National Mapping Program

USGS Digital Cartographic Data Standards

Digital Line Graphs From 1:2,000,000-Scale Maps

Geological Survey
Circular 895-D

US GeoData

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DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

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and Hugh W. Calkins

USGS Digital Cartographic Data Standards

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FOREWORD

In recent years, the disciplines of cartography and geography have undergone a rapid and striking reorientation as the techniques for digital collection and manipulation of data have evolved from fledgling laboratory procedures into dominant and driving forces that now pervade the disciplines. Digital techniques have provided a variety of new and powerful capabilities to collect, manipulate, analyze, and display spatial data. However, this evolution also has introduced a number of new and complex problems. One of the most pressing problems, and one which is receiving particular attention at present, is the issue of digital cartographic data standards.

The U.S. Geological Survey (USGS) has been actively developing digital cartographic and geographic techniques for over a decade and has taken significant steps to develop and define in-house standards governing the various types of digital cartographic data that are being collected and archived in a national digital cartographic data base. The in-house standards are expressed in the form of specifications documents that were prepared to govern collection of the data and in the form of user guides that were prepared for distribution with the data.

In an effort to fulfill lead agency requirements for promulgation of Federal standards in the earth sciences, the documents have been assembled with explanatory text into this USGS Circular consisting of separately bound chapters. This Circular describes some of the pertinent issues relating to digital cartographic data standards, documents the digital cartographic data standards currently in use within the USGS National Mapping Division, and details USGS efforts to define national digital cartographic data standards.

Chapter A is an overview in which the major issues involved in developing digital cartographic data standards are discussed and the activities of the USGS related to digital cartographic data production and standards development are described in detail. Succeeding chapters comprise the pertinent documents that establish USGS in-house standards for the various types of digital cartographic data currently produced by the National Mapping Division--that is, digital elevation data, digital planimetric data, digital land use and land cover data, and digital geographic names data.

This compendium of relevant material is prepared to serve as a benchmark and to assist ongoing efforts to establish acceptable standards and conventions for both Federal agencies and the public.

Dallas L. Peck
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PREFACE

This Circular is the result of the efforts of numerous individuals who have contributed to the research, development, and preparation of various digital cartographic and geographic standards for the National Mapping Division of the U.S. Geological Survey. The individuals named as chapter authors represent both the originators of the various concepts as well as the writers who expanded and clarified these ideas. Their contributions, either to the concepts or the writing, are of such magnitude as to warrant crediting as authors.

Atef A. Elassal was largely responsible for the original data structures and computer file formats that are used for the digital line graphs and digital elevation models. The attribute coding scheme was first developed by members of the Digital Applications Team under the direction of Robert B. McEwen. The Geographic Names Information System was conceived and developed by Sam Stulberg and Roger L. Payne. The Geographic Information Retrieval and Analysis System was developed by Robin G. Fegeas, K. Eric Anderson, Stephen C. Guptill, Cheryl A. Hallam, and William B. Mitchell. The small-scale Digital Line Graph data structure and attribute coding scheme was developed by Warren E. Schmidt and Michael A. Domaratz.

The Circular was compiled in part from various user guides and technical instructions of the National Mapping Division. These documents were originally prepared by several individuals; credit is acknowledged to G. Michael Callahan, A. Joan Szeide, William R. Allder, Vincent M. Caruso, Hugh W. Calkins, Donna Cedar-Southworth, and Cheryl A. Hallam. The compilation of the various guides, instructions, and other material into the Circular format was performed with major assistance by Clark H. Cramer, Eloise R. Byrd, and Cynthia L. Cunningham.

We acknowledge these substantial contributions that have led to this publication.

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DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

By Michael A. Domaratz, Cheryl A. Hallam, Warren E. Schmidt, and Hugh W. Calkins

Abstract

The discipline of cartography is undergoing a number of profound changes that center on the emerging influence of digital manipulation and analysis of data for the preparation of cartographic materials and for use in geographic information systems. Operational requirements have led to the development by the USGS National Mapping Division of several documents that establish in-house digital cartographic standards.

In an effort to fulfill lead agency requirements for promulgation of Federal standards in the earth sciences, the documents have been edited and assembled with explanatory text into a USGS Circular. This Circular describes some of the pertinent issues relative to digital cartographic data standards, documents the digital cartographic data standards currently in use within the USGS, and details the efforts of the USGS related to the definition of national digital cartographic data standards. It consists of several chapters; the first is a general overview, and each succeeding chapter is made up from documents that establish in-house standards for one of the various types of digital cartographic data currently produced. This chapter, 895-D, describes the digital line graphs which were digitized from the 1:2,000,000-scale sectional maps (U.S. regions) of the National Atlas of the United States of America. They are produced and available in both a topologically structured format and a simpler format optimized for graphic display.

INTRODUCTION

U.S Geological Survey (USGS) digital cartographic data files may be grouped into three basic forms. The first of these, called a digital line graph (DLG), is the line map information in digital form. The data files include information on planimetric base categories such as transportation, hydrography, and boundaries. The second form, called a digital elevation model, consists of a sampled array of elevations for a number of ground positions that are at regularly spaced intervals. The third form, the Geographic Names Information System, is an automated data system that provides primary information for all known places, features, and areas in the United States identified by a proper name.

This document describes only DLG files collected from the 1:2,000,000-scale National Atlas sectional maps.

The digital data are useful for the production of cartographic products such as plotting base maps and for various kinds of spatial analysis. A major use of these digital cartographic data is to combine them with other geographically referenced data and thus enable scientists to conduct automated analyses in support of various decisionmaking processes.

DATA CONTENT

The 1:2,000,000-scale map series of cartographic data files contain selected categories of cartographic data in

digital (computer-compatible) form. The data files are derived from the sectional maps of the 1970 National Atlas of the United States of America. Selective updating of the sectional maps was done before the digitizing operations. Appendix E lists the source materials used to revise the sectional maps.

The data are recorded in separate files or subfiles according to major category:

- Political boundaries
- Administrative boundaries
- Roads and trails
- Railroads
- Streams
- Water bodies
- Cultural features (airports, Alaska pipeline)
- Hypsography (Continental Divide only)

Although coverage is nationwide, the data were digitized predominantly in multistate blocks (to minimize edge-join problems if a user has a need to aggregate the data). The total number of files is 21--15 for the conterminous United States, 5 for Alaska, and 1 for Hawaii. The grouping of the States is shown in figure 1.

All data contained in the DLG data files are represented on maps as points, lines, and areas (fig. 2).

- Points -- Features such as airfields.
- Lines -- Features such as roads, railroads, and streams.
- Areas -- Features such as national forests and water bodies.

In digital form, these points, lines, and areas are represented as various kinds of "lines" as follows:

- Point features -- Degenerate lines; lines with no length.
- Line features -- Directly represented as lines.
- Area features -- A line that describes the boundary of the feature.

When these data are abstracted and represented as lines and are topologically encoded to retain the spatial relationships, a logical and consistent data file is created for computer processing.

DATA FORMAT

Digital line graphs from 1:2,000,000-scale maps are available in two formats:

- A graphics format (suitable for preparing maps using the Geological Survey Cartographic Automatic Mapping GS-CAM) software.
- A topologically structured format (standard DLG format).

Graphics Format Files -- A major use of the 1:2,000,000-scale DLG data will be automatic plotting of small-scale maps. To facilitate this process, the data are available in a special graphics format. This simplified format is designed especially for use with GS-CAM plotting package. GS-CAM, a modified version of the CIA's Cartographic Automatic Mapping computer mapping program, is available from the National Cartographic Information Center (NCIC).

The graphics format files contain only line descriptions and are derived from the standard DLG data files. Such a graphic file contains only minimal descriptive information about each line, and the relationship between lines is unspecified. The graphics format files are organized by feature type. Within a given file, if a line has two attributes (for example, a boundary between a national forest and an Indian reservation), the line will appear twice in the file, once with a feature code indicating national forest and once with a feature code indicating Indian reservation. The format for the graphics format files is given in Appendix D.

Topologically structured data files -- Digital line graph is the term adopted by the USGS to describe line map data that are available in digital form. The DLG concept is based on graph theory, in which a diagram can be expressed as a set of nodes and links in a manner that shows logical relationships. Applied to a map, this concept is used to abstract the features shown on the map and to represent these features as various kinds of

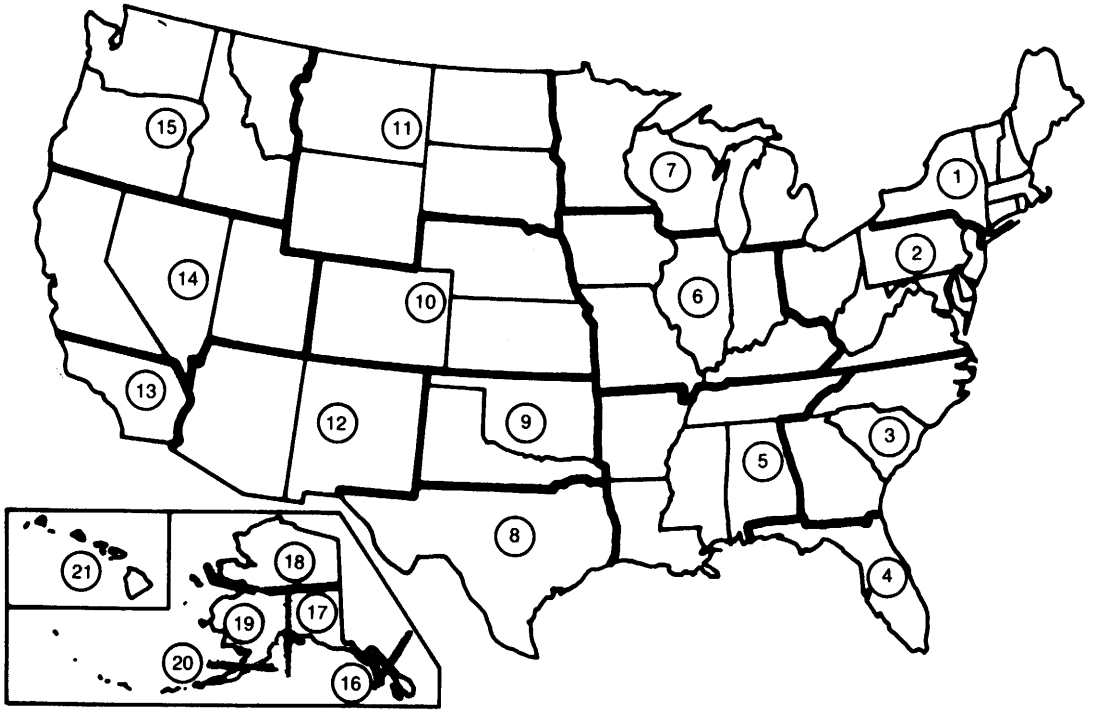


Figure 1.--Multistate blocks used for digital line graphs from 1:2,000,000-scale maps.

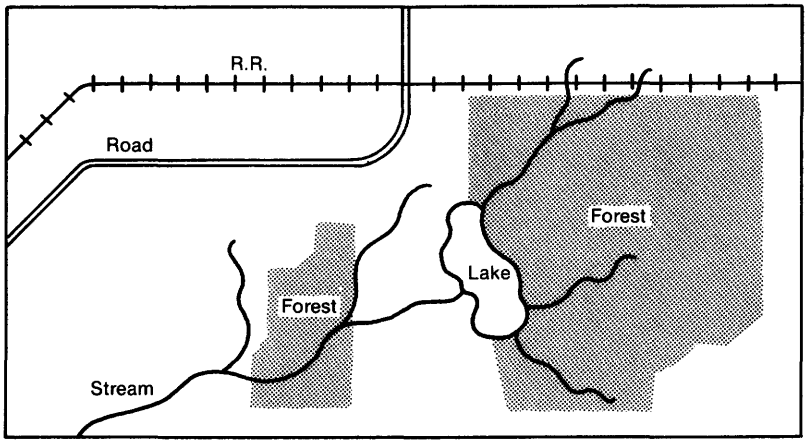


Figure 2.--Map elements.

lines. The abstraction of the map data according to the rules of graph theory is necessary to preserve the spatial relationships inherent in map data and to create a logical and consistent data file structure for computer processing. A digital data file of cartographic/geographic data that maintains the spatial relationships inherent in the map is called a topologically structured data file.

A topologically structured data file has the spatial relationships inherent in the data explicitly coded. For example, a boundary is a line separating two areas. Generally, in a topologically structured data file, the boundary description contains references (termed pointers) to each area separated by the boundary, a description of each area, and pointers to all lines that make up the complete boundary of the area.

It is necessary to define map features in this manner because the spatial relationships, obvious when a map is examined visually, are lost when the map is converted to digital form unless those relationships are explicitly encoded.

Topological structuring is illustrated in figure 3. Specific DLG data file topology is defined by lines 1, 2, 3, 4, and 5, which separate areas A and B. Each line description contains pointers to both areas A and B indicating that area A is on one side of the line and that area B is on the other side. Area A in this example is an actual feature such as a national forest. Area B, however, is the remainder of the map and carries a special code that indicates this fact. In this case, area B does not correspond to an actual feature but must be encoded to maintain the logic and consistency of the data file. In addition to recognizing all areas within the map, it is necessary to define the area outside a map sheet (area C, fig. 3) in order to encode the map boundary in a consistent manner.

DATA CATEGORIES

There are two types of categories in the 1:2,000,000-scale DLG data files:

- Network categories, which include roads and trails, railroads, streams, cultural features, and hypsography.
- Area categories, which include political boundaries, administrative boundaries, and water bodies.

Network Categories -- For network categories, the topological coding recognizes only two areas--one within the map (background area) and one outside the map. All line descriptions in a network category, except the map border, are described as being within the background area of the map (fig. 4A).

Area Categories -- Each real feature (for example, a national forest) is an area and is given a unique area identification number. In addition, any area within the map that is not part of a real

area is assigned to one or more background areas, and the area outside of the map border is coded. Figure 4B represents these relationships.

DATA RECORDS

The map data in digital form contain three types of information:

1. Topological codes define spatial relationships.
2. x,y coordinate values define the location of the feature (see p. 13).
3. Feature codes describe each point, line, or area or some characteristic of that point, line, or area (see p. 11).

Topological Codes -- Spatial relationships are represented in three kinds of data records:

1. Node records define locations that are needed for topological consistency, computer editing, and quality control. Nodes are used to define the starting and ending points of a line, the intersection of two or more lines, significant points on a line, or any arbitrary point.
2. Area records define the actual area features on the map, the remainder of the map (background area), and the area outside of the map.
3. Line records define the location of a line. The line represents either a linear feature on the map (for example, a road or a stream), a boundary of an area (for example, a lake or a county), or a point feature, which is a degenerate line (for example, an airfield).

The line record contains the topological codes to relate nodes to lines and lines to areas (fig. 5). Data for point features are contained in the line record. The line--the primary structure of the files, carries the topology. The area and node records provide additional information.

A typical node record looks like this:

```
 N   1     -3326    -1074    0      0
(1) (2)        (3)        (4)    (5)
```

Node records contain the following information:

(1) Type of record indicator (N for node record).
(2) Internal sequential identification number. In this example, it is the first node record (1) in the overlay.
(3) x,y coordinate values for the node. In this example, x=-3326 and y=-1074. In DLG files, x and y coordinate values can be negative because the origin of the internal file coordinate system is in the middle of the map.
(4) Indicator specifying the number of feature codes that describe the node (in this example, 0).
(5) Indicator specifying the length of the text string (that is, number of characters) used to describe the node (in this example, 0).

For the 1:2,000,000-scale DLG's, the values of (4) and (5) will always be 0, an indication that neither feature codes nor text has been encoded.

A typical area record looks like this:

```
 A  3    -1250  1087   1        0
(1)(2)       (3)     (4)      (5)

            90  104
```

Area records contain the following information:

(1) Type of record indicator (A for area record).
(2) Internal sequential identification number. In this example, it is the third area record in the overlay (3).
(3) x,y coordinate values of a reference point. In this example, x=-1250 and

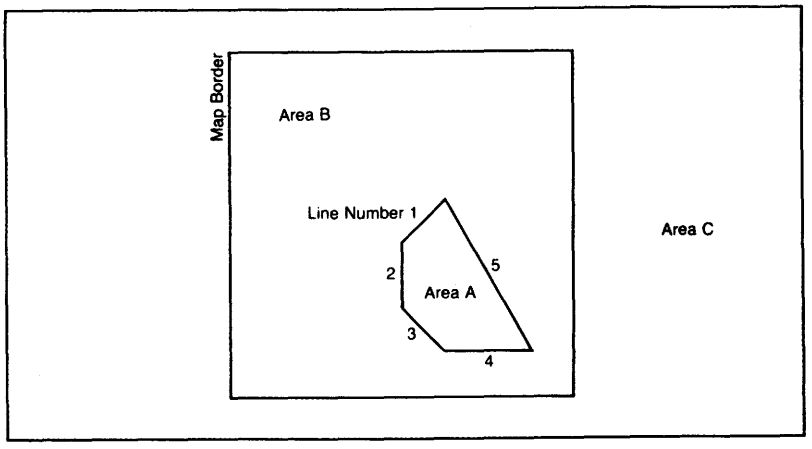


Figure 3.--Areas used to define map topology.

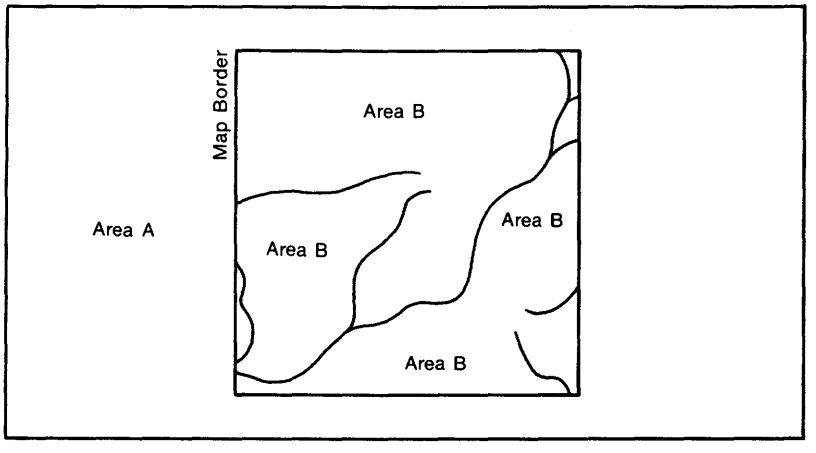


Figure 4A.--Network-type category. All area within the map is defined as a single background area, designated in this example as Area B.

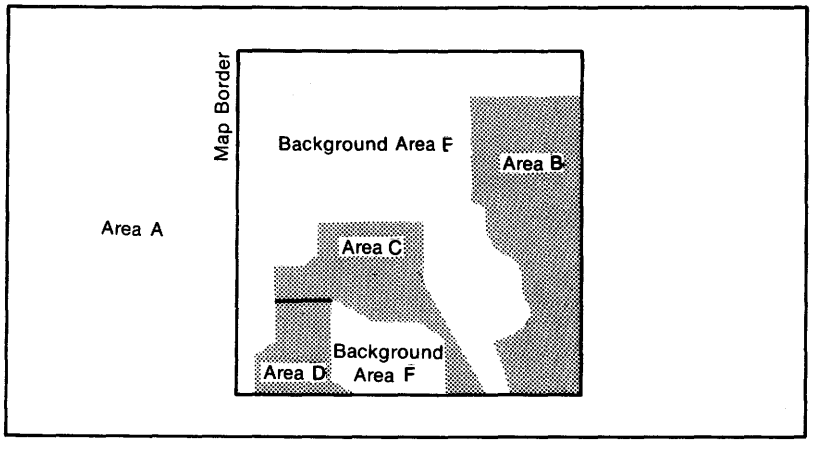


Figure 4B.--Area-type category. Each area (real and background) within the map is assigned a unique identifier.

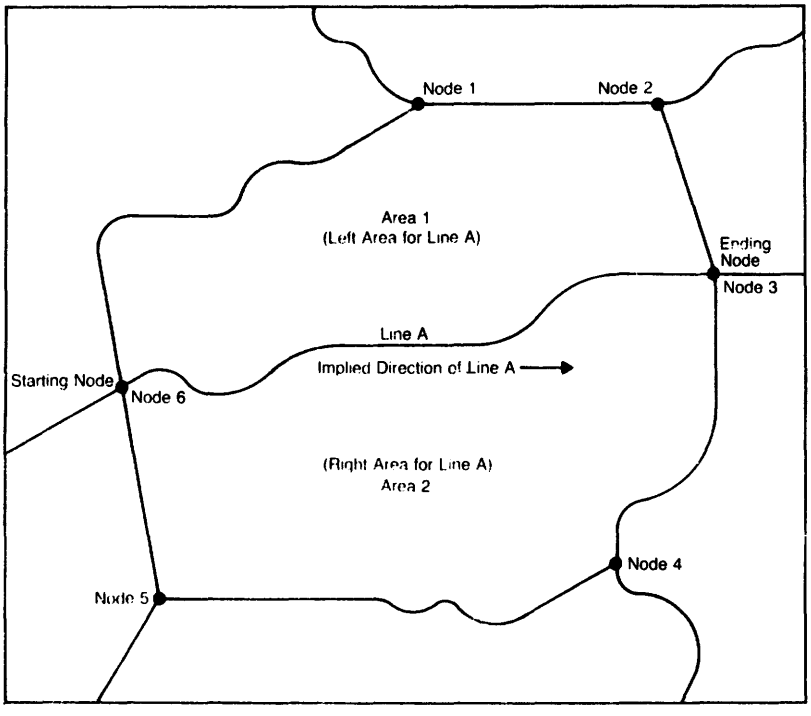


Figure 5.--An example of digital line graph topology relating nodes to lines and lines to areas.

y=1087. (This reference point is not required to fall within the area that it represents).

(4) Indicator specifying the number of feature codes that describe the area; in this example, 1.

(5) Indicator specifying the length of text string used to describe the area (for 1:2,000,000-scale DLG's, always 0.)

When the indicator specifying the number of feature codes that describe the area is other than 0, the feature codes will follow in a separate record. In this example, 90 104, the feature code, indicates a national forest.

A typical line record looks like this:

```
 L 14  24  21  12  11   2  2  0
(1)(2) (3) (4) (5) (6) (7)(8)(9)

        1672   -2808   1584  -2656

                  290  6091  290  6087
```

Line records contain the following information:

(1) Type of record indicator (L for line record).

(2) Internal sequential identification number (in this example, 14).

(3) Internal sequential identification number of the starting node of the line (in this example, 24).

(4) Internal sequential identification number for the ending node of the line (in this example, 21).

(5) Internal sequential identification number of the area to the left of the line (in this example, 12).

(6) Internal sequential identification number of the area to the right of the line (in this example, 11).

(7) The number of x,y coordinate pairs that describe the line (in this example, 2).

(8) The number of feature codes that describe the line (in this example, 2).

(9) The length of text string that describes the line (for 1:2,000,000-scale DLG's, always 0.)

Since the value for (7) is 2 we know that, immediately following the line record description will be the actual x,y coordinate values that describe the line (in this case 1672 -2808, and 1584 -2656).

Since the value in (8) (number of feature codes) is greater than 0 (in this case, 2), these codes will be listed following the coordinate data (in this example, 290 6091 and 290 6087).

The x,y coordinate values, feature codes, and text strings are in separate logical records.

A line record representing a point feature (a degenerate line) can be identified by comparing the starting and ending nodes, which in all cases will have the same value and will have exactly two coordinate pairs.

The complete description of any given feature can be obtained by examining all node, area, and line records that describe the feature. For example, figure 6 shows Catron County, New Mexico, and its nodes, areas, and lines. Table 1 lists the data records that completely describe Catron County.

Catron County is fully described in the data file by 13 entries: 6 nodes, 1 area, and 6 lines. The six node records contain only the x,y coordinate values

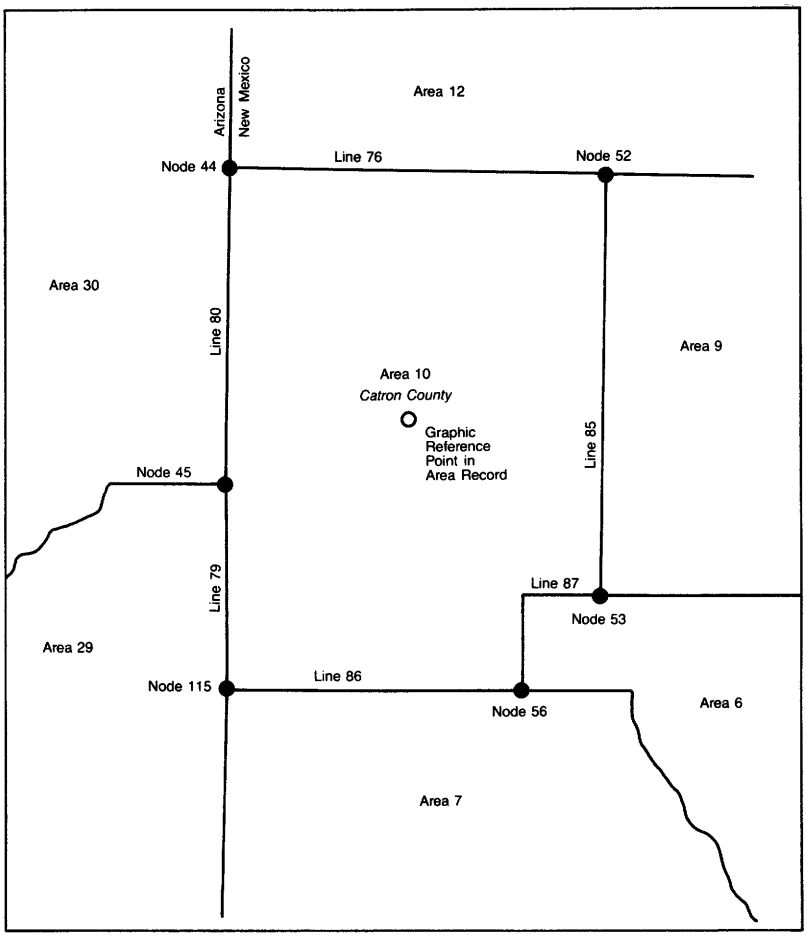


Figure 6.--Sample topology, Catron County, New Mexico.

Table 1.--Small-scale DLG data records for Catron County, New Mexico

[N, node; A, area; L, line]

```
N     44   -86   948     0     0
N     45   -90  -831     0     0
  .
  .
  .
N     52  2297   947     0     0
N     53  2361 -1484     0     0
  .
  .
  .
N     56  1840 -2085     0     0
  .
  .
  .
N    115   -91 -2102     0     0
  .
  .
  .
A     10   428  -934     2     0
    91    35    92     3
  .
  .
  .
L     76    44    52    12    10     4     1     0
   -86   948  1155   938  1565   940  2297   947
   290  6009
  .
  .
  .
L     79   115    45    29    10     3     1     0
   -91 -2102   -91 -1770   -90  -831
   290  6005

L     80    45    44    30    10     3     1     0
   -90  -831   -86     8   -86       948
   290  6005
  .
  .
  .
L     85    53    52    10     9     4     1     0
  2361 -1484  2329  -706  2319   252  2297   947
   290  6009

L     86   115    56    10     7     3     1     0
   -91  2102   195 -2091  1840 -2085
   290  6009

L     87    56    53    10     6     4     1     0
  1840 -2085  1842 -1482  2285 -1484  2361 -1484
   290    6009
```

for each node and are used for editing and quality control. The area record contains the identifying information: the internal sequential identification number (10), the x,y coordinates of a graphic reference point (428 -934), and an indicator specifying the number of feature codes in the following record (2). The feature codes appear in the next logical record. The major codes 91 and 92 indicate that the following minor codes are the State and county Federal Information Processing Standards (FIPS) codes. The minor codes 35 and 3 are the State and county FIPS codes for New Mexico and Catron County, respectively. The boundary of the county is made up of six lines. Following each line record are the x,y coordinate and feature code records. The feature codes 290 6009 and 290 6005 identify the lines as county and State boundary lines, respectively.

ORGANIZATION OF RECORDS IN THE FILE

The DLG data files contain nine record types, shown in the right column.

Record Type	Contents
A	Header record containing DLG identification information
B	Header record containing projection information and registration points
C	Header record identifying data categories contained in this DLG and indicating the number of nodes, areas, and lines in each category
D.1	A node or an area record
D.2	A line record
E	Record containing x,y coordinate string
F	Record containing the feature codes
G	Record containing the text string
H	Record containing accuracy estimates

(Records G and H do not exist for any DLG file)

The relationships between these record types is shown diagrammatically in Appendix F. The actual sequence of records in the data file is as follows:

1. Header records
   - Type A (one record)
   - Type B (one record)
   - Type C (one record)

2. Data records
   - Node records
     - Node description (D.1)
     - Feature codes (F)
     - Text string (G)

     (Repeated for each node within a category)
   - Area records
     - Area description (D.1)
     - Feature codes (F)
     - Text string (G)

     (Repeated for each area within a category)
   - Line records
     - Line description (D.2)
     - x,y coordinates (E)
     - Feature codes (F)
     - Text string (G)

     (Repeated for each line within a category)

   (Repeated for each data category)

3. Accuracy estimate
   - Type H (one record)

FEATURE CODES

In the DLG data files, feature codes are used to identify each feature (such as a road or stream) and to provide additional information about the feature.

The feature code consists of two parts: a three-digit major code and a four-digit minor code. This structure covers all DLG data files created and maintained by the USGS. In the 1:2,000,000-scale DLG data files, the major code is usually 290, indicating a small-scale data base. There are, however, a few exceptions. A listing of all feature codes used for the 1:2,000,000-scale DLG files is contained in Appendix A. The minor code describes the feature. This same structure is used to enter additional information about a feature.

The feature codes have been assigned to various map features in a manner designed to facilitate the production of small-scale maps (1:2,000,000 to 1:10,000,000 scale). Two capabilities are built into the feature codes. (1) The size of the feature is included so that features can be excluded from a given map as a function of the scale and (or) intended use of the map. (2) Feature codes can be grouped together in various ways to produce logical sets of information. Examples of these capabilities are presented below.

First, feature selection by size is shown. The feature codes for single-line perennial rivers and streams are shown in table 2.

A map produced at a scale of 1:2,000,000 might include all streams and rivers listed, from feature codes 290 3003 through 290 3016 (fig. 7A). However, a map at a scale of 1:5,000,000 could exclude all rivers and streams of less than 50 km (fig. 7B). In this case, feature codes 290 3007 through 290 3016 would be used to produce the map, whereas feature codes 290 3003 through 290 3006 would not be used because these features fall below the minimum size for this type of feature at this particular scale. Finally, at a scale of 1:10,000,000 feature codes 290 3010 through 290 3016 may be used; all rivers and streams less than 100 km in length (fig. 7C) would thereby be excluded.

Table 2.--DLG feature codes for single-line perennial rivers and streams

Major code	Minor code	Description
290	3003	length <20 km (<12 mi)
290	3004	length 20-<30 km (12-<19 mi)
290	3005	length 30-<40 km (19-<25 mi)
290	3006	length 40-<50 km (25-<31 mi)
290	3007	length 50-<60 km (31-<37 mi)
290	3008	length 60-<80 km (37-<50 mi)
290	3009	length 80-<100 km (50-<62 mi)
290	3010	length 100-<125 km (62-<78 mi)
290	3011	length 125-<150 km (78-<93 mi)
290	3012	length 150-<200 km (93-<124 mi)
290	3013	length 200-<250 km (124-<155 mi)
290	3014	length 250-<300 km (155-<186 mi)
290	3015	length 300-<350 km (186-<217 mi)
290	3016	length 350+ km (217+ mi)

The second example, which uses a group of feature codes to produce a logical set, can be illustrated by looking at the roads and trails data file. Consider the feature codes in table 3.

Table 3.--DLG feature codes for roads and trails data file

Major code	Minor code	Description
290	5001	Interstate
290	5002	Major U.S., limited access, divided
290	5003	Major State, limited access, divided
290	5004	Major other, limited access, divided
290	5005	Toll road
290	5006	Interstate connector
290	5007	Limited access, divided connector
290	5008	Toll connector
290	5009	Interstate, under construction
290	5010	Interstate, proposed

The interstate highway system can be represented in two ways: (1) the road segments that are actually classified as

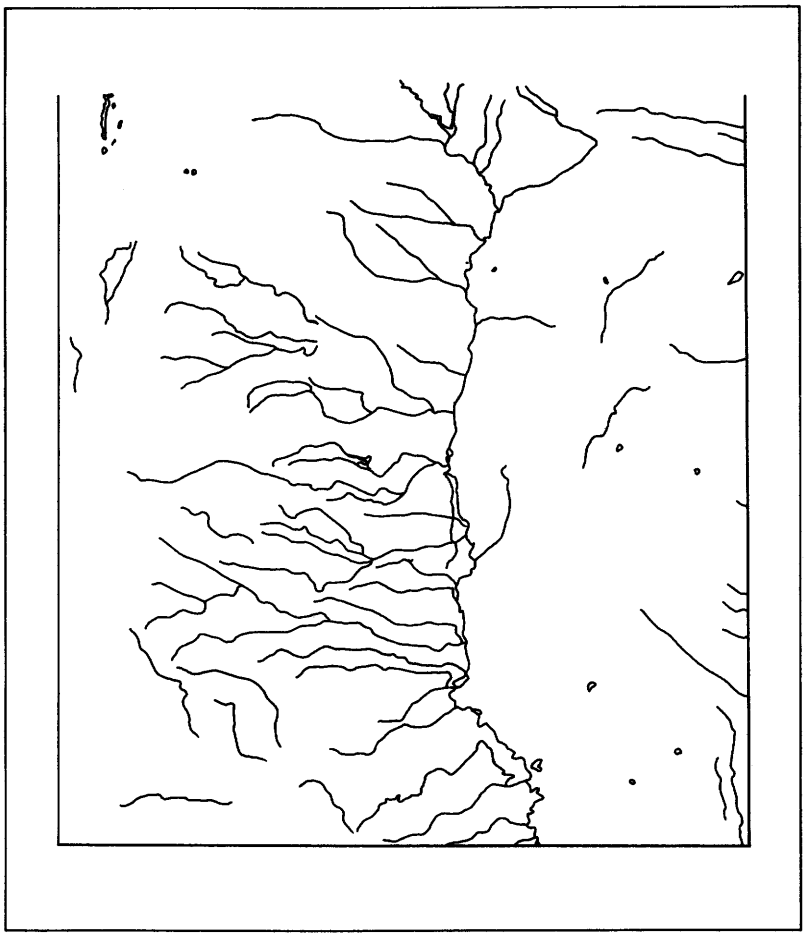


Figure 7A.--Pecos River, southeastern New Mexico.
Scale: 1:2,000,000.

part of the interstate system (feature codes 290 5001, 290 5009, and 290 5010) and (2) how a motorist might perceive the interstate highway system (feature codes 290 5001 through 290 5010). The map resulting from this second case would show a completely connected highway system, made up of the interstate system and the other roads that act as connectors. Figures 8A and 8B are partial maps illustrating the interstate system plotted both ways.

Feature codes are recorded in separate records, following either an area or a line record. However, not all area and line records will have a feature code. The absence of a feature code means that the code for the feature can be derived from adjacent, connecting, or bounding factors and that no additional information is carried in that particular record. The main feature code (that which defines the feature) will be assigned to either an area or a line record, depending on what the feature represents. Additional feature codes may be carried with the main feature code to convey more descriptive information about the feature. For example, consider figure 9.

Area 34 is an Indian reservation (90 107). Area 49 is a national scenic waterway or wilderness area (90 106). Notice that area 49 is also a forest or grassland (90 104).

Line 107 carries feature codes indicating that it is the boundary for a national wilderness area (290 6045), a national forest (290 6055), and an Indian reservation (290 6070).

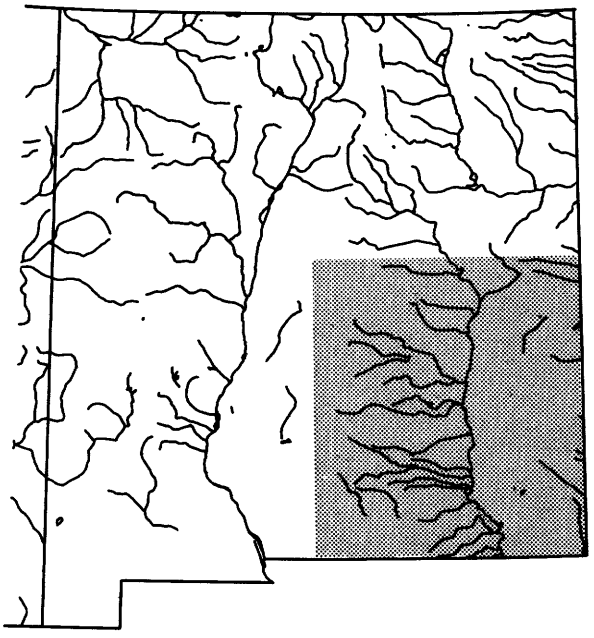


Figure 7B.--Rivers and water bodies, New Mexico.
Scale: 1:5,000,000.

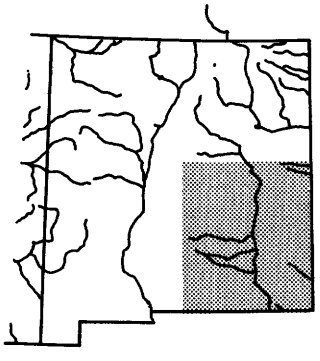


Figure 7C.--Rivers and water bodies, New Mexico.
Scale: 1:10,000,000.

Multiple feature codes (maximum of 20) may be entered for any area or line record of a DLG data file. When multiple codes are entered, they are not entered in any specific order.

COORDINATE SYSTEMS

The DLG data files are encoded and stored by using an internal file reference coordinate system.

The origin of the internal file reference coordinate is in the center of the map sheet (fig. 10). All map features (nodes, areas, and lines) are specified in terms of these internal file reference coordinates. The internal file reference coordinate system is in units of 0.001 inch at map scale. The file-header records contain information describing the ground planimetric reference system for the file (Albers equal area), the longitudes and latitudes of the corner points of the map sheet (in degrees and decimal degrees), and the file-to-map coordinate projection parameters. This information can be used to convert the internal file reference coordinates to the ground planimetric reference system for the Albers equal area projection. An example of this calculation is given in Appendix G.

PROJECTION INFORMATION

The 1:2,000,000-scale data file comprises three zones: Continental United States, Hawaiian Islands, and Alaska. The base parallel, central meridian, standard parallels, and maximum and minimum latitude and longitude values for each zone are as follows:

Continental United States

Base parallel	23° N.
Central meridian	96° W.
Standard parallels	29.5° N. and 45.5° N.
Longitude extent	66° W. to 125° W.
Latitude extent	24° N. to 50° N.

Hawaiian Islands

Base parallel	3° N.
Central meridian	157° W.
Standard parallels	8° N. and 18° N.
Longitude extent	154° W. to 162° W.
Latitude extent	18° N. to 23° N.

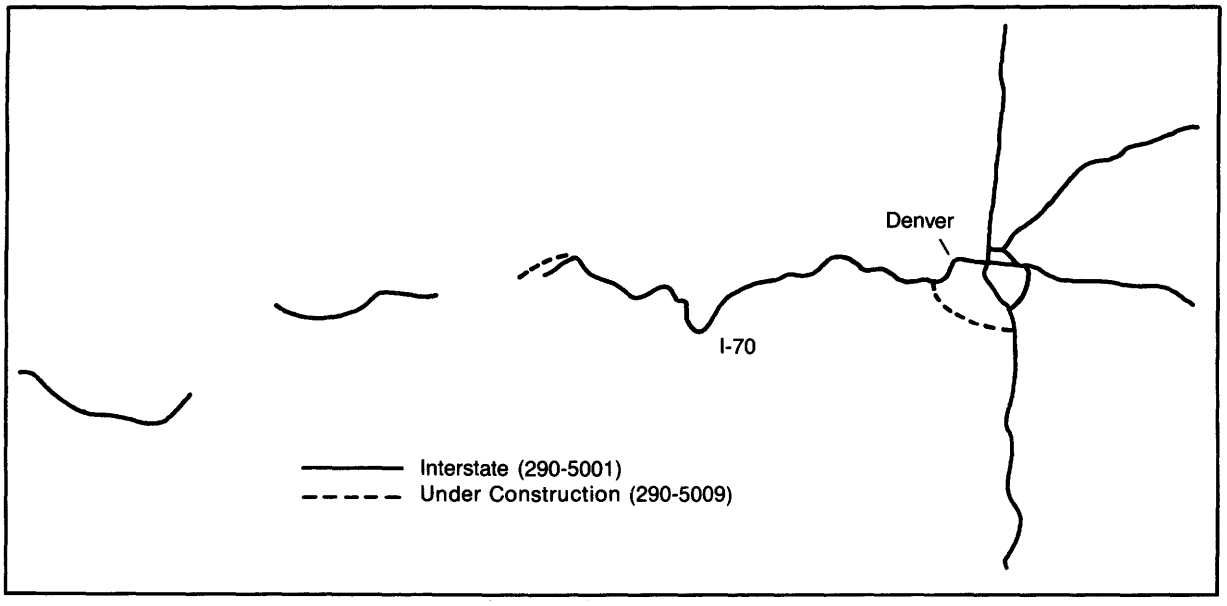


Figure 8A.--Interstate highway segments west of Denver, Colo.

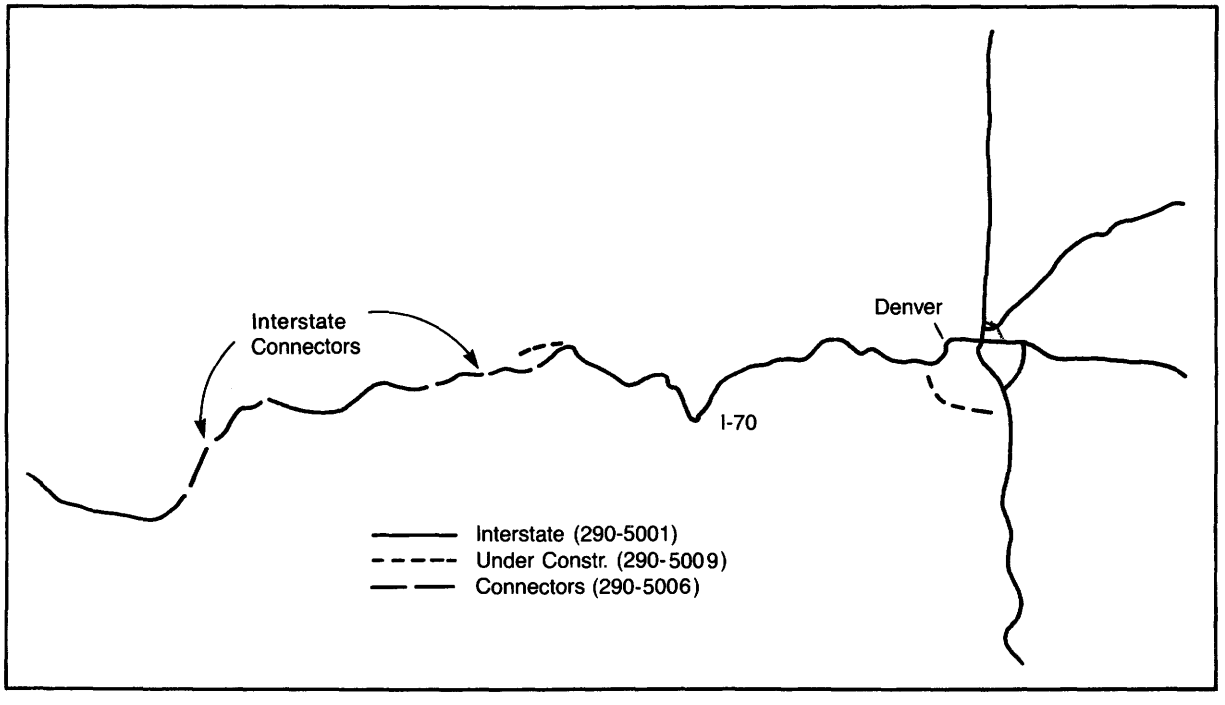
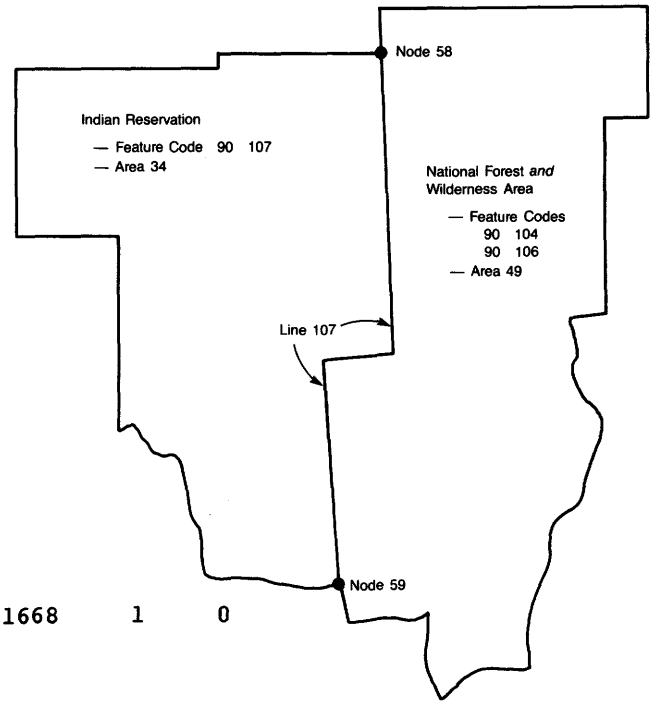


Figure 8B.--Interstate highway segments with connectors west of Denver, Colo.




```
A      34      3859     1668      1       0
        90      107
         .
         .
         .
A      49       4591     1311      2       0
       90    106         90    104
         .
         .
         .
         .
L    107       59      58       34       49       3       3    0
    4569       1507       4617       1510    4693    1515
       290      6045       290       6055      290    6070
```

Figure 9.--Feature code assignment.

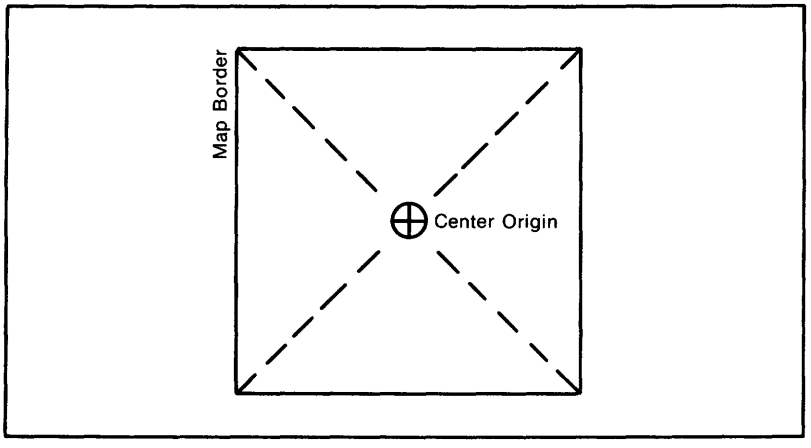


Figure 10.--Location of origin of file reference coordinates.

Projections Information--cont'd.

Alaska

Base parallel	50° N.
Central meridian	154° W.
Standard parallels	55° N. and 65° N.
Longitude extent	129° W. to 172° E.
latitude extent	54° N. to 72° N.

The Clarke, 1866 spheroid is used for the map projection.

(For Alaska, the Aleutian Islands extend westward to 172° E. For computational simplicity the longitude values ranging from 180° to 172°E. have been entered in the data files as 180° to 188° [or -180 to -188].)

APPENDIXES

APPENDIX A.--DLG Feature Codes

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			AREA ATTRIBUTES
Water bodies....	040	0100	Perennial lake or pond
		0102	Intermittent lake or pond
		0104	Dry lake or pond
		0105	Alkali flat
		0106	Reservoir
		0107	Intermittent reservoir
		0110	Glacier or snowfield
		0150	Island
		0199	Area not in water body (remainder of map)
Political boundaries.	090	0101	Incorporated city, village, town, borough, or hamlet
		0197	Canada
		0198	Mexico
		0199	Area outside a national boundary
Administrative boundaries.	090	0103	National park, monument, lakeshore, parkway, battlefield, or recreation area
		0104	National forest or grassland
		0105	National wildlife refuge, game preserve, or fish hatchery
		0106	National scenic waterways or wilderness area
		0107	Indian reservation
		0108	Military reservation

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			PARAMETER CODES
			Line records
Roads and trails.	102	0---	Interstate route number, two or three digits right justified
	103	0---	U.S. route number, two or three digits right justified
	104	0---	State route number, two or three digits right justified
			Area records
Political boundaries.	091	00--	State FIPS code, two digits right justified
	092	0---	County or county equivalent FIPS code, three digits, right justified
			LINE ATTRIBUTES
Hypsography.....	290	2017	Continental Divide
Rivers and streams.	290	3001	River/stream (double line, shoreline)
		3002	River/stream (double line, centerline)
		3003*	River/stream (single line), perennial, length <20 km, or ≤12 mi
		3004	River/stream (single line), perennial, length 20-<30 km, or 12-<19 mi
		3005	River/stream (single line), perennial, length 30-<40 km, or 19-<25 mi
		3006	River/stream (single line), perennial, length 40-<50 km, or 25-<31 mi
		3007	River/stream (single line), perennial, length 50-<60 km, or 31-<37 mi
		3008	River/stream (single line), perennial, length 60-<80 km, or 37-<50 mi
		3009	River/stream (single line), perennial, length 80-<100 km, or 50-<62 mi
		3010	River/stream (single line), perennial, length 100-<125 km, or 62-<78 mi

*This code was only used in the Alaskan drainage files.

Note: Listing of FIPS codes available as National Bureau of Standards (U.S.), Federal Information Processing Standards Publication (FIPS PUB) 6-3, 39 p. for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Rivers and streams (cont'd.)	290	3011	River/stream (single line), perennial, length 125-<150 km, or 78-<93 mi
		3012	River/stream (single line), perennial, length 150-<200 km, or 93-<124 mi
		3013	River/stream (single line), perennial, length 200-<250 km, or 124-<155 mi
		3014	River/stream (single line), perennial, length 250-<300 km, or 155-<186 mi
		3015	River/stream (single line), perennial, length 300-<350 km, or 186-<217 mi
		3016	River/stream (single line), perennial, length 350+ km, or 217+ mi
		3017*	River/stream (single line), intermittent, length <20 km, or <12 mi
		3018	River/stream (single line), intermittent, length 20-<30 km, or 12-<19 mi
		3019	River/stream (single line), intermittent, length 30-<40 km, or 19-<25 mi
		3020	River/stream (single line), intermittent, length 40-<50 km, or 25-<31 mi
		3021	River/stream (single line), intermittent, length 50-<60 km, or 31-<37 mi
		3022	River/stream (single line), intermittent, length 60-<80 km, or 37-<50 mi
		3023	River/stream (single line), intermittent, length 80-<100 km, or 50-<62 mi
		3024	River/stream (single line), intermittent, length 100-<125 km, or 62-<78 mi
		3025	River/stream (single line), intermittent, length 125-<150 km, or 78-<93 mi
		3026	River/stream (single line), intermittent, length 150-<200 km, or 93-<124 mi
		3027	River/stream (single line), intermittent, length 200-<250 km, or 124-<155 mi
		3028	River/stream (single line), intermittent, length 250-<300 km, or 155-<186 mi
		3029	River/stream (single line), intermittent, length 300-<350 km, or 186-<217 mi
		3030	River/stream (single line), intermittent, length 350+ km, or 217+ mi
		3035*	River/stream, centerline in water body, perennial, length <2 km, or <1 mi
		3036	River/stream, centerline in water body, perennial, length 2-<4 km, or 1-<2 mi
		3037	River/stream, centerline in water body, perennial, length 4-<6 km, or 2-<4 mi
		3038	River/stream, centerline in water body, perennial, length 6-<8 km, or 4-<5 mi
		3039	River/stream, centerline in water body, perennial, length 8-<10 km, or 5-<6 mi
		3040	River/stream, centerline in water body, perennial, length 10-<15 km, or 6-<9 mi
		3041	River/stream, centerline in water body, perennial, length 15-<20 km, or 90-12 mi
		3042	River/stream, centerline in water body, perennial, length 20-<25 km, or 12-<16 mi
		3043	River/stream, centerline in water body, perennial, length 25-<30 km, or 16-<19 mi
		3044	River/stream, centerline in water body, perennial, length 30-<40 km, or 19-<25 mi
		3045	River/stream, centerline in water body, perennial, length 40-<50 km, or 25-<31 mi
		3046	River/stream, centerline in water body, perennial, length 50-<60 km, or 31-<37 mi

*This code was only used in the Alaskan drainage files.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Rivers and streams (cont'd.)	290	3047	River/stream, centerline in water body, perennial, length 60-<80 km, or 37-<50 mi
		3048	River/stream, centerline in water body, perennial, length 80+ km, or 50+ mi
		3050	River/stream, centerline in water body, intermittent, length <2 km, or <1 mi
		3051	River/stream, centerline in water body, intermittent, length 2-<4 km, or 1-<2 mi
		3052	River/stream, centerline in water body, intermittent, length 4-<6 km, or 2-<4 mi
		3053	River/stream, centerline in water body, intermittent, length 5-<8 km, or 4-<5 mi
		3054	River/stream, centerline in water body, intermittent, length 8-<10 km, or 5-<6 mi
		3055	River/stream, centerline in water body, intermittent, length 10-<15 km, or 6- <9 mi
		3056	River/stream, centerline in water body, intermittent, length 15-<20 km, or 9-<12 mi
		3057	River/stream, centerline in water body, intermittent, length 20-<25 km, or 12-<16 mi
		3058	River/stream, centerline in water body, intermittent, length 25-<30 km, or 16-<19 mi
		3059	River/stream, centerline in water body, intermittent, length 30+ km, or 19+ mi
		3060	Braided stream, average width of braid 6+ km, or 4+ mi
		3061	Braided stream, average width of braid 0-<2 km, or 0-<1 mi
		3062	Braided stream, average width of braid 2-<4 km, or 1-<2 mi
		3063	Braided stream, average width of braid 4-<6 km, or 2-<4 mi
		3070*	Canal, navigable, length <1 km, or <1 mi
		3071	Canal, navigable, length 1-<10 km, or 1-<6 mi
		3072	Canal, navigable, length 10-<20 km, or 6-<12 mi
		3073	Canal, navigable, length 20-<40 km, or 12-<25 mi
		3074	Canal, navigable, length 40-<60 km, or 25-<37 mi
		3075	Canal, navigable, length 60-<80 km, or 37-<50 mi
		3076	Canal, navigable, length 80+ km, or 50+ mi
		3077	Canal, other, length <1 km, or <1 mi
		3078	Canal, other, length 1-<10 km, or 1-<6 mi
		3079	Canal, other, length 10-<20 km, or 6-<12 mi
		3080	Canal, other, length 20-<40 km, or 12-<25 mi
		3081	Canal, other, length 40-<60 km, or 25-<37 mi
		3082	Canal, other, length 60-<80 km, or 37-<50 mi
		3083	Canal, other, length 80+ km, or 50+ mi
		3086	Ditch (perennial)
		3095	Intercoastal waterway

*This code was only used in the Alaskan drainage files.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water bodies....290		4000	U.S. coastline including Great Lakes
		4001*	Perennial water body, lake, reservoir, and island, length <2 km, or <1 mi
		4002	Perennial water body, lake, reservoir, and island, length 2-<4 km, or 1-<2 mi
		4003	Perennial water body, lake, reservoir, and island, length 4-<6 km, or 2-<4 mi
		4004	Perennial water body, lake, reservoir, and island, length 6-<8 km, or 4-<5 mi
		4005	Perennial water body, lake, reservoir, and island, length 8-<10 km, or 5-<6 mi
		4006	Perennial water body, lake, reservoir, and island, length 10-<15 km, or6-<9 mi
		4007	Perennial water body, lake, reservoir, and island, length 15-<20 km, or -<12 mi
		4008	Perennial water body, lake, reservoir, and island, length 20-<25 km, or 12-<16 mi
		4009	Perennial water body, lake, reservoir, and island, length 25-<30 km, or 16-<19 mi
		4010	Perennial water body, lake, reservoir, and island, length 30-<40 km, or 19-<25 mi
		4011	Perennial water body, lake, reservoir, and island, length 40-<50 km, or 25-<31 mi
		4012	Perennial water body, lake, reservoir, and island, length 50-<60 km, or 31- 37 mi
		4013	Perennial water body, lake, reservoir, and island, length 60-<80 km, or 37- 50 mi
		4014	Perennial water body, lake, reservoir, and island, length 80+ km, or 50+ mi
		4021*	Intermittent water body, lake or reservoir, length <2 km, or <1 mi
		4022	Intermittent water body, lake or reservoir, length 2-<4 km, or 1-<2 mi
		4023	Intermittent water body, lake or reservoir, length 4-<6 km, or 2-<4 mi
		4024	Intermittent water body, lake or reservoir, length 6-<8 km, or 4-<5 mi
		4025	Intermittent water body, lake or reservoir, length 8-<10 km, or 5-<6 mi
		4026	Intermittent water body, lake or reservoir, length 10-<15 km, or 6-<9 mi
		4027	Intermittent water body, lake or reservoir, length 15-<20 km, or 9-<12 mi
		4028	Intermittent water body, lake or reservoir, length 20-<25 km, or 12-<16 mi
		4029	Intermittent water body, lake or reservoir, length 25-<30 km, or 16-<19 mi
		4030	Intermittent water body, lake or reservoir, length 30-<40 km, or 19-<25 mi
		4031	Intermittent water body, lake or reservoir, length 40-<50 km, or 25-<31 mi
		4032	Intermittent water body, lake or reservoir, length 50-<60 km, or 31-<37 mi
		4033	Intermittent water body, lake or reservoir, length 60-<80 km, or 37-<50 mi
		4034	Intermittent water body, lake or reservoir, length 80+ km, or 50+ mi
		4040*	Marsh/swamp and salt marsh, length <10 km, or <6 mi
		4041	Marsh/swamp and salt marsh, length 10-<17 km, or 6-<11 mi
		4042	Marsh/swamp and salt marsh, length 17-<25 km, or 11-<16 mi

*This code was only used in the Alaskan drainage files.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water bodies (cont'd.)	290	4043	Marsh/swamp and salt marsh, length 25-<37 km, or 16-<23 mi
		4044	Marsh/swamp and salt marsh, length 37-<50 km, or 23-<31 mi
		4045	Marsh/swamp and salt marsh, length 50+ km, or 31+ mi
		4050	Dry lake and alkali flat, length <2 km, or <1 mi
		4051	Dry lake and alkali flat, length 2-<4 km, or 1-<2 mi
		4052	Dry lake and alkali flat, length 4-<6 km, or 2-<4 mi
		4053	Dry lake and alkali flat, length 6+ km, or 4+ mi
		4060*	Glacier, length <4 km, or <2 mi
		4061	Glacier, length 4-<10 km, or 2-<6 mi
		4062	Glacier, length 10-<17 km, or 6-<11 mi
		4063	Glacier, length 17-<25 km, or 11-<16 mi
		4064	Glacier, length 25-<37 km, or 16-<23 mi
		4065	Glacier, length 37-<50 km, or 23-<31 mi
		4066	Glacier, length 50+ km, or 31+ mi
Roads and trails.	290	5001	Interstate
		5002	Major U.S., limited access, divided
		5003	Major State, limited access, divided
		5004	Major other, limited access, divided
		5005	Toll road[1]
		5006	Interstate connector[1]
		5007	Limited access, divided connector[1]
		5008	Toll connector[1]
		5009	Interstate, under construction
		5010	Interstate, proposed
		5013	Minor U.S., limited access, 310 km (500 mi) and longer
		5014	U.S. non-limited access, 310 km (500 mi) and longer
		5015	Minor U.S. limited access, less than 310 km (500 mi)

*This code was only used in the Alaskan drainage files.
[1]Redundant entry used to provide additional information.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Roads and trails (cont'd.)	290	5016	U.S. non-limited access, less than 310 km (500 mi)
		5017	Other minor U.S. limited access
		5018	Other U.S.[2]
		5019	Other minor State primary, limited access
		5020	Other State primary
		5021	Minor U.S. parallel, within 10 km (6 mi)
		5022	U.S. parallel, within 10 km (6 mi)
		5023	Minor State parallel, within 10 km (6 mi)
		5024	State parallel, within 10 km (6 mi)
		5028	State secondary (all weather, hard surface)
		5031	Light duty (all weather, improved)
		5041	Unimproved (fair or dry weather)
		5061	Tunnel, road
		5062	Ferry, auto
Railroads.....	290	5071	Class 1, category A, main line
		5072	Class 1, category B, main line
		5073	Class 1, category A, branch line
		5074	Class 1, category B, branch line
		5075	Other railroad
		5078	Tunnel, railroad
		5079	Ferry, railroad
		5080	Class 1, category A, main-line connector[1]
Political boundaries.	290	6000	International treaty line
		6001	National (land)
		6002	National (water)

[1]Redundant entry used to provide additional information.
[2]U.S. business, alternate, bypass, and routes paralleling U.S. or interstate routes within 10 to 25 km.

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Political boundaries (cont'd.)	290	6005	State/provincial (land)
		6006	State/provincial (water)
		6009	County, parish, Alaskan borough, or large independent city (land)
		6010	County, parish, Alaskan borough, or large independent city (water)
		6011	Corporate limit (1 million and over population)
		6012	Corporate limit (1/2 to less than 1 million population)
		6014	Small independent city (usually not shown as a county)
Administrative boundaries.	290	6021	National park, length at longest dimension 0-<2 km, or 0-<1 mi
		6022	National park, length at longest dimension 2-<8 km, or 1-<5 mi
		6023	National park, length at longest dimension 8-<14 km, or 5-<9 mi
		6024	National park, length at longest dimension 4-<20km, or 9-<12 mi
		6025	National park, length at longest dimension 20+ km, or 12+ mi
		6026	National monument, length at longest dimension 0-<2 km, or 0-<1 mi
		6027	National monument, length at longest dimension 2-<8 km, or 1-<5 mi
		6028	National monument, length at longest dimension 8-<14 km, or 5-<9 mi
		6029	National monument, length at longest dimension 14-<20 km, or 12+ mi
		6030	National monument, length at longest dimension 20+ km, or 12+ mi
		6031	National seashore or lakeshore, length at longest dimension 0-<2 km, or 0-<1 mi
		6032	National seashore or lakeshore, length at longest dimension 2-<8 km, or 1-<5 mi
		6033	National seashore or lakeshore, length at longest dimension 8-<14 km, or 5-<9 mi
		6034	National seashore or lakeshore, length at longest dimension 4-<20 km, or 9-<12 mi
		6035	National seashore or lakeshore, length at longest dimension 20+ km, or 12+ mi
		6036	National recreation area, length at longest dimension 0-<2 km, or 0-<1 mi
		6037	National recreation area, length at longest dimension 2-<8 km, or 1-<5 mi
		6038	National recreation area, length at longest dimension 8-<14 km, or 5-<9 mi
		6039	National recreation area, length at longest dimension 14-<20 km, or 9-<12 mi
		6040	National recreation area, length at longest dimension 20+ km, or 12+ mi
		6041	National wilderness area, length at longest dimension 0-<2 km, or 0-<1 mi
		6042	National wilderness area, length at longest dimension 2-<8 km, or 1-<5 mi
		6043	National wilderness area, length at longest dimension 8-<14 km, or 5-<9 mi

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Administrative boundaries (cont'd.)	290	6044	National wilderness area, length at longest dimension 14-<20 km, or 9-<12 mi
		6045	National wilderness area, length at longest dimension 20+ km, or 12+ mi
		6051	National forest, length at longest dimension 0-<2 km, or 0-<mi
		6052	National forest, length at longest dimension 2-<8 km, or 1-<5 mi
		6053	National forest, length at longest dimension 8-<14 km, or 5-<9 mi
		6054	National forest, length at longest dimension 14-<20 km, or 9-<12 mi
		6055	National forest, length at longest dimension 20+ km, or 12+ mi
		6056	National grassland, length at longest dimension 0-<2 km, or 0-<1 mi
		6057	National grassland, length at longest dimension 2-<8 km, or 1-<5 mi
		6058	National grassland, length at longest dimension 8-<14 km, or 5-<9 mi
		6059	National grassland, length at longest dimension 14-<20 km, or 9-<12 mi
		6060	National grassland, length at longest dimension 20+ km, or 12+ mi
		6061	National wildlife refuge, length at longest dimension 0-<2 km, or 0-<1 mi
		6062	National wildlife refuge, length at longest dimension 2-<8 km, or 1-<5 mi
		6063	National wildlife refuge, length at longest dimension 8-<14 km, or 5-<9 mi
		6064	National wildlife refuge, length at longest dimension 14-<20 km, or 9-<12 mi
		6065	National wildlife refuge, length at longest dimension 20+ km, or 12+ mi
		6066	Federal Indian reservation, length at longest dimension 0-<2 km, or 0-<1 mi
		6067	Federal Indian reservation, length at longest dimension 2-<8 km, or 1-<5 mi
		6068	Federal Indian reservation, length at longest dimension 8-<14 km, or 5-<9 mi
		6069	Federal Indian reservation, length at longest dimension 14-<20 km, or 9-<12 mi
		6070	Federal Indian reservation, length at longest dimension 20+ km, or 12+ mi
		6081	Federal Military reservation, areas of 1-<405 ha, or 1-<1000 acres
		6082	Federal Military reservation, areas of 405+ ha, or 1000+ acres
		6087	National park, closure line
		6088	National monument, closure line
		6089	National seashore or lakeshore, closure line
		6090	National recreation area, closure line
		6091	National wilderness area, closure line
		6092	National forest, closure line
		6093	National grassland, closure line
		6094	National wildlife refuge, closure line

APPENDIX A.--DLG Feature Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Administrative boundaries (cont'd.)	290	6095	Indian reservation, closure line
		6097	Military reservation, closure line
Cultural features.	290	7001	Commmercial airfield
		7002	Military airfield
		7020	Alaska pipeline

APPENDIX B.--DLG Record Formats

[DLG data files are available in two forms: standard ASCII and IBM binary. ASCII files contain fixed length records of 144 characters. Binary files are IBM standard variable-length records. The following format table describes both types of DLG data files.]

Logical Record Type A

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	Name of digital cartographic unit.	ALPHA	A.1	A144	A	144	Characters 1-40, name of digital cartographic unit. Characters 42-51, date of original source material (for example, 1956) followed by latest revision date (if applicable) (for example 1956, 1965). Characters 53-60, scale of the source material (for example, 62500). Characters 61-144, unused. The name of the map will be used when practical.
2	DLG level code	INTEGER* 2	A.2 (1-6)	I6	A	2	Code = 3, DLG 3
3	Code defining ground planimetric reference system.	INTEGER* 2	A.2 (7-12)	[1]I6	A	2	Code = 3, Albers conical equal area
4	Code defining zone in ground planimetric reference system.	INTEGER* 2	A.2 (13-18)	I6	A	2	Codes = 9999
5	Map projection parameters.	REAL* 8	A.2	[2]5D24.15	A	120	Definition of the parameters for this projection are given in Appendix C.
---	Filler	---	---	6 spaces	-	---	Filler for ASCII format only.

[1]Integer fields with a value of zero will have leading zeros suppressed. For example, an I6 field would be "bbbbb0." (b = blank)

[2]Any field with the format of D24.15 which has a value of zero will be represented as "bbb0.0bbbbbbbbbbbbbbbbbb." (b = blank)

Logical Record Type A--continued

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
	Map Projection parameters (cont'd).	REAL* 8	A.3 (1-144) A.4 (1-96)	6D24.15 4D24.15	A A		Definition of the parameters for this projection are given in Appendix C.
6	Code defining units of measure for ground planimetric coordinates throughout the file.	INTEGER* 2	A.4 (97-102)	I6	A	2	Code = 2, meters
7	Resolution	REAL* 8	A.4 (103-126)	D24.15	A	8	The smallest unit of ground coordinate of data element that is recorded in file.
8	Accuracy code for planimetric data.	INTEGER* 2	A.4 (127-136)	I6	A	2	Code = 0, unknown accuracy
9	Number (n) of registration points.	INTEGER* 2	A.4 (133-138)	I6	A	2	n = 4
---	Filler	---	---	6 spaces	---	---	ASCII only
10	An (4,2) array containing the latitude and the longitude of coordinates of registration points.	REAL* 8	A.5 (1-44) A.6 (1-48)	3(2D24.15)	A	64	The array is stored row-wise and coordinates are in geographic longitude and latitude in units of degrees and decimal degrees.
---	Filler	---	---	96 spaces	---		ASCII only.

APPENDIX B.--DLG Record Formats--continued

Logical Record Type B

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	Parameters (A1,A2,A3,A4) on file-to-map projection transformation; the explicit form of the transformation is: x=A1x+A2y+A3 y=A1y+A2x+A4 where: x,y are coordinates in file reference system and XY are coordinates in map projection reference system.	REAL* 8	B.1 (1-96)	4D24.15	B	32	x,y coordinates resulting from this transformation will be the units of measure defined by data element 6 of Logical Record Type A.
2	Number (m) of registration points.	INTEGER* 2	B.1 (97-102)	I6	B	2	m=4
---	Filler	---	---	42 spaces	---	---	ASCII only
3	An (4,3) array containing identifications and coordinates of registration points. Coordinates are expressed in the file reference coordinate system.	ALPHA/ INTEGER* 2	B.2 (1-56)	4(A2,2I6)	B	24	When there are four registration points, the identification sequence is SW, NW, NE, SE. The array is stored row-wise. Coordinates in the file reference sysstem are usually expressed in units of thousandths of an inch.
---	Filler	---	---	88 spaces	---	---	ASCII only

APPENDIX B.--DLG Record Formats--continued

Logical Record Type C

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	Number (q) of categories (overlays) in the DLG file.	INTEGER* 4	C.1 (1-6)	I6	C	4	q=1
---	Filler	---	---	138 spaces	---	---	ASCII only
2	A (1,7) array containing names as well as maximum and actual number of node, area, and line elements in each network.	ALPHA/ INTEGER*2	C.2 (1-56)	(A20,616)	C	32	This array is stored row-wise. The first element is the network name consisting of 20 alphanumeric characters, the first 4 of which must be unique. Columns 2 and 3 of the array contain maximum and actual number of nodes in the network. Columns 4 and 5 contain maximum and actual number of areas in the network. Columns 6 and 7 are the maximum and actual number of line segments.
---	Filler	---	---	88 spaces	---	----	ASCII only

APPENDIX B.--DLG Record Formats--continued

Logical Record Type D.1

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	Type of element code	ALPHA	D.1 (1-2)	A2	D.1	2	Code = N, for node element A, for area element
2	Element's internal identification number.	INTEGER* 2	D.1 (3-8)	I6	D.1	2	Number is unique within each element type.
3	x y file coordinate of node point or representative point for the area element.	INTEGER* 2	D.1 (9-20)	2I6	D.1	4	The representative area point is usually contained within the the area but is not necessarily a centroid.
4	Number (t) of classification attributes attached to the node or area element (t≥0).	INTEGER* 2	D.1 (9-20)	I6	D.1	2	Absence of attribute codes is indicated by t=0. (For node elements in 1:2,000,000-scale DLG file, t will always be 0.)
5	Number (k) of pairs of text characters which are attached to the node or area element (k≥0).	INTEGER* 2	D.1 (27-32)	I6	D.1	2	k=0. There are no text attributes for 1:2,000,000-scale DLG data.
---	Filler	---	---	112 spaces	---	---	ASCII only

APPENDIX B.--DLG Record Formats--continued

Logical Record Type D.2

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	Code indicating a line segment graph element.	ALPHA	D.2 (1-2)	A2	D.2	2	Code = L for line segment
2	Line segments internal identification number.	INTEGER* 2	D.2 (3-8)	I6	D.2	2	Number is unique within each element type.
3	Internal identification number of starting node.	INTEGER* 2	D.2 (9-14)	I6	D.2	2	Number refers to data element 2 in Logical Record Type D.1.
4	Internal identification number of ending node.	INTEGER* 2	D.2 (15-20)	I6	D.2	2	Number refers to data element 2 in Logical Record Type D.1.
5	Internal identification number of area left.	INTEGER* 2	D.2 (21-26)	I6	D.2	2	Number refers to data element 2 in Logical Record Type D.1.
6	Internal identification number of area right.	INTEGER* 2	D.2 (27-32)	I6	D.2	2	Number refers to data element 2 in Logical Record Type D.1.
7	Number (v) of coordinate pairs that define the line segment.	INTEGER* 2	D.2 (33-35)	I6	D.2	2	$1500 \geq v \geq 2$
8	Number (t) of classification attributes attached to the line segment ($t \geq 0$).	INTEGER* 2	D.2 (39-44)	I6	D.2	2	Absence of classification attribute codes is indicated by t=0.
9	Number (k) of pairs of text characters attached to the line segment ($k \geq 0$).	INTEGER* 2f	D.2 (45-50)	I6	D.2	2	k=0. There are no text attributes for 1:2,000,000-scale DLG data.
---	Filler	---	---	94 spaces	---	---	ASCII only.

Logical Record Type E

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	A (v,2) array containing coordinate pairs that define the image presentation of a line element.	INTEGER* 2	E.1 to E.n	[3]v(2I6)	E	4v	Coordinates are expressed in file reference system, usually in units of thousandths of an inch. The array is stored row-wise.
---	Filler	---	---	0 to 132 spaces			ASCII only

[3]The number of coordinate pairs, "v", is given in record D.2. There will be v(2I6) coordinate pairs, of which a maximum of 12 pairs will fit on a 144-character ASCII record. The space filler will vary in size depending on the value of "v". If "v" equals 12 or is an even multiple of 12, there will be no spaces as filler.

Logical Record Type F

Data Element	Contents	Type (FORTRAN notation)	Physical record # format: ASCII record #	ASCII Format (bytes)	BINARY record #	BINARY Format (bytes)	Comment
1	A (t,2) array containing major and minor classification codes for a graph element.	INTEGER* 2	F.1 to F.n	[4]t(2I6)	F	4t	The array is stored row-wise; the first column contains the major classification attribute, and the second column contains the minor classification attribut.
---	Filler	---	---	0 to 132 spaces			ASCII only

[4]The number of feature (attribute) codes is given as "t" in the D.1 and D.2 records. The F logical record is an array of t (2I6) codes of which a maximum of 12 (2I6) will fit on a 144 character ASCII record. The space filler will vary depending on the value of "t". If "t" is 12 or an even multiple of 12, there will be no space filling at the end of the record.

APPENDIX C.--DLG Parameter Codes used for Albers Conic Equal-Area Projection

Code	Parameter
1	Semimajor axis of ellipsoid
2	Eccentricity squared of ellipsoid
3	Latitude of first standard parallel
4	Latitude of second standard parallel
5	Longitude of central meridian
6	Latitude of projection origin
7	False easting
8	False northing
9-15	Not used

APPENDIX D.--Graphics Format for DLG Data

The simplified, graphics format that can be used with the GS-CAM plotting package is described below. In this format, each line record from the DLG format has been reformatted into two record types: one line identifier record and multiple latitude-longitude records (one for each coordinate pair). If a line record has more than one feature code associated with it in the DLG format, that line record appears in the graphics format files multiple times (once for each feature code). The graphics format files are organized by feature type.

Record 1: Line identifier record

		Position	Length	Format
1.	Line identifier	1-7	7	I7
2.	Rank (last two digits of feature code (described in Appendix A--unique within category)	8-9	2	I2
3.	Number of points in the line (NP) (latitude and longitude)	10-15	6	I6
4.	First five digits of feature code (described in Appendix A)	16-20	5	I5

Record 2: Latitude-longitude record (repeated NP times)

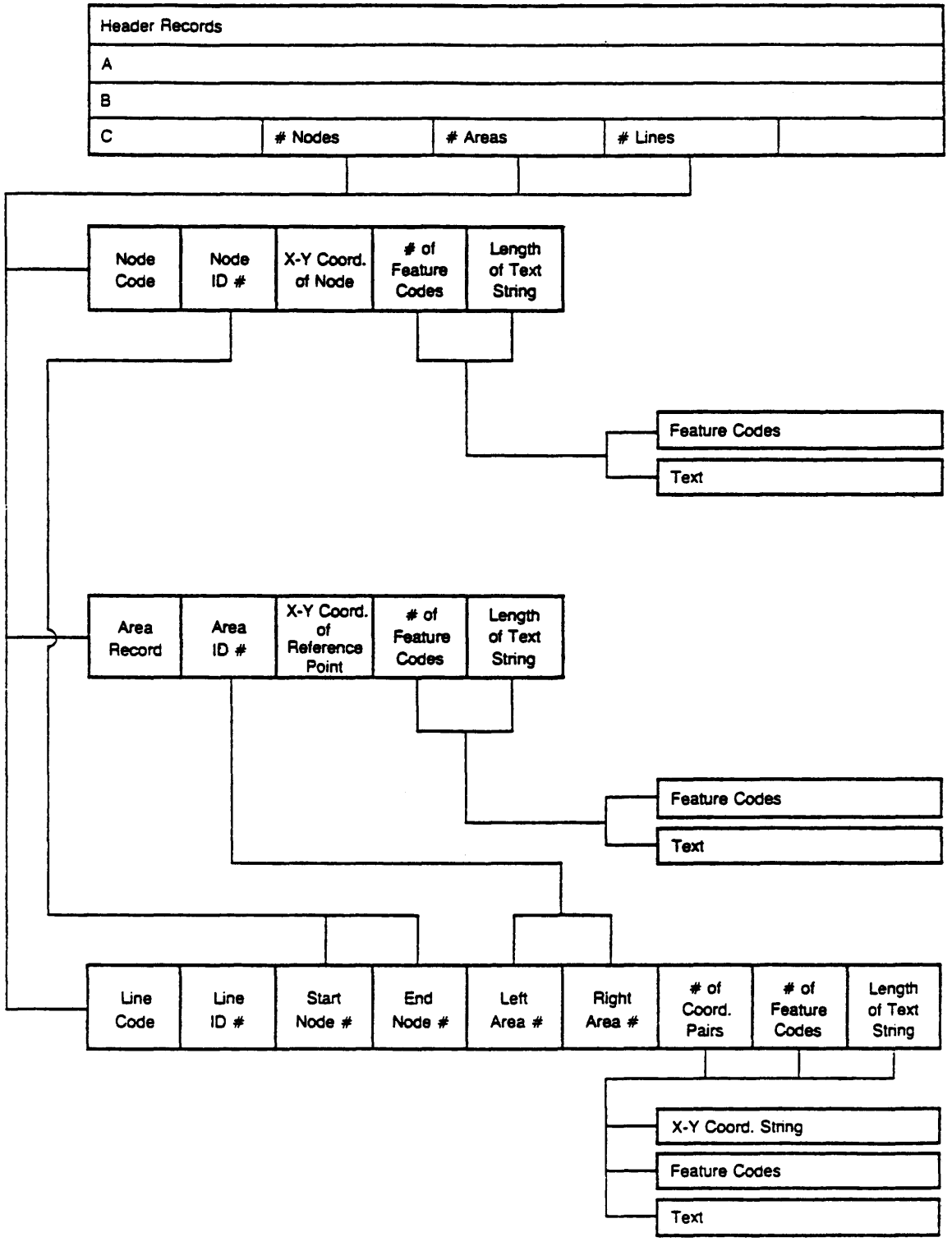
1.	Latitude (DDMMSSI)	1-7	7	3I2, A1
2.	Longitude (DDDMMSSI)	8-15	8	I3, 2I2, A1
3.	Sequence count	16-20	5	I5

APPENDIX E.--Data Sources and Currency

The published 1:2,000,000-scale National Atlas sectional maps were completely revised in 1972-73. Selected information from these maps was revised before digitizing. The source and date of the updated information are presented below:

Overlay	Source	Currency of Data
Political Boundaries		
Alaskan borough boundaries	Bureau of the Census	1979
Administrative Boundaries	Administering Federal agency	Various
Roads and trails	Various	1980
Railroads	Interstate Commerce Commission	1979
Streams		
Alaska	Landsat imagery	1979
Water bodies		
Major reservoirs	National Oceanic and Atmospheric Administration Sectional Aeronautical Charts	1979-80
Cultural features		
Airports	Federal Aviation Administration	1980
Alaska pipeline	USGS maps	1979

APPENDIX F.--DLG Record Layout



APPENDIX G.--Coordinate Conversion

This appendix illustrates the procedure for converting internal file coordinates to ground planimetric reference coordinates. The formulas for this conversion are as follows:

$$X=A1x+A2y+A3$$

$$Y=A1y-A2x+A4$$

where X and Y are the ground planimetric coordinate values and x and y are the internal file coordinates.

The parameters for these formulas (A1, A2, A3, and A4) are contained in Header Record B, as double-precision floating-point numbers.

This example converts four coordinate pairs from internal file coordinates to ground planimetric coordinate values (Albers Conic Equal-Area Projection). The parameters are as follows:

A1=50.325538142
A2=6.9275199981
A3=-1185878.9723
A4=1314164.3401

The internal file coordinates to be converted are:

	x	y
1st pair	-11238	-6583
2d pair	-10405	6583
3d pair	10405	6583
4th pair	11238	-6583

The calculation to determine the ground planimteric coordinates for the first pair are as follows:

X=(50.325538142)(-11238)+(6.9275199981)(-6583)
+(-1185878.9723)
=-1797041.23

Y=(50.325538142)(-6583)-(6.9275199981)(-11238)
+(1314164.3401)
=1060722.79

The resulting x,y coordinate values for the four pairs given above are as follows:

1st pair	-1,797,041.23	1,060,722.79
2d pair	-1,663,912.33	1,717,538.20
3d pair	-616,637.88	1,573,376.51
4th pair	-665,924.44	905,019.86

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