<u>Working Paper 488/</u>
<u>Computer Manual 27</u>

GIMMS* explained: how to use the package
to produce maps of the United Kingdom
at the University of Leeds

Philip Rees

John Stillwell

Peter Boden

May 1987

School of Geography
University of Leeds
Leeds LS2 9JT

* GIMMS = Geographic Information Management and
          Mapping System produced by Tom Waugh
          and others at the University of Edinburgh.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

The GIMMS package provides a means of producing thematic maps of high quality on the computer. For its successful use, it demands, however, much knowledge of both the computing system environment in which it sits and of all the many steps necessary in map production. The main GIMMS manual is comprehensive but rather lacking in examples of how to use commands. Much oral advice is needed for project completion (see the acknowledgments).

This manual is designed to help in the use of GIMMS at Leeds by providing examples of the process of assembling locational data files − the most difficult of the steps in map creation using GIMMS. It also documents procedures on local terminals and output devices (the trivial key presses and commands needed, the lack of which can stymie the user). We have also used the manual to document the procedures used in the construction of a set of boundary files for use in a joint project on Migration in Britain, a subset of which have been placed for general use on the Geography library (GEO6LIB) disk.

The plan of the manual proceeds as follows. The next section provides references to the documents that the user of GIMMS needs to consult. Section 3 provides a simple guide to using BBC microcomputer terminals as GIMMS workstations. The fourth section describes how to use the departmental digitizer, how to transfer the boundary coordinates to a disk file on the IBM PCXT, and how to use KERMIT to transfer that file to the Amdahl mainframe. Section 5 explains the process of creating a map using GIMMS at Leeds. Section 6 provides a comprehensive description of the area boundary files available for Great Britain, Northern Ireland and the United Kingdom, which can be accessed on the Geography Program and Data library disk.

Note that we say nothing about the facilities for producing graphs using GIMMS. Generally speaking, users have been able to use this part of the package with relative ease. Similarly, little need be said about the GIMMS data management capabilities since these are fairly easily learned or can be substituted for by another package (SPSS[x] or SAS, for example).

2.   DOCUMENTS

It is often said that a software system is only as good as the
documents that describe it. Careful study of the software documents
before and during use of any package more than repays the time
invested. Online HELP systems are useful for the experienced user,
but you have to know what to look for, and this is, in our opinion,
still much easier using a printed document with a good contents page
and detailed index.

2.1   The operating system and editor on the Amdahl 580

To use the GIMMS package at Leeds, the user must be familiar with the
CMS operating system, the XEDIT editing package and the use of the

BBC microcomputer as a terminal. See Computing Service (1985) for a
guide to CMS and XEDIT, and Naden (1986) on how to use the variety of
mainframe terminals available.

2.2   The GIMMS package at Leeds

First, having logged on to the Amdahl in the usual way, issue the
command

SETUP PACKAGES

and then type

HELP GIMMS

in which Jacoby (1984) provides details of the Leeds
implementation. This may be browsed through in an XEDIT environment.

To obtain a printed copy, type

SPOOL PRINTER CLASS D (or whatever CLASS you desire)

PRINT GIMMS HELPLDS Y.

See section 3 for further notes on using the package.

2.3   GIMMS manuals

The current version of the package at Leeds is 4.5. Within a year
version 5 is likely to be delivered but this should consist only of
additions and corrections rather than a major revision (Ann
Carruthers, personal communication).

2.3.1   The introductory manual

Start with;-

A.W. Carruthers (1985) Introductory User Guide to GIMMS Gimms Ltd,

Edinburgh.

This an excellent starter manual packed with examples on every page which the beginner should read first before going on to the main manual.

Copies: 2 in the Geography Departmental Map Library (reference only)
        1 in 47 University Road (see Mark Birkin)
        1 in the main building (see Phil Rees).

2.3.2 The main manual

The main manual is:

T.C. Waugh and J. McCalden (1983) GIMMS reference manual Gimms Ltd,

   Edinburgh.

This is a dense manual which details all commands and their many options. There are quite a lot of examples but they cover only a fraction of the command options available. These have to be explored by trial and error (hence the importance of using screen plots), and be seeking advice.

Copies: 1 in the Geography Departmental Map library (reference only)
        1 in 47 University Road (see Peter Boden)
        1 in the main building (see Phil Rees)

The manuals can be obtained via the Information Office of the University Computing Service (9.30-10.30 a.m., see Joan Hatherley or Cathy Britton) or from GIMMS Ltd, 30 Keir Street, Edinburgh, EH3 9EU.

2.4 GIMMS data sets at the University of Manchester Regional Computer Centre (UMRCC)

Available at UMRCC are digitized boundary data sets for all wards in Great Britain. These were compiled by the marketing and software firm SIA under contract to the Department of the Environment, and provided free to authorized users at Universities for bona fide research.

Full descriptions of the data sets are contained in

K. Cole (1985) Notes on using the DoE digitized boundary data base. UMRCC, University of Manchester, which can be listed on the printer as

:WW.INFO.CENSUS.DBD81 at UMRCC

or   UMRCCDBD INFO   on the Geography library disk.

See Dr. Joanna Schmidt, University Computing Service, to obtain authorization forms.

3

2.5 Other GIMMS data sets on the GEO6LIB library disk

The boundary data sets for wards in West Yorkshire districts described in Birkin and Rees (1982) are still available together with boundary data sets for 137 zones in Leeds districts that are aggregations of 1981 Census Enumeration Districts. Data for these 137 zones is available via the DATAPAC package (Hirschfield and Rees, 1984). Further details are given in Appendix A.2.

3.   USING BBC MICRO TERMINALS AS GIMMS WORKSTATIONS

3.1   BBC workstations

The most convenient terminal on which to carry out GIMMS work is a
BBC fitted with a Leeds University Terminal Emulation Read Only
Memory microchip, attached to one of the campus networks, and with a
dot matrix printer attached. Screen displays of graphics can be
obtained, and screen dumps can be effected immediately (useful for
recording the progress of map development, rather than the production
of maps).
BBC workstations of the above type are located as follows:

(1) Geography Computing laboratory
      3 PAD terminals, 2 dot matrix printers

(2) 41 University Road
      1 WTAC terminal, 1 dot matrix printer

(3) Staff offices
      At least 4 have currently this type of setup.

(4) Baines Wing Laboratory
      We hope to connect the BBCs to the network yielding 9 PAD/X25
      terminals also connected to dot matrix printers.

It is possible to carry out GIMMS work on other terminal types but
only a few have graphics capabilities. It is essential to use the
screen to weed out errors and improve map designs.

3.2   Using the BBC workstation

The stages involved are set out in Table 1. In the body of the
table, commands that should be typed exactly as specified are
represented in upper case, special keys are enclosed in angle
brackets; items in lower case require the user to substitute the
appropriate entry. Normally, you press the <RETURN> or <ENTER> key
after each command. Where such a key press is indicated, this
indicates an extra press after no other entries.

      Stage (1) involves switching on the BBC, the monitor and
printer, selecting the appropriate screen mode, 3 for a screen of 25
lines by 80 characters of text, 0 for a screen of 32 lines by 80
characters for text or graphics. The command *VDU loads the terminal
emulation program.

      Stage (2) involves threading through the network to the Amdahl
computer. Screen messages inform the user whether the terminals are
connected to either the West Terminal Access Controller (TAC) or one
of the West (Textiles) Packet Assembler-Disassemblers (PADs).

      Stage (3) is the usual logging on sequence, that involves
typing your userid and password. The extra <RETURN> is to obtain a

5

work disk.

Stage (4) involves the user obtaining a 2 megabyte (2 million byte) memory, needed for using GIMMS.

Stage (5) gives the two general commands you will need for running any GIMMS job. SETUP PACKAGES connects the user to the P disk, where the program resides. To run the program the user types the keyword GIMMS followed by the name of the file contaning the instructions to the package, and the name of the device for which plotter output is to be prepared (e.g. DT22 for screen plots, C1012 for the CALCOMP 1012 plotter, HP for the Hewlett Packard plotter: see HELP GIMMS for full details). Normally, stage (5) will be reached only after various files have been prepared of instructions, locational data and non-locational data. The two commands of stage (5) are best embedded in the user's own executive file together with the relevant file definitions statements (see section 5 and 6 for examples).

Stage (6) is necessary if you wish to output the map to the screen and you haven't selected MODE 0 at stage (1).

Stage (7) enables a map on the screen to be dumped onto a dot matrix printer if one is attached to the BBC via the printer or RS432 ports. The map will be a little crude and a little distorted in the vertical dimension, but does give a reasonable result for research (as opposed to publication) purposes. Screen dumping does take a little time.

Stage (8) is needed if you want to revert to text MODE 3. This is only essential if you want to print out text files on the dot matrix printer using the

            AUTOLF filename filetype

command. In MODE 0 this works via the Screen Dump facility and you get double-size characters (useful for displays?).

Stage (9) is for use by those who get bored by seeing all maps in light foreground on dark background. See the VIEW manual or BBC manual (VDU 19 command) for explanations.

4. DIGITIZING

The exact procedures in digitizing a map depend on the software that uses the digitized coordinates of the map. Here the digitizing method is designed to digitize boundary segments for use in GIMMS, as described in Carruthers (1985) and Waugh and McCalden (1983).

The stages in digitizing are spelt out in Table 2. First, the map and digitizing plan must be prepared. Secondly, the IBMPC and digitizer must be set up. Thirdly, the software and disk needs to be readied. And fourthly, the digitizing itself can be carried out.

4.1 Preparation of the map and digitizing plan

The map to be digitized should not exceed approximately 50 cm by 50 cm: larger maps must be digitized in parts or be photoreduced prior to digitizing. The digitizing plan will depend on whether points, segments or polygons are to be digitized. Here we describe the strategy for digitizing segments or boundaries that separate one area from another.

Figure 1 shows the boundaries and names of the districts of Northern Ireland, which we wish to digitize. To do this a zone labelling plan and a contiguity matrix are drawn up (Figure 2). All zone labels must begin with a letter. The other numbers are used to capture a hierarchy of areas, each label having the general form

Zrrccdd

where rr = the region number
cc = the "county" number within the region
dd = the district number within the "county"

with districts being arranged alphabetically within county groups. The shaded squares in the diagram indicate which areas share a common boundary. The segments to be digitized number half of the shaded squares and a suitable plan might be to work across each row from the principal diagonal rightwards, digitizing segments thus:

```
Z300101 Z300102  ...   ...                              /
Z300101 Z300107  ...   ...                              /
Z300101 Z300303  ...   ...                              /
          .
          :
Z300604 Z999958  ...   ...                              /
```

4.2 Setting up the digitizer and the IBMPC

The steps are specified in Table 1: ask someone to show you how the first time you use the facility.

4.3   Setting up the program and data disk

The program that you can use is called DIGIT.BAS and there is a copy
on the hard (C) disk. First, load the BASIC compiler by typing
BASICA and then load the program. Insert a formatted disk in drive A
to receive the digitized data. If the disk is not formatted, type
FORMAT and wait for the process to be carried out.

4.4   Digitizing the map

Type RUN and then read and follow the program's instructions (see
Table 2). A steady hand, patience and several hours are required to
carry out the complete process. The program being used is listed in
Figure 3. This writes the digitized coordinates to the data file
after each segment is complete. You can therefore carry out the
digitizing in several sessions, although you will need to merge the
resulting data files before use of GIMMS. Leave the map fixed to
the digitizing tablet between sessions. If this isn't possible (or
someone removes your map), your data are still usable, provided you
digitize four corners of the map with known map coordinates each time
you fix the map to the digitizer. If you end up with such separate
data files you will need to write a program to transform each set of
data to common map coordinates, carrying out translation, rotation
and scaling in the process (see McGregor and Watt 1983, - sections
3.1, 3.2). Such a routine is also built into GIMMS but its use
requires that all segment data be merged first.

The moral: try to complete the digitizing in one work session,
or in as short a time as possible.

4.5   Transferring the data file to the mainframe

Once the digitizing is complete you will need to transfer the data
file to the Amdahl. Table 3 sets out the procedures, employing the
computer-to-computer interface provided by KERMIT (see the KERMIT
HELP file).

5.   CREATING A MAP

Most of the information about producing a map using GIMMS is given in the two GIMMS manuals (Waugh and McCalden, 1983; Caruthers, 1985). Here we explain how to set up the map production process most conveniently on the Leeds Amdahl computer. The map production process can be split into two stages: the creation of a polygon file (Figure 4.1), and the compilation of a map (Figure 4.2). You will carry out the first stage only once for a set of maps. The second stage is used for each map or set of maps produced together with further instructions.

5.1   Creating a polygon file

Figure 4.1 shows the files involved in polygon creation. The user assembles a boundary data file (as described in section 4), a commands file of instructions to the GIMMS package. The package produces a listing file that reports on the execution of commands and any errors, a segments file of boundary data for each segment in compressed format and finally a polygon file of compiled and compressed boundary segments for each zone.

5.1.1 The EXEC file explained

Under CMS each file must be explicitly connected via a data set number or channel to the package, and the program must be executed after these file definitions have been specified. This is best done by creating an EXECutive file. Figure 5 shows an example that can be adapted for most polygon creation problems.

line (1): EXEC SETUP PACKAGES

This links the user to the packages disk in case this has not been done already.

line (2): FI 5 DISK &1 GIMMS

The file on channel 5 is to be found on the user's workdisk with a filename to be specified at runtime and filetype of GIMMS. You replace the &1 with an appropriate filename.

line (3): FI 6 DISK &1 LISTING

Output from the package will be written on channel 6 to the user's disk file with a filename to be specified at runtime and a filetype of LISTING. This may be inspected on screen for errors.

line (4): FI 10 DISK &1 DAT

Channels 10-16 are available to users to connect to data files of various kinds. Here channel 10 is assigned to the raw digitized coordinate data for the boundaries we are interested in. The first

9

portion of such a file for Northern Ireland districts is listed in Figure 6.

line (5): FI 11 DISK &1 SEGMENTS

Channel 11's disk file will be used to create a compressed data file of the digitized coordinates.

line(6): FI 12 DISK &1 GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088

The file on channel 12 is assigned to store the polygon output from the GIMMS package. Note the special disk number and file specifications needed.

line (7): EXEC GIMMS &1

The final line issues the executive command GIMMS which accesses another EXEC file which is used to run the package. One argument – &1 must be supplied to this EXEC: that of the filename for the family of files being used.

To initiate a run of the program the user would type the following command at the keyboard:

    NIGIMMS NI

5.1.2 The GIMMS file

Figure 7 displays the contents of a sample commands file for polygon creation. See the GIMMS manuals for detailed explanations of each command. Note that the channel numbers specified in FILEIN= and

FILEOUT= options to the *FILEIN, *CHECK and *POLYGON commands must correspond with those specified in the EXEC file. Thus, the data input module,*FILEIN, receives the data via channel 10, and outputs to the SEGMENTS file on channel 11. This file is later connected on channel 11 for input to the *CHECK and *POLYGON modules.

5.1.3 The LISTING file

A portion of the LISTING file is displayed in Figure 8. The user can check whether commands have been interpreted as intended or whether an error has been made. Note that LISTING files are not automatically saved to the user's filestore.

5.2 Map compilation

The second stage in map production is illustrated in Figure 4.2. The polygon created at the first stage is input to the GIMMS package along with the commands file and, if necessary, the non-locational data file.

5.2.1 The EXEC file explained

Figure 9 gives an example of an executive file used to control the creation of maps using GIMMS. This is very similar to the previous EXEC, with the following exceptions.

line (4): FI 10 DISK &1 DATA

Channel 10 now links to a non-locational data file.

line (6): EXEC GIMMS &1 &3

A third parameter appears in the executive file as the second parameter to the GIMMS command. This names the device type for which output is to be produced.

5.2.2 The GIMMS file

An example of a commands file for producing an outline map of Northern Ireland's districts is shown in Figure 9. Note the importance of including the parameter TRUSCALE to obtain a map at the size specified by the MAPSIZE option. Otherwise the map will be drawn at the default size of the device selected. To view a map on a VDU screen the TRUSCALE parameter should be omitted if the intended map size exceeds the maximum screen dimensions (17 cm by 17 cm). The largest map that can be produced at Leeds is one with vertical dimension 36 cm (on the Calcomp 1039W plotter).

5.2.3 The map plots

A screen plot of the map is obtained by issuing EXEC commands such as

        UKMAP NI NI DT22

Where NI is the generic filename for the command and polygon files "DT22" is the device name for the screen. A paper copy of this may be obtained via the screen dump command on the BBC micro terminal

        <SHIFT> + <F0>

(see Table 1). Figure 11 shows the result produced on a dot matrix printer.

A graph plot of an outline map of Northern Ireland districts is shown in Figure 12.

6.   UNITED KINGDOM BOUNDARY FILES

From reading sections 4 and 5 of the manual, you will have gathered
that the creation of locational data and polygon files is a time-
consuming process that involves considerable care. The more you can
use pre-prepared files, produced by other users or other
institutions, the easier it is to get on with the job of using
computer drawn maps as research tools or devices for displaying
research results. This section of the manual describes two sets of
locational files for the United Kingdom. The first consists of three
standard area geographies for districts, counties and regions. The
second set consists of three geographies that either mix units from
the standard geographies or adopt another map base. Table 4 sets out
the organization of the standard area files and Table 5 the
organization of the hybrid area files. Each table contains 9 blocks
formed by three row blocks that refer to the areal unit employed and
three column blocks that refer to the collectivity of areal units or
universe involved. Within each block of the table some 9 functions
are identified to which the names of files are attached that fulfill
those functions. These functions are those identified in Figure 4
(except for LISTING files which are emphemeral and non-locational
data files, with which this manual is not concerned).

Note that the raw data function can be fulfilled by a SEGMENTS
file (if this has been created in a previous job) or by POLYGON files
(when these are to be merged). The empty blocks in Table 4 result
from the absence of counties in Northern Ireland (although we did
employ a pseudo-county label for consistency with the Great Britain
zone labelling). The empty blocks in Table 5 indicate that the UK
file for demographic regions was constructed directly rather than
being an amalgam of Great Britain and Northern Ireland polygon files,
although these latter could be constructed quite easily using GIMMS'
INCLUDE and EXCLUDE options. That is left as an exercise for the
reader!

6.1   Locational data files for Great Britain

The locational data files that underlie the Great Britain polygon
files for districts, counties and regions have been imported from the
University of Durham, courtesy of Mike Blakemore of the Department of
Geography.   The files originate from the Department of the

Environment, courtesy of Dick Baxter
"The following conditions of use are attached to the outline data:

    a) For mapping in the case of bona fide unpublished research there
       are no conditions.

    b) If the outlines are used in any map which is to be published,
       acknowledgement must be made to Dr. Baxter, for the original
       work, and to Michael Blakemore of Durham University, for making
       them available.

c) For any form of commercial or contract work, the user should contact the DoE."
(Blakemore in the GBINFO DATA file).

Three files in the GEO6LIB library disk contain information on the Great Britain locational data:

(1) GBSEGS DATA   contains the coordinates of all inter-district boundaries in Great Britain

(2)   GBINFO DATA   describes the data and gives lists of zone labels for regions, counties and districts

(3)   GBCOM DATA   gives GIMMS commands for constructing district, county or region polygon files, which have been adapted to produce those files at Leeds.

These files can be used by users to create their own polygon files.

6.1.1 Great Britain districts

Figure 13 lists the two EXEC and two GIMMS files used in the production of the district outline map (Figure 14).

The LIMITS command in GBDIST GIMMS file shows that the map is defined to be 6550 map units across (X axis or easting) and 12100 units up (Y axis or northing). These map units refer to the Ordnance Survey grid, in which point 0,0 is to the south west of the Scilly Isles. Each map unit represents one tenth of a kilometre or 100 metres.

The way in which the production of district polygons is assured is through use of the MINZONE and MAXZONE options. Districts are identified by 7 alphanumeric character labels. Zone Z100101 is the first (Berwickshire) and Z290804 is the last (Swansea) – see GBINFO DATA for the full list. Note that, when the polygon file GBDIST GIMMSFIL is used, the non-locational data must be in the correct GIMMS order specified in GBINFO DATA. This applies to all polygon files: the zone ordering or area list for each is given in the "INFO" file given at bottom of each block of Table 4 and Table 5.

6.1.2 Great Britain counties

The polygon file for counties in Great Britain – GBCOUNTY GIMMSFIL – was produced from the SEGMENTS file produced in creating the districts map. Figure 15 shows the result. Note that Scottish regions are regarded here as the equivalent of English and Welsh counties.

6.1.3 Great Britain regions

The polygon file for Great Britain regions   GBREGION GIMMSFIL   was produced in the same way as counties with a command file – GBREGION

GIMMS - derived from that supplied by Dick Baxter of DoE - GBCOM DATA. The region outlines are shown on the later United Kingdom map (Figure 18).

6.2 Locational data files for Northern Ireland

6.2.1 Northern Ireland districts

The digitizing of the Inter-district boundaries in Northern Ireland was described in section 4. The original map used was that on p. 15 of <u>Philips' New World Atlas</u> (George Philip, London; 4th Edition, 1981) blown up by 100% on a photocopier, and hence can be regarded as only a first approximation. There is probably a slight Northward displacement of Northern Ireland relative to its true position with respect to Great Britain.

To merge the Great Britain and Northern Ireland district maps, the digitizer coordinates had to be related to the Great Britain Ordnance coordinates (not the Ireland Ordnance Survey coordinates). This was done by using the CONVERT option of the *FILEIN command in which the 4 corners of the Northern Ireland map sheet are given both map and digitizer coordinates:

```
CONVERT
     0000   4600   4290    7956
     0000   6200   4290   12536
     2000   6200   9966   12536
     2000   4600   9966    7956
```

These are approximate conversions only and need revision if detailed cartography is to be undertaken. The CONVERT option information was inserted at the head of the NI DAT file after the SEGMENTS option. A polygon file, NIDIST GIMMSFIL, is then created, and checked by being plotted using the same map commands as for Great Britain districts (files NIDMAP GIMMS and NIDMAP PLOT).

6.2.2 Northern Ireland counties

The Northern Ireland zone labels for districts (see Figure 2) have been arranged with the following county codes

```
01   Antrim
02   Armagh
03   Down
04   Fermanagh
05   Londonderry
06   Omagh
```

but these are merely aggregations of local authority district areas rather than administrative areas. The equivalent polygon file was not produced, though could be quite easily.

6.2.3 Northern Ireland region

Northern Ireland is the eleventh region recognized in UK official statistics. The files listed in Table 4 were merely used to create a polygon file based on OS(GB) coordinates for later merger with the equivalent GB file.

6.3 Locational data files for the United kingdom

6.3.1 United Kingdom districts

GIMMS provides a procedure for merging polygon files together, and this is used to merge the Great Britain and Northern Ireland district polygon files. Clearly, to do this the two files must have been prepared on the same basis: using the same map coordinates and the same scheme for zone labelling. Hence the need to use the more elaborate GB zone labelling system for Northern Ireland districts, and the need to convert the digitizer coordinates to OS(GB) coordinates.

Figure 16 displays the files required to merge the two component polygon files and to produce a plot file for producing the map shown in Figure 17.

6.3.2 United kingdom regions

The same procedures as for districts are used to merge the regional polygon files for Great Britain and Northern Ireland and Figure 18 shows the resultant outline map.

6.4 Locational data files for Family Practitioner Committee Areas (FPCAs)

The general practice service of the National Health Service is organized by Family Practitioner Committees whose areas cover (roughly) former metropolitan districts and counties in England and Wales. The National Health Service Central Register (at Southport) keeps records of patient transfers between Family Practitioner Committee Areas (FPCAs) and the Office of Population Censuses and Surveys prepares files and listings of these statistics as quarterly and annual records of migration in England and Wales. Migration flows between FPCAs in England and Wales and Scotland, Northern Ireland and overseas are also recorded. Our interest then was to

construct a polygon file that would enable us to map migration variables for the 96 zones of this set of FPCAs in England and Wales (94 zones) together with Scotland and Northern Ireland.

6.4.1 FPCAs in Great Britain

To do this we used two files of digitized boundary information for wards kindly pre-processed (with respect to zone labels) by Keith Cole of UMRCC. The first - KCFILE1 SEGSMET - contains the inter-ward segments for the districts of former metropolitan counties; the

15

second contains inter-ward segments for the districts of non-metropolitan counties. These files are built up from the county ward files described in Cole (1985). It was decided not to attempt to compile the FPCA polygon from one raw data file, given the large size and fine scale (digitizing to the nearest 10 metres) of the complete ward data set for Great Britain).

Many difficulties were experienced in carrying out this task, and we describe here the way these were overcome just in case we or other users may need to create polygon files based on the ward boundary data.

(1) The large version of GIMMS was required to deal with the large number of points per segment involved (particularly for Scotland as one area). The large version of GIMMS was specially mounted on the package disk and was accessed via an exec LGIMMS EXEC. Since this large version is only likely to be used occasionally, it may well be removed again from the P disk. On request, the Computing Service will remount it.

(2) Very large scratch files are required by the LGIMMS version to accomplish the task, and the user needs to acquire a large temporary disk on which to do the work. The method for doing this is summarized in Table 7.

(3) If difficulty is still experienced with the size of the polygon file being created, then employ the REDUCE option to the *POLYGON command in GIMMS which removes points closer together than the parameter which follows the option. In creating the FPCA polygon file, we employed REDUCE 40 so that points closer than 40 map units together (i.e. 400 metres) were ignored.

Figure 19 sets out the stages in compiling the FPCA polygon file. Job A (files with name KCA) created the polygon file for FPCAs in metropolitan counties and Greater London; job B (files with name KCB) created the polygon file for FPCAs in non-metropolitan counties plus Scotland as one zone. Job C (files with name KCC) merged the two together.

6.4.2 FPCAs in the United Kingdom

The next step was to create a polygon file for Northern Ireland as a zone and to add it to the England and Wales plus Scotland file to

yield a UK FPCA zone system. The file of Northern Ireland digitized boundary coordinates had to be modified to be compatible with the FPCA polygon file for GB in two respects: the zone number of Northern Ireland was changed from 30 to 98 and the CONVERT option was changed to increase the number of digits in the OS(GB) coordinates. The LIMITS option in the command file were changed to 0,0,70000,110000 from 0,0,6550,12500 of the previous districts and region polygon files. The Northern Ireland and England and Wales plus Scotland polygon files were then merged. Table 5 lists the files involved in

16

these procedures.

The final product, an outline map of the United Kingdom FPCA zone system, is shown in Figure 21. The command file used to construct is listed in Figure 20. This listing shows the technique for achieving insets. The FPCAs in each metropolitan area are reproduced at double the general map scale.

6.5 Locational data files for European Community Level 2 regions

European Community Level 2 regions number 20 in the UK. They have been widely used by OPCS in the migration tables from 1971 and 1981 censuses, and have been used for interregional migration modelling and multiregional population projection by Stillwell (1986) and Rees (1986).

To create the Great Britain polygon file, the district boundary data file used to create the district, county and region maps (Table 4) was modified. The zone labels were carefully extended from the form

        Zrrccdd

where rr=region number, cc=county number and dd=district number, to the form

        Zzzrrccdd

where zz was the EC2 level sequence number used in the work of Stillwell (1986) and Rees (1986) – see the information file UKZONE LIST for details. Table 5 lists the files involved in the production of the polygon file GBZONE GIMMSFIL.

A Northern Ireland polygon file was then created after modifying the Northern Ireland region number in NI DAT to 01 from 30, and this was merged with the GB zone polygon file to yield the polygon file for the whole UK, UKZEC2 GIMMSFIL. The resulting outling map is shown in Figure 22.

6.6 A demographic map of European Community Level 2 regions

The final polygon file for a UK geography that has been placed on the library disk is that for a sketch map! The original map was produced by John Craig of OPCS (Craig, 1977) for regions: the boundaries of the region were drawn so that the areas were roughly proportional to population, and as close to a generalized version of their real geographic shape as possible. The map was further modified to represent European Community Level 2 regions, and then digitized directly from a tracing on graph coordinate paper.

Figure 23 shows a listing of the file used to produce the outline map (Figure 24). In this example, because the map is fairly simple and demands relatively few digitized points for definition,

17

the instructions for polygon creation, the boundary data itself and
the instructions for drawing an outline map have all been included in
one file for convenience.

6.7 A summary of the files available on the Geography library disk

Only some of the files described in this section of the manual and
listed in Tables 4 and 5 have been placed on the common access
Geography library (GEO6LIB) disk. They are represented in capital
letters in Tables 4 and 5, but have been reproduced for convenient
reference in Table 6. Access to the other files referenced in Tables
4 and 5 (located in the filestore of GEO6PHR) can be arranged.
Principal use will be made of the <u>polygon files</u> listed in the centre
of Table 6 for thematic map production. <u>Polygon creation</u> and
<u>map compilation files</u> have been included, also, so that users can
develop their own versions from a convenient base. The
<u>information files</u> give crucial information on the ordering and
definition of zones in each polygon file. Three <u>data</u> files are
included so that users can create their own polygon files for any set
of polygons that are combinations of districts, or counties or
regions.

7. CONCLUDING REMARKS

In writing this manual we have had the aim of making computer mapping more accessible. To achieve this, the manual has documented the procedures for using a powerful and flexible thematic mapping package on the University of Leeds Amdahl computer. It has also documented a set of locational data files which we are currently using in our research and which others may also find of use. Success will be gauged by the numbers of applications for access to the digitized boundary information that are generated, and by the number of maps that roll off the campus graph plotters in future.

REFERENCES

Birkin, M. and Rees, P. (1882)
    The 1981 Census small area statistics for West Yorkshire wards: how to
    access, extract and analyse. Working Paper 342/Computer Manual 17,
    School of Geography, University of Leeds, Leeds.

Carruthers, A.W. (1985)
    Introductory user guide to GIMMS. GIMMS Ltd, Edinburgh.

Cole, K. (1985)
    Notes on using the DoE digitized boundary data base. University of
    Manchester Regional Computer Centre, Manchester.

Computing Service (1985)
    Operating system: Amdahl computer. Chapter AC of Users' Manual,
    Computing Service, University of Leeds, Leeds.

Computing Service (1986)
    KERMIT help file [KERMIT HELPLDS Y]. Computing Service, University of
    Leeds, Leeds (original programs by F. da Cruz, Columbia University and
    H. Fischer, Litton Data Systems, Van Nuys, California, and others).

Craig, J. (1977)
    Population scale mapping. Population Trends, 8, 18-19

Hirschfield, A. and Rees, P. (1984)
    DATAPAC: a program for the extraction of census and vital statistics
    for Leeds wards. Working Paper 392/Computer Manual 22, School of
    Geography, University of Leeds, Leeds.

Jacoby, P. (1984)
    Information on GIMMS, version 4.5 at Leeds. Computing Service,
    University of Leeds, Leeds.

McGregor, J. and Watt, A. (1983)
    Advanced programming techniques for the BBC micro. Addison-Wesley,
    London.

Naden, P. (1986)
    A guide to using terminals and microcomputers. Course document,
    Geography Practical 2, School of Geography, University of Leds, Leeds.

Rees, P.H. (1986)
    Choices in the construction of regional population projections.
    Chapter 7 in R.I. Woods and P.H. Rees (eds.) Population structures and
    models. George Allen and Unwin, London. Pp. 126-159.

Stillwell, J.C.H. (1986)
    The analysis and projection of interregional migration in the United
    Kingdom. Chapter 8 in R.I. Woods and P.H. Rees (eds)
    Population structures and models. George Allen and Unwin, London. Pp
    160-202.

Waugh, T.C. and McCalden, J. (1983)
    GIMMS reference manual GIMMS Ltd, Edinburgh.

TABLE 1. How to get set up for GIMMS WORK

STAGE (1) STARTING				
user actions		SWITCH ON MODE 3 or MODE 0 *VDU \<RETURN\>		

STAGE (2)	ROUTING THROUGH THE NETWORK	West TAC	West TAC	West TAC	West PAD
		North TAC	Central TAC	Central TAC 7171 Controller	
		Amdahl	Amdahl	Amdahl	Amdahl
user actions		N	C	C	CALL CMS1
		A	A	B	
				\<CTRL\>+\<F4\>	
				BBCMICRO	

STAGE (3) LOGGING ON			
User actions	LOGON	userid	
		password	
		\<RETURN\>	

STAGE (4) OBTAINING MORE MEMORY	
user actions	CP DEF STOR 2M
	IPL CMS or I CMS
	ACCESS IAI A or ACC IAI A or B

STAGE (5) ACCESSING THE PACKAGE	
user actions	SETUP PACKAGES
	GIMMS filenname devicename

STAGE (6) OBTAINING MODE 0 FOR SCREEN GRAPHICS		
	(1) North TAC or CTAC via A or PAD	(2) CTAC via B

		LINEMODE ON
user actions	\<CTRL>+\<F0> \<RETURN>	\<CTRL>+\<F0> \<RETURN>

STAGE (7) SCREEN DUMPING & SCREEN CLEARING		

	\<SHIFT>+\<F0>	
user actions	\<CTRL>+\<F6>	

STAGE (8) OBTAINING MODE 3 FOR TEXT AGAIN		
	(1) NorthTAC or CTAC via A or PAD	(2) CTAC via B

		LINEMODE OFF
user actions	\<CTRL>+\<F3> \<RETURN>	\<CTRL>+\<F3> \<RETURN>

STAGE (9) OBTAINING DIFFERENT SCREEN COLOURS		
	(1) Dark on light on monochrome monitors	(2) White on blue on colour monitors

	\<CTRL> + \<F8>	
	\<CTRL> + S	
	07000 \<RETURN> \<DELETE> \<RETURN> \<RETURN>	04000 \<RETURN> \<DELETE> \<RETURN> \<RETURN>
user actions	\<CTRL>+\<F8> \<CTRL>+S 10000 \<RETURN> \<DELETE> \<RETURN> \<RETURN>	

Glossary of abbreviations used in Table 1

MODE	type of screen supported by BBC micro
VDU	visual display unit
TAC	terminal access controller
PAD	packet assembler and disassembler
West	West computing constituency
	(grouping of departments) = Colour Chemistry, Geography, Plant Sciences, Psychology, SPHSS, Textiles, Transport, Zoology
North (N)	North computing constituency
	(Grouping of departments) = Engineering and Applied Science departments
7171	device for emulationg IBM 3270 screens on lower functionality terminals
CMS	Conversational monitor system (operating system on Amdahl)
Central (C)	Central computing constituency
Amdahl (A)	the university's largest mainframe
B	command for accessing the Amdahl via the 7171
L	logon
CP	control program (operating system on Amdahl)
IPL or I	initial program load
ACCESS or ACC	provide access to named disk or disk with filemode indicated
<RETURN>	return or enter key on keyboard
<CTRL>	control key on keyboard
<F0>...<f9>	function key
LINEMODE ON	non-7171 mode on terminals connected to 7171

TABLE 2. Stages in digitizing a map

STAGE	DETAILED INSTRUCTIONS
(1) PREPARE THE MAP AND DIGITIZING PLAN	Obtain a copy of the map at suitable size (not bigger than 50 x 50 cm) Define zone labels and names Draw up a contiguity matrix Draw up a plan for the order of segment digitising Mount the map on the digitizer
(2) SET UP THE DIGITIZER & IBMPC	Connect the digitizer cable to the communications port on the IBM PCXT Switch on the IBM PCXT Load the disk operating system (DOS) usually automatic on switching on Switch on the digitizer
(3) SET UP THE PROGRAM & DATA DISK	Type BASICA (this loads the advanced BASIC compiler) LOAD DIGIT.BAS, (should be available on the hard or C disk) Insert a formatted data disk in the A drive, on which the digits file will be written
(4) DIGITIZING THE MAP	Type RUN Follow the instructions given on the screen by the program to transfer digitized coordinates from the digitizer via presses of the cursor button
N.B.	First digitize a "dummy" segment consisting of the 4 corners of map, the map coordinates of which are known. This information will be used to convert digitizer coordinates to map coordinates in GIMMS. When you have finished, check that you have the file of digitized coordinates on the data disk via the command: DIR A:filename.fileextension

TABLE 3.	Transferring the data file from the IBMPC to the Amdahl

STAGE	DETAILED INSTRUCTIONS
(1) SET UP THE IBMPC	Make sure the terminal cable is connected to the socket on the wall. If you have just finished digitizing (Table 2), just type SYSTEM otherwise switch on and load DOS (automatically with disk drive door open)
(2) CONNECT TO THE MAINFRAME & AND LOAD KERMIT	Check the line is available and switch to the IBMPC. Load KERMIT The screen prompt should change from C> to KERMIT-MS> Type CONNECT or C
(3) LOGON TO THE MAINFRAME & LOAD KERMIT	<RETURN> to get the TAC message Logon to the Amdahl in the usual way (see stages (2) and (3) in Table 1) When the screen prompt (.) is available, Type KERMIT The screen prompt should change to KERMIT-CMS>. Type SERVER to connect to file server mode type <CTRL>+] (=the ESCAPE character) Then type CONNECT or C to move to the IBMPC
(4) TRANSFER THE FILE	KERMIT-MS> now appears Type SEND drivename: filename.fileextension e.g. SEND A: NI.DAT Wait: KERMIT informs you about the progress of the transfer
(5) FINISHING OFF	When the file transfer is done, type FINISH and then type CONNECT or C to move the mainframe. Press <RETURN> to reaccess CMS Type LIST filename fileextension (D to check that the file has been successfully transferred. Logoff

Note: for details about KERMIT see HELP KERMIT .....

TABLE 4.   Files for standard geographies

		UNIVERSE		
UNITS	FUNCTION	Great Britain (England, Wales and Scotland)	Northern Ireland	United Kingdom (Great Britain, Northern Ireland)
		GB	NI	UK
	Data	GBSEGS DATA	NI DAT	GBDIST GIMMSFIL nidist gimmsfil
	Executive	gbgimms exec	nigimms exec	nigbdmrg exec
Districts	Command	GBDIST GIMMS	nidist gimms	nigbdmrg gimms
	Segment	gbsegs segments	nidist segments	–
(D-set)	Polygon	GBDIST GIMMSFIL	nidist gimmsfil	UKDIST GIMMSFIL
	Executive	GBMAP EXEC	GBMAP EXEC	GBMAP EXEC
	Command	GBDMAP GIMMS	nidmap gimms	ukdmap gimms
	Plot	gbdmap plot	nidmap plot	ukdmap plot
	Area list	GBINFO DATA	NIINFO LIST	UKINFO LIST
	Data	gbsegs segments		
	Executive	gbgimms2 exec		
	Command	gbcounty gimms	<Not	<Not
Counties	Segment	gbsegs segments		
	Polygon	GBCOUNTY GIMMSFIL	produced>	produced>
(C-set)	Executive	GBMAP EXEC		
	Command	gbcmap gimms		
	Plot	gbcmap plot		
	Area list	GBINFO DATA		
	Data	gbsegs segments	nidist segments	GBREGION GIMMSFIL niregion gimmsfil
	Executive	gbgimms2 exec	nigimms2 exec	nigbrmrg exec
	Command	gbregion gimms	niregion gimms	nigbrmrg gimms
Regions	Segment	gbsegs segments	nidist segments	–
	Polygon	GBREGION GIMMSFIL	niregion gimmsfil	UKREGION GIMMSFIL
(R-Set)	Executive	GBMAP EXEC	GBMAP EXEC	GBMAP EXEC
	Command	gbrmap gimms	nirmap gimms	ukrmap
	Plot	gbrmap plot	nirmap plot	ukrmap plot
	Area list	GBINFO DATA	NIINFO LIST	UKINFO LIST

See GBCOM DATA for suggested GIMMS commands for use
(after adaption) with GBSEGS

Nomenclature for files:-

GBDIST GIMMSFIL – on the GEO6LIB library disk (user's 'D' disk)

gbgimms exec – a listing of file given in text of manual

ukdmap gimms – file available in GEO6PHR filestore (see author for access)

gbcmap plot – example map produced from this file reproduced in the text

27

TABLE 5. Files for hybrid area geographies

UNITS	FUNCTION	UNIVERSE		
		Great Britain (England, Wales and Scotland)	Northern Ireland	United Kingdom (Great Britain, Northern Ireland)
		GB	NI	UK
Family Practit-ioner committee Areas (F-set)	Data	kcfile1 segsmet kcfile2 segscnty	nifp data	FPCAEWS GIMMSFIL niregfp gimmsfil
	Executive	kca,kcb,kcc exec	nigimfp exec	nigbfmrg exec
	Command	kca,kcb,kcc exec	niregfp gimms	nigbfmrg gimms
	Segment	kca,kcb bsf	niregfp segments	-
	polygon	FPCAEWS GIMMSFIL	niregfp gimmsfil	UKFPCA GIMMSFIL
	Executive	fpcamap exec	-	GBMAP EXEC
	Command	fpca1 gimms	-	UKFMAP GIMMS
	Plot	fpca1 plot	-	ukfmap plot
	Area list	KCFILE0 LIST fpseq exec, fpseq fortran	NIINFO LIST	UKFPCA LIST
European Community Level 2 regions (e-set)	Data	gbzsegs data	nizone data	GBZONE GIMMSFIL
	Executive	gbzone exec	nizone exec	nigbzmrg exec
	Command	gbzone gimms	nizone gimms	nigbzmrg gimms
	Segment	gbzone segments	nizone segments	
	Polygon	GBZONE GIMMSFIL	nizone gimmsfil	UKZEC2 GIMMSFIL
	Executive	GBMAP EXEC	-	GBMAP EXEC
	Command	gbzmap gimms	-	ukzmap gimms
	Plot	gbzmap plot	-	ukzmap plot
	Area list	UKZONE LIST	UKZONE LIST	UKZONE LIST
Demo-graphic EC2 regions (P-set)	Data			UKZONE GIMMS
	Executive			ukzgimms exec
	Command	< Not	<Not	UKZONE GIMMS
	Segment	produced>	produced>	ukzone segments
	Polygon			UKZONE GIMMSFIL
	Executive			GBMAP EXEC
	Command			ukzone0 gimms
	Plot			ukzone0 plot
	Area list			UKZONE LIST

Nomenclature for files:-
UKFPCA GIMMSFIL – on the GEO6LIB library disk (user's 'D'disk)
UKZONE GIMMS – a listing of the file given in the textofthe manual
nizone data – file available in GEO6PHR filestor (see author for access)
ukzmap plot – example map shown in the text

28

TABLE 6. **Summary of mapping files available on the Geography library disk GEO6LIB)**

File sets and filenames		Description
DATA FILES		
GBSEGS	DATA	Segment file for GB districts: OS coordinates
NI	DAT	Segment file for NI districts: digitizer coordinates
UKZONE	GIMMS	Segment file for UK population zones: graph coordinates
POLYGON CREATION COMMAND FILES		
GBCOM	DATA	Dick Baxter's GIMMS commands for GBSEGS DATA
GBDIST	GIMMS	Adapted version of above for GB districts
POLYGON FILES		
GBDIST	GIMMSFIL	GB districts: OS coordinates (100m)
NI	GIMMSFIL	NI districts; digitizer coordinates (100m)
UKDIST	GIMMSFIL	UK districts: OS coordinates (100m)
GBCOUNTY	GIMMSFIL	GB counties: OS coordinates (100m)
GBREGION	GIMMSFIL	GB regions: OS coordinates (100m)
UKREGION	GIMMSFIL	UK regions: OS coordinates (100m)
FPCAEWS	GIMMSFIL	EW FPCAS+ Scotland: OS coordinates (10m)
UKFPCA	GIMMSFIL	EW FPCAS+ Scotland: OS coordinates (10m)
GBZONE	GIMMSFIL	GB EC2 regions: OS coordinates (100m)
UKEC2	GIMMSFIL	UK EC2 regions: OS coordinates (100m)
UKZONE	GIMMSFIL	UK population zones (EC2): graph coordinates
MAP COMPILATION GIMMS FILES		
GBMAP	EXEC	General executive file for map compilation
GBMAP	GIMMS	GB districts: GIMMS commands for outlines
INFORMATION FILES		
GBINFO	DATA	Zone labels & names for GB districts, counties & regions
NIINFO	LIST	Zone labels & names NI districts
UKINFO	LIST	Zone labels & names UK districts
KCFILE0	LIST	Zone labels & names for FPCAs in EWS
UKFPCA	LIST	Zone labels & names for FPEAs in UK
UKZONE	LIST	Zone label & names for EC2 level regions in UK

TABLE 7. Getting and using a large temporary work disk for use with a large version of GIMMS

STEP	CMS COMMAND	MEANING
(1)	DEF T3350 AS 111 CYL 30	Define temporary disk, type 3350 as user's 111 disk, size 30 cylinders (15 times an ordinary work disk)
(2)	FORMAT 111 A	This initiates a procedure for formatting the disk. You need to answer two questions – one to erase existing files and the second to name the disk
(3)	ACCESS 1A1 B	This enables you to access files on your work disk as your B disk
(4)	COPY filename filetype B = = A	Copy over all files needed for the work disk to the temporary disk
(5)	Carry out the polygon creation	
(6)	COPY filename filetype A = = B	Copy over all files needed for future use to the work disk from the temporary disk

N.B. Double check that all work has been transferred or printed when you have finished. Files on temporary disks are temporary only

FIGURE 1.   The districts of Northern Ireland

NORTHERN IRELAND - DISTRICTS

BE=BELFAST
CF=CARRICKFERGUS
CR=CASTLEREAGH
ND=NORTH DOWN
NE=NEWTONABBEY
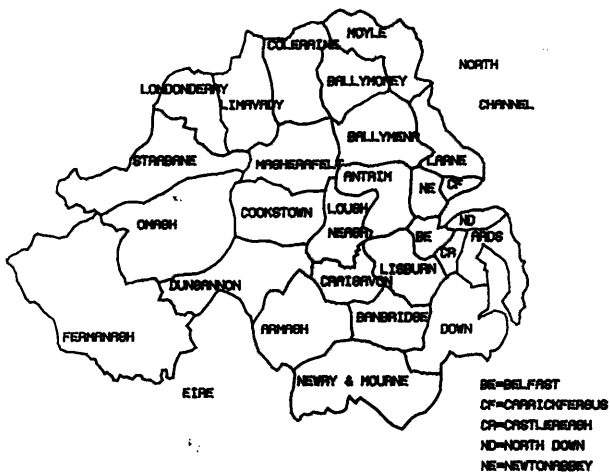
FIGURE 2. A contiquity matrix for Northern Ireland districts
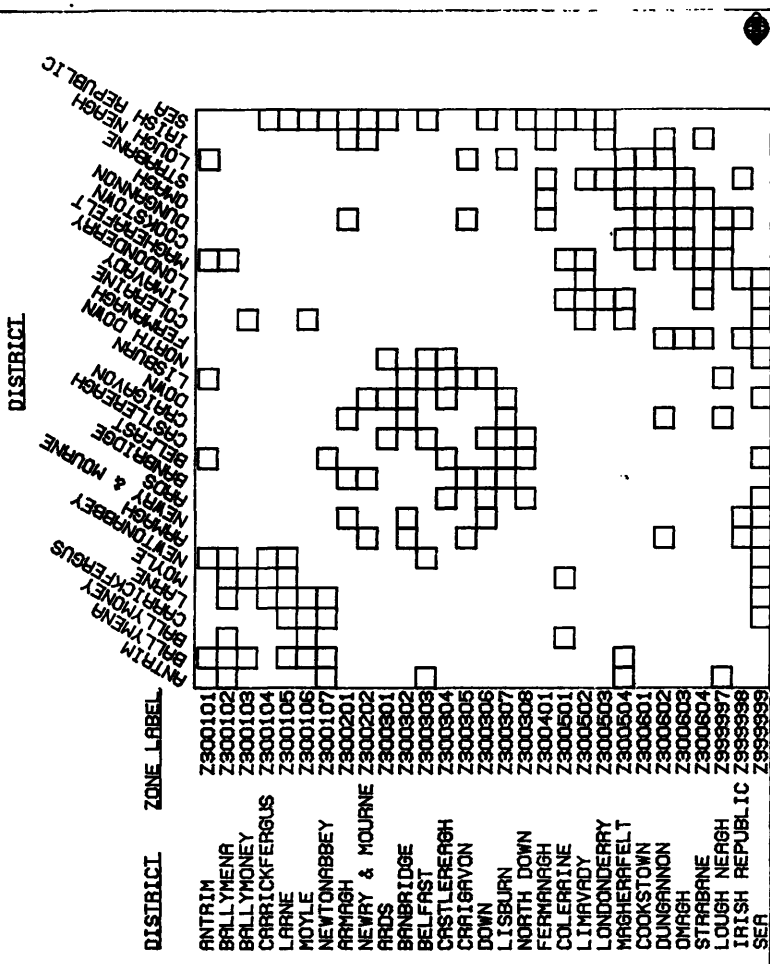
FIGURE 3. A listing of DIGIT.BAS, a digitizing program

```
================================================================================
10 REM DIGIT.BAS = PROGRAM FOR DIGITIZING LINE SEGMENTS
20 REM on the IBMPC XT with the GTCO digitizer
30 REM Adpated from programs by Jim Hogg and Mark Birkin
40 REM Author:  Phil Rees, April 1987
45 REM A maximum of 100 points per segment is catered for
50 OPEN "COM1:2400,E,7,1,CS,DS" AS £1
60 DIM X(100),Y(100),POINTS(100)
70 REM The starting screen is set up
75 CLS
80 LOCATE 2,30:PRINT "DIGIT"
90 LOCATE 4,10:PRINT "This is a simple program to digitize"
100 LOCATE 5,10:PRINT "the boundaries of line segments on maps"
110 LOCATE 6,10:PRINT "for use with the GIMMS package."
120 LOCATE 9,15:PRINT "The cursor buttons should be used as follows:"
130 LOCATE 11,15:PRINT "1. to digitize points"
140 LOCATE 12,15:PRINT "2. to digitize nodes (endpoints of segments)"
150 LOCATE 13,15:PRINT "4. to abort the current line segment"
160 LOCATE 16,10:PRINT "Button positions:"
170 LOCATE 18,10:PRINT "4   2  1"
180 LOCATE 19,10:PRINT "O   O  O"
190 LOCATE 20,10:PRINT "8      ?"
200 LOCATE 21,10:PRINT "O      O"
210 LOCATE 23,10:INPUT "Press enter key to continue ";G$
220 CLS
230 LOCATE 1,10:PRINT "To digitize any line segement:"
240 LOCATE 3,12:PRINT "A. type in the first zone name at the keyboard"
250 LOCATE 5,12:PRINT "B. type in the second zone name at the keyboard"
260 LOCATE 5,12:PRINT "C. press cursor button 1 to digitize each point
    until the last"
270 LOCATE 6,12:PRINT "D. press cursor button 2 to digitzize the end
    point (node)"
280 PRINT:INPUT "Enter a short name (<= 6 chars) for the file";FILNAM$
290 FILNAM$="A:"+FILNAM$+".DAT"
300 OPEN FILNAM$ FOR OUTPUT AS £2
310 INPUT "Do you wish to digitize another line segment (Y for yes, N for
    no)";A$
320 IF A$ = "N" THEN 1000
330 IF A$ <> "Y" THEN 310
340 PRINT "Line segment digitizing begins:"
350 INPUT "Name of right hand zone (<= 8 alphanumeric characters)";RZONE$
360 INPUT "Name of left hand zone (<= 8 alphanumeric characters)";LZONE$
370 PRINT:PRINT "Input coordinates for current segment"
380 NP=0
390 F$=INPUT$(14,£1)
================================================================================
```

33

FIGURE 3.   Continued

```
==================================================================
400 NP=NP+1
410 PRINT:PRINT F$
420 BUT=VAL(LEFT$(F$,1))
430 XCOORD=VAL(MID$(F$,2,5)):YCOORD=VAL(MID$(F$,8,5))
440 PRINT "XCOORD= ";XCOORD;TAB(3);"YCOORD= ";YCOORD
450 X(NP)=XCOORD: Y(NP)=YCOORD
460 IF(BUT=1) THEN GOTO 390
470 IF(BUT=2) THEN GOTO 500
480 IF(BUT=4) THEN PRINT "Segment deleted": GOTO 310
500 PRINT£2,RZONE$;" ";LZONE$
510 FORM$="   £££££   £££££"
520 FOR I=1 TO NP
530 PRINT£2,USING FORM$;X(I),Y(I)
600 NEXT I
605 PRINT£2," /"
610 GOTO 310
1000 CLOSE£2
1010 END
==================================================================
```

34

FIGURE 4. Files involved in map production using GIMMS at Leeds

4.1 Creating a polygon file

```
COMMANDS FILE                        BOUNDARY FILE
   (FI 5)                               (FI 10)

                \                     /
                 →  GIMMS PACKAGE  ←
                    /        |                    Controlled
                   /         |                    by an EXECutive
  LISTING FILE        SEGMENTS FILE               file and
    (FI 6)              (FI 11)                    associated
                          |                       command
                          ↓
                     GIMMS PACKAGE
                          |
                          ↓
                     POLYGON FILE
                       (FI 12)
```

4.2 Map compilation

```
COMMANDS FILE    POLYGON FILE    NON-LOCATIONAL DATA FILE
   (FI 5)          (FI 12)             (FI 10)

         \            |            /
          →    GIMMS PACKAGE    ←               Controlled
                     |                          by an EXECutive
                     |                          file and
                     ↓                          associated
                 PLOT FILE                      command
               (FI PLOTTER)
               /           \
              ↓             ↓
          SCREEN         PLOTTER FILE
            |                 |
            ↓                 ↓
     DOT MATRIX MAP      PEN PLOTTED MAP
```
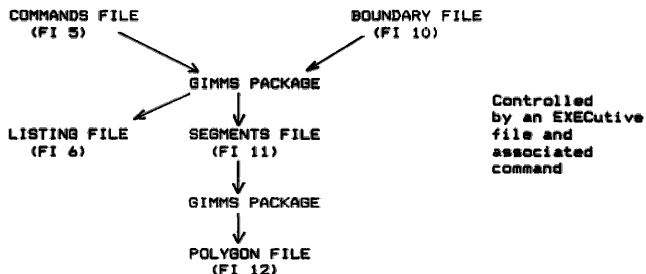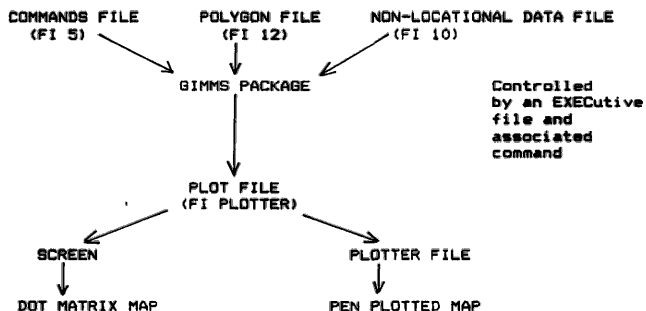
FIGURE 5. <u>An example of an executive file for polygon creation</u>

FILE: NIGIMMS EXEC
```
================================================================
EXEC SETUP PACKAGES
FI 5 DISK &1 GIMMS
FI 6 DISK &1 LISTING
FI 10 DISK NI DAT
FI 11 DISK &1 SEGMENTS
FI 12 DISK &1 GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088 '
EXEC GIMMS &1
================================================================
```

FIGURE 6. <u>An example of a boundary data file</u>

```
FILE:  NI DATA
=================
SEGMENTS
Z300101 Z300102
   7519  10594
   7560  10594
   7603  10593
   7637  10599
   7672  10610
   7703  10610
   7745  10600
   7779  10591
   7816  10582
   7851  10582
   7902  10589
   7966  10607
   8017  10615
   8064  10624
   8097  10622
   8102  10627
   8152  10614
   8181  10593
   8205  10575
   8224  10561
 /
Z300101 Z300107
   8223  10560
   8226  10514
   8224  10466
   8220  10415
   8218  10377
   8217  10324
   8205  10280
   8206  10248
   8208  10206
   8218  10172


      .        .
      .        .
      .        .

 /
=================
```

FIGURE 7. <u>An example of a commands file used for polygon construction</u>

```
FILE:  NI GIMMS
========================================================================
<-------------- FILE = NI GIMMS -------------------->
<-------- CRUDE DIGITIZING OF NORTHERN IRELAND ------>
<-------- DISTRICTS, PSEUDO-COUNTIES AND REGION ----->
<-------- APRIL 1987, PHIL REES, SCHOOL OF GEOGRAPHY->
*PLOTPARM PLOTTER,TITLE='NORTHERN IRELAND BOUNDARIES'
*FILEIN SEGMENT FILEIN= 10 FILEOUT=11 FILENAME=NISEGS
  TITLE= 'NORTHERN IRELAND DISTRICTS, PSEUDO-COUNTIES & REGION'
  LIMITS= 4000,7000,10000,13000  AUTONODE TOL=20
  BEGIN
*CHECK FILEIN= 11, DIAGS=2, EXCLUDE ZONES= Z999997 Z999998 Z999999 *
*POLYGON FILEIN= 11, FILEOUT=12, FILENAME=NIGFIL
  DIAGS=4, NZONES=40, MAXPTS=1500
  EXCLUDE ZONES = Z999997 Z999998 Z999999
  ALPHA, CULDESAC
*STOP
========================================================================
```

FIGURE 8. <u>An example of a listing file associated with polygon creation</u>

FILE: NI LISTING
===
...GIMMS......GIMMS......GIMMS......GIMMS......GIMMS......GIMMS...
T.C.WAUGH
GIMMS LTD.
RELEASE : 4.5

 >>>>>>-------------- FILE = NI GIMMS --------------------->

 >>>>>>-------- CRUDE DIGITIZING OF NORTHERN IRELAND ------>

 >>>>>>-------- DISTRICTS, PSEUDO-COUNTIES AND REGION ----->

 >>>>>>-------- APRIL 1987, PHIL REES, SCHOOL OF GEOGRAPHY->
COMMAND:*PLOTPARM

OPTION = PLOTTER
OPTION = TITLE   = 'NORTHERN IRELAND BOUNDARIES'
GINO-F MARK 2.6   1/1/80

GRAPHICS OUTPUT IS TO GINO DEVICE C1012
DEVICE CHOSEN IS PLOTTER

COMMAND:*FILEIN

OPTION = SEGMENT
OPTION = FILEIN   = 10
OPTION = FILEOUT   = 11
OPTION = FILENAME = NISEGS
OPTION = TITLE   = 'NORTHERN IRELAND DISTRICTS, PSEUDO-COUNTIES & REGION'
OPTION = LIMITS   = 4000
OPTION = YL   = 7000
OPTION = XH   = 10000
OPTION = YH   = 13000
OPTION = AUTONODE
OPTION = TOL   = 20
OPTION = BEGIN

TYPE COMMAND:SEGMENTS
SEGNO   NAMES   NODES   START   COORD FINISH   COORD PTS
  Z300101   Z300102   Z300101   Z300107   Z300101   Z300303
Z300101   Z300307   Z300101   Z999997   Z300101   Z300504
Z300102   Z300103   Z300102   Z300106   Z300102   Z300105
Z300102   Z300107   Z300102   Z300504   Z300103   Z300106
Z300103   Z300501   Z300104   Z300105   Z300104   Z999999
===

39

FIGURE 9. An example of an executive file for map compilation

FILE: UKMAP EXEC
===
EXEC SETUP PACKAGES
FI 5 DISK &1 GIMMS
FI 6 DISK &1 LISTING
FI 10 DISK &1 DATA
FI 12 DISK &2 GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
EXEC GIMMS &1 &3
===   .

FIGURE 10. An example of an executive file used for map compilation

FILE: NIMAP GIMMS
===
:--------- FILE = NIDMAP GIMMS ---------------->
:---- THE INSTRUCTIONS FOR PRODUCING A DISTRICT MAP --->
*PLOTPROG
  *PLOTPARM DEVICE=PLOTTER
    *NEWMAP MAPSIZE=20,16 FRAME TRUSCALE
     *GIMMSFILE=12 < ----------- THE LOCATIONAL DATA FILE ---->
    *SCALE YSIZE=16
    *DRAWMAP OUTLINES=ALL   `.
    *TEXT POSITION= 0.75,14.5 SIZE=0.2
     TEXT= 'DISTRICTS'
    *TEXT POSITION= 0.50,15.5 SIZE=0.2 TEXT='NORTHERN IRELAND'
 END
 STOP
===
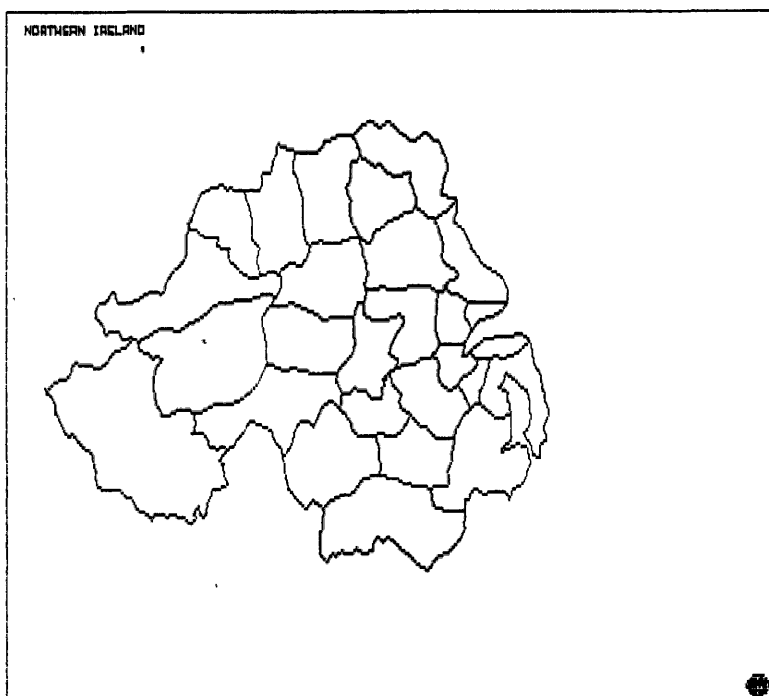
NORTHERN IRELAND

FIGURE 12. <u>A graph plot of an outline map produced on a plotter</u>

NORTHERN IRELAND

DISTRICTS

FIGURE 13. **Files used in producing a polygon file and outline**
          map for Great Britain districts

FILE: GBGIMMS EXEC
```
=================================================================
EXEC SETUP PACKAGES
FI 5 DISK &1 GIMMS
FI 6 DISK &1 LISTING
FI 10 DISK GBSEGS DATA
FI 11 DISK &1 SEGMENTS
FI 12 DISK &1 GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
EXEC GIMMS &1
=================================================================
```

FILE: GBDIST GIMMS
```
=================================================================
<----------- THE INSTRUCTIONS FOR BUILDING A SEGMENT FILE -------->
*FILEIN SEGMENT
    <-------- INPUT FILE IS ON 10, OUTPUT FILE IS ON 11 ----------->
    FILEIN=10 FILEOUT=11
    FILENAME=GBSEGS TITLE 'G.B. RAW SEGMENTS'
    LIMITS= 0,0,6550,12100
    NONODES INPUT=10
    BEGIN
<------------- THE INSTRUCTIONS FOR BUILDING A DISTRICT FILE------->
*POLYGON
    FILEIN=11 FILEOUT=12
    FILENAME= GBDIST  TITLE 'G.B. DISTRICTS'
    NZONES=1000
    LIMITS= 0,0,6500,12100
    MINZONE=Z100101  MAXZONE=Z290804
    EXCLUDE ZONE=Z999999
    ALPHA CULDESAC
  *END
*STOP
=================================================================
```

FIGURE 13. Continued

```
FILE:  GBMAP EXEC
================================================================
EXEC SETUP PACKAGES
FI 5 DISK &1 GIMMS
FI 6 DISK &1 LISTING
FI 12 DISK &2 GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
EXEC GIMMS &1 &3
================================================================


FILE:  GBDMAP GIMMS
================================================================
:---------- FILE = GBDMAP GIMMS ---------------->
:---- THE INSTRUCTIONS FOR PRODUCING A REGIONS MAP --->
+PLOTPROG
  *PLOTPARM DEVICE=PLOTTER TRUSCALE
    *NEWMAP MAPSIZE=12,17 FRAME
    *GIMMSFILE=12  < ----------- THE LOCATIONAL DATA FILE ---->
    *SCALE YSIZE=17
    *DRAWMAP OUTLINES=ALL
    *TEXT POSITION= 0.75,16.5 SIZE=0.2
     TEXT= 'DISTRICTS'
    *TEXT POSITION= 0.50,15.5 SIZE=0.2 TEXT='GREAT BRITAIN'
+END
+STOP
================================================================
```

44

FIGURE 14.   An outline map of the districts of Great Britain

DISTRICTS

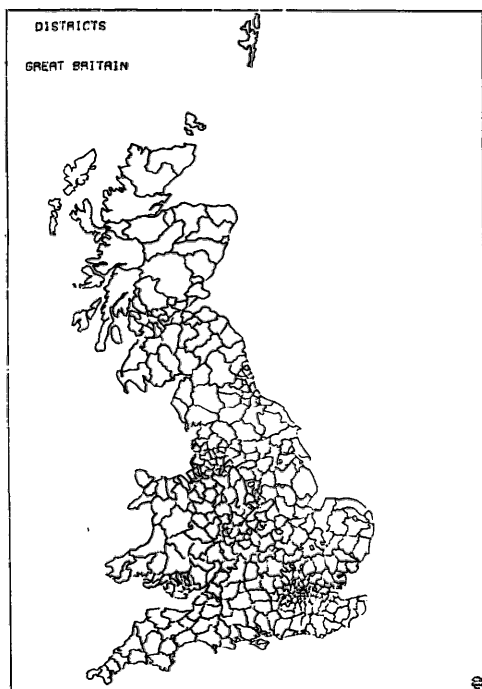GREAT BRITAIN

COUNTIES

GREAT BRITAIN

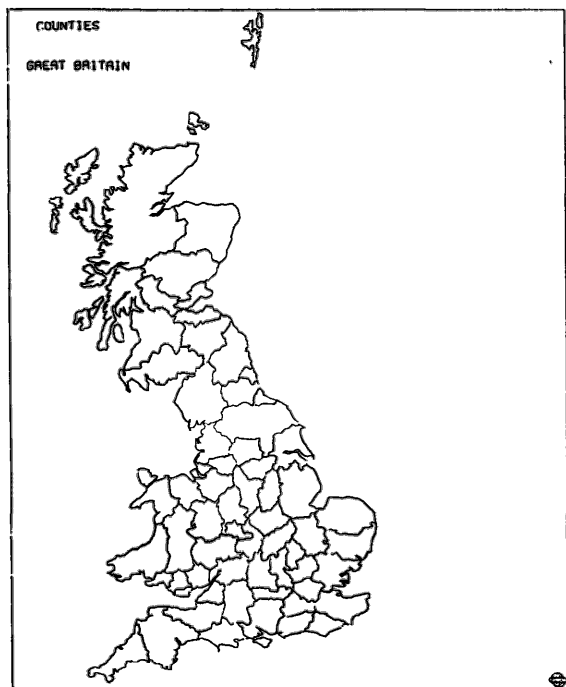**FIGURE 16.** <u>Files used in producing a polygon file and an</u>
<u>outline map for the United Kingdom districts</u>

```
FILE:  NIGBDMRG EXEC
=====================================================================
EXEC SETUP PACKAGES
FI 5  DISK NIGBDMRG GIMMS
FI 6  DISK NIGBDMRG LISTING
FI 10 DISK GBDIST   GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
FI 11 DISK NIDIST   GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
FI 14 DISK UKDIST   GIMMSFIL A4 (RECFM VBS LRECL 1028 BLOCK 3088
EXEC GIMMS NIGBDMRG
=====================================================================


FILE:  NIGBDMRG GIMMS
==============================================
*SYSPARM DIAGS=1 LINKS=1000
*UTILITIES
  *MERGE FILEIN= 10,11
         FILEOUT= 14
         FILENAME= UKDIST
         TITLE 'UNITED KINGDOM DISTRICTS'
  *END
*STOP
==============================================


FILE:  UKDMAP GIMMS
=====================================================================
<--------- FILE = UKDMAP GIMMS --------------------------------->
<---- THE INSTRUCTIONS FOR PRODUCING A DISTRICT MAP ---------->
*PLOTPROG
  *PLOTPARM DEVICE=PLOTTER TRUSCALE
    *NEWMAP MAPSIZE=20,25 FRAME
    *GIMMSFILE=12  < ----------- THE LOCATIONAL DATA FILE ---->
    *SCALE YSIZE=25
    *DRAWMAP OUTLINES=ALL
    *TEXT POSITION= 0.75,16.5 SIZE=0.2
     TEXT= 'DISTRICTS'
    *TEXT POSITION= 0.50,16.5 SIZE=0.2 TEXT='UNITED KINGDOM'
  *END
*STOP
=====================================================================
```

FIGURE 17. <u>An outline map of the districts of the United Kingdom</u>

DISTRICTS
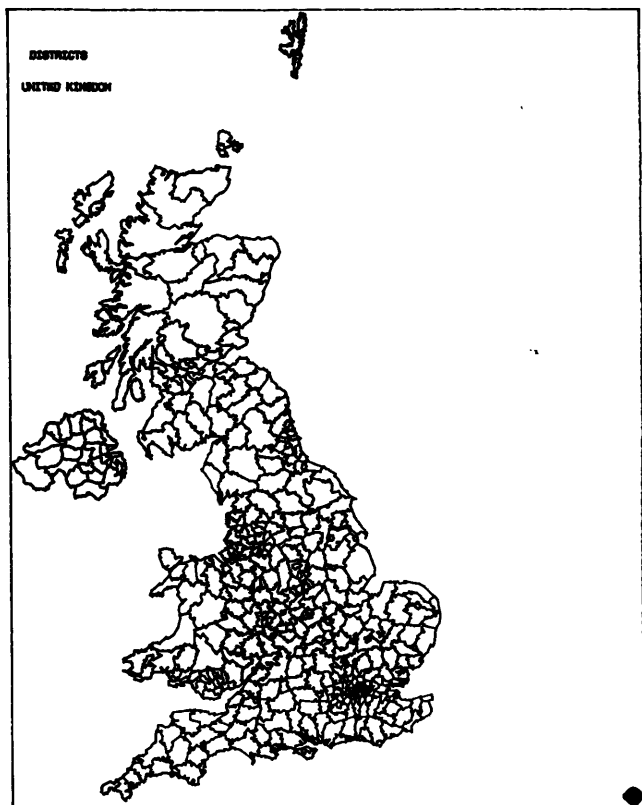
UNITED KINGDOM

FIGURE 18. <u>An outline map of the regions of the United Kingdom</u>

REGIONS

UNITED KINGDOM
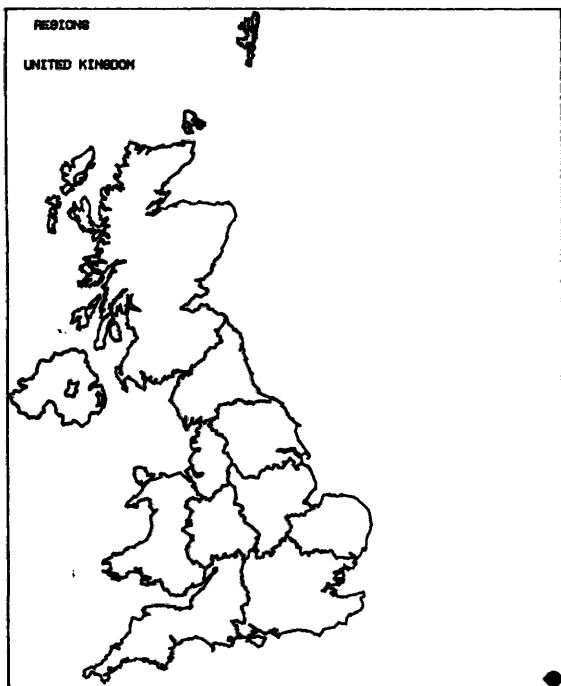
FIGURE 19. Jobs and files used in creating an FPCA polygon file

Job A

METRO COUNTY
WARD FILE

EXEC FILE   COMMANDS FILE

GIMMS PACKAGE

METRO COUNTY
SEGMENTS FILE

METRO COUNTY
POLYGON FILE

Job B

NON-METRO COUNTY
WARD FILE

EXEC FILE   COMMANDS FILE

GIMMS PACKAGE

NON-METRO COUNTY
SEGMENTS FILE

Job C

EXEC FILE   COMMANDS FILE

NON-METRO COUNTY
POLYGON FILE

GIMMS PACKAGE

FPCAs (GB)
POLYGON FILE

50

FIGURE 20.   A command file for drawing a map of FPCAs for the UK

```
SYSPARM LINKS=1000 DIAGS=1
 *PLOTPROG
   *PLOTPARM PLOTTER              <DELETE TRUSCALE FOR DT22 PLOTS>
     *NEWMAP MAPSIZE=17,17 FRAME
     *GIMMSFILE FILE=12           <NAME= 'UKFPCA GIMMSFIL' (MERGED FILE)>
     *SCALE YSIZE=17
     *ORIGIN PLOT=1,0
     *DRAWMAP OUTLINES=ALL
=============== MAP TITLE =======================================>
     *TEXT POSITION=7,0.5, SIZE=0.3, TEXT='FPCAS: ENG.&WALES + SCOT.& NI'
=============== FRAME FOR THE SHETLANDS ============================>
     *FRAME P1= 7.5,13.2    P2= 10,15.7
=============== INSET FOR LONDON FPCAS ==============================>
     *WINDOW P1=12.1,1  P2=15.1,4  FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=13.5,2.5  MAP=52885,17769
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR SOUTH YORKSHIRE FPCAS ====================>
     *WINDOW P1=11.8,4.5  P2=15.5,6.9   FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=13.5,5.5  MAP=44000,39769
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR WEST YORKSHIRE FPCAS ====================>
     *WINDOW P1=9.5,7.6 P2=12.7,10.5   FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE MAIN MAP>
     *ORIGIN PLOT=11.5,9 MAP=42731,42308
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR TYNE & WEAR FPCAS ========================>
     *WINDOW P1=9.5,11.1    P2=11.5,13    FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=10.5,12  MAP=42731,55846
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR GREATER MANCHESTER FPCAS ==================>
     *WINDOW P1=13.1,7.6  P2=16.1,10.4   FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=15,9    MAP=38500,40192
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR MERSEYSIDE FPCAS ========================>
     *WINDOW P1=0.5,4.5  P2=3,7    FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=1.5,5.25  MAP=33846,38923
     *DRAWMAP OUTLINES=ALL
=============== INSET FOR WEST MIDLANDS FPCAS ======================>
     *WINDOW P1=0.5,1.5    P2=3,4        FRAME
     *SCALE FACTOR=.0005      <APPROX. DOUBLE SCALE OF MAIN MAP>
     *ORIGIN PLOT=1.5,2.5   MAP=41038,28769
     *DRAWMAP OUTLINES=ALL
 *END
STOP
```
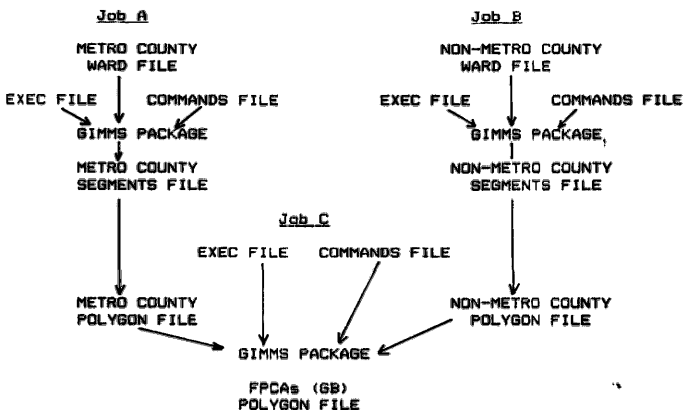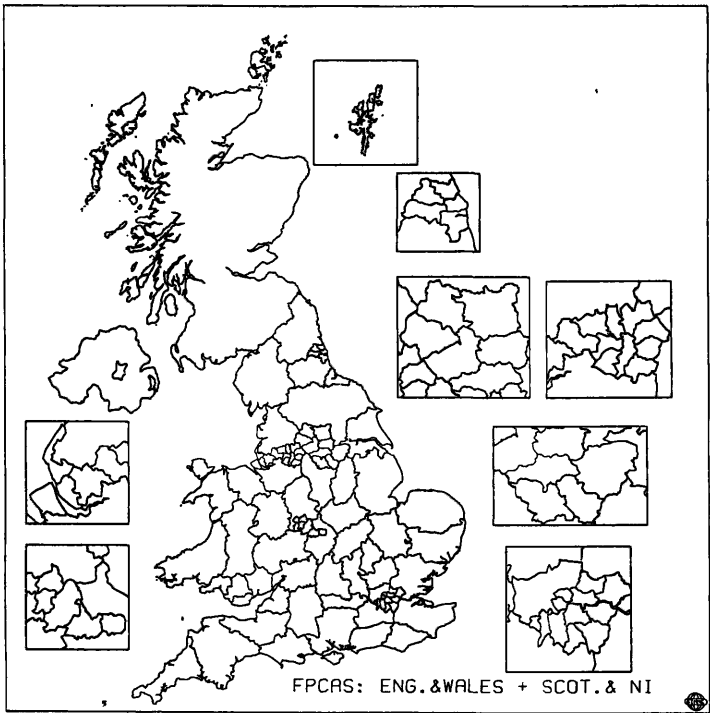
FPCAS: ENG.&WALES + SCOT.& NI

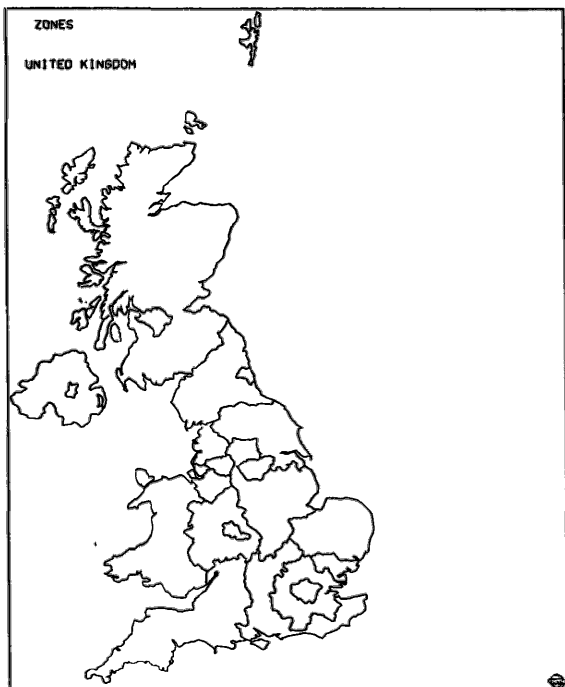FIGURE 22. <u>An outline map of EC level 2 regions for the UK</u>

ZONES

UNITED KINGDOM

FIGURE 23. <u>The commands and data file for creating a demographic</u>
<u>map of EC level 2 regions for the UK</u>

FILE: UKZONE GIMMS
```
================================================================
<----- FILE = UKZONE GIMMS : FOR CREATION OF DEMOGRAPHIC MAP------------->
<----- OF METRO/NON-METRO OR EC2 LEVEL REGIONS IN THE UK --------------->
<----- REVISION OF APRIL 1987    PHIL REES, SCHOOL OF GEOGRAPHY --------->
*PLOTPARM PLOTTER, 'Test file to generate UK zone map coordinates'
*SYSPARM DIAGS=2 INPUT=5,OUTPUT=6 *
*FILEIN SEGMENT FILEOUT=10 FILENAME=UKSEGS
TITLE='United Kingdom zones:  base segment file'
LIMITS 200,300,1100,1300
BEGIN
SEGMENTS
ZO1 SEA   321 1020,345 1050,354 1075,395 1092,442 1021,395 990 375 1010
          331 1009, 321 1020 /
ZO2 ZO3   500 1055,500 1175,580 1175,580 1095,545 1055,500 1055 /
ZO3 ZO5   660 1112,540 1030 /
ZO3 SEA   540 1030,468 1030,465 1040,490 1070,480 1120,470 1121,465 1100
          460 1100,470 1150,475 1180,490 1220,515 1260,580 1260,547 1230
          610 1227,620 1210,599 1171,632 1167,610 1140,648 1139,660 1112 /
ZO4 ZO5   690 1070,680 1040,610 1000,570 1000,560 1025,675 1100 /

    .    .                                               `.
    .    .
    .    .

Z20 SEA   490 540,450 511,400 512,399 530,345 530
          340 541,440 592,468 660,460 721,430 725
          430 720,414 717,420 730,440 745,482 753 /
END
*CHECK FILEIN=10, DIAGS=2 *
*POLYGON FILEIN=10,FILEOUT=11,FILENAME=GIMMSFILE,DIAGS=4
 NZONES=21,MAXPTS 200,EXCLUDE ZONES=SEA
 ALPHA,CULDESAC,TITLE='UKZONE COORDINATE FILE'
*PLOTPROG
*NEWMAP MAPSIZE=9,10 FRAME
*GIMMSFILE=11
*DRAWMAP OUTLINES=ALL
*END
*STOP
================================================================
```
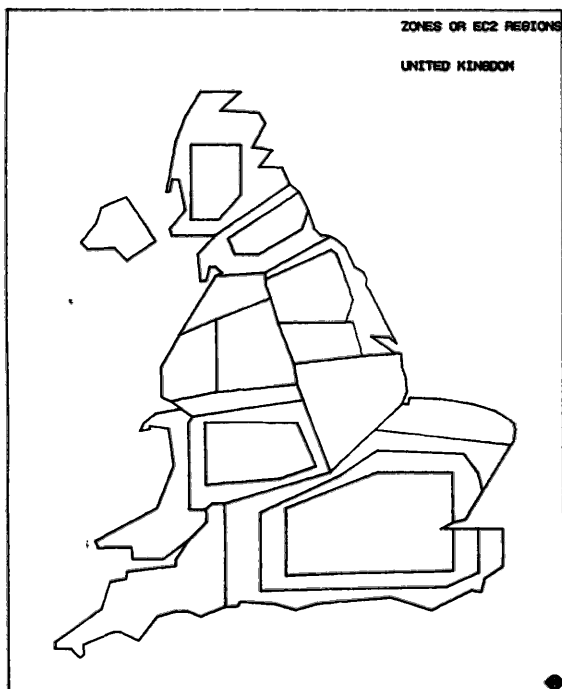
FIGURE 24.   An outline map of demographic EC level 2 regions for the UK

ZONES OR EC2 REGIONS

UNITED KINGDON

UNIVERSITY OF MANCHESTER REGIONAL COMPUTER CENTRE

The DoE Digitised Boundary Information. CONDITIONS OF USE.

This application is made on the understanding that:

1. The person named overleaf as USER confirms that this person is a member of a university, polytechnic, or non-university research institute recognised as eligible for UK Research Council research grants.

2. The data and related material are to be used only by the USER for academic research and/or teaching and not for commercial purposes or consultancy work or in connection with any work undertaken for financial reward or gain. The results of any work which makes use of these data and related material will be freely available to the academic community subject to Clause 3 below.

3. The data and related material are to be kept confidential and may not be transferred to any other person or body except to persons or bodies having authority to access the data.

   Research results incorporating maps or other material with or without other information produced from the data and related material may only be published with prior agreement of the Crown. For the purposes of this Agreement publishing includes the sale or free distribution of any publication based on the data. On receiving a request for permission to publish the Crown in conjunction with the Ordnance Survey will consider what if any royalties will be payable based on the size of the map and what proportion of that total map product related to the data.

   Prior permission to publish research results incorporating maps or other material produced from the data in a thesis being submitted for the award of a recognised degree or qualification or in an article submitted to a recognised learned journal need not be sought provided the following statement is included in the thesis or article.

   > "Material in this publication has been produced using data or other material relating to digitised boundary information and these data or other material remain the property and copyright of the Crown"

   and intention of publication is notified to the Crown Agency by the author(s) of the thesis or article. Notification of intention to publish should include details of or copies of relevant material for evaluation purposes.

   It is the responsibility of the persons or bodies wishing to publish research results covered by this clause to seek prior permission to publish, except as provided for above, and to pay any royalties due directly to the Crown Agency.

   Copies of all material subsequently published should be provided free of charge to the Crown so that records can be maintained.

4. All copyright and other property rights in the data and related material remain the property of the Crown. The data and related material may not be reproduced adapted or used for any other purpose without the permission of the Crown.

5. Confidential information relating to the method of accessing the data or related material will not be disclosed to a third party except in those cases where permission has been sought in writing and granted in writing.

Enquiries and notification of publication should be sent to the Department of Environment at the following address: SPPGI, DoE, Room P2/141, Marsham Street, London SW1.

UNIVERSITY OF MANCHESTER REGIONAL COMPUTER CENTRE

APPLICATION FOR AUTHORITY TO ACCESS THE DoE

DIGITISED BOUNDARY INFORMATION

(i)   I.................................(full name) hereinafter
        referred to as the USER, apply for authority to access the DoE
        Digitised Boundary Information. I agree to accept and abide by the
        Conditions of Use set out in 1 to 5 overleaf. I am a registered user
        of the UMRCC computer system.

(ii)   Institution of which USER is a member of staff/research student/student*

        Department ....

        Institution ....

        Full Address ....

        ....

        Telephone Number: .... Extension: ....

(iii)   UMRCC (Amdahl) username: ....

(iv)   Short description of intended use of data and related material:

(v)   Research Council or organisation funding the work in which the data
        and related material may be used. All sources of funding must be
        declared.

(vi)   Intended duration of use of data and related material.

(vii)   Results of work likely to be published in (subject to prior agreement
        of the Crown):

                        Signature: .... Date: ....

                        Signature of UMRCC Representative: ....

*delete as appropriate.

Please return this form to Database Support, User Services, University of
Manchester Regional Computer Centre, Oxford Road, Manchester M13 9PL. A
copy will be returned to the applicant when authority has been granted.

For UMRCC Use   Ref No.................. Access granted(date) ....

                     Username .... Signature: ....

APPENDIX A.2   Local polygon files

A set of files are available on the Geography Library disk for wards and
enumeration district aggregations in West Yorkshire. The files were
originally described in Birkin and Rees (1982). This note updates that
information.

Universe	Units	Filename, filetype Online = upper case Offline = lower case	Notes
LEEDS DISTRICT	Wards	leeds81 boundary leeds81 gimms LEEDS81 MEMO LEEDS81 COORD LEEDS81 NEWBOUND LEEDS81 NEWGIMMS	Coordinates in GIMMS 3.0 form Polygon file in GIMMS 3.0 form Information file Centroids of wards Coordinates in GIMMS 4.5 form Polygon file in GIMMS 4.5 form
LEEDS DISTRICT	E.D. groups (new zones)	NEWZONE BOUNDS newzone labels leeds81e nzones	Polygon file in GIMMS 4.5 form Names of new zones in order E.D. membership of new zones
BRADFORD	Wards	bradfd81 boundary bradfd81 gimms BRADFD81 MEMO BRADFD81 COORD BRADFD81 NEWBOUND BRADFD81 NEWGIMMS	Coordinates in GIMMS 3.0 form Polygon file in GIMMS 3.0 form Information file Centroids of wards Coordinates in GIMMS 4.5 form Polygon file in GIMMS 4.5 form
CALDERDALE DISTRICT	Wards	calder81 boundary calder81 gimms calder81 memo	Coordinates in GIMMS 3.0 form Polygon file in GIMMS 3.0 form Information file
KIRKLEES	Wards	kirkls81 boundary kirkls81 gimms kirkls81 memo	Coordinates in GIMMS 3.0 form Polygon file in GIMMS 3.0 form Information file
WAKEFIELD	Wards	wakefd81 boundary wakefd81 gimms wakefd81 memo	Coordinates in GIMMS 3.0 form Polygon file in GIMMS 3.0 form Information

For wards in other districts of England and Wales see Cole (1975), which is
reproduced as UMRCCDBD INFO on the Geography Library disk.

54