. New data can be typed into the fields.

The tab labels are active whilst data is being added. The header of the tab cards with Name, Description and Data source appears the same on all the cards of one data record and the Accept button can be clicked on any of the cards and will accept the complete data record from all the tab cards. The user can wait until all the input data on all the tab cards is complete before clicking the Accept button. Alternatively the Accept button can be clicked after each set of data has been entered to ensure it is not lost by a system failure. Data input can then be continued by clicking the Amend button.

When the user clicks the Accept button the data is entered in the database. The fields all become inactive, the Accept and Cancel buttons are de-activated and greyed, and the Network database buttons turn black and are re-activated. The menu bar is re-activated. The name of the currently displayed data record is stored in the database so that it can be redisplayed if the window is closed and re-opened or if a subsequent operation is cancelled.

This new set of data is stored under the name in the Name field, which must not be the same as the Name of any other set of network data. If the same name is used again then a warning is displayed as follows:

Add record
The name is already in use.
Please use a different name.
OK
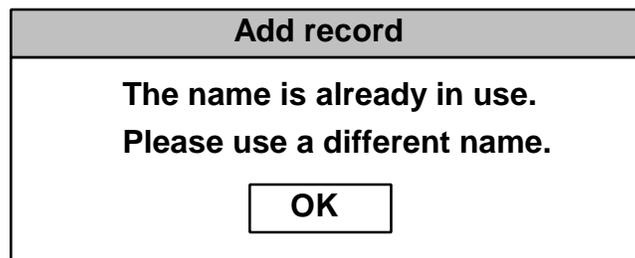
When the user clicks the OK button the warning closes and the Name field can be changed to one that is unique.

Some of the data fields are "required" in the sense that a non-blank value must be entered. The system will provide default values for

some of the fields and will display a warning message if any field still requires data when the Accept button is clicked.

Add record
You must enter a value for the field:
Name
OK

When the user clicks the OK button the message box closes and the field shown can be given a value.

Clicking Cancel instead of Accept on the tab card will abandon the new data, redisplay the previously displayed record, de-activate the Accept and Cancel buttons, and re-activate the database buttons and menu bar. If data is displayed then all the database buttons will be active. If no data is displayed only the View, and Add buttons are active.

Amend   This allows the fields to be edited so as to amend the currently displayed data. The Accept and Cancel buttons are active. The database buttons are not active. The tab card labels are active. The menu bar is not active.

When the amendments are complete the user clicks the Accept button and the amended data is entered in the database. If the Cancel button is used the fields are refreshed from the database and any amendments are abandoned. In both cases the fields all become inactive, the Accept and Cancel buttons are then de-activated and greyed, and the database buttons are re-activated. The menu bar is re-activated.

The amended data is checked, and if necessary warning messages are given so the user can correct the data and try again.

When the Amend operation is in progress the amendment applies to all the tab cards and all the data fields on all the cards become active. The Accept button accepts the amendments made on all the tab cards.

If the fields are all empty the Amend button acts in the same way as Add.

Copy   This allows the currently displayed data record to be copied, including all the data fields on all the tab cards. The Accept and Cancel buttons are active. The database buttons are not active. The tab card labels are active. The menu bar is not active.

A new record name must be entered since every record must have a different name, and the other fields can be amended at the same time if required. When the amendments are complete the user clicks the Accept button and the new data is entered in the database. If the Cancel button is used the fields are refreshed from the database and any amendments are abandoned. In both cases the fields all become inactive, the Accept and Cancel buttons are then de-activated and greyed, and the database buttons are re-activated. The menu bar is re-activated.

The new data is checked, and if necessary warning messages are given so the user can correct the data and try again.

Delete   The delete button deletes the current record in the database. If other records exist in the database it then displays the next record in the view list. If there are no other records it displays a blank record. Before the deletion takes place a warning is displayed.

Delete record
The network record and all comms and functions linked to it will be deleted. Continue?
OK   **Cancel**
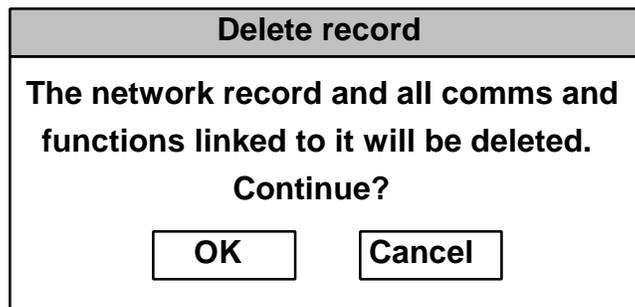
Click OK to continue and Cancel to leave the database as it was.

Print   This button is used to make a formatted printout of the currently selected set of data. The printout includes all the tab cards of the network data and not just the one displayed .

5.2   File menu

When the network database window is displayed the file menu contains the items below. These are not active when an amendment is in progress, in which case the Accept button must be clicked before the menu bar can be used.

New   Only one database can be open at a time and so this will close the current one and then create a new empty database.

Open   This displays a file-open dialog box and allows the user to select an existing database to open. Only one file can be open at once, and so if a file is already open it is closed before the next one is opened.

Save   Any unsaved data or results are written to the current file.

Save As   The data from this file is copied to a new file. The previous file is closed and the new file becomes the active file. The new file name is displayed on the window title strip.

Close   Saves any unsaved data. Closes the network data window. Closes the current database. Leaves the system running with the Copyright screen visible so that a further file can be opened.

Exit   Saves any unsaved data. Closes the current file. Exits the Load Profile Database.

5.4   Network database - summary

As shown above the Summary tab card shows two scrolling lists of the customer groups and distribution substations attached to this primary.

The customer list shows the full range of customer types defined in the fixed data together with their size. Against these are the percentage of the total load on the primary made up by each customer group and the numbers of each type of customer attached to this primary. Some types of customer may have zero percentage and number showing that none of this type are attached to this substation. Below the customer list are the total number of customers, their total demand, and the resulting utilisation of the primary.

The distribution substation list shows the complete list of types of DSS and sizes taken from the fixed data, together with the numbers actually attached to this primary. Some types may have the number zero showing that no DSS of this type is attached to this primary.

In order to protect the user against inadvertent errors the data fields are not active when the window first opens and displays the data from the file. To make any changes the Amend button must be clicked. If this is a new network data record, and data has not previously been entered then all the fields are blank. To enter the new data the Add button must be clicked.

On this tab card the only active fields are the Primary Size, the columns for % of load in the upper grid and the column for Number in the lower grid.

Creating a new primary

When creating a new primary the user first enters on the Summary tab card a size for the primary. The upper grid displays the complete list of customer types from the fixed data and the user can enter the percentage of the total load taken by each group. The corresponding number of customers is calculated and displayed, together with the resulting utilisation, being the ratio of the total demand to the total capacity.

The substation list automatically shows the list of available types, but the numbers of each will still be zero if the distribution substations have not yet been determined. There are two methods of entering the numbers of each type of substation as follows.

(a) Enter the number of each type of substation by hand. This is done by typing the numbers of each type of substation into the table.

(b) Enter the types of substations typically used to supply each type of customer, and hence determine the numbers of each type of substation required. This uses data entered on the tab card labelled Typical substations.

Having fixed the number of each type of substation the customers can be allocated to each of these substations in two different ways.

(a) Click the Auto allocate button for a fully automatic allocation.

(b) Set up generic substations with a particular mix of customer types and then make copies of these substations. After a number of such copies the remaining customers can be allocated automatically as for method (a).

Manual entry of substation numbers

Type the numbers of each type of substation into the lower grid on the summary tab card. When the data is accepted the system checks that the largest distribution substation is larger than the demand of the largest type of customer, and if not it displays a message.

Substation customer check
No substation is large enough for the largest customers.
OK
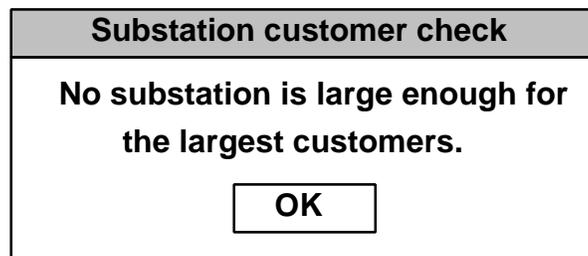
After clicking the OK button the user must add a larger substation type before the data can be accepted.

At this stage the numbers of customers and substations have been entered but the system does not know how the customers are distributed between the different substations.

Automatic allocation of customer to substations

Once the substation number data has been accepted the automatic allocation of customers to substations is started by clicking the Auto allocate button. The hour glass is displayed whilst the calculation is in progress and when it completes the pointer returns and the tab card labelled "Actual DSS" is displayed. These results are described below on page 16.

After the numbers of substations have been entered the target percentage utilisation is entered in the field at the bottom of the Summary tab card.

5.5 Network database - typical distribution substations

The numbers of different types of substations can be entered manually as described above, but it may be more convenient to calculate the numbers from the percentages of each customer type typically supplied by each size of substation. This uses data entered on the tab card labelled "Typical DSS" which is displayed when the tab label is clicked.

```
┌────────────────────────────────────────────────────────────────────────────┐
│  ▬          eaCOMMS - Network database - PROJECT1                    ▼ ▲     │
│  File      Fixed data      Help                                              │
│ ╱Summary ╲╱ Typical DSS ╲╱ Generic copies ╲╱ Actual DSS ╲    Network         │
│                                                              Database        │
│   Name        │ scenario 1 │   Data file: PROJECT1       │Accept│           │
│                                                                  │ View │    │
│   Description │ Big city primary in country 44 │         │Cancel│           │
│                                                                  │ Add  │    │
│   Use the percentage of each customer type supplied by each type of         │
│   substation to find the number of each required.                │ Amend│   │
│                                                                             │
│                          Distribution substation types           │ Copy │   │
│   Customer type       small      medium     large    very large ▲           │
│   large domestic        35         35        25         5        │ Delete│   │
│   small domestic        40         30        20        10       □            │
│   small commercial      20         30        40        10        │ Print │   │
│   large commercial       5         35        50        10       ▼            │
│                     ◄        □                            ►                  │
│                                                               Rollout        │
│   Distribution subst type   Size MW   total MW   Number  ▲    Analysis       │
│   small                      0.100      1.5       50                         │
│   medium                     0.400     53.7       14     □     Comms         │
│   large                      0.800     29.5        4          Database       │
│   very large                 1.500     26.2       10     ▼                   │
│           Total number of substations required    78          Functions     │
│                                                               Database       │
└────────────────────────────────────────────────────────────────────────────┘
```

When the Typical DSS tab card is displayed the top grid displays the complete list of customer types from the fixed data, but this time there is one column for each of the types of substation. The user can enter the percentage of load for each customer type that is typically supplied by each type of substation.

As the data is entered the numbers are validated to lie in the range 0 to 100. Data outside this range cannot be entered in the cell. When the cursor moves to another row the numbers are checked to make sure that each row adds up to 100. If not a warning is displayed as follows.

```
┌──────────────────────────────────────┐
│         Typical percentages          │
├──────────────────────────────────────┤
│  The percentages for customer type:  │
│             small domestic           │
│           add up to     95 %         │
│              ┌──────────┐            │
│              │    OK    │            │
│              └──────────┘            │
└──────────────────────────────────────┘
```

When the user clicks OK the percentages must be corrected before the data can be accepted.

When each row is completed the system calculates how much load is supplied from each type of substation and therefore how many of each type of substation is required. These figures are displayed in the lower grid, together with the total number of substations required. No fields in the lower grid are active for user input.

When the data is complete the Accept button will store it in the database and the command button labelled "Use these numbers" is made active. Clicking the button will cause the numbers of each type of substation to be copied to the grid on the summary tab card, overwriting any that were there before.

The user can then return to the Summary tab card and use the Auto allocate button to allocate customers to the substations just calculated, or alternatively the allocation of customers can be done by the copying of generic substations.

5.6   Network database - copying generic substations

Some or all of the customers can be allocated to the substations by first making up a generic substation and then creating a set of copies of it. With care all the customers can be allocated in this way but if required the process can stop before all the customers are allocated and the remainder can be allocated by the automatic method as described above.

The generic substation data is entered on the tab card labelled "Generic copies" as shown below.

eaCOMMS - Network database - PROJECT1

File   Fixed data   Help

Summary | Typical DSS | Generic copies | Actual DSS

Name: scenario 1   Data file: PROJECT1   [Accept]

Description: Big city primary in country 44   [Cancel]

The number of each type of customer on each type of substation and the number of copies.

DSS type		total	copies	small dom	large dom	small com		
small	▼	12	10	150	35	35		
medium	▼	6	5	40	30	20		
large	▼	8	7	20	30	40		
very large	▼	4	3	5	35	50		

		Customer type			
Totals	No of DSS	small dom	large dom	small com	large com
All the copies	25	2110	820	546	678
The primary	40	8000	4000	2500	700

[Make the copies]

Network Database
[View]
[Add]
[Amend]
[Copy]
[Delete]
[Print]

Rollout Analysis

Comms Database

Functions Database

The upper grid has one row for each generic substation which provides the pattern for a set of copies to be made. The first column has a drop down list of all the substation types and any type can be selected. The second column displays the number of that type of substation attached to the primary and in the third column the user enters the number of copies required. Several generic substations can have the same type and the total number of copies of those generic substations will be checked to ensure that it is less than or equal to the number of substations of the given type. If the number of copies is less than the total number of substations then some will be left without any customers allocated, and so they can to be populated by the Auto allocate button on the Summary tab card.

The remaining columns of the grid represent the different types of customer and allow the user to enter the numbers of each customer type to be attached to each generic substation.

When the cursor leaves each row of the upper grid the lower grid is updated. This shows the total number of substations that would be created by making all the copies of the generic substations and the resulting numbers of customers of each type. The row labelled "The primary" is copied from the primary load mix on the Summary tab card.

If the new entries on any row in the upper grid lead to the number of one of the types of customer in the copies row exceeding the corresponding number on the primary row then a warning is displayed. In this case the user must reduce the number of copies of

one of the substations, or reduce the number of customers of the offending customer type on one of the substations.

When the set of generic substations has been specified the user can click the button labelled "Make the copies", and the system will create all the distribution substations required and display the results both on the Summary tab card and on the tab card labelled "Actual DSS".

The making of copies of generic substations takes precedence over the automatic allocation of customers to substations. If the "Make the copies" button is clicked any customers previously allocated automatically to substations are deleted and a new allocation is started. If the allocation by generic copies does not allocate all the customers then the user can return to the Summary tab card and click the Auto allocate button to complete the allocation process.

When the Accept button is clicked the system deletes any generic substations for which the number of copies is zero. It also sorts the rows of the top grid into the order of the substation types so that rows of the same type are brought together.

5.7   Network database - the actual substations

After the substations have been created and customers have been allocated to them, the details can be seen on the tab card labelled "Actual DSS". This contains a grid with one row per substation and one column for each type of customer. As there may be a large number of rows the grid is broken down by selecting first the type of substation. The grid then shows all the substations of the selected type. The numbering of the substations runs continuously through all the substation types.

| eaCOMMS - Network database - PROJECT1 | | | | | | ▼ ▲ |

File   Fixed data   Help

Summary / Typical DSS \/ Generic copies \/ Actual DSS \

Network Database

Name   scenario 1   Data file: PROJECT1   [Accept] [View]

Description   Big city primary in country 44   [Cancel]

[Add]

The number of customers of each type attached to each actual substation

[Amend]

DSS type   small ▼   Size MW 1   Number 12

[Copy]

Customer type

No	util %	small dom	large dom	small com	large com	small ind	large ind
1	85	150	35	35	5	5	5
2	89	150	35	35	5	5	5
3	92	20	30	40	10	8	8
4	73	20	30	40	10	8	8
5	95	20	30	40	10	8	8
6	67	10	30	20	20	20	20
7	89	10	30	20	20	20	20
8	81	5	35	50	50	2	2
9	80	7	10	15	25	3	3

[Delete]

[Print]

Rollout Analysis

Comms Database

Functions Database

The first column is the substation number, the second column is the actual utilisation of that substation, and the remaining columns are the number of customers of each type connected to each substation.

If required the user can edit the numbers of customers on any substation on this form. When the Accept button is clicked the numbers are checked and if the total number of any type of customer exceeds the number on the primary then a warning is given. The user must reduce the number of the offending type of customer before the data can be accepted. Similarly the number of customers on all the substations must not be less than the number on the primary, since all customers on the primary must be connected to one of the substations. If any customers have been left unattached a warning is given.

The Rollout analysis button at the right of the window is used to specify which records from the Comms and Functions databases are to be linked together to form a rollout programme. This cannot be done until after the required Comms and Functions records have been created and so it is described below in a separate chapter on page 36.

6   The Comms database

The communications media can be assigned to the customers only after the customers have been assigned to the distribution substations. The network database record must therefore be selected before the Comms database command button becomes active. When the Comms button is clicked the network database window closes and the Comms database window opens as shown below. The Network database buttons have contracted to a single button and the Comms database button has expanded into a set of database control buttons. The name of the current network database record is displayed on the tab card heading and for this network record a set of several alternative comms database records can be created.

The Network data is checked and if any customers are still not attached to a substation then a warning is displayed and the Comms data cannot be entered. The user must return to the Network data before proceeding with the Comms data.

As with the network database window when the window first opens all the tab cards can be viewed but the fields are inactive. New data can be entered only after the Add button is clicked, and the displayed data can be changed only after the Amend button has been clicked.

The records describing the communications used by each customer can be stored in the comms database, but they refer only to one particular network record in the network database. Thus the comms database may hold many records but the only ones that are visible at any time are those relevant to the current network and customer configuration. If a record in the network database is deleted then the records in the comms database linked to it are automatically deleted at the same time, since no record can exist in the comms database unless it is linked to a record in the network database.

6.1   Comms database - customer comms

The customer comms tab card allows the user to view the summary of the attachments of communications to the customers. It can also be used to specify the percentage of each type of customer that uses each type of communications. The percentages can be different for each type of customer, or they can be the same for all customers. To make the data entry easier for that case the button labelled "All types the same" will copy the first row in the grid to all the rows below it. All customer types will then be given the same set of communications media.

eaCOMMS - Communications database - PROJECT1

File   Fixed data   Help

Customer Comms / Primary Comms / Actual / Radio cells

Name   comms rec 1   Network record: scenario1   Accept

Description   All comms allocated automatically   Cancel

The percentage of each customer type using each comms type

Customer type	total %	Customer Comms type				
		DLC	phone	CATV	radio	▲
small domestic	60	30	30	0	0	
large domestic	60	30	30	0	0	☐
small commercial	40	0	40	0	0	
large commercial	40	0	30	0	10	▼

All types the same   Auto attach

	total	DLC	phone	CATV	radio
customer numbers	286500	34500	256500	0	500

Network Database

Rollout Analysis

Comms Database

View

Add

Amend

Copy

Delete

Print

Functions Database

Once the percentages in the top grid have been entered the user can accept the data and then click the Auto attach button to actually make the attachments specified. When this is done the lower grid is updated with the customer numbers.

6.2   Comms database - the actual comms

The detailed effect of the attachment of communications can be seen on the tab card labelled "Actual" which displays all the actual substations and the communications attached to each customer group. To make the lists more manageable the user first selects the type of substation and the grid then shows all the substations of the chosen type. Each substation occupies several rows with one row for each customer type actually present on the substation. Rows with all zero entries are omitted since they cannot be given communications types if they don't exist at the substation level. The grid has two fixed columns and then several columns for each of the communications types. The grid scrolls up and down and if required also left and right over the columns of the communications types.

eaCOMMS - Communications database - PROJECT1

File   **Fixed data**   **Help**

/ Customer Comms \/ Primary Comms \/ Actual \/ Radio cells \

Name   comms rec 1   **Network record: scenario1**   [Accept]

Description   All comms allocated automatically   [Cancel]

The number of customers of each type with each type of communications attached to each distribution substation

DSS type   small urban ▼   **Size MW**   1

No	Customer type	Max	Total	Comms type			
				DLC	phone	CATV	radio
1	small domestic	3000	2500	1000	1000	500	0
1	large domestic	2500	2000	750	750	500	0
1	small commercial	600	540	300	200	0	40
1	large commercial	150	130	50	50	0	30
1	large industrial	15	12	5	5	0	2
2	small domestic	3000	2500	1000	1000	500	0
2	large domestic	2500	2000	750	750	500	0
2	small commercial	600	540	300	200	0	40
2	large commercial	200	130	50	50	0	30

Network Database

Rollout Analysis

Comms Database

[View]

[Add]

[Amend]

[Copy]

[Delete]

[Print]

Functions Database

If more control over the attachment of communications is required the user can display the Actual tab card and type in the numbers of customers of each type who have each type of communications on each substation. This supersedes blanket attachments that were made by the Auto attach button. However if the user goes back to the Customer Comms tab card and clicks the Auto attach button again, then that will overwrite any specific attachments made by hand on the Actual tab card. It is best therefore to use the blanket attachment first and then edit the attachments by hand later if required.

The column headed "Max" shows the total number of the given type of customer on the given substation. A customer is only ever given one type of comms and so the "Total" column shows the sum of the numbers that have been given the different comms types. The difference between the Max and the Total shows how many of this customer group have no comms allocated at all.

6.3   Comms database - primary comms

The communications used between distribution substation and the primary is entered by the user on the tab card labelled Primary Comms as shown below.

eaCOMMS - Communications database - PROJECT1		
File **Fixed data** **Help**		

Customer Comms / **Primary Comms** / **Actual** / **Radio cells**

Name   comms rec 1   **Network record: scenario1**   Accept

Description   All comms allocated automatically   Cancel

Comms from gateways to primary
◉ **MV-DLC**   ○ **phone**   ○ **radio**

Customer DLC and radio require gateways to the primary comms

Customer comms	Gateways to primary comms		
	MV-DLC	**phone**	**radio**
LV-DLC	30	0	0
radio	18	0	0

Phone and CATV use separate exchanges

Customer comms	no of customers	no of exchanges
phone	4500	5
CATV	6000	3

Network Database

Rollout Analysis

Comms Database
- View
- Add
- Amend
- Copy
- Delete
- Print

Functions Database

The Primary comms type is entered by clicking on one of the selection buttons, since only one primary comms medium can be specified. The upper grid shows the number of distribution substations that use each type of customer comms, and the number of gateways needed to pass signals from the customer comms level to the primary comms level. These are calculated from the details of customer communications entered previously and cannot be altered here by the user. The lower grid shows the number of customers using the direct methods of customer comms and the number of exchanges or cells needed to support them.

6.4   Comms database - radio cells

If any customers have been allocated radio communications then radio cells must be assigned to deal with their traffic. This is done on the tab card labelled "Radio cells" which is shown below.

The first field is for the entry of the number of radio cells if this is known. If it is not known it can be calculated by clicking the button labelled "Calculate" as described below. Below the number of cells are two grids. The top one lists all the distribution substations, giving the type, the capacity, and the number of customers with radio communications. Substations with no radio customers are omitted, and so if the customer communications have not yet been assigned then the grid is empty.

The last column is the radio cell number to which each DSS is assigned. The user can enter the number of one of the radio cells. Several substations can be assigned to each cell, but if a cell is left with no substations when the accept button is clicked then a warning is displayed. The user can proceed with a cell unassigned but the cost of the unused cell will be added to the communications totals.

If a substation that has radio customers attached is left with no radio cell when the accept button is clicked then a warning is displayed. The user must assign the substation to a radio cell before proceeding.

The lower grid provides a summary of the radio cell assignments and is updated every time the cursor leaves one of the rows in the upper grid. It shows the total number of radio customers in each radio cell and the breakdown by customer type. It cannot be edited by the user.

6.5 Comms database - calculate radio cells

If the user clicks on the button labelled "Calculate" then the window below opens and allows the required data to be entered.

```
┌─────────────────────────────────────────────────────────────┐
│              eaCOMMS - calculate radio cells                 │
├─────────────────────────────────────────────────────────────┤
│                                                              │
│  Radius of primary substation, km    │  24.60  │   │Calculate││
│  Terrain of primary region           │ large city │▼│         │
│  Transmitter power, W                 │  10.0   │      │  OK   ││
│  Transmitter aerial height, m         │  30.0   │              │
│  Transmitter gain, dB                 │  10.0   │    │ Cancel ││
│  Receiver aerial height, m            │   3.0   │              │
│  Receiver gain, dB                    │  10.0   │              │
│  Carrier frequency, MHz               │  400.0  │              │
│                                                              │
│                                                              │
│  Calculated number of cells           │   5.7   │              │
│  Rounded number of cells              │    6    │              │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

The terrain is selected from a drop down list of the following options which cannot be edited or added to by the user since they determine the calculations used for the correction factor for the aerial height.

> small city
> medium city
> large city
> suburban area
> open area

When suitable values have been entered in the data fields the Calculate button is made active. When it is clicked the system calculates the number of cells and displays it first as a real number with one decimal and below that rounded up to the next integer.

When the screen opens for the first time for a particular network record the fields display the global defaults as shown above. Only the first two input fields and the calculated fields are blank. Subsequently for a new comms record the defaults values displayed are the values for the previous comms record for this network record if any have been entered.

When the OK button is clicked the data is written to the database, the window closes, and the integer number of cells is copied to the field on the radio cells tab card. If the OK button is clicked before the Calculate button then the data is written to the database but the number of cells is not calculated.

If the Cancel button is clicked the window is closed and all the data is discarded. The field on the radio cells tab card remains as it was when the window opened.

7   The Functions Database

The functions database is viewed by clicking the Functions database button, but this is active only after a network has been defined, its customers have been attached, and their modes of communications have been assigned.

The records describing the functions used by each customer can be stored in the functions database but they refer only to one particular network and customer record in the network database and one particular comms record in the comms database. Thus the functions database may hold many records but the only ones that are visible at any time are those relevant to the current network and communications configuration.

If a record in the comms database is deleted then the records in the functions database linked to it are automatically deleted at the same time, since no record can exist in the functions database unless it is linked to a record in the comms database.

7.1   Functions database - allocation of functions

The functions can be allocated to customers according to the customer type and communications type using the tab card labelled "Allocation".

eaCOMMS - Functions database - PROJECT1 - scenario1					

File   Fixed data   Help

Allocation / **Actual** / **Benefits** / **Increments**

Name   functions1   **Comms record: comms rec 1**   Accept

Description   functions allocated by customer type   Cancel

Allocate functions by both customer type and comms type

The percentage of customers with each comms type that use each function

Customer type	Comms type	function1	function 2	function 3
small domestic	LV-DLC	35	25	5
small domestic	radio	30	20	10
small domestic	phone	30	40	10
small domestic	CATV	35	50	10
large domestic	phone	35	50	10
large domestic	CATV	35	25	5
large domestic	radio	30	20	10
small commercial	LV-DLC	30	40	10
small commercial	radio	35	50	10

Copy rows for all types of :-

Comms   Customers

Allocate these functions

Network Database

Rollout Analysis

Comms Database

Functions Database

View

Add

Amend

Copy

Delete

Print

Results

The grid displays the customer type and for each customer type the comms type. Any row is omitted if the given customer type does not have the particular comms type.

Using the above tab card the functions are attached in fixed percentages to customers of the given type with the given communications using the same percentages for every substation. The user first sets up the table of percentages specifying what allocations are required and then clicks the Accept button to save this specification in the database. The button labelled "Allocate these functions" is then made active and can be clicked to actually make the allocations, overwriting any previous allocations. The actual allocations are then immediately stored in the database too.

The values in any row do not add up to 100% because a specified customer group could have 100% in each column. The only check is that all entries are between 0% and 100%.

The two buttons labelled Comms and Customers at the bottom left of the tab card help with the rapid input of simpler cases where the allocations do not vary by comms type or they do not vary by customer type. The Comms button will make the function allocations the same for all types of comms by copying every row for DLC comms to the three rows below it. The Customers button will make the function allocations the same for every customer type by copying the block of four rows for the first customer type to all the customer types below. These buttons overwrite any previous entries in the target rows.

7.2   Functions database - the actual allocations

Once the functions have been allocated to the customers the effect can be seen by clicking on the tab card labelled "Actual". This is like the Actual tab card of the network database window and the Actual tab card of the Comms database window. It shows the list of actual substations with the numbers of customers attached and their communications media. Here it also shows the customer functions.

eaCOMMS - Functions database - PROJECT1 - scenario1						

File   Fixed data   Help

Allocation   Actual   Benefits   Increments

Network Database

Name   functions1   Comms record: comms rec 1   Accept

Rollout Analysis

Description   functions allocated by customer type   Cancel

Comms Database

The number of customers on each substation that use each function broken down by customer type and communications.

DSS type   small urban ▼   Size MW   1

Functions Database

DSS	Customer type	Comms	Max	function1	function 2	function 3
1	small domestic	LV-DLC	3000	2354	1500	15
1	small domestic	radio	2500	2378	1250	10
1	small domestic	phone	600	345	100	10
1	small domestic	CATV	150	126	129	10
1	large domestic	phone	15	365	198	10
1	large domestic	CATV	3000	2376	1065	5
1	large domestic	radio	2500	287	167	10
1	small commercial	LV-DLC	600	30	40	10
1	small commercial	radio	200	35	50	10

View
Add
Amend
Copy
Delete
Print
Results

The results for each individual substation stretch over several rows in order to give the full breakdown of the number of customers of a given type with a given communications. The numbers in each row do not necessarily add up to the total number of customers of the specified type since they might all have each of the functions. The only check is that no figure can be more than the number of customers of the specified type.

If required, the user can edit the numbers in the table, though this would normally be possible only in simple cases since the number of rows may often be very large. For example if there are 100 distribution substations, 10 customer types, and 4 communications types then there are 4000 rows in the table. Since this would be difficult to manage the table is broken down by DSS type. Therefore if there are, say, 10 DSS types then there will be 10 tables, each of about 400 rows.

7.3   Functions database - benefits

The eaCOMMS system does not evaluate the benefits to the customer or the utility arising from a DSM program which provides the functions that have been entered in

the Functions database. However the Benefits tab card is made available for the user to enter the benefits if these are known so that the Analysis phase can then complete the discounted benefit and cost calculation. This data is stored with the functions database since the benefits are intimately related to the functions provided.

The benefits can be entered year by year if they are known in that detail and the discount calculation can be done by the system. Alternatively it may be more convenient just to enter the discounted benefit and leave the table blank. Even if the benefits are not known the discount rate, the start year, and the end year must be entered since these are used to calculate the discounted costs.

The start and end years default to the current year and the current year plus 9. The discount rate defaults to zero.

7.4   Functions database - increments

The Increments tab card on the Function database window is used for the automated increases in customers with specific functions that are required for setting up the stages of a rollout programme. It is described in detail in the section about rollout programmes on page 38.

8   Results

Once the functions have been assigned to the customers the data flows generated by those functions on the communications system can be evaluated, together with the costs associated with the communications infrastructure. The details of these results can be seen by clicking the Results button after a record on the Functions database has been selected. The Results window then opens and shows the results for the single study of one selected network and customer record, one selected comms record, and one selected functions record. The heading on each of the Results tab cards shows the names of the selected records from the three databases. The window heading shows the filename of the complete database file that is currently open. There is no menu bar on the Results window.

8.1   Results - primary traffic flows

The first tab card on the Results window shows the communications traffic at the primary level. There are no user data inputs on the Results window since the numbers are all calculated from previous inputs. There are, however, alternative views of the results available that can be selected by the user. If any channel is found to be overloaded then the user can return to the Functions database and reduce the number of customers with one or more of the functions. Alternatively it may also be necessary to return to the Fixed data, Customer comms or Fixed data, Primary comms and increase the capacity of an overloaded channel.

eaCOMMS - Results - PROJECT1

Tabs: Primary traffic | Customer traffic | Cost Summary | Cost/Benefit

Buttons: Print | Export | Close

Network: scenario1   Comms: comms rec 1   Functions: functions1

Primary type	nodes	cust	data up	data down	capacity	% util
MV-DLC	30	2400	25000	12400	28000	95

Traffic from the node to the primary   ● show overloads   ○ show all

Substation No.	cust	data up	data down	capacity	% util
1	1400	5000	200	28000	95
2	2000	300	200	28000	15
3	1000	240	200	28000	15
4	350	200	150	28000	99
5	4500	250	200	28000	89

Radio Cell No.	cust	data up	data down	capacity	% util
1	1400	500	200	28000	95
2	2000	270	300	28000	45
3	1000	400	400	28000	67
4	350	200	150	28000	99
5	4500	250	200	28000	89

The primary communications links connect the primary to each of the distribution substations and each of the radio cells. The two grids therefore show the traffic on those links. They give the number of customers feeding data into the link, which may be less than the total number of customers on the substation because the other customers use direct communications via radio, phone, or CATV. The percentage utilisation is show at the right and will indicate an overload by a number over 100%. The selection buttons above the grid can be used to suppress the display of substations for which there is not an overload, so as to draw attention to those with overloads.

The two grids therefore show the following data

Primary comms type	Traffic on each row	Capacity on each row
MV-DLC	total MV-DLC traffic generated by customers on the specified distribution substation or radio cell	total capacity of the MV-DLC system (same as the summary line, same for all rows)
radio	total radio traffic generated by customers on the specified distribution substation or radio cell	total capacity of the primary radio system (same as the summary line, same for all rows)
phone	total phone traffic generated by customers on the specified distribution substation or radio cell	capacity of the individual phone link to the specified substation

There are no user data inputs on the Results window and so the only actions available are to select which results to view and to use the command buttons as follows.

Print   The print button sends a formatted printout of the complete set of results from all the tab cards to the current Windows printer.

Export   The Export button allows the user to select a text file into which to write the complete results so that they can be subsequently processed by a word processor or spreadsheet program.

Close   The Close button closes the Results window and returns to the Functions database window.

8.2   Results - customer traffic flows

The second tab card on the Results window shows the communications traffic at the customer level. If one or more channels are found to be overloaded then the user can return to the Functions database "Actual" tab card and reduce the functions or reduce the number of customers. Alternatively it may also be possible to return to the Comms database and increase the capacity of an overloaded channel or change some customers to a different comms type.

The column headed "!" at the right of the top grid is used to indicate when a communications channel is overloaded. Thus if any of the entries in the % utilisation column is over 100% then a ! sign is displayed beside it. In addition one of the individual links may be over 100% utilisation even when the aggregate of all the links is not. In that case the % utilisation may appear well below 100% but the presence of the ! sign provides a warning that one of the individual links may be overloaded.

The data in the top grid is somewhat different for each of the comms types as shown in the table.

Comms type	traffic on each row	capacity on each row
LV-DLC	average LV-DLC traffic per distribution substation	capacity of LV-DLC comms per substation
radio	average traffic per radio cell	capacity of one radio cell
phone	average for each phone line for the given customer type	capacity of one phone exchange
CATV	average for each CATV line for the given customer type	capacity of one CATV node

The lower grid shows an expanded view of the data in one of the rows of the summary grid. When the user puts the cursor in a row of the top grid the pointer in column 1 shows which row is selected, and the lower grid changes to give the corresponding data which was aggregated to make the single row in the summary.

In the example shown above the row labelled LV-DLC has been selected by a single click anywhere in the row and the lower grid therefore displays the data for all the substations that use LV-DLC. The column labelled "nodes" had the figure 30 in the upper grid and so the lower grid has 30 rows, one for each of those 30 distribution substations, and the scroll bar can be used to reveal those currently out of sight. The LV-DLC comms is not broken down by customer type and so the word "all" is displayed in the customer type column.

In the lower grid an overloaded link is shown by a utilisation of more than 100%, but without any ! signs. The selection buttons can be used to display all the substations or just those with overloads. The lower grid layout is the same for whichever row is selected in the upper grid, but the meaning of the numbers changes as follows.

row selected in upper grid	heading for column 1 in lower grid	data on each row of lower grid
LV-DLC	DSS number with customer type "all"	total LV-DLC traffic for each distribution substation
radio	cell number with customer type "all"	total traffic for each radio cell
phone	DSS number and customer type	average for each phone line for the given customer type on the given substation
CATV	DSS number and customer type	average for each CATV line for the given customer type on the given substation

The results must be interpreted with care since the different modes of communications are of two kinds. For communications by LV-DLC and radio all the customers on one substation share a single channel and so the up and down traffic shown on the lower grid is the total of all the customer traffic on the one substation or radio cell, and the capacity is quoted for the substation or cell as a whole.

On the other hand for customers with phones there is one row in the lower grid for each substation and customer type. The capacity is quoted for a single line used by that customer type. The up and down traffic is then the average for the customer type on the substation.

eaCOMMS - Results - PROJECT1

Primary traffic | **Customer traffic** | **Cost Summary** | **Cost/Benefit**

Network: scenario1   Comms: comms rec 1   Functions: functions1

Print

Export

Close

Summary of comms traffic from the customer to the node

	Comms type	nodes	cust	data up	data down	capacity	% util	!
	LV-DLC	30	2400	25000	12400	28000	95	
	radio	5	1480	5890	240	8000	78	
▶	phone	7	7000	1000	1000	2600	89	
	CATV	6	5500	1000	1000	2400	99	!

◉ show overloads   ○ show all

Details for the type selected above

DSS	Customer type	cust	data up	data down	capacity	% util	
1	small domestic	1400	500	200	2400	35	▲
1	large domestic	2000	300	460	2400	29	
1	small commercial	1000	450	200	2400	30	
1	large commercial	350	200	150	2400	20	
1	large industrial	4500	250	3100	2400	134	
2	small domestic	50	100	1905	2400	89	▼

8.3 Results - cost summary

The Costs tab card on the Results window shows the costs of all the communications equipment for this one study. The upper grid gives the capital costs that are paid once at the start of the project, and the lower grid gives the annual running costs that must be paid each year that the project continues. The costs are broken down into the components for each type of communications.

```
┌──────────────────────────────────────────────────────────────────────┐
│  �largeeaCOMMS - Results - PROJECT1                            ▼ ▲     │
└──────────────────────────────────────────────────────────────────────┘
```

eaCOMMS - Results - PROJECT1

/ Primary traffic \ / Customer traffic \ / Cost Summary \ / Cost/Benefit \

Network: scenario1   Comms: comms rec 1   Functions: functions1

Print

Export

Close

The capital cost of communications, £

		Totals	DLC	telephone	CATV	radio
	Customer comms	171750	143500	15750	4670	12500
►	Primary comms	190600	35000	0	---	0
	Gateways/exchanges	103050	45000	50750	2365	7300
	Total capital cost	465300	223500	216400	6900	25400

The annual running cost, £/y

		Totals	DLC	telephone	CATV	radio
	Customer comms	42050	14500	15050	1236	12500
►	Primary comms	24110	13500	0	---	0
	Gateways/exchanges	29850	43500	10750	4317	5600
	Total running cost	66000	81500	40810	5553	23700

Show details

Since there can be only one type of primary comms, the rows for primary comms must contain two zero elements. In addition the primary comms can never be CATV and so the CATV entry on the primary rows is shown as "---". All costs of CATV are shown on the rows for customer comms and gateways/exchanges.

If a more detailed breakdown of the costs is required the user can click on any row in either grid on the cost summary. Both pointers in the left hand column of each grid will move to the corresponding row. The user can then click the Show details button to open a new window with the full details.

8.4   Results - customer cost details

The customer cost details window opens when the user clicks the Show details button on the cost summary window.

	eaCOMMS - Results - Customer Cost Details						
Network: scenario1	**Comms: comms rec 1**			**Functions: functions1**			

The number of customers of each type with each type of communications attached to each distribution substation, together with their costs.

DSS type small urban ▼   **Size MW** 1

no	customer type	total no	cost	cost/y	DLC no	cost	cost/y	
1	small domestic	2500	2500	1000	1000	5000	1567	▲
1	large domestic	2000	2000	750	750	500	13000	
1	small commercial	540	540	300	0	0	0	
1	large commercial	130	130	50	50	345	30	
1	large industrial	12	567	234	5	2435	123	
2	small domestic	2500	2500	1000	1000	500	2468	
2	large domestic	2000	2000	750	750	500	3564	
2	small commercial	540	540	300	200	0	40	
2	large commercial	130	130	50	50	0	30	
2	small industrial	540	540	300	200	0	40	
2	largeindustrial	130	130	50	50	0	30	▼

There is one table for each type of substation and the first column gives the actual substation number. There are several rows for each substation with one for each customer type. There are 15 columns with 3 for each type of comms plus 3 for the totals. These give the number of customers, the capital cost, and the cost per year for each comms type.

The corresponding window for the primary comms takes the form shown below. The detailed costs for the gateways and exchanges are also shown on the same screen as the primary level communications and so the same window is opened whether the row selected on the cost summary screen is for primary comms or gateways/exchanges.

eaCOMMS - Results - Primary Cost Details

Network: scenario1   Comms: comms rec 1   Functions: functions1

Print

Export

Close

Cost of communications links at the primary level

Type	nodes	customers	cost	cost/y
MV-DLC	30	2400	25000	12400
primary phone	0	0	0	0
radio	0	0	0	0

The cost of gateways

Type (cust to primary)	nodes	customers	cost	cost/y
LV-DLC to MV-DLC	47	1200	143567	43700
LV-DLC to phone	0	0	0	0
LV-DLC to radio	0	0	0	0
radio to MV-DLC	23	1200	243568	65378
radio to phone	0	0	0	0
radio to radio	0	0	0	0

The cost of exchanges

Type	nodes	customers	cost	cost/y
CATV	47	1200	143567	43700
phone	0	0	0	0

8.5 Results - cost benefit analysis

The Cost/Benefit tab card on the Results window shows the total cost and total benefit of the project. The total cost is copied from the Costs tab card and the benefit and discount details are taken from the Functions - Benefits tab card. If no benefits have been entered then the Net benefit and Benefit/Cost ratio fields display zero.
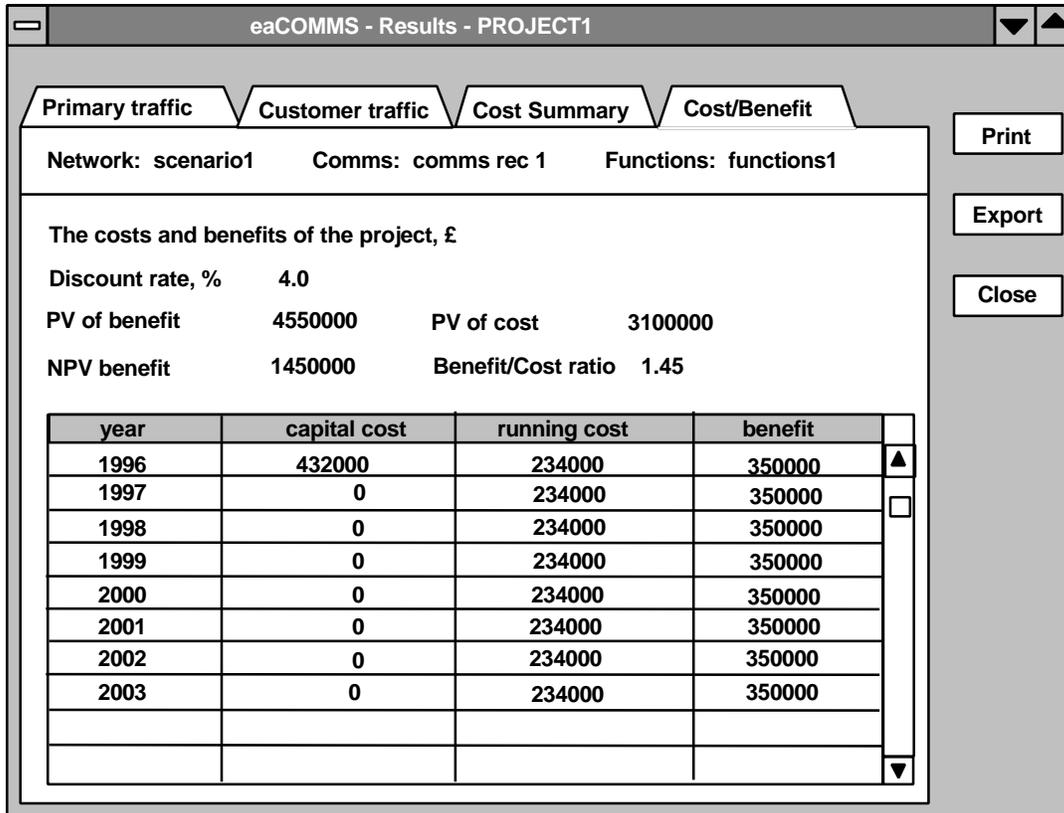
⬛	eaCOMMS - Results - PROJECT1	🔽🔼

Primary traffic	Customer traffic	Cost Summary	Cost/Benefit		Print

Network: scenario1   Comms: comms rec 1   Functions: functions1

Export

The costs and benefits of the project, £

Close

Discount rate, %   4.0

PV of benefit   4550000   PV of cost   3100000

NPV benefit   1450000   Benefit/Cost ratio   1.45

year	capital cost	running cost	benefit	
1996	432000	234000	350000	▲
1997	0	234000	350000	☐
1998	0	234000	350000	
1999	0	234000	350000	
2000	0	234000	350000	
2001	0	234000	350000	
2002	0	234000	350000	
2003	0	234000	350000	
				▼

None of the data can be edited by the user here.

9 Rollout programmes

The process of rollout is the gradual spread of the functions to more and more customers. This can be modelled as a two stage process. First a set of studies is created showing the stages of the different phases of the investment required to implement the rollout. Then the second stage is to link these separate studies together so that the incremental investment can be evaluated and the year by year results can be displayed.

The first stage of the rollout modelling is to designate the current study as the starting year of the rollout programme. All years of the rollout programme will refer to the same network record and the same customers, with only the functions and perhaps the comms records changing from year to year. The situation at the second year of the program is created by making a copy of the current functions database record. The copy is initially identical to the previous record but it is then modified to show exactly how the numbers of customers with each function are to increase. However this may be rather tedious to specify in detail and so several types of automated increases are available. For example, all functions could be increased by 10%. Thus it becomes quick and simple to specify the separate scenarios representing the years of the rollout programme.

If the number of customers with any particular function is increased then the comms traffic also increases. The traffic overloads must therefore be recalculated and any overloads detected and corrected. This may be done by limiting the increase in the customer functions or it may be done by increasing the comms capacity. If the comms capacity is to increase, then the relevant comms database record can be copied to the new scenario as well as just the functions.

When the comms costs are evaluated the results show the total investment needed to set up the current study, but by subtracting the costs from the scenario representing the previous year the incremental investment in the current year can be found.

When the studies representing the years of the rollout programme have been created they can be linked together and the results displayed for the complete rollout programme.

9.1 Rollout - copy functions

The Network database copy button makes a copy of the current network record and allows it to be saved with a different record name. It also copies all the records in Comms database linked below it and all those in the Functions database linked below those Comms records. The Comms database copy button makes a copy of the current record and all the records in the Functions database linked to it.

The copy button of the Functions database has a slightly different capability. It can make copies of the current functions record but it cannot make copies of any records linked below it as there aren't any. However it can if required make a copy of the Comms record linked above it. This is a useful feature for setting up the stages of a

rollout programme because it enables the functions to be copied and increased, and if a comms overload occurs the comms can be increased as well, but only for the new functions record not for the one representing the previous year.

Thus when the Functions database Copy button is clicked a message box appears and asks whether to copy the Comms record as well.

Copy Functions record
Copy Comms record too?
Yes   **No**
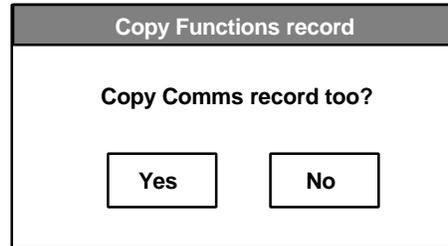
The user is not immediately asked for a name for the new comms record. Instead this is created automatically by putting the characters "(2)" in the last three positions of the record name. If the comms record already has a number of this type in the last three characters then the number is increased by one every time it is copied. If required, these characters can subsequently be edited by the user and replaced with some other name for the new record. The example discussed below uses the year of the rollout programme instead of these automatic numbers.

When the data has been copied the user can switch to the Actual tab card of the Functions database screen, see page 25, to increase the numbers of customers with any function for any customer group with any comms type on any substation. This allows a rollout programme of any conceivable complexity to be created, but it could be rather inconvenient to set up.

9.2 Rollout - increment functions

To smooth the process of creating rollout programmes the Increment tab card is provided on the Functions database screen to make automated increases to the numbers of customers in particular groups.

eaCOMMS - Functions database - PROJECT1 - scenario1		

File   Fixed data   Rollout   Help

Allocation / Actual / Benefits / Increments

Name `functions1`   **Comms record: comms rec 1**   [Accept]

Description `functions allocated by customer type`   [Cancel]

Increase
- ○ all groups
- ● functions
- ○ comms types
- ○ customer types

percentage increase	
meter reading	10
storage heater on/off	0
kWh display	0
annual consumption	0

Apply the Increases

Network Database

Rollout Analysis

Comms Database

Functions Database
- View
- Add
- Amend
- Copy
- Delete
- Print
- Results

Overloaded customer groups

DSS	Customer type	Comms	Function	Customers	Rises to
1	small domestic	DLC	meter reading	3000	3540
3	small industrial	radio	kWh display	2500	2600
7	small domestic	phone	storage heater on/off	600	610
24	medium comm	CATV	meter reading	150	167
35	large domestic	phone	meter reading	15	16
36	large domestic	CATV	storage heater on/off	3000	3094
45	large domestic	radio	kWh display	2500	2765
57	small commercial	DLC	storage heater on/off	600	610

The Increment tab card is used after a functions record has been copied so as to increase the numbers of customers with particular functions in a controlled and automated manner.

 The selection buttons allow four choices:-

(1) increase the numbers of customers that have functions for all customer types and comms types. This is the default. The required percentage increase must be specified. For example, increase the use of all functions by 10%.

(2) increase the number of customers that have a specific function for all customer types and comms types. For example, increase the number of customers with meter reading by 10%.

(3) increase the numbers of customers that have functions for specific type of comms for all customer types and function types. For example, increase all functions by 10% for customers with phones.

(4) increase the numbers of a specific type of customer with functions for all comms types and function types. For example, increase all functions by 10% for small domestic customers.

When each case is selected the grid at the right changes to list the names of the appropriate type of group and the required percentage can then be entered. For case 1 there is only one line in the grid saying "all groups", but there will be exactly 4 for the type of comms, perhaps 20 for the type of function, and perhaps 20 for the number of customer groups.

The above four cases provide an automated method of increasing the functions in situations that would otherwise by very tedious to do by hand. The other possible cases however can readily be done using the facilities already provided on the Allocation and Actual tab cards of the Functions database.

(5) increase the numbers of customers with a specific function with a specific comms type for all customer types. For example, increase the numbers of telephone customers with meter reading. This relates to the meter reading column on the Allocation tab card of page 23. There is one entry for phone comms for each customer group, say 20 entries in total.

(6) increase all functions for all customers of a specific type with a specific comms type. For example, increase all functions for small domestic customers with phones. This relates to all the entries on one row on the Allocation tab card of page 23 for small domestic customers with phones, say 20 entries in total.

(7) increase a specific function for a specific customer type for all comms types. For example, increase the number of small domestic customers with meter reading. This relates to an adjacent block of entries in the meter reading column on the Allocation tab card of page 23 for small domestic customers with each comms type, 4 entries in total.

(8) increase a specific function for a specific customer type with a specific comms type. For example increase the number of small domestic phone customers with meter reading. This relates to a single entry in the meter reading column on the Allocation tab card of page 23 for small domestic customers with phone, 1 entry only.

(9) increase a function on a particular substation. This can be done on the Actual tab card of the Functions database on page 25.

The percentages in all of these cases is based on the number of customers in the group with the same function not the group with the same comms. For example consider the group of small domestic customers with phones is of size 2000 which is divided into the following function groups:-
        1000 have meter reading
        500 have kWh display
        0 have storage heater switching.
When a 10% increase is made the new function groups will be:-
        1100 have meter reading
        550 have kWh display
        0 have storage heater switching.

In this way the function groups increase by the same percentage but by different numbers of customers.

There is a special case when the number of customers with a function reaches the maximum for that customer comms group. In the example above there are 2000 small domestic customers with the same comms and so when they have all got a particular function no further increase in that function is possible.

The saturation of the customer comms group is dealt with as follows. When the user clicks the command button labelled "Apply the increases" on the Increments tab card on page 38 the system first checks whether any of the increased values will exceed the number of customers in its customer comms group. If no such cases are detected then it proceeds to make all the required increases and the outcome can be seen in detail on the Actual tab card. To indicate a successful outcome the display switches automatically to the Actual tab card.

If, on the other hand, one or more customer comms groups would be exceeded, then the system displays in the lower grid on the Increments tab card the number of customers requested for each exceeded group. This is shown in the column labelled "rises to". In this case the increases are not actually applied to the customer groups, the display does not switch to the Actual tab card, and the Actual tab card still displays the data as it was before the automatic increase was requested.

To resolve the problem the user can take the following steps.

(a) reduce the percentage increase requested and try again, or
(b) check which customer comms groups would be exceeded, change to the linked Comms record, either the Customer Comms tab card on shown page 18 or the Actual tab card on shown page 19, and increase the number of customers in the exceeded customer comms group.

Another form of saturation occurs when the increase in the number of customers with a particular function increases the comms traffic to the extent that the comms capacity is overloaded and needs to be increased. This can be checked on the Functions Results window described on page 31. If it is intended that the rollout will increase the comms then the comms record must be copied from year to year at the same time as the functions record.

The comms and function records created in this way represent the stages in the rollout programme. However they do not need to represent every single year of the program. Only those years when the functions and perhaps the comms are increased need to be included. The intervening years, when the customers carry on using the functions and comms they already have, are represented by counting the annual running costs of all the systems without additional capital or installation costs.

Using these extended copy functions the user can create stages of a rollout programme of any desired complexity. The next step is to link the stages together so that the year-by-year results can be displayed together.

9.3   Rollout - analysis

The data for a rollout programme all applies to a single record in the network database. The rollout analysis data is therefore stored as a separate database that lies between the Network database and the Comms database. The data in the database consists mostly of links to the records in the Comms and Functions databases, and so it cannot be used until the appropriate sets of Comms and Functions data have been defined as described above.

If a record in the Network database is deleted then any rollout data linked to it is automatically deleted as well. If a record in the Rollout database is deleted the Comms and Functions records it refers to are not affected.

When the Rollout database button is clicked the screen shown below opens. The start year and end year specify the years of the rollout programme and the grid shows one row for each of those years. These years would normally be the same as the years in the Functions - Benefits data, but this is not essential.

In each cell of the second column of the grid is a drop down list that displays the names of the Comms records linked to the current network record. When the Comms record has been selected the adjacent cell in the third column displays the names of the Functions records linked to that Comms record. If no Comms records or no Functions records have been defined yet then the drop down lists are empty.

Each record in the rollout database is a specification of a rollout programme. There can if required be several rollout programmes defined for the same Network record. For example, the same set of Comms and Functions records could be used, but spread

over a different number of years. These separate Rollout records can be viewed, Amended, Copied, etc. in just the same way as the other data records.

The records do not have to be different in each cell, as is shown in the example. Here the comms record changes only every two years whereas the functions record changes every year. This signifies a rollout programme where the functions increase every year but the communications equipment is upgraded only every two years. In the intervening years the existing equipment is used and the cost is just the running cost for that equipment.

When the Comms and Functions records have been selected for the rollout programme and the data accepted into the database the Calculate button becomes active. This button performs the rollout calculation and opens the Rollout analysis - Results window as shown below.

eaCOMMS - Rollout analysis - Results					
Cost/Benefit	**Primary traffic**	**Customer traffic**			

Name   rollout 10b   Network record: scenario1

Description   the ten year rollout programme, version b

The costs and benefits of the rollout programme, £

Discount rate, %   4.0

PV of benefit   4550000   PV of cost   3100000

NPV benefit   3450000   Benefit/Cost ratio   1.45

year	incremental cap cost	running cost	benefit
1996	432000	234000	350000
1997	0	234000	365000
1998	242000	250000	450000
1999	0	250000	465000
2000	250000	315000	512000
2001	0	315000	567000
2002	125000	360000	612000
2003	0	360000	625000

Print

Export

Chart

Close

This window takes the same form as the cost/benefit window for each of the individual studies. The difference is that the values include the combined effect of all the studies that make up the rollout programme. In this case there is an investment in network upgrading every two years, but the benefits accrue year by year with a total NPV benefit of £3.45M. The capital cost in the first row is the full cost of the initial scenario, but the subsequent rows are the additional capital cost of the additional investment in that year.

The results can be printed or exported to a text file by clicking on the control buttons on the right. The Close button closes the window and returns the focus to the Rollout analysis window.

When the Chart button is clicked a new window opens with a chart of the year by year values as shown below.
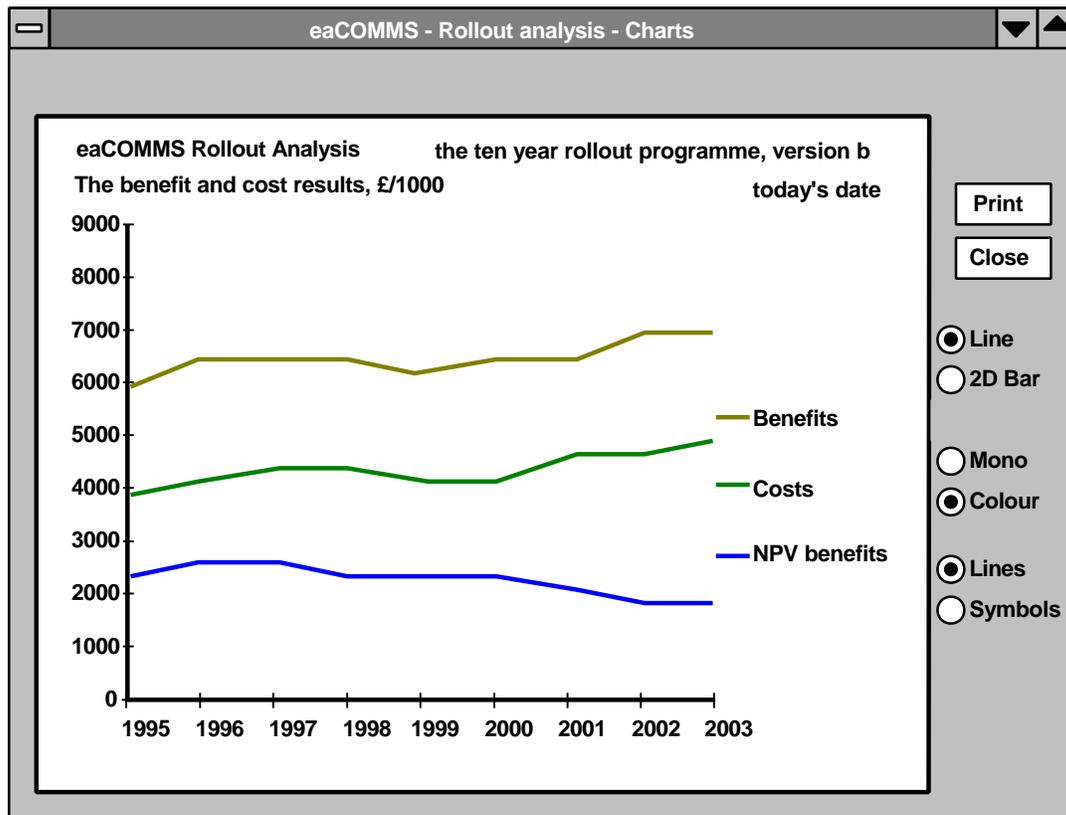
The appearance of the chart can be altered by the control buttons on the right of the diagram, and it can be printed by clicking the Print button. The Close button closes the chart window and returns the focus to the Rollout results window.

The chart displays the Description of the rollout database record and the heading gives the y-axis units of £/1000.

9.4   Rollout - communications traffic

The rollout analysis also makes available the communications traffic on the primary links and the customer links. The tab card labelled Primary traffic takes the form shown below and provides a set of selection buttons and a table of results for the selected channels for each year.

eaCOMMS - Rollout analysis - Results					

Cost/Benefit   Primary traffic   Customer traffic

Name   rollout 10b   Network record: scenario1

Description   the ten year rollout programme, version b

Select results to display

⦿ total traffic at the primary

○ traffic at substation (DSS) number   7

○ traffic at radio cell number   8

Print

Export

Chart

Close

Growth of traffic from the nodes to the primary

year	data up	data down	capacity	% util
1996	300	200	2400	20
1997	350	220	2400	27
1998	410	250	2400	32
1999	460	280	2400	41
2000	490	340	2400	45
2001	550	400	2400	50
2002	620	510	2400	54
2003	700	650	2400	58

Click the column heading to select a column for charting

The Print button sends a formatted printout of the selected results to the current printer. The Export button sends the results to a text file for subsequent processing by a word processor or spreadsheet. The Close button closes the results window and returns to the Rollout Analysis window.

The Chart button displays a chart of the selected results with one or more of the columns from the grid. Any column in the grid can be selected for charting by clicking on its column heading. The column heading cell changes to white to indicate that it has been selected for charting. Clicking again on the same heading deselects the column so that it will not appear on the chart, and returns it to the original colour. The axes are chosen automatically and so curves of widely differing values will not appear clearly on the chart.

The primary traffic charts all take the form shown below.
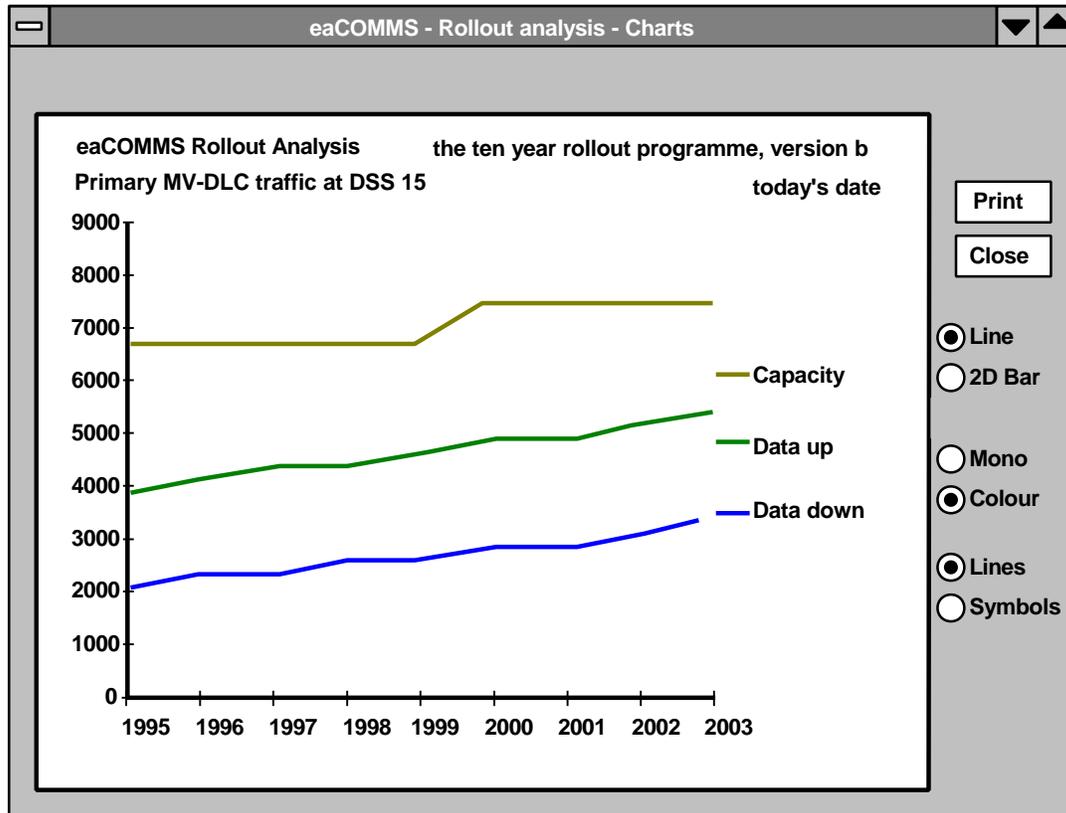
eaCOMMS - Rollout analysis - Charts

eaCOMMS Rollout Analysis   **the ten year rollout programme, version b**
Primary MV-DLC traffic at DSS 15   **today's date**

Print

Close

○ Line
○ 2D Bar

○ Mono
● Colour

● Lines
○ Symbols

Chart with vertical axis 0 to 9000 (in steps of 1000), horizontal axis years 1995 to 2003. Three curves: Capacity, Data up, Data down.

Each selected column from the grid becomes a curve on the chart, and the legend shows which is which. The chart heading gives the Description from the rollout database record and the identification of the data in one of the forms:-

> Total primary traffic
> Primary traffic at DSS nnn
> Primary traffic at cell nnn

The chart can be printed by clicking the Print button, and the window can be closed by clicking the Close button returning to the Rollout analysis - results window.

The tab card labelled Customer traffic takes the form shown below and provides a set of selection buttons and a table of results for the selected channel for each year.

```
┌──────────────────────────────────────────────────────────────────────┐
│ ▬           eaCOMMS - Rollout analysis - Results              ▼  ▲ │
├──────────────────────────────────────────────────────────────────────┤
│   ╱Cost/Benefit ╲  ╱ Primary traffic ╲ ╱ Customer traffic ╲          │
│                                                                        │
│   Name        │ rollout 10b │   Network record: scenario1             │
│   Description  │ the ten year rollout programme, version b │          │
│                                                                        │
│   ┌─ Select results to display ──────────────────┐   ┌─────────┐      │
│   ● LV-DLC traffic on DSS number    │ 7 │ ▲▼     │   │  Print  │      │
│   ○ traffic in radio cell number    │ 3 │ ▲▼     │   └─────────┘      │
│   ○ phone for customers │ small industrial │▼ on DSS │7│▲▼  │ ┌───────┐│
│   ○ CATV for customers  │ medium domestic │▼ on DSS │7│▲▼    │Export ││
│                                                     │   └───────┘      │
│      Growth of traffic from the customers to the nodes  ┌───────┐      │
│                                                         │ Chart │      │
│                                                         └───────┘      │
│                                                         ┌───────┐      │
│                                                         │ Close │      │
│                                                         └───────┘      │
└──────────────────────────────────────────────────────────────────────┘
```

year	data up	data down	capacity	% util
1996	300	200	2400	20
1997	350	220	2400	27
1998	410	250	2400	32
1999	460	280	2400	41
2000	490	340	2400	45
2001	550	400	2400	50
2002	620	510	2400	54
2003	700	650	2400	58

As with the customer traffic results described on page 30, care is needed to interpret the values for the different comms types. For LV-DLC and radio the values are the total for all the customers on the selected substation or radio cell. For phone and CATV the values are the mean for the selected customer type on the selected substation.

The Print button sends a formatted printout of the selected results to the current printer. The Export button sends the results to a text file for subsequent processing by a word processor or spreadsheet. The Close button closes the results window and returns to the Rollout Analysis window.

The Chart button displays a chart of the selected results with one or more of the columns from the grid. Any column in the grid can be selected for charting by clicking on the column heading. The column heading cell changes to white to indicate that it has been selected for charting. Clicking again on the same heading deselects the column so that it will not appear on the chart, and returns it to the original colour. The axes are chosen automatically and so curves of widely differing values will not appear clearly on the chart.

The customer traffic charts all take the form shown below.
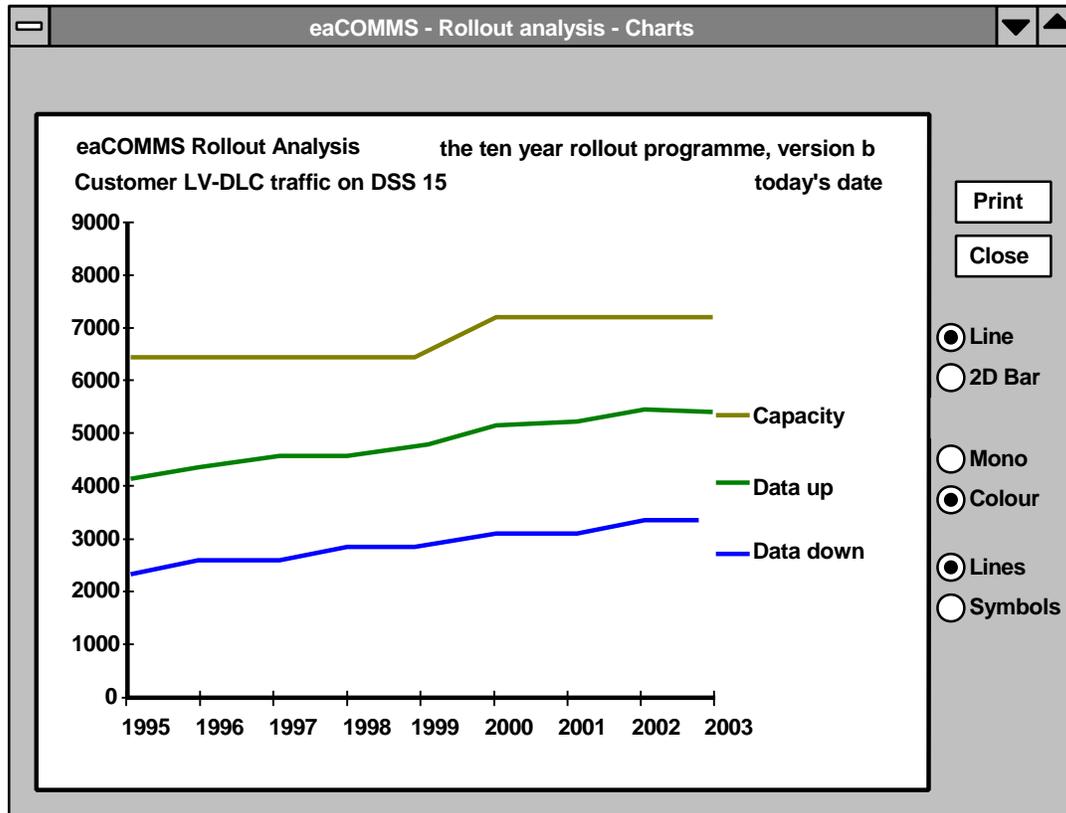
Each selected column from the grid becomes a curve on the chart, and the legend shows which is which. The chart heading gives the description of the rollout programme and the identification of the data in one of the forms:-

       Customer LV-DLC traffic on DSS nnn
       Customer radio traffic in cell nnn
       Customer phone traffic for small industrial on DSS nnn
       Customer CATV traffic for small domestic on DSS nnn

The chart can be printed by clicking the Print button, and the window can be closed by clicking the Close button returning to the Rollout analysis - results window.

10   The Global Fixed Data

The database of global fixed data is used to hold all the data that is likely to remain the same from one study to the next. It contains the list of customer types, communications types, etc. including the throughput of the communications links, the data requirements of the different functions, and the costs of all the communications equipment.

When the study is started the system makes a copy of the global fixed data it needs and stores it as the scenario fixed data. This means that if the global fixed data is subsequently altered it doesn't affect any previously calculated results. For example, if a customer type is deleted from the global fixed data it will remain in the scenario fixed data for any previously defined scenarios, but it would not appear in any new scenarios. This also means however that if a parameter of the global fixed data, such as the bit rate of a comms type is altered, it will not affect any previously defined scenarios, only the new ones.

The global copy of the fixed data is viewed by clicking on "Global fixed data" on the menu bar on the opening screen. The Fixed data menu options are as follows:

> DSS types
> Customer types and comms
> Primary comms types
> Gateway types
> Function types

When any of these menu items is selected the corresponding screen is displayed, as shown below.

10.1 Fixed data - substation type

The screen on which the types of distribution substation are entered takes the form shown below.

The fixed data screens all operate in the same way. The data records are displayed on a scrolling datasheet but the fields cannot be edited directly. To change the data the command buttons are used as follows.

Add   The Add button is used to add a new row to the data sheet and to specify the values to go on it. The system opens a new window called Details with one field for each column in the table. The user enters the required values and then clicks either OK to return to the data sheet with the new values added, or Cancel to abandon the new values and return to the datasheet as it was left.

This may seem cumbersome where only two fields appear on the Details window, but it has the advantage of consistency across all the types of fixed data, some of which have much more data.

Amend	The user selects which row to amend by clicking anywhere in that row and then clicks the Amend button. The Details window opens and displays the values from the datasheet in the input fields. These values can be amended and then the OK button returns them to the datasheet, and the Cancel button restores the previous values.

Delete   The user selects which row to delete by clicking anywhere in that row and then clicks the Delete button. The window is redrawn with the deleted row missing.

The Delete button is not active for the screens of primary comms or gateways since these types are programmed into the system

Print   This button sends a formatted printout of the currently displayed data to the currently selected Windows printer. The printout includes the complete data record even if some of it is scrolled out of sight off the screen.

Close   When the editing of the data is complete the user clicks the Close button to close the fixed data window.

The DSS type is a text string containing any description of the substation, and the size is the maximum capacity of the substation in MW. The Size can be entered as a number with 3 decimal places.

10.2   Fixed data - customer type and comms

The customer types and their communications are entered by selecting the menu options Fixed data, Customer type and comms. The window below then displays a scrolling datasheet with the customer type as a text string, the peak load of that type of customer in kW, and then five columns for each of the four possible types of customer comms in the order DLC, radio, phone, and CATV. These contain the capital cost in £, annual cost in £, call charge rate in £/min, bit transfer rate in bits/sec, and set-up delay in sec. To see all the data the horizontal scroll bar must be used.

File   Help

The customer types and communications

Customer type	load kW	DLC £/cust	DLC £/y/cust	DLC £/min	DLC
small domestic	1.5	37.75	87.95	0.05	30
large domestic	8.0	37.75	87.95	0.05	30
small commercial	10.0	37.75	87.95	0.05	30
large commercial	25.0	37.75	87.95	0.05	30
small industrial	10.0	37.75	87.95	0.05	30
large industrial	100.0	37.75	87.95	0.05	30

Add
Amend
Delete
Print
Close

As shown above, the costs may often be the same for all customer types but the facility is provided for making these different for each customer group. When a row has been selected the details screen shown below is displayed with the details for one customer type. For DLC, radio, and CATV the bit rate will normally be the same for all customer types, though the costs may be higher for customer types with more functions.

Customer details

Customer type   small domestic
Customer load, kW   2.5

Comms type	£/customer	£/y/cust	£/minute	bits/sec	delay sec
DLC	37.75	87.95	0.05	300	0.0
radio	53.75	81.25	0.75	300	2.0
phone	18.56	25.87	0.55	300	5.0
CATV	73.75	8.95	0.05	1200	0.0

**The cost includes the customer modem
and any equipment needed for the DSM functions.**

OK   Cancel

10.3 Fixed data - primary comms

The types of primary communications and their properties and costs are entered on the screen below which is called from the menu Fixed data, Primary Comms.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ▭           eaCOMMS - Fixed data - PROJECT1                      ▼ ▲      │
├─────────────────────────────────────────────────────────────────────────┤
│ File              Help                                                    │
├─────────────────────────────────────────────────────────────────────────┤
│                                                              ┌─────────┐  │
│                                                              │  Add    │  │
│   The types of communications links from the Gateways        └─────────┘  │
│   to the Primary                                             ┌─────────┐  │
│                                                              │ Amend   │  │
│     ┌──────┬────────┬─────────┬──────────┬──────────┐        └─────────┘  │
│     │ Type │ £/link │ £/y/link│ bits/sec │ delay sec│        ┌─────────┐  │
│     ├──────┼────────┼─────────┼──────────┼──────────┤        │ Delete  │  │
│     │ DLC  │ 24.60  │  2.50   │  36000   │   0.0    │        └─────────┘  │
│   ► │ phone│ 18.56  │  5.87   │  45000   │   2.0    │        ┌─────────┐  │
│     │ radio│ 37.75  │ 87.95   │  50000   │   5.0    │        │  Print  │  │
│     └──────┴────────┴─────────┴──────────┴──────────┘        └─────────┘  │
│                                                              ┌─────────┐  │
│                                                              │  Close  │  │
│                                                              └─────────┘  │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

The details screen on which the primary communications data is entered takes the form shown below.

```
┌─────────────────────────────────────────────────┐
│             Primary comms  details              │
├─────────────────────────────────────────────────┤
│                                                 │
│   Primary comms  type              DLC          │
│                                 ┌──────────┐    │
│   Capital cost per link, £       │  24.60   │   │
│                                 └──────────┘    │
│                                 ┌──────────┐    │
│   Running cost per link, £/year  │   2.50   │   │
│                                 └──────────┘    │
│                                 ┌──────────┐    │
│   Transfer capacity, bits/sec/link│  1000   │   │
│                                 └──────────┘    │
│                                 ┌──────────┐    │
│   Set up delay, seconds          │   5.0    │   │
│                                 └──────────┘    │
│                                                 │
│              ┌──────┐   ┌──────────┐            │
│              │  OK  │   │  Cancel  │            │
│              └──────┘   └──────────┘            │
└─────────────────────────────────────────────────┘
```

The type of primary communications is built into the database and cannot be altered by the user.

10.4 Fixed data - gateways

The information on communications gateways is displayed on the screen shown below.

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File	**Help**	

The gateways

Type (cust to primary)	£/gateway	£/y/gateway
LV-DLC to MV-DLC	24.60	2.50
LV-DLC to phone	37.75	87.95
► LV-DLC to radio	18.56	5.87
radio to MV-DLC	37.75	87.95
radio to phone	37.75	87.95
radio to radio	37.75	87.95

Buttons: Add, Amend, Delete, Print, Close

The exchanges

Type	£/exchange	£/y/exchange	customers/exchange
► CATV	37.75	87.95	1000
phone	18.56	15.87	1000

Since there are two grids on this screen the pointer on one grid will go grey when any row on the other grid is selected. In that way it will always be clear which row in which grid is selected.

The details screen on which the customer communications data is entered takes the form shown below.

Gateway and exchange details

Gateway/exchange type	LV-DLC to MV-DLC
Capital cost per gateway, £	24.60
Running cost per gateway, £/year	2.50
Customers per exchange (not required for gateways)	0

OK   Cancel

10.5   Fixed data - functions

The information on customer functions is displayed on the screen shown below.

	Type	broad	freq	per	up bits	down bits	response
	meter reading	N	1.0	min	1.0	4.5	1.0
	storage heater on/off	Y	12.0	day	12.0	4.5	4.5
▶	kWh display	N	2.5	hour	2.5	1.2	1.2
	meter reading	N	4.0	year	4.0	24.6	4.6
	annual consumption	N	1.0	year	1.0	0.4	0.4
	kWh display	N	2.5	hour	2.5	1.2	1.2
	meter reading	N	4.0	year	4.0	24.6	4.6
	annual consumption	N	1.0	year	1.0	0.4	0.4

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File   Help

The customer functions

Buttons: Add, Amend, Delete, Print, Close

The details screen on which the customer communications data is entered takes the form shown below.

Customer function details

Function type	meter reading
Type of signal required	○ broadcast ● specific
Frequency of service, times	4.0
per interval, min, hour, day, yr	year
Data up, bits	512
Data down, bits	128
Max response time, sec	1.0

OK   Cancel

10.6   The scenario fixed data

The scenario fixed data is created automatically whenever a new scenario is created by copying from the global fixed data. The values of the scenario fixed data can be edited

by clicking on the Fixed data menu on the network data screen. The scenario fixed data editing screens look and act exactly the same as described above for the global fixed data with the following exceptions.

1. The screen titles all have the words "Scenario fixed data" instead of "Fixed data".
2. Once the actual substations have been created the Delete button is disabled so that no row in any table can be deleted. This prevents the deletion, for example, of a customer type that is in use.
3. Some fields can be edited as required and the new value will appear next time the appropriate window is opened. These are as follows:
    text of substation type
    text of customer type
4. Some fields can be edited as required and will affect the results next time the Function, Results button is clicked and the complete results are recalculated. These are as follows:
    customer comms data
    primary comms data
    gateway and exchange data.
5. The alteration of some fields will make the whole scenario inconsistent and so will force the deletion of all the actual substations and all the comms and functions data. These are as follows:
    size of distribution substation
    load of customer type

One set of scenario fixed data applies to all the studies in a scenario and hence all the years of a rollout programme.