NOAA Manual NOS NGS 2

Input Formats and Specifications of the National Geodetic Survey Data Base

Volume I. Horizontal Control Data

Rockville, Md.
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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey

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Ludvik Pfeifer, Commander, NOAA

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UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

USER'S GUIDE TO THE

INPUT FORMATS AND SPECIFICATIONS

OF THE

NATIONAL GEODETIC SURVEY

DATA BASE

VOLUME I

HORIZONTAL CONTROL DATA

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Chapter 1

HORIZONTAL CONTROL (HZTL) DATA

INTRODUCTION

For coding and processing purposes, the data associated with geodetic horizontal control (HZTL data) have been divided into three groups. The three horizontal control data groups are (1) the field observations (OBS data), (2) station descriptions and recovery notes (DESC data), and (3) adjusted positions (POS data). Detailed instructions and formats for the coding and keying of the OBS, DESC, and POS horizontal control data sets are contained in Chapters 2, 3, and 4, respectively. All data normally generated in the course of a classical horizontal control survey operation (triangulation, trilateration, and/or traverse) are covered, with the exception of astronomic observations, which will be treated in Chapter 9.

Although data of all three types are normally generated in connection with a horizontal control survey project, OBS, DESC, and POS data must be submitted to NGS as separate data sets. There are two modes in which horizontal control data may be submitted to NGS for insertion in the National Geodetic Survey Data Base. In order of preference, they are:

MODE 1 - Field Observations and Station Descriptive Data
(HZTL OBS and HZTL DESC data)

MODE 2 - Adjusted Positions and Station Descriptive Data
(HZTL POS and HZTL DESC data)

The foregoing implies that every horizontal control survey project (or several small projects submitted as one "job" - see below) will be received at NGS as two distinct data sets: either OBS and DESC data sets under MODE 1, or POS and DESC data sets under MODE 2. The two data sets of each horizontal control job must be submitted at the same time.

There are distinct benefits to be realized when horizontal control data intended for insertion in the National Geodetic Survey Data Base are submitted in MODE 1 configuration. Because the field observations which connect the survey points are given, MODE 1 data can be rigorously combined with data held by NGS and incorporated (adjusted) into the national horizontal control network. This process insures that the positions of the new survey points will be consistent with the existing horizontal control in that area. By contrast, MODE 2 data consist of isolated points whose positions are accepted as determined by the submitting agency. Because the connecting observations are not available, these positions cannot be verified, and they cannot be rigorously updated when the horizontal control network in their vicinity is readjusted.

For reasons cited in the preceding paragraph, horizontal control data intended for insertion in the National Geodetic Survey Data Base should be submitted as MODE 1 data. MODE 2 data will be accepted only on an exception basis after consultation between NGS and the submitting agency.

JOB CODE AND SURVEY POINT NUMBERING

The basic unit or grouping of data to be submitted is given the name "job." A horizontal control job may consist of data for a maximum of 999 control points - see definition of "control point" below. If the number of control points in a horizontal control survey project exceeds this limit, the data must be divided and submitted as two or more jobs. A job will normally consist of one project (i.e., one unit of field work); however, several small projects may be included in one job, even though they may have no points in common. It is suggested that geographic proximity be the determining factor in selecting horizontal control survey projects for inclusion in any one job.

A two-character alphanumeric code must be assigned to each horizontal control job submitted by an agency in accordance with this publication. This job code, the data set type, the name of the submitting agency, and the data set creation date will serve to uniquely identify every data set received by NGS. The first character of the two-character job code must always be a letter; the second character may be either a letter or a number (1 through 9). Begin the assigning of job codes with A1 and end with ZZ, i.e., A1, A2, ..., A9, B1, ..., Z1, ..., Z9, AA, AB, ..., ZZ. This allows for a total of 910 uniquely-identified horizontal control jobs to be submitted by any one agency. Should this sequence be exhausted, start assigning job codes again from the beginning - A1, A2, etc.

A horizontal control point is defined as any survey point whose (adjusted) position is given (POS data), whose position is to be determined in an adjustment (OBS data), or whose position is available from other sources. A survey point, in turn, is defined as any point which has one or more directions, angles (horizontal or vertical), or distances measured to it or from it. A survey point may be a monumented (or otherwise permanently marked) control point, a reference mark or azimuth mark, a temporary point (not permanently marked and therefore nonrecoverable) such as an auxilliary point, or an unmonumented recoverable landmark (usually an intersection station) such as a flagpole or church spire. An eccentric instrument setup and eccentric target (or reflector) also qualify as survey points under this definition.

Each control point in a horizontal control job must be assigned a unique three-digit station serial number in the range 001 through 999. Although only control points should normally be numbered in this manner, any other survey point may also be assigned an individual three-digit station serial number if this should be convenient or necessary for any reason.

There normally are, however, many survey points in a horizontal control job which are not intended to be control points and which are, by their nature, peripheral to a control point. Such peripheral points should be identified by a one-letter suffix which is appended to the three-digit station serial number of the control point to which they belong. Examples of peripheral points which should be identified in this manner are unoccupied reference and azimuth marks.

Eccentric instrument setups and eccentric targets (or reflectors) are also such peripheral points if the respective eccentric observations are to be reduced to center. This is usually the case when the eccentric point is not permanently marked. However, if an eccentric point is offset more than 10 meters from the control point to which it belongs (even though it may be unmarked), or when the eccentric point is permanently marked (e.g. a reference mark is occupied), then the respective eccentric observations should not be reduced to center, and the eccentric point should be treated as another control point.

In assigning suffixed station serial numbers to peripheral points, reserve the letters at the beginning of the alphabet (A, B, C, etc. through J) for unmarked eccentric points whose offset distance from the respective control point does not exceed 10 meters. If there is more than one eccentric point of this kind in the vicinity of a control point, care must be taken to assign a different suffix to each of these eccentric instrument setups and/or eccentric target or reflector positions, unless it can be verified that the same point (e.g. a temporarily marked point) was actually used on more than one occasions. When a peripheral point of this kind is encountered in the NGS data processing stream, the respective eccentric observations will be reduced to center, the eccentric point itself will cease to exist, and the original (eccentric) observations will not be retained. If, for any reason, this is not desired, the eccentric point in question must be carried as a control point and must be assigned an unsuffixed three-digit serial number of its own.

Suffixes K through R are reserved for unoccupied reference marks, and the last eight letters of the alphabet (S through Z) are reserved for unoccupied azimuth marks. An unoccupied reference or azimuth mark is one which has one or more directions, angles, and/or distances measured to it but not from it (i.e., one which does not occur as a standpoint in any observation). A reference mark or azimuth mark which is occupied as a part of the survey scheme (e.g. as an eccentric occupation of the respective control point) should always be treated as a distinct control point. However, a reference or azimuth mark with directions, angles, and/or distances measured from it (as well as to it) for the purpose of verifying and/or supplementing the observations which tie together the control point and its peripheral points may remain a peripheral point. If there are more than eight reference marks or more than eight azimuth marks associated with a horizontal control point, treat some of the reference or azimuth marks (preferably those which can be positioned) as control points, i.e., assign unsuffixed station serial numbers to them.

The observations (directions, angles, and/or distances) which link the peripheral points with the respective control points must appear in the appropriate subset of the HZTL OBS data set (see Chapter 2).

Figures 1-1 and 1-2 on the following pages illustrate the assignment of station serial numbers to control points and to their peripheral points (reference marks, azimuth marks, and/or eccentric points). This numbering system provides unique identifiers for all survey points which occur in a horizontal control job. It must be emphasized that peripheral points (those identified by suffixed station serial numbers) may occur only in the OBS data set of a horizontal control job. Only points identified by unsuffixed station serial numbers will appear in a DESC or POS data set. In particular, a point for which descriptive data appear in the DESC data set must not be carried as a peripheral point in the corresponding OBS data set, i.e., such a point must be identified by an unsuffixed station serial number regardless of its peripheral or nonperipheral status. The same station serial number must be consistently used when reference is made to the same point in either the OBS, DESC, or POS data set of a horizontal control job.

As pointed out in the INTRODUCTION, a horizontal control job consists of two separate data sets - either the HZTL OBS and HZTL DESC data sets under MODE 1, or the HZTL POS and HZTL DESC data sets under MODE 2. When MODE 2 data are submitted, there will normally be a one-to-one correspondence between points in the respective POS and DESC data sets, because every control point in the POS data set must also have a station description and/or recovery note(s) in the corresponding DESC data set. When MODE 1 data are submitted, however, there will usually be a greater number of points in the OBS data set than in the corresponding DESC data set. This is because there will be no descriptive data for the peripheral points and for the unmarked (auxilliary) points. Station descriptions and subsequent recovery notes are required only for recoverable control points, and apart from the peripheral points, there may be a number of nonrecoverable control points (either originally unmarked or confirmed lost) which must be carried along in the OBS data set for network integrity purposes. In isolated instances, there may also be recoverable control points for which no descriptive data are available.

When the data-recording medium is magnetic tape (see MEDIA FOR SUBMITTING DATA), the two data sets of a horizontal control job must be submitted as two separate files. These files may be on the same reel of tape or on different reels if the data is organized so that a tape contains data sets of only one type (e.g. HZTL OBS data sets) when many jobs are being submitted. When the data-recording medium is punched cards, the two data sets must be submitted as two separate decks. In any case, the first record of every data set (see Chapters 2, 3, and 4) must contain the information by means of which the respective data sets are positively identified and correlated - the job code, the data set type, the name of the submitting agency, and the data set creation date.

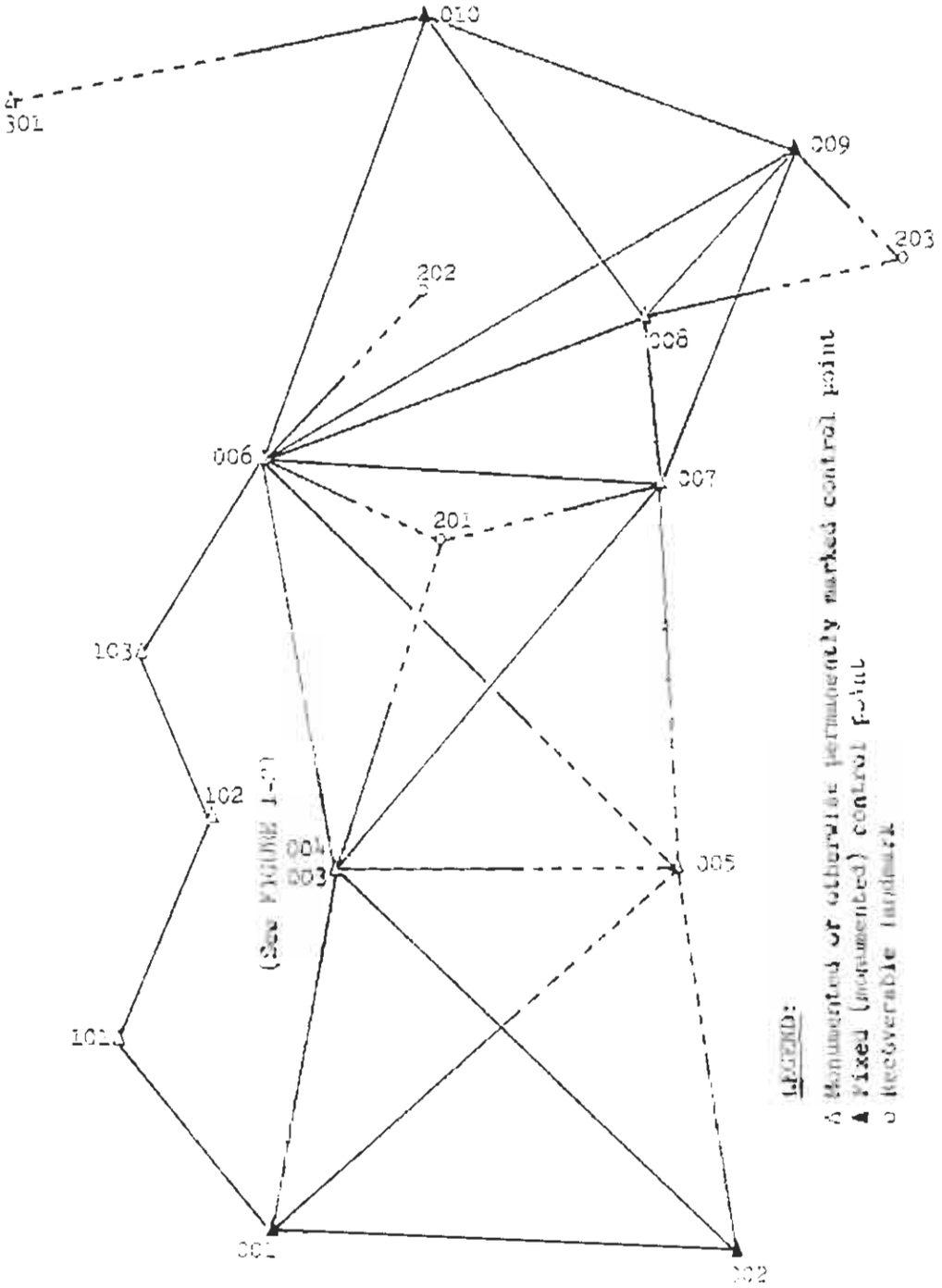

FIGURE 1-1 - Unsuffixed station serial numbers assigned to control points.

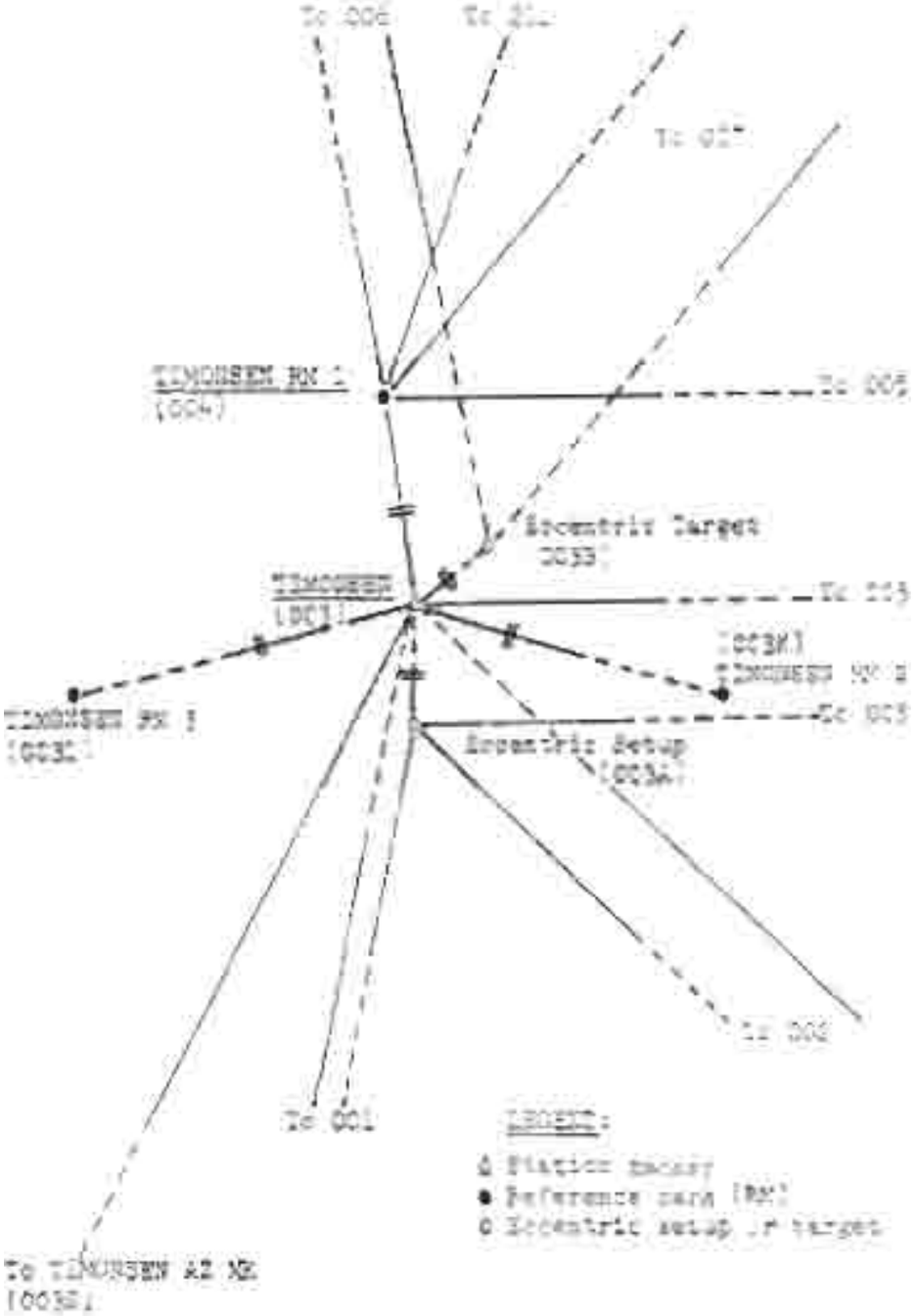

FIGURE 1-2 - Station serial numbers with and without suffix assigned to control points and to peripheral points.

MEDIA FOR SUBMITTING DATA

Although in principle any computer-readable, general-purpose data-recording medium can be handled, the two media acceptable to NGS on a routine basis at the present time are punched cards (80 columns) and standard 1/2 inch magnetic tape. Magnetic tape is the preferred medium for both small and large volumes of data; agencies submitting large volumes of data should use this medium exclusively. Punched cards should be used only for small, isolated jobs.

When the data are submitted as decks of punched cards, care must be taken to package each deck separately in order to minimize the likelihood of cards from different decks becoming intermingled. Provision is made for a sequence number to appear on every card of a deck, however, only the first card of each deck contains the deck identification data. The following information must be given for each data set submitted as a deck of cards:

1. Name and address of the submitting agency.

2. Contents of the deck by job code and data type (e.g. A1 HZTL OBS, XX HZTL DESC, etc.).

3. Character representation code (BCD, EBCDIC, etc.) and/or keypunch equipment used (e.g. IBM 026, IBM 029, etc.).

4. Name and phone number of person to be contacted in case of difficulty with the data.

This information should be given in a letter of transmittal, a copy of which should be packed with the data set in question.

When the data are submitted as files of formatted records on magnetic tape, the following information is expected to be given for each reel of tape:

1. Name and address of the submitting agency.

2. Reel number or identification symbol assigned by the submitting agency.

3. Number of files and contents of each file by job code and data type (e.g. A1 HZTL OBS, XX HZTL DESC, etc.).

4. Computer system on which the tape was created (e.g. IBM 360/XXX, CDC 6600, etc.).

5. Internal label information (e.g. non-labeled, standard IBM label, etc.).

6. Number of tracks (7 or 9) and parity (even or odd).

7. Recording density (556, 800, or 1600 BPI).

8. Record length (LRECL) and block size (BLKSIZE).

9. Character representation code (BCD, EBCDIC, etc.) and keytape equipment designation, if applicable.

10. Name and phone number of person to be contacted in case of difficulty with the data.

In addition to being given in the respective letter of transmittal, this information should be entered on one or more stick-on labels affixed to the magnetic tape reel.

A letter of transmittal in which the data are described and itemized should always be prepared for each data shipment. One copy should be enclosed with the data shipment, one sent by separate mail to NGS, and another copy should be retained by the sender. See ANNEX K for the current mailing instructions. In every case, the submitting agency should retain a backup copy of all data included in a shipment until the receipt of that specific data is acknowledged by NGS.

CODING, KEYING, AND DATA VERIFICATION

All data submitted to NGS for insertion in the National Geodetic Survey Data Base must be coded and keyed in strict conformity with the formats and specifications contained in this publication. In addition, the keying of all data must be verified.

Detailed formats and specifications for the coding and keying of horizontal control jobs are contained in Chapter 2 (HZTL OBS data), Chapter 3 (HZTL DESC data), and in Chapter 4 (HZTL POS data). The formats were designed to allow the keying and verification of the data to be accomplished on standard keypunch or keytape equipment. The 80-character record (one punched card image) has been adopted as standard for all applications.

In keying the data entries, care must be taken to insure that alphabetic characters (letters) are always keyed using the alphabetic keys of the keying device, and that numeric characters (numbers) are always keyed using the numeric keys. In particular, the miskeying of the following characters must be avoided:

0 - number "zero"	1 - number "one"	2 - number "two"
O - letter "O"	L - letter "L"	Z - letter "Z"

SPECIAL CHARACTERS

In addition to alphabetic characters (letters A through Z) and numeric characters (numbers 0 through 9), the following special characters are allowed:

(*) asterisk	(+) plus sign
( ) blank or space	(-) minus sign or hyphen
(,) comma	(=) equal sign
(.) period or decimal point	(/) slash or solidus
($) dollar sign	(() left parenthesis
	()) right parenthesis

SEQUENTIAL RECORD NUMBERING

The first six characters of every record are reserved for a record sequence number. The purpose of the sequential numbering of records is to insure that the proper sequence of individual records in a data set can be verified and, if necessary, restored. The record sequence numbers must form one continuing sequence throughout each data set, starting with the first record (the Data Set Identification Record) and ending with the last record (the Data Set Termination Record).

Start with assigning sequence number 000010 to the first record in the data set (the Data Set Identification Record) and increment by 10 on each successive record. This numbering system allows up to nine records to be inserted between any two originally numbered records without the necessity of renumbering any records in the data set. Even when a large block of omitted records must be inserted, only few of the existing records will have to be renumbered. However, to allow for the detection of missing records, all insertions and/or deletions which cause deviation from the basic 000010, 000020, 000030, etc. "increment-by-ten" record sequence must be accounted for in the respective letter of transmittal.

Discounting any after-the-fact insertions, the above-described sequential numbering system will permit a maximum of 99,999 uniquely-numbered records in any one data set. Should there ever be a need for a greater number of records in a data set, retain only the last six digits of the higher sequence numbers, i.e., ... 999980, 999990, 000000, 000010, etc.

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Chapter 2

HORIZONTAL OBSERVATION (HZTL OBS) DATA

INTRODUCTION

The purpose of this chapter is to provide detailed specifications and instructions for the coding and keying of the observation data set of a horizontal control job. As was explained in Chapter 1, a horizontal control job consists of two distinct data sets which must be submitted together. The companion data set to the horizontal observation (HZTL OBS) data set treated in this chapter is the data set containing descriptions and/or recovery notes for the control points which occur in the horizontal control job. This descriptive (HZTL DESC) data set is treated in Chapter 3.

HZTL OBS DATA SET RECORDS

The data which constitute an HZTL OBS data set are organized into nine categories, which are as follows:

1. Project Data
2. Horizontal Direction Data
3. Horizontal Angle Data
4. Vertical Angle/Zenith Distance Data
5. Distance Data
6. Azimuth Data
7. Survey Equipment Data
8. Survey Point Data
9. Fixed Control Data

Within these categories, the respective data have been grouped into one or more logical units called "records." A record is a string of characters containing data coded according to a specific format. Every record in an HZTL OBS data set consists of 80 characters or "columns" (standard punched card image). Within each record, the 80 columns are divided into fixed-length "character fields", each field being the space reserved for a specific data item. Accordingly, for every desired data item, there exists a field of appropriate length into which the data item in question is to be entered after it is converted into a string of alphanumeric characters. The set of rules according to which specific data items are converted into strings of alphanumeric characters to be entered in the fields of a record is known as the "format" of that record.

The types of records which may appear in an HZTL OBS data set are listed in Table 2-1 on the following page. Each type of record has been given a name, and a block diagram illustrating the respective format has been prepared to serve as a model for that record - see under FORMAT DIAGRAMS.

TABLE 2-1
HORIZONTAL OBSERVATION DATA SET RECORDS

	FIRST RECORD
aa	Data Set Identification Record
	PROJECT DATA
10	Project Title Record
11	Project Title Continuation Record
12	Project Information Record
13	Geodetic Datum and Ellipsoid Record
	HORIZONTAL DIRECTION DATA
20	Horizontal Direction Set Record
21	Horizontal Direction Comment Record (Optional)
22	Horizontal Direction Record
	HORIZONTAL ANGLE DATA
30	Horizontal Angle Set Record
31	Horizontal Angle Comment Record (Optional)
32	Horizontal Angle Record
	VERTICAL ANGLE/ZENITH DISTANCE DATA
40	Vertical Angle Set Record
41	Vertical Angle Comment Record (Optional)
42	Vertical Angle Record
	DISTANCE DATA
50	Taped Distance Record
51	Unreduced Distance Record
52	Reduced Distance Record
53	Unreduced Long Line Record
54	Reduced Long Line Record
55	Distance Comment Record (Optional)
	AZIMUTH DATA
60	Laplace Azimuth Record
61	Geodetic Azimuth Record
	SURVEY EQUIPMENT DATA
70	Instrument Record
	SURVEY POINT DATA
80	Control Point Record
81	Control Point Record (UTM/SPC)
82	Reference or Azimuth Mark Record
83	Bench Mark Record
84	Geoid Height Record (Optional)
85	Deflection Record (Optional)
	FIXED CONTROL DATA
90	Fixed Control Record
	LAST RECORD
aa	Data Set Termination Record

Note: The symbol "aa" denotes the two-character job code assigned by the submitting agency - see Chapter 1.

Except for the first and last records of the data set, the second character field of each record (columns 7-10) contains a two-digit numerical data code, preceded and followed by an asterisk, which specifies the type of that record (*10*,*11*,...,*90* - see Table 2-1). The first and last records of the data set (the Data Set Identification Record and the Data Set Termination Record) display the two-character alphanumeric job code assigned by the submitting agency in this field (*A1*,*A2*,...,*ZZ* - see Chapter 1). The first character field of every record (columns 1-6) is reserved for the respective record sequence number - see Chapter 1. The remaining portion of each record (columns 11-80) contains character fields which are peculiar to each individual type of record.

STRUCTURE OF THE HZTL OBS DATA SET

The first record of an HZTL OBS data set must be the Data Set Identification Record which contains the required information to identify the data set and to correlate it with its companion HZTL DESC data set - job code, data type (HZTL OBS), name of submitting agency, and date the data set was created. The last record of the data set must be the Data Set Termination Record recognized as such because it is the only other record in the data set on which the respective job code appears in the same field (columns 7-10) as on the Data Set Identification Record.

The HZTL OBS data set records which are bracketed by these two delimiting records may pertain to one or more units of field work, i.e., field observation data for several horizontal control survey projects may be submitted in one HZTL OBS data set under the same job code, provided that the total number of control points does not exceed 999 (see Chapter 1). When two or more projects are included in a job, each project must appear as a complete unit in the respective HZTL OBS data set, i.e., as a block of records which contains all information pertinent to that project. Each project must begin with a *10* record, contain any number of the other types of records in proper sequence, and terminate with one or more *90* records.

TABLE 2-2 - HZTL OBS STRUCTURE

Data Set Identification Record	
10 record :::: *90* record	First Project
10 record :::: *90* record	Second Project
::::	::::
10 record :::: *90* record	Last Project
Data Set Termination Record	

A horizontal control survey project is defined as a unit of field work consisting of a number of survey points (control points and peripheral points - see Chapter 1) which are connected by observations - horizontal directions, horizontal angles, vertical angles, and/or distance measurements. When coded as a part of an HZTL OBS data set, a project is a block of records comprising record groups arranged in the following order:

1. Project Data (*10*-Series) Records:

   10,*11*,*12*,*13* records

2. Horizontal Direction Data (*20*-Series) Records:

   20,*21*,*22*,...,*22* for first set of horizontal directions
   20,*21*,*22*,...,*22* for second set of horizontal directions
   ::::
   20,*21*,*22*,...,*22* for last set of horizontal directions

3. Horizontal Angle Data (*30*-Series) Records:

   30,*31*,*32*,...,*32* for first set of horizontal angles
   30,*31*,*32*,...,*32* for second set of horizontal angles
   ::::
   30,*31*,*32*,...,*32* for last set of horizontal angles

4. Vertical Angle/Zenith Distance Data (*40*-Series) Records:

   40,*41*,*42*,...,*42* for first set of vertical angles
   40,*41*,*42*,...,*42* for second set of vertical angles
   ::::
   40,*41*,*42*,...,*42* for last set of vertical angles

5. Distance Data (*50*-Series) Records:

   50,*55* for each taped distance
   51,*55* for each unreduced line-of-sight distance
   52,*55* for each reduced line-of-sight distance
   53,*55* for each unreduced long-line distance
   54,*55* for each reduced long-line distance

6. Azimuth Data (*60*-Series) Records:

   60 for each Laplace azimuth observed in the project
   61 for each geodetic azimuth used in the project

7. Survey Equipment Data (*70*) Records:

   70 for each item of survey equipment used in the project

8. Survey Point Data (*80*-Series) Records:

80 or *81* (possibly *82* or *83*) for first control point
82 for each peripheral RM or Az Mk at first control point
83,*84*,*85*, as applicable, for first control point
80 or *81* (possibly *82* or *83*) for second control point
82 for each peripheral RM or Az Mk at second control point
83,*84*,*85*, as applicable, for second control point
::::
80 or *81* (possibly *82* or *83*) for last control point
82 for each peripheral RM or Az Mk at last control point
83,*84*,*85*, as applicable, for last control point

9. Fixed Control Data (*90*) Records:

90 for each control point to be held fixed

PROJECT DATA RECORDS

10 - Project Title Record
11 - Project Title Continuation Record
12 - Project Information Record
13 - Geodetic Datum and Ellipsoid Record

The project data records, identified by *10*-series data codes, are listed above. The *10* record which contains the title of the project is always required; a *11* record is required only if the project title exceeds the 70-character field allowed for it on the *10* record. Do not divide words between *10* and *11* records. The *12* record is always required. The *13* record defines the geodetic datum with respect to which geodetic positions, deflections of vertical, geoid heights, and/or ellipsoidal distances given in this project are specified. This record is required only if the geodetic datum is other than the North American 1927 (NAD 27) datum. The entries on these records (see FORMAT DIAGRAMS) are self-explanatory, however, the following data items will be explained in greater detail:

Project Title: The desired elements of a horizontal control survey project title are (1) the order of accuracy of the survey, (2) the type of the survey, and (3) the geographic locality of the survey. Since the first two elements are coded elsewhere (*12* record), only the geographic locality of the survey needs to be spelled out in the title. The use of geographic locality alone as the title of a horizontal control survey project has traditionally been the practice of NGS and its predecessors.

In general, the title by which the project is known to the submitting agency should be given, supplemented to reflect geographic locality, as required. When the project is an area network (triangulation or trilateration), give the geographic locality covered by the survey (e.g. KING COUNTY). When the project is an arc of triangulation or trilateration, or if it is a traverse which is not confined within one locality, give the

geographic localities of its endpoints, in the order of progress of the survey (e.g. CHARLESTON TO CAPE ROMAIN). Unless it is a part of the geographic locality name, omit the state or country designation if only one state or country is involved which is same as the primary state or country coded on the *12* record; otherwise use abbreviations listed in ANNEX A. Omit commas, periods, etc., and abbreviate in the interest of fitting the entire title on the *10* record, if possible.

Type of Survey: A one-digit code is provided on the *12* record to specify the survey method used - triangulation (1), trilateration (2), or traverse (3). For horizontal control survey projects in which more than one survey method is prominent, enter the code for that survey method which best characterizes the project as a whole.

Order and Class of Survey: A two-digit code is provided on the *12* record to specify the order of accuracy of the survey. The first digit of this code reflects the order and the second digit the class of the survey in accordance with the "Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys", prepared by the Federal Geodetic Control Committee (FGCC), and published by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, Rockville, MD (February 1974). In addition to the five horizontal control survey categories defined in this publication, two other survey categories need to be considered - surveys of the Trans-Continental Traverse (TCT) type, and surveys of lower-than-third-order accuracy. The respective two-digit codes are as follows:

00 - Trans-Continental Traverse
10 - First Order
21 - Second Order Class I
22 - Second Order Class II
31 - Third Order Class I
32 - Third Order Class II
40 - Lower Than Third Order

The order-and-class code assigned to a horizontal control survey project should reflect the procedures and specifications according to which the main-scheme network was observed, it being understood that there usually are supplemental control points and intersected landmarks in the network to which and/or from which observations of lesser order of accuracy are normally taken.

When well-defined parts of a project fall into different order-and-class categories, consideration should be given to dividing the project accordingly and submitting the parts as individual projects. If this is not practical, assign order-and-class code which corresponds to the part of highest order of accuracy to the entire project (i.e., if networks of both 1st Order and 2nd Order Class I appear in a horizontal control survey project, assign order-and-class code 10 to the project as a whole). In this case, however, special care must be taken to identify the respective control points correctly as to the order of accuracy of the main-scheme

network to which they belong by the appropriate order-and-type code assigned to each control point on the corresponding *80* or *81* record - see section entitled SURVEY POINT DATA RECORDS and also see ANNEX E.

DATE AND TIME

Date of the HZTL OBS data set creation must appear on the Data Set Identification Record, and the dates on which survey operations commenced and terminated are to be entered on one of the project data records (*12* record). In addition, character fields are reserved for the date and time of observation on most of the observation data records. Throughout the HZTL OBS data set, date and time are to be coded as follows:

Date: Full date is coded as an eight-digit integer number consisting of four two-digit groups denoting (from left to right) the last whole century, number of full years since the last turn of century, month of the year, and day of the month (CCYYMMDD). When the century is omitted, the date is coded as a six-digit integer number denoting the year, month, and day (YYMMDD). If the day is not known, leave the last two columns of the field blank; if the month is not known, leave the last four columns of the field blank. For example, 8 February 1970 would be coded as follows:

1.	Full date is known:	19700208	or	700208
2.	Day of the month is not known:	197002	or	7002
3.	Month of the year is not known:	1970	or	70

Time: Whenever applicable, a five-character field is reserved for the time of day on the observation data records. The time of day is coded as a four-digit integer number consisting of two two-digit groups denoting (from left to right) the hours and minutes of a 24-hour clock (HHMM), to be entered in the leftmost four columns of the field. The last column of the five-character time field is reserved for the appropriate one-letter U.S. Navy time zone designation (see below). In every case, the local zone time is to be used; in this manner ambiguities are avoided concerning the date, which is always assumed to be the "local" date (i.e., the date changes at local midnight).

Time Zone: A time zone is a geographic region in which uniform time differing by an integer number of hours from the Greenwich Mean Time (GMT) is maintained by law. In theory, a time zone extends 7-1/2 degrees in longitude east and west of a "time meridian" whose longitude is a multiple of 15 degrees (since the Earth rotates 360 degrees in 24 hours, 15 degrees of longitude difference equals one hour of time difference). In practice, the lines which separate adjacent time zones follow political boundaries and are therefore rather irregular. Associated with every time zone is a "time zone description" - an integer number positive west of Greenwich and negative east of Greenwich - which represents the number of hours which must be added (algebraically) to the local zone time in order to obtain the corresponding GMT. The time zone description is reduced by one hour when the standard zone time is changed to daylight-saving time.

Instead of the numerical time zone descriptions, it is more convenient to use the U.S. Navy one-letter codes which uniquely identify every time zone around the world. In this system, GMT is the "Z" (Zulu) Time Zone. Time zones east of Greenwich are identified by letters A,B,C, etc., through L, with the letter J omitted. Time zones west of Greenwich are identified by letters N,O,P, etc., through X. The letter Y is used to designate the western half of the time zone centered on the meridian of longitude 180 degrees (International Date Line), and the letter M is used to designate the eastern half of this zone.

The world-wide use of the time zone descriptions and of the U.S. Navy one-letter designations is illustrated in ANNEX H. In the continental United States, Alaska (AK), and Hawaii (HI) the time zones are as follows:

TABLE 2-3 - U.S. NAVY TIME ZONE DESIGNATIONS

STANDARD TIME	DAYLIGHT TIME	TIME MERIDIAN	TIME ZONE DESCRIP'N	U.S. NAVY DESIGNATION
Atlantic AST	Eastern EDT	60W	+4	Q (Quebec)
Eastern EST	Central CDT	75W	+5	R (Romeo)
Central CST	Mountain MDT	90W	+6	S (Sierra)
Mountain MST	Pacific PDT	105W	+7	T (Tango)
Pacific PST	Yukon YDT	120W	+8	U (Uniform)
Yukon YST	AK/HI HDT	135W	+9	V (Victor)
AK/HI HST	Bering BDT	150W	+10	W (Whiskey)

If the time zone cannot be reliably ascertained, leave the last column of the time field blank. In this case, the time coded into the first four columns of the time field will be interpreted as the standard time in a zone determined on the basis of the longitude of the survey point from which the respective observation was taken.

OBSERVATION DATA RECORDS

In connection with classical survey operations, the term "observation" is used in a narrow sense to denote one of many angular and linear measurements accomplished to quantify geometric relationships among survey points. In this context, the observations which occur in a horizontal control survey project can be classified as (1) horizontal directions, (2) horizontal angles, (3) vertical angles (or zenith distances), and (4) distance measurements. In addition, Laplace and geodetic azimuths used for orientation control may also be regarded as a type of observation. The HZTL OBS data set records which pertain to these observations are categorized as follows:

20-Series Records - Horizontal Direction Data
30-Series Records - Horizontal Angle Data
40-Series Records - Vertical Angle/Zenith Distance Data
50-Series Records - Distance Data
60-Series Records - Azimuth Data

The basic element of an observation is the numerical value of the respective measured quantity expressed in appropriate units of measurement. The units of measurement used consistently for all observations in the HZTL OBS data set are (1) sexagesimal degrees, minutes, seconds, and decimals of second of arc for angular observations, and (2) meters and decimals of meter for distance measurements. In addition to the respective measured quantity, other necessary elements of a horizontal control survey observation are (1) the type of observation, (2) the identity of the survey points from which and to which the observation is taken (standpoint and forepoint - see below), and (3) an estimate of accuracy of the measured quantity.

The type of observation is specified by the data code of the record on which the respective measured quantity is entered, and the survey points associated with a horizontal control survey observation are identified by unique, job-specific station serial numbers (see below). A reliable, specific estimate of the overall accuracy of a horizontal control survey observation is rarely at hand, however, a generalized accuracy estimate can be inferred from several data items which are normally available - the order and class of survey, the type of survey equipment used, the number of replications (independent measurements) taken, and the rejection limit enforced. With the exception of the Job-Specific Instrument Number (see below), the observation data items related to the estimate of accuracy of a horizontal control survey observation will be treated in the section entitled ACCURACY OF THE OBSERVATIONS.

Several data items which appear on the observation records are treated below. Detailed explanation of other observation data items is given elsewhere in this chapter.

Standpoint and Forepoint: In connection with a horizontal control survey observation, the point from which the observation is taken (e.g. the point which is occupied with a surveying instrument) will be referred to as the "standpoint." The point to which the observation is taken (e.g. the point to which the "foresight" is directed) will be referred to as the "forepoint."

Station Serial Number and Suffix: For the purpose of identifying the standpoint and forepoint on the observation records in a concise manner, each survey point (control point or peripheral point) is assigned a job-specific station serial number in the range 001 to 999, to which a one-letter suffix may be appended if the survey point in question is a peripheral point. See Chapter 1 for a detailed explanation of the survey point numbering system. See also the next section, the title of which is ASSIGNMENT OF STATION SERIAL NUMBERS.

Weather Code: Where applicable, five adjacent one-character fields have been reserved on the observation records for five one-digit codes, which will be referred to collectively as the "weather code." The first of these codes is a general problem indicator, which should be the digit "0" under normal conditions or the digit "1" if a problem was encountered

during the execution of the observation, in which case the problem must be explained on one or more comment records to follow immediately the respective observation record. The other four one-digit codes are indicators of visibility, temperature, cloud cover, and wind, in that order. These indicators may assume the values 0, 1, or 2 (see Table 2-4 below). Any one of these five indicators may be left blank if the condition it represents is either not known or not applicable.

TABLE 2-4 - WEATHER CODE

CODE***	0	1	2
PROBLEM INDICATOR	No Problem Encountered	See Comment	Not Used
VISIBILITY INDICATOR	Good (Over 15MI)	Fair (7MI to 15MI)	Poor (Under 7MI)
TEMPERATURE INDICATOR	Normal Range (32°F to 80°F)	Hot (Over 80°F)	Cold (Below 32°F)
CLOUD COVER INDICATOR	Clear (Below 20%)	Partly Cloudy (20% to 70%)	Overcast (Over 70%)
WIND INDICATOR	Calm (Under 5MPH)	Moderate* (5MPH to 15MPH)	Strong** (Over 15MPH)

*No effect on observations. **Possibly affecting observations.
***Blank if the condition is not known or not applicable.

Job-Specific Instrument Number: The instrument used to accomplish a horizontal control survey observation must be known; the type of survey equipment (i.e., its resolution and expected accuracy) will be used as an accuracy indicator of the observation. In order to identify the instrument on the respective observation record in a concise manner, a unique three-digit number in the range 001 to 999 is to be assigned to each individual item of survey equipment used in the job. In cases where this may be impractical, a three-digit instrument number may be assigned to a class of survey equipment (e.g. all 100-foot uncalibrated steel tapes could be treated as one "instrument"), it being understood that such a class label must reflect correctly the type, resolution, and expected accuracy of all instruments covered by it.

In a manner analogous to the assignment of station serial numbers, the instrument numbers are to be unique throughout a job, i.e., an item of survey equipment which appears in more than one project in the job must be consistently identified by the same number, while different items of survey equipment must be identified by different numbers throughout the HZTL OBS data set. A *70* record must be prepared for each item of survey equipment which has been assigned an instrument number - see SURVEY EQUIPMENT DATA RECORDS.

Height of Instrument and Height of Target: Horizontal control survey observations are seldom mark-to-mark measurements between the survey points involved. Normally, they are measurements from a surveying instrument installed on a tripod, wooden stand, or survey tower erected over the standpoint to a "target" (e.g. a survey light, retro-reflector, or remote instrument) installed on a similar structure over the forepoint.

Height of instrument (also known as "height of telescope" or HT) is the vertical distance from the top of the occupied survey point mark to the optical center of the surveying instrument, positive if the instrument is above the mark, and negative if it is below the mark. Analogously, height of target (also known as "height of object" or HO) is the vertical distance from the top of the respective survey point mark to the point which is used as target for angular observations, or to the optical center of the retro-reflector (or of the antenna system of the remote instrument) in the case of electronic distance measurements.

Together with the elevation (and geoid height) of the respective survey points, height of instrument and height of target are desired or required data items in connection with most horizontal control survey observations. For horizontal directions and horizontal angles, height of instrument and height of target are desired in the computation of the respective skew normal and deflection corrections. For vertical angles, height of instrument and height of target are required in every case for the reduction of the respective instrument-to-target measurements to mark-to-mark values.

In connection with electronic distance measurements, height of instrument and height of target (i.e., height of retro-reflector or of remote instrument) are required data items in the process of reducing instrument-to-reflector or instrument-to-instrument slant-range distance measurements to the respective mark-to-mark, sea-level (i.e., geoidal), or ellipsoidal values. For precisely taped distances, the heights of the tape supports over the respective survey point marks are required for the same purpose. In addition, height of instrument and height of target are desired in connection with every line-of-sight observation as an indicator of intervisibility.

When the surveying instrument cannot be installed directly over the desired survey point and eccentric observations are submitted which are to be reduced to center (i.e., the eccentric instrument setup is a peripheral point identified by a station serial number with suffix A,B,C,..., etc., through J - see next section), the height of instrument entered on the respective observation record must be the vertical distance between the top of the survey point mark to which the eccentric observations are to be reduced and the horizontal plane passing through the optical center of the horizontally-offset surveying instrument. The same considerations apply to an eccentric target, retro-reflector, or remote instrument.

Visibility Code: Information concerning intervisibility between monumented control points is of great value to the local surveyor, who is not normally prepared to build survey towers over the control points he wishes to occupy or sight upon. To allow for the recording of this information, where it is readily available, a provision was made for a one-letter visibility code on the observation records which pertain to line-of-sight observations. This code indicates whether or not the forepoint (i.e., a target which might be easily constructed over the forepoint) can be seen from ground level (height of eye) at the standpoint.

Since reference marks, azimuth marks, and the horizontal control point to which they belong are normally intervisible at ground level, the visibility code is also used to indicate whether the forepoint is an RM or an Az Mk associated with the standpoint. The respective one-letter codes are listed below. If a conflict arises in the assignment of a visibility code, the hierarchy indicated by this list should be followed. In each case, by "forepoint" is meant either a natural target or a simple target installed at height-of-eye level over the forepoint, and "ground" implies height-of-eye level at the respective standpoint.

1. N - Forepoint is not visible from ground.
2. R - Forepoint is an RM associated with standpoint.
3. Z - Forepoint is an Az Mk associated with standpoint.
4. V - Forepoint is visible from ground.

The codes R and Z are to be used only for reference and azimuth marks which are associated with the standpoint, i.e., in connection with observations from the respective horizontal control point to its own reference or azimuth marks, or possibly in connection with observations taken among the reference or azimuth marks belonging to the same control point. When the forepoint is an RM or Az Mk which belongs to another control point, the codes N or V, as applicable, should be used. The codes R and Z should always be entered if they are applicable to the forepoint in question; otherwise, the visibility code field should be left blank if the intervisibility between the respective standpoint and forepoint is not known.

ASSIGNMENT OF STATION SERIAL NUMBERS

Station serial number is a three-digit number in the range 001 to 999, to which a one-letter suffix may be appended, used to identify in a unique manner every survey point which appears in an HZTL OBS data set. Detailed explanation of the survey point numbering system was given in Chapter 1. To recapitulate, a survey point is defined as any point in a survey project which has one or more observations measured to it or from it. In a horizontal control network, a survey point is either a control point or a peripheral point.

Control Points: Control points are survey points whose geodetic positions are to be determined by the survey project, or whose positions have been determined by a previous survey. Examples of control points are (1) a monumented (or otherwise permanently marked) triangulation, trilateration, or traverse station, (2) a recoverable landmark (usually an intersection station) such as a flagpole or church spire, or (3) an unmarked (and hence nonrecoverable) survey point which must be carried as a control point for network integrity purposes. A survey point which cannot be positioned because of insufficient observations, whose geodetic position is not available from other sources, and which does not qualify as a peripheral point (see below) must also be treated as a control point, in that such a survey point must be identified by a unique, unsuffixed station serial number (see *82* record under FORMAT DIAGRAMS).

Each control point in a horizontal control job must be assigned a unique, unsuffixed station serial number. When more than one project appears in a job, care must be taken to insure that (1) the same station serial number is assigned to a control point which several of the projects may have in common, and that (2) different control points are assigned different station serial numbers throughout the horizontal control job. The station serial numbers assigned to control points in the OBS data set of a horizontal control job must be the same as those used to identify the same control points in the corresponding DESC data set. In particular, any survey point for which a description and/or recovery note is to be submitted in the DESC data set must be identified by a unique, unsuffixed station serial number, i.e., it must be carried as a control point in the corresponding OBS data set.

Peripheral Points: Peripheral points are survey points in the vicinity of a control point which are not intended to be positioned, such as reference marks and azimuth marks which are normally associated with a horizontal control point. These points are identified by a one-letter suffix which is appended to the three-digit station serial number of the control point to which they belong. In addition to unoccupied reference and azimuth marks, unmonumented eccentric instrument setups and eccentric targets/reflectors are also such peripheral points if the respective observations are to be reduced to center.

Different letters of the alphabet must be used in order to identify uniquely each peripheral point associated with a control point. Provided that the respective eccentric point, RM, or Az Mk does not have to be treated as a control point (see below), the letter suffix which will identify it as a peripheral point must be assigned as follows:

A,B,C, etc., through J for peripheral eccentric points
K,L,M, etc., through R for peripheral reference marks
S,T,U, etc., through Z for peripheral azimuth marks

Should there ever be more than ten peripheral eccentric points, more than eight peripheral reference marks, or more than eight peripheral azimuth marks, treat some of the eccentric points, reference marks, or azimuth marks (preferably those which can be positioned) as control points, i.e., assign individual unsuffixed station serial numbers to them.

An eccentric point, RM, or Az Mk is not always treated as a peripheral point. If the eccentric instrument setup or target/reflector placement is made over a monumented (or otherwise permanently marked) point which can serve as a control point (e.g. when a reference mark is occupied), it may be desirable to treat the eccentric point as another control point. In any case, when an eccentric point is offset more than 10 meters from the respective control point, the eccentric observations should not be reduced to center (see next section), and the eccentric point should be treated as a control point, whether it is permanently marked or not.

An RM or an Az Mk which has not been occupied (i.e., one which has one or more directions, angles, and/or distances measured to it but not from it) is a peripheral point, except when it is to be positioned, in which case it must be treated as another control point and assigned an unsuffixed station serial number of its own. An RM or Az Mk which is occupied as a part of the survey scheme (e.g. as an eccentric occupation of the respective control point) should always be treated as a distinct control point. An RM or Az Mk which has directions, angles, and/or distances measured from it (as well as to it) for the purpose of verifying and/or supplementing the observations which tie together the control point and its peripheral points may remain a peripheral point, i.e., a peripheral RM (suffix K through R) or Az Mk (suffix S through Z) may appear as a standpoint on an observation record in this particular case.

The observations which establish the linkage between a peripheral point and its respective control point must appear among the appropriate observation data records. As a minimum, the following observations are required:

1. Eccentric Points: At least one angular observation (horizontal direction or horizontal angle) and one distance measurement, either from the eccentric point to the respective control point, or from the control point to the eccentric point.

2. Reference Marks: At least one angular observation (horizontal direction or horizontal angle) and one distance measurement from the respective control point to the RM in question.

3. Azimuth Marks: At least one angular observation (horizontal direction or horizontal angle) from the respective control point to the Az Mk in question.

TREATMENT OF ECCENTRIC OBSERVATIONS

When the surveying instrument cannot be installed directly over the desired control point (i.e., when the control point cannot be "occupied"), observations must be taken with the instrument offset a short distance from the intended standpoint. Analogously, when the target, retro-reflector, or remote instrument cannot be installed directly over the intended forepoint, observations are made to a target, retro-reflector, or remote instrument which is offset a short distance from the respective control point. When such a condition exists, the offset point from which and/or to which the observations are actually taken is said to be "eccentric" with respect to the control point in question, which is referred to as the "center."

Eccentric observations are normally "reduced to center" as a part of the field computation process, i.e., a correction is computed for each eccentric observation based on the magnitude and direction of the offset and on the direction and length of the eccentrically-observed line. After such a correction is applied, the respective observation ceases to be "eccentric", i.e., it is regarded for all practical purposes as having been taken from

the intended standpoint to the intended forepoint, just as a non-eccentric observation. As a general rule, eccentric observations should be reduced to center by the submitting agency and included in the HZTL OBS data set as normal (i.e., non-eccentric) observations.

When eccentric observations are submitted, care must be taken to select one of the two possible methods of handling eccentric observations which is applicable to the eccentric point in question, and to identify the respective eccentric point accordingly - either as a peripheral point if Method A is applicable, or as a control point if Method B is applicable (see preceding section for definitions of "control point" and "peripheral point").

Method A: The eccentric observations are to be reduced to center. In this case, the eccentric point must be identified as a peripheral point with a suffix A,B,C, etc., through J (see preceding section). When such a peripheral point is encountered as a standpoint or forepoint on an observation record, the respective observation will be reduced to center, and the original (eccentric) observation will not be retained. This method is applicable only to eccentric points which are offset not more than 10 meters from the respective control point. For offsets of greater magnitude Method B is mandatory.

Method B: The eccentric point is to be treated as a control point, whether permanently marked or not. In this case, no reduction to center is involved, as the respective observations are not regarded as eccentric. The respective (eccentric) standpoint or forepoint, however, must be identified by a unique, unsuffixed three-digit station serial number just as any other control point (see preceding section), it must be given a name (e.g. SMITH ECC, if the name of the respective control point is SMITH), and a *80* or *81* record containing its (approximate) geodetic position and elevation must appear among the *80*-series records. This method should be used for eccentric points which are permanently marked, regardless of the offset distance involved. Method B must be used for eccentric points which are offset more than 10 meters from the respective control point, whether the eccentric point in question is permanently marked or not.

ACCURACY OF THE OBSERVATIONS

For every horizontal control survey observation, an estimate of the absolute accuracy of the measured quantity must be available for the purpose of assigning appropriate weight to that observation when it participates in the adjustment of the respective horizontal control network. Absolute accuracy of a measurement is defined as the degree to which the result of that measurement approximates the true value of the measured quantity. Since the true value of a direction, angle, or distance is not known, it follows that the accuracy of a horizontal control survey observation can only be estimated (1) by comparing the results of different measurements of the same quantity, and (2) by analyzing the misclosures by which the measured quantities fail to satisfy geometric conditions in the respective horizontal control network (e.g. triangle misclosures).

A horizontal control survey observation is rarely taken as a single, isolated measurement. Once the required surveying equipment is installed over the survey points in question, it is a common practice to measure the same quantity (direction, angle, or distance) several times within a short span of time, each complete measurement being carried out according to an observation scheme which has been carefully designed to eliminate instrumental errors (and possibly other constant and systematic errors as well). The advantage of such "replication" is that large blunders can be immediately detected and eliminated, and that the resulting group of measurements can be treated as a statistical sample.

Each of the replicated measurements is corrected for any known remaining constant and/or systematic errors associated with that particular type of observation which can be evaluated and eliminated by the application of computed corrections to the respective measurements. The resulting corrected sample elements are normally screened for outliers (larger-than-expected random errors which are suspected to be blunders), usually by the application of a fixed, empirical rejection limit, and the mean of the remaining measurements is used as the best approximation to the true value of the respective measured quantity which can be attained on the basis of the sample of measurements taken.

Assuming that the blunders and/or outliers have been eliminated by dropping the respective measurements from the sample, and that the constant and/or systematic errors from all known sources have been eliminated either by the observing procedure or by the application of computed corrections to the respective measurements, other errors remain, as evidenced by a random disagreement (however small) which still normally exists among the "corrected" sample elements. Furthermore, if another sample of measurements of the same quantity is taken with the same type of instrument but under different environmental conditions, the mean value of the second sample will normally differ appreciably from that of the first sample, and if many such samples are taken, the mean values of the reobserved samples will be found to disagree in a random manner as well.

The errors which remain after the blunders and outliers are eliminated and after the sample elements are corrected for constant and systematic errors are therefore seen as random errors of two different kinds. Random errors of the first kind are those errors which manifest themselves as discrepancies among the elements of a sample. Since the presence and general magnitude of these errors are readily apparent when the elements of the sample are compared, random errors of the first kind are known as "sample-internal" or "internal" errors. Random errors of the second kind are those errors which remain constant for all measurements within a sample but vary in a random manner for samples which are reobserved under different conditions. Since they introduce the same bias into every measurement in the sample, the presence and general magnitude of these errors become apparent only when the mean values of several reobserved samples are compared, or when misclosures of geometric conditions in the respective horizontal control network are analyzed. Because of this fact, random errors of the second kind are known as "sample-external" or "external" errors.

The accuracy estimate needed to determine the proper weight for a horizontal control survey observation is the standard error (sigma) reflecting the combined effect of the internal and external errors which affect that observation. Such a one-sigma estimate of the total uncertainty associated with the respective measured quantity is given by the vector sum (square root of the sum of squares) of the one-sigma estimates reflecting the contributions of the corresponding internal and external errors.

A direct estimate of the contribution of the respective internal errors (i.e., the Internal Consistency Sigma - see below) can be obtained as the standard deviation of the computed sample mean; a value based on experience may be given when the sample size is one. If no value is specified on the respective observation record (i.e., the field is left blank), a one-sigma estimate will be obtained as a function of the rejection limit and number of replications, or a default value based on the type of survey equipment used, number of replications taken, and on the order-and-class of the survey will be assigned if the rejection limit is not specified.

A direct estimate of the contribution of the respective external errors (i.e., the External Consistency Sigma - see below) is rarely at hand, as horizontal control survey observations are not normally reaccomplished by design under different environmental conditions for the purpose of evaluating the effect of the external errors. A value based on experience may be given; however, if no value is specified on the respective observation record (i.e., the field is left blank), a default value based on the survey equipment used, order-and-class of the survey, and on the type of the survey points involved will be assigned. In connection with triangulation projects, a collective estimate of the external error affecting horizontal directions (or horizontal angles) in that project will be recovered from the set of triangle misclosures when that project is first adjusted by NGS.

The data items which pertain to the accuracy estimate of the respective horizontal control survey observation not treated elsewhere in this chapter are defined below.

Number of Replications: Number of independent measurements of the same quantity, normally carried out within a short span of time (i.e., under the same environmental conditions) by the same personnel using the same equipment (i.e., sample size). In connection with horizontal control survey observations, it is the number of times a complete measurement procedure (observing scheme) is executed with the objective of obtaining a group of measurements the mean value of which is to be used as the observed quantity (e.g. number of positions in a set of horizontal directions).

Rejection Limit: Maximum variation allowed in a group of measurements. The individual measurements which exceed this limit are normally dropped from the sample and hence do not enter into the computation of sample mean. For horizontal directions and horizontal angles, the rejection limit is expressed as the maximum deviation of the individual measurements from the respective sample mean. For vertical angles and for distance measurements,

the rejection limit is expressed as the maximum spread between the individual observations included in the sample (i.e., maximum range).

Internal Consistency Sigma: One-sigma estimate reflecting the contribution of the sample-internal random errors to the total uncertainty associated with a measured quantity. In connection with horizontal control survey observations, a direct estimate of the effect of the respective internal errors is usually available as the standard deviation of the computed sample mean. See discussion above concerning the treatment of the accuracy estimate of an observation for which this data item is missing.

External Consistency Sigma: One-sigma estimate reflecting the contribution of the sample-external random errors to the total uncertainty associated with a measured quantity. In connection with horizontal control survey observations, a direct estimate of the effect of the respective external errors is not normally available; however, a value based on experience may be given. See discussion above concerning the treatment of the accuracy estimate of an observation for which this data item is missing.

HORIZONTAL DIRECTION DATA RECORDS

20 - Horizontal Direction Set Record
21 - Horizontal Direction Comment Record (Optional)
22 - Horizontal Direction Record

The horizontal direction data records, identified by *20*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS.

Since one horizontal direction by itself is meaningless, horizontal directions must be observed in sets of two or more directions. The respective observations are normally recorded in a field record book and later abstracted onto a standard form which is usually referred to as the "abstract of horizontal directions." As recorded on the "abstract", each direction consists of a group of "pointings" reflecting the clockwise angle from the "initial" (direction to the first object sighted in the observing sequence), which is normally assigned the value zero. For each forepoint included in the set, the horizontal direction value desired is the mean value of the respective group of pointings (in sexagesimal degrees, minutes, seconds, and decimals of second), corrected for eccentricity of the instrument and/or target, if applicable (see TREATMENT OF ECCENTRIC OBSERVATIONS).

Each set of horizontal directions is to be submitted as a group of records which must lead off with one *20* record. In addition to containing information which pertains to the set as a whole, the *20* record also contains the data items associated with the initial direction. Following the *20* record, there may be one or more *21* comment records. These comment records are optional, except when the problem indicator on the *20* record (first digit of the weather code) is 1, in which case at least one *21* record containing an explanation of the problem encountered is required.

After the *21* record or records, or immediately after the *20* record if no *21* records are present, one or more *22* records must follow, one for each additional direction observed in the set. In addition to the same standpoint designation, each of these *22* records must bear the same set number (see below) as the *20* record of that horizontal direction set.

When there are two or more sets of horizontal directions observed at the same station, each set must be submitted as a separate, complete group of *20*-series records (i.e., a *20* record, one or more *21* records if applicable, followed by one or more *22* records). All sets observed at the same station must be assigned different set numbers and must appear as consecutive sets in the order of their increasing set numbers among the *20*-series records. For this purpose, since the respective horizontal directions are to be reduced to center, sets observed at peripheral eccentric points of the same control point (i.e., whose standpoint designation is the same three-digit station serial number with a suffix A,B,C, etc., through J appended) must appear as members of the same sequence together with any set or sets observed directly over the corresponding control point.

Set Number: Normally coded as 01, unless there are two or more sets of horizontal directions observed at the same standpoint (either to the same or to different forepoints), in which case these sets must appear adjacent among the horizontal direction data records. The first set in the sequence must be assigned a two-digit set number, e.g. 01, and each additional consecutive set bearing the same standpoint designation must be assigned a higher number, e.g. 02, 03, etc. For this purpose, sets observed at peripheral eccentric points bearing suffix A through J are considered to belong with the respective control point and must be grouped accordingly. The set numbers of successive sets of horizontal directions observed at the same station need not be consecutive, however, they must be increasing.

Number of Objects Sighted in This Set: Number of forepoints to which directions were observed in the set of horizontal directions, including the initial. This number minus one equals the number of *22* records which must appear behind the respective *20* record in that set.

Date and Time: Date of observation is required (at least the year) and must appear on every *20* record. Time of observation, where available, is desired to indicate the approximate time of day; any time associated with the set of horizontal directions (e.g. time of first observation, mean time of the set, etc.) is acceptable.

HORIZONTAL ANGLE DATA RECORDS

30 - Horizontal Angle Set Record
31 - Horizontal Angle Comment Record (Optional)
32 - Horizontal Angle Record

The horizontal angle data records, identified by *30*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS.

Horizontal angles, as opposed to horizontal directions, are normally observed in connection with surveys of low accuracy (e.g. third order or lower) using repeating theodolites and engineer's transits. The characteristic feature of these instruments is the double concentric motion about the vertical axis by means of which the horizontal circle can be set precisely to zero when one of the forepoints is sighted upon, and the desired horizontal angle to another forepoint can be "repeated", i.e., measured several times in succession, each time allowing the horizontal circle reading to be incremented by the magnitude of the measured angle. The desired angular measure, expressed to a greater precision than the resolution of the respective instrument, is obtained when the total angle accumulated on the horizontal circle is divided by the number of "repetitions."

The number of repetitions must not be confused with the number of replications, as one angle measurement by this method, involving any number of repetitions, constitutes but <u>one</u> determination of that angle (i.e., <u>one</u> replication). Normally, several such determinations are made; the desired horizontal angle value is the mean value of the respective group of measurements (in sexagesimal degrees, minutes, seconds, and decimals of second), corrected for eccentricity of instrument and/or target, if applicable (see TREATMENT OF ECCENTRIC OBSERVATIONS). Two forepoints are involved with every horizontal angle observation; the value given must be the <u>clockwise</u> angle from the first (left) forepoint to the second (right) forepoint.

Since a horizontal angle is a complete observation in itself, every horizontal angle may be submitted as a "set of size one," i.e., as a *30* record followed by one or more *31* comment records. These comment records are optional, except when the problem indicator on the *30* record (first digit of the weather code) is 1, in which case at least one *31* record containing an explanation of the problem encountered is required. When more than one angle is measured as a part of the same observing scheme (e.g. angle observation by Schreiber's method), the additional angles in the same set should be submitted as *32* records to follow after the *31* record or records, or immediately after the *30* record if no *31* records are present. In addition to the same standpoint designation, each of these *32* records must bear the same set number (see below) as the *30* record of that horizontal angle set.

When there are two or more sets of horizontal angles observed at the same station, each set must be submitted as a separate, complete group of *30*-series records (i.e., a *30* record, one or more *31* records if applicable, followed by one or more *32* records). All sets observed at the same station must be assigned different set numbers and must appear as consecutive sets in the order of their increasing set numbers among the *30*-series records. For this purpose, since the respective horizontal angles are to be reduced to center, sets observed at peripheral eccentric points of the same control point (i.e., whose standpoint designation is the same three-digit station serial number with a suffix A,B,C, etc., through J appended) must appear as members of the same sequence together with any set or sets observed directly over the corresponding control point.

Set Number: Normally coded as 01, unless there are two or more sets of horizontal angles observed at the same standpoint (either between the same or between different forepoints), in which case these sets must appear adjacent among the horizontal angle data records. The first set in the sequence must be assigned a two-digit set number, e.g. 01, and each additional consecutive set bearing the same standpoint designation must be assigned a higher number, e.g. 02, 03, etc. For this purpose, sets observed at peripheral eccentric points bearing suffix A through J are considered to belong with the respective control point and must be grouped accordingly. The set numbers of successive sets of horizontal angles observed at the same station need not be consecutive, however, they must be increasing.

Number of Angles Observed in This Set: Total number of horizontal angles observed as a part of the same observing scheme. This number minus one equals the number of *32* records which must appear behind the respective *30* record in that set.

Date and Time: Date of observation is required (at least the year) and must appear on every *30* record. Time of observation, where available, is desired to indicate the approximate time of day; any time associated with the horizontal angle observation (e.g. starting time, mean time, ending time, etc.) is acceptable.

VERTICAL ANGLE/ZENITH DISTANCE DATA RECORDS

40 - Vertical Angle Set Record
41 - Vertical Angle Comment Record (Optional)
42 - Vertical Angle Record

The vertical angle/zenith distance data records, identified by *40*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS. Vertical angles (or zenith distances) are observed in connection with classical horizontal control survey projects for the purpose of obtaining elevations of the horizontal control points by trigonometric leveling. Since only a difference in elevation between the respective standpoint and forepoint can be derived from a vertical angle (and distance) determination, it follows that, in a network of survey points connected by vertical angles, the elevation of one or more of the survey points involved must be reliably known from some other source.

In addition to vertical angles and distances between the survey points, the determination of the respective elevation differences by trigonometric leveling requires the knowledge of the geoid height at every survey point involved and of the deflection of vertical in the direction of each vertical angle observed at every standpoint. Since the respective geoid heights and deflections of vertical are seldom known, it is a common practice to assume the zero value for these quantities, and therefore only approximate results can normally be obtained. For this reason, vertical control should not be extended by this method without frequent ties to existing bench marks in the project area.

Aside from the difficulties mentioned in the preceding paragraph, the trigonometric leveling method of extending vertical control suffers from the fact that the measurement of vertical angles is subject to a large uncertainty due to atmospheric refraction. This uncertainty is brought about by the unpredictable nature of the irregular, preponderantly vertical bending of an optical ray due to the variation of the refraction gradient along its path. This effect of atmospheric refraction is the dominant source of the external random error associated with vertical angle observations. To control the influence of this external error, the magnitude of which grows with the length of the observed line, reciprocal vertical angles are often observed simultaneously or nearly-simultaneously from both ends of the respective line.

In a manner similar to other types of horizontal control survey observations, a vertical angle is usually measured several times in rapid succession following a standard observing scheme. The desired vertical angle value is the mean value of the respective group of measurements (in sexagesimal degrees, minutes, seconds, and decimals of second) accompanied by the appropriate angle code (see below) which identifies the value given as an elevation angle (E), depression angle (D), or a zenith distance (Z). Since the magnitude of the dominant external error affecting the vertical angle measurement is proportional to the length of the observed line (see above), the respective External Consistency Sigma is expressed as seconds of arc per kilometer.

Since a vertical angle is a complete observation in itself, every vertical angle may be submitted as a "set of size one," i.e., as a *40* record followed by one or more *41* comment records. These comment records are optional, except when the problem indicator on the *40* record (first digit of the weather code) is 1, in which case at least one *41* record containing an explanation of the problem encountered is required. When two or more vertical angles to different forepoints are measured at a station as a part of the same observing scheme, the additional vertical angles in the same set should be submitted as *42* records to follow after the *41* record or records, or immediately after the *40* record if no *41* records are present. In addition to the same standpoint designation, each of these *42* records must bear the same set number (see below) as the *40* record of that vertical angle set.

When there are two or more sets of vertical angles observed at the same station, each set must be submitted as a separate, complete group of *40*-series records (i.e., a *40* record, one or more *41* records if applicable, followed by one or more *42* records). All sets observed at the same station must be assigned different set numbers and must appear as consecutive sets in the order of their increasing set numbers among the *40*-series records. For this purpose, sets observed at peripheral eccentric points of the same control point (i.e., whose standpoint designation is the same three-digit station serial number with suffix A,B,C, etc., through J appended) must appear as members of the same sequence together with any set or sets observed directly over the corresponding control point.

Set Number: Normally coded as 01, unless there are two or more sets of vertical angles observed at the same standpoint (either to the same or to different forepoints), in which case these sets must appear adjacent among the vertical angle data records. The first set in the sequence must be assigned a two-digit set number, e.g. 01, and each additional consecutive set bearing the same standpoint designation must be assigned a higher number, e.g. 02, 03, etc. For this purpose, sets observed at peripheral eccentric points bearing suffix A through J are considered to belong with the respective control point and must be grouped accordingly. The set numbers of successive sets of vertical angles observed at the same station need not be consecutive, however, they must be increasing.

Number of VAs or ZDs Observed in This Set: Number of forepoints to which vertical angles (or zenith distances) were observed as a part of the same observing scheme. This number minus one equals the number of *42* records which must appear behind the respective *40* record in that set of vertical angles.

Date and Time: Date of observation is required (at least the year) and must appear on every *40* record. The full date and the time of vertical angle observation to each forepoint involved should be supplied whenever possible, so that automatic search based on date and time can be made for simultaneous or nearly-simultaneous reciprocal vertical angle observations. For this purpose, a time field appears on the *42* record as well as on the *40* record.

Angle Code: Vertical angles are measured with respect to the direction of the gravity vector at the respective standpoint by theodolites or transits which are equipped with appropriate vertical circles. Depending on the graduation system involved, the origin (zero graduation mark) of the vertical circle points either in a direction perpendicular to that of the gravity vector, in which case the origin of the vertical circle lies in the local astronomic horizon, or else it points in the direction opposite to that of the gravity vector, in which case the origin of the vertical circle indicates the local astronomic zenith.

When the zero of the vertical circle defines the astronomic horizon, the vertical angle measured is an "elevation angle" or a "depression angle" depending on whether the object sighted is above or below the astronomic horizon. When the zero of the vertical circle points in the direction of the astronomic zenith, the vertical angle measured is called a "zenith distance." It follows that the zenith distance of an object above the astronomic horizon is less than 90 degrees, while the zenith distance of an object below the astronomic horizon is greater than 90 degrees.

The angle code is a one-letter indicator of the type of the vertical angle given. The three possible codes are as follows:

E - elevation angle
D - depression angle
Z - zenith distance

DISTANCE DATA RECORDS

50 - Taped Distance Record
51 - Unreduced Distance Record
52 - Reduced Distance Record
53 - Unreduced Long Line Record
54 - Reduced Long Line Record
55 - Distance Comment Record (Optional)

The distance data records, identified by *50*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS.

Submit a *50*, *51*, *52*, *53*, or *54* record, followed by one or more *55* comment records, for every distance determination in the horizontal control survey project. The comment records are optional, except when the problem indicator (first digit of the weather code) is 1, in which case at least one *55* record containing an explanation of the problem encountered must follow the respective *50*, *51*, or *52* distance record; the weather code has been omitted on the *53* and *54* long-line records. In every case, the desired distance value is the mean value of the respective group of replicated measurements to which all corrections applicable to that type of distance measurement have been applied (in meters and decimals of meter), further corrected for eccentric setup at either end of the measured line, if applicable (see TREATMENT OF ECCENTRIC OBSERVATIONS). It must be accompanied by the appropriate distance code (see below) which identifies the distance value given as to its type.

The *50* record is intended for distances measured with either calibrated or uncalibrated (i.e., standardized or unstandardized) steel or invar tapes. Included are distances consisting of any number of segments taped horizontally, taped distances consisting of any number of segments which have all been individually reduced to a common horizontal reference surface (other than the sea level or the ellipsoid), and one-segment unreduced taped distances (less than or equal to one tape length) measured along a slope. The limitation to one segment only in this last case is forced by the additional data items (the elevation difference between the respective marks and the heights of tape supports over the marks) required for each such taped distance segment. Excluded are taped distances which have been reduced to sea level (geoid), to the ellipsoid, or to mark-to-mark, for which the *52* record should be used. In every case, the respective standardization, catenary, and temperature corrections, as applicable to the method of measurement and/or to the equipment used, are assumed to have been applied.

The *51* record is intended for unreduced slant-range distances under 100 kilometers measured by electronic distance-measuring equipment (DME). Included are line-of-sight instrument-to-reflector distances measured by electro-optical DME and master-to-remote distances measured by microwave DME with a resolution (i.e., precision) of one centimeter or better. Excluded are distances measured to a precision coarser than one centimeter (because the respective Rejection Limit, Internal Consistency Sigma, and

External Consistency Sigma should be expressed in different units), which may be submitted as *53* records. In every case, the respective instrument and/or reflector calibration corrections and refraction correction, as applicable to the method of measurement and/or to the equipment used, are assumed to have been applied.

The *52* record is intended for taped distances, and for distances under 100 kilometers measured by electronic DME with a precision of one centimeter or better, which have been reduced (1) to sea level (i.e., to the geoid), (2) to the ellipsoid (either NAD 27 or as specified on the *13* record), or (3) to mark-to-mark. For the same reason given in the preceding paragraph, reduced distances measured to a coarser precision than one centimeter should be submitted as *54* records. In every case, the distance given is assumed to be the appropriately reduced value corresponding to the mean of the respective sample of distance measurements to which all applicable corrections have been applied. Among the required data items on this record are the values of the elevations (and of the geoid heights, if applicable) which were used in the respective reduction process (possibly different than those given on the corresponding *80*-series records).

The preponderant external random errors affecting precisely taped distances or line-of-sight distances measured by fine-resolution electronic DME arise out of the inadequacy of the mathematical models used to correct the respective distance measurements for distance-dependent systematic errors, such as the temperature and catenary corrections in case of taped distances, or the refraction correction in case of distances measured by precise electro-optical or electromagnetic DME. The magnitude of the respective external random errors is therefore also proportional to the length of the measured line. For this reason, the External Consistency Sigma on the *50*, *51*, and *52* records is expressed as a parts-per-million (ppm) value.

The *53* and *54* records are counterparts of the *51* and *52* records intended, respectively, for unreduced and reduced long-line distances (100 kilometers and longer) measured with either fine or coarse resolution by an indirect method. Examples of such long-line distances are the antenna-to-antenna spacial chords and the corresponding reduced sea-level (geoidal), ellipsoidal, or mark-to-mark distances derived from line-crossing measurements with a long-range, airborne electromagnetic DME (e.g. HIRAN), or obtained by extra-terrestrial techniques (e.g. VLBI). These records may also be used, respectively, for unreduced and reduced slant-range distances under 100 kilometers measured directly by a coarse-resolution DME. Since the preponderant external random errors associated with long-line and/or coarse-resolution distance measurements do not normally exhibit any relationship with the length of the respective line, the External Consistency Sigma on the *53* and *54* records is expressed in meters.

Date and Time: Date of observation is required (at least the year) and must appear on every distance observation record. Time of observation, where available, is desired to indicate the approximate time of day; any time associated with the distance observation (e.g. starting time, mean time, ending time, etc.) is acceptable.

Distance Code: A one-letter indicator of the type of distance involved. This indicator must appear immediately following the distance field on the distance observation records. The possible distance codes are as follows:

1. Unreduced Distances:

   T - distance taped horizontally
   H - taped distance reduced to horizontal
   S - slope distance or slant-range distance
   C - spacial chord distance

2. Reduced Distances:

   G - sea-level (geoidal) distances
   E - ellipsoidal distances
   X - mark-to-mark distances

AZIMUTH DATA RECORDS

60 - Laplace Azimuth Record
61 - Geodetic Azimuth Record

The azimuth data records, identified by *60*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS.

Laplace azimuth is an astronomic azimuth determination (e.g. by observation of the star Polaris) converted to the corresponding geodetic azimuth by the application of the Laplace correction. A necessary data element in the computation of the Laplace correction is the east-west (prime-vertical) component of the deflection of vertical at the respective standpoint. For this reason, if this deflection component is not known from other sources, astronomic longitude must also be observed. A horizontal control point at which the prime-vertical component of the deflection of vertical is known, and at which a determination of astronomic azimuth has been made, is called a "Laplace station."

Laplace azimuths are the primary means of orienting a survey project, if such orientation cannot be made with respect to established horizontal control points (e.g. because of intervisibility problems). When a survey project is extended away from existing horizontal control, Laplace stations must be established at regular intervals to guard against the buildup of systematic errors which may cause a gradual swing in the orientation of the network, i.e., to provide orientation control for the network in a manner analogous to baselines, which must be measured at regular intervals to provide scale control.

Submit a *60* record for every Laplace azimuth used in the project. If there are two or more sets of astronomic azimuth observations (e.g. sets observed on different nights), submit a separate *60* record for each set. The desired Laplace azimuth value is the mean value of the respective set of astronomic azimuth observations to which all applicable corrections, including the Laplace correction, have been applied (in sexagesimal degrees, minutes, seconds, and decimals of second), further corrected for eccentricity of instrument and/or target, if applicable (see TREATMENT OF ECCENTRIC OBSERVATIONS).

A required data item on the *60* record is the Prime-Vertical Component of Deflection (Eta), i.e., the difference between the astronomic and geodetic longitudes of the standpoint, as used in the computation of the respective Laplace correction. In addition to its absolute numerical value in seconds, the direction of the prime-vertical component of the deflection of vertical, i.e., the Direction of Eta must be specified as "E" or "W" according to whether the astronomic longitude falls east or west of the corresponding geodetic longitude of the standpoint.

Results of astronomic observations in the form of Laplace azimuth and of the meridional and prime-vertical components of the deflection of vertical are called for on the *60* and *85* records of the HZTL OBS data set. In addition, the respective astronomic latitude, longitude, and/or azimuth observations should be submitted separately in full detail for rigorous processing and incorporation into the astronomic data file of the National Geodetic Survey Data Base. To this end, the necessary formats, specifications, and instructions for the coding, keying, and submittal of astronomic data will be found in Chapter 9.

Geodetic azimuths come into consideration when orientation control for a survey project is obtained with respect to the existing horizontal control network by including an azimuth reference object (e.g. the azimuth mark) among the forepoints to which horizontal directions or horizontal angles are observed at one or more existing horizontal control points. Such control points, occupied for the purpose of establishing connection with the existing horizontal control network, must be identified as "fixed" by means of *90* Fixed Control Records (see FIXED CONTROL DATA RECORDS).

Submit a *61* record containing the respective geodetic azimuth value (in sexagesimal degrees, minutes, seconds, and decimals of second) for every azimuth reference object to which a horizontal direction or horizontal angle has been observed for the purpose of providing orientation control for the survey project. However, do not submit a *61* record if the azimuth reference object in question is another control point in the HZTL OBS data set, i.e., if a *80* or *81* record defining its geodetic position appears among the *80*-series records (see SURVEY POINT DATA RECORDS). Instead, if such a control point is used for azimuth reference, it must be identified as "fixed" by means of a *90* Fixed Control Record in the same manner as the respective standpoint (see above).

Date and Time: Date of the astronomic azimuth observation is required (at least the year) and must appear on the respective *60* Laplace Azimuth Record. Time of observation is desired to indicate the approximate time; any time associated with the astronomic azimuth observation (e.g. starting time, mean time, ending time, etc.) is acceptable. Date and time have been omitted on the *61* Geodetic Azimuth Record.

Origin of Azimuth: A one-letter code indicating the branch of the meridian (north or south) with respect to which the azimuth given on a *60* or *61* record is specified. Azimuth of a line joining a standpoint and a forepoint is defined as the clockwise horizontal angle (0 to 360 degrees) measured from either the north or the south branch of the meridian at the standpoint to the forepoint in question. Since the azimuth may be defined as either "from the north" or "from the south", the origin of the azimuth must be specified as "N" or "S", whichever applies.

SURVEY EQUIPMENT DATA RECORDS

70 - Instrument Record

The purpose of the *70* record is to provide descriptive information pertaining to an item of survey equipment which has been identified by a Job-Specific Instrument Number (see under OBSERVATION DATA RECORDS). Submit a *70* record for each item of survey equipment used in the project; the individual *70* records should appear in the order of increasing Job-Specific Instrument Number. The entries on the *70* record (see FORMAT DIAGRAMS) are self-explanatory, however, the following data items will be explained in greater detail:

NGS Survey Equipment Code: A three-digit numerical identification code assigned to every category of survey equipment, and within each category to specific instruments or other items of survey equipment commonly used in the United States - see ANNEX F.

Resolution of the Instrument and Units: The size of the smallest directly-readable linear or angular measurement unit characteristic of the respective item of survey equipment, followed by a two-letter symbol for the units in which it is expressed:

MT - meters	FT - feet	SA - seconds of arc
MM - millimeters	MF - millifeet	MA - minutes of arc

The character fields reserved for Resolution of the Instrument and for Units on the *70* record may be left blank if the resolution of the surveying instrument in question cannot be expressed in these units (e.g. if the measurement is obtained in terms of arbitrary "dial" units which do not bear a fixed relationship to the measured quantity).

SURVEY POINT DATA RECORDS

80 - Control Point Record
81 - Control Point Record (UTM/SPC)
82 - Reference or Azimuth Mark Record
83 - Bench Mark Record
84 - Geoid Height Record (Optional)
85 - Deflection Record (Optional)

The survey point data records, identified by *80*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS.

Submit a group of *80*-series records for every control point which appears in the horizontal control survey project. See ASSIGNMENT OF STATION SERIAL NUMBERS for definition of "control point" and "peripheral point" and for an explanation of the survey point numbering system. Start with the control point identified by the numerically lowest station serial number and continue with control points in the order of their increasing (not necessarily consecutive) station serial numbers.

The group of *80*-series records pertaining to a control point will usually consist of either a *80* record or a *81* record followed by as many *82* records as there are peripheral reference marks and/or azimuth marks associated with the horizontal control point in question. Use the *80* record if the geodetic position of the control point (see below) is given in geographic coordinates (latitude and longitude); use the *81* record if the position is given either in the Universal Transverse Mercator (UTM) coordinates or in State Plane Coordinates (SPC). Following the *80* or the *81* record, submit one *82* record for each peripheral RM or Az Mk of that control point, i.e., one which is identified by the same three-digit station serial number as the respective control point to which a suffix K through Z has been appended. Do not submit a *82* record for an RM or Az Mk which is being treated as a control point, i.e., one which is identified by another (unsuffixed) three-digit station serial number and for which a *80* or *81* record appears elsewhere among the survey point data records.

After the *82* records, or after the *80* or *81* record if no *82* records are present, there may follow one or more *83* records, a *84* record, and a *85* record. Submit a *83* record if the horizontal control point in question is also a vertical control point, i.e., if it is a bench mark (BM) in a line of differential leveling connected to the national vertical control network (Elevation Code B on the respective *80* or *81* record), or when the horizontal control point has been connected to a nearby bench mark by a spur level line (Elevation Code L). Since a horizontal control point can conceivably be connected by several spur level lines to more than one bench mark, several *83* records (one for each connection) are allowed. Lastly, a *84* record should be submitted if the geoid height is known for that control point, and a *85* record should be submitted if either one or both the meridional and prime-vertical components of the deflection of vertical are known.

Two special cases are recognized, in which either a *82* or a *83* record must be submitted for a control point instead of the usual *80* or *81* record. The first case has to do with survey points in the project which would normally be regarded as horizontal control points (i.e., they do not qualify as peripheral points), which cannot be positioned because of insufficient observations, and whose geodetic position cannot be obtained from other sources. Such a survey point must be identified by an unsuffixed three-digit station serial number just as a normal control point, however, since the respective geodetic position is not available, submit a *82* record for a point of this kind in lieu of a *80* or *81* record, then proceed as for any other normal control point, i.e., submit additional *82* records, one or more *83* records, a *84* record, and a *85* record, as applicable.

The second case has to do with survey points in the project which are used as vertical control points only, i.e., bench marks or other points to which and/or from which one or more vertical angles and distances have been observed, but no horizontal directions or angles. Survey points of this kind must also be identified by unsuffixed three-digit station serial numbers. If such a survey point is positionable (e.g. by trilateration), then it should be treated as a normal control point. Otherwise, submit a *83* record for a point of this kind in lieu of a *80* or *81* record. A *84* record and a *85* record may follow, if applicable, but not any *82* records. Should such a point have any peripheral reference or azimuth marks, then it should be treated as in the first special case described in the preceding paragraph.

The entries on the *80*-series records (see FORMAT DIAGRAMS) are self-explanatory, however, the following data items will be explained in greater detail:

Station Name: In the United States, it has traditionally been the preferred practice to assign intelligible names as primary identifiers of horizontal control points. Such "station names" have the important advantage of being mnemonic - a quality which pure numbers or arbitrary alphanumeric symbols do not possess. In addition, a properly chosen station name may in itself be descriptive and/or indicative of the general location of the respective horizontal control point, which is a desirable property. For automatic data processing purposes, however, the use of station names as primary identifiers does pose some difficulty, in that their length must, of necessity, be limited to a specific number of characters, and that, contrary to common usage of intelligible names, exactly the same abbreviation and/or spelling of the respective station name must be used whenever a reference is made to a horizontal control point in computer-readable media.

The name of a monumented horizontal control point is usually concise, being limited in length by the space which is available on a standard disk marker for the die-stamping of the respective station name. The usual practice is to stamp the name above the survey point symbol (e.g. triangle) which appears in the center of a standard disk marker, and the year (e.g. 1935) in which the mark was set is usually stamped below the survey point symbol.

In addition to this "year mark set" which normally appears stamped on every monumented survey point, another date is associated with every horizontal control point, i.e., with every survey point which is positioned, whether it is a monumented control point or an unmonumented recoverable landmark (see below). Referred to as the "year established," it is the year in which observations were first performed for the purpose of determining the position of that horizontal control point; this is normally also the year in which the original description of that control point was prepared. The "year established" and "year-mark-set" of a monumented horizontal control point are often identical.

Another type of horizontal control point is an unmonumented recoverable landmark (usually an intersection station) such as a flagpole or church spire. The name of a horizontal control point of this type must be sufficiently descriptive in order to identify the respective landmark (and frequently a specific feature of the landmark) adequately, and for this reason it is usually lengthy.

For data processing purposes (i.e., in the HZTL OBS and/or HZTL POS data sets) the length of a station name (including all imbedded blanks) is limited to 30 characters, and the same limit applies to the name or designation of a reference mark (RM) or azimuth mark (Az Mk). Accordingly, the name of every horizontal control point to be entered on the *80* or *81* record (as well as the name or designation of an RM or Az Mk to be entered on the *82* record) must be abbreviated and/or edited if it exceeds 30 characters. Guidelines for survey point names and designations, including recommended abbreviations, are given in ANNEX D. Note that the name or designation of a bench mark (BM) is limited to 25 characters (see Vertical Control Data, Chapters 5, 6, 7, and 8).

For some of the lengthier names of horizontal control points (e.g. those of unmonumented recoverable landmarks) this contraction to 30 characters will involve rather drastic abbreviation and editing, in which process much of the desired intelligibility and descriptiveness may be lost. To minimize this effect in connection with geodetic materials which are intended for use by the general public, up to 40 characters are allowed for the name of a horizontal control point in the HZTL DESC data set (see Chapter 3), and this 40-character station name will be used in the automated publication of geodetic data sheets, station descriptions, and associated indexes. This implies that there must be two versions of every station name which exceeds 30 characters in length - a 30-character version used for data processing purposes, and a 40-character version used for publication purposes. The two versions should differ only as to the manner in which the station name is abbreviated and/or edited.

The name of a horizontal control point to be entered on the *80* or *81* record should be taken as it appears under "Station Name" in the heading of the respective station description and subsequent recovery notes. For monumented horizontal control points, this station name is normally identical to or closely resembles the name stamped above the survey point symbol on the respective disk marker. Note that neither the "year established"

nor the "year mark set" does normally appear as a part of the station name. While parts of a lengthy station name may be abbreviated or edited out in order to conform to the 30-character limit, nothing should be added, except as necessary to render the station name unique within the job (see below). Parentheses are not permitted to appear in a station name. Other special characters such as periods, commas, etc. (see Chapter 1) - as well as any unnecessary spaces (blanks) - should also be edited out whenever possible.

In the same manner as the job-specific station serial number of a horizontal control point, which is unique within a job, it is highly desirable that a station name be unique within a job as well. If two or more control points with identical names occur in a job, they should be rendered unique by appending to the respective station names, in order of preference:

1. The name of the county (parish, census division) in which the station is located, followed by the symbol CO (PA,CD) - Example: JONES CLALLAM CO and JONES KING CO (SMITH ORLEANS PA and SMITH DE SOTO PA, ROCK KENAI-COOK INLET CD and ROCK ANCHORAGE CD).

2. The name of a locality other than county, parish, or census division - Example: PIPE SAN ANTONIO and PIPE LACKLAND AFB.

3. The "year mark set" - Example: PEDRO SILAS AZ MK 1935 and PEDRO SILAS AZ MK 1972.

4. The "year established" - Example - ROCKVILLE MUNICIPAL TANK 1908 and ROCKVILLE MUNICIPAL TANK 1969.

Whenever the name of a horizontal control point is modified in this manner in the HZTL OBS data set for the purpose of making it unique within the respective job, the appended information becomes part of the station name, and care must be taken that exactly the same information is appended to the station name in the heading of the description and of all subsequent recovery notes which are given for that horizontal control point in the companion HZTL DESC data set (see Chapter 3).

When a lengthy name of a horizontal control point must be contracted to 30 characters, the abbreviation and/or editing of the station name in question should be accomplished with due regard to the following two facts. First, a 40-character version of the same station name is required in the HZTL DESC data set which is to be submitted concurrently with the HZTL OBS data set (see INTRODUCTION), and this less drastically contracted version of the station name will be used for publication purposes. Second, the names of reference and azimuth marks are normally formed by appending the symbols RM 1, RM 2, ..., RM 13, etc., and AZ MK (possibly AZ MK 2, AZ MK 3, etc.) to the station name of the control point to which they belong. For this reason, the name of a horizontal control point which has peripheral reference marks and/or azimuth mark(s) may have to be further contracted to 24 characters (and possibly less) in order to allow for the respective reference and azimuth mark names to conform to the 30-character limit.

Name or Designation of RM or Az Mk: Reference marks and azimuth marks are usually identified by standard disk markers which display an arrow as the survey point smybol at their center; the markers are set in such a way that the arrow points toward the respective horizontal control point. Two or more reference marks are normally established in the immediate vicinity of a monumented horizontal control point. The purpose of the reference marks is to act as "pointers" toward the respective horizontal control point, thereby aiding in its recovery, and to provide means of verifying whether or not the station monument has been disturbed. In addition to the reference marks, an azimuth mark may be established at some distance away to provide an azimuth reference point which is visible from ground level at the respective horizontal control point, if a well-defined permanent object is not otherwise available for this purpose. Less frequently, more than one azimuth mark is established for the same horizontal control point.

The originally-established reference marks of a horizontal control point are normally assigned sequential numbers, e.g. NO 1, NO 2, etc. Any subsequently-established reference mark should be assigned the next unused number in the sequence, even though one or more of the previously-established reference marks may have been destroyed. The standard practice is to stamp the name of the horizontal control point to which a reference mark belongs above the arrow which appears in the center of the respective disk marker, the number of the reference mark (i.e., NO 1, NO 2, etc.) immediately below the arrow, and the year in which the reference mark was set farther below the arrow. The same procedure is followed in the case of an azimuth mark, except that a number is normally assigned and stamped on the respective disk marker only if more than one azimuth mark is involved.

The name or designation of a reference mark (RM) or an azimuth mark (Az Mk) to be entered on the *82* record must not exceed 30 characters in length. It should normally consist of the name of the horizontal control point to which the respective RM or Az Mk belongs, with the symbol RM 1, RM 2, ..., RM 13, etc. appended for reference marks NO 1, NO 2, ..., NO 13, etc. For azimuth marks, the symbol AZ MK is appended if only one azimuth mark is involved, otherwise the symbol AZ MK 2, AZ MK 3, etc. for azimuth marks NO 2, NO 3, etc. In general, nothing else should be added to the name of an RM or Az Mk, except when the numbering system outlined in the preceding paragraph has not been followed, with the result that two or more reference or azimuth marks associated with a horizontal control point are referred to by the same name. In this case, the "year mark set" should be further appended to make the respective names unique (e.g. KELLEY AZ MK 1918 and KELLEY AZ MK 1975, if the Az Mk set in 1975 has not been stamped "NO 2").

Considering that the total length of an RM or Az Mk name must not exceed 30 characters, the name of the horizontal control point to which the RM 1, RM 2, etc., and/or AZ MK symbols are appended must itself be limited to 24 characters, and may have to be further contracted if a numeral must follow the AZ MK symbol and/or the "year mark set" has to be added. The name of the respective horizontal control point must be taken as it appears on the corresponding *80* or *81* record (see Station Name), except for possible further abbreviation and/or editing which may be required.

The same general considerations apply in connection with a reference or azimuth mark which is being treated as a control point (i.e., which is not regarded as a peripheral RM or Az Mk), whose 30-character name is to be entered on the respective *80* or *81* record. Occasionally, an existing monumented survey point of another agency is used for a reference mark or, more frequently, for an azimuth mark. Such a survey point must be treated as a control point, i.e., it must be identified by an unsuffixed three-digit station serial number. If it can be positioned (or if its geodetic position is available from other sources), submit a *80* or *81* record for a control point of this kind; otherwise submit a *82* record to give its name or designation.

Name or Designation of Bench Mark: A bench mark (BM) is a monumented (or otherwise permanently marked) vertical control point whose elevation above mean sea level (MSL) has been accurately determined by differential leveling. Bench marks occur in a horizontal control survey project if (1) a horizontal control point is also a BM in a line of differential leveling connected to the national vertical control network, (2) a spur level line connection exists between a horizontal control point and a nearby BM, or (3) a BM is included as a control point in the project for the purpose of extending vertical control by trigonometric leveling (vertical angles).

The name or designation of a bench mark to be entered on a *83* record must not exceed 25 characters in length. It should be taken as it appears in the heading of the respective bench mark description, which normally is identical to or closely resembles the name or designation stamped on the respective disk marker. If the name or designation of a bench mark must be contracted in order to conform to the 25-character limit, the same general considerations apply as for the abbreviation and/or editing of the name of a horizontal control point (see Station Name above).

Geodetic Position: The geodetic position of every horizontal control point for which a *80* or *81* record is submitted must be given to serve either as a fixed position or as a preliminary position in the adjustment of the respective horizontal control survey project. The geodetic position may be expressed either in terms of geographic coordinates (latitude and longitude) on the *80* record, or it may be expressed in one of two plane coordinate systems - the Universal Transverse Mercator (UTM) coordinates, or the State Plane Coordinates (SPC) - on the *81* record.

For previously established horizontal control points which are identified as "fixed" by means of a *90* record (see FIXED CONTROL DATA RECORDS), the geodetic position given should be either the published position, if the control point in question is an existing point of the national horizontal control network, or else a position obtained in a constrained adjustment, i.e., a position which is consistent with existing horizontal control in the area. For horizontal control points which are to be positioned, the geodetic position given should be as determined by a preliminary adjustment, or else the unadjusted "field" position computed on the basis of selected observations should be supplied.

The *80* record is intended for horizontal control points whose geodetic position is given in terms of geographic coordinates, i.e., as Latitude and Longitude. In addition to the respective absolute values (in sexagesimal degrees, minutes, seconds, and decimals of second), the Direction of Latitude must be specified as "N" or "S", and the Direction of Longitude must be specified as "E" or "W", whichever applies, by one-letter codes adjacent to the respective latitude and longitude fields.

The *81* record is intended for horizontal control points whose geodetic position is given in terms of plane coordinates, i.e., as an X-Coordinate (Easting) and a Y-Coordinate (Northing), followed by the appropriate four-digit zone designation, which also serves as a coordinate system code. If the plane coordinates used are the Universal Transverse Mercator (UTM) coordinates, the easting and northing values are expected to be given in meters and decimals of meter, and the zone designation must be the respective UTM Zone Number (0001-0060). If the plane coordinates used are the State Plane Coordinates (SPC), the easting and northing values are expected to be given in feet and decimals of foot, and the zone designation must be the respective State and Zone Code as given in ANNEX B.

Elevation and Elevation Code: Elevation is the vertical distance above the geoid - an equipotential surface which along the sea coast is defined by the mean sea level (MSL). Also referred to as the "orthometric height," elevation is normally the dominant component of ellipsoidal height which is given as the sum of elevation and geoid height, geoid height being the name given to the vertical separation between the geoid and the reference ellipsoid of the geodetic datum used (NAD 27 or as specified on the *13* record). The ellipsoidal heights of horizontal control points must be known for the purpose of reducing distance measurements to the reference ellipsoid and for the computation of the skew normal and deflection corrections which are to be applied to horizontal directions and/or horizontal angles observed to and/or from the horizontal control points in question.

Because the geoid height value associated with a horizontal control point is often unknown, it is a common practice to assume it to be zero, and to use the elevation as the best available approximation for the corresponding ellipsoidal height. When this approximation is used, the respective observations are considered to have been reduced to the sea level (i.e., to the geoid), rather than to the reference ellipsoid. Since in the continental United States the magnitude of a geoid height defined with respect to the North American 1927 datum (NAD 27) rarely exceeds 25 meters and is normally much less (e.g. 3 or 5 meters), the error introduced by this approximation is imperceptible, except in connection with accurate distance measurements.

The elevation of every horizontal control point for which a *80* or *81* record is submitted must be given, except for unmonumented recoverable landmarks positioned by intersection. Since no distances are involved, and since the expected accuracy of an intersected landmark's position is such as to allow the skew normal and deflection corrections of the respective horizontal directions (or horizontal angles) to be neglected, the elevation field of such a landmark may be left blank. When given, the elevation of

a horizontal control point which is an unmonumented recoverable landmark should be the ground level elevation (e.g. obtained from a topographic map, if a more accurate value is not available), and the height above ground level of the point actually sighted should be entered as the height of target on the respective observation record.

The elevation of a survey point is determined most accurately by differential leveling, i.e., as a result of accumulation of elevation differences measured in short increments between a bench mark (BM) of the national vertical control network (or any other survey point the elevation of which has been previously determined) and the survey point in question. Other less accurate methods of determining the elevation of a survey point are (1) trigonometric leveling using reciprocal vertical angles, (2) trigonometric leveling using nonreciprocal (i.e., one-sided) vertical angles, and (3) photogrammetric methods. In addition, an estimate of elevation based on the exponential decrease of atmospheric pressure with altitude can be obtained by a barometric leveling scheme (e.g. with the aid of an altimeter). As a last resort, if elevation from another source is not at hand, the survey point must be plotted on the best available topographic map and its approximate elevation obtained by interpolation between adjacent elevation contour lines.

In every case, the source and general accuracy of the elevation value given on a *80* or *81* record must be indicated by a one-letter Elevation Code adjacent to the respective elevation field. The possible elevation codes are as follows:

B - The horizontal control point is a bench mark (BM).
L - Elevation determined by level line connection to nearby BM.
R - Elevation determined by reciprocal vertical angles.
V - Elevation determined by nonreciprocal vertical angles.
P - Elevation determined by a photogrammetric method.
M - Elevation obtained by barometric leveling or from a map.

Station Order and Type: A two-character field is reserved on the *80* and *81* records for a two-digit order-and-type code. The purpose of this code is to characterize the horizontal control point as to the general order of accuracy of the main-scheme network of which it is a part, and to indicate whether the horizontal control point in question is monumented (or otherwise permanently marked), unmonumented but recoverable (e.g. a landmark), or unmonumented and nonrecoverable (e.g. an auxilliary point). In addition, the purpose of this code is to characterize the horizontal control point as to the type of the survey scheme of which it is a part and/or by means of which it is positioned (i.e., triangulation, trilateration, traverse, intersection, or resection), and to indicate whether the horizontal control point in question is a main-scheme station or a supplemental station in the respective survey scheme.

In every case, care must be taken to assign an order-and-type code which reflects the usage of the horizontal control point in the project at hand. For example, if a horizontal control point established as a station of a

first-order triangulation network is occupied in the course of a second-order traverse project, then it must be assigned order-and-type code which indicates it to be a second-order traverse station rather than first-order triangulation station, etc. The same considerations apply to previously-established horizontal control points which are used as fixed control in the project. For control points which cannot be positioned within the project because of insufficient observations (but for which an accurate geodetic position is available from other sources, and hence for which a *80* or *81* record is submitted), the order-and-type code is to be left blank.

The first digit of the order-and-type code indicates the order of accuracy of the main-scheme network, i.e., it reflects the surveying methods used, procedures followed, and specifications enforced in the project in connection with observations taken to and/or from the horizontal control point in question. It is also intended to indicate whether the horizontal control point is a monumented (or otherwise permanently marked) control point, an unmonumented recoverable landmark, or a temporary point, not permanently marked and therefore nonrecoverable, which must be treated as a control point (e.g. an unmarked eccentric point which is offset more than 10 meters from the respective control point). The respective "order digits" are as follows:

1. Order Digits of Permanently Marked Stations:

   0 - Trans-Continental Traverse (TCT)
   1 - First-Order Survey Scheme
   2 - Second-Order (Class I and Class II) Survey Scheme
   3 - Third-Order (Class I and Class II) Survey Scheme
   4 - Lower-Than-Third-Order Survey Scheme and
       Supplemental Unmonumented Recoverable Landmarks (see below).

2. Order Digits of Nonrecoverable Points:

   5 - First-Order Survey Scheme
   6 - Second-Order (Class I and Class II) Survey Scheme
   7 - Third-Order (Class I and Class II) Survey Scheme
   8 - Lower-Than-Third-Order Survey Scheme

In general, the order-and-type codes of all monumented (or otherwise permanently marked) horizontal control points in a project should have the same order digit (equal to the order digit of the order-and-class code assigned to the project - see under PROJECT DATA RECORDS), except when survey work of more than one order-and-class category is included in the project. In this case, special care must be taken to assign the appropriate order digit to every monumented control point according to the order-and-class category of the respective section of the project; control points which qualify for more than one order designation must be assigned the order digit which corresponds to the higher order-and-class category (i.e., the one which is numerically lower). However, in a project of Trans-Continental Traverse (TCT) type, only the stations of the high-precision traverse proper (i.e., stations connected by horizontal directions and by distances measured with

electro-optical DME on two nights) should carry the order digit "0"; other horizontal control points occupied and/or sighted upon should be treated as comparable stations in a first-order project.

As a matter of convention, the order digit "4" is assigned to horizontal control points which are unmonumented recoverable landmarks positioned as supplemental stations, i.e., as intersections or spur traverse stations which are incidental to the primary survey scheme, regardless of the order-and-class category of the project or section of project of which they are a part. However, if such a landmark (e.g. a flagpole or church spire) occurs as an unoccupied main-scheme station in a triangulation network, then it must be assigned the same order digit as any other main-scheme station in its vicinity, i.e., a main-scheme intersection station which is an unmonumented recoverable landmark must be assigned the same order digit as a monumented control point.

Considering the discussion in the preceding two paragraphs, the allowable order digits of the order-and-type codes assigned to horizontal control points within a project (or within a section of a project) are as follows:

TABLE 2-5 - ALLOWABLE ORDER DIGITS

SURVEY SCHEME ORDER-AND-CLASS CATEGORY	ALLOWABLE ORDER DIGITS
Trans-Continental Traverse (TCT)	0,1,4,5
First-Order	1,4,5
Second-Order (Class I and Class II)	2,4,6
Third-Order (Class I and Class II)	3,4,7
Lower-Than-Third-Order	4,8

The second digit of the order-and-type code indicates the type of survey scheme of which the horizontal control point in question is a part and/or the (primary) surveying method by means of which it is positioned. It is also intended to indicate whether the horizontal control point is a main-scheme station (i.e., one which is <u>essential</u> to the primary survey scheme) or a supplemental station (i.e., one which is <u>incidental</u> to the primary survey scheme). The respective "type digits" are as follows:

1. <u>Type Digits of Main-Scheme Stations</u>:

   1 - Positioned Primarily by Triangulation
   2 - Positioned Primarily by Trilateration
   3 - Positioned Primarily by Traverse

2. <u>Type Digits of Supplemental Stations</u>:

   4 - Positioned Primarily by Triangulation
   5 - Positioned Primarily by Trilateration
   6 - Positioned Primarily by Traverse
   7 - Positioned by Intersection (Note: 1 if Main-Scheme Station)
   8 - Positioned by Resection

As indicated above, an intersection station which occurs as a main-scheme station in a triangulation network is to be assigned the type digit "1", i.e., when an intersection station is essential to the primary survey scheme, it should be treated as any other main-scheme triangulation station in the project.

If it is not clear whether a horizontal control point is a main-scheme or supplemental station in a 1st-Order or 2nd-Order (Class I or Class II) network, it should be treated as a main-scheme station and assigned type digit 1, 2, or 3, as applicable. In particular, if special effort has been made to preserve the nominal accuracy of the respective main-scheme network in the positioning of a station which is not essential to the primary survey scheme (e.g. extra angular observations were taken and/or a distance was measured with electro-optical DME), such a supplemental station should be regarded as a main-scheme station and assigned a type digit accordingly.

In a third-order or lower-than-third-order survey scheme, the distinction between main-scheme and supplemental stations is unimportant, and hence the type digits 4, 5, and 6 are not used with order digits 3 and 4; however, the type digits 7 and 8 are still to be used to identify supplemental intersections and resections. In particular, the order-and-type code assigned to a recoverable landmark which is incidental to the survey scheme should be 47 if positioned by intersection (43 if positioned by a spur traverse) in a survey scheme of any order and class. In view of the above, the allowable type digits of the order-and-type code assigned to horizontal control points within a project (or within a section of a project) are as follows:

TABLE 2-6 - ALLOWABLE TYPE DIGITS

ORDER DIGIT	ALLOWABLE TYPE DIGITS
0	3,6
1,5	1,2,3,4,5,6,7,8
2,6	1,2,3,4,5,6,7,8
3,7	1,2,3,7,8
4,8	1,2,3,7,8

Whenever a horizontal control point qualifies for more than one type digit (i.e., when a station can be considered to be positioned by two or more different survey methods), the type digit which reflects the survey method resulting in the strongest position, when used alone, should be assigned. A hierarchy of order-and-type codes is given in ANNEX E.

Geoid Height: Geoid height is the vertical separation between the reference ellipsoid of the geodetic datum (NAD 27 or as specified on the *13* record) and the geoid. Geoid, in turn, is the name given to the equipotential surface which along the sea coast is coincident with the mean sea level (MSL), with respect to which elevations are defined. The algebraic sum of elevation and geoid height is the "ellipsoidal height" which must be known for every horizontal (and vertical) control point for the purpose of reducing the respective horizontal control survey observations to the reference ellipsoid (and for the extension of vertical control by trigonometric leveling). Since the geoid height value associated with a horizontal (or

vertical) control point is often unknown, it is a common practice to assume it to be zero, and hence to use the elevation as the best available approximation for the desired ellipsoidal height.

If a reliable value of geoid height is known, a *84* record should be submitted on which the respective geoid height is given in meters and decimals of meter. Note that the geoid height is positive when the geoid is above the ellipsoid (i.e., when ellipsoidal height minus elevation is a positive number), and that it is negative when the geoid is below the ellipsoid (i.e., when ellipsoidal height minus elevation is a negative number). The geoid height value given should be accompanied by an estimate of its absolute accuracy in the form of a standard error (Sigma).

Deflection of Vertical: Deflection of vertical is the angle formed by the tangent to the direction of gravity (known as the "vertical") and the "normal" to the reference ellipsoid of the geodetic datum (NAD 27 or as specified on the *13* record). In addition to the magnitude of this angle, usually given in seconds and decimals of second of arc, the direction (e.g. the geodetic azimuth) of the deflection must also be specified. Alternatively, the direction of the deflection of vertical is implied when the deflection is given in terms of two rectangular components - e.g. the north-south or meridional component and the east-west or prime-vertical component.

Deflection of vertical comes into consideration in connection with horizontal directions, horizontal angles, and vertical angles observed with theodolites or transits which are leveled (i.e., oriented with respect to the direction of gravity). Accordingly, the deflection of vertical must be known at every point from which horizontal directions, horizontal angles, or vertical angles have been observed, so that appropriate corrections can be computed by means of which these observed quantities are converted from the gravity-oriented "astronomic" frame of reference to the ellipsoid-oriented geodetic system.

Because the deflection of vertical at a given horizontal control point is often unknown, it is a common practice to assume it to be zero. Since in the continental United States the magnitude of the maximum deflection of vertical defined with respect to the North American 1927 datum (NAD 27) seldom exceeds 20 seconds of arc and is normally much less (e.g. 3 or 5 seconds), the error introduced by this approximation in connection with the reduction of horizontal directions and horizontal angles is imperceptible except for long, inclined lines of sight in mountainous regions. However, in connection with the use of vertical angles for the determination of elevation differences, this approximation is one of the major sources of error which render inaccurate the extension of vertical control by trigonometric leveling.

If the deflection of vertical is reliably known (e.g. as a result of astronomic latitude and longitude observations), a *85* record should be submitted on which the deflection is given in terms of the respective meridional (i.e., north-south) and prime-vertical (i.e., east-west) components, each expressed in seconds and decimals of second of arc.

The desired Meridional Component (Xi) of the deflection of vertical is the difference between the astronomic and geodetic latitudes of the horizontal control point in question. In addition to the respective absolute value (in seconds and decimals of second), the direction of the meridional component, i.e., the Direction of Xi must be specified as "N" or "S" according to whether the astronomic latitude falls north or south of the corresponding geodetic latitude. The desired Prime-Vertical Component (Eta) of the deflection of vertical is the difference between the astronomic and geodetic longitudes of the horizontal control point in question multiplied by the cosine of the respective (approximate, i.e., astronomic or geodetic) latitude. In addition to the respective absolute value (in seconds and decimals of second), the direction of the prime-vertical component, i.e., the Direction of Eta must be specified as "E" or "W" according to whether the astronomic longitude falls east or west of the corresponding geodetic longitude. Both the meridional and prime-vertical components of the deflection of vertical should be accompanied by an estimate of their absolute accuracy in the form of a standard error (Sigma).

Results of astronomic observations in the form of Laplace azimuth and of the meridional and prime-vertical components of the deflection of vertical are called for on the *60* and *85* records of the HZTL OBS data set. In addition, the respective astronomic latitude, longitude, and/or azimuth observations should be submitted separately in full detail for rigorous processing and incorporation into the astronomic data file of the National Geodetic Survey Data Base. To this end, the necessary formats, specifications, and instructions for the coding, keying, and submittal of astronomic data will be found in Chapter 9.

85 deflection LLC
60 Laplace
61 (inversed or) computed to unpublished point

FIXED CONTROL DATA RECORDS

90 - Fixed Control Record

The purpose of the *90* record is to allow for the identification of horizontal control points which are to be used as "fixed control" in the project, i.e., those control points whose coordinates are to be held fixed in the adjustment of the respective horizontal control network. Submit a *90* record for each horizontal control point to be held fixed; a *80* or *81* record must appear among the *80*-series records (see SURVEY POINT DATA RECORDS) for each horizontal control point identified as "fixed" by a *90* record.

Normally, two or more horizontal control points will be designated as fixed control in a horizontal control survey project. If only one horizontal control point is so identified, the necessary scale and orientation of the respective horizontal control network must be provided by *50*-series and *60*-series records (see DISTANCE DATA RECORDS and AZIMUTH DATA RECORDS).

FORMAT DIAGRAMS

For each record which may appear in an HZTL OBS data set (see Table 2-1), a block diagram has been prepared to illustrate the respective format. These "format diagrams" have been designed to fulfill the following objectives:

1. Each record is 80 characters long (standard punched card immage).

2. Each record has a fixed format, i.e., every data field has a specific length and specific position within the record.

3. Each format diagram is a graphical image of the respective record.

4. Within the limits of available space, information and instructions concerning the data item to be entered in each data field are provided on the format diagrams to render them self-explanatory.

5. Whenever appropriate, sample entries are shown in the data entry line of each format diagram.

6. Each data field is characterized as to its type by a string of lower-case characters which appear immediately below the data entry line.

Data Field Types:

1. Alpha Field (aa...a) - intended for a data item which is coded as a string of alphabetic, numeric, and/or special characters, with or without imbedded blanks, to be entered into the respective data field left-justified and blank-filled on the right. See Chapter 1 for a list of special characters which are allowed.

2. Blank Field (bb...b) - to be blank-filled. Data fields which are designated as blank fields must be left blank, i.e., no data items may be entered in these fields.

3. Floating-Point Field (ff...fdd...d) - intended for a data item which is coded as a decimal number, i.e., as a string of numeric characters (prefixed with minus sign if the number is negative) which may contain one leading, imbedded, or trailing period (the decimal point), but may not contain any imbedded blanks. If the decimal point is present, the character string representing the integer digits, the decimal point, and the decimal fraction digits may be positioned anywhere within the respective field (generally left-justified), and the unused columns of the data field are blank-filled.

When the decimal point is not coded, the "f" portion of the floating-point field is to contain the integer part of the decimal number, and the "d" portion the corresponding decimal fraction part, the decimal point being implied between the rightmost "f" column and the leftmost "d" column of the field. Accordingly, a string of numeric characters representing m integer digits followed by n decimal fraction digits with the decimal point absent must be positioned in the floating-point field in such a manner that its integer part falls into the m rightmost "f" columns, and its decimal fraction part into the n leftmost "d" columns, with any unused columns of the data field being blank-filled. When a negative number is entered, code the minus sign immediately preceding the leading digit.

A floating-point field may consist of the integer part only (ff...f), in which case the decimal point is implied immediately following the rightmost "f" column. It may also consist of the fractional part only (dd...d), in which case the decimal point is implied immediately preceding the leftmost "d" column. A decimal number coded as a string of numeric characters with a leading, imbedded, or trailing decimal point may be entered in such a field just as in the case of the full floating-point field (ff...fdd...d) - the coded decimal point overrides the implied decimal point position in every case.

4. Integer Field (ii...i) - intended for a data item which is coded as a string of numeric characters representing a positive or negative integer number, to be entered in the respective data field right-justified. In the case of a positive integer number, zero-fill any unused columns on the left. In the case of a negative integer number, code the minus sign immediately preceding the leftmost non-zero digit, and blank-fill any unused columns to the left of the minus sign.

5. Specific Character Field (ss...s) - intended to contain a specific alphabetic, numeric, or special character or a specific group of characters. Every "s" column of a specific character field must contain the character shown in that position in the data entry line of the respective format diagram.

Required Data: In general, only those records which are applicable to the data at hand should be included in an HZTL OBS data set (e.g. no *60* records need to be submitted if there are no Laplace azimuths in the respective horizontal control survey project). The character fields intended for data items which are deemed essential have been shaded on the format diagrams; if applicable to the data being coded, these character fields must be filled out in accordance with the instructions given on the respective format diagrams or in the text of Chapter 2. Records which are optional or those which may be omitted under certain circumstances are clearly so designated in the heading of the corresponding format diagrams.

Data Set Identification Record. This must be the first record of every data set submitted. A data set may be submitted either as a deck of cards or as a magnetic tape file containing formatted records. Magnetic tape is preferred; use punched cards for small, isolated jobs only.

000000 123456	0001 7890	1111 1234	1111 5678	122222 901234	222223333333333444444444455555555556666666 567890123456789012345678901234567890123456	666777 789012	77777778 34567890
Sequence Number - must be 000010 on this record. Increment by 10 on successive records to allow for insertions.	Job Code - preceded and followed by asterisk.	Data Class - HZTL for horizontal control data.	Data Type - OBS for field observation data.	Abbreviation - must be unique. Enter the symbol listed in ANNEX C. See footnote for other agencies or firms.	Name of Submitting Agency or Firm Full Name		Date Data Set Created (e.g. date this record keyed). Century, year, month, day (CCYYMMDD). If day is unknown, leave last two columns blank. If month is unknown, leave last four columns blank.
	Data Set Identification						
000010	*A1*	HZTL	OBS	OH0070	AKRON CITY SURVEY		19750705
iiiiii	saas	ssss	ssss	aaaaaa	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	bbbbbb	iiiiiiii
000000 123456	0001 7890	1111 1234	1111 5678	122222 901234	222223333333333444444444455555555556666666 567890123456789012345678901234567890123456	666777 789012	77777778 34567890

Important: To insure uniqueness, agencies or firms not listed in ANNEX C must have their proposed abbreviation symbol accepted by NGS prior to first submittal of data - see ANNEX K.

10 - Project Title Record and *11* - Project Title Continuation Record. Project Title Record must be the leading record of each project within the Job. Project Title Continuation Record is optional. Project Information Record (*12*) must follow the *10* and *11* records.

```
000000000111111111122222222223333333333444444444455555555556666666666777777777778
123456789012345678901234567890123456789012345678901234567890123456789012345678890
nnnnnn*10*SMITHVILLE TO KRANKSTON
iiiiiisiisaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
000000000111111111122222222223333333333444444444455555555556666666666777777777778
123456789012345678901234567890123456789012345678901234567890123456789012345678890
```

Columns	Description
1–6	Sequence Number Increment by 10 on successive records to allow for insertions.
7–10	Data Code - preceded and followed by asterisk. *10* Project Title, *11* Project Title Continuation
11–80	Project Title Use Project Title Continuation Record (*11*) if project title exceeds 70 characters. Only one continuation record is allowed. Do not divide words between *10* and *11* records. Omit punctuation marks (periods, commas, etc.) and parentheses whenever possible. Do not include state or country designation if only one state or country is involved which is the same as that indicated by the Primary State or Country Code on the *12* record.

12 - Project Information Record. This record must follow the Project Title Record (*10*) or the Project Title Continuation Record (*11*) of each project included in the Job.

Columns	Field	Example	Format
1–6	Sequence Number Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7–10	Data Code - preceded and followed by asterisk. (*12* - Project Information Record)	*12*	siis
11–16	Date Field Operations Commenced Century, year, month (CCYYMM). If month is unknown, leave last two columns blank.	196806	iiiiii
17–22	Date Field Operations Terminated Century, year, month (CCYYMM). If month is unknown, leave last two columns blank.	196808	iiiiii
23–25	Initials and Name of Person Responsible for the Survey (Chief of Party), 1st: Initials of Chief of Party Leave blank if unknown.	FJS	aaa
26–47	Full Name of Chief of Party Surname and initials separated by blanks - do not enter periods or any other special characters. Omit initials if surname only is known; leave blank if surname is not known.	SCHRECENGOST F J	aaaaaaaaaaaaaaaaaaaaaa
48–50	Initials and Name of Person Responsible for the Survey (Chief of Party), 2nd: Initials of Chief of Party Leave blank if unknown.	LP	aaa
51–65	Full Name of Chief of Party Surname and initials separated by blanks - do not enter periods or any other special characters. Omit initials if surname only is known; leave blank if surname is not known.	PFEIFER L	aaaaaaaaaaaaaaa
66–75	*Use 00 for Trans-Continental Traverse (TCT)		bbbbbbbbbb
76	Type of Survey - see footnote.	3	i
77–78	Primary State or Country Code - see ANNEX A.	OH	aa
79–80	Order and Class of Survey - see above.	21	ii

ORDER AND CLASS OF SURVEY

ORDER	1st	2nd		3rd		LOWER
CLASS	--	I	II	I	II	--
CODE*	10	21	22	31	32	40

Primary State or Country Code - The state or country under which this project is to be archived.

Type of Survey - Primary survey method used: Triangulation-1, Trilateration-2, Traverse-3.

13 - Geodetic Datum and Ellipsoid Record. Defines the datum and reference ellipsoid for the geodetic positions, deflections of vertical, geoid heights, and/or ellipsoidal distances which appear in this project. This record may be omitted for the North American 1927 (NAD 27) datum.

	Sequence Number Increment by 10 on successive records to allow for insertions.			
	Data Code - preceded and followed by asterisk. (*13* - Geodetic Datum and Ellipsoid Record)			
Geodetic Datum	Datum Name or Designation Do not include the word DATUM in datum name. Abbreviate if neccessary.	Reference Ellipsoid	Name of the Ellipsoid	
			Semi-Major Axis (a) in meters (XXXXXXXxxx).	
			Inverse Flattening (1/f) (XXXxxxxxxx). Enter for ellipsoids defined by a and 1/f (e.g. International). Do not enter for ellipsoids defined by a and b.	
			Semi-Minor Axis (b) in meters (XXXXXXXxxx). Enter for ellipsoids defined by a and b (e.g. Clarke 1866). Do not enter for ellipsoids defined by a and 1/f.	

```
0000000001111111112222222223333333334444444445555555556666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456
nnnnnn*13*US STANDARD 1901      CLARKE 1866      6378206.4
iiiiiisisaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaffffffdddfffddddddfffffffddd
0000000001111111112222222223333333334444444445555555556666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456
```

20 - Horizontal Direction Set Record. Use this record for the initial of every set of directions. Use Horizontal Direction Record (*22*) for the remaining directions observed in the same set. Use Comment Record (*21*) immediately following *20* record for any comments.

Columns	Example	Format	Group	Field
1-5	nnnnn	iiiii		Sequence Number. Increment by 10 on successive records to allow for insertions.
6-9	*20*	siis		Data Code - preceded and followed by asterisk. (*20* - Horizontal Direction Set Record)
10-13	001	iiia	Standpoint and Set Information	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
14-15	01	ii	Standpoint and Set Information	Set Number - use 02,03,etc. for successive sets.
16-22	13214	aaaaaaa	Standpoint and Set Information	Field Record Book Volume Number - leave blank if field record book designation is not known.
23-24	06	ii	Standpoint and Set Information	Number of Objects Sighted in This Set
25-29	00 10	iiiii	Standpoint and Set Information	problem / visibility / temperature / cloud cover / wind: Weather Code - see ANNEX G. If problem indicator is 1 use *21* record for explanation.
30-32	JS	aaa	Standpoint and Set Information	Initials of the Observer
33-35	009	iii	Standpoint and Set Information	Job-Specific Instrument Number - see text.
36-39	985	ffdd	Standpoint and Set Information	Height of Instrument above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.
40-45	680701	iiiiii	Date & Time	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.
46-50	2230R	iiiia	Date & Time	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.
51-54	002	iiia	Forepoint	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
55-58	52	ffdd	Forepoint	Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.
59	N	a	Forepoint	Visibility Code - leave blank if unknown.
60-61	16	ii	Horizontal Direction	Number of Replications - see Glossary of Terms.
62-63	04	ii	Horizontal Direction	Rejection Limit (deviation from mean) in sec.
64-72	0000000	iiiiiiidd	Horizontal Direction	Initial Direction (mean) - degrees, minutes, seconds (DDDMMSSss). If not zero, leave last column blank if it is given to the nearest tenth of second, leave last two columns blank if it is given to nearest second, and leave last four columns blank if to nearest minute.
73-76	33	ffdd		Internal Consistency Sigma in seconds (XXxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
77-80	71	ffdd		External Consistency Sigma in seconds (XXxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

21 - Horizontal Direction Comment Record (Optional). Use this record for any comments pertinent to the set of directions. A comment explaining the problem encountered is required if the problem indicator (Column 25) on the respective Horizontal Direction Set Record (*20*) is 1.

Columns 1–6	Columns 7–10	Columns 11–80
000000 123456	0001 7890	1111111112222222222333333333344444444445555555555666666666677777777778 1234567890123456789012345678901234567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*21* - Horizontal Direction Comment Record)	Comment If the comment(s) exceed 70 characters, use another *21* record for continuation. Any number of *21* records is allowed. Do not divide words between consecutive *21* records.
nnnnnn	*21*	
iiiiii	siis	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
000000 123456	0001 7890	1111111112222222222333333333344444444445555555555666666666677777777778 1234567890123456789012345678901234567890123456789012345678901234567890

22 - Horizontal Direction Record. Use this record for the second and subsequent directions observed in the same set; use Horizontal Direction Set Record (*20*) for the first direction (initial) observed in the set.

Columns	Description	Example	Format
1-6	Sequence Number Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7-10	Data Code - preceded and followed by asterisk. (*22* - Horizontal Direction Record)	*22*	siis
11-14	Station Serial Number and Suffix of Standpoint — Must be same as on the respective *20* record.	001	iiia
15-16	Set Number — Must be same as on the respective *20* record.	01	ii
17-50			bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
51-54	Forepoint: Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	003	iiia
55-58	Forepoint: Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	23	ffdd
59	Forepoint: Visibility Code - leave blank if unknown.	V	a
60-61	Number of Replications - see Glossary of Terms.	16	ii
62-63	Horizontal Direction: Rejection Limit (deviation from mean) in sec.	04	ii
64-72	Horizontal Direction: Clockwise Direction (mean) - degrees, minutes, seconds (DDDMMSSss). Leave last column blank if the direction is given to the nearest tenth of second, leave last two columns blank if it is given to nearest second, and leave last four columns blank if to nearest minute.	07314072	iiiiiiidd
73-76	Internal Consistency Sigma in seconds (XXxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.	40	ffdd
77-80	External Consistency Sigma in seconds (XXxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.	71	ffdd

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

30 - Horizontal Angle Set Record. Use this record for the first angle of every set of angles observed at a station. Use Horizontal Angle Record (*32*) for the remaining angles observed in the same set. Use Comment Record (*31*) immediately following *30* record for any comments.

Columns	Group	Field description	Example	Type
1-6		Sequence Number. Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7-10		Data Code - preceded and followed by asterisk. (*30* - Horizontal Angle Set Record)	*30*	siis
11-14	Standpoint and Set Information	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	301	iiia
15-16	Standpoint and Set Information	Set Number - use 02,03,etc. for successive sets.	01	ii
17-22	Standpoint and Set Information	Field Record Book Volume Number - leave blank if field record book designation is not known.	AH354	aaaaaa
23-24	Standpoint and Set Information	Number of Angles Observed in This Set	02	ii
25	Standpoint and Set Information	problem (Weather Code - see ANNEX G. If problem indicator is 1 use *31* record for explanation.)	0	i
26	Standpoint and Set Information	visibility (Weather Code)	1	i
27	Standpoint and Set Information	temperature (Weather Code)		i
28	Standpoint and Set Information	cloud cover (Weather Code)		i
29	Standpoint and Set Information	wind (Weather Code)	1	i
30-32	Standpoint and Set Information	Initials of the Observer	JGG	aaa
33-35	Standpoint and Set Information	Job-Specific Instrument Number - see text.	022	iii
36-39	Standpoint and Set Information	Height of Instrument above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	156	ffdd
40-45	Date & Time	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.	680625	iiiiii
46-50	Date & Time	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.	1415R	iiiia
51-54	Left Forepoint	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	455A	iiia
55-58	Left Forepoint	Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	3	ffdd
59	Left Forepoint	Visibility Code - leave blank if unknown.	V	a
60-61	Horizontal Angle	Number of Replications - see Glossary of Terms.	04	ii
62-63	Horizontal Angle	Rejection Limit (deviation from mean) in sec.	10	ii
64-71	Horizontal Angle	Clockwise Angle (mean) - degrees, minutes, seconds (DDDMMSSs). Leave last column blank if the angle is given to nearest second; leave last three columns blank if it is given to nearest minute.	0553802	iiiiiiid
72-75	Right Forepoint	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	308	iiia
76-79	Right Forepoint	Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	25	ffdd
80	Right Forepoint	Visibility Code - leave blank if unknown.	V	a

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

31 - Horizontal Angle Comment Record (Optional). Use this record for any comments pertinent to the set of angle observations. A comment explaining the problem encountered is required if the problem indicator (Column 25) on the respective Horizontal Angle Set Record (*30*) is 1.

000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777778 12345678901234567890123456789012345678901234567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*31* - Horizontal Angle Comment Record)	Comment If the comment(s) exceed 70 characters, use another *31* record for continuation. Any number of *31* records is allowed. Do not divide words between consecutive *31* records.
nnnnnn	*31*	
iiiiii	siis	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777778 12345678901234567890123456789012345678901234567890123456789012345678901234567890

32 - Horizontal Angle Record. Use this record for the second and subsequent angles observed in the same set; use Horizontal Angle Set Record (*30*) for the first angle observed in the set.

000000000111111111122222222223333333334444444445555555556666666667777777778	
123456789012345678901234567890123456789012345678901234567890123456789012345678	
nnnnn	Sequence Number Increment by 10 on successive records to allow for insertions.
*32*301 01	Data Code - preceded and followed by asterisk. (*32* - Horizontal Angle Record)
	Station Serial Number and Suffix of Standpoint Set Number Must be same as on the respective *30* record.
455A	Left Forepoint: Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
3	Left Forepoint: Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.
V	Left Forepoint: Visibility Code - leave blank if unknown.
02	Horizontal Angle: Number of Replications - see Glossary of Terms.
30	Horizontal Angle: Rejection Limit (deviation from mean) in sec.
120830	Horizontal Angle: Clockwise Angle (mean) - degrees, minutes, seconds (DDDMMSSs). Leave last column blank if the angle is given to nearest second; leave last three columns blank if it is given to nearest minute.
301K	Right Forepoint: Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
R	Right Forepoint: Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank. Right Forepoint: Visibility Code - leave blank if unknown.

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

40 - Vertical Angle Set Record. Use for the first vertical angle (VA) or zenith distance (ZD) observed in a set. Use Vertical Angle Record (*42*) for the remaining VAs or ZDs observed in the same set. Use Comment Record (*41*) immediately following *40* record for any comments.

```
00000000011111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

- Sequence Number — Increment by 10 on successive records to allow for insertions.
- Data Code - preceded and followed by asterisk. (*40* - Vertical Angle Set Record)

Standpoint and Set Information

- Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
- Set Number - use 02,03,etc. for successive sets.
- Field Record Book Volume Number - leave blank if field record book designation is not known.
- Number of VAs or ZDs Observed in This Set
- problem / visibility / temperature / cloud cover / wind — Weather Code - see ANNEX G. If problem indicator is 1 use *41* record for explanation.
- Initials of the Observer
- Job-Specific Instrument Number - see text.
- Height of Instrument above mark in meters (XXxx). Enter to nearest centimeter.

Date & Time

- Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.
- Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.

Forepoint

- Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
- Height of Target above mark in meters (XXxx). Enter to nearest centimeter.
- Visibility Code - leave blank if unknown.

Vertical Angle or Zenith Dist

- Number of Replications - see Glossary of Terms.
- Rejection Limit (spread between obs) in sec.
- VA or ZD (mean) - degrees, minutes, seconds (DDDMMSSs). Leave last column blank if the VA or ZD is given to nearest second; leave last three columns blank if it is given to nearest minute.
- Angle Code - E-elevation, D-depression, Z-ZD.

- Internal Consistency Sigma in seconds (XXxx).
- External Consistency Sigma in sec/km (XXxx).

See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

```
nnnnnn*40*101A0113214 0300 10CFK005 1676807131355R102  212V031000104132E  20  26
iiiiiisiisiiiaiiaaaaaaiiiiiiiaaaiiiffddiiiiiiiiiiaiiiatfddaiiiiiiiiiiiiidaffddffdd
00000000011111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

41 - Vertical Angle Comment Record (Optional). Use for any comments pertinent to the set of vertical angles or zenith distances. A comment explaining the problem encountered is required if the problem indicator (Column 25) on the respective Vertical Angle Set Record (*40*) is 1.

00000000011111111122222222223333333334444444445555555556666666667777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
nnnnnn*41*
iiiiiisiiS
00000000011111111122222222223333333334444444445555555556666666667777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890

Sequence Number Increment by 10 on successive records to allow for insertions.	
Data Code - preceded and followed by asterisk. (*41* - Vertical Angle Comment Record)	
Comment If the comment(s) exceed 70 characters, use another *41* record for continuation. Any number of *41* records is allowed. Do not divide words between consecutive *41* records.	

42 - Vertical Angle Record. Use this record for the second and subsequent vertical angles (VAs) or zenith distances (ZDs) observed in the same set; use Vertical Angle Set Record (*40*) for the first VA or ZD observed in the set.

000000000111111111222222222233333333334444444445555555556666666667777777778
123456789012345678901234567890123456789012345678901234567890123456789012345678
Sequence Number Increment by 10 on successive records to allow for insertions.
Data Code - preceded and followed by asterisk. (*42* - Vertical Angle Record)
Station Serial Number and Suffix of Standpoint
Set Number
Must be same as on the respective *40* record.
Time
Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.
Forepoint
Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
Height of Target above mark in meters (XXxx). Enter to nearest centimeter.
Visibility Code - leave blank if unknown.
Vertical Angle or Zenith Dist
Number of Replications - see Glossary of Terms.
Rejection Limit (spread between obs) in sec.
VA or ZD (mean) - degrees, minutes, seconds (DDDMMSSs). Leave last column blank if the VA or ZD is given to nearest second; leave last three columns blank if it is given to nearest minute.
Angle Code - E-elevation, D-depression, Z-ZD
See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
Internal Consistency Sigma in seconds (XXxx).
External Consistency Sigma in sec/km (XXxx).
nnnnnn*42*101A01 1405R103C 305V03100002805100 18 26
iiiiiisiisiiiaiibbbbbbbbbbbbbbbbbbbbbbbbbbbbbbiiiiaiiiaffddaiiiiiiiiiiiaffddffdd
000000000111111111222222222233333333334444444445555555556666666667777777778
123456789012345678901234567890123456789012345678901234567890123456789012345678

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

45 - Observed Difference of Elevation Record. Use this record for the observed difference. Use the Difference of Elevation Record (*47*) for the remaining data in this set. Use the Comment Record (*46*) immediately following *45* record for any comments.

Length of Section
Distance in Kilometers (XXxx)

Accuracy of Leveling
Sigma in Millimeters (XXxx)

Difference of Elevation

Observed Difference of Elevation between two marks, which may or maynot have an established vertical elevation (Bench Mark) for either one, in meters (XXXXXxxxx).

Number of Replications-See Glossary Terms.

Forepoint

Visibility Code - leave blank if unknown.

Station Serial Number and Suffix - See Chap 1. Leave last column blank if no suffix assigned.

Date & Time

Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.

Date of Observation - year, month, day (YYMMDD)

Standpoint & Set Information

Number of leveling setups

Job-Specific Instrument Number - (Level)

Initials of the Observer

Weather Code - See ANNEX G. if problem indicator is 1 use *46* record for explanation. (wind, cloud cover, temperature, visibility, problem)

Number of Objects Sighted in this Set

Field Record Book Volume Number - leave blank if field record book designation is not known.

Set Number - Use 2,3,etc. on successive sets

Station Serial Number and Suffix - See Chap 1. Leave last column blank if no suffix assigned.

Data Code - preceded and followed by an asterisk. (*45* - Difference of Elevation Set Record)

Sequence Number
Increment by 10 on successive records to allow for insertions.

46 - Difference of Elevation Comment Record (Optional). Use this record for any comments pertinent to this observation. A comment explaining the problem encountered is required if the problem indicator (Column 25) on the respective Difference of Elevation Set Record (*45*) is 1.

000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777 1234567890123456789012345678901234567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by an asterisk. (*46* - Difference of Elevation Comment Record)	Comment If the comment(s) exceed 70 characters, use another *46* record for continuation. Any number of *46* records is allowed. Do not divide words between consecutive *46* records.
nnnnnn	*46*	
iiiiii	siis	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777 1234567890123456789012345678901234567890123456789012345678901234567890

47 - Observed Difference of Elevation Record. Use this record for the second record in the same set. Use this record to indicate the Job-Specific Instrument (JSI) Number of the leveling rod and to show the Initials of the Observing Agency. Additional information will be coded using the Bench Mark Record (*83*) if either mark is an establish bench mark with a published elevation.

0000000001111111112222222223333333334444444445555555556666666777777778 1234567890123456789012345678901234567890123456789012345678901234567890				
Sequence Number **Increment by 10 on successive records to allow for insertions.**				
Data Code - preceded and followed by an asterisk. **(*47* - Difference of Elevation Set Record)**				
Must be the same as on the respective *45* record.	Set Number			
	Station Serial Number and Suffix of Standpoint			
		USGS	207	NGS
	Agency which Established or Maintains the mark(s) if one or the other has an established elevation. Use abbreviations listed in ANNEX C.			
	Job-Specific Instrument Number (Level Rod)			
	Agency which ran the levels between the two marks. Use abbreviations listed in ANNEX C			
nnnnn *47* 206 01				
iiiiisiiiaibbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb				
0000000001111111112222222223333333334444444445555555556666666777777778 1234567890123456789012345678901234567890123456789012345678901234567890				

50 - Taped Distance Record. Use for distances taped horizontally (Code T), reduced to horizontal (Code H), or less-than-one-tape-length distances measured along a slope (Code S). Use *52* record for taped distances reduced to sea level, to the ellipsoid, or to mark-to-mark.

Columns	Sample entry	Format	Group	Field description
01–06	nnnnnn	iiiiii		Sequence Number. Increment by 10 on successive records to allow for insertions.
07–10	*50*	siis		Data Code - preceded and followed by asterisk. (*50* - Taped Distance Record)
11–14	205	iiia	Standpoint Information	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
15		i	Standpoint Information	problem — Weather Code - see ANNEX G. If problem indicator is 1 use *55* record for explanation.
16		i	Standpoint Information	visibility
17		i	Standpoint Information	temperature
18		i	Standpoint Information	cloud cover
19		i	Standpoint Information	wind
20–22	LSB	aaa	Standpoint Information	Initials of the Observer
23–25	001	iii	Standpoint Information	Job-Specific Instrument Number - see text. Nor assigned to each tape or class of tapes in job.
26–29	52	ffdd	Standpoint Information	Tape Support Height above mark in meters (XXxx). Enter to nearest cm - for Code S distance only.
30–34		ffffd	Standpoint Information	Elevation of mark in meters (XXXXx). For Code H distance enter elevation to which the taped distance was reduced. Leave blank if unknown.
35–40	680723	iiiiii	Date & Time	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.
41–45	1545R	iiiia	Date & Time	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.
46–49	205M	iiia	Forepoint	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
50–53	21	ffdd	Forepoint	Tape Support Height above mark in meters (XXxx). Enter to nearest cm - for Code S distance only.
54–58	-128	fffdd	Forepoint	Elevation Difference with respect to standpoint (mark to mark) in meters (XXXxx). Enter to nearest cm - for Code S distance only.
59	R	a	Forepoint	Visibility Code - leave blank if unknown.
60–61	02	ii	Corrected Taped Distance	Number of Replications - see Glossary of Terms.
62–63	05	ii	Corrected Taped Distance	Rejection Limit (spread between obs) in mm.
64–72	11387	fffffdddd	Corrected Taped Distance	Corrected Taped Distance - horizontally taped (Code T), reduced to horizontal (Code H), or slope (Code S) distance with standardization, catenary, and temperature corrections applied as applicable to the method of measurement and/or equipment used, in meters (XXXXXxxxx).
73	S	a	Corrected Taped Distance	Distance Code - see above.
74–76	1	ffd		Internal Consistency Sigma in mm (XXx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
77–80	80	fffd		External Consistency Sigma in ppm (XXXx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

Visibility Code - Enter R (or Z) if the forepoint is RM (or Az Mk) regardless of station serial number suffix; otherwise enter V (or N) if the forepoint is (or is not) visible from ground.

51 - Unreduced Distance Record. Use for slant-range distances under 100km measured by electronic DME - instrument-to-reflector distances (electro-optical DME) or master-to-remote (microwave DME) - with resolution of 1cm or better. Use *52* record for coarser-resolution DME.

00000000011111111112222222223333333334444444445555555556666666667777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
nnnnn*51*001 0001BKM003 981 6807022310R002 435 NN43019458080 S 48 10
iiiiiisisiiiaiiiiiaaaiiiiffddbbbbbiiiiiiiiiiaiiiaffddbbbbbaiiiiffffddddsffdffd
00000000011111111112222222223333333334444444445555555556666666667777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890

Sequence Number
Increment by 10 on successive records to allow for insertions.

Data Code - preceded and followed by asterisk. (*51* - Unreduced Distance Record)

Standpoint Information

Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.

problem indicator
visibility
temperature
cloud cover
wind

Weather Code - see ANNEX G. If problem indicator is 1 use *55* record for explanation.

Initials of the Observer

Job-Specific Instrument Number - see text.

Height of Instrument above mark in meters (XXxx) Enter to nearest centimeter.

Date & Time

Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.

Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.

Forepoint

Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.

Height of Reflector above mark in meters (XXxx). Enter to nearest centimeter.

Visibility Code - leave blank if unknown.

Corrected Slant Range Distance

Number of Replications - see Glossary of Terms.

Rejection Limit (spread between obs) in mm.

Corrected Slant-Range Distance - with instrument, reflector, and refraction corrections applied, as applicable to the method of measurement and/or equipment used, in meters (XXXXXxxxx).

Distance Code - always S on this record.

Internal Consistency Sigma in mm (XXx).

External Consistency Sigma in ppm (XXXx).

See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

Visibility Code - Enter R (or Z) if the forepoint is RM (or Az Mk) regardless of station serial number suffix; otherwise enter V (or N) if the reflector is (or is not) visible from ground.

52 - Reduced Distance Record. Use this record for distances under 100km measured to a precision of 1cm or better which have been reduced to sea level or geoid (Code G), to the ellipsoid (Code E), or to mark-to-mark (Code X). Use *54* record for courser-precision distances.

Columns	Format	Example	Description	Group
1–6	nnnnnn		Sequence Number. Increment by 10 on successive records to allow for insertions.	
7–10	*52*	*52*	Data Code - preceded and followed by asterisk. (*52* - Reduced Distance Record)	
11–14	iiis	001	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Standpoint Information
15–19	iiiii	00010	problem, visibility, temperature, cloud cover, wind — Weather Code - see ANNEX G. If problem indicator is 1 use *55* record for explanation.	Standpoint Information
20–22	aaa	BKM	Initials of the Observer.	Standpoint Information
23–25	iii	003	Job-Specific Instrument Number - see text.	Standpoint Information
26–29	fffd	-33	Geoid Height used in the reduction process, in meters (XXXx). Leave blank for Code G distance.	Standpoint Information
30–34	ffffd	2830	Elevation of the mark, as used in the reduction process, in meters (XXXXx).	Standpoint Information
35–40	iiiiii	680702	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.	Date & Time
41–45	iiiia	2310R	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.	Date & Time
46–49	iiia	002	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Forepoint
50–53	fffd	-38	Geoid Height used in the reduction process, in meters (XXXx). Leave blank for Code G distance.	Forepoint
54–58	ffffd	2504	Elevation of the mark, as used in the reduction process, in meters (XXXXx).	Forepoint
59	a	N	Visibility Code - leave blank if unknown.	Forepoint
60–61	ii	04	Number of Replications - see Glossary of Terms.	
62–63	ii	30	Rejection Limit (spread between obs) in mm.	Reduced Distance
64–72	ffffffddd	019457220	Reduced Distance - distance reduced to sea level or geoid (Code G), to the ellipsoid (Code E), or to mark-to-mark (Code X), in meters (XXXXXxxxx). Do not enter to more decimals of meter than is warranted by the precision of the observation.	Reduced Distance
73	a	E	Distance Code - see above.	Reduced Distance
74–76	ffd	48	Internal Consistency Sigma in mm (XXx).	See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
77–80	fffd	10	External Consistency Sigma in ppm (XXXx).	See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

Visibility Code - Enter R (or Z) if the forepoint is NM (or Az Mk) regardless of station serial number suffix; otherwise enter V (or N) if the reflector is (or is not) visible from ground.

53 - Unreduced Long Line Record. Use this record for instrument-to-instrument spacial-chord distances derived from long-range electronic DME observations (e.g. HIRAN), obtained by extra-terrestrial methods (e.g. VLBI), or for slant-range distances measured by coarse-resolution DME.

Columns	Group	Field	Example	Format
1–6		Sequence Number Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7–10		Data Code - preceded and followed by asterisk. (*53* - Unreduced Long Line Record)	*53*	siis
11–14	Standpoint Information	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	750	iiia
15–22	Standpoint Information			bbbbbbbb
23–25	Standpoint Information	Job-Specific Instrument Number - see text.	905	iii
26–29	Standpoint Information	Height of Instrument (antenna) above mark in meters (XXxx).	159	ffdd
30–34	Standpoint Information			bbbbb
35–40	Date & Time	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.	650209	iiiiii
41–45	Date & Time	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.	1330I	iiiia
46–49	Forepoint	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	800A	iiia
50–53	Forepoint	Height of Instrument (antenna) above mark in meters (XXxx).	311	ffdd
54–58	Forepoint			bbbbb
59–60		Number of Replications - see Glossary of Terms.	06	ii
61–63	Corrected Spacial Chord Distance	Rejection Limit (spread between observations) in meters (XXx).	10	ffd
64–73	Corrected Spacial Chord Distance	Corrected Spacial-Chord Distance - derived instrument-to-instrument (antenna-to-antenna) spacial chord (Code C) or directly-observed slant range (Code S), with all applicable corrections applied, in meters (XXXXXXXxxx).	5920823	fffffffddd
74		Distance Code - see above.	C	a
75–77		Internal Consistency Sigma in meters (Xxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.	21	fdd
78–80		External Consistency Sigma in meters (Xxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.	3	fdd

54 - Reduced Long Line Record. Use this record for long lines (100km and longer), or for any distances measured to a precision coarser than 1cm, which have been reduced to sea level or geoid (Code G), to the ellipsoid (Code E), or to mark-to-mark spacial-chord distance (Code X).

Group	Example	Description
	nnnnnn	Sequence Number. Increment by 10 on successive records to allow for insertions.
	54	Data Code - preceded and followed by asterisk. (*54* - Reduced Long Line Record)
Standpoint Information	750	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
Standpoint Information		
Standpoint Information	905	Job-Specific Instrument Number - see text.
Standpoint Information		Geoid Height used in the reduction process, in meters (XXXx). Leave blank for Code G distance.
Standpoint Information	15240	Elevation of the mark, as used in the reduction process, in meters (XXXXx).
Date & Time	650209	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known.
Date & Time	1330L	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.
Forepoint	800A	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.
Forepoint		Geoid Height used in the reduction process, in meters (XXXx). Leave blank for Code G distance.
Forepoint	60960	Elevation of the mark, as used in the reduction process, in meters (XXXXx).
	06	Number of Replications - see Glossary of Terms.
Reduced Distance	10	Rejection Limit (spread between observations) in meters (XXx).
Reduced Distance	59212440	Reduced Distance - distance reduced to sea level or geoid (Code G), to the ellipsoid (Code E), or to mark-to-mark (Code X), in meters (XXXXXXXxxx). Do not enter to more decimals of meter than is warranted by the precision of the observation.
Reduced Distance	G	Distance Code - see above.
	21	Internal Consistency Sigma in meters (Xxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
	3	External Consistency Sigma in meters (Xxx). See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

55 - Distance Comment Record (Optional). Use immediately following a *50*,*51*,*52*,*53*,*54* record for any comments pertinent to the distance observation. A comment explaining the problem encountered is required if the problem indicator (Column 15) on the *50*,*51*,*52* record is 1.

000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777778 1234567890123456789012345678901234567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*55* - Distance Comment Record)	Comment If the comment(s) exceed 70 characters use another *55* record for continuation. Any number of *55* records is allowed. Do not divide words between consecutive *55* records.
nnnnnn	*55*	
iiiiii	siis	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
000000 123456	0001 7890	11111111122222222223333333333444444444455555555556666666666777777777778 1234567890123456789012345678901234567890123456789012345678901234567890

60 - Laplace Azimuth Record. Use for each astro azimuth set observed in this project. In addition to being given here in Laplace azimuth form, each astro azimuth set must also appear among the Astronomic (ASTR) Data (astro latitudes, longitudes, and azimuths) - see Chapter 9.

Columns	Format	Example	Description	Group
1-6	iiiiii	nnnnnn	Sequence Number. Increment by 10 on successive records to allow for insertions.	
7-10	siis	*60*	Data Code - preceded and followed by asterisk. (*60* - Laplace Azimuth Record)	
11-14	iiia	301	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Standpoint Information
15-17	ffd	27	Prime-Vertical Component of Deflection (Eta) as used in Laplace correction, in seconds (XXXx).	Standpoint Information
18	a	E	Direction of Eta - E or W.	Standpoint Information
19-28	bbbbbbbbbb			Standpoint Information
29-31	aaa	AST	Initials of the Observer	Standpoint Information
32-34	iii	018	Job-Specific Instrument Number - see text.	Standpoint Information
35-38	ffdd	165	Height of Instrument above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	Standpoint Information
39-44	iiiiii	680627	Date of Observation - year, month, day (YYMMDD). Leave last 2 columns blank if day is not known. Leave last 4 columns blank if month not known. Use separate records for different sets (nights).	Date & Time
45-49	iiiia	2200R	Local Time - hours and minutes (HHMM) followed by time zone designation - see ANNEX H. Leave blank if time of observation is not known.	Date & Time
50-53	iiia	301S	Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Forepoint
54-57	ffdd	122	Height of Target above mark in meters (XXxx). Enter to nearest cm, dm, or m, else leave blank.	Forepoint
58	a	Z	Visibility Code - leave blank if unknown.	Forepoint
59-60	ii	16	Number of Replications - see Glossary of Terms.	
61-62	ii	05	Rejection Limit (deviation from mean) in sec.	Laplace Azimuth
63-70	iiiiiiid	03548013	Laplace Azimuth - degrees, minutes, seconds (DDDMMSSs) - astro azimuth (mean of one set) with Laplace correction applied, but without skew normal, geodesic, and deflection corrections applied to the respective direction.	Laplace Azimuth
71	a	S	Origin of Azimuth - N or S.	Laplace Azimuth
72-75	ffdd	5	Internal Consistency Sigma in seconds (XXxx).	See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.
76-80	ffdd	15	External Consistency Sigma in seconds (XXxx).	See Glossary of Terms. Enter only if reliable estimates are available; otherwise leave blank.

Visibility Code - Enter R (or Z) if the forepoint is RM (or azimuth mark) regardless of station serial number suffix; otherwise enter V (or N) if the target is (or is not) visible from ground.

61 - Geodetic Azimuth Record. Use this record for each geodetic azimuth used to orient the survey - either azimuth to an azimuth mark at a previously-established (e.g. published) station which was occupied in this project, or geodetic azimuth obtained by inverse position computation.

Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*61* - Geodetic Azimuth Record)	Standpoint Information: Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Forepoint: Station Serial Number and Suffix - see Chap 1. Leave last column blank if no suffix assigned.	Geodetic Azimuth: Geodetic Azimuth - degrees, minutes, seconds (DDDMMSSs). Either published azimuth to an azimuth mark or geodetic azimuth obtained by inverse position computation. Origin of Azimuth - N or S.
0000000001111111112222222223333333334444444445555555556666666667777777778				
1234567890123456789012345678901234567890123456789012345678901234567890				
nnnnnn	*61*	229	229	2240139S
iiiiiisisiiiiabbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb				
0000000001111111112222222223333333334444444445555555556666666667777777778				
1234567890123456789012345678901234567890123456789012345678901234567890				

70 - Instrument Record. Use this record for identification data pertaining to each instrument. A *70* record must be prepared for each job-specific instrument number assigned to an individual instrument or to a class of instruments (e.g. 100-ft uncalibrated steel tapes) in this project.

Columns	Description	Sample	Format
1–6	Sequence Number Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7–10	Data Code - preceded and followed by asterisk. (*70* - Instrument Record)	*70*	siis
11–13	Job-Specific Instrument Number - see text.	001	iii
14–17	NGS Survey Equipment Code - see ANNEX F.	1461	iiii
18–20	Resolution of the Instrument - the size of the smallest directly-readable measurement unit (XXxx).	001	fdd
21–22	Units - in which resolution of instrument is given.	FT	aa
23–42	Manufacturer of the Instrument - examples: WILD, KERN, ZEISS/OBERKOCHEN, ZEISS/JENA, KEUFFEL AND ESSER, HILGER-WATTS, GURLEY, AGA, PLESSEY, HEWLETT-PACKARD, CUBIC, SPECTRA-PHYSICS, FAIRCHILD, LSE	KEUFFEL AND ESSER	aaaaaaaaaaaaaaaaaaaa
43–62	Type of Instrument or Trade Name - examples: DIRECTION THEODOLITE, REPEATING THEODOLITE, ENGINEERS TRANSIT, LIGHTWAVE DME, INFRARED DME, MICROWAVE DME, CALIB INVAR TAPE, CALIB STEEL TAPE, UNCAL STEEL TAPE, GEODIMETER, GEODOLITE, RANGEMASTER, MICRORANGER, AKKURANGER, DISTOMAT, TELLUROMETER, ELECTROTAPE, MICROCHAIN	UNCAL STEEL TAPE	aaaaaaaaaaaaaaaaaaaa
63–70	Model or Class of Instrument - examples: T-3, T-2, DKM3, DKM2, TH2, THEO-010, CA-1000, MA-100, 30-MT, 100-FT	100-FT	aaaaaaaa
71–80	Serial Number - alphanumeric, left-justified. Leave blank if the serial number is not known.		aaaaaaaaaa

Units - MT meters, MM millimeters, FT feet, MF millifeet, SA seconds of arc, MA minutes of arc

Leave Resolution and Units blank if not expressible in these units.

80 - Control Point Record. Use this record for the name, position in geographic coordinates (latitude and longitude), and elevation of each control point. Use *81* record if the position is given in Universal Transverse Mercator (UTM) coordinates or in State Plane Coordinates (SPC).

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0000000001111111112222222223333333334444444445555555556666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789
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nnnnnn	Sequence Number Increment by 10 on successive records to allow for insertions.
80	Data Code - preceded and followed by asterisk. (*80* - Control Point Record)
iiiiii	Station Serial Number (unsuffixed) - see Chapter 1.
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	Station Name - must not exceed 30 characters. The name of a horizontal control point with peripheral reference and/or azimuth marks must not exceed 24 characters in order to allow the symbol RM 1, RM 2, etc. and/or AZ MK to be appended without exceeding the 30-character total length limit. Neither the "year mark set" nor the "year established" are normally included in a station name - see text for exceptions. See ANNEX C and ANNEX D for abbreviation guidelines. Omit punctuation marks (periods, commas, etc.) and parentheses. NOTE - ELEVATION OF A LANDMARK INTERSECTION STATION MAY BE OMITTED
ddddddd	Geodetic Position in Geographic Coordinates Enter field, adjusted, or published position. Latitude Degrees, minutes, seconds (DDMMSSssssss).
a	Direction of Latitude - N or S.
ddddddd	Longitude Degrees, minutes, seconds (DDDMMSSssssss).
a	Direction of Longitude - E or W.
fffdd	Elevation of mark above MSL in meters (XXXXxx). Enter to nearest cm (Code B,L), dm (Code R), or m (Code V,P,M). Prepare *83* record for Code B or L.
a	Elevation Code - see footnote.
aa	State or Country Code - see ANNEX A.
i	Station Order and Type - see text and ANNEX E.

```
0000000001111111112222222223333333334444444445555555556666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789
```

nnnnnn*80*015 AKRON 1 41065825 30 N0813255 9192 W 3309 0BOH23

Elevation Code - B bench mark (BM) R reciprocal vertical angles P photogrammetric
L spur level line to BM V non-recipr vertical angle(s) M map or barometric

81 - Control Point Record (UTM/SPC). Use for the name, position in Universal Transverse Mercator (UTM) coordinates or in State Plane Coordinates (SPC), and elevation of each control point. Use *80* record if the position is given in geographic coordinates (latitude and longitude).

Columns	Sample entry	Format	Description
1–6	nnnnnn	iiiiii	Sequence Number. Increment by 10 on successive records to allow for insertions.
7–10	*81*	siis	Data Code - preceded and followed by asterisk. (*81* - Control Point Record (UTM/SPC))
11–14	015	iiii	Station Serial Number (unsuffixed) - see Chapter 1.
15–44	AKRON	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	Station Name - must not exceed 30 characters. The name of a horizontal control point with peripheral reference and/or azimuth marks must not exceed 24 characters in order to allow the symbol RM 1, RM 2, etc. and/or AZ MK to be appended without exceeding the 30-character total length limit. Neither the "year mark set" nor the "year established" are normally included in a station name - see text for exceptions. See ANNEX C and ANNEX D for abbreviation guidelines. Omit punctuation marks (periods, commas, etc.) and parentheses. NOTE - ELEVATION OF A LANDMARK INTERSECTION STATION MAY BE OMITTED
45–54	226206921	fffffffddd	UTM - X-Coordinate in Meters (Easting). SPC - X-Coordinate in Feet (XXXXXXXxxx).
55–64	52951228	fffffffddd	UTM - Y-Coordinate in Meters (Northing). SPC - Y-Coordinate in Feet (YYYYYYYyyy).
65–68	3401	iiii	UTM - Zone Number (0001 - 0060). SPC - State and Zone Code (SSZZ) - see ANNEX B.
69–75	33090	ffffdd	Elevation of mark above MSL in meters (XXXXxx). Enter to nearest cm (Code B,L), dm (Code R), or m (Code V,P,M). Prepare *83* record for Code B or L.
76	B	a	Elevation Code - see footnote.
77–78	OH	aa	State or Country Code - see ANNEX A.
79–80	23	ii	Station Order and Type - see text and ANNEX E.

Geodetic Position in UTM or SP Coordinates (columns 45–68): Enter field, adjusted, or published position.

Elevation Code - B bench mark (BM)
L spur level line, to BM
R reciprocal vertical angles
V non-recipr vertical angle(s)
P photogrammetric
M map or barometric

82 - Reference or Azimuth Mark Record. Use this record to give the name or designation of each reference mark (RM) or azimuth mark (Az Mk). Use the Control Point Record (*80* or *81*) if the position of the RM or Az Mk is to be determined (i.e., when the RM or Az Mk is a control point).

000000 123456	0001 7890	1111 1234	111112222222222333333333344444 567890123456789012345678901234	444445555555555666666666677777777778 567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*82* - Reference or Azimuth Mark Record)	Station Serial Number and Suffix - see Chapter 1. Suffix must be K-R (RM) or S-Z (Az Mk).	Name or Designation of RM or Az Mk - must not exceed 30 characters. Normally, the name of an RM or Az Mk is composed by appending the symbol RM 1, RM 2, etc. or the symbol AZ MK to the name of the respective control point (see text). Omit punctuation marks (periods, commas, etc.) and parentheses.	Note - Use this record in lieu of *80* or *81* record for control points (identified by unsuffixed station serial number) to which direction, angle, and/or distance observations were made but which (1) cannot be positioned using data of this project alone, and (2) for which a position is not available from other sources. See footnote on *83* record for the treatment of unpositionable vertical control points.
nnnnnn	*82*	015K	AKRON RM 1	
iiiiii	siis	iiia	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
000000 123456	0001 7890	1111 1234	111112222222222333333333344444 567890123456789012345678901234	444445555555555666666666677777777778 567890123456789012345678901234567890

Important - Distance, direction, and/or angle observations to an RM or Az Mk must appear among the *20*-series (direction), *30*-series (angle), and *50*-series (distance) observation records.

83 - Bench Mark Record. Use this record for each bench mark (BM) which is also a horizontal control point (Elev Code B), from which a spur level line was run to a horizontal control point (Elev Code L), or which is a vertical control point only (i.e., not positionable) - see footnote.

`00000000011111111112222222222333333333344444444445555555555666666666677777777778`
`12345678901234567890123456789012345678901234567890123456789012345678901234567890`

Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*83* - Bench Mark Record)	Station Serial Number and Suffix - see Chapter 1. Leave blank if none assigned (BM used for Code L).	Name or Designation of Bench Mark or of vertical control point - see footnote.		Agency which Established and/or Maintains the BM. Use abbreviations listed in ANNEX C - or the one specified on the Data Set Identification Record.	Elevation of the BM in meters (XXXXxxx). Leave blank for vertical control points whose elevation is to be determined - see footnote.	For Elev Code L Only — Spur Level Line Between BM & Horizontal Control Point: Agency which Ran the Spur Level Line. Enter abbreviation listed in ANNEX C or on Data Set Identification Record.	Approximate Length in km (Xxx).	Number of Setups	Elevation Difference (plus or minus) from BM to horizontal control point in meters (XXXXxxx) - preceded by minus sign if the elev difference is negative.	Sigma - estimated accuracy of the elevation difference in meters (Xxxx).
nnnnnn	*83*	015	AKRON		NGS	330900					
iiiiii	siis	iiia	aaaaaaaaaaaaaaaaaaaaaaaaa	bbbbb	aaaaaa	fffdddd	aaaaaa	fdd	iii	ffffddd	fddd
000000	0001	1111	1111122222222223333333333	44444	444445	5555555	556666	666	666	7777777	7778
123456	7890	1234	5678901234567890123456789	01234	567890	1234567	890123	456	789	0123456	7890

Note - Use this record in lieu of *80* or *81* record for survey points to and/or from which vertical angle(s) and distance(s) have been observed, but no horizontal directions or angles.

84 - Geoid Height Record (Optional). Use this record to give the source and the value of the height of geoid above (positive) or below (negative) the reference ellipsoid. The datum must be North American 1927 or as specified on the Geodetic Datum and Ellipsoid (*13*) record.

000000 123456	0001 7890	1111 1234	1 5	11112 67890	222222222333333333344444444445555555555666666666677 123456789012345678901234567890123456789012345678901	77777 23456	7778 7890
						Geoid Height	
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*84* - Geoid Height Record)	Station Serial Number (unsuffixed) - see Chapter 1.		Source - agency which determined the geoid height. Use abbreviations listed in ANNEX C - or the one specified on the Data Set Identification Record.	Comment Use this space for any comments which might further clarify the source of geoid height information.	Geoid Height above (positive) or below (negative) the reference ellipsoid, in meters (XXXXx).	Sigma - estimated accuracy (standard error) of the geoid height, in meters (XXXx).
nnnnnn	*84*	015		TPC	ASTRO-GEODETIC GEOID CONTOUR MAP (US ARMY TOPOCOM)	-35	10
iiiiii	siis	iii	b	aaaaa	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	ffffd	fffd
000000 123456	0001 7890	1111 1234	1 5	11112 67890	222222222333333333344444444445555555555666666666677 123456789012345678901234567890123456789012345678901	77777 23456	7778 7890

85 - Deflection Record (Optional). Use to give the source and the values of the meridional component (Xi) and/or prime-vertical component (Eta) of the deflection of vertical. The datum must be North American 1927 or as specified on the Geodetic Datum and Ellipsoid (*13*) record.

Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*85* - Deflection Record)	Station Serial Number (unsuffixed) - see Chapter 1.	Source - agency which determined the deflection. Use abbreviations listed in ANNEX C - or the one specified on the Data Set Identification Record.	Comment Use this space for any comments which might further clarify the source of deflection information.			Xi	Eta
					Meridional Component (Xi) of the deflection of vertical, in seconds (XXXxx).	6	S	W
					Direction of Xi - N or S.			
					Sigma - estimated accuracy (standard error) of Xi, in seconds (Xxx).	5		
					Prime-Vertical Component (Eta) of the deflection of vertical, in seconds (XXXxx).	17	W	S
					Direction of Eta - E or W.			
					Sigma - estimated accuracy (standard error) of Eta, in seconds (Xxx).	8		
nnnnn	*85*	015	OH0070	SECOND ORDER ASTRO LATITUDE AND LONGITUDE				

90 - Fixed Control Record. Use to identify previously-established horizontal control points from which and/or to which horizontal control was extended in this project. Two or more fixed control points will normally be expected in a horizontal control survey project - see footnote.

Columns	Example	Description
01-06	nnnnnn	Sequence Number Increment by 10 on successive records to allow for insertions.
07-10	*90*	Data Code - preceded and followed by asterisk. (*90* - Fixed Control Record)
11-14	0015	Station Serial Number (unsuffixed) - see Chapter 1.
15		
16-20	NGS	Source - agency which determined the coordinates. Use abbreviations listed in ANNEX C or the one on Data Set Identification Record, else leave blank.
21-74		Comment If the name of the agency which determined the coordinates does not appear in ANNEX C or on the Data Set Identification Record, give the full name of the agency in this space. Otherwise, use this space for any comments pertinent to the control point.
75-80	G01285	NGS Source Number - if known; blank for control points of other agencies.

Important - If only one previously-established horizontal control point is identified as fixed, scale and orientation must be given by *50*-series (distance) and *60*-series (azimuth) records.

Data Set Termination Record. This must be the last record of every data set submitted.

000000	0001	1111111112222222222333333333344444444445555555555566666666667777777778
1234567	8901	2345678901234567890123456789012345678901234567890123456789012345678901
Sequence Number Increment by 10 on successive records to allow for insertions.	Job Code - preceded and followed by asterisk.	
nnnnnn	*A1*	
iiiiii	saas	bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
000000	0001	1111111112222222222333333333344444444445555555555566666666667777777778
1234567	8901	2345678901234567890123456789012345678901234567890123456789012345678901

Data Set Structure:
An HZTL OBS data set may contain one or more projects.

Data Set Identification Record	
10-series records *20*-series records :::: *90* records	FIRST PROJECT
10-series records *20*-series records :::: *90* records	SECOND PROJECT
:::: ::::	:::: ::::
10-series records *20*-series records :::: *90* records	LAST PROJECT
Data Set Termination Record	

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Chapter 3

HORIZONTAL DESCRIPTIVE (HZTL DESC) DATA

INTRODUCTION

The purpose of this chapter is to provide detailed specifications and instructions for the coding and keying of the descriptive data set of a horizontal control job. This data set contains station descriptions and/or recovery notes pertaining to the control points which occur in one or more survey projects contained in the horizontal control job.

As was explained in Chapter 1, a horizontal control job consists of two distinct data sets which must be submitted together. For data submitted in MODE 1 configuration (Field Observations and Station Descriptive Data), the companion data set to the horizontal descriptive (HZTL DESC) data set treated in this chapter is the corresponding HZTL OBS data set (see Chapter 2). For data submitted in MODE 2 configuration (Adjusted Positions and Station Descriptive Data), the companion data set is the corresponding HZTL POS data set (see Chapter 4).

In addition to the respective definitions, a discussion of the relative merit of submitting data in MODE 1 versus MODE 2 configuration is given in Chapter 1.

HZTL DESC DATA SET RECORDS

The data which constitute an HZTL DESC data set are organized into nine categories, which are as follows:

General Station Description and Recovery Data

1. Station Identification Data
2. Monumentation and Recovery Data
3. Reference Data
4. General Descriptive Text

Optional Partially Coded Descriptive Text

5. Station Location Text
6. Station Paragraph
7. Reference Mark Paragraph
8. Azimuth Mark Paragraph
9. Additional Descriptive Text

Within these categories, the respective data have been grouped into one or more logical units called "records." A record is a string of characters containing data coded according to a specific format. Every record

in an HZTL DESC data set consists of 80 characters or "columns" (standard punched card image). Within each record, the 80 columns are divided into fixed-length "character fields," each field being the space reserved for a specific data item. Accordingly, for every desired data item, there exists a field of appropriate length into which the data item in question is to be entered after it is converted into a string of alphanumeric characters. The set of rules according to which specific data items are converted into strings of alphanumeric characters to be entered in the fields of a record is known as the "format" of that record.

The types of records which may appear in an HZTL DESC data set are listed in Table 3-1 on the following page. Each type of record has been given a name, and a block diagram illustrating the respective format has been prepared to serve as a model for that record - see under FORMAT DIAGRAMS.

Except for the first and last records of the data set, the second character field of each record (columns 7-10) contains a two-digit numerical data code preceded and followed by an asterisk, which specifies the type of that record (*10*,*14*,*20*,...,*90* - see Table 3-1). On some of the records, more than one such data codes appear in other fixed positions (i.e., columns 33-36, 54-57, and 70-73) to serve as labels for important data items to be entered immediately following the respective data codes.

The first and last records of the data set (the Data Set Identification Record and the Data Set Termination Record) display the two-character alphanumeric job code, preceded and followed by asterisk, in the field normally occupied by the first data code (columns 7-10). This job code is assigned sequentially (*A1*, *A2*,...,*ZZ* - see Chapter 1) by the submitting agency. The first character field of every record (columns 1-6) is reserved for the respective record sequence number - see Chapter 1.

STRUCTURE OF THE HZTL DESC DATA SET

The first record of an HZTL DESC data set must be the Data Set Identification Record which contains the required information to identify the data set and to correlate it with its companion HZTL OBS (or HZTL POS) data set, i.e., the job code, data type (HZTL DESC), name of submitting agency, and date the data set was created. The last record of the data set must be the Data Set Termination Record recognized as such because it is the only other record in the data set on which the respective job code appears in the same field (columns 7-10) as on the Data Set Identification Record.

Between these two delimiting records, the descriptive data submitted in the HZTL DESC data set must be organized as one or more data blocks, each containing the station description and/or one or more recovery notes which pertain to the same horizontal control point. Furthermore, these "station blocks" must follow sequentially in the order of increasing Station Serial Number of the respective horizontal control points - see Chapter 1 for the definition of Station Serial Number.

TABLE 3-1
HORIZONTAL DESCRIPTIVE DATA SET RECORDS

FIRST RECORD
aa - Data Set Identification Record
STATION IDENTIFICATION DATA
10,*11*,*12*,*13* - Station Identification Record
14,*15* - Station Name Record
MONUMENTATION AND RECOVERY DATA
20,*21*,*22*,*23* - Monument-by-Agency Record
24,*25*,*26*,*27* - Recovery-by-Agency Record
REFERENCE DATA
30 - Reference Object Record (also *30*$ and *30*$$)
GENERAL DESCRIPTIVE TEXT
40 - Descriptive Text Record (also *40*$ and *40*$$)
OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT RECORDS
STATION LOCATION TEXT
50 - Landmark Description Text Record
51 - Station Location Text Record
52 - To-Reach-From Text Record
STATION PARAGRAPH
60 - Surface Mark Description Text Record
61 - Surface Mark Standard Disk Record
62 - Surface Mark Set in Concrete/Steel Pipe Record
63 - Surface Mark Set in Rock Outcrop/Boulder Record
64 - Surface Mark Setting/Location Text Record
65 - Surface Mark Local Reference Record
66 - Underground Mark Description Text Record
67 - Underground Mark Standard Disk Record
68 - Underground Mark Setting Record
REFERENCE MARK (RM) PARAGRAPH
70 - RM Description Text Record
71 - RM Standard Disk Record
72 - RM Set in Concrete/Steel Pipe Record
73 - RM Set in Rock Outcrop/Boulder Record
74 - RM Setting/Location Text Record
75 - RM Local Reference Record
AZIMUTH MARK (AZ MK) PARAGRAPH
80 - Az Mk Description Text Record
81 - Az Mk Standard Disk Record
82 - Az Mk Set in Concrete/Steel Pipe Record
83 - Az Mk Set in Rock Outcrop/Boulder Record
84 - Az Mk Setting/Location Text Record
85 - Az Mk Local Reference Record
86 - Az Mk To-Reach-From Text Record
ADDITIONAL DESCRIPTIVE TEXT
90 - Additional Text Record (also *90*$ and *90*$$)
LAST RECORD
aa - Data Set Termination Record

Note: The symbol "aa" denotes the two-character job code assigned by the submitting agency - see Chapter 1.

For descriptive data extracted from archives, each station block of an HZTL DESC data set should contain the original station description or the oldest recovery note on file, followed by all subsequent recovery notes for that station in chronological order. For descriptive data submitted at the completion of a horizontal control survey project, each station block will normally contain just one station description if the station is a new horizontal control point, or else just one recovery note if the station is a previously-established horizontal control point which was recovered in the course of the project. The overall structure of the HZTL DESC data set is shown in Table 3-2 below.

TABLE 3-2 - STRUCTURE OF THE HZTL DESC DATA SET

Data Set Identification Record	
Description or Recovery Note Subsequent Recovery Note :::: Subsequent Recovery Note (if any)	First Station
Description or Recovery Note Subsequent Recovery Note :::: Subsequent Recovery Note (if any)	Second Station
:::: ::::	:::: ::::
Description or Recovery Note Subsequent Recovery Note :::: Subsequent Recovery Note (if any)	Last Station
Data Set Termination Record	

Station Description: Station description is a document which is normally prepared for every horizontal control point when it is first established (i.e., positioned), be it a monumented survey point or an unmonumented recoverable landmark (usually an intersection station) such as a flagpole or church spire. The purpose of the station description is to provide, in a concise and standardized manner, all pertinent information which may be necessary or useful to locate, positively identify, and/or utilize the horizontal control point.

In addition to the respective station identification, monumentation, and reference data sections, a station description normally contains a narrative section which gives the location of the station, specific directions how it may be reached from a readily locatable landmark such as a public building in a nearby town or the crossroads of prominent highways, and a detailed description of the station mark or monument itself and of the reference and azimuth marks associated with it, if any. This narrative section may be coded either as a sequence of general descriptive text records or, optionally, as a sequence of partially coded text records. See Tables 3-3, 3-4, and 3-5 for the three possible structures of a station description.

TABLE 3-3
RECORD SEQUENCE IN THE DESCRIPTION OF A LANDMARK OR MONUMENTED STATION WITH GENERAL DESCRIPTIVE TEXT

10,*11*,*12*,*13* Station Identification Record *14*,*15* Station Name Record		STATION ID DATA
20,*21*,*22*,*23* Monument-by-Agency Record		MONUM DATA
30 *30* Reference Object :::: Records *30*	First Reference Data Set	REFERENCE DATA (if any)
30$ Reference Data Separation Record		
30 *30* Reference Object :::: Records *30*	Second Reference Data Set	
30$ Reference Data Separation Record		
::::	::::	
::::	::::	
30$ Reference Data Separation Record		
30 *30* Reference Object :::: Record *30*	Last Reference Data Set	
30$$ Reference Data Termination Record		
40 *40* Descriptive :::: Text Record(s) *40*	First Paragraph	GENERAL DESCRIPTIVE TEXT
40$ Paragraph Separation Record		
40 *40* Descriptive :::: Text Record(s) *40*	Second Paragraph	
40$ Paragraph Separation Record		
::::	::::	
::::	::::	
40$ Paragraph Separation Record		
40 *40* Descriptive :::: Text Record(s) *40*	Last Paragraph	
40$$ Text Data/Description Termination Record (always required)		

TABLE 3-4

RECORD SEQUENCE IN THE DESCRIPTION OF A MONUMENTED STATION WITH OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

10,*11*,*12*,*13* Station Identification Record *14*,*15* Station Name Record			STATION ID DATA	
20,*21*,*22*,*23* Monument-by-Agency Record			MONUM DATA	
30 *30* Reference Object :::: Records *30*	First Reference Data Set		REFERENCE DATA (if any)	
30$ Reference Data Separation Record				
:::: ::::	:::: ::::			
30$ Reference Data Separation Record				
30 *30* Reference Object :::: Records *30*	Last Reference Data Set			
30$$ Reference Data Termination Record				
51 *51* Station Location :::: Text Record(s) *51*	Station Location Paragraph		STATION LOCATION TEXT	
52 *52* To-Reach-From :::: Text Record(s) *52*	To-Reach-From Paragraph			
60 *60* Surface Mark Description :::: Text Record(s) *60*	-OR- *61* Surface Mark Standard Disk Record		Surface Mark	STATION PARAGRAPH
Surface Mark Set in *62* Concrete/Steel Pipe Record -OR- Surface Mark Set in *63* Rock Outcrop/Boulder Record	*64* -AND/OR- *64* Surface Mark :::: Set/Loc Text *64* Record(s)			
65 *65* Surface Mark Local Reference :::: Record(s) *65*				
66 *66* Underground Mark Description :::: Text Record(s) *66*	-OR- *67* Underground Mark Standard Disk Record		U-ground Mark (if any)	
68 Underground Mark Setting Record				

(CONTINUED ON NEXT PAGE)

TABLE 3-4 - CONTINUED
RECORD SEQUENCE IN THE DESCRIPTION OF A MONUMENTED STATION
WITH OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

70 *70* RM Description :::: Text Record(s) *70*		-OR- *71* RM Standard Disk Record	Repeat for each additional RM REFERENCE MARK (RM) PARAGRAPH (if any)
RM Set in *72* Concrete/Steel Pipe Record -OR- RM Set in *73* Rock Outcrop/Boulder Record		*74* -AND/OR- *74* RM Set/Loc :::: Text Record(s) *74*	
75 *75* RM Local Reference :::: Record(s) *75*			
80 *80* Az Mk Description :::: Text Record(s) *80*		-OR- *81* Az Mk Standard Disk Record	Repeat for each additional Az Mk AZIMUTH MARK (AZ MK) PARAGRAPH (if any)
Az Mk Set in *82* Concrete/Steel Pipe Record -OR- Az Mk Set in *83* Rock Outcrop/Boulder Record		*84* -AND/OR- *84* Az Mk Set/Loc :::: Text Record(s) *84*	
85 *85* Az Mk Local Reference :::: Record(s) *85*			
86 *86* Az Mk To-Reach-From :::: Text Record(s) *86*			
90 *90* Additional :::: Text Record(s) *90*		First Paragraph	ADDITIONAL DESCRIPTIVE TEXT (if any)
90$ Paragraph Separation Record			
::::		::::	
::::		::::	
90$ Paragraph Separation Record			
90 *90* Additional :::: Text Record(s) *90*		Last Paragraph	
90$$ Text Data/Description Termination Record (always required)			

TABLE 3-5
RECORD SEQUENCE IN THE DESCRIPTION OF A LANDMARK
WITH OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

<table>
<tr><td colspan="2">*10*,*11*,*12*,*13* Station Identification Record
14,*15* Station Name Record</td><td>STATION ID DATA</td></tr>
<tr><td colspan="2">*20*,*21*,*22*,*23* Monument-by-Agency Record</td><td>MONUM DATA</td></tr>
<tr><td>*30*
30 Reference Object
:::: Records
30</td><td>First
Reference
Data
Set</td><td rowspan="5">REFERENCE DATA (if any)</td></tr>
<tr><td colspan="2">*30*$ Reference Data Separation Record</td></tr>
<tr><td>::::
::::</td><td>::::
::::</td></tr>
<tr><td colspan="2">*30*$ Reference Data Separation Record</td></tr>
<tr><td>*30*
30 Reference Object
:::: Records
30</td><td>Last
Reference
Data
Set</td></tr>
<tr><td colspan="2">*30*$$ Reference Data Termination Record</td><td rowspan="4">STATION LOCATION TEXT</td></tr>
<tr><td>*50* Landmark
50 Description
:::: Text
50 Record(s)</td><td>Landmark Description Paragraph</td></tr>
<tr><td>*51*
51 Station Location
:::: Text Record(s)
51</td><td>Station Location Paragraph</td></tr>
<tr><td>*52*
52 To-Reach-From
:::: Text Record(s)
52</td><td>To-Reach-From Paragraph</td></tr>
<tr><td colspan="3">*90*$$ Text Data/Description Termination Record (always required)</td></tr>
</table>

Recovery Note: Similar in form to station description, recovery note is a document normally prepared for every previously-established horizontal control point which is "recovered" - i.e., either used as a control point in a survey project or just visited and inspected. The purpose of the recovery note is to provide a statement about the condition of the respective survey monument or landmark, and to update, supplement, or correct the original station description and/or previous recovery note(s).

A recovery note differs from station description in two aspects. First, the Recovery-by-Agency Record must be present, either in place of or in addition to the Monument-by-Agency Record which is optional. Second, the narrative section of a recovery note may be limited to just one paragraph containing a concise report on the condition of the station and of its peripheral reference and azimuth marks, if any, followed by a statement concerning the adequacy of the respective station description or previous recovery notes. If, however, sufficient changes have taken place in the

TABLE 3-6

RECORD SEQUENCE IN THE RECOVERY NOTE OF A LANDMARK OR MONUMENTED STATION WITH OR WITHOUT NEW DESCRIPTION IN GENERAL DESCRIPTIVE TEXT

10,*11*,*12*,*13* Station Identification Record *14*,*15* Station Name Record		STATION ID DATA (see footnote)
20,*21*,*22*,*23* Monument-by-Agency Record (optional)		MONUM DATA
24,*25*,*26*,*27* Recovery-by-Agency Record		RECOV DATA
30 *30* Reference Object :::: Records *30*	First Reference Data Set	REFERENCE DATA (if any)
30$ Reference Data Separation Record		
::: ::::	:::: ::::	
30$ Reference Data Separation Record		
30 *30* Reference Object :::: Records *30*	Last Reference Data Set	
30$$ Reference Data Termination Record		
40 *40* Descriptive :::: Text Record(s) *40*	Recovery Paragraph	RECOVERY TEXT
40$ Paragraph Separation Record		NEW DESCRIPTION IN GENERAL DESCRIPTIVE TEXT (if any)
40 *40* Descriptive :::: Text Record(s) *40*	First Paragraph of New Description	
40$ Paragraph Separation Record		
::: ::::	:::: ::::	
40$ Paragraph Separation Record		
40 *40* Descriptive :::: Text Record(s) *40*	Last Paragraph of New Description	
40$$ Text Data/Recovery Note Termination Record (always required)		

STATION ID and MONUM data are omitted in a Combined Set - see page 3-12.

vicinity of the station to render a previous description inadequate, a new complete description should follow the recovery paragraph. In a manner analogous to the narrative section of a station description, the new description which is given as a part of a recovery note may be coded either as a sequence of general descriptive text records or, optionally, as a sequence of partially coded text records. See Tables 3-6, 3-7, and 3-8 for the three possible structures of a recovery note.

TABLE 3-7

RECORD SEQUENCE IN THE RECOVERY NOTE OF A MONUMENTED STATION
WITH OR WITHOUT NEW DESCRIPTION
IN OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

10,*11*,*12*,*13* Station Identification Record *14*,*15* Station Name Record		STATION ID DATA (see footnote)
20,*21*,*22*,*23* Monument-by-Agency Record (optional)		MONUM DATA
24,*25*,*26*,*27* Recovery-by-Agency Record		RECOV DATA
30 *30* Reference Object :::: Records *30*	First Reference Data Set	REFERENCE DATA (if any)
30$ Reference Data Separation Record		
:::: ::::	:::: ::::	
30$ Reference Data Separation Record		
30 *30* Reference Object :::: Records *30*	Last Reference Data Set	
30$$ Reference Data Termination Record		
40 *40* Descriptive :::: Text Record(s) *40*	Recovery Paragraph	RECOVERY TEXT

40$$ Termination Record - use only if no new description follows.

51 *51* Station Location :::: Text Record(s) *51*	Station Location Paragraph	STATION LOCATION TEXT
52 *52* To-Reach-From :::: Text Record(s) *52*	To-Reach-From Paragraph	
60 *60* Surface Mark Description :::: Text Record(s) *60*	-OR- *61* Surface Mark Standard Disk Record	STATION PARAGRAPH
Surface Mark Set in *62* Concrete/Steel Pipe Record -OR- Surface Mark Set in *63* Rock Outcrop/Boulder Record	*64* -AND/OR- *64* Surface Mark :::: Set/Loc Text *64* Record(s)	
65 *65* Surface Mark Local Reference :::: Record(s) *65*		

(CONTINUED ON NEXT PAGE)

TABLE 3-7 - CONTINUED
RECORD SEQUENCE IN THE RECOVERY NOTE OF A MONUMENTED STATION
WITH OR WITHOUT NEW DESCRIPTION
IN OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

70 *70* RM Description :::: Text Record(s) *70*		-OR- *71* RM Standard Disk Record	Repeat for each additional RM REFERENCE MARK (RM) PARAGRAPH (if any)
RM Set in *72* Concrete/Steel Pipe Record -OR- RM Set in *73* Rock Outcrop/Boulder Record		*74* -AND/OR- *74* RM Set/Loc :::: Text Record(s) *74*	
75 *75* RM Local Reference :::: Record(s) *75*			
80 *80* Az Mk Description :::: Text Record(s) *80*		-OR- *81* Az Mk Standard Disk Record	Repeat for each additional Az Mk AZIMUTH MARK (AZ MK) PARAGRAPH (if any)
Az Mk Set in *82* Concrete/Steel Pipe Record -OR- Az Mk Set in *83* Rock Outcrop/Boulder Record		*84* -AND/OR- *84* Az Mk Set/Loc :::: Text Record(s) *84*	
85 *85* Az Mk Local Reference :::: Record(s) *85*			
86 *86* Az Mk To-Reach-From :::: Text Record(s) *86*			
90 *90* Additional :::: Text Record(s) *90*		First Paragraph	ADDITIONAL DESCRIPTIVE TEXT (if any)
90$ Paragraph Separation Record			
::::		::::	
::::		::::	
90$ Paragraph Separation Record			
90 *90* Additional :::: Text Record(s) *90*		Last Paragraph	
90$$ Termination Record - required to terminate the new description.			

STATION ID and MONUM data are omitted in a Combined Set - see page 3-12.

TABLE 3-8

RECORD SEQUENCE IN THE RECOVERY NOTE OF A LANDMARK
WITH OR WITHOUT NEW DESCRIPTION
IN OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

10,*11*,*12*,*13* Station Identification Record *14*,*15* Station Name Record		STATION ID DATA (see footnote)
20,*21*,*22*,*23* Monument-by-Agency Record (optional)		MONUM DATA
24,*25*,*26*,*27* Recovery-by-Agency Record		RECOV DATA
30 *30* Reference Object :::: Records *30*	First Reference Data Set	REFERENCE DATA (if any)
30$ Reference Data Separation Record		
:::: ::::	:::: ::::	
30$ Reference Data Separation Record		
30 *30* Reference Object :::: Records *30*	Last Reference Data Set	
30$$ Reference Data Termination Record		
40 *40* Descriptive :::: Text Record(s) *40*	Recovery Paragraph	RECOVERY TEXT

40$$ Termination Record - use only if no new description follows.

50 Landmark *50* Description :::: Text *50* Record(s)	Landmark Description Paragraph	STATION LOCATION TEXT
51 *51* Station Location :::: Text Record(s) *51*	Station Location Paragraph	
52 *52* To-Reach-From :::: Text Record(s) *52*	To-Reach-From Paragraph	
90$$ Termination Record - required to terminate the new description.		

STATION ID and MONUM data are omitted in a Combined Set - see below.

Combined Set: When one or more recovery notes are submitted in addition to the station description or leading recovery note in a station block of an HZTL DESC data set, the station identification data section (Station Identification Record and Station Name Record) as well as the optional monumentation data section (Monument-by-Agency Record) may be omitted in all the recovery notes which follow the station description

or leading recovery note. Such a combined set consisting of a complete leading element (station description or recovery note) followed by one or more subsequent recovery notes without the respective station identification and monumentation data sections must be flagged by the DRC Code "C" on the Station Identification Record of the leading element - see STATION IDENTIFICATION DATA RECORDS below.

STATION IDENTIFICATION DATA RECORDS

10,*11*,*12*,*13* Station Identification Record
14,*15* Station Name Record

The station identification data records, bearing the *10*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS. More than one data codes appear on these records (see the respective format diagrams) to serve as labels for important data items and thereby to facilitate the extracting and coding of these data items from the source documents. The data items to be entered on these records are explained in detail below.

Station Serial Number: Whether submitted as MODE 1 data (HZTL OBS and HZTL DESC data sets) or MODE 2 data (HZTL POS and HZTL DESC data sets), the data contained in a horizontal control job (see Chapter 1) pertains to a set of control points, each of which must be identified in a unique manner. To this end, every control point in a horizontal control job is assigned a three-digit station serial number in the range 001 through 999 to serve as a unique identifier of the respective control point within that horizontal control job - see Chapter 1 (JOB CODE AND SURVEY POINT NUMBERING) and/or Chapter 2 (ASSIGNMENT OF STATION SERIAL NUMBERS).

The station serial number is the vital link by means of which data pertaining to the same control point in either the HZTL OBS and HZTL DESC data sets (MODE 1 data) or the HZTL POS and HZTL DESC data sets (MODE 2 data) are positively correlated prior to their entry into the National Geodetic Survey Data Base. For this reason, the same station serial number must be consistently used to identify the same control point in either the OBS, DESC, or POS data sets of a horizontal control job. In particular, the station serial number assigned to a station in the HZTL DESC data set must be the same as that used to identify the same horizontal control point in the companion HZTL OBS (or HZTL POS) data set.

DRC Code: This is a one-letter code which is used to identify the descriptive data as to its type. It is assigned as follows:

D - Self-standing station description.
R - Self-standing recovery note.
C - Combined set consisting of one complete station description or recovery note followed by any number of subsequent recovery notes for the same station in which data items *10* through *23* have been omitted.

Quad Identifier (QID): The primary indexing and identification system adopted by the National Geodetic Survey Data Base for all horizontal (and vertical) control points is based on 1x1° "quads" defined by integer-degree latitude and longitude gridlines (parallels and meridians), and on the successive quadrantal subdivision of the basic 1x1° quads into 30x30' quads, 15x15' quads, and 7½x7½' quads accomplished by successive halving of the latitude and longitude gridline interval. The respective quad identifier or QID is a nine-character symbol coded as HLLWWWABC, where:

H - Hemisphere (N or 0 for northern, S or 1 for southern)
LL - Latitude of SE corner of the 1x1° quad (00-89°N, 01-90°S)
WWW - Longitude of SE corner of the 1x1° quad (000-359°W)
A - 30' subdivision indicator (1-NE, 2-SE, 3-SW, 4-NW subquad)
B - 15' subdivision indicator (1-NE, 2-SE, 3-SW, 4-NW subquad)
C - 7½' subdivision indicator (1-NE, 2-SE, 3-SW, 4-NW subquad)
(A,B,C = 0 or blank indicates no further subdivision)

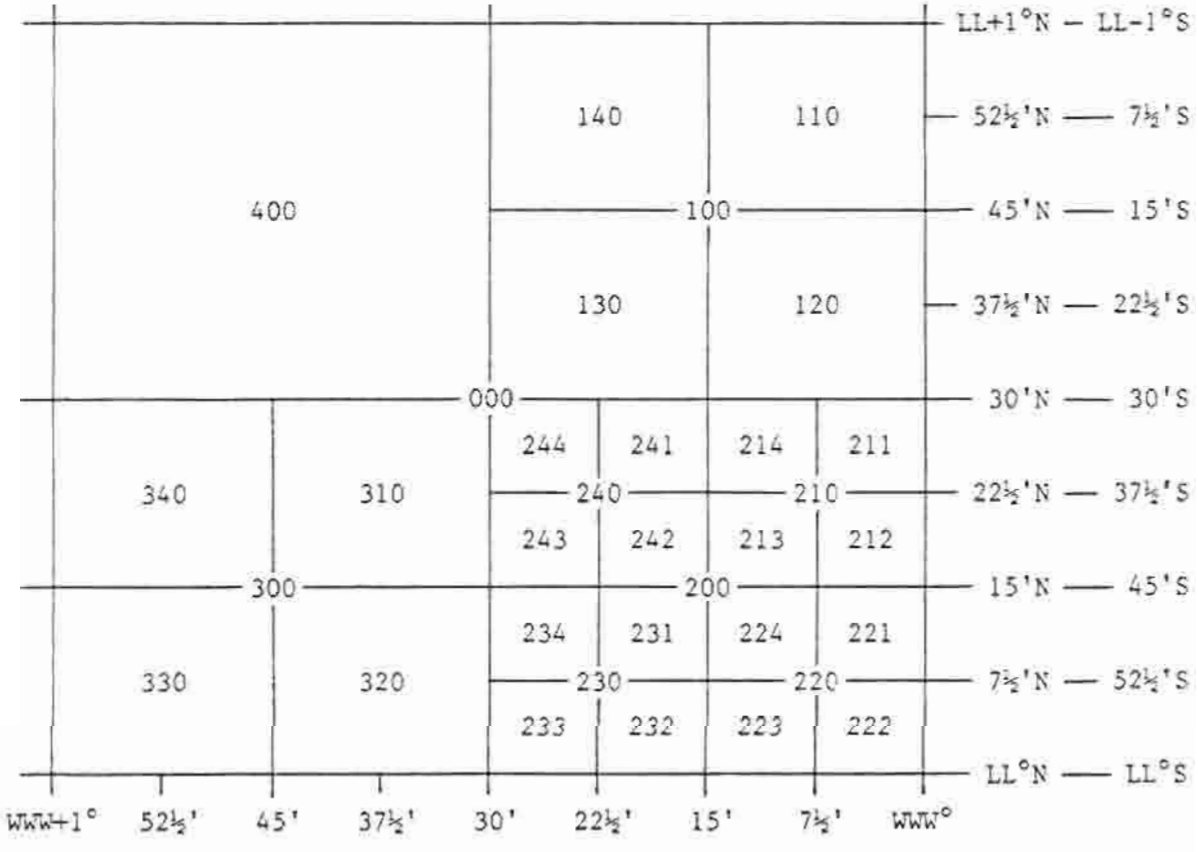

FIGURE 3-1 - Successive quadrantal subdivision of the 1x1° quad.

On the Station Identification Record of a recovery note for a horizontal control point whose QID has been published as a part of the respective station description and/or previous recovery note, enter the quad identifier exactly as published. For a horizontal control point without previously published quad identifier or whose quad identifier is unknown, determine the QID (at least to the nearest 30x30' subquad) from the best available geodetic position of that point.

Quad Station Number (QSN): To distinguish among horizontal (and vertical) control points which share the same quad identifier, every control point is assigned a sequential quad station number or QSN which is unique within the respective quad.

A system used for many years by the National Geodetic Survey in the publication of horizontal control data employs 30x30' quad identifiers and four-digit quad station numbers starting with 1001 with an occasional one-letter suffix (e.g. 1001, 1002, 1002A, 1003, etc.) assigned to the horizontal control points in the same 30x30' quad. The National Geodetic Survey Data Base has been designed to index both horizontal and vertical control points at the 7½x7½' quad level, with four-digit quad station numbers starting with 0001 (i.e., 0001, 0002, 0003, etc.) without any suffix assigned sequentially to the control points (both horizontal and vertical) which fall into the same 7½x7½'quad.

Since the QSN is assigned by NGS, it follows that this data item can be entered only on the Station Identification Record of a recovery note, and then only for a horizontal control point whose QSN has been published by the NGS as a part of the respective station description and/or previous recovery note. Whenever it is known, enter the 7½x7½' quad station number assigned by the National Geodetic Survey Data Base; alternatively, enter the 30x30' quad station number (followed by one-letter suffix, if any). If neither the 7½x7½' QSN nor the 30x30' QSN is known, leave the QSN field blank.

Surface Mark Type: The surface mark type is a pair of codes which together identify the type of the surface mark or monument which constitutes the horizontal control point. The Mark Type consists of the one-letter Mark Code followed by the two-digit Setting Code (or by the two-digit Landmark Code, if the Mark Code is "L" for "landmark") - see below.

The Mark Type replaces the time-honored Standard Numbered Notes for Description of Marks defined in Manual of Geodetic Triangulation, Special Publication No. 247, Coast and Geodetic Survey, U.S. Department of Commerce, Revised Edition, 1959. The mark types equivalent to the standard numbered notes are given in Table 3-9 on the following page.

A third code, the one-letter M-Code, may be appended to the two-code Mark Type for the purpose of denoting the magnetic property of the mark or monument, if applicable. See farther below for the detailed treatment of the Mark Code, Setting Code, Landmark Code, and M-Code.

Underground Mark Type: In a manner analogous to the surface mark type treated in the preceding paragraph, the underground mark type consists of a pair of codes (the Mark Code and the Setting Code - see below) which together identify the type of underground mark, if such a mark has been set for the respective horizontal control point. All the other comments concerning the surface mark type given in the preceding paragraph also apply, with the exception of the Landmark Code which is not used in connection with an underground mark (i.e., the mark code of the mark type assigned to an underground mark must not be "L" for "landmark").

TABLE 3-9
MARK TYPE EQUIVALENT TO STANDARD NUMBERED NOTE
(USC&GS SPECIAL PUBLICATION NO. 247)

STANDARD NOTE	*MARK TYPE	STANDARD NOTE	*MARK TYPE	STANDARD NOTE	*MARK TYPE
1A,11A,16A	D09	6A,13A,18A	D22	8B	D99
1B,11B,16B	D08	6B,13B,18B	D23	8C	B05
1C,11C,16C	D04	6C,13C,18C	D20	8D	S05
2 ,12A,17A	D55	6D,13D,18D	D24	9A	D75
2A	D57	7A	D04	9B	D97
2B	D58	7B	B04	9C	B75
2C	D56	7C	N04	9D	S75
3 ,12B,17B	D95	7D	G04	10A	G02
4 ,12C,17C	D75	7E	J04	10B	J02
5 ,12D,17D	D97	8A	D05	10C	Y02

*See Mark Code and Setting Code below.

Mark Code: The Mark Code is a set of one-letter codes for the most commonly occurring objects, devices, or signs used as the surface mark for a horizontal control point and/or as the respective underground mark, if applicable. The Mark Code is to be used as a prefix to the two-digit Setting Code (or else to the two-digit Landmark Code, if the surface mark is given by the code "L"), which together constitute the surface or underground mark type - see above. A complete list of the specific mark codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

*	A - aluminum marker	I - metal rod	R - rivet
	B - bolt	J - earthenware jug	S - spike
	C - cap-and-bolt	K - clay tile pipe	T - chiseled triangle
	D - survey disk (any type)	L - landmark	U - concrete post
		M - ammo shell casing	V - stone monument
	E - earthenware pot	N - nail	X - chiseled cross
*	F - flange-encased rod	O - chiseled circle	Y - drill hole in brick
	G - glass bottle	P - pipe cap	Z - see description
	H - drill hole	Q - chiseled square	

Setting Code: The Setting Code is a comprehensive set of two-digit numerical codes covering a wide variety of possible settings for a survey point marker. These codes are to be used with all Mark Code prefixes except "L" (landmark), in which case the Landmark Code (see farther below) must be used in place of the Setting Code. A complete list of the specific setting codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

00 - setting not listed - see description

01 - driven into the ground
02 - imbedded in the ground
03 - surrounded by a mass of concrete
04 - set into the top of an irregular mass of concrete
05 - set into a drill hole in bedrock
06 - set into a drill hole in a concrete slab
07 - set into a drill hole in a concrete ledge
08 - set into the top of a round concrete monument
09 - set into the top of a square concrete monument

10 - crimped onto a metal rod driven into the ground *

set into the top of a metal pipe ... *
11 - ... driven into the ground
12 - ... imbedded in the ground
13 - ... surrounded by a mass of concrete
14 - ... imbedded in a mass of concrete

set in concrete at the center of a clay tile pipe ...
20 - ... cemented to a wooden pile driven into marsh
22 - ... imbedded in the ground
23 - ... surrounded by a mass of concrete
24 - ... imbedded in a mass of concrete

set into a prefabricated concrete block ...
32 - ... imbedded in the ground
33 - ... surrounded by a mass of concrete
34 - ... imbedded in a mass of concrete

set into the top of a prefabricated concrete post ...
42 - ... imbedded in the ground
43 - ... surrounded by a mass of concrete
44 - ... imbedded in a mass of concrete

50 - in rock outcrop
55 - set into a drill hole in rock outcrop
56 - ... at the intersection of two chiseled lines
57 - ... and surrounded by a chiseled triangle
58 - ... and surrounded by a chiseled circle
59 - ... and surrounded by a chiseled square

60 - in a rock ledge
65 - set into a drill hole in a rock ledge
66 - ... at the intersection of two chiseled lines
67 - ... and surrounded by a chiseled triangle
68 - ... and surrounded by a chiseled circle
69 - ... and surrounded by a chiseled square

70 - in a boulder
75 - set into a drill hole in a boulder
76 - ... at the intersection of two chiseled lines
77 - ... and surrounded by a chiseled triangle
78 - ... and surrounded by a chiseled circle
79 - ... and surrounded by a chiseled square

80 - in a partially exposed boulder
85 - set into a drill hole in a partially exposed boulder
86 - ... at the intersection of two chiseled lines
87 - ... and surrounded by a chiseled triangle
88 - ... and surrounded by a chiseled circle
89 - ... and surrounded by a chiseled square

90 - in bedrock

set into a mass of concrete ...
95 - ... in a depression in rock outcrop
96 - ... in a depression in a rock ledge
97 - ... in a depression in a boulder
98 - ... in a depression in a partially exposed boulder
99 - ... in a depression in the bedrock

Landmark Code: The Landmark Code is a comprehensive set of two-digit numerical codes for a wide variety of natural and man-made landmarks which are frequently positioned (usually as intersection stations) in the course of a horizontal control survey project. These codes are to be used with the Mark Code prefix "L" (landmark) only. A complete list of the specific landmark codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

Landmarks Not Listed:	Waterfront Landmarks and Visual Aids to Navigation:	Aeronautical and Electronic Aids to Navigation:
00-see description		
	11-piling	21-airport beacon
Natural Objects:	12-dolphin	22-airway beacon
	13-lighthouse	23-VOR antenna
01-lone tree	14-navigation light	24-RBN antenna
02-conspicuous rock	15-range marker	25-radar antenna
03-mountain peak	16-daybeacon	26-spherical radome
04-rock pinnacle	17-flag tower	27-radio range mast
05-rock awash	18-signal mast	28-LORAN mast

Broadcast and Communications Facilities:

41-antenna mast
42-radio/TV mast
43-radio/TV tower
44-microwave mast
45-microwave tower

Tanks and Towers:

51-tank
52-standpipe tank
53-elevated tank
54-water tower
55-tower
56-skeleton tower
57-lookout tower
58-control tower

Miscellaneous Landmarks:

61-pole
62-flagpole
63-stack
64-silo
65-grain elevator
66-windmill
67-oil derrick
68-commercial sign
69-regulatory sign
70-monument
71-boundary monument
72-cairn
73-lookout house
74-large cross
75-belfry

Features of a Building:

81-gable
82-finial
83-flagstaff
84-lightning rod
85-chimney
86-cupola
87-dome
88-observatory dome
89-spire
90-church spire
91-church cross
92-antenna
93-microwave antenna
94-rooftop ventilator
95-rooftop blockhouse

M-Code: The M-Code (Magnetic Code) is a set of one-letter codes the purpose of which is to indicate the magnetic property of the survey mark or monument resulting from imbedded or attached bar magnets, imbedded steel rods (rebars), or from the material composition of the respective marker or monument itself (e.g. standard survey disk set into the top of a steel pipe driven into the ground). The magnetic property of a survey mark or monument is desired to be known so that the decision can be made whether or not to employ a magnetic field detection device to aid in the location of the respective survey point.

A complete list of the specific magnetic codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

A - steel rod adjacent to monument
B - bar magnet imbedded in monument
H - bar magnet set in drill hole
I - marker is a steel rod
M - marker equipped with bar magnet
N - no magnetic materials
O - other - see description
P - marker is a steel pipe
R - steel rod imbedded in monument
S - steel spike imbedded in monument
T - steel spike adjacent to monument

Whenever the magnetic property of a survey point marker or monument is unknown, leave the respective M-Code field blank.

Station Name: Customarily assigned by the agency which monumented (or otherwise established) the horizontal control point, the station name or designation is the primary identifier by means of which the horizontal control point is known to the general public. A maximum of 40 characters (including all imbedded blanks) are allowed for a station name or designation to be entered as the *14* data item on the *14*,*15* Station Name Record.

The preferred practice is to assign an intelligible name to a horizontal control point. Such a "station name" has the important advantage of being mnemonic - a desirable property which a "designation" such as a pure number or an arbitrary alphanumeric symbol does not possess. The name or designation of a monumented horizontal control point usually is identical to or closely resembles the name or designation which normally appears die-stamped on the respective disk marker (or otherwise inscribed on the station mark or monument).

The name assigned to a monumented horizontal control point should be concise, preferably consisting of one word only, although two or more words (up to the 40-character total length limit) are permitted. Such a station name should reflect, in order of preference, (1) the locality, (2) property ownership, (3) physical setting of the station mark or monument, or (4) the type of mark or monument involved. Only when these guidelines prove impractical should a meaningless name or an arbitrary designation be assigned to a monumented horizontal control point. Examples:

ASHLAND - station name reflecting locality
HARTMANN - station name reflecting property ownership
SIDEWALK - station name reflecting physical setting
POST - station name reflecting type of mark or monument
BRUCE - arbitrary station name
T-138A - arbitrary station designation

On the other hand, the name assigned to a horizontal control point which is an unmonumented recoverable landmark (usually an intersection station) must be sufficiently descriptive in order to identify the landmark (and frequently a specific feature of the landmark) adequately, and hence is usually lengthy. Such a landmark station name normally consists of several words, preferably reflecting the locality, property ownership, type of landmark, and the specific feature of the landmark, as appropriate. In its full extent, the name of a landmark station often exceeds 40 characters, in which case it must be edited and/or abbreviated as necessary to conform to the 40-character length limit, with care being taken to detract as little as possible from the intended intelligibility or descriptiveness of the respective landmark station name. Examples:

DUNLOP MOUNTAIN ATT MICROWAVE TOWER
LAS CRUCES SPRR WATER TANK
SHAWNEE COUNTY COURTHOUSE FLAGPOLE
IRONTON CATHOLIC CHURCH SPIRE
PORT ANGELES WEYERHOUSER EAST STACK

While 40 characters are allowed for the name of a horizontal control point on the *14*,*15* Station Name Record, only 30 characters are allowed for the name of a reference object on the *30* Reference Object Record, two or more of which make up the reference data section of a station description or recovery note (see REFERENCE DATA RECORDS). A neighboring horizontal control point normally appears as the "initial" reference object, and other horizontal control points may also be given as visible-from-the-ground (VG) reference objects in the round of directions which constitutes the reference data section. Furthermore, in the companion data set which contains the corresponding field observations (the HZTL OBS data set, see Chapter 2) or adjusted positions (the HZTL POS data set, see Chapter 4), to be submitted together with the HZTL DESC data set, the length of the name of a horizontal control point is also limited to 30 characters.

The foregoing implies that whenever a station name exceeds 30 characters, two versions of the station name must exist - a 30-character version for use in data processing (i.e., in the HZTL OBS or HZTL POS data set) and in the reference data section of station descriptions and recovery notes, and a 40-character version for use in those instances where the full name of the horizontal control point is desired to appear, as in the heading of the respective station description or recovery note. The two versions of the station name should differ only as to the manner in which the name is abbreviated and/or edited. See ANNEX D for editing guidelines and for a list of recommended abbreviations.

The names of the reference and/or azimuth marks which are customarily set in the vicinity of a monumented horizontal control point are also subject to the 40- and 30-character total length limits discussed in the preceding paragraphs. The names of such peripheral reference and azimuth marks are normally formed by appending the symbols RM 1, RM 2, ..., RM 13, etc., and AZ MK (possibly AZ MK 2, AZ MK 3, etc.) to the name of the horizontal control point to which they belong. For this reason, the name of a horizontal control point which has peripheral reference marks and/or azimuth mark(s) may have to be further contracted to 34 or 24 characters (and possibly less) in order to allow for the respective reference or azimuth mark name to conform to the appropriate total length limit.

Except for the abbreviation and/or editing which may be required, the name or designation of a horizontal control point to be entered on the *14*,*15* Station Name Record should be taken exactly as it appears on the original station description and/or previous recovery notes, if any. However, awkward abbreviations, misspellings, or any other obvious defects detected in a previously-published station name should be corrected. Parentheses are not permitted to appear in a station name, and other special characters such as periods, commas, etc. (see Chapter 1) - as well as any unnecessary spaces (blanks) - should also be edited out whenever their omission can be tolerated.

Aside from the names of agencies or firms with commonly used initials or acronyms (e.g. ATT for American Telephone and Telegraph Co.), which should never be spelled out, and aside from certain symbols which are mandatory

(e.g. RM and AZ MK discussed above, CO, PA, and CD specified below, see ANNEX D for others), abbreviations should be used in a station name only when required to conform to the respective total length limit. Once the lengthy name of a horizontal control point is abbreviated and/or edited, special effort must be made to use that same contracted version of the respective station name consistently throughout the horizontal control job, i.e., in the companion HZTL OBS or HZTL POS data set as well as in the HZTL DESC data set.

Note that neither the "year mark set" (i.e., the year which is customarily stamped on the respective disk marker) nor the "year established" * (i.e., the year in which the station was first occupied and/or observed) does normally appear as a part of the station name. While parts of a lengthy station name may be abbreviated or edited out in order to conform to the appropriate 40- or 30-character total length limit, nothing should be added, except as necessary to render the station name unique within the horizontal control job. If two or more horizontal control points with identical names occur in the job, they should be rendered unique by appending to the respective station name, in order of preference:

1. The name of the county (parish, census division) in which the station is located, followed by the symbol CO (PA,CD) - Example: JONES CLALLAM CO and JONES KING CO (SMITH ORLEANS PA and SMITH DE SOTO PA, ROCK KENAI-COOK INLET CD and ROCK ANCHORAGE CD).

2. The name of a locality other than county, parish, or census division - Example: PIPE SAN ANTONIO and PIPE LACKLAND AFB.

3. The "year mark set" - Example: PEDRO SILAS AZ MK 1935 and PEDRO SILAS AZ MK 1972.

4. The "year established" - Example: ROCKVILLE MUNICIPAL TANK 1908 and ROCKVILLE MUNICIPAL TANK 1969.

Whenever the name of a horizontal control point is modified in this manner for the purpose of making it unique within the respective job, the appended information becomes part of the station name, and care must be taken that exactly the same information is appended to the name of that horizontal control point wherever it appears, i.e., in the companion HZTL OBS or HZTL POS data set as well as in the HZTL DESC data set.

State or Country Code: This is a two-letter code the purpose of which is to indicate the political unit and/or geographic area in which the horizontal control point is located. For points in the United States or in Canada, enter the appropriate code for the respective state, commonwealth, province, or territory. For points outside the United States and Canada, enter the appropriate code for the respective country, island group, or geographic area. A complete list of the two-letter State or Country Codes is given in ANNEX A.

County: The name of the next lower political subdivision in which the horizontal control point is located. For points in the United States and in Canada, enter the name of the first-order political subdivision of the respective state, commonwealth, province, or territory (i.e., county, parish, census division, independent city, etc.). The name of an independent city must be preceded by the symbol C OF (e.g. C OF ST LOUIS for St. Louis City. MO). For points in other countries, enter the name of the primary political subdivision of the respective country, such as state, province, district, etc. Up to 20 characters are allowed; use standard abbreviations if necessary.

MONUMENTATION AND RECOVERY DATA RECORDS

20,*21*,*22*,*23* Monument-by-Agency Record
24,*25*,*26*,*27* Recovery-by-Agency Record

The monumentation and recovery data records, bearing the *20*-series data codes, are listed above; the block diagrams illustrating the respective formats will be found under FORMAT DIAGRAMS. The *20*,*21*,*22*,*23* Monument-by-Agency Record is required in every station description and is optional in a recovery note; the *24*,*25*,*26*,*27* Recovery-by-Agency Record is required in every recovery note.

Analogously to the station identification data records treated in the preceding section, more than one data codes appear on the monumentation and recovery data records (see the respective format diagrams) to serve as labels for important data items, and thereby to facilitate the extracting and coding of these data items from the source documents. The data items to be entered on these two records are self-explanatory; however, the following data items will be explained in greater detail.

Agency Code: This is a one-digit code intended to indicate the type of survey organization which monumented (or otherwise established) the horizontal control point (*20*,*21*,*22*,*23* Monument-by-Agency Record) or the type of survey organization which recovered the horizontal control point (*24*,*25*,*26*,*27* Recovery-by-Agency Record). A complete list of the specific agency codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

0 - unknown *
1 - NGS and CGS (USC&GS)
2 - U.S. Geological Survey (USGS)
3 - U.S. Department of Defense (DOD)
4 - other federal or interstate agency
5 - state agency
6 - county, city, or regional agency
7 - commercial organization or private firm *
8 - National Ocean Survey (NOS)
9 - foreign government agency

Marker Type: This is a one-letter code the purpose of which is to indicate the specific type of survey disk which marks the horizontal control point, or the type of certain other special-purpose survey markers. The marker type code is intended to be used as an additional clarifier of the surface mark code given as a part of the *12* data item on the *10*,*11*,*12*,*13* Station Identification Record.

The Marker Type appears on the *20*,*21*,*22*,*23* Monument-by-Agency Record only; on the *24*,*25*,*26*,*27* Recovery-by-Agency Record, the Condition Code (see next paragraph) is given in its place. A complete list of the specific marker type codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

A - astro pier
B - bench mark (BM) disk
C - chiseled mark
D - survey disk (not listed)
E - traverse station disk
G - gravity station disk
H - horizontal control disk
L - landmark
M - magnetic station disk
O - other (see descriptive text)
P - base line pier
Q - calibration base line disk
R - reference mark (RM) disk
S - triangulation station disk
T - topographic station disk
U - boundary marker
V - vertical control disk
Z - azimuth mark (Az Mk) disk

Condition Code: This is a one-letter code the purpose of which is to indicate the condition of the station mark or monument as determined upon the recovery of the respective horizontal control point. Note that the condition code pertains to the station mark or monument only; the condition of the associated peripheral reference and/or azimuth marks, if any, should be indicated in the text of the recovery note.

The Condition Code appears on the *24*,*25*,*26*,*27* Recovery-by-Agency Record only; on the *20*,*21*,*22*,*23* Monument-by-Agency Record, the Marker Type (see above) is given in its place. A complete list of the specific condition codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected.

G - good, fair
N - not recovered, not found, lost
O - other (see recovery text)
P - poor, disturbed, mutilated
X - destroyed

Transportation Code: This is a one-letter code the purpose of which is to indicate the mode of transportation used to reach the station. On the *20*,*21*,*22*,*23* Monument-by-Agency Record, enter the code which reflects the recommended mode of transportation; on the *24*,*25*,*26*, *27* Recovery-by-Agency Record, enter the code which reflects the mode of transportation actually used. In either case, indicate the mode of transportation used (or to be used) to reach the station or to reach the location where packing begins, if packing is required. A complete list of the specific transportation codes is given below; this list will also be found in ANNEX I where all codes peculiar to HZTL DESC data set are collected:

A - light airplane
B - boat
C - car (or station wagon)
F - float airplane
H - helicopter
O - other (see descriptive text)
P - light truck (pickup, caryall, etc.)
T - truck (larger than 3/4 ton)
W - tracked vehicle (weasel, snowcat, etc.)
X - four-wheel-drive vehicle

Pack Time: Give the time required to carry equipment from the last point of transportation to the station, expressed in hours and minutes (HHMM). If the immediate vicinity of the station can be reached using the mode of transportation indicated by the preceding transportation code (e.g. if the horizontal control point is a "drive" station), enter zero in both the hours and minutes fields (0000); leave blank if the pack time is unknown (e.g. when coding descriptions or recovery notes extracted from archives which make no mention of packing being necessary).

Height of Telescope: Enter the greatest height of instrument above the mark which was required for the lines of sight to clear surrounding obstructions (in meters, left-justified, with imbedded or leading decimal point if given to greater precision than the nearest meter). Leave blank if the station was not occupied with a survey instrument.

REFERENCE DATA RECORDS

30 Reference Object Record

The purpose of the *30* records is to provide the means for the recording of the round of directions which is customarily observed at the respective station to those neighboring horizontal control points which are visible from the ground (VG) and to the reference and azimuth marks which are peripheral to it, as well as of the distances which are customarily measured with a steel tape to (and between) the peripheral reference and azimuth marks. The entries on the *30* Reference Object Record (see FORMAT DIAGRAMS) will be explained in detail farther below in this section.

The *30* Reference Object Records must be submitted in sets of two or more records, and the leading record of every such reference data set must correspond to the "initial" reference object (to which the observed direction is zero). Whenever possible, the initial should be a distant horizontal control point (preferably a monumented station rather than a landmark), and the respective round of directions should include all the peripheral reference and azimuth marks which belong to the station being described or recovered, as well as selected other neighboring horizontal control points which are visible from the ground (height-of-eye level). For every such object included in the reference data set, a *30* record must follow the initial *30* Reference Object Record, in the sequence as the respective objects are sighted, clockwise from the initial.

It is often the case that no neighboring horizontal control points are visible from the ground. When such is the case and observations are made from survey towers, the round of directions taken for use as the reference data set in the respective station description or recovery note may have as its initial a horizontal control point which is not visible from the ground. The initial of a reference data set, therefore, is not necessarily visible from the ground; however, all the other reference objects included in the reference data set (and especially the azimuth mark) are assumed to be visible from the ground. Since it is useful to know if the initial is visible from the ground, provision is made to indicate this fact by means of the HSV Code (see below).

Although the reference data set is intended to contain a round of directions observed with a theodolite or engineer's transit, when the station in question has not been occupied with such an instrument, magnetic azimuths to the respective reference objects, as obtained with a compass, may be given instead. In this case, the leading (initial) *30* record of the reference data set must have 'MAGNETIC NORTH' in the Name or Description of Reference Object field and '000' as degrees in the Direction to Reference Object field, with minutes and seconds blank. Analogously, the magnetic azimuths to the respective reference objects appearing on the second and subsequent *30* records of the reference data set must be given to the nearest degree only, with minutes and seconds left blank.

Aside from the horizontal directions observed to reference objects which are visible from the ground, the *30* record provides for the recording of measured distances to the nearby peripheral reference marks, if any, and of estimated distances to other reference objects included in the respective reference data set. As is the standard practice, it is assumed that the distances from the station to its peripheral reference marks are measured with a steel tape in feet (to the nearest 0.01ft) or in meters (to the nearest 0.001m), or preferably in both feet and meters to obtain a check. Accordingly, on every *30* record, one field is provided for distance measured in feet, and another for distance measured in meters. Provision is also made to indicate (by means of the HSV Code - see below) whether the distance in question was measured with the tape held horizontal (which is to be preferred) or along the sloping ground.

Distances measured with electronic distance-measuring equipment (DME) to more distant reference objects may also be entered in these fields just as distances measured with a tape, provided that the capacity of these fields is not exceeded, i.e., provided that the respective distance can be expressed by at most six characters (five digits with one imbedded decimal point) if given in feet, or by at most seven characters (six digits with one imbedded decimal point) if given in meters. Otherwise, such measured distances should be rounded off and/or expressed as decimal fraction of statute mile (MI) or of kilometer (KM) and entered in the Estimated Distance field of the respective *30* Reference Object Record, left-justified, followed by one blank and the applicable units symbol (MI, KM, etc. - see Estimated Distance and Units farther below).

The *30* Reference Object Records may also be used to record distances measured between peripheral points (reference and/or azimuth marks) of the station being described or recovered. Two consecutive *30* records must be used for every such measured distance. The first *30* record of such a pair must contain the name or designation of one endpoint of the measured distance (e.g. KELLY RM 2) in the Name or Description of Reference Object field, with the remainder of the record to the right of this field totally blank. The second *30* record of such a pair must contain the name or designation of the other endpoint of the measured distance (e.g. KELLY RM 3) in the Name or Description of Reference Object field and the respective distance (given in feet or in meters, or in both feet and meters) in the appropriate Measured Distance field, with the Compass Heading, Estimated Distance, and Direction to the Reference Object fields being left blank.

When present, *30* record pairs containing distances measured between peripheral reference objects of the station being described or recovered must appear last in the respective reference data set, i.e., they must follow after the last *30* record which contains a direction observation and/or distance measurement from the station in question to a reference object.

Normally, the reference data section of a station description or recovery note consists of only one reference data set; however, it may consist of two or more such sets, in which case the individual reference data sets must be separated by the Reference Data Separation Record (*30*$). The last record of the reference data section (i.e., the last record of the last reference data set) must be the Reference Data Termination Record (*30*$$) - see STRUCTURE OF THE HZTL DESC DATA SET.

Although it is highly desirable that a station description or recovery note have a reference data section, this section may be omitted in its entirety if the respective data are not available, in which case no *30* records would appear in the respective station description or recovery note. In particular, the reference data section will normally be absent in the description or recovery note of a landmark station.

Mark Type and Magnetic Code: The Mark Type is a pair of codes which together identify the mark or monument which constitutes the horizontal control point used as a reference object in a reference data set. It consists of the one-letter Mark Code followed by the two-digit Setting Code (or by the two-digit Landmark Code, if the Mark Code is "L" for "landmark"). A third code, the one-letter M-Code, may be appended to the two-code Mark Type for the purpose of denoting the magnetic property of the respective mark or monument, if it is known. See STATION IDENTIFICATION DATA RECORDS for detailed treatment and listings of the specific mark codes, setting codes, landmark codes, and magnetic codes.

Normally, in a reference data set, the Mark Code, Setting Code, and M-Code are required to be given for all peripheral points (reference and azimuth marks) which belong to the station being described or recovered, to the extent these codes are known and applicable. For other monumented horizontal control points and/or landmarks used as reference objects in the reference data set, the listing of the respective Mark Code, Setting or Landmark Code, and M-Code is optional.

Name or Description of Reference Object: This is the identification of the reference object to which the *30* record pertains. For reference objects which are neighboring horizontal control points (monumented stations or landmarks), enter the 30-character version of the respective station name; for reference objects which are peripheral points (reference or azimuth marks) of the station being described or recovered, enter the 30-character version of the respective reference or azimuth mark name or designation (see Station Name, p. 3-20). Recall that the names of peripheral reference and azimuth marks are normally formed by appending the symbols RM 1, RM 2, etc., and AZ MK (possibly AZ MK 2, AZ MK 3, etc.) to the name of the horizontal control point to which they belong (e.g. KELLY RM 1, KELLY RM 2, ..., KELLY AZ MK, etc.).

Occasionally, a well-defined permanent object in the vicinity of the station being described or recovered, which is neither a neighboring horizontal control point nor a peripheral point of the respective station, is included in the reference data set. In this case, enter a phrase which describes such a reference object (maximum 30 characters including all imbedded blanks).

Compass Heading: Standard cardinal (i.e., N,E,S,W) or inter-cardinal point of compass which approximates the true azimuth (from North) or the magnetic azimuth of the line from the station being described or recovered to the respective reference object. The 16 possible compass headings are as follows (clockwise from North):

N	E	S	W
NNE	ESE	SSW	WNW
NE	SE	SW	NW
ENE	SSE	WSW	NNW

HSV Code: This is a one-letter, dual-purpose code used (1) to indicate whether the measured distance to the respective reference object (which appears in the following two fields - see below) is "horizontal" (HSV Code H) or "slope" (HSV Code S), or (2) to indicate whether or not a distant reference object is visible from ground (VG) - HSV Code V or N, respectively. Restated, the HSV codes are as follows:

H - measured distance is horizontal distance
S - measured distance is ground-slope distance
V - distant reference object is visible from ground
N - distant reference object is not visible from ground

In a reference data set, measured distances are normally given only for nearby peripheral points which are, by their nature, visible from ground. Distant reference objects are the ones which may or may not be visible from ground and for which intervisibility information is of relevance. Since for distant reference objects an estimated (rather than measured) distance is normally given, no conflict between the H,S and V,N codes is anticipated. Should a situation arise in which a measured distance is more appropriately given for a distant reference object, use HSV Code H or S, whichever applies, whether or not the reference object in question is visible from ground.

In addition to distances measured horizontally, slope distances which have been reduced to horizontal (as well as measured distances which may have been reduced to sea level or to the ellipsoid) should be included in the "horizontal" category when used for reference purposes.

Distance in Feet: This six-character field is reserved for the distance measured in feet with a steel tape or other distance-measuring equipment (DME) from the station being described or recovered to the reference object (or between peripheral reference objects). Distances up to 1000ft (if given to the nearest 0.01ft) or up to 10000ft (if given to the nearest 0.1ft) can be handled. Longer measured distances should be rounded to the nearest multiple of 100ft (optionally expressed in statute miles) and entered in the Estimated Distance field - see below.

Enter the distance measured in feet (normally given to the nearest 0.01ft), left-justified and blank-filled on the right, with imbedded decimal point (if any). Do not enter distance measured in meters and converted to feet; leave blank if the distance in question has not been measured in feet. Both Distance in Feet and Distance in Meters (see below) must be blank if estimated distance to the respective reference object is given.

Distance in Meters: This seven-character field is reserved for distance measured in meters with a steel tape or other distance-measuring equipment (DME) from the station being described or recovered to the reference object (or between peripheral reference objects). Distances up to 1000m (if given to the nearest 0.001m) or up to 10000m (if given

to the nearest 0.01m) can be handled. Longer measured distances should be rounded to the nearest multiple of 10m (optionally expressed in kilometers) and entered in the Estimated Distance field - see below.

Enter the distance measured in meters (normally given to the nearest 0.001m), left-justified and blank-filled on the right, with imbedded decimal point (if any). Do not enter distance measured in feet and converted to meters; leave blank if the distance in question has not been measured in meters. Both Distance in Meters and Distance in Feet (see above) must be blank if estimated distance to the respective reference object is given.

A-Flag: Enter 'A' in this one-character field if the abbreviation 'APPROX' (followed by one blank) is desired to precede the estimated distance (given as a string of alphanumeric characters in the following field - see below) when the estimated distance is printed out for publication purposes; otherwise leave this field blank.

Use the A-Flag to indicate that the estimated distance was "guessed-at" rather than obtained by more reliable means (such as scaling from a topographic map). The A-Flag field must be blank if no estimated distance is given.

Estimated Distance and Units: This ten-character field of the *30* record is reserved for estimated distance from the station being described or recovered to the respective reference object. Estimated distance should be given for every reference object to which a measured distance is not given. If measured distance is given (in the Distance in Feet and/or Distance in Meters fields - see above), the Estimated Distance field (as well as the A-Flag field) must be blank.

Enter the numerical value of the estimated distance as a string of alphanumeric characters (i.e., left-justified) followed by one blank and the symbol for the length units used (see below). The distance may be given as an integer number (e.g. 1500 FT, 210 M, etc.), as a decimal fraction with one or two decimal digits (e.g. 0.6 MI, 3.51 KM, etc.), or as a proper or improper (mixed) fraction (e.g. 1/4 MI, 3-1/2 KM, etc.). In the latter case (mixed fraction), a hyphen should be used to separate the respective integer and fractional parts.

Normally, an estimated distance given for reference purposes is expressed in statute miles (MI) or in kilometers (KM), but any other commonly used units of length are acceptable. Where choice exists, metric units (M or KM) are to be preferred. Frequently used units and corresponding symbols are as follows:

FT - feet	M - meters
YD - yards	KM - kilometers
MI - statute miles	NM - nautical miles

Direction to the Reference Object: This is the horizontal angle which is normally measured clockwise from a selected initial reference object with a theodolite or engineer's transit set up over the station being described or recovered. In every case, the observed (rather than adjusted) values should be given. Leave this field blank if directions to the respective reference objects have not been observed (see below for the alternative use of this field to record magnetic azimuths).

When horizontal directions are given, the leading *30* record of the reference data set must pertain to the respective initial reference object, to which the observed direction is (by definition) identically zero. This "initial" of the reference data set should be a distant horizontal control point (preferably a monumented station rather than a landmark), so that accurate geodetic azimuth can be obtained by inverse position computation for the line joining the station being described or recovered and the respective initial reference object.

As was already pointed out in the introductory paragraphs of this section, it is not unusual that there are no neighboring horizontal control points which are visible from the ground. When such is the case and observations are made from survey towers, the round of directions taken for use as the reference data set in the respective station description or recovery note may have as its initial a horizontal control point which is not visible from the ground. Aside from the initial, however, all reference objects included in the reference data set should be visible from the ground (height-of-eye level), as they would be of no use for reference purposes otherwise.

As a minimum, in addition to the selected initial reference object, directions (and measured distances) should be given to all peripheral reference marks and azimuth marks which belong to the station being described or recovered, as well as to any other monumented survey point (e.g. a bench mark) in the immediate vicinity. Furthermore, directions (and estimated distances) should be given to selected distant horizontal control points and/or well-defined man-made or natural landmarks which are visible from the ground.

On the *30* record which pertains to the initial reference object, the Direction to the Reference Object field must be completely zero-filled. On the subsequent *30* records of the reference data set, enter the respective horizontal direction (expressed in sexagesimal degrees, minutes, and seconds) in the corresponding Sexagesimal Degrees, Minutes, Seconds, and Tenths of Second subfields of the Direction to the Reference Object field. The direction should be given to the nearest 0".1 only for distant, well-defined reference objects; for nearby reference objects it should be given to the nearest 1" or to the nearest 10", commensurate with the attainable repeatability of the direction observations to the respective reference object; in this case, leave the Tenths of Second subfield blank. Leave both the Seconds and Tenths of Second subfields blank if the respective direction is given to the nearest minute only.

Use of Magnetic Azimuths: The situation may arise that measured distances to nearby peripheral reference objects are at hand, while the corresponding round of directions observed with a theodolite or engineer's transit is not available. When such is the case, the Direction to the Reference Object field (see above) will be blank on all *30* records of the reference data set in question.

Alternatively, to specify the directions to the reference objects more precisely than to the nearest point of compass (see Compass Heading), magnetic azimuths to the respective reference objects may be given. Magnetic azimuth is the horizontal angle measured clockwise from the local magnetic North, as determined with a magnetic needle compass, usually to no greater precision than to the nearest degree of arc.

When magnetic azimuths are given, the leading record of the reference data set must have 'MAGNETIC NORTH' in the Name or Description of Reference Object field (see above) and '000' in the Sexagesimal Degress subfield of the Direction to the Reference Object field, with the Minutes, Seconds, and Tenths of Second subfields blank. On the subsequent *30* records of the reference data set, the respective magnetic azimuths should be given to the nearest degree only, with the remainder of the Direction to the Reference Object field being left blank.

Distance Measurements Between Peripheral Reference Objects: In the introductory paragraphs of this section, mention was made of the fact that distance measurements between reference objects in the immediate vicinity of the station being described or recovered (as opposed to distance measurements from the station in question to the respective reference objects) may also be given as a part of the reference data set. Such distance measurements betweeen peripheral reference marks, azimuth marks, etc., are often made for check purposes, and may be of great value in connection with subsequent recoveries of the station in question.

Two consecutive *30* records must be used for every such distance measurement between peripheral reference objects. The first *30* record must contain the name or designation of one endpoint of the measured distance (e.g. KELLY RM 2) in the Name or Description of Reference Object field, with the remainder of the record to the right of this field totally blank. The second *30* record must contain the name or designation of the other endpoint of the measured distance (e.g. KELLY AZ MK) in the Name or Description of Reference Object field and the respective distance (given in feet or in meters, or in both feet and meters) in the appropriate subfield(s) of the Measured Distance field, with the Compass Heading, Estimated Distance, and Direction to the Reference Object fields left blank.

When present, *30* record pairs containing distances measured between peripheral reference objects must appear last in the respective reference data set, i.e., they must follow after the last *30* record which contains a direction observation and/or distance measurement from the station being described or recovered to a reference object.

GENERAL DESCRIPTIVE TEXT RECORDS

40 Descriptive Text Record

The purpose of the *40* record is to provide the space for the recording of one "line" of descriptive text. For the purpose at hand, a line of descriptive text is assumed to contain at most 70 characters (including all imbedded blanks). Accordingly, aside from the Sequence Number and Data Code fields which are common to all records, the *40* Descriptive Text Record contains a 70-character Descriptive Text field (see FORMAT DIAGRAMS).

Narrative Section of a Station Description: Every station description must contain a narrative section in which the respective horizontal control point is described in detail. Recall that station description is a document which is normally prepared for every horizontal control point when it is first established (i.e., positioned), be it a monumented survey point or an unmonumented recoverable landmark. The narrative section of a station description may consist of any number of *40* general descriptive text records (usually grouped into "paragraphs"), or it may consist of an appropriate combination of the optional partially coded descriptive text records (*50*, *51*, ..., *90* records). The use of the optional partially coded descriptive text records will be the subject of the remainder of this chapter.

When the *40* general descriptive text records are used, the narrative section of a station description consists of one or more paragraphs of descriptive text. Each paragraph, in turn, consists of one or more consecutive *40* records. When two or more paragraphs appear in the narrative section, consecutive paragraphs must be separated by the Paragraph Separation Record (*40*$). Furthermore, the last record of a narrative section made up by *40* general descriptive text records (i.e., the last record of the last paragraph) must be the Text Data Termination Record (*40*$$). The respective record sequence is shown graphically in Table 3-3 entitled Record Sequence in the Description of a Landmark or Monumented Station With General Descriptive Text (see p. 3-5).

Narrative Section of a Recovery Note: Every recovery note must also contain a narrative section in which, as a minimum, a recovery paragraph must appear. Recall that recovery note is a document which is normally prepared for every previously-established horizontal control point which is "recovered" (i.e., either used as a control point in a survey project or just visited and inspected). The recovery paragraph should indicate whether or not the station was recovered (i.e., found) and the condition of the station mark or monument in question, as well as the condition of the associated peripheral reference and/or azimuth marks, if any. In addition, the recovery paragraph should contain a statement as to the adequacy of the respective station description and/or previous recovery note(s); alternatively, following the recovery paragraph, a new partial or complete narrative description may be given.

The recovery paragraph which must appear as the first paragraph (possibly the only paragraph) in the narrative section of a recovery note consists, in every case, of *40* general descriptive text records. When the recovery information is more voluminous than usual, two or more paragraphs of recovery data are allowed, in which case any two consecutive paragraphs must be separated by the Paragraph Separation Record (*40*$). If no new narrative description follows, the last record of the recovery paragraph (or the last record of the last recovery paragraph, if more than one paragraphs are used for the recovery information) must be the Text Data Termination Record (*40*$$).

Whenever sufficient changes have taken place in the vicinity of the horizontal control point in question to render a previous narrative description inadequate, a new partial or complete narrative description is normally given following the recovery paragraph(s) in the narrative section of the respective recovery note.

In a manner analogous to the narrative section of a station description, this new narrative description may be given as one or more additional paragraphs of *40* general descriptive text records, with a Paragraph Separation Record (*40*$) inserted between the recovery paragraph (or the last recovery paragraph) and the first paragraph of the new narrative description (as well as between consecutive paragraphs of the new narrative description proper) and with the Text Data Termination Record (*40*$$) appended as the last record of the narrative section of the recovery note. The respective record sequence is shown graphically in Table 3-6 entitled Record Sequence in the Recovery Note of a Landmark or Monumented Station With or Without New Description in General Descriptive Text (see p. 3-9).

Alternatively, the new partial or complete narrative description may be given as an appropriate combination of the optional partially coded descriptive text records treated farther below in this chapter. When this option is selected, neither the *40*$ Paragraph Separation Record nor the *40*$$ Text Data Termination Record may appear as the last record of the recovery paragraph (or of the last recovery paragraph). Instead, the first *50* Landmark Description Text Record of the landmark description paragraph or else the first *51* Station Location Text Record of the station location paragraph (see STATION LOCATION TEXT RECORDS), whichever applies, must follow immediately after the last *40* Descriptive Text Record of the recovery paragraph (or of the last recovery paragraph).

The respective record sequence which applies in this latter case is shown graphically in Table 3-7 entitled Record Sequence in the Recovery Note of a Monumented Station With or Without New Description in Optional Partially Coded Descriptive Text (see p. 3-10) and in Table 3-8 entitled Record Sequence in the Recovery Note of a Landmark With or Without New Description in Optional Partially Coded Descriptive Text (see p. 3-12).

Format of the Narrative Description: The format of the narrative description may vary from concise, one-paragraph descriptions to detailed, multi-paragraph descriptions according to the type of horizontal control point, the type of the respective station mark or monument, the presence or absence of peripheral reference and/or azimuth marks, and the volume of information required to specify the location of the horizontal control point in question adequately and to provide sufficiently detailed directions how it may be reached from a well-defined point of departure.

As a general rule, survey organizations which have developed their own format should submit station descriptions and recovery notes with narrative descriptions cast in such organization-specific format which is well suited for their applications of horizontal control. Where guidance is needed or desired, applicable segments of the NGS practice (see below) should be followed.

NGS Practice: The NGS practice with respect to the composition of narrative descriptions of horizontal control points is the product of a distillation of good ideas and sound practices on the part of competent field personnel of the National Geodetic Survey (and of its predecessor, the U.S. Coast and Geodetic Survey) which have withstood the test of time over the past century-and-half of active expansion and densification of the primary horizontal control network in the United States. Two basic narrative description formats have evolved, corresponding to the two basic types of horizontal control points - the monumented station (normally marked with a standard survey disk) and the landmark station.

A horizontal control point which is a natural or man-made landmark is normally a large, well-defined object, easily identified at a distance, usually positioned by intersection from several distant monumented stations or else by a short (typically one-legged) traverse from a nearby monumented station, normally not to be occupied and devoid of any peripheral reference and/or azimuth marks. Accordingly, a brief narrative description is normally sufficient for a landmark station.

On the other hand, the narrative description of a horizontal control point which is a monumented (or otherwise permanently marked) station intended to be occupied with surveying instruments and normally having several associated reference and/or azimuth marks in its immediate vicinity must, of necessity, be more detailed and lengthier.

The principal elements of the two basic narrative description formats, together with the respective guidelines for the composition of adequate narrative descriptions (and of adequate recovery statements), which are in effect for NGS field parties, are given below separately for the monumented station case and for the landmark case. The guidelines and examples provided are intended to serve as exhaustive models for the two types of narrative description format. Specific cases may require only some of the elements listed, in which case those elements which are not applicable should be omitted.

Monumented Station: The elements of the narrative section of a station description or recovery note pertaining to a monumented horizontal control point (which, in NGS practice, normally consists of the station mark or monument, two or more peripheral reference marks, and one peripheral azimuth mark) are given below, accompanied by examples of the respective text.

1. Recovery Paragraph (recovery notes only) - in which the statement is made that the station in question was (or was not) recovered. If it was not recovered, further statements should indicate whether evidence was found that the station has been destroyed, or else that the station was searched for but not found. If it was recovered, further statements should indicate in what condition the station mark or monument was found, which of its peripheral points were also recovered and which were not recovered, noting especially any physical damage or dislocation of the respective marks or monuments. Mention should be made of any marks which were repaired and of any new marks set. A statement concerning the adequacy of the respective station description and/or previous recovery notes, if any, should appear last in the Recovery Paragraph; however, such a statement may be omitted if a new, complete narrative description follows. (This paragraph does not apply to original station descriptions.) Example:

> THE STATION MARK, REFERENCE MARKS 1, 2, AND 3, THE ASTRO POINT, AND THE AZIMUTH MARK WERE RECOVERED IN GOOD CONDITION. THE DIRECTIONS TO ALL MARKS CHECKED PREVIOUS DATA WITH THE EXCEPTION OF RM 1 WHICH DIFFERED BY 17 MINUTES 33 SECONDS. THE DISTANCES TO REFERENCE MARKS 1, 2, 3, AND TO THE ASTRO POINT DIFFERED FROM PREVIOUS DATA. ALL DISTANCES WERE LONGER, TO RM 1 BY 1.9 FEET OR 0.582 METERS, TO RM 2 BY 0.18 FEET OR 0.054 METERS, TO RM 3 BY 0.24 FEET OR 0.073 METERS, AND TO THE ASTRO POINT BY 0.16 FEET OR 0.049 METERS. FOLLOWING IS A NEW DESCRIPTION.

2. Station Location Paragraph - in which the general and specific location of the monumented station is given in as great a detail as necessary and appropriate, to include the name, address, and/or telephone number of the property owner or other competent person from whom permission was obtained to enter the premises for the purpose of establishing or recovering the horizontal control point in question, if such permission was necessary to gain access to the station site. Example:

> THE STATION IS ABOUT 9-1/2 MILES SOUTHWEST OF CONFLUENCE, 6 MILES SOUTHEAST OF FARMINGTON, 2 MILES WEST-NORTHWEST OF MARKLEYSBURG, 1-3/4 MILES NORTH-NORTHWEST OF THE TRI-STATE CORNER OF PENNSYLVANIA, MARYLAND, AND WEST VIRGINIA, IN A CLEARED AREA ON TOP OF A SMALL KNOLL AND ON PROPERTY OWNED BY GERALD NESS OF MORGANTOWN, TELEPHONE NUMBER 412-329-4788.

3. To-Reach-From Paragraph - in which specific directions are given how the station in question may be reached from a readily locatable point of departure such as a public building in a nearby town or the crossroads

of prominent highways, to include the mode of transportation used (or to be used) if other than a common road vehicle, points at which the mode of transportation must be changed (if any), and the approximate packing time (in hours and minutes), if packing of any consequence is required from the last point of transportation to the station site. If applicable and convenient, specific directions to reach the azimuth mark (which is normally located at some distance away from the station proper) may also be given in this paragraph. Example:

> TO REACH THE STATION FROM THE JUNCTION OF US HIGHWAY 40 AND STATE HIGHWAY 381 IN FARMINGTON, GO EAST ON US HIGHWAY 40 FOR 5.2 MILES TO A SIDE ROAD RIGHT AT A CEMENT BLOCK PLANT. TURN RIGHT AND GO SOUTH ON A PAVED ROAD FOR 1.45 MILES TO THE UNION CHAPEL CHURCH ON THE RIGHT AND A FIELD ROAD ON THE LEFT. (TO REACH THE AZIMUTH MARK FROM THIS POINT, TURN LEFT AND GO EAST ON THE FIELD ROAD FOR 0.05 MILE TO THE AZIMUTH MARK ON THE RIGHT.) CONTINUE SOUTH ON THE PAVED ROAD FOR 0.3 MILE TO A SIDE ROAD RIGHT, JUST PAST A HOUSE. TURN RIGHT AND GO NORTHWEST ON A TRACK ROAD FOR 0.1 MILE TO THE NORTH CORNER OF AN OPEN FIELD. TURN LEFT AND GO SOUTH ACROSS THE OPEN FIELD FOR ABOUT 150 FEET TO THE CENTER OF THE OPEN FIELD AND THE STATION.

4. Station Paragraph - in which a detailed description of the station mark or monument (and of the underground mark, if any) is given, to include the type of marker used, the exact name or designation and year which are customarily die-stamped or otherwise inscribed on the respective mark or monument, if applicable, followed by a description of the object or structure into which the marker is set.

Whenever the "stamped" or "inscribed" information is given, three consecutive hyphens (---) without any preceding or following blanks must be inserted immediately before and after the string of characters which represents the stamped or inscribed information. In particular, for station marks or monuments which are unstamped or otherwise unlabeled, the character strings '---UNSTAMPED---' or '---UNLABELED---' should be used, as appropriate.

In addition to the foregoing, the location of the station mark or monument with respect to permanent objects in the immediate vicinity (in the form of measured distance and point-of-the-compass heading from each such reference object to the respective station mark or monument) should be given as a part of the Station Paragraph. However, distances and headings from the peripheral reference and/or azimuth marks which appear in the Reference Section (see REFERENCE DATA RECORDS) should not be given again in this paragraph. Example:

> THE STATION IS A STANDARD US GEOLOGICAL SURVEY DISK STAMPED---FIKE 1945---SET INTO A DRILL HOLE IN A BURIED BOULDER 18 INCHES BELOW THE GROUND SURFACE. THERE WERE NO LOCAL OBJECTS TO REFERENCE FROM.

5. Reference Mark Paragraph(s) - in which a detailed description is given of a peripheral reference mark (RM) following the same guidelines as for the station mark or monument given in the Station Paragraph above. Two or more Reference Mark Paragraphs normally appear in the narrative description of a monumented station, one for each associated reference mark. Example:

REFERENCE MARK 3 IS A STANDARD US GEOLOGICAL SURVEY DISK STAMPED---RM 3 1945 2486 FT---SET INTO A DRILL HOLE IN ROCK OUTCROP, LOCATED 112 FEET EAST FROM THE CENTERLINE OF A TRACK ROAD, 8.2 FEET WEST FROM AN 8-INCH OAK TREE, AND 5.1 FEET NORTH FROM THE CENTER OF A 3X3-FOOT BOULDER.

6. Azimuth Mark Paragraph(s) - in which a detailed description is given of a peripheral azimuth mark (Az Mk) following the same guidelines as for the station mark or monument given in the Station Paragraph above, with the addition of concise directions how the azimuth mark may be reached if directions how to reach the azimuth mark in question have not been given in the To-Reach-From Paragraph (see farther above). Normally, there will be only one Azimuth Mark Paragraph; however, two or more may appear in the narrative description of a monumented station if more than one azimuth marks are associated with the respective station. Example:

AZIMUTH MARK IS A STANDARD US ARMY CORPS OF ENGINEERS DISK ---UNSTAMPED---SET INTO THE TOP OF A SQUARE CONCRETE MONUMENT 12 INCHES ON THE SIDE, PROJECTING 2 INCHES ABOVE THE GROUND, LOCATED 14 FEET SOUTHWEST FROM THE CENTERLINE OF A GRADED ROAD, 2.9 FEET SOUTH FROM A METAL WITNESS POST, AND 2.0 FEET SOUTHWEST FROM A POWER LINE POLE.

7. Other-Survey-Point Paragraph(s) - in which a detailed description is given of any other monumented (or otherwise permanently marked) survey point (e.g. a bench mark) which is located in the immediate vicinity of the monumented station in question, following the same guidelines as for the station mark or monument given in the Station Paragraph (see above), repeated as necessary to describe all such survey points in the immediate vicinity of the respective station. Example:

FIKE ASTRO ECC IS A STANDARD US ARMY MAP SERVICE DISK STAMPED--- FIKE ASTRO ECC A.M.S. 1968---SET INTO THE TOP OF A ROUND CONCRETE MONUMENT 10 INCHES IN DIAMETER, RECESSED 12 INCHES BELOW THE GROUND, LOCATED IN THE SOUTHWEST EDGE OF THE OPEN FIELD.

8. Other-Relevant-Information Paragraph(s) - in which any other useful information may be given. Example:

HEIGHT OF LIGHT ABOVE STATION MARK WAS 22.7 METERS. THE AZIMUTH MARK IS NO LONGER VISIBLE FROM THE GROUND. THERE WAS NO SUITABLE LOCATION FOR ADDITIONAL AZIMUTH MARK DUE TO HEAVY TIMBER.

Landmark Station: The elements of the narrative section of a station description or recovery note pertaining to a horizontal control point which is an unmonumented recoverable landmark (normally unoccupied, positioned by intersection or by a short traverse) are given farther below, accompanied by examples of the respective text.

As was pointed out earlier, the descriptive name of a landmark station is usually lengthy, and frequently words must be left out and/or abbreviations must be used in the name of a landmark station in order to conform to the 40-character total length limit (see Station Name, p. 3-20). Because of this fact, the leading element of the narrative section of a station description partaining to a landmark station is the Landmark Description Paragraph (rather than the Station Location Paragraph), which must start off with the phrase 'THE STATION, (full unabbreviated descriptive name of the landmark), ...' Example: The narrative section pertaining to the landmark station CENTERVILLE GAS CO MICROWAVE MAST leads off with the phrase 'THE STATION, CENTERVILLE TEXAS EASTERN GAS COMPANY MICROWAVE RELAY MAST, IS THE LIGHT ATOP....'

In the case of a recovery note pertaining to a landmark station, the leading element of the narrative section is the Recovery Paragraph, which must also start off with this standard phrase containing the full unabbreviated descriptive name of the respective landmark station. In a manner analogous to the recovery note of a monumented station, a new partial or complete narrative description may follow after the Recovery Paragraph. However, because of the fact that a landmark station is normally a large, well-defined object which is readily spotted and positively identified at a distance regardless of new construction or other changes in the general vicinity, a new narrative description following the Recovery Paragraph is seldom, if ever, given as a part of the recovery note.

The elements of the narrative section of a landmark station description or recovery note are as follows:

1. Recovery Paragraph (recovery notes only) - in which the full unabbreviated descriptive name of the landmark is given and the statement is made that the landmark station in question was (or was not) recovered. If it was not recovered, further statements should reflect what has become of the respective landmark and what parts of the landmark remain, if any. Special note should be made in those cases when, as it often happens, a landmark such as a water tank or radio mast has been dismantled and a new, similar structure is found erected nearby, perhaps even over the same foundation. In a case of this nature, it is importatnt to draw the attention of the prospective user to the fact that, althought it appears to be still there, the landmark station in question no longer exists. If the landmark station was recovered, note should be made of any obvious changes in the landmark itself (e.g. a water tank painted different color and/or bearing different lettering than previously described) as well as of any notable changes in the general vicinity of the landmark. (This paragraph does not apply to original landmark station descriptions.) Example:

THE STATION, BARKER RIDGE TELEVISION STATION WHTN MAST, WAS RECOVERED AS DESCRIBED IN 1957. IT IS NOTED THAT THE TELEVISION STATION IS NOW STATION WOWK, CHANNEL 13. A TALLER MAST HAS BEEN ERECTED VERY NEAR THIS STATION, MAKING IT THE SHORTER OF TWO MASTS.

2. Landmark Description Paragraph - in which the full unabbreviated descriptive name of the landmark is given, followed by a detailed description of the landmark station in question (and of the specific feature of the landmark, if applicable). Example:

THE STATION, LOTRIDGE TUPPERS PLAINS CHESTER WATER DISTRICT TANK, IS THE VENT PIPE LOCATED AT TOP CENTER OF A FOUR-LEGGED SELF-SUPPORTED ELEVATED WATER TANK THAT IS OWNED BY THE TUPPERS PLAINS CHESTER WATER DISTRICT. THEIR OFFICE IS LOCATED 3.1 MILES SOUTHWEST OF THE TUPPERS PLAINS POST OFFICE ALONG STATE HIGHWAY 7. THE STRUCTURE IS PAINTED LIGHT BLUE WITH BLACK LETTERING---TP-C WATER DIST---ON THE NORTH SIDE, WITH AN OVERALL HEIGHT OF 100 FEET.

3. Station Location Paragraph - in which the general and specific location of the landmark station in question is given in as great a detail as necessary and appropriate. Example:

THE STATION IS LOCATED ABOUT 13 MILES SOUTHEAST OF ATHENS, 5 MILES WEST OF COOLVILLE, AND 3/4 MILE NORTHEAST OF LOTRIDGE, IN THE SOUTHEAST QUADRANT OF THE SOUTH HALF OF SECTION 16, CARTHAGE TOWNSHIP.

4. To-Reach-From Paragraph - in which specific directions are given how the landmark station in question may be reached from a readily locatable point of departure such as a public building in a nearby town or the crossroads of prominent highways. Example:

TO REACH THE STATION FROM THE JUNCTION OF US HIGHWAY 50 AND STATE HIGHWAY 7, ABOUT 2 MILES SOUTH OF COOLVILLE, GO WESTERLY ON US HIGHWAY 50 FOR 4.5 MILES TO A SIDE ROAD LEFT. TURN LEFT AND GO FOR 0.05 MILE TO THE JUNCTION OF COUNTY ROAD 53. TURN LEFT AND GO SOUTH ON COUNTY ROAD 53 FOR 0.2 MILE TO A GRAVELED ROAD LEFT, THE CARTHAGE TOWNSHIP ROAD. TURN LEFT AND GO SOUTH ON THE CARTHAGE TOWNSHIP ROAD FOR 0.2 MILE TO A GRAVELED ROAD LEFT. TURN LEFT AND GO NORTH FOR 0.1 MILE TO THE TOP OF THE HILL AND THE STATION.

Because of the fact that both the landmark description data and the station location data are usually brief, these two elements of the narrative description of a landmark station may be combined into one paragraph. Furthermore, because of the inherent nature of a landmark station, the To-Reach-From Paragraph may be omitted if directions to reach the landmark station are unnecessary. Example:

THE STATION, ALBANY MUNICIPAL STANDPIPE, IS THE CENTER OF THE TOP OF A 90-FOOT TALL STANDPIPE WHICH IS PRESENTLY PAINTED SILVER. IT IS 0.35 MILE WEST OF THE JUNCTION OF ALTON AND WASHINGTON STREETS AND ON THE NORTH SIDE OF ALTON STREET IN ALBANY.

Rules for the Keying of Descriptive Text: The narrative section of a station description or recovery note may be keyed as a sequence of *40* general descriptive text records with *40*$ Paragraph Separation Records inserted between paragraphs and the *40*$$ Text Data Termination Record appended as the last record of the station description or recovery note. (See EXAMPLE - GENERAL DESCRIPTIVE TEXT on the following page.) Alternatively, the narrative section of a station description may be keyed as an appropriate combination of the optional partially coded descriptive text records (*50*, *51*, ..., *90* records); these records may also be used to key the narrative description following the recovery statement in a recovery note - see OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT.

As specified in Chapter 1, only the following special characters are allowed in addition to the usual alphabetic (A-Z) and numeric (0-9) characters:

(*) asterisk	(+) plus sign
( ) blank or space	(-) minus sign or hyphen
(,) comma	(=) equal sign
(.) period or decimal point	(/) slash or solidus
($) dollar sign	(() left parenthesis
	()) right parentesis

Care must be exercised to avoid miskeying the following characters:

O - number "zero"	1 - number "one"	2 - number "two"
O - letter "O"	L - letter "L"	Z - letter "Z"

In addition, the following rules apply:

1. Do not indent paragraphs.
2. Do not divide words (or other character groups) between successive records (however, a character string containing the separator '-', '--', or '---' may be divided at either end of such a separator).
3. Key two spaces (blanks) following the period before the start of a new sentence.
4. Substitute period (.) for semicolon (;) and 'AND' (in text) or plus sign (+) (in abbreviation or acronym) for ampersand (&). *
5. Substitute two consecutive hyphens (--) without any preceding or following blanks for a colon (:), i.e., XXXXXX: YYYYYY key as XXXXXX--YYYYYY.
6. Key a dash as space-hyphen-space, i.e., as XXXXXX - YYYYYY.
7. Omit (i.e., do not key) any other special characters which are not listed above.
8. Key a hyphen (instead of a blank) in an improper (mixed) fraction (e.g. 5-1/2, etc.).
9. Whenever "stamped" information is given, insert three consecutive hyphens (---) without any preceding or following blanks immediately before and after the string of characters which represents the stamped information (see p. 3-37).

EXAMPLE - GENERAL DESCRIPTIVE TEXT

An example of a station description coded using the general descriptive text records (*40* records) is given below. The same station description, formatted for publication, appears on the following page.

```
000010*G2*HZTLDESCNGS   NATIONAL GEODETIC SURVEY                          19761217

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

003580*10*057D                  *11*N390792          *12*D08R        *13*D04N
003590*14*SNAGGY                                     *15*MD/GARRETT
003600*20*1/NGS                 *21*1975JRS          *22*SP0000      *23*19.5
003610*30*    BEAR                          N                 10.1 MI   00000000
003620*30*D55 SNAGGY RM 1                   E  H58.45 17.816            0935609
003630*30*D06 SNAGGY RM 2                   WNWH51.24 15.619            2984400
003640*30*D85 ALTA USGS                     NW H46.07 14.041            31006477
003650*30*L57 SNAGGY MOUNTAIN LOT           NW  46.1  14.04             31007
003660*30*    SNAGGY RM 1
003670*30*    SNAGGY RM 2                      S107.09
003680*30*$$
003690*40*THE STATION IS ABOUT 8-1/2 MILES SOUTHWEST OF MCHENRY, 6-1/2 MILES
003700*40*NORTHWEST OF OAKLAND, 4-1/2 MILES NORTHEAST OF TERRA ALTA (WEST
003710*40*VIRGINIA), ON TOP OF SNAGGY MOUNTAIN, NEAR THE SNAGGY MOUNTAIN
003720*40*LOOKOUT TOWER, ON LAND OWNED BY THE MARYLAND DEPARTMENT OF NATURAL
003730*40*RESOURCES.  PERMISSION WAS GRANTED BY GEORGE GILMORE, STATE FORESTRY
003740*40*SUPERVISOR, TELEPHONE NUMBER 301-724-8530, CUMBERLAND, MARYLAND.
003750*40*$
003760*40*TO REACH THE STATION FROM THE COURTHOUSE IN OAKLAND, GO NORTH ON
003770*40*US HIGHWAY 219 FOR 0.1 MILE TO THE JUNCTION WITH GREEN STREET.  TURN
003780*40*LEFT AND GO WEST ON GREEN STREET AND A PAVED ROAD FOR 6.0 MILES
003790*40*TO A FORK AND A SIGN--SWALLOW FALLS STATE PARK.  TAKE THE LEFT FORK
003800*40*AND CONTINUE WESTERLY ON A PAVED ROAD FOR 1.3 MILES TO A GRAVELED
003810*40*SIDE ROAD LEFT.  TURN LEFT AND GO SOUTHERLY ON THE GRAVELED ROAD
003820*40*FOR 0.6 MILE TO A SIDE ROAD RIGHT.  TURN RIGHT AND GO NORTHWESTERLY
003830*40*ON A ROUGH ROCKY ROAD FOR 1.15 MILES TO A FORK.  TAKE THE LEFT FORK
003840*40*(GRADED ROAD), AND CONTINUE NORTHWESTERLY FOR 0.5 MILE TO THE TOP
003850*40*OF THE HILL, THE LOOKOUT TOWER, AND THE STATION.
003851*40*$
003860*40*STATION MARKS ARE STANDARD DISKS STAMPED---SNAGGY 1975---.  THE
003870*40*SURFACE DISK IS SET IN THE TOP OF A 12-INCH CYLINDRICAL CONCRETE
003880*40*MONUMENT WHICH PROJECTS 5 INCHES ABOVE THE GROUND.  IT IS 55.4 FEET
003890*40*EAST OF A STATE LINE MONUMENT, 35.8 FEET EAST OF THE SOUTHEAST LEG
003900*40*OF THE LOOKOUT TOWER, 31.0 FEET SOUTH OF A TRIANGLE BLAZED TREE, AND
003910*40*3.5 FEET NORTH OF A WITNESS POST.  THE UNDERGROUND DISK IS SET IN
003920*40*AN IRREGULAR MASS OF CONCRETE 26 INCHES BELOW THE GROUND SURFACE.
003930*40*$
003940*40*REFERENCE MARK 1 IS A STANDARD DISK STAMPED---SNAGGY NO 1 1975---
003950*40*CEMENTED IN A DRILL HOLE IN ROCK OUTCROP THAT IS FLUSH WITH THE
003960*40*GROUND.  IT IS 61.5 FEET NORTHEAST OF THE WITNESS POST, 43.0 FEET
003970*40*EAST OF THE TRIANGLE BLAZED TREE, AND 9.5 FEET NORTH OF THE
003980*40*CENTERLINE OF A GRADED ROAD.
003990*40*$
004000*40*REFERENCE MARK 2 IS A STANDARD DISK STAMPED---SNAGGY NO 2 1975---
004010*40*CEMENTED IN A DRILL HOLE IN THE CONCRETE FOUNDATION FOR THE SOUTHWEST
004020*40*LEG OF THE LOOKOUT TOWER.  IT IS 49.0 FEET WEST OF THE WITNESS POST,
004030*40*AND 8.0 FEET NORTHEAST OF THE STATE LINE MONUMENT.
004040*40*$
004050*40*ALTA USGS IS A STANDARD DISK OF THE US GEOLOGICAL SURVEY STAMPED---
004060*40*ALTA 1945---CEMENTED IN A DRILL HOLE IN A 1X1-FOOT BOULDER THAT
004070*40*PROJECTS 7 INCHES ABOVE THE GROUND.  THE MARK IS LOCATED IN THE CENTER
004080*40*OF THE BASE OF THE LOOKOUT TOWER AND IS VERY LOOSE IN THE GROUND.
004090*40*$
004100*40*THERE WAS NO SUITABLE LOCATION FOR AN AZIMUTH MARK.
004110*40*HEIGHT OF LIGHT ABOVE MARK 22.1 METERS.
004120*40*$$

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

011280*G2*
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FIGURE 3-2 - Station description coded using general descriptive text records.

```
******************** S T A T I O N   D E S C R I P T I O N ********************
STATION NAME- SNAGGY                          STATE--MD  COUNTY--GARRETT              QUAD--N390794 [illegible]--1027
********************************** YEAR  CDP ****************************** REACHED BY ***** PACK TIME ** HGT OF TELESCOPE
MONUMENT BY--NAT GEODETIC SURVEY  1975  JDS   ORR TYPE--TRIANG STN DISK   LIGHT TOWER      00 HRS 00 MIN     19.5 METERS

              CODE MARK TYPE ********** SETTING/LANDMARK TYPE ************************************** MAGNETIC PROPERTY
     SURFACE--0008 SURVEY DISK          SET INTO THE TOP OF A ROUND CONCRETE MONUMENT               STEEL ROD IMPROVED
 UNDERGROUND--0010 SURVEY DISK          SET INTO THE TOP OF AN IRREGULAR MASS OF CONCRETE           NO MAGNETIC MATERIAL
              033  SURVEY DISK          SET INTO DRILL HOLE IN ROCK OUTCROP
              006  SURVEY DISK          SET INTO DRILL HOLE IN A CONCRETE SLAB
              045  SURVEY DISK          SET INTO DRILL HOLE IN A PARTIALLY EXPOSED BOULDER
              153  LANDMARK             LOOKOUT TOWER

                   REFERENCE OBJECT ********** BEARING/DISTANCE (MEASURED OR ESTIMATED) ** DIRECTION
                   [illegible]                 N     [illegible] 10.1 MI                       0 [illegible]
              033  SNAGGY RM 1                 E     HORIZ  50.45 FEET  15.[illegible] METERS   93 56 [illegible]
              006  SNAGGY RM 2                 NNW   HORIZ  51.24 FEET  15.619 METERS   296 44 06
              045  ALTA [illegible]            NW    HORIZ  46.07 FEET  14.042 METERS   310 06 07.7
              153  SNAGGY MOUNTAIN LOT         NW           46.1  FEET  14.04  METERS   310 07
                      SNAGGY RM 1
                   TO SNAGGY RM 2                          SLOPE 107.09 FEET
```

THE STATION IS ABOUT [illegible] 1/2 MILES [illegible] OF [illegible], [illegible] 1/2 MILES [illegible] OF OAKLAND, [illegible] 1/2 MILES NORTHEAST OF TERRA ALTA, WEST VIRGINIA, ON TOP OF SNAGGY MOUNTAIN, NEAR THE SNAGGY MOUNTAIN LOOKOUT TOWER, ON LAND OWNED BY THE MARYLAND DEPARTMENT OF NATURAL RESOURCES. PERMISSION WAS GRANTED BY [illegible], STATE FORESTRY SUPERVISOR, TELEPHONE NUMBER [illegible], [illegible], MARYLAND.

TO REACH THE STATION FROM THE COURTHOUSE IN OAKLAND, GO NORTH ON US HIGHWAY 219 FOR 0.[illegible] MILE TO THE JUNCTION WITH GREEN STREET. TURN LEFT AND GO WEST ON GREEN STREET AND A PAVED ROAD FOR [illegible] MILES TO A FORK AND A SIGN SWALLOW FALLS STATE PARK. TAKE THE LEFT FORK AND CONTINUE [illegible] ON A PAVED ROAD FOR 1.[illegible] MILES TO A GRAVELED SIDE ROAD LEFT. TURN LEFT AND GO [illegible] ON THE GRAVELED ROAD FOR [illegible] MILE TO A SIDE ROAD RIGHT. TURN RIGHT AND GO [illegible] ON A ROUGH ROCKY ROAD FOR [illegible] MILES TO A FORK, TAKE THE LEFT FORK [illegible], AND CONTINUE [illegible] FOR [illegible] MILE TO THE TOP OF THE HILL, THE LOOKOUT TOWER, AND THE STATION.

STATION MARKS ARE STANDARD DISKS STAMPED---SNAGGY 1975---. THE SURFACE DISK IS SET IN THE TOP OF A [illegible] INCH CYLINDRICAL CONCRETE MONUMENT WHICH PROJECTS [illegible] INCHES ABOVE THE GROUND. IT IS [illegible] FEET EAST OF A STATE LAND MONUMENT, [illegible] FEET EAST OF THE SOUTHEAST LEG OF THE LOOKOUT TOWER, [illegible] FEET [illegible] OF A TRIANGLE BLAZED TREE, AND [illegible] FEET NORTH OF A WITNESS POST. THE UNDERGROUND MARK IS SET IN AN IRREGULAR MASS OF CONCRETE [illegible] INCHES BELOW THE GROUND SURFACE.

REFERENCE MARK 1 IS A STANDARD DISK STAMPED---SNAGGY NO 1 1975---CEMENTED IN A DRILL HOLE IN ROCK OUTCROP THAT IS FLUSH WITH THE GROUND. IT IS [illegible] FEET [illegible] OF THE WITNESS POST, [illegible] FEET EAST OF THE TRIANGLE BLAZED TREE, AND [illegible] FEET NORTH OF THE CENTERLINE OF A GRADED ROAD.

REFERENCE MARK 2 IS A STANDARD DISK STAMPED---SNAGGY NO 2 1975---CEMENTED IN A DRILL HOLE IN THE CONCRETE FOUNDATION FOR THE SOUTHWEST LEG OF THE LOOKOUT TOWER. IT IS [illegible] FEET WEST OF THE WITNESS POST, AND [illegible] FEET [illegible] OF THE STATE LAND MONUMENT.

ALTA [illegible] IS A STANDARD DISK OF THE US GEOLOGICAL SURVEY STAMPED---ALTA [illegible]---CEMENTED IN A DRILL HOLE IN A [illegible]-FOOT BOULDER THAT PROJECTS [illegible] INCHES ABOVE THE GROUND. THE MARK IS LOCATED IN THE CENTER OF THE BASE OF THE LOOKOUT TOWER AND IS VERY LOOSE IN THE GROUND.

THERE WAS NO SUITABLE LOCATION FOR AN AZIMUTH MARK. HEIGHT OF LIGHT ABOVE MARK [illegible] METERS.

FIGURE A-1 - Station description in publishable format

OPTIONAL PARTIALLY CODED DESCRIPTIVE TEXT

Text and format diagrams to be prepared in the near future.

FORMAT DIAGRAMS

For each record which may appear in an HZTL DESC data set (see Table 3-1), a block diagram has been prepared to illustrate the respective format. These "format diagrams" have been designed to fulfill the following objectives:

1. Each record is 80 characters long (standard punched card image).

2. Each record has a fixed format, i.e., every data field has a specific length and specific position within the record.

3. Each format diagram is a graphical image of the respective record.

4. Within the limits of available space, information and instructions concerning the data item to be entered in each data field are provided on the format diagrams to render them self-explanatory.

5. Whenever appropriate, sample entries are shown in the data entry line of each format diagram.

6. Each data field is characterized as to its type by a string of lower-case characters which appear immediately below the data entry line.

Data Field Types:

1. Alpha Field (aa...a) - intended for a data item which is coded as a string of alphabetic, numeric, and/or special characters, with or without imbedded blanks, to be entered into the respective data field left-justified and blank-filled on the right. See Chapter 1 (or p. 3-41) for a list of special characters which are allowed.

2. Blank Field (bb...b) - to be blank-filled. Data fields which are designated as blank fields must be left blank, i.e., no data items may be entered in these fields.

3. Constant (Numeric) Field (cc...c) - intended for a data item which is a number (i.e., an integer, a proper or improper fraction, or a decimal fraction) coded as a string of numeric characters (prefixed with minus sign if the number is negative) which may contain one leading or imbedded (but not trailing) decimal point if it is a decimal fraction, or an imbedded hyphen and/or slash if it is a proper or improper (mixed) fraction such as 3/4, 5-1/2, etc., to be entered into the respective data field left-justified and blank-filled on the right.

4. Integer Field (ii...i) - intended for a data item which is coded as a string of numeric characters representing a positive or negative integer number, to be entered into the respective data field right-justified. In the case of a positive integer number, zero-fill any unused columns to the left. In the case of a negative integer number, code the minus sign immediately preceding the leftmost nonzero digit, and blank-fill any unused columns to the left of the minus sign.

5. Specific Character Field (ss...s) - intended to contain a specific alphabetic, numeric, or special character or a specific group of characters. Every "s" column of a specific character field must contain the character shown in that position in the data entry line of the respective format diagram.

Required Data: In general, only those records which are applicable to the station description or recovery note at hand should be submitted for that station description or recovery note in the HZTL DESC data set. The required record sequences for the various station description and recovery note coding options are shown in Table 3-3 (p. 3-5), Table 3-4 (p. 3-6), Table 3-5 (p. 3-8), Table 3-6 (p. 3-9), Table 3-7 (p. 3-10), and in Table 3-8 (p. 3-12). The character fields intended for data items which are deemed essential have been shaded on the format diagrams; if applicable to the station description or recovery note being coded, these character fields must be filled out in accordance with the instructions given on the respective format diagrams or in the text of Chapter 3.

Data Set Identification Record. This must be the first record of every data set submitted. A data set may be submitted either as a deck of cards or as a magnetic tape file containing formatted records. Magnetic tape is preferred; use punched cards for small, isolated jobs only.

Columns 1–6	Columns 7–10	Columns 11–14	Columns 15–18	Columns 19–24	Columns 25–66	Columns 67–72	Columns 73–80
Sequence Number - must be 000010 on this record. Increment by 10 on successive records to allow for insertions.	Job Code - preceded and followed by asterisk.	Data Class - HZTL for horizontal control data.	Data Type - DESC for descriptive data.	Abbreviation - must be unique. Enter the symbol listed in ANNEX C. See footnote for other agencies or firms.	Full Name		Date Data Set Created (e.g. date this record keyed). Century, year, month, day (CCYYMMDD). If day is unknown, leave last two columns blank. If month is unknown, leave last four columns blank.
	Data Set Identification			Name of Submitting Agency or Firm			
000010	*B2*	HZTL	DESC	NGS	NATIONAL GEODETIC SURVEY		19760622
iiiiii	saas	ssss	ssss	aaaaaa	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	bbbbbb	iiiiiiii

Important: To insure uniqueness, agencies or firms not listed in ANNEX C must have their proposed abbreviation symbol accepted by NGS prior to first submittal of data - see ANNEX K.

10,*11*,*12*,*13* Station Identification Record. This must be the leading record of every self-standing station description (DRC Code D), self-standing recovery note (DRC Code R), and of the first element (description or recovery note) in a combined set (DRC Code C - see footnote).

Columns	Format	Example	Description
1-6	iiiiii	nnnnnn	Sequence Number Increment by 10 on successive records to allow for insertions.
7-10	siis	*10*	Data Code - preceded and followed by asterisk. (*10* - Station Serial Number and DRC Code)
11-14	iiii	001	Station Serial Number (SSN) - must be identical to SSN of same point in HZTL OBS or HZTL POS data set.
15	a	R	DRC Code - see footnote.
16-32	bbbbbbbbbbbbbbbbb		NOTE - Subsequent recovery notes following the leading description or recovery note in a combined set (DRC Code C) must start with the *24*,*25*,*26*,*27* Recovery-by-Agency Record.
33-36	siis	*11*	Data Code - optional when no information follows. (*11* - Quad Identifier and Quad Station Number)
37	a	N	Hemisphere - N or S. — 1°x1° Quad containing the station - blank if unknown. — Quad Identifier (QID)
38-39	ii	41	Latitude of SE Corner
40-42	iii	075	Longitude of SE Corner 000-359 W of Greenwich.
43-45	iii	124	30', 15', 7½' Quadrantal Subdivision Indicators 1-NE, 2-SE, 3-SW, 4-NW sub-quads, else blank.
46-50	iiiia	0001	Quad Station Number (QSN) - enter the 7½x7½' QSN (0001,0002,etc.) or the 30x30' QSN (1001,1002,etc.) followed by suffix (if any). Leave blank if unknown.
51-53	bbb		
54-57	siis	*12*	Data Code - optional when no information follows. (*12* - Surface Mark Type and Magnetic Code)
58	a	D	Mark Code — Surface Mark Type and M-Code See ANNEX I - blank if unk.
59-60	ii	09	Setting/Landmark Code
61	a		M-Code
62-70	bbbbbbbbb		
71-74	siis	*13*	Data Code - optional when no information follows. (*13* - Underground Mark Type and Magnetic Code)
75	a	D	Mark Code — Underground Mark Type and M-Code See ANNEX I - blank if unknown.
76-77	ii	05	Setting Code
78	a		M-Code
79-80	bb		

DRC Code: D - description, R - recovery note, C - combined set consisting of a description or recovery note followed by one or more subsequent recovery notes for the same station.

14,*15* Station Name Record. This record contains the name or designation of the horizontal control point, a two-letter code for the U.S. state, Canadian province, or foreign country (see ANNEX A), and the name of the next lower political subdivision in which the station is located.

```
0000000001111111111222222222233333333334444444444555555555566666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789 0
```

Columns	Field	Description	Example	Format
1–6	Sequence Number	Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7–10	Data Code	Data Code - preceded and followed by asterisk. (*14* - Station Name or Designation)	*14*	siis
11–50	Station Name	Station Name - must not exceed 40 characters. This is the name or designation which will be associated with the horizontal control point for publication purposes. Note that for data processing purposes (i.e., in the HZTL OBS or HZTL POS data set) the name of a horizontal control point is limited to 30 characters (see Chapters 2 and 4). Consequently, there must be two versions of every station name which exceeds 30 characters; the two versions should differ only as to the manner in which the station name is edited and/or abbreviated. Guidelines for survey point names and designations, including recommended abbreviations, are given in ANNEX D. Note that neither the "year mark set" nor the "year established" is normally included in the station name - see text for exceptions. Parentheses are not permitted to appear in a station name. Other special characters such as commas, periods, etc. (see Chapter 1) - as well as any unnecessary spaces (blanks) - should also be edited out of the station name whenever possible.	KELLY	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
51–53				bbb
54–57	Data Code	Data Code - preceded and followed by asterisk. (*15* - State or Country Code and County Name)	*15*	siis
58–59	State or Country Code	State or Country Code - see footnote and ANNEX A.	PA	aa
60			/	s
61–80	County	County - or county-equivalent. Enter the name of the next lower political subdivision in which the station is located; abbreviate if necessary. For points in the U.S. and in Canada, enter the name of the first-order political subdivision of the state, commonwealth, province, or territory (i.e., county, parish, census division, independent city, etc.). The name of an independent city must be prefixed by the symbol C OF (e.g. C OF BALTIMORE for the city of Baltimore, MD). For points in other countries, enter the name of the primary political subdivision such as state, province, district, etc.	WAYNE	aaaaaaaaaaaaaaaaaaaa

State or Country Code: Enter the two-letter state, commonwealth, or territory code for points in the U.S., the province or territory code in Canada, or the respective country code elsewhere.

20, *21*, *22*, *23* Monument-by-Agency Record. Use to indicate the agency which set the mark (or otherwise established the survey point) and to give other data pertaining to the establishment of the station. This record is required for descriptions and optional for recovery notes.

Columns	Format	Example	Description
1-6	nnnnnn	nnnnnn	Sequence Number Increment by 10 on successive records to allow for insertions.
7-10	siis	*20*	Data Code - preceded and followed by asterisk. (*20* - Agency Code and Agency Name)
11	i	1	Agency Code - see footnote and ANNEX I.
12-33	saaaaaaaaaaaaaaaaaaaaa	/CGS	Monument by Agency - name of the agency or firm which is to be credited for the monumentation or establishment of the horizontal control point - e.g. the agency or firm whose name appears cast on the survey disk. For agencies or firms listed in ANNEX C, enter the respective six-character abbreviation. For others, enter the full or abbreviated name (up to 20 characters) - see ANNEX C for examples.
34-37	siis	*21*	Data Code - preceded and followed by asterisk. (*21* - Year and Chief of Party)
38-41	iiii	1940	Year of Monumentation - as stamped on the disk. For landmarks, enter the year in which positioned.
42-44	aaa	RJS	Chief of Party - initials of the person responsible for monumentation or establishment of the station.
45-53	bbbbbbbbb		NOTE - Transportation Code: A-Light Airplane B-Boat C-Car/Sta Wagon F-Float Airplane H-Helicopter O-Other/See Text P-Pickup/Carryall T-Truck W-Tracked Vehicle X-Four-Wheel-Drive
54-57	siis	*22*	Data Code - preceded and followed by asterisk. (*22* - Marker Type and Transportation Data)
58	a	S	Marker Type - see footnote and ANNEX I.
59	a	T	Transportation Code - see NOTE above and ANNEX I.
60-61	ii	00	Hours: Pack Time - leave blank if unknown,
62-63	ii	10	Minutes: zero-fill if no packing is required.
64-69	bbbbbb		NOTE - On this record, indicate the recommended (most practical) mode of transportation to reach the station (i.e., to use just prior to packing).
70-73	siis	*23*	Data Code - optional when no information follows. (*23* - Height of Telescope)
74-77	cccc	19	Height of Telescope above mark in meters - the largest height of instrument used for observation.
78-80	bbb		

Agency Code: 1-NGS/CGS, 2-USGS, 3-DOD, 4-Other Federal, 5-State, 6-County/City, etc. see ANNEX I.

Marker Type: S-Triang Sta Disk, R-RM Disk, Z-Az Mk Disk, B-BM Disk, L-Landmark, etc. see ANNEX I.

24, *25*, *26*, *27* Recovery-by-Agency Record. Use this record to indicate the agency which recovered the horizontal control point and to give other data pertaining to the recovery. This record is required for recovery notes only.

Columns	Description	Example	Format
1–6	Sequence Number Increment by 10 on successive records to allow for insertions.	nnnnnn	iiiiii
7–10	Data Code - preceded and followed by asterisk. (*24* - Agency Code and Agency Name)	*24*	siis
11	Agency Code - see footnote and ANNEX I.	1	i
12		/	s
13–32	Recovery by Agency - name of the agency or firm which recovered the horizontal control point. For agencies or firms listed in ANNEX C, enter the respective six-character abbreviation. For others, enter the full or abbreviated name (up to 20 characters) - see ANNEX C for examples.	CGS	aaaaaaaaaaaaaaaaaaaa
33–36	Data Code - preceded and followed by asterisk. (*25* - Year and Chief of Party)	*25*	siis
37–40	Year of Recovery of the horizontal control point.	1942	iiii
41–43	Chief of Party - initials of the person in charge of the survey operation resulting in the recovery.	FQ	aaa
44–53	NOTE - Transportation Code: B-Boat C-Car/Sta Wagon A-Light Airplane H-Helicopter O-Other/See Text F-Float Airplane T-Truck W-Tracked Vehicle P-Pickup/Carryall X-Four-Wheel-Drive		bbbbbbbbbb
54–57	Data Code - preceded and followed by asterisk. (*26* - Condition Code and Transportation Data)	*26*	siis
58	Condition Code - see footnote and ANNEX I.	G	a
59	Transportation Code - see NOTE above and ANNEX I.	P	a
60–61	Hours — Pack Time - leave blank if unknown,	00	ii
62–63	Minutes — zero-fill if no packing is required.	00	ii
64–69	NOTE - On this record, indicate the mode of transportation actually used to reach the station (i.e., used just prior to packing).		bbbbbb
70–73	Data Code - optional when no information follows. (*27* - Height of Telescope)	*27*	siis
74–77	Height of Telescope above mark in meters - the largest height of instrument used for observation.	1.8	cccc
78–80			bbb

Agency Code: 1-NGS/CGS, 2-USGS, 3-DOD, 4-Other Federal, 5-State, 6-County/City, etc. see ANNEX I.

Condition Code: G-Good/Fair, N-Not Recovered, O-Other/See Text, P-Poor/Disturbed, X-Destroyed.

*

30 Reference Object Record. Submit this record for each reference object or peripheral point (in sets of two or more) to which a distance and/or direction has been measured from the station. The leading record of every *30* record set must be the "initial" to which the direction is zero.

000000 123456	0001 7890	1111 1234	111112222222222333333333344444 567890123456789012345678901234	444 567	4 8	455555 901234	5555566 5678901	6 2	6666666777 3456789012	777 345	77 67	77 89	8 0
Sequence Number Increment by 10 on successive records to allow for insertions.	Data Code - preceded and followed by asterisk. (*30* - Reference Object Record)	Mark Code / Setting/Landmark Code / M-Code — Mark Type and Magnetic Code - see ANNEX I. Leave blank if unknown.	Name or Description of Reference Object - must not exceed 30 characters; edit and/or abbreviate as necessary. For measurements from the station to its peripheral points, enter the full name or designation (e.g. KELLY RM 1, KELLY RM 2, KELLY AZ MK, etc.). For distance measurements between peripheral points, use two *30* records, one bearing the name of the standpoint, and the other the name of the forepoint and the measurement(s). NOTE - The last *30* record must be the Reference Data Termination Record; also, insert a Reference Data Separation Record between successive sets when two or more ref data sets are given - see footnotes.	Compass Heading - the cardinal or inter-cardinal direction to the reference object.	HSV Code - H-horiz, S-slope, V-VG, N-not VG.	Measured Distance Feet Distance in Feet - do not enter distance measured in meters and converted to feet.	Measured Distance Meters Distance in Meters - do not enter distance measured in feet and converted to meters.	A-Flag - A-approximately, blank otherwise.	Estimated Distance Estimated Distance and Units - enter the estimated distance to the reference object followed by units (abbreviated), as a string of alphanumeric characters.	Sexagesimal Degrees	Minutes	Seconds	Tenths of Second
										Direction to the Reference Object - clockwise angle from the initial reference object in sexagesimal units.			
nnnnnn	*30*		EQUINUNK	N	V					000	00	00	0
nnnnnn	*30*	D09	KELLY RM 1	NE	H	54.30	16.552			037	45	55	
nnnnnn	*30*	D55	KELLY AZ MK	SSW					1.3 MI	201	42	39	5
nnnnnn	*30*	I53	EQUINUNK MUNICIPAL WATER TANK	NW				A	8-1/2 MI	314	47	50	
iiiiii	siis	aiia	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	aaa	a	cccccc	ccccccc	a	aaaaaaaaaa	iii	ii	ii	i
000000 123456	0001 7890	1111 1234	111112222222222333333333344444 567890123456789012345678901234	444 567	4 8	455555 901234	5555566 5678901	6 2	6666666777 3456789012	777 345	77 67	77 89	8 0

Reference Data Separation Record: Insert nnnnnn*30*$ to separate multiple reference data sets.

Reference Data Termination Record: Append nnnnnn*30*$$ to indicate end of reference data.

40 Descriptive Text Record. Use this record for each line of text of 70 characters or less. Do not divide words between successive records. The last *40* record must be the Text Data Termination Record; also, insert a Paragraph Separation Record between paragraphs - see footnotes.

```
0000000001111111112222222222333333333444444444555555555566666666677777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789
```

Descriptive Text: Key the narrative section of an existing station description or recovery note as a sequence of *40* records with Paragraph Separation Records inserted between paragraphs and the Text Data Termination Record appended as the last record (see footnotes). For a new description or recovery note, the optional partially coded text records (*50*,*51*,...,*90* records) may be used instead of the *40* Descriptive Text Records. A recovery statement followed by a new full or partial description may be keyed as a set of *40* records (with Paragraph Separation Records, if applicable, but without the Text Data Termination Record) followed immediately by the appropriate *50*,*51*,...,*90* records. See Chapter 1 for a list of special characters which are allowed in the narrative section of a description or recovery note. In addition, the following rules apply:

1. Do not indent paragraphs.
2. Do not divide words (or other character groups) between successive records.
3. Key two spaces (blanks) following a period before the start of new sentence.
4. Substitute period (.) for semicolon (;) and 'AND' or (+) for ampersand (&).
5. Substitute two consecutive hyphens (--) without any preceding or following blanks for a colon (:), i.e., XXXXX: YYYYY key as XXXXX--YYYYY.
6. Key a dash as space-hyphen-space, i.e., as XXXXX - YYYYY.
7. Omit (i.e., do not key) any other special characters not listed in Chapter 1.
8. Key a hyphen (instead of a blank) in an improper fraction (e.g. 5-1/2, etc.).
9. Whenever "stamped" information is given, insert three consecutive hyphens (---) without any preceding or following blanks immediately before and after the string of characters which represents the stamped information.
   Example: STATION IS A STANDARD DISK STAMPED--SAFFORD 2 1976--SET INTO....
   Example: REFERENCE MARK 3, STAMPED--SAFFORD NO. 3 1940---, IS SET INTO....

Sequence Number
Increment by 10 on successive records to allow for insertions.

Data Code - Descriptive Text Record)
(*40* preceded by asterisk, followed by a space and

```
nnnnnn*40*THE STATION WAS RECOVERED IN GOOD CONDITION. NEW DESCRIPTION FOLLOWS:
iiiiiisiisaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
0000000001111111112222222222333333333444444444555555555566666666677777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789
```

Paragraph Separation Record: Insert nnnnnn*40*$ to separate consecutive paragraphs of text.

Text Data Termination Record: Append nnnnnn*40*$$ to indicate end of descriptive text.

*

Data Set Termination Record. This must be the last record of every data set submitted.

0000000001 columns 1–6	columns 7–10	columns 11–80
000000 / 123456	0001 / 7890	1111111111222222222233333333334444444444555555555566666666667777777778 / 1234567890123456789012345678901234567890123456789012345678901234567890
Sequence Number Increment by 10 on successive records to allow for insertions.	Job Code - preceded and followed by asterisk.	
nnnnnn	*B2*	
iiiiii	saas	bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
000000 / 123456	0001 / 7890	1111111111222222222233333333334444444444555555555566666666667777777778 / 1234567890123456789012345678901234567890123456789012345678901234567890

Data Set Structure: The HZTL DESC Data Set is made up of station data blocks, each containing station description and/or recovery note(s), arranged in sequence by Station Serial Number.

Data Set Identification Record	
Description or Recovery Note Subsequent Recovery Note } (if any) :::: Subsequent Recovery Note	First Station
Description or Recovery Note Subsequent Recovery Note } (if any) :::: Subsequent Recovery Note	Second Station
:::: ::::	:::: ::::
Description or Recovery Note Subsequent Recovery Note } (if any) :::: Subsequent Recovery Note	Last Station
Data Set Termination Record	

ANNEX A

NGS STATE AND COUNTRY CODES

NORTH AMERICA AND GREENLAND

GREENLAND . . . . . GL

CANADA . . . . . CD

Provinces and Territories:

Alberta	AB	Newfoundland	NF	Prince Edward Is	PE
British Columbia	BC	Northwest Terr's	NW	Quebec	PQ
Manitoba	MB	Nova Scotia	NS	Saskatchewan	SK
New Brunswick	NB	Ontario	ON	Yukon Territory	YK

UNITED STATES . . . . . US

States and District of Columbia:

Alabama	AL	Kentucky	KY	North Dakota	ND
Alaska	AK	Louisiana	LA	Ohio	OH
Arizona	AZ	Maine	ME	Oklahoma	OK
Arkansas	AR	Maryland	MD	Oregon	OR
California	CA	Massachusetts	MA	Pennsylvania	PA
Colorado	CO	Michigan	MI	Rhode Island	RI
Connecticut	CT	Minnesota	MN	South Carolina	SC
Delaware	DE	Mississippi	MS	South Dakota	SD
Dist of Columbia	DC	Missouri	MO	Tennessee	TN
Florida	FL	Montana	MT	Texas	TX
Georgia	GA	Nebraska	NE	Utah	UT
Hawaii	HI	Nevada	NV	Vermont	VT
Idaho	ID	New Hampshire	NH	Virginia	VA
Illinois	IL	New Jersey	NJ	Washington	WA
Indiana	IN	New Mexico	NM	West Virginia	WV
Iowa	IA	New York	NY	Wisconsin	WI
Kansas	KS	North Carolina	NC	Wyoming	WY

Other Political Units and Territories:

American Samoa	AS	Misc U.S. Caribbean Islands	BQ	*
Canal Zone	CZ	Phoenix Islands (Canton Is)	CQ	*
Guam	GU	Johnston Atoll	JQ	*
Puerto Rico	PR	Midway Islands	MQ	*
Virgin Islands	VI	Wake Island	WQ	
Trust Terr of Pacific Islands (Marianas, Carolines, Marshalls)			TQ	

BERMUDA . . . . . BD

MEXICO . . . . . MX

CENTRAL AMERICA AND THE CARIBBEAN AREA

BAHAMA ISLANDS	BM	FRENCH ANTILLES	FA
BARBADOS	BB	GUATEMALA	GT
BELIZE (British Honduras)	BH	HONDURAS	HO
BRITISH VIRGIN ISLANDS	BV	HAITI	HA
BRITISH WEST INDIES	BI	JAMAICA	JM
CAYMAN ISLANDS	CI	NETHERLANDS ANTILLES	NA
COLOMBIA	CB	NICARAGUA	NI
COSTA RICA	CR	PANAMA	PN
CUBA	CU	TRINIDAD AND TOBAGO	TD
DOMINICAN REPUBLIC	DR	TURKS AND CAICOS ISLANDS	TC
EL SALVADOR	ES	VENEZUELA	VE

OTHER COUNTRIES OR AREAS OF INTEREST TO NGS

ASCENSION/ST HELENA ISLANDS	SH	LINE ISLANDS (Christmas Is)	XI
BRAZIL	BR	PHILIPPINE ISLANDS	PI
ETHIOPIA	ET	SOUTH AFRICA	SA
FRENCH GUIANA	FG	SOVIET UNION	UR
FRENCH SOMALILAND	FS	SUDAN	SU
GILBERT AND ELLICE ISLANDS	GE	SURINAM (Dutch Guiana)	DG
GUYANA (British Guiana)	BG	TRISTAN DA CUNHA ISLANDS	TR

ANNEX B

STATE PLANE COORDINATES (SPC) ZONE CODES

NAD 83

SPC	ZONE	CODE
AL	E	0101
	W	0102
AK	1	5001
	2	5002
	3	5003
	4	5004
	5	5005
	6	5006
	7	5007
	8	5008
	9	5009
	10	5010
AZ	E	0201
	C	0202
	W	0203
AR	N	0301
	S	0302
CA	1	0401
	2	0402
	3	0403
	4	0404
	5	0405
	6	0406
	7	0407
CO	N	0501
	C	0502
	S	0503
CT		0600
DE		0700
FL	E	0901
	W	0902
	N	0903
GA	E	1001
	W	1002

SPC	ZONE	CODE
HI	1	5101
	2	5102
	3	5103
	4	5104
	5	5105
ID	E	1101
	C	1102
	W	1103
IL	E	1201
	W	1202
IN	E	1301
	W	1302
LA	N	1401
	S	1402
KS	N	1501
	S	1502
KY	N	1601
	S	1602
LA	N	1701
	S	1702
	O	1703
ME	E	1801
	W	1802
MD		1900
MA	M	2001
	O	2002
MI	ETM	2101
	CTM	2102
	WTM	2103
	NLC	2111
	CLC	2112
	SLC	2113

SPC	ZONE	CODE
MN	N	2201
	C	2202
	S	2203
MS	E	2301
	W	2302
MO	E	2401
	C	2402
	W	2403
MT	N	2501
	C	2502
	S	2503
NE	N	2601
	S	2602
NV	E	2701
	C	2702
	W	2703
NH		2800
NJ		2900
NM	E	3001
	C	3002
	W	3003
NY	E	3101
	C	3102
	W	3103
	LI	3104
NC		3200
ND	N	3301
	S	3302
OH	N	3401
	S	3402

2500

SPC	ZONE	CODE
OK	N	3501
	S	3502
OR	N	3601
	S	3602
PA	N	3701
	S	3702
RI		3800
SC	N	3901
	S	3902
SD	N	4001
	S	4002
TN		4100

SPC	ZONE	CODE
TX	N	4201
	NC	4202
	C	4203
	SC	4204
	S	4205
UT	N	4301
	C	4302
	S	4303
VT		4400
VA	N	4501
	S	4502
WA	N	4601
	S	4602

SPC	ZONE	CODE
WV	N	4701
	S	4702
WI	N	4801
	C	4802
	S	4803
WY	E	4901
	EC	4902
	WC	4903
	W	4904
PR		5201
VI		5201
VI	SX	5202
AS		5300

LEGEND:

C - Central Zone
CLC- Central Zone, Lambert Conformal Conic Projection
CTM- Central Zone, Transverse Mercator Projection
E - Eastern Zone
EC - East-Central Zone
ETM- Eastern Zone, Transverse Mercator Projection
LI - Long Island Zone
M - Mainland Zone
N - Northern Zone
NC - North-Central Zone
NLC- Northern Zone, Lambert Conformal Conic Projection
O - Offshore Zone
S - Southern Zone
SC - South-Central Zone
SLC- Southern Zone, Lambert Conformal Conic Projection
SX - St Croix Island Zone
W - Western Zone
WC - West-Central Zone
WTM- Western Zone, Transverse Mercator Projection

ANNEX B

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) 1983 DEFINING CONSTANTS

LEGEND:

T - Transverse Mercator Projection
L - Lambert Conformal Conic Projection
O - Hotine Oblique Mercator Projection
UTM - Universal Transverse Mercator Projection
1:M - Scale Reduction at Central Meridian

METERS		FEET	
		US Survey	International
152400.3048	=	500000.0	
213360.0	=		700000.0
304800.6096	=	1000000.0	
609600.0	=		2000000.0
609601.2192	=	2000000.0	
914401.8289	=	3000000.0	

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State / Zone	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Origin of Projection: Geographic Position Longitude (DDD-MM)	False Coordinates at Origin: North(Y) (Meters)	False Coordinates at Origin: East(X) (Meters)	Scale Factor (1:M)	Standard Parallels: -South- (DD-MM)	Standard Parallels: -North- (DD-MM)
Alabama									
East	0101	T	30°30'N	85°50'W	0.0	200000.0	25000		
West	0102	T	30 00	87 30	0.0	600000.0	15000		
Alaska									
Zone 1	5001	O	57 00	133 40	-5000000.	5000000.0	10000	Axis Az	$Tan^{-1}(-3/4)$
Zone 2	5002	T	54 00	142 00	0.0	500000.0	10000		
Zone 3	5003	T	54 00	146 00	0.0	500000.0	10000		
Zone 4	5004	T	54 00	150 00	0.0	500000.0	10000		
Zone 5	5005	T	54 00	154 00	0.0	500000.0	10000		
Zone 6	5006	T	54 00	158 00	0.0	500000.0	10000		
Zone 7	5007	T	54 00	162 00	0.0	500000.0	10000		
Zone 8	5008	T	54 00	166 00	0.0	500000.0	10000		
Zone 9	5009	T	54 00	170 00	0.0	500000.0	10000		
Zone 10	5010	L	51 00	176 00	0.0	1000000.0		51°50'N	53°50'N
Arizona									
East	0201	T	31 00	110 10	0.0	213360.0	10000		
Central	0202	T	31 00	111 55	0.0	213360.0	10000		
West	0203	T	31 00	113 45	0.0	213360.0	15000		
Arkansas									
North	0301	L	34 20	92 00	0.0	400000.0		34 56	36 14
South	0302	L	32 40	92 00	400000.0	400000.0		33 18	34 46
California									
Zone 1	0401	L	39 20	122 00	500000.0	2000000.0		40 00	41 40
Zone 2	0402	L	37 40	122 00	500000.0	2000000.0		38 20	39 50
Zone 3	0403	L	36 30	120 30	500000.0	2000000.0		37 04	38 26
Zone 4	0404	L	35 20	119 00	500000.0	2000000.0		36 00	37 15
Zone 5	0405	L	33 30	118 00	500000.0	2000000.0		34 02	35 28
Zone 6	0406	L	32 10	116 15	500000.0	2000000.0		32 47	33 53

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State / Zone	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Origin of Projection: Geographic Position Longitude (DDD-MM)	False Coordinates: North(Y) (Meters)	False Coordinates: East(X) (Meters)	Scale Factor (K/M)	Standard Parallels: -South- (DD-MM)	Standard Parallels: -North- (DD-MM)
Colorado									
North	0501	L	39°20'N	105°30'W	304800.6096	914401.8289		39°43'N	40°47'N
Central	0502	L	37 50	105 30	304800.6096	914401.8289		38 27	39 45
South	0503	L	36 40	105 30	304800.6096	914401.8289		37 14	38 26
Connecticut	0600	L	40 50	72 45	152400.3048	304800.6096		41 12	41 52
Delaware	0700	T	38 00	75 25	0.0	200000.0	200004		
Florida									
East	0901	T	24 20	81 00	0.0	200000.0	17003		
West	0902	T	24 20	82 00	0.0	200000.0	17000		
North	0903	L	29 00	84 10	0.0	600000.0		29 35	30 45
Georgia									
East	1001	T	30 00	82 10	0.0	200000.0	10003		
West	1002	T	30 00	84 10	0.0	700000.0	10000		
Hawaii									
Zone 1	5101	T	18 50	155 30	0.0	500000.0	30003		
Zone 2	5102	T	20 20	156 40	0.0	500000.0	10003		
Zone 3	5103	T	21 10	158 00	0.0	500000.0	100003		
Zone 4	5104	T	21 50	159 30	0.0	500000.0	100003		
Zone 5	5105	T	21 40	160 30	0.0	500000.0			
Idaho									
East	1101	T	41 40	112 10	0.0	200000.0	19000		
Central	1102	T	41 40	114 00	0.0	500000.0	19000		
West	1103	T	41 40	115 45	0.0	800000.0	15000		
Illinois									
East	1201	T	36 40	88 20	0.0	300000.0	40000		
West	1202	T	36 40	90 10	0.0	700000.0	17000		

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State Zone	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Origin of Projection: Geographic Position Longitude (DDD-MM)	False Coordinates North(Y) (Meters)	False Coordinates East(X) (Meters)	Scale Factor (1:M)	Standard Parallels -South- (DD-MM)	Standard Parallels -North- (DD-MM)
Indiana									
East	1301	T	37°30'N	85°40'W	250000.0	100000.0	30000		
West	1302	T	37 30	87 05	250000.0	900000.0	30000		
Iowa									
North	1401	L	41 30	93 30	1000000.0	1500000.0		42°04'S	43°16'N
South	1402	L	40 00	93 30	0.0	500000.0		40 37	41 47
Kansas									
North	1501	L	38 20	98 00	0.0	400000.0		38 43	39 47
South	1502	L	36 40	98 30	400000.0	400000.0		37 16	38 34
Kentucky									
North	1601	L	37 30	84 15	0.0	500000.0		37 58	38 58
South	1602	L	36 20	85 45	500000.0	500000.0		36 44	37 56
Louisiana									
North	1701	L	30 30	92 30	0.0	1000000.0		31 10	32 40
South	1702	L	28 30	91 20	0.0	1000000.0		29 18	30 42
Offshore	1703	L	25 30	91 20	0.0	1000000.0		26 10	27 50
Maine									
East	1801	T	43 40	68 30	0.0	300000.0	10000		
West	1802	T	42 50	70 10	0.0	900000.0	30000		
Maryland	1900	L	37 40	77 00	0.0	400000.0		38 18	39 27
Massachusetts									
Mainland	2001	L	41 00	71 30	750000.0	200000.0		41 43	42 41
Island	2002	L	41 00	70 30	0.0	500000.0		41 17	41 29

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State Zone	SPCS Zone Code	Proj. Type (T/L/O)	ORIGIN of Projection: Geographic Position Latitude (DD-MM)	Longitude (DDD-MM)	False Coordinates: Northing (Y) (Meters)	False Coordinates: East (X) (Meters)	Scale Factor (1:K)	Standard Parallels: *South* (DD-MM)	Standard Parallels: *North* (DD-MM)
Michigan									
North	2111	L	44*47'N	87*00'W	0.0	8000000.0		45*29'N	47*05'N
Central	2113	L	43 19	84 22	0.0	6000000.0		44 11	45 42
South	2116	L	41 30	84 22	0.0	4000000.0		42 06	43 40
Minnesota									
North	2201	L	46 30	93 06	100000.0	800000.0		47 02	48 38
Central	2202	L	45 00	94 15	100000.0	800000.0		45 37	47 03
South	2203	L	43 00	94 00	100000.0	800000.0		43 47	45 13
Mississippi									
East	2301	T	29 38	88 50	0.0	300000.0	20000		
West	2302	T	29 30	90 20	0.0	700000.0	20000		
Missouri									
East	2401	T	35 50	90 30	0.0	250000.0	15000		
Central	2402	T	35 50	92 30	0.0	500000.0	15000		
West	2403	T	36 10	94 30	0.0	850000.0	17000		
Montana	2500	L	44 15	109 30	0.0	600000.0		45 00	49 00
Nebraska	2600	L	39 50	100 00	0.0	500000.0		40 00	43 00
Nevada									
East	2701	T	34 45	115 35	8000000.0	200000.0	10000		
Central	2702	T	34 45	116 40	6000000.0	500000.0	10000		
West	2703	T	34 45	118 35	4000000.0	800000.0	10000		
New Hampshire	2800	T	42 30	71 40	0.0	300000.0	30000		
New Jersey	2900	T	38 50	74 30	0.0	150000.0	10000		

U.S. STATE PLANE COORDINATE SYSTEMS (SPCSs) --- 1983 DEFINING CONSTANTS

State Zone	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Longitude (DDD-MM)	False Coordinates North(Y) (Meters)	East(X) (Meters)	Scale Factor (1:M)	Standard Parallels -South- (DD-MM)	-North- (DD-MM)
New Mexico									
East	3001	T	31° 00'N	104°20'W	0.0	165000.0	11000		
Central	3002	T	31 00	106 15	0.0	500000.0	10000		
West	3003	T	31 00	107 50	0.0	830000.0	12000		
New York									
East	3101	T	38 30	74 30	0.0	150000.0	10000		
Central	3102	T	40 00	76 35	0.0	250000.0	16000		
West	3103	T	40 00	78 35	0.0	350000.0	16000		
Long Island	3104	L	40 10	74 00	0.0	300000.0		40°40'N	41°02'N
North Carolina	3200	L	33 45	79 00	0.0	609601.22		34 20	36 10
North Dakota									
North	3301	L	47 00	100 30	0.0	600000.0		47 26	48 44
South	3302	L	45 40	100 30	0.0	600000.0		46 11	47 29
Ohio									
North	3401	L	39 40	82 30	0.0	600000.0		40 26	41 42
South	3402	L	38 00	82 30	0.0	600000.0		38 44	40 02
Oklahoma									
North	3501	L	35 00	98 00	0.0	600000.0		35 34	36 46
South	3502	L	33 20	98 00	0.0	600000.0		33 56	35 14
Oregon									
North	3601	L	43 40	120 30	0.0	2500000.0		44 20	46 00
South	3602	L	41 40	120 30	0.0	1500000.0		42 20	44 00
Pennsylvania									
North	3701	L	40 10	77 45	0.0	600000.0		40 53	41 57
South	3702	L	39 20	77 45	0.0	600000.0		39 56	40 58

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State Zone	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Longitude (DDD-MM)	False Coordinates: North(Y) (Meters)	East(X) (Meters)	Scale Factor (1=M)	Standard Parallels: -South- (DD-MM)	-North- (DD-MM)
Rhode Island	3800	T	41° 05'N	71° 30'W	0.0	100000.0	160000		
South Carolina	3900	L	31 50	81 00	0.0	609600.0		32° 30'N	34° 50'N
South Dakota									
North	4001	L	43 50	100 00	0.0	600000.0		44 25	45 41
South	4002	L	42 20	100 20	0.0	600000.0		42 50	44 24
Tennessee	4100	L	34 20	86 00	0.0	600000.0		35 15	36 25
Texas									
North	4201	L	34 00	101 30	1000000.0	200000.0		34 39	36 11
North Central	4202	L	31 40	98 30	2000000.0	600000.0		32 08	33 58
Central	4203	L	29 40	100 20	3000000.0	700000.0		30 07	31 53
South Central	4204	L	27 50	99 00	4000000.0	600000.0		28 23	30 17
South	4205	L	25 40	98 30	5000000.0	300000.0		26 10	27 50
Utah									
North	4301	L	40 20	111 30	1000000.0	500000.0		40 43	41 47
Central	4302	L	38 20	111 30	2000000.0	500000.0		39 01	40 39
South	4303	L	36 40	111 30	3000000.0	500000.0		37 13	38 21
Vermont	4400	T	42 30	72 30	0.0	500000.0	28000		
Virginia									
North	4501	L	37 40	78 30	2000000.0	3500000.0		38 02	39 12
South	4502	L	36 20	78 30	1000000.0	3500000.0		36 46	37 58
Washington									
North	4601	L	47 00	120 50	0.0	500000.0		47 30	48 44
South	4602	L	45 20	120 30	0.0	500000.0		45 50	47 20

U.S. STATE PLANE COORDINATE SYSTEMS (SPCS) --- 1983 DEFINING CONSTANTS

State Area	SPCS Zone Code	Proj. Type (T/L/O)	Origin of Projection: Geographic Position Latitude (DD-MM)	Origin of Projection: Geographic Position Longitude (DDD-MM)	False Coordinates: North(Y) (Meters)	False Coordinates: East(X) (Meters)	Scale Factor (1=N)	Standard Parallels: -South- (DD-MM)	Standard Parallels: -North- (DD-MM)
West Virginia									
North	4701	L	38°30'N	79°30'W	0.0	600000.0		39°00'N	40°15'N
South	4702	L	37 00	81 00	0.0	600000.0		37 29	38 53
Wisconsin									
North	4801	L	43 49	90 00	0.0	600000.0		45 34	46 46
Central	4802	L	41 50	90 00	0.0	600000.0		44 15	45 30
South	4803	L	42 00	90 00	0.0	600000.0		42 44	43 04
Wyoming									
East	4901	T	40 30	105 10	0.0	200000.0	16000		
East Central	4902	T	40 30	107 20	100000.0	400000.0	16000		
West Central	4903	T	40 30	108 45	0.0	600000.0	16000		
West	4904	T	40 30	110 05	100000.0	800000.0	16000		
Puerto Rico	5200	L	17 50	66 26	200000.0	200000.0		18 02	18 26
Virgin Islands	5200	L	17 50	66 26	200000.0	200000.0		18 02	18 26
St Croix	5200	L	17 50	66 26	200000.0	200000.0		18 02	18 26
Dist of Columbia		L	(Use state of Maryland 1900)						
American Samoa	5300								
Guam	5400	T	00°00'N	147°00'E	0.0	500000.0	2500	(UTM Zone 55)	
Saipan	5400	T							

1/1/81

ANNEX C

CONTRIBUTORS OF GEODETIC CONTROL DATA

This ANNEX contains a list of organizations which have contributed (or are expected to contribute) data resulting from geodetic control established to extend and/or densify the national horizontal and vertical geodetic control networks.

A unique six-character identification symbol has been assigned to each organization listed. As far as possible, this symbol is identical to the commonly used abbreviation or acronym of the respective organization. However, to insure uniqueness, modifications of the commonly used abbreviations and acronyms, as well as arbitrary symbols, had to be assigned in many cases. Organizations not listed in this ANNEX may contact the National Geodetic Survey (see ANNEX K) to have a unique identification symbol assigned. *

The abbreviation or acronym of the organization whose name is precast in the monument should be included as part of the designation (except for NGS, NOS, or C&GS). For marks not having a precast agency name: if the agency that set the mark is known, append that agency's acronym or abbreviation. The abbreviation or acronym to be used for this purpose should be: *

a. The identification symbols listed in this ANNEX, except for county and city agencies. *

b. For county and city agencies, an appropriate and intelligible acronym or abbreviation (e.g., K CO for King County, C of R for the City of Richmond, etc.). *

Note: For organizations not listed in this ANNEX, append the acronym or abbreviation commonly used to refer to the organization, or as specified by the organization itself. For state, commonwealth, or territorial organizations, the first two letters of the acronym or abbreviation must be the standard two-letter abbreviations listed in ANNEX A. *

In addition to the six-character unique identification symbol, a 20-character standard abbreviated name is also given for each organization listed. The respective organizations are grouped under 13 categories, and within each category they are listed in the alphabetic order of their identification symbols. The 13 categories are given in an index which appears on the following page.

CATEGORIES OF CONTRIBUTORS OF GEODETIC CONTROL DATA — PAGE

a. International and Foreign Government Agencies C-3
b. Federal and Interstate Agencies C-3
c. State, Commonwealth, and Territorial Agencies C-4
d. County Agencies C-7
e. City Agencies C-10
f. Public Inter-City and Regional Agencies C-14
g. Railroads C-14
h. Petroleum and Pipeline Companies C-16
i. Gas and Electric Utility Companies C-17
j. Surveying and Construction Industry C-17
k. Miscellaneous Commercial Organizations and Private Firms C-19
l. Academic Institutions and Amateur Organizations C-20
m. General Non-Specific Designators C-21

CONVENTIONS USED IN THE FORMATION OF IDENTIFICATION SYMBOLS

a. State, Commonwealth, and Territorial Agencies: The six-character identification symbol of a state, commonwealth, or territorial agency consists of the respective two-character state code (see ANNEX A) to which up to four letters (e.g. the initials of the agency's name) may be appended. In general, "S" for "state" and "O" for "of" should be omitted.

b. County Agencies: The six-character identification symbol of a county agency consists of the two-character code denoting the state in which the county is located (see ANNEX A) followed by a hyphen and by a three-digit number which has been assigned to the respective county in Worldwide Geographic Location Codes prepared by the Office of Finance, General Services Administration (GSA), November 1976. Agencies which do not have access to this publication may contact the National Geodetic Survey (see ANNEX K) to obtain the appropriate county code.

c. City Agencies: The six-character identification symbol of a city agency consists of the two-character code denoting the state in which the city is located (see ANNEX A) followed by a four-digit number which has been assigned to the respective city in Worldwide Geographic Location Codes prepared by the Office of Finance, General Services Administration (GSA), November 1976. Agencies which do not have access to this publication may contact the National Geodetic Survey (see ANNEX K) to obtain the appropriate city code.

NOTE: For the purposes of this ANNEX, agencies of independent cities which are also counties or county-equivalents should be considered to be city (rather than county) agencies and assigned identification symbol accordingly.

CONTRIBUTORS OF GEODETIC CONTROL DATA AS OF 800801

NOTE - AGENCY SYMBOLS LISTED HEREIN ARE FOR NGS INTERNAL USE ONLY
AGENCY ABBREVIATIONS IN STATION NAMES SHOULD BE RETAINED AS GIVEN

INTERNATIONAL AND FOREIGN GOVERNMENT AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
DTENAL	DETENAL DE MEXICO	ESTUDIOS DEL TERRITORIO NACIONAL DE MEXICO
GSC	GEOD SURV OF CANADA	GEODETIC SURVEY OF CANADA
IAGS	INTER AMER GEOD SURV	INTER AMERICAN GEODETIC SURVEY
IBC	INT BOUNDARY COMM	INTERNATIONAL BOUNDARY COMMISSION
IBWC	INT BDRY WTR COMM	INTERNATIONAL BOUNDARY AND WATER COMMISSION
ONCADH	ONTARIO DEPT OF HIGH	ONTARIO CANADA DEPARTMENT OF HIGHWAYS
PICGS	PI C AND G SURVEY	PHILIPPINE COAST AND GEODETIC SURVEY

FEDERAL AND INTERSTATE AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AEC	ATOMIC ENERGY COMM	ATOMIC ENERGY COMMISSION (NOW ERDA)
AMS	ARMY MAP SERVICE	US ARMY MAP SERVICE (NOW DMA)
BLM	BUR OF LAND MGT	US BUREAU OF LAND MANAGEMENT
BOF	BUR OF FISHERIES	US BUREAU OF COMMERCIAL FISHERIES
BOM	BUR OF MINES	US BUREAU OF MINES
BOR	BUR OF RECLAMATION	US BUREAU OF RECLAMATION (NOW WPRS)
BPA	BONNEVILLE PWR ADMIN	BONNEVILLE POWER ADMINISTRATION
BPR	BUR OF PUBLIC ROADS	US BUREAU OF PUBLIC ROADS
CAB	CIVIL AERONAUT BOARD	CIVIL AERONAUTICS BOARD
CGS	COAST AND GEOD SURV	US COAST AND GEODETIC SURVEY (NOW NOS)
DI	DEPT OF INTERIOR	US DEPARTMENT OF INTERIOR
DMA	DEFENSE MAP AGENCY	DEFENSE MAPPING AGENCY
DOD	DEPT OF DEFENSE	US DEPARTMENT OF DEFENSE
FAA	FDRL AVIATION ADMIN	FEDERAL AVIATION ADMINISTRATION
IRC	ILLINOIS RIVER COMM	ILLINOIS RIVER COMMISSION
MORC	MISSOURI RIVER COMM	MISSOURI RIVER COMMISSION
MRC	MISS RIVER COMM	MISSISSIPPI RIVER COMMISSION
NASA	NAT AERO SPACE ADMIN	NATIONAL AERONAUTICS AND SPACE ADMIN
NBS	NAT BUR OF STANDARDS	NATIONAL BUREAU OF STANDARDS
NGS	NAT GEODETIC SURVEY	NATIONAL GEODETIC SURVEY
NIH	NAT INST OF HEALTH	NATIONAL INSTITUTES OF HEALTH
NMTXBC	NM TX BOUNDARY COMM	NEW NEXICO AND TEXAS BOUNDARY COMMISSSION
NOS	NAT OCEAN SURVEY	NATIONAL OCEAN SURVEY
NOSAMC	NOS ATLAN MARINE CTR	NOS ATLANTIC MARINE CENTER
NOSPMC	NOS PACIF MARINE CTR	NOS PACIFIC MARINE CENTER
NPS	NAT PARK SERVICE	NATIONAL PARK SERVICE
NSL	NAVY STANDARDS LAB	US NAVY STANDARDS LABORATORY AT POMONA
PBPP	PUB BLDGS AND PARKS	OFFICE OF PUBLIC BUILDINGS AND PUBLIC PARKS
SCS	SOIL CONSERV SERVICE	SOIL CONSERVATION SERVICE
TPC	USATOPOCOM	US ARMY TOPOGRAPHIC COMMAND (NOW DMA)
TVA	TENN VALLEY AUTH	TENNESSEE VALLEY AUTHORITY
USA	US ARMY	US ARMY

FEDERAL AND INTERSTATE AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
USAF	US AIR FORCE	US AIR FORCE
USCG	US COAST GUARD	US COAST GUARD
USDA	DEPT OF AGRICULTURE	US DEPARTMENT OF AGRICULTURE
USDWC	US DEEP WTRWAY COMM	US DEEP WATERWAY COMMISSION
USE	US ENGINEERS	US ARMY CORPS OF ENGINEERS
USFS	US FOREST SERVICE	US FOREST SERVICE
USFWA	FEDERAL WORKS AGENCY	US FEDERAL WORKS AGENCY
USFWS	FISH AND WILDLIFE	US FISH AND WILDLIFE SERVICE
USGLO	US GOVT LAND OFFICE	US GOVERNMENT LAND OFFICE
USGS	US GEOLOGICAL SURVEY	US GEOLOGICAL SURVEY
USGS-E	USGS EASTERN MAP CTR	USGS EASTERN MAPPING CENTER
USGS-M	USGS MIDCONT MAP CTR	USGS MID-CONTINENT MAPPING CENTER
USGS-R	USGS ROCKYMT MAP CTR	USGS ROCKY MOUNTAIN MAPPING CENTER
USGS-W	USGS WESTERN MAP CTR	USGS WESTERN MAPPING CENTER
USLHS	US LIGHTHSE SERVICE	US LIGHTHOUSE SERVICE (NOW USCG)
USLS	US LAKE SURVEY	US LAKE SURVEY
USMC	US MARINE CORPS	US MARINE CORPS
USN	US NAVY	US NAVY
USPS	US POSTAL SERVICE	US POSTAL SERVICE
USSC	US SUPREME COURT	US SUPREME COURT
USTD	US TREASURY DEPT	US TREASURY DEPARTMENT
USWB	US WEATHER BUREAU	US WEATHER BUREAU (NOW NWS)
WPRS	WATER AND POWER RES	US WATER AND POWER RESOURCES SERVICE

STATE, COMMONWEALTH, AND TERRITORIAL AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AKDAVI	AK DIV OF AVIATION	ALASKA DIVISION OF AVIATION
AKHD	AK HIGHWAY DEPT	ALASKA HIGHWAY DEPARTMENT
AKPWR	AK POWER ADMIN	ALASKA POWER ADMINISTRATION
ALGS	AL GEODETIC SURVEY	ALABAMA GEODETIC SURVEY
ALHD	AL HIGHWAY DEPT	STATE OF ALABAMA HIGHWAY DEPARTMENT
ARGLS	AR GEOLOGICAL SURVEY	ARKANSAS GEOLOGICAL SURVEY
ARGS	AR GEODETIC SURVEY	ARKANSAS GEODETIC SURVEY
ARHD	AR HIGHWAY DEPT	ARKANSAS STATE HIGHWAY DEPARTMENT
AZDT	AZ DEPT OF TRANSP	ARIZONA DEPARTMENT OF TRANSPORTATION
AZHD	AZ HIGHWAY DEPT	ARIZONA HIGHWAY DEPARTMENT (NOW AZDT)
CADH	CA DIV OF HIGHWAYS	CALIFORNIA DIVISION OF HIGHWAYS (NOW CADT)
CADPW	CA DEPT OF PUB WORKS	CALIFORNIA DEPARTMENT OF PUBLIC WORKS
CADT	CA DEPT OF TRANSP	CALIFORNIA DEPARTMENT OF TRANSPORTATION
CADWR	CA DEPT OF WATER RES	CALIFORNIA DEPARTMENT OF WATER RESOURCES
CAEC	CA EARTHQUAKE COMM	CALIFORNIA EARTHQUAKE COMMISSION
CAGS	CA GEODETIC SURVEY	CALIFORNIA GEODETIC SURVEY
CASLC	CA STATE LANDS COMM	CALIFORNIA STATE LANDS COMMISSION
CASPC	CA STATE PARKS COMM	CALIFORNIA STATE PARKS COMMISSION
CODH	CO DEPT OF HIGHWAYS	COLORADO STATE DEPARTMENT OF HIGHWAYS
COGS	CO GEODETIC SURVEY	COLORADO GEODETIC SURVEY
CTCSF	CT COMM SHELL FISH	CONNECTICUT COMMISSION OF SHELL FISHERIES
CTDT	CT DEPT OF TRANSP	CONNECTICUT DEPARTMENT OF TRANSPORTATION
CTGS	CT GEODETIC SURVEY	CONNECTICUT GEODETIC SURVEY

STATE, COMMONWEALTH, AND TERRITORIAL AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
DCDHT	DC DEPT OF HIGHWAYS	DC DEPARTMENT OF HIGHWAYS AND TRAFFIC
DEDHT	DE DEPT OF HIGHWAYS	DELAWARE DEPARTMENT OF HIGHWAYS AND TRANSP
FLDNR	FL DEPT OF NAT RES	FLORIDA DEPARTMENT OF NATURAL RESOURCES
FLDPW	FL DEPT OF PUB WORKS	FLORIDA DEPARTMENT OF PUBLIC WORKS
FLDT	FL DEPT OF TRANSP	FLORIDA DEPARTMENT OF TRANSPORTATION
FLGS	FL GEODETIC SURVEY	FLORIDA GEODETIC SURVEY
FLHD	FL HIGHWAY DEPT	FLORIDA HIGHWAY DEPARTMENT (NOW FLDT)
GADT	GA DEPT OF TRANSP	GEORGIA DEPARTMENT OF TRANSPORTATION
GAGS	GA GEODETIC SURVEY	GEORGIA GEODETIC SURVEY
GAHD	GA HIGHWAY DEPT	GEORGIA HIGHWAY DEPARTMENT (NOW GADT)
HIDT	HI DEPT OF TRANSP	HAWAII DEPARTMENT OF TRANSPORTATION
HIGS	HI GEODETIC SURVEY	HAWAII GEODETIC SURVEY
HITS	HI TERRIT SURVEY	HAWAII TERRITORIAL SURVEY
IAHD	IA HIGHWAY DEPT	IOWA HIGHWAY DEPARTMENT
IDDH	ID DEPT OF HIGHWAYS	IDAHO DEPARTMENT OF HIGHWAYS (NOW IDDT)
IDDT	ID DEPT OF TRANSP	IDAHO DEPARTMENT OF TRANSPORTATION
IDGS	ID GEODETIC SURVEY	IDAHO GEODETIC SURVEY
IDPWD	ID DEPT OF PUB WORKS	IDAHO DEPARTMENT OF PUBLIC WORKS
ILDPW	IL DEPT OF PUB WORKS	ILLINOIS DEPARTMENT OF PUBLIC WORKS
ILDT	IL DEPT OF TRANSP	ILLINOIS DEPARTMENT OF TRANSPORTATION
ILDW	IL DIV OF WATERWAYS	ILLINOIS DIVISION OF WATERWAYS
ILGS	IL GEODETIC SURVEY	ILLINOIS GEODETIC SURVEY
ILHD	IL HIGHWAY DEPT	ILLINOIS HIGHWAY DEPARTMENT (NOW ILDT)
ILSC	IL SANITARY COMM	ILLINOIS SANITARY COMMISSION
INDNR	IN DEPT OF NAT RES	INDIANA DEPARTMENT OF NATURAL RESOURCES
INFCC	IN FLOOD CONTR COMM	INDIANA FLOOD CONTROL AND WATER RES COMM
INGS	IN GEODETIC SURVEY	INDIANA GEODETIC SURVEY
INHD	IN HIGHWAY DEPT	INDIANA HIGHWAY DEPARTMENT
IOWAGS	IA GEODETIC SURVEY	IOWA GEODETIC SURVEY
KSDT	KS DEPT OF TRANSP	KANSAS DEPARTMENT OF TRANSPORTATION
KSGS	KS GEODETIC SURVEY	KANSAS GEODETIC SURVEY
KSHC	KS HIGHWAY COMM	STATE HIGHWAY COMM OF KANSAS (NOW KSDT)
KSWRB	KS WATER RES BOARD	KANSAS WATER RESOURCES BOARD
KYDT	KY DEPT OF TRANSP	KENTUCKY DEPARTMENT OF TRANSPORTATION
KYGS	KY GEODETIC SURVEY	KENTUCKY GEODETIC SURVEY
KYHD	KY HIGHWAY DEPT	KENTUCKY STATE HIGHWAY DEPARTMENT (NOW KYDT)
LADH	LA DEPT OF HIGHWAYS	LOUISIANA DEPARTMENT OF HIGHWAYS (NOW LADTD)
LADTD	LA TRANSP AND DEV	LOUISIANA DEPT OF TRANSP AND DEVELOPMENT
LAGS	LA GEODETIC SURVEY	LOUISIANA GEODETIC SURVEY
LASCC	LA CONSERVATION COMM	LOUISIANA STATE CONSERVATION COMMISSION
LAWRRI	LA WATER RES INST	LOUISIANA WATER RESOURCE RESEARCH INSTITUTE
MADLH	MA DEPT LAND-HARBORS	MASSACHUSETTS DEPARTMENT OF LAND AND HARBORS
MADPW	MA DEPT OF PUB WORKS	MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
MAGS	MA GEODETIC SURVEY	MASSACHUSETTS GEODETIC SURVEY
MDBCSM	MD BUR SURV AND MAPS	MARYLAND BUREAU OF CONTROL SURVEYS AND MAPS
MDDT	MD DEPT OF TRANSP	MARYLAND DEPARTMENT OF TRANSPORTATION
MDGS	MD GEODETIC SURVEY	MARYLAND GEODETIC SURVEY
MDSFC	MD SHELL FISH COMM	MARYLAND SHELL FISHERIES COMMISSION
MDSRC	MD STATE ROADS COMM	MARYLAND STATE ROADS COMMISSION (NOW MDDT)
MEDT	ME DEPT OF TRANSP	MAINE DEPARTMENT OF TRANSPORTATION
MEGS	ME GEODETIC SURVEY	MAINE GEODETIC SURVEY
MEHD	ME HIGHWAY DEPT	MAINE HIGHWAY DEPARTMENT (NOW MEDT)
MEPUC	ME PUB UTIL COMM	MAINE PUBLIC UTILITIES COMMISSION

STATE, COMMONWEALTH, AND TERRITORIAL AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
MIDH	MI DEPT OF HIGHWAYS	MICHIGAN DEPT OF STATE HIGHWAYS AND TRANSP
MIDNR	MI DEPT OF NAT RES	MICHIGAN DEPARTMENT OF NATURAL RESOURCES
MIGS	MI GEODETIC SURVEY	MICHIGAN GEODETIC SURVEY
MNDT	MN DEPT OF TRANSP	MINNESOTA DEPARTMENT OF TRANSPORTATION
MNGS	MN GEODETIC SURVEY	MINNESOTA GEODETIC SURVEY
MNHD	MN HIGHWAY DEPT	MINNESOTA HIGHWAY DEPARTMENT (NOW MNDT)
MOGS	MO GEODETIC SURVEY	MISSOURI GEODETIC SURVEY
MOHC	MO HIGHWAY COMM	MISSOURI STATE HIGHWAY COMMISSION
MSGS	MS GEODETIC SURVEY	MISSISSIPPI GEODETIC SURVEY
MSHD	MS HIGHWAY DEPT	MISSISSIPPI STATE HIGHWAY DEPARTMENT
MTBOR	MT BUR OF PUB ROADS	MONTANA BUREAU OF PUBLIC ROADS
MTDH	MT DEPT OF HIGHWAYS	MONTANA DEPARTMENT OF HIGHWAYS
MTGS	MT GEODETIC SURVEY	MONTANA GEODETIC SURVEY
MTSHC	MT HIGHWAY COMM	MONTANA STATE HIGHWAY COMMISSION
NCDF	NC DIV OF FORESTRY	NORTH CAROLINA DIVISION OF FORESTRY
NCDOT	NC DOT DIV OF HWYS	NORTH CAROLINA DEPT OF TRANS DIV OF HWYWS
NCGS	NC GEODETIC SURVEY	NORTH CAROLINA GEODETIC SURVEY
NCHPWC	NC HWY AND P W COMM	NORTH CAROLINA HIGHWAY AND PUBLIC WORKS COMM
NDGS	ND GEODETIC SURVEY	NORTH DAKOTA GEODETIC SURVEY
NDHD	ND HIGHWAY DEPT	NORTH DAKOTA HIGHWAY DEPARTMENT
NDWC	ND WATER COMMISSION	NORTH DAKOTA WATER COMMISSION
NEDR	NE DEPT OF ROADS	NEBRASKA DEPARTMENT OF ROADS
NEGS	NE GEODETIC SURVEY	NEBRASKA GEODETIC SURVEY
NHDPW	NH DEPT OF PUB WORKS	NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS
NHGS	NH GEODETIC SURVEY	NEW HAMPSHIRE GEODETIC SURVEY
NHHD	NH HIGHWAY DEPT	NEW HAMPSHIRE HIGHWAY DEPARTMENT
NJBCN	NJ BOARD OF COMMERCE	NEW JERSEY BOARD OF COMMERCE AND NAVIGATION
NJDCED	NJ CONS AND ECON DEV	NEW JERSEY DEPT OF CONSERVATION AND ECON DEV
NJDT	NJ DEPT OF TRANSP	NEW JERSEY DEPARTMENT OF TRANSPORTATION
NJGS	NJ GEODETIC SURVEY	NEW JERSEY GEODETIC SURVEY
NMGS	NM GEODETIC SURVEY	NEW MEXICO GEODETIC SURVEY
NMHD	NM HIGHWAY DEPT	NEW MEXICO STATE HIGHWAY DEPARTMENT
NVDH	NV DEPT OF HIGHWAYS	NEVADA DEPARTMENT OF HIGHWAYS
NVGS	NV GEODETIC SURVEY	NEVADA GEODETIC SURVEY
NYDPW	NY DEPT OF PUB WORKS	NEW YORK STATE DEPARTMENT OF PUBLIC WORKS
NYDT	NY DEPT OF TRANSP	NEW YORK STATE DEPARTMENT OF TRANSPORTATION
NYGS	NY GEODETIC SURVEY	NEW YORK GEODETIC SURVEY
NYHD	NY DEPT OF HIGHWAYS	NEW YORK DEPARTMENT OF HIGHWAYS (NOW NYDT)
NYLISP	NY LONG ISLAND SPA	NEW YORK LONG ISLAND STATE PARK AUTHORITY
NYNPA	NY NIAGARA PWR AUTH	NEW YORK NIAGARA POWER AUTHORITY
NYSS	NY STATE SURVEY	NEW YORK STATE SURVEY
OHDT	OH DEPT OF TRANSP	OHIO DEPARTMENT OF TRANSPORTATION
OHGS	OH GEODETIC SURVEY	OHIO GEODETIC SURVEY
OHHD	OH HIGHWAY DEPT	OHIO HIGHWAY DEPARTMENT (NOW OHDT)
OKCC	OK CONSERVATION COMM	OKLAHOMA CONSERVATION COMMISSION
OKDH	OK DEPT OF HIGHWAYS	OKLAHOMA DEPARTMENT OF HIGHWAYS
OKGS	OK GEODETIC SURVEY	OKLAHOMA GEODETIC SURVEY
ORDT	OR DEPT OF TRANSP	OREGON DEPARTMENT OF TRANSPORTATION
ORGS	OR GEODETIC SURVEY	OREGON GEODETIC SURVEY
ORHD	OR HIGHWAY DEPT	OREGON STATE HIGHWAY DEPARTMENT (NOW ORDT)
ORSLB	OR STATE LAND BOARD	OREGON STATE LAND BOARD
PADFW	PA DEPT FORESTS WTRS	PENNSYLVANIA DEPT OF FORESTS AND WATERS
PADH	PA DEPT OF HIGHWAYS	PENNSYLVANIA DEPT OF HIGHWAYS (NOW PADT)

STATE, COMMONWEALTH, AND TERRITORIAL AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
PADT	PA DEPT OF TRANSP	PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
PAGS	PA GEODETIC SURVEY	PENNSYLVANIA GEODETIC SURVEY
RIBPR	RI BUR OF PUB ROADS	RHODE ISLAND BUREAU OF PUBLIC ROADS
RIGS	RI GEODETIC SURVEY	RHODE ISLAND GEODETIC SURVEY
SCGS	SC GEODETIC SURVEY	SOUTH CAROLINA GEODETIC SURVEY
SCHD	SC HIGHWAY DEPT	SOUTH CAROLINA STATE HIGHWAY DEPARTMENT
SDDT	SD DEPT OF TRANSP	SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
SDHD	SD HIGHWAY DEPT	SOUTH DAKOTA HIGHWAY DEPARTMENT (NOW SDDT)
TNDG	TN DIV OF GEOLOGY	TENNESSEE DIVISION OF GEOLOGY
TNDT	TN DEPT OF TRANSP	TENNESSEE DEPARTMENT OF TRANSPORTATION
TNGS	TN GEODETIC SURVEY	TENNESSEE GEODETIC SURVEY
TNHD	TN HIGHWAY DEPT	TENNESSEE HIGHWAY DEPARTMENT (NOW TNDT)
TXGS	TX GEODETIC SURVEY	TEXAS GEODETIC SURVEY
TXHD	TX HIGHWAY DEPT	TEXAS HIGHWAY DEPARTMENT
TXRD	TX RECLAMATION DEPT	TEXAS RECLAMATION DEPARTMENT
UTDH	UT DEPT OF HIGHWAYS	UTAH STATE DEPARTMENT OF HIGHWAYS
VACF	VA COMM OF FISHERIES	VIRGINIA COMMISSION OF FISHERIES
VADH	VA DEPT OF HIGHWAYS	VIRGINIA DEPARTMENT OF HIGHWAYS
VAGS	VA GEODETIC SURVEY	VIRGINIA GEODETIC SURVEY
VTAT	VT AGENCY OF TRANSP	VERMONT AGENCY OF TRANSPORTATION
VTDH	VT DEPT OF HIGHWAYS	VERMONT DEPARTMENT OF HIGHWAYS (NOW VTAT)
VTFS	VT FOREST SERVICE	VERMONT FOREST SERVICE
VTGS	VT GEODETIC SURVEY	VERMONT GEODETIC SURVEY
WADNR	WA DEPT OF NAT RES	WASHINGTON DEPARTMENT OF NATURAL RESOURCES
WADPL	WA DEPT OF PUB LANDS	WASHINGTON STATE DEPARTMENT OF PUBLIC LANDS
WAGS	WA GEODETIC SURVEY	WASHINGTON GEODETIC SURVEY
WAHC	WA HIGHWAY COMM	WASHINGTON STATE HIGHWAY COMMISSION
WATBA	WA TOLL BRIDGE AUTH	WASHINGTON STATE TOLL BRIDGE AUTHORITY
WIDNR	WI DEPT OF NAT RES	WISCONSIN DEPARTMENT OF NATURAL RESOURCES
WIDT	WI DEPT OF TRANSP	WISCONSIN DEPARTMENT OF TRANSPORTATION
WIGS	WI GEODETIC SURVEY	WISCONSIN GEODETIC SURVEY
WIHD	WI HIGHWAY DEPT	WISCONSIN HIGHWAY DEPARTMENT (NOW WIDT)
WIPSC	WI PUB SERVICE COMM	WISCONSIN PUBLIC SERVICE COMMISSION
WIRRC	WI RAILROAD COMM	WISCONSIN RAILROAD COMMISSION
WVGS	WV GEODETIC SURVEY	WEST VIRGINIA GEODETIC SURVEY
WVHD	WV HIGHWAY DEPT	WEST VIRGINIA HIGHWAY DEPARTMENT
WYHD	WY HIGHWAY DEPT	WYOMING HIGHWAY DEPARTMENT

COUNTY AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AL-107	PICKENS CO	PICKENS COUNTY ALABAMA
AL-119	SUMTER CO	SUMTER COUNTY ALABAMA
CA-001	ALAMEDA CO	ALAMEDA COUNTY CALIFORNIA
CA-013	CONTRA COSTA CO	CONTRA COSTA COUNTY CALIFORNIA
CA-019	FRESNO CO	FRESNO COUNTY CALIFORNIA
CA-023	HUMBOLDT CO	HUMBOLDT COUNTY CALIFORNIA
CA-025	IMPERIAL CO	IMPERIAL COUNTY CALIFORNIA
CA-027	INYO CO	INYO COUNTY CALIFORNIA
CA-029	KERN CO	KERN COUNTY CALIFORNIA

COUNTY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
CA-031	KINGS CO	KINGS COUNTY CALIFORNIA
CA-033	LAKE CO	LAKE COUNTY CALIFORNIA
CA-037	LOS ANGELES CO	LOS ANGELES COUNTY CALIFORNIA
CA-041	MARIN CO	MARIN COUNTY CALIFORNIA
CA-043	MARIPOSA CO	MARIPOSA COUNTY CALIFORNIA
CA-045	MENDOCINO CO	MENDOCINO COUNTY CALIFORNIA
CA-051	MONO CO	MONO COUNTY CALIFORNIA
CA-053	MONTEREY CO	MONTEREY COUNTY CALIFORNIA
CA-055	NAPA CO	NAPA COUNTY CALIFORNIA
CA-059	ORANGE CO	ORANGE COUNTY CALIFORNIA
CA-063	PLUMAS CO	PLUMAS COUNTY CALIFORNIA
CA-065	RIVERSIDE CO	RIVERSIDE COUNTY CALIFORNIA
CA-067	SACRAMENTO CO	SACRAMENTO COUNTY CALIFORNIA
CA-069	SAN BENITO CO	SAN BENITO COUNTY CALIFORNIA
CA-071	SAN BERNARDINO CO	SAN BERNARDINO COUNTY CALIFORNIA
CA-073	SAN DIEGO CO	SAN DIEGO COUNTY CALIFORNIA
CA-075	SAN FRANCISCO CO	SAN FRANCISCO COUNTY CALIFORNIA
CA-077	SAN JOAQUIN CO	SAN JOAQUIN COUNTY CALIFORNIA
CA-079	SAN LUIS OBISPO CO	SAN LUIS OBISPO COUNTY CALIFORNIA
CA-081	SAN MATEO CO	SAN MATEO COUNTY CALIFORNIA
CA-083	SANTA BARBARA CO	SANTA BARBARA COUNTY CALIFORNIA
CA-087	SANTA CRUZ CO	SANTA CRUZ COUNTY CALIFORNIA
CA-089	SHASTA CO	SHASTA COUNTY CALIFORNIA
CA-091	SIERRA CO	SIERRA COUNTY CALIFORNIA
CA-093	SISKIYOU CO	SISKIYOU COUNTY CALIFORNIA
CA-097	SONOMA CO	SONOMA COUNTY CALIFORNIA
CA-099	STANISLAUS CO	STANISLAUS COUNTY CALIFORNIA
CA-103	TEHAMA CO	TEHAMA COUNTY CALIFORNIA
CA-105	TRINITY CO	TRINITY COUNTY CALIFORNIA
CA-107	TULARE CO	TULARE COUNTY CALIFORNIA
CA-109	TUOLUMNE CO	TUOLUMNE COUNTY CALIFORNIA
CA-111	VENTURA CO	VENTURA COUNTY CALIFORNIA
CA-113	YOLO CO	YOLO COUNTY CALIFORNIA
CO-017	CHEYENNE CO	CHEYENNE COUNTY COLORADO
CO-061	KIOWA CO	KIOWA COUNTY COLORADO
FL-011	BROWARD CO	BROWARD COUNTY FLORIDA
FL-025	DADE CO	DADE COUNTY FLORIDA
FL-053	HERNANDO CO	HERNANDO COUNTY FLORIDA
FL-057	HILLSBOROUGH CO	HILLSBOROUGH COUNTY FLORIDA
FL-071	LEE CO	LEE COUNTY FLORIDA
FL-081	MANATEE CO	MANATEE COUNTY FLORIDA
FL-099	PALM BEACH CO	PALM BEACH COUNTY FLORIDA
FL-101	PASCO CO	PASCO COUNTY FLORIDA
FL-103	PINELLAS CO	PINELLAS COUNTY FLORIDA
FL-131	WALTON CO	WALTON COUNTY FLORIDA
IA-105	JONES CO	JONES COUNTY IOWA
IA-113	LINN CO	LINN COUNTY IOWA
IA-159	RINGGOLD CO	RINGGOLD COUNTY IOWA
IA-165	SHELBY CO	SHELBY COUNTY IOWA
IL-031	COOK CO	COOK COUNTY ILLINOIS
IL-051	FAYETTE CO	FAYETTE COUNTY ILLINOIS
IL-103	LEE CO	LEE COUNTY ILLINOIS
IL-163	ST CLAIR CO	ST CLAIR COUNTY ILLINOIS

COUNTY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
IL-195	WHITESIDE CO	WHITESIDE COUNTY ILLINOIS
IN-003	ALLEN CO	ALLEN COUNTY INDIANA
IN-039	ELKHART CO	ELKHART COUNTY INDIANA
IN-085	KOSCIUSKO CO	KOSCIUSKO COUNTY INDIANA
IN-127	PORTER CO	PORTER COUNTY INDIANA
IN-131	PULASKI CO	PULASKI COUNTY INDIANA
IN-141	ST JOSEPH CO	ST JOSEPH COUNTY INDIANA
KS-189	STEVENS CO	STEVENS COUNTY KANSAS
KS-203	WICHITA CO	WICHITA COUNTY KANSAS
LA-033	EAST BATON ROUGE PAR	EAST BATON ROUGE PARISH LOUISIANA
MD-021	FREDERICK CO	FREDERICK COUNTY MARYLAND
MD-043	WASHINGTON CO	WASHINGTON COUNTY MARYLAND
ME-007	FRANKLIN CO	FRANKLIN COUNTY MAINE
MI-005	ALLEGAN CO	ALLEGAN COUNTY MICHIGAN
MI-011	ARENAC CO	ARENAC COUNTY MICHIGAN
MI-033	CHIPPEWA CO	CHIPPEWA COUNTY MICHIGAN
MI-053	GOGEBIC CO	GOGEBIC COUNTY MICHIGAN
MI-061	HOUGHTON CO	HOUGHTON COUNTY MICHIGAN
MI-063	HURON CO	HURON COUNTY MICHIGAN
MI-075	JACKSON CO	JACKSON COUNTY MICHIGAN
MI-081	KENT CO	KENT COUNTY MICHIGAN
MI-125	OAKLAND CO	OAKLAND COUNTY MICHIGAN
MI-163	WAYNE CO	WAYNE COUNTY MICHIGAN
MN-061	ITASCA CO	ITASCA COUNTY MINNESOTA
MS-135	TALLAHATCHIE CO	TALLAHATCHIE COUNTY MISSISSIPPI
MS-145	UNION CO	UNION COUNTY MISSISSIPPI
ND-057	MERCER CO	MERCER COUNTY NORTH DAKOTA
NJ-017	HUDSON CO	HUDSON COUNTY NEW JERSEY
NV-027	PERSHING CO	PERSHING COUNTY NEVADA
NY-023	CORTLAND CO	CORTLAND COUNTY NEW YORK
NY-025	DELAWARE CO	DELAWARE COUNTY NEW YORK
NY-055	MONROE CO	MONROE COUNTY NEW YORK
NY-057	MONTGOMERY CO	MONTGOMERY COUNTY NEW YORK
NY-059	NASSAU CO	NASSAU COUNTY NEW YORK
NY-065	ONEIDA CO	ONEIDA COUNTY NEW YORK
NY-069	ONTARIO CO	ONTARIO COUNTY NEW YORK
NY-091	SARATOGA CO	SARATOGA COUNTY NEW YORK
NY-103	SUFFOLK CO	SUFFOLK COUNTY NEW YORK
NY-111	ULSTER CO	ULSTER COUNTY NEW YORK
NY-119	WESTCHESTER CO	WESTCHESTER COUNTY NEW YORK
OH-051	FULTON CO	FULTON COUNTY OHIO
OH-095	LUCAS CO	LUCAS COUNTY OHIO
OH-099	MAHONING CO	MAHONING COUNTY OHIO
OH-113	MONTGOMERY CO	MONTGOMERY COUNTY OHIO
OH-133	PORTAGE CO	PORTAGE COUNTY OHIO
OH-151	STARK CO	STARK COUNTY OHIO
OK-133	SEMINOLE CO	SEMINOLE COUNTY OKLAHOMA
OR-017	DESCHUTES CO	DESCHUTES COUNTY OREGON
OR-019	DOUGLAS CO	DOUGLAS COUNTY OREGON
OR-029	JACKSON CO	JACKSON COUNTY OREGON
OR-039	LANE CO	LANE COUNTY OREGON
PA-003	ALLEGHENY CO	ALLEGHENY COUNTY PENNSYLVANIA
PA-085	MERCER CO	MERCER COUNTY PENNSYLVANIA

COUNTY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
PA-133	YORK CO	YORK COUNTY PENNSYLVANIA
TN-069	HARDEMAN CO	HARDEMAN COUNTY TENNESSEE
TX-049	BROWN CO	BROWN COUNTY TEXAS
TX-141	EL PASO CO	EL PASO COUNTY TEXAS
UT-035	SALT LAKE CO	SALT LAKE COUNTY UTAH
VA-059	FAIRFAX CO	FAIRFAX COUNTY VIRGINIA
VA-085	HANOVER CO	HANOVER COUNTY VIRGINIA
VA-087	HENRICO CO	HENRICO COUNTY VIRGINIA
WA-033	KING CO	KING COUNTY WASHINGTON
WA-049	PACIFIC CO	PACIFIC CO WASHINGTON
WI-027	DODGE CO	DODGE COUNTY WISCONSIN
WI-101	RACINE CO	RACINE COUNTY WISCONSIN
WV-069	OHIO CO	OHIO COUNTY WEST VIRGINIA
WV-085	RITCHIE CO	RITCHIE COUNTY WEST VIRGINIA

CITY AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AL2130	C OF MONTGOMERY	CITY OF MONTGOMERY ALABAMA
AR3880	C OF TUPELO	CITY OF TUPELO ARKANSAS
AR4063	C OF WELDON	CITY OF WELDON ARKANSAS
CA0010	C OF ALAMEDA	CITY OF ALAMEDA CALIFORNIA
CA0340	C OF BERKELEY	CITY OF BERKELEY CALIFORNIA
CA0470	C OF BUENA PARK	CITY OF BUENA PARK CALIFORNIA
CA0480	C OF BURBANK	CITY OF BURBANK CALIFORNIA
CA0537	C OF CAMPBELL	CITY OF CAMPBELL CALIFORNIA
CA0710	C OF CHULA VISTA	CITY OF CHULA VISTA CALIFORNIA
CA0790	C OF COLTON	CITY OF COLTON CALIFORNIA
CA1182	C OF ENCINITAS	CITY OF ENCINITAS CALIFORNIA
CA1220	C OF EUREKA	CITY OF EUREKA CALIFORNIA
CA1364	C OF FREMONT	CITY OF FREMONT CALIFORNIA
CA1370	C OF FRESNO	CITY OF FRESNO CALIFORNIA
CA1430	C OF GLENDALE	CITY OF GLENDALE CALIFORNIA
CA1520	C OF GUSTINE	CITY OF GUSTINE CALIFORNIA
CA1540	C OF HANFORD	CITY OF HANFORD CALIFORNIA
CA1580	C OF HEMET	CITY OF HEMET CALIFORNIA
CA1560	C OF HAYWARD	CITY OF HAYWARD CALIFORNIA
CA1970	C OF LONG BEACH	CITY OF LONG BEACH CALIFORNIA
CA1980	C OF LOS ANGELES	CITY OF LOS ANGELES CALIFORNIA
CA2090	C OF MARTINEZ	CITY OF MARTINEZ CALIFORNIA
CA2290	C OF MORRO BAY	CITY OF MORRO BAY CALIFORNIA
CA2390	C OF NEWMAN	CITY OF NEWMAN CALIFORNIA
CA2480	C OF OAKLAND	CITY OF OAKLAND CALIFORNIA
CA2550	C OF ONTARIO	CITY OF ONTARIO CALIFORNIA
CA2650	C OF PALM SPRINGS	CITY OF PALM SPRINGS CALIFORNIA
CA2700	C OF PASADENA	CITY OF PASADENA CALIFORNIA
CA2780	C OF PISMO BEACH	CITY OF PISMO BEACH CALIFORNIA
CA2840	C OF PLEASANTON	CITY OF PLEASANTON CALIFORNIA
CA2880	C OF PORTERVILLE	CITY OF PORTERVILLE CALIFORNIA
CA2940	C OF RED BLUFF	CITY OF RED BLUFF CALIFORNIA

CITY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
CA2970	C OF REDONDO BEACH	CITY OF REDONDO BEACH CALIFORNIA
CA2980	C OF REDWOOD CITY	CITY OF REDWOOD CITY CALIFORNIA
CA3210	C OF SAN BERNARDINO	CITY OF SAN BERNARDINO CALIFORNIA
CA3260	C OF SAN DIEGO	CITY OF SAN DIEGO CALIFORNIA
CA3280	C OF SAN FERNANDO	CITY OF SAN FERNANDO CALIFORNIA
CA3290	C OF SAN FRANCISCO	CITY OF SAN FRANCISCO CALIFORNIA
CA3340	C OF SAN JOSE	CITY OF SAN JOSE CALIFORNIA
CA3370	C OF SAN LUIS OBISPO	CITY OF SAN LUIS OBISPO CALIFORNIA
CA3380	C OF SAN MARINO	CITY OF SAN MARINO CALIFORNIA
CA3390	C OF SAN MATEO	CITY OF SAN MATEO CALIFORNIA
CA3410	C OF SAN RAFAEL	CITY OF SAN RAFAEL CALIFORNIA
CA3420	C OF SANTA ANA	CITY OF SANTA ANA CALIFORNIA
CA3460	C OF SANTA MARIA	CITY OF SANTA MARIA CALIFORNIA
CA3480	C OF SANTA PAULA	CITY OF SANTA PAULA CALIFORNIA
CA3490	C OF SANTA ROSA	CITY OF SANTA ROSA CALIFORNIA
CA3590	C OF SELMA	CITY OF SELMA CALIFORNIA
CA3660	C OF SONOMA	CITY OF SONOMA CALIFORNIA
CA3800	C OF SUSANVILLE	CITY OF SUSANVILLE CALIFORNIA
CA3920	C OF TULARE	CITY OF TULARE CALIFORNIA
CA4020	C OF VALLEJO	CITY OF VALLEJO CALIFORNIA
CA4027	C OF VENTURA	CITY OF VENTURA CALIFORNIA
CA4070	C OF WALNUT CREEK	CITY OF WALNUT CREEK CALIFORNIA
CA4100	C OF WATSONVILLE	CITY OF WATSONVILLE CALIFORNIA
CO2150	C OF ROCKY FORD	CITY OF ROCKY FORD COLORADO
CT0080	C OF BRIDGEPORT	CITY OF BRIDGEPORT CONNECTICUT
CT0280	C OF HARTFORD	CITY OF HARTFORD CONNECTICUT
CT0360	C OF MADISON	CITY OF MADISON CONNECTICUT
CT0370	C OF MERIDEN	CITY OF MERIDEN CONNECTICUT
CT0380	C OF MIDDLETOWN	CITY OF MIDDLETOWN CONNECTICUT
CT0430	C OF NEW HAVEN	CITY OF NEW HAVEN CONNECTICUT
CT0810	C OF WATERBURY	CITY OF WATERBURY CONNECTICUT
FL0290	C OF BOCA RATON	CITY OF BOCA RATON FLORIDA
FL0570	C OF CLEARWATER	CITY OF CLEARWATER FLORIDA
FL0780	C OF DAYTONA BEACH	CITY OF DAYTONA BEACH FLORIDA
FL1420	C OF HOLLYWOOD	CITY OF HOLLYWOOD FLORIDA
FL1510	C OF JACKSONVILLE	CITY OF JACKSONVILLE FLORIDA
FL2010	C OF MIAMI	CITY OF MIAMI FLORIDA
FL2730	C OF ST PETERSBURG	CITY OF ST PETERSBURG FLORIDA
FL2940	C OF TALLAHASSEE	CITY OF TALLAHASSEE FLORIDA
GA0760	C OF BRUNSWICK	CITY OF BRUNSWICK GEORGIA
GA3440	C OF MARIETTA	CITY OF MARIETTA GEORGIA
HI2400	C OF HONOLULU	CITY OF HONOLULU HAWAII
IA2520	C OF DYSART	CITY OF DYSART IOWA
IA2530	C OF EAGLE GROVE	CITY OF EAGLE GROVE IOWA
IA5240	C OF MAQUOKETA	CITY OF MAQUOKETA IOWA
IA7490	C OF SAC CITY	CITY OF SAC CITY IOWA
IA8880	C OF WEBSTER CITY	CITY OF WEBSTER CITY IOWA
IL0840	C OF BLOOMINGTON	CITY OF BLOOMINGTON ILLINOIS
IL1670	C OF CHICAGO	CITY OF CHICAGO ILLINOIS
IL2380	C OF DIXON	CITY OF DIXON ILLINOIS
IL3200	C OF FREEBURG	CITY OF FREEBURG ILLINOIS
IL3910	C OF HIGHLAND PARK	CITY OF HIGHLAND PARK ILLINOIS
IL4710	C OF LAWRENCEVILLE	CITY OF LAWRENCEVILLE ILLINOIS

CITY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
IL4910	C OF LOCKPORT	CITY OF LOCKPORT ILLINOIS
IL5360	C OF MASON CITY	CITY OF MASON CITY ILLINOIS
IL6850	C OF PEORIA	CITY OF PEORIA ILLINOIS
IL7640	C OF ST CHARLES	CITY OF ST CHARLES ILLINOIS
IL9210	C OF WESTERN SPRINGS	CITY OF WESTERN SPRINGS ILLINOIS
IN1830	C OF GOSHEN	CITY OF GOSHEN INDIANA
IN3480	C OF NEW HAVEN	CITY OF NEW HAVEN INDIANA
KS5400	C OF TOPEKA	CITY OF TOPEKA KANSAS
KY2090	C OF LOUISVILLE	CITY OF LOUISVILLE KENTUCKY
LA0040	C OF ALEXANDRIA	CITY OF ALEXANDRIA LOUISIANA
LA1150	C OF JONESBORO	CITY OF JONESBORO LOUISIANA
LA1690	C OF NEW ORLEANS	CITY OF NEW ORLEANS LOUISIANA
LA2410	C OF WEST MONROE	CITY OF WEST MONROE LOUISIANA
MA0035	C OF ANDOVER	CITY OF ANDOVER MASSACHUSETTS
MA0120	C OF BOSTON	CITY OF BOSTON MASSACHUSETTS
MA0170	C OF CAMBRIDGE	CITY OF CAMBRIDGE MASSACHUSETTS
MA0660	C OF MALDEN	CITY OF MALDEN MASSACHUSETTS
MD0050	C OF BALTIMORE	CITY OF BALTIMORE MARYLAND
MD0580	C OF FREDERICK	CITY OF FREDERICK MARYLAND
MD0730	C OF HAGERSTOWN	CITY OF HAGERSTOWN MARYLAND
ME0250	C OF BANGOR	CITY OF BANGOR MAINE
ME6400	C OF PORTLAND	CITY OF PORTLAND MAINE
MI0490	C OF BIRMINGHAM	CITY OF BIRMINGHAM MICHIGAN
MI0700	C OF CADILLAC	CITY OF CADILLAC MICHIGAN
MI0890	C OF CHARLOTTE	CITY OF CHARLOTTE MICHIGAN
MI1150	C OF CROSWELL	CITY OF CROSWELL MICHIGAN
MI1260	C OF DETROIT	CITY OF DETROIT MICHIGAN
MI1730	C OF FLINT	CITY OF FLINT MICHIGAN
MI1800	C OF FRANKFORT	CITY OF FRANKFORT MICHIGAN
MI2010	C OF GRAND RAPIDS	CITY OF GRAND RAPIDS MICHIGAN
MI2520	C OF KALAMAZOO	CITY OF KALAMAZOO MICHIGAN
MI2990	C OF MANTON	CITY OF MANTON MICHIGAN
MI3320	C OF MONROE	CITY OF MONROE MICHIGAN
MI3740	C OF OTSEGO	CITY OF OTSEGO MICHIGAN
MI4020	C OF PONTIAC	CITY OF PONTIAC MICHIGAN
MI4760	C OF STURGIS	CITY OF STURGIS MICHIGAN
MI5310	C OF WYANDOTTE	CITY OF WYANDOTTE MICHIGAN
MN4760	C OF MINNEAPOLIS	CITY OF MINNEAPOLIS MINNESOTA
MO7070	C OF ST JOSEPH	CITY OF ST JOSEPH MISSOURI
MO7080	C OF ST LOUIS	CITY OF ST LOUIS MISSOURI
NC1460	C OF ELIZABETH CITY	CITY OF ELIZABETH CITY NORTH CAROLINA
NC1940	C OF GREENSBORO	CITY OF GREENSBORO NORTH CAROLINA
NC4070	C OF SALISBURY	CITY OF SALISBURY NORTH CAROLINA
NH0020	C OF BERLIN	CITY OF BERLIN NEW HAMPSHIRE
NJ1775	C OF LYNDHURST	CITY OF LYNDHURST NEW JERSEY
NJ2130	C OF NEWARK	CITY OF NEWARK NEW JERSEY
NJ2510	C OF PATERSON	CITY OF PATERSON NEW JERSEY
NJ2570	C OF PERTH AMBOY	CITY OF PERTH AMBOY NEW JERSEY
NJ3705	C OF WOODBRIDGE	CITY OF WOODBRIDGE NEW JERSEY
NM0030	C OF ALBUQUERQUE	CITY OF ALBUQUERQUE NEW MEXICO
NV0139	C OF MOUNTAIN CITY	CITY OF MOUNTAIN CITY NEVADA
NV0170	C OF RENO	CITY OF RENO NEVADA
NY0750	C OF BUFFALO	CITY OF BUFFALO NEW YORK

CITY AGENCIES - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
NY3070	C OF LACKAWANNA	CITY OF LACKAWANNA NEW YORK
NY3340	C OF LOCKPORT	CITY OF LOCKPORT NEW YORK
NY3940	C OF MOUNT VERNON	CITY OF MOUNT VERNON NEW YORK
NY4120	C OF NEW ROCHELLE	CITY OF NEW ROCHELLE NEW YORK
NY4170	C OF NEW YORK	CITY OF NEW YORK NEW YORK
NY4210	C OF NIAGARA FALLS	CITY OF NIAGARA FALLS NEW YORK
NY5230	C OF ROCHESTER	CITY OF ROCHESTER NEW YORK
NY6450	C OF WATERTOWN	CITY OF WATERTOWN NEW YORK
NY6820	C OF YONKERS	CITY OF YONKERS NEW YORK
OH0070	C OF AKRON	CITY OF AKRON OHIO
OH1320	C OF CANTON	CITY OF CANTON OHIO
OH1610	C OF CINCINNATI	CITY OF CINCINNATI OHIO
OH1680	C OF CLEVELAND	CITY OF CLEVELAND OHIO
OH1800	C OF COLUMBUS	CITY OF COLUMBUS OHIO
OH2090	C OF DAYTON	CITY OF DAYTON OHIO
OH3895	C OF KETTERING	CITY OF KETTERING OHIO
OH4820	C OF MASSILLON	CITY OF MASSILLON OHIO
OH8070	C OF TIFFIN	CITY OF TIFFIN OHIO
OH8120	C OF TOLEDO	CITY OF TOLEDO OHIO
OR1310	C OF MEDFORD	CITY OF MEDFORD OREGON
OR1650	C OF PORTLAND	CITY OF PORTLAND OREGON
OR1810	C OF SALEM	CITY OF SALEM OREGON
PA0110	C OF ALLENTOWN	CITY OF ALLENTOWN PENNSYLVANIA
PA1230	C OF CHAMBERSBURG	CITY OF CHAMBERSBURG PENNSYLVANIA
PA1296	C OF CHESTER TOWNSHP	CITY OF CHESTER TOWNSHIP PENNSYLVANIA
PA2270	C OF EASTON	CITY OF EASTON PENNSYLVANIA
PA4010	C OF JOHNSTOWN	CITY OF JOHNSTOWN PENNSYLVANIA
PA6600	C OF PITTSBURGH	CITY OF PITTSBURGH PENNSYLVANIA
PA8880	C OF WASHINGTON	CITY OF WASHINGTON PENNSYLVANIA
PA8920	C OF WAYNESBORO	CITY OF WAYNESBORO PENNSYLVANIA
TX1730	C OF DALLAS	CITY OF DALLAS TEXAS
TX2450	C OF FORT WORTH	CITY OF FORT WORTH TEXAS
TX3280	C OF HOUSTON	CITY OF HOUSTON TEXAS
TX6090	C OF SAN ANTONIO	CITY OF SAN ANTONIO TEXAS
VA1720	C OF NEWPORT NEWS	CITY OF NEWPORT NEWS VIRGINIA
VA1760	C OF NORFOLK	CITY OF NORFOLK VIRGINIA
VA2060	C OF RICHMOND	CITY OF RICHMOND VIRGINIA
VA2540	C OF VIRGINIA BEACH	CITY OF VIRGINIA BEACH VIRGINIA
WA1960	C OF SEATTLE	CITY OF SEATTLE WASHINGTON
WI1760	C OF FORT ATKINSON	CITY OF FORT ATKINSON WISCONSIN
WI2320	C OF JANESVILLE	CITY OF JANESVILLE WISCONSIN
WI3100	C OF MILWAUKEE	CITY OF MILWAUKEE WISCONSIN
WI3810	C OF PLYMOUTH	CITY OF PLYMOUTH WISCONSIN
WI4060	C OF RHINELANDER	CITY OF RHINELANDER WISCONSIN
WI4330	C OF SHEBOYGAN	CITY OF SHEBOYGAN WISCONSIN
WV0260	C OF BLUEFIELD	CITY OF BLUEFIELD WEST VIRGINIA

PUBLIC INTER-CITY AND REGIONAL AGENCIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
ACWD	ALAMEDA CO WTR DISTR	ALAMEDA COUNTY WATER DISTRICT
AEWD	ARVIN-EDISON W DISTR	ARVIN-EDISON WATER DISTRICT
CID	CENTER IRRIG DISTR	CENTERVILLE IRRIGATION DISTRICT
CRGS	CLEVE REG GEOD SURV	CLEVELAND REGIONAL GEODETIC SURVEY
DMWW	DENVER MUN WATER WKS	DENVER MUNICIPAL WATER WORKS
EBDA	EAST BAY DISCH AUTH	EAST BAY SEWAGE DISCHARGE AUTHORITY
EBMUD	E BAY MUN UTIL DISTR	EAST BAY MUNICIPAL UTILITIES DISTRICT
HCFC	HARRIS CO FLOOD DIST	HARRIS COUNTY TEXAS FLOOD CONTROL DISTRICT
HHWS	HETCH HETCHY WTR SUP	HETCH HETCHY WATER SUPPLY DISTRICT
IID	IMPERIAL IRRIG DISTR	IMPERIAL IRRIGATION DISTRICT
LACFCD	LA FLOOD CONTROL DIST	LOS ANGELES FLOOD CONTROL DISTRICT
LAHRBR	LA HARBOR DEPARTMENT	LOS ANGELES HARBOR DEPARTMENT
LAWPC	LA WTR AND PWR COMM	LOS ANGELES WATER AND POWER COMMISSION
MARTA	METRO ATLANTA RTA	METROPOLITAN ATLANTA RAPID TRANSIT AUTHORITY
MID	MODESTO IRRIG DISTR	MODESTO IRRIGATION DISTRICT
MRGCD	MDL RIO GRANDE DIST	MIDDLE RIO GRANDE CONSERVATION DISTRICT
MRMSC	MILWAUKEE-RACINE MSC	MILWAUKEE-RACINE METROPOLITAN SEWAGE COMM
MWDSC	METRO WTR DISTR S CA	METROPOLITAN WATER DISTRICT OF SO CALIFORNIA
NOS+WB	NEW ORLEANS SEWERAGE	NEW ORLEANS SEWERAGE AND WATER BOARD
NYPA	NY PORT AUTHORITY	NEW YORK PORT AUTHORITY
OID	OAKDALE IRRIG DISTR	OAKDALE IRRIGATION DISTRICT
OROW	OHIO RIVER ORD WORKS	OHIO RIVER ORDINANCE WORKS
RIRD	RYER IS RECLAM DISTR	RYER ISLAND RECLAMATION DISTRICT
SDWD	SAN DIEGO WTR DISTR	SAN DIEGO WATER DISTRICT
SEWRPC	SE WI REG PLAN COMM	SE WISCONSIN REGIONAL PLANNING COMMISSION
SFLWMD	S FL WATER MGMT DIST	SOUTH FLORIDA WATER MANAGEMENT DISTRICT
SFWD	S FRANCISCO WTR DEPT	SAN FRANCISCO WATER DEPARTMENT
SJID	SAN JOAQUIN IRR DIST	SAN JOAQUIN IRRIGATION DISTRICT
SVIP	SACRAMENTO IRRIG	SACRAMENTO VALLEY IRRIGATION PROJECT
SWFWMD	SW FL WTR MGMT DIST	SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
TID	TURLOCK IRRIG DISTR	TURLOCK IRRIGATION DISTRICT
TLAKE	TULARE LAKE IRRIG	TULARE LAKE IRRIGATION DISTRICT
WMATA	WASH METRO TRANSIT	WASHINGTON METROPOLITAN AREA TRANSIT AUTH
WSSC	WASH SUBURB SAN COMM	WASHINGTON SUBURBAN SANITARY COMMISSION

RAILROADS

SYMBOL	STANDARD ABBREV NAME	FULL NAME
ACYRR	AKRON RAILROAD	AKRON CANTON AND YOUNGSTOWN RAILROAD
AGSRR	ALABAMA GREAT SO RR	ALABAMA GREAT SOUTHERN RAILROAD
ATNRR	ALABAMA NORTHERN RR	ALABAMA TENNESSEE AND NORTHERN RAILROAD
ATSFRR	SANTA FE RAILROAD	ATCHISON TOPEKA AND SANTA FE RAILROAD
BARR	BANGOR AND AROOSTOOK	BANGOR AND AROOSTOOK RAILROAD
BLERR	BESSEMER RAILROAD	BESSEMER AND LAKE ERIE RAILROAD
BMRR	BOSTON AND MAINE RR	BOSTON AND MAINE RAILROAD
BNRR	BURLINGTON NORTHERN	BURLINGTON NORTHERN RAILROAD
BORR	BALTIMORE AND OHIO	BALTIMORE AND OHIO RAILROAD
CBQRR	BURLINGTON RAILROAD	CHICAGO BURLINGTON AND QUINCY RAILROAD
CHWRR	CHESAPEAKE AND WEST	CHESAPEAKE AND WESTERN RAILROAD
CIMRR	ILLINOIS MIDLAND RR	CHICAGO AND ILLINOIS MIDLAND RAILROAD

RAILROADS - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
CLGRR	COLUMBUS-GREENVILLE	COLUMBUS AND GREENVILLE RAILROAD
CMPPRR	MILWAUKEE AND PACIF	CHICAGO MILWAUKEE ST PAUL AND PACIFIC RR
CNJRR	CENTRAL OF NJ RR	CENTRAL OF NEW JERSEY RAILROAD
CNWRR	CHICAGO AND NW RR	CHICAGO AND NORTH WESTERN RAILROAD
CORR	CHESAPEAKE AND OHIO	CHESAPEAKE AND OHIO RAILROAD
CPRR	CANADIAN PACIFIC RR	CANADIAN PACIFIC RAILROAD
CRNRR	CAROLINA AND NW RR	CAROLINA AND NORTHWESTERN RAILROAD
CVRR	CENTRAL VERMONT RR	CENTRAL VERMONT RAILROAD
DHRR	DELAWARE AND HUDSON	DELAWARE AND HUDSON RAILROAD
DLWRR	DELAWARE RAILROAD	DELAWARE LACKAWANNA AND WESTERN RAILROAD
DMIRRR	IRON RANGE RAILROAD	DULUTH MISSABE AND IRON RANGE RAILROAD
DMRR	DETROIT AND MACKINAW	DETROIT AND MACKINAW RAILROAD
DRGWRR	RIO GRANDE RAILROAD	DENVER AND RIO GRANDE WESTERN RAILROAD
DTSRR	TOLEDO SHORE LINE RR	DETROIT AND TOLEDO SHORE LINE RAILROAD
DWPRR	DULUTH AND PACIFIC	DULUTH-WINNIPEG AND PACIFIC RAILROAD
ELRR	LACKAWANNA RAILROAD	ERIE LACKAWANNA RAILROAD
ERIERR	ERIE RAILROAD	ERIE RAILROAD
FECRR	FL EAST COAST RR	FLORIDA EAST COAST RAILROAD
GCSFRC	GULF CO + SANTA FE	GULF COLORADO AND SANTA FE RAILWAY COMPANY
GMORR	GULF RAILROAD	GULF MOBILE AND OHIO RAILROAD
GNRR	GREAT NORTHERN RR	GREAT NORTHERN RAILROAD
GTWRR	GRAND TRUNK WESTERN	GRAND TRUNK WESTERN RAILROAD
GWRR	GREAT WESTERN RR	GREAT WESTERN RAILROAD
ICRR	ILLINOIS CENTRAL RR	ILLINOIS CENTRAL RAILROAD
INTRR	INTERSTATE RAILROAD	INTERSTATE RAILROAD
KCSRR	KC SOUTHERN RAILROAD	KANSAS CITY SOUTHERN RAILROAD
LARR	LOUISIANA-ARKANSAS	LOUISIANA AND ARKANSAS RAILROAD
LIRR	LONG ISLAND RAILROAD	LONG ISLAND RAILROAD
LNRR	LOUIS AND NASH RR	LOUISVILLE AND NASHVILLE RAILROAD
LVRR	LEHIGH VALLEY RR	LEHIGH VALLEY RAILROAD
MCRR	MICHIGAN CENTRAL RR	MICHIGAN CENTRAL RAILROAD
MKTRR	MKT RAILROAD	MISSOURI KANSAS TEXAS RAILROAD
MPRR	MISSOURI PACIFIC RR	MISSOURI PACIFIC RAILROAD
NCRR	NASHVILLE RAILROAD	NASHVILLE CHATTANOOGA AND ST LOUIS RAILROAD
NPRR	NORTHERN PACIFIC RR	NORTHERN PACIFIC RAILROAD
NSRR	NORFOLK SOUTHERN RR	NORFOLK SOUTHERN RAILROAD
NWPRR	NW PACIFIC RAILROAD	NORTHWESTERN PACIFIC RAILROAD
NWRR	NORFOLK AND WESTERN	NORFOLK AND WESTERN RAILROAD
NYCRR	NEW YORK CENTRAL RR	NEW YORK CENTRAL RAILROAD
NYSLRR	NEW YORK ST LOUIS RR	NEW YORK CHICAGO AND ST LOUIS RAILROAD
NYSWRR	SUSQUEHANNA RAILROAD	NEW YORK SUSQUEHANNA AND WESTERN RAILROAD
PCRR	PENN CENTRAL RR	PENN CENTRAL RAILROAD
PLERR	PITTSBURGH RAILROAD	PITTSBURGH AND LAKE ERIE RAILROAD
PMRR	PERE MARQUETTE RR	PERE MARQUETTE RAILROAD
PRR	PENNSYLVANIA RR	PENNSYLVANIA RAILROAD
RDGRR	READING RAILROAD	READING RAILROAD
RIRR	ROCK ISLAND RAILROAD	CHICAGO ROCK ISLAND AND PACIFIC RAILROAD
SCLRR	SEABOARD RAILROAD	SEABOARD COAST LINE RAILROAD
SLSFRR	ST LOUIS SAN FRAN RR	ST LOUIS SAN FRANCISCO RAILROAD
SLSWRR	ST LOUIS SW RAILROAD	ST LOUIS SOUTHWESTERN RAILROAD
SNRR	SACRAMENTO NORTHERN	SACRAMENTO NORTHERN RAILROAD
SOORR	SOO LINE RAILROAD	SOO LINE RAILROAD
SOURR	SOUTHERN RAILROAD	SOUTHERN RAILROAD

RAILROADS - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
SPRR	SOUTHERN PACIFIC RR	SOUTHERN PACIFIC RAILROAD
TMRR	TEXAS MEXICAN RR	TEXAS MEXICAN RAILROAD
TPWRR	TOLEDO AND WESTERN	TOLEDO PEORIA AND WESTERN RAILROAD
UPRR	UNION PACIFIC RR	UNION PACIFIC RAILROAD
VTRR	VERMONT RAILROAD	VERMONT RAILROAD
WARR	WESTERN OF ALABAMA	WESTERN OF ALABAMA RAILROAD
WLERR	WHEELING RAILROAD	WHEELING AND LAKE ERIE RAILROAD
WMRR	WESTERN MARYLAND RR	WESTERN MARYLAND RAILROAD
WPRR	WESTERN PACIFIC RR	WESTERN PACIFIC RAILROAD
YVRR	YOSEMITE VALLEY RR	YOSEMITE VALLEY RAILROAD

PETROLEUM AND PIPELINE COMPANIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AMOCO	AMOCO	AMOCO OIL COMPANY
AOCO	ASSOCIATED OIL CO	ASSOCIATED OIL COMPANY
ARFUEL	AR FUEL OIL COMPANY	AR FUEL OIL COMPANY
ATRECO	ATLANTIC REFINING CO	ATLANTIC REFINING COMPANY
BOCO	BELRIDGE OIL COMPANY	BELRIDGE OIL COMPANY
CHOCO	CHEVRON OIL COMPANY	CHEVRON OIL COMPANY
CITGO	CITIES SERVICE CO	CITIES SERVICE COMPANY
CONOCO	CONTINENTAL OIL CO	CONTINENTAL OIL COMPANY
CREOLE	CREOLE PETROLEUM CO	CREOLE PETROLEUM COMPANY
GPCC	GENERAL PETROLEUM	GENERAL PETROLEUM CORPORATION OF CALIFORNIA
GULF	GULF REFINING CO	GULF REFINING COMPANY
HOCO	HONOLULU OIL COMPANY	HONOLULU OIL COMPANY
HUMBLE	HUMBLE OIL COMPANY	HUMBLE OIL AND REFINING COMPANY
LPCO	LAKEHEAD PIPELINE CO	LAKEHEAD PIPELINE COMPANY
MWPLC	MI-WI PIPELINE CO	MICHIGAN-WISCONSIN PIPELINE COMPANY
NGPCA	NATURAL GAS CO	NATURAL GAS PIPELINE COMPANY OF AMERICA
OHOCO	OHIO OIL COMPANY	OHIO OIL COMPANY
PHILIP	PHILLIPS PETROLEUM	PHILLIPS PETROLEUM COMPANY
ROCO	RICHFIELD OIL CO	RICHFIELD OIL COMPANY
SHELL	SHELL OIL COMPANY	SHELL OIL COMPANY
SOCO	STANDARD OIL COMPANY	STANDARD OIL COMPANY
SOGCO	SIGNAL OIL AND GAS	SIGNAL OIL AND GAS COMPANY
SUNOCO	SUN OIL COMPANY	SUN OIL COMPANY
SUPOCO	SUPERIOR OIL COMPANY	SUPERIOR OIL COMPANY
TENNEC	TENNECO	TENNESSEE GAS AND PIPELINE COMPANY
TWOCO	TIDEWATER OIL CO	TIDEWATER OIL COMPANY
UOCO	UNION OIL COMPANY	UNION OIL COMPANY
VOCO	VALVOLINE OIL CO	VALVOLINE OIL COMPANY

GAS AND ELECTRIC UTILITY COMPANIES

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AGASEL	ASSOCIATED G AND E	ASSOCIATED GAS AND ELECTRIC COMPANY
ALPCO	ALABAMA POWER CO	ALABAMA POWER COMPANY
APC	APPALACHIAN POWER CO	APPALACHIAN POWER COMPANY
ARLAGC	AR-LA GAS COMPANY	AR-LA GAS COMPANY
CONED	CONSOLIDATED EDISON	CONSOLIDATED EDISON POWER COMPANY
CONSPC	CONSUMER POWER CO	CONSUMER POWER COMPANY OF MICHIGAN
CTP&L	CT POWER AND LIGHT	CONNECTICUT POWER AND LIGHT COMPANY
DECO	DETROIT EDISON CO	DETROIT EDISON COMPANY
FLPCO	FLORIDA POWER CO	FLORIDA POWER COMPANY
HLPCO	HOUSTON L AND P CO	HOUSTON LIGHTING AND POWER COMPANY
IMECO	IN-MI ELECTRIC CO	INDIANA-MICHIGAN ELECTRIC COMPANY
LONESR	LONE STAR GAS CO	LONE STAR GAS COMPANY
MINPCO	MI NORTHERN POWER CO	MICHIGAN NORTHERN POWER COMPANY
MSP+L	MS POWER AND LIGHT	MISSISSIPPI POWER AND LIGHT COMPANY
NJP+L	NJ POWER AND LIGHT	NEW JERSEY POWER AND LIGHT COMPANY
OHPCO	OHIO POWER COMPANY	OHIO POWER COMPANY
PEPCO	POTOMAC EDISON POWER	POTOMAC EDISON POWER COMPANY
PG+E	PACIFIC G AND E CO	PACIFIC GAS AND ELECTRIC COMPANY
PHELCO	PHILA ELECTRIC CO	PHILADELPHIA ELECTRIC COMPANY
PWPCO	PA WTR AND POWER CO	PENNSYLVANIA WATER AND POWER COMPANY
SCECO	SO CALIFORNIA EDISON	SOUTHERN CALIFORNIA EDISON COMPANY
SCE+G	SC ELECTRIC AND GAS	SOUTH CAROLINA ELECTRIC AND GAS COMPANY
SDG+E	SAN DIEGO G AND E CO	SAN DIEGO GAS AND ELECTRIC COMPANY

SURVEYING AND CONSTRUCTION INDUSTRY

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AAS	ATLANTIC AERIAL SURV	ATLANTIC AERIAL SURVEYS
ABRAMS	ABRAMS AERIAL SURV	ABRAMS AERIAL SURVEYS
ACFPS	ACF SURVEYS	ACF PRECISION SURVEYS INCORPORATED
AEROS	AERO SERVICE CORP	AERO SERVICE CORPORATION
AHI	ATWELL HICKS INC	ATWELL HICKS INC
AIRSUR	AIR SURVEY CORP	AIR SURVEY CORPORATION
AISS	A I SILANDER AND SON	A I SILANDER AND SON
ALSTER	ALSTER ASSOCIATES	ALSTER AND ASSOCIATES ENGINEERS
BAKER	M BAKER JR INC	M BAKER JR INC
BGAS	BRUCE + GUNN SURVEYS	BRUCE AND GUNN AERIAL SURVEYS
BMMS	BOUTELLE MACFARLANE	BOUTELLE MACFARLANE MEYER AND SELEE
BRADY	BRADY LAND SURVEYING	BRADY LAND SURVEYING INC
BRWE	BROCK AND WEYMOUTH	BROCK AND WEYMOUTH ENGINEERS
BWDCO	BERKELEY WTRF DEV CO	BERKELEY WATERFRONT DEVELOPMENT COMPANY
CEJA	C E JOHNSON ASSOC	C E JOHNSON AND ASSOCIATES INC
CFM	C F MERRIAM SURVEYOR	C F MERRIAM SURVEYOR
CHAMBA	CHAMBLIN ASSOCIATES	CHAMBLIN AND ASSOCIATES
CHIPPR	CHIPPERFIELD NAVIG	N R CHIPPERFIELD NAVIGATION SERVICES
CL	CLIFFORD LEISURE CE	CLIFFORD LEISURE CIVIL ENGINEER
COLGOV	COLBURN AND GOVE	COLBURN AND GOVE CONSULTING ENGINEERS
CTMALE	C T MALE ASSOCIATES	C T MALE ASSOCIATES
DARA	D A RATEKIN ASSOC	D A RATEKIN AND ASSOCIATES
DEC	DAHLING ENGINEER CO	DAHLING ENGINEERING COMPANY

SURVEYING AND CONSTRUCTION INDUSTRY - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
DECKER	R L DECKER	R L DECKER
DELTA	DELTA ENGINEERS INC	DELTA ENGINEERS INC
DUNLAP	DUNLAP ASSOCIATES	DUNLAP ASSOCIATES
EESCC	E E STULLER CONST CO	E E STULLER CONSTRUCTION COMPANY
EWB	E W BRAASCH CONS ENG	E W BRAASCH CONSULTING ENGINEER
FAMC	FALCON AIR MAPS CO	FALCON AIR MAPS COMPANY
FAS	FAIRCHILD AER SURV	FAIRCHILD AERIAL SURVEYS
GHA	G HENKENHOFF ASSC	G HENKENHOFF AND ASSOCIATES
HALSEY	HALSEY CIVIL ENG INC	W H HALSEY CIVIL ENGINEERS INC
HDA	HORTON DENNIS ASSOC	HORTON DENNIS ASSOCIATES
ISBELL	ISBELL CONST COMPANY	ISBELL CONSTRUCTION COMPANY
JBB	J B BLYDENBURGH SURV	J B BLYDENBURGH SURVEYOR
JKPLS	JEFF KERN PLS	JEFF KERN PROFESSIONAL LAND SURVEYOR
KONSKI	KONSKI ENGINEERS	KONSKI ENGINEERS
LAFAVE	LAFAVE LAND SURVEYOR	A LAFAVE LAND SURVEYOR
LDA	L DICKERSON ASSOC	LEWIS DICKERSON AND ASSOCIATES CONS ENG
LEAS	LIMBAUGH ENGINEERING	LIMBAUGH ENGINEERING AND AERIAL SURVEY INC
LEGER	LEGER SURVEYS INC	LEGER SURVEYS INC
LEVITT	ITT LEVITT CORP	ITT LEVITT CORPORATION
LINDSY	F M LINDSEY ASSOC	F M LINDSEY AND ASSOCIATES
MADHOP	MADDOX AND HOPKINS	MADDOX AND HOPKINS SURVEYORS
MAI	MEYER AND ASSOCIATES	MEYER AND ASSOCIATES INCORPORATED
MATOTA	MATOTAN ASSOCIATES	WILLIAM MATOTAN AND ASSOCIATES
MCCENG	MCCLELLAND ENGINEERS	MCCLELLAND ENGINEERS
MCTUER	MCCARTER AND TULLER	MCCARTER AND TULLER INCORPORATED
MGA	MOORE GARDNER ASSC	MOORE GARDNER AND ASSOCIATES
MHAS	MARK HURD AER SURV	MARK HURD AERIAL SURVEYS
MKWS	M K WELCH SURVEYS	M K WELCH SURVEYS
MLI	MILLER AND LUX INC	MILLER AND LUX INC
MME	MYERS-MACOMBER ENG	MYERS-MACOMBER ENGINEERS
MPS	MCNAMEE PORTER AND S	MACNAMEE PORTER AND SEELEY
NAVSER	NAVIGATION SERVICES	NAVIGATION SERVICES INCORPORATED
OMAN	OMAN CONSTRUCTION CO	OMAN CONSTRUCTION COMPANY
PAS	PARK AERIAL SURVEYS	PARK AERIAL SURVEYS INC
PGEG	PETTY GEOPHYSICAL CO	PETTY GEOPHYSICAL ENGINEERING COMPANY
PHELPS	B E PHELPS INC	B E PHELPS INC
PORTER	NORMAN PORTER ASSOC	NORMAN PORTER ASSOCIATES
SBI	SHERWOOD BROS INC	SHERWOOD BROTHERS INC
SCAN	SCANLON ASSOCIATES	SCANLON AND ASSOCIATES
SECO	SOUTHERN ENGINEERING	SOUTHERN ENGINEERING COMPANY
SELLS	SELLS INC CONS ENG	CHAS H SELLS INC CONSULTING ENGINEERS
SPAN	SPAN INTERNATIONAL	SPAN INTERNATIONAL INCORPORATED
SWECO	STONE WEBSTER ENG	STONE WEBSTER ENGINEERING CORPORATION
THOMAS	THOMAS ENG AND SURV	THOMAS ENGINEERING AND SURVEYING COMPANY
TURNER	A E TURNER ARCHITECT	A E TURNER ARCHITECT
TSI	TOBIN SURVEYS	TOBIN SURVEYS INCORPORATED
URS	URS COMPANY	URS COMPANY
VJV	V J VANLINT CONS ENG	V J VANLINT CONSULTING ENGINEER
VOGI	VOGI IVERS AND ASSOC	VOGI IVERS AND ASSOCIATES
WAA	WALKER + ASSOCIATES	WALKER AND ASSOCIATES INCORPORATED
WARD	E J WARD	E J WARD
WAWHI	WALKER + WHITEFORD	WALKER AND WHITEFORD INCORPORATED
WBCC	WARREN BROS CONST CO	WARREN BROTHERS CONSTRUCTION COMPANY

SURVEYING AND CONSTRUCTION INDUSTRY - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
WFTA	W F TURNEY ASSC	W F TURNEY AND ASSOCIATES
WRA	WHIGMAN-REQUARDT	WHIGMAN AND REQUARDT ASSOCIATES
WESGEO	WESTERN GEOPHYSICAL	WESTERN GEOPHYSICAL COMPANY OF AMERICA
WSA	WILLIAMS-STACKHOUSE	WILLIAMS AND STACKHOUSE ASSOCIATES

MISCELLANEOUS COMMERCIAL ORGANIZATIONS AND PRIVATE FIRMS

SYMBOL	STANDARD ABBREV NAME	FULL NAME
AKGEO	ALASKAN GEOPHYSICAL	ALASKAN GEOPHYSICAL
AKLPCO	AK LUMBER AND PULP	ALASKA LUMBER AND PULP COMPANY
ATCO	ASSOC TRACTION CO	ASSOCIATED TRACTION COMPANY
ATT	AMERICAN T AND T CO	AMERICAN TELEPHONE AND TELEGRAPH COMPANY
BGCO	BROWN GEOPHYSICAL CO	BROWN GEOPHYSICAL COMPANY
BW	BRADFORD WASHBURN	BRADFORD WASHBURN
BWCO	BONO-WILLIAMS CO	BONO-WILLIAMS COMPANY
BULE	BULE AND ASSOCIATES	BULE AND ASSOCIATES
CCCC	CARBIDE AND CARBON	CARBIDE AND CARBON CHEMICALS CORPORATION
CCICO	CLEVE CLIFFS IRON CO	CLEVELAND CLIFFS IRON COMPANY
CH2M	CH2M HILL INC	CH2M HILL INCORPORATED
CLA	CROZER LAND ASSOC	CROZER LAND ASSOCIATION
CPFC	CHAMPION PAPER CO	CHAMPION PAPER AND FIBER COMPANY
CROSET	CROSSETT LUMBER CO	CROSSETT LUMBER COMPANY
DBA	DBA SYSTEMS INC	DBA SYSTEMS INCORPORATED
DOWCO	DOW CHEMICAL COMPANY	DOW CHEMICAL COMPANY
DSI	DESIGN SCIENCES INC	DESIGN SCIENCES INC
DVLCO	D VARDEN LUMBER CO	DOLLY VARDEN LUMBER COMPANY
ENVENG	ENVIRONMENT ENG INC	ENVIRONMENTAL ENGINEERING INC
FMCO	FORD MOTOR COMPANY	FORD MOTOR COMPANY
GCC	GLOGORA COAL COMPANY	GLOGORA COAL COMPANY
GE	GENERAL ELECTRIC	GENERAL ELECTRIC CORPORATION
GEON	GEONAUTICS INC	GEONAUTICS INC
GRDC	GULF RESEARCH CO	GULF RESEARCH AND DEVELOPMENT COMPANY
HAPT	HUGHES AIRPORT	HUGHES AIRPORT
HMCO	HANNA MINING CO	HANNA MINING COMPANY
KETCH	KETCHIKAN PULP CO	KETCHIKAN PULP COMPANY
LAICO	LA INVESTMENT CO	LOS ANGELES INVESTMENT COMPANY
MACCO	MACCO CORPORATION	MACCO CORPORATION
MCAM	MOLYBDENUM CORP	MOLYBDENUM CORPORATION OF AMERICA
MCLCO	MI-CA LUMBER COMPANY	MICHIGAN-CALIFORNIA LUMBER COMPANY
NAAV	NORTH AMERICAN	NORTH AMERICAN AVIATION
NJZINC	NEW JERSEY ZINC CO	NEW JERSEY ZINC COMPANY
PECO	POHLY EXPLORATION CO	POHLY EXPLORATION COMPANY
PACTT	PACIFIC T AND T CO	PACIFIC TELEPHONE AND TELEGRAPH COMPANY
PANAM	PAN AMERICAN	PAN AMERICAN AIRLINES
PCC	PEABODY COAL CO	PEABODY COAL COMPANY
PHILCM	PHILLIPS CHEMICAL CO	PHILLIPS CHEMICAL COMPANY
PPCC	PACIFIC PORT CEMENT	PACIFIC PORTLAND CEMENT CORPORATION
PVE	PALOS VERDES ESTATES	PALOS VERDES ESTATES
REGIS	ST REGIS PAPER CO	ST REGIS PAPER COMPANY
RRLC	RED RIVER LUMBER CO	RED RIVER LUMBER COMPANY

MISCELLANEOUS COMMERCIAL ORGANIZATIONS AND PRIVATE FIRMS - CONTINUED

SYMBOL	STANDARD ABBREV NAME	FULL NAME
SANDIA	SANDIA CORPORATION	SANDIA CORPORATION
SSC	SEISMOGRAPH SERVICE	SEISMOGRAPH SERVICE CORPORATION
SWBELL	SW BELL TELEPHONE CO	SOUTH WESTERN BELL TELEPHONE COMPANY
TLDYNE	TELEDYNE INC	TELEDYNE INCORPORATED
VAILCO	VAIL COMPANY	VAIL COMPANY
VITRO	VITRO CORPORATION	VITRO CORPORATION
WHITE	WHITE PIGMENT CO	WHITE PIGMENT COMPANY
WE	WESTERN ELECTRIC	WESTERN ELECTRIC COMPANY

ACADEMIC INSTITUTIONS AND AMATEUR ORGANIZATIONS

SYMBOL	STANDARD ABBREV NAME	FULL NAME
BMS	BOSTON MUSEUM OF SCI	BOSTON MUSEUM OF SCIENCE
BSA	BOY SCOUTS	BOY SCOUTS OF AMERICA
CORUNI	CORNELL UNIVERSITY	CORNELL UNIVERSITY
CU	COLUMBIA UNIVERSITY	COLUMBIA UNIVERSITY
ECM	ENG CLUB OF MEMPHIS	ENGINEERS CLUB OF MEMPHIS
FSNSCH	FARMINGTON STATE	FARMINGTON STATE NORMAL SCHOOL
IASUNI	IOWA STATE UNIV	IOWA STATE UNIVERSITY
JPL	JET PROPULSION LAB	JET PROPULSION LABORATORY
KSU	KANSAS STATE UNIV	KANSAS STATE UNIVERSITY
LAFCOL	LAFAYETTE COLLEGE	LAFAYETTE COLLEGE
LAHSCH	LOS ALTOS HIGH SCH	LOS ALTOS HIGH SCHOOL
LASU	LOUISIANA STATE UNIV	LOUISIANA STATE UNIVERSITY
LEHIGH	LEHIGH UNIVERSITY	LEHIGH UNIVERSITY
MISCOL	MICHIGAN ST COLLEGE	MICHIGAN STATE COLLEGE
MIT	MASS INST OF TECH	MASSACHUSETTS INSTITUTE OF TECHNOLOGY
MITU	MICHIGAN TECH UNIV	MICHIGAN TECHNICAL UNIVERSITY
MSSU	MISSISSIPPI STATE	MISSISSIPPI STATE UNIVERSITY
MUNIV	MARQUETTE UNIVERSITY	MARQUETTE UNIVERSITY
NDSU	NORTH DAKOTA STATE U	NORTH DAKOTA STATE UNIVERSITY
ORTI	OREGON TECH INST	OREGON TECHNICAL INSTITUTE
SUNIV	STANFORD UNIVERSITY	STANFORD UNIVERSITY
TCU	TEXAS CHRISTIAN UNIV	TEXAS CHRISTIAN UNIVERSITY
UC	UNIV OF CALIFORNIA	UNIVERSITY OF CALIFORNIA
UFL	UNIV OF FLORIDA	UNIVERSITY OF FLORIDA
UHI	UNIV OF HAWAII	UNIVERSITY OF HAWAII
UNM	UNIVERSITY OF NM	UNIVERSITY OF NEW MEXICO
UTU	UNIVERSITY OF UTAH	UNIVERSITY OF UTAH
UTX	UNIVERSITY OF TEXAS	UNIVERSITY OF TEXAS
UVA	UNIV OF VIRGINIA	UNIVERSITY OF VIRGINIA
UWI	UNIV OF WISCONSIN	UNIVERSITY OF WISCONSIN
WILCOL	WILLIAMS COLLEGE	WILLIAMS COLLEGE AT WILLIAMSTOWN MA
WVUNIV	WEST VIRGINIA UNIV	WEST VIRGINIA UNIVERSITY

GENERAL NON-SPECIFIC DESIGNATORS

SYMBOL	STANDARD ABBREV NAME	FULL NAME
LOCENG	LOCAL ENGINEER	LOCAL ENGINEER (INDIVIDUAL OR FIRM)
LOCSUR	LOCAL SURVEYOR	LOCAL SURVEYOR (INDIVIDUAL OR FIRM)
UNK	UNKNOWN	UNKNOWN PERSON OR FIRM

ANNEX D

GUIDELINES FOR SURVEY POINT NAMES AND DESIGNATIONS

VERTICAL CONTROL POINTS

A vertical control point, commonly referred to as a "bench mark" (BM), is a monumented (or otherwise permanently marked) survey point established for the purpose of providing elevation reference for mapping and charting activities and for a wide variety of engineering and scientific applications.

A vertical control point is normally identified by a number or by an alphanumeric symbol which is usually stamped on the respective disk marker (or otherwise inscribed on the bench mark monument). Less frequently, a bench mark is assigned a concise, intelligible name. In principle, the designation by means of which a vertical control point is identified for publication purposes should be identical to or closely resemble the designation which actually appears on the respective marker; however, extraneous information is frequently present which is not desired to be included as a part of the designation. For example, the designation of a bench mark should not include the elevation which may also be stamped on the respective disk marker, and it does not generally include the "year mark set" (except for bench marks which have been reset - see below).

In every case, the designation assigned to a bench mark for automatic data processing purposes must be as close as possible to the designation which appears in the heading of the respective bench mark descriptions, subject to the following guidelines:

1. A bench mark designation must not exceed 25 alphanumeric characters (including all imbedded blanks). Abbreviate and/or edit an existing designation as necessary to conform to this limit.

2. A bench mark designation may include the name or abbreviation of the agency or organization which established the vertical control point (if other than NGS or CGS) - see ANNEX C, p. C-1.

Example:	Designation:
2903 (USGS)	2903 USGS
GAGING STA MORC	GAGING STA MORC

3. The only special characters permitted in a bench mark designation are the blank ( ), plus (+), minus (-), equals (=), slash (/), and the decimal point (.); when used, these special characters must not be separated from adjacent characters by any blanks. Commas and parentheses are not allowed to appear in a bench mark designation.

Example:	Designation:
CH 1174, USGS = 297+00 (A)	CH 1174=297+00 A USGS

4. Unless a hyphen (minus sign) is specifically indicated, all alpha and numeric character groupings which occur in a bench mark designation must be separated by a blank. Care should be taken that only one blank is used. for this purpose; two blanks in a row will be interpreted as end of the designation.

Example:	Designation:
TT17B	TT 17 B
TT-17B	TT-17 B
TT-17-B	TT-17-B

5. A period may not appear imbedded in or adjacent to a grouping of alpha characters; however, a decimal point may appear imbedded in (but not adjacent to) a grouping of numeric characters.

Example:	Designation:
MI. 14.2	MI 14.2
4419.	4419
PALMER N.E. BASE	PALMER NE BASE

6. For bench marks which carry multiple stamped designation, the designations involved should be concatenated with the equal sign (=) used as separator, subject to the 25-character total length limit.

Example:	Designation:
H 14 (USGS) and TIDAL 3	H 14 USGS=TIDAL 3
P99, C 104, and GAGING STA	P 99=C 104=GAGING STA
STA. NO. 3 and MI. 182.5	STA NO 3=MI 182.5

7. Other multiple designations which are not concatenated as indicated in the preceding paragraph (either because they do not appear stamped on the respective disk marker or because they had to be left out in order to meet the 25-character total length limit) must be given as separate data items to be carried as "aliases" in the descriptive data.

8. Non-specific descriptive terms are not to be treated as "double designations" and hence are not to be carried as aliases, either.

Example:	Designation:
A 307, TIDAL BM	A 307
H 14, TIDAL 3	H 14=TIDAL 3
114.3, CHISELED SQUARE	114.3
C 104, STA 1 TIDAL 2	C 104=STA 1 TIDAL 2

9. Elevation stamped on the disk marker (or otherwise inscribed on the bench mark monument) is not to be carried as a part of the respective bench mark designation.

Example:	Designation:
H 325 230.695FT	H 325
140B (MORC) ELEV 95.3 FT	140 B MORC

10. The "year mark set" is to be carried as a part of a bench mark designation only for those bench marks whose designation has not been altered after they were reset. In such a case, the word RESET and the respective year (e.g. RESET 1975) must be appended to the original bench mark designation; however, if the original designation exceeds 14 characters in length, the word RESET is to be omitted and only the "year mark set" appended. In the case of a bench mark which has been reset more than once, only the most recent "year mark set" is to be indicated.

Example:	Designation:
203, reset in 1950 and 1967	203 RESET 1967
H325 1965 USGS 320.695FT	H 325 USGS
TT 8 1935, reset in 1965	TT 8 RESET 1965
LAKE WASHINGTON, reset in 1970	LAKE WASHINGTON 1970

11. Occasionally, a horizontal control point is included as a bench mark in a vertical control network. In such a case, the published name of the horizontal control point in question (i.e., the name which appears in the heading of the respective station description and/or subsequent recovery notes), modified as necessary to conform to the guidelines contained herein, should be used as the bench mark designation.

Example:	Designation:
CHARLOTTE (USGS)	CHARLOTTE USGS
BOULDER 1935	BOULDER
CHICO 1948, reset in 1971	CHICO RESET 1971

12. When the reference mark of a horizontal control point is included as a bench mark in a vertical control network, the name or designation of the reference mark in question, modified as necessary to conform to the guidelines contained herein, should be used as the bench mark designation. The name of a reference mark is normally formed by appending the symbols RM 1, RM 2, ..., RM 13, etc. to the name of the respective horizontal control point for reference marks stamped NO 1, NO 2, ..., NO 13, etc.

Example:	Designation:
CHARLOTTE NO. 1	CHARLOTTE RM 1
BOULDER 1935 NO 6	BOULDER RM 6
CHICO 1948 NO 3, reset in 1971	CHICO RM 3 RESET 1971

13. When the azimuth mark of a horizontal control point is included as a bench mark in a vertical control network, the name or designation of the azimuth mark in question, modified as necessary to conform to the guidelines contained herein, should be used as the bench mark designation. The name of an azimuth mark is normally formed by appending to the name of the respective horizontal control point the symbol AZ MK if only one azimuth mark is involved (as is the usual case), or else the symbols AZ MK 2, AZ MK 3, etc. for azimuth marks stamped NO 2, NO 3, etc.

Example:	Designation:
CHARLOTTE (azimuth mark)	CHARLOTTE AZ MK

Example (continued):	Designation:
BOULDER 1935 NO.3	BOULDER AZ MK 3
CHICO 1948, reset in 1971	CHICO AZ MK RESET 1971
N WASH AZI	N WASH AZ MK

14. A temporary bench mark (TBM) must carry the letters "TBM" as the first three characters of the designation.

Example:	Designation:
TBM 1A	TBM 1 A
14	TBM 14

Whenever the need arises for a guideline to deal with a situation not covered herein, the user is encouraged to communicate with the Director, National Geodetic Survey Information Center (NGSIC), to have the proposed guideline confirmed and incorporated in this ANNEX.

HORIZONTAL CONTROL POINTS - TO BE COMPILED. Sufficient guidelines concerning the names and/or designations of horizontal control points, reference marks, and azimuth marks will be found in Chapter 2, p. 2-30 - 2-35, and in Chapter 3, p. 3-20 - 3-22.

ANNEX E

STATION ORDER-AND-TYPE (OT) CODES

This ANNEX contains lists of the various types of horizontal control points with the corresponding two-digit Order-and-Type (OT) Codes which are used to classify every horizontal control point according to the general order of accuracy of the main-scheme network of which it is a part and according to the surveying method by means of which it is positioned. The use of the OT Codes is explained in Chapter 2 (p. 2-36 - 2-39).

The first digit (i.e., the "order digit") of the OT Code indicates the order of accuracy of the main-scheme network of which the horizontal control point in question is a part or to which it is connected. It also indicates whether the horizontal control point is permanently marked and recoverable (e.g. a monumented station or a landmark) or not permanently marked and hence nonrecoverable (e.g. an auxilliary point):

ORDER DIGITS OF RECOVERABLE POINTS:

0 - Trans-Continental Traverse (TCT)
1 - 1st-Order Survey Scheme
2 - 2nd-Order (Class I and Class II) Survey Scheme
3 - 3rd-Order (Class I and Class II) Survey Scheme
4 - Lower-Than-3rd-Order Survey Scheme and Supplemental Unmonumented Recoverable Landmarks (see p. E-4)

ORDER DIGITS OF NONRECOVERABLE POINTS:

5 - 1st-Order Survey Scheme
6 - 2nd-Order (Class I and Class II) Survey Scheme
7 - 3rd-Order (Class I and Class II) Survey Scheme
8 - Lower-Than-3rd-Order Survey Scheme

The second digit (i.e., the "type digit") of the OT Code indicates the type of the (primary) surveying method by means of which the horizontal control point is positioned. It also indicates whether the horizontal control point in question is a main-scheme station (i.e., one which is essential to the survey scheme) or a supplemental station (i.e., one which is incidental to the survey scheme):

TYPE DIGITS OF MAIN-SCHEME STATIONS:

1 - Positioned Primarily by Triangulation (or by Intersection)
2 - Positioned Primarily by Trilateration
3 - Positioned Primarily by Traverse

TYPE DIGITS OF SUPPLEMENTAL STATIONS:

4 - Positioned Primarily by Triangulation
5 - Positioned Primarily by Trilateration
6 - Positioned Primarily by Traverse
7 - Positioned by Intersection (Note: 1 if Main-Scheme Station)
8 - Positioned by Resection

ORDER-AND-TYPE (OT) CODES OF RECOVERABLE HORIZONTAL CONTROL POINTS - monumented (or otherwise permanently marked) stations, published as indicated.

SURVEY PROCEDURES	STATION TYPE	OT	PUBLISHED
STATIONS OF THE TRANS-CONTINENTAL TRAVERSE (TCT)			
TCT Procedures	Main-Scheme*	03	1st-Order
TCT Procedures	Supplemental**	06	1st-Order
MONUMENTED STATIONS POSITIONED PRIMARILY BY TRIANGULATION			
1st-Order	Main-Scheme	11	1st-Order
1st-Order	Supplemental	14	2nd-Order
2nd-Order (Class I or II)	Main-Scheme	21	2nd-Order
2nd-Order (Class I or II)	Supplemental	24	2nd-Order
3rd-Order (Class I or II)	All Stations	31	3rd-Order
Lower-Than-3rd-Order	All Stations	41	Low-Order
MONUMENTED STATIONS POSITIONED PRIMARILY BY TRILATERATION			
1st-Order	Main-Scheme	12	1st-Order
1st-Order	Supplemental	15	2nd-Order
2nd-Order (Class I or II)	Main-Scheme	22	2nd-Order
2nd-Order (Class I or II)	Supplemental	25	2nd-Order
3rd-Order (Class I or II)	All Stations	32	3rd-Order
Lower-Than-3rd-Order	All Stations	42	Low-Order
MONUMENTED STATIONS POSITIONED PRIMARILY BY TRAVERSE			
1st-Order	Main-Scheme	13	1st-Order
1st-Order	Supplemental	16	2nd-Order
2nd-Order (Class I or II)	Main-Scheme	23	2nd-Order
2nd-Order (Class I or II)	Supplemental	26	2nd-Order
3rd-Order (Class I or II)	All Stations	33	3rd-Order
Lower-Than-3rd-Order	All Stations	43	Low-Order
MONUMENTED STATIONS POSITIONED BY INTERSECTION			
1st-Order	Main-Scheme	11	1st-Order
1st-Order	Supplemental	17	2nd-Order
2nd-Order (Class I or II)	Main-Scheme	21	2nd-Order
2nd-Order (Class I or II)	Supplemental	27	2nd-Order
3rd-Order (Class I or II)	All Stations	37	3rd-Order
Lower-Than-3rd-Order	All Stations	47	Low-Order
MONUMENTED STATIONS POSITIONED BY RESECTION			
1st-Order	All Stations	18	2nd-Order
2nd-Order (Class I or II)	All Stations	28	2nd-Order
3rd-Order (Class I or II)	All Stations	38	3rd-Order
Lower-Than-3rd-Order	All Stations	48	Low-Order

* Main-Scheme Station - one which is essential to the survey scheme.
** Supplemental Station - one which is incidental to the survey scheme.

ORDER-AND-TYPE (OT) CODES OF NONRECOVERABLE HORIZONTAL CONTROL POINTS - temporary or auxilliary points, not permanently marked, which must be carried in the files for network integrity purposes. These horizontal control points will not be published.

SURVEY PROCEDURES	STATION TYPE	OT
UNMARKED STATIONS POSITIONED PRIMARILY BY TRIANGULATION		
1st-Order	Main-Scheme*	51
1st-Order	Supplemental**	54
2nd-Order (Class I or II)	Main-Scheme	61
2nd-Order (Class I or II)	Supplemental	64
3rd-Order (Class I or II)	All Stations	71
Lower-Than-3rd-Order	All Stations	81
UNMARKED STATIONS POSITIONED PRIMARILY BY TRILATERATION		
1st-Order	Main-Scheme	52
1st-Order	Supplemental	55
2nd-Order (Class I or II)	Main-Scheme	62
2nd-Order (Class I or II)	Supplemental	65
3rd-Order (Class I or II)	All Stations	72
Lower-Than-3rd-Order	All Stations	82
UNMARKED STATIONS POSITIONED PRIMARILY BY TRAVERSE		
1st-Order	Main-Scheme	53
1st-Order	Supplemental	56
2nd-Order (Class I or II)	Main-Scheme	63
2nd-Order (Class I or II)	Supplemental	66
3rd-Order (Class I or II)	All Stations	73
Lower-Than-3rd-Order	All Stations	83
UNMARKED STATIONS POSITIONED BY INTERSECTION		
1st-Order	Main-Scheme	51
1st-Order	Supplemental	57
2nd-Order (Class I or II)	Main-Scheme	61
2nd-Order (Class I or II)	Supplemental	67
3rd-Order (Class I or II)	All Stations	77
Lower-Than-3rd-Order	All Stations	87
UNMARKED STATIONS POSITIONED BY RESECTION		
1st-Order	All Stations	58
2nd-Order (Class I or II)	All Stations	68
3rd-Order (Class I or II)	All Stations	78
Lower-Than-3rd-Order	All Stations	88

* Main-Scheme Station - one which is essential to the survey scheme.
** Supplemental Station - one which is incidental to the survey scheme.

ORDER-AND-TYPE (OT) CODES OF UNMONUMENTED RECOVERABLE LANDMARKS - normally positioned as supplemental low-accuracy control points, possibly used as main-scheme triangulation stations (e.g. a well-defined church spire used as the unoccupied center of a central-point figure in a triangulation network), published as indicated.

SURVEY PROCEDURES	STATION TYPE	OT	PUBLISHED
LANDMARKS USED AS MAIN-SCHEME TRIANGULATION STATIONS			
1st-Order	Main-Scheme	11	1st-Order
2nd-Order (Class I or II)	Main-Scheme	21	2nd-Order
3rd-Order (Class I or II)	Main-Scheme	31	3rd-Order
Lower-Than-3rd-Order	Main-Scheme	41	Low-Order
LANDMARKS POSITIONED AS SUPPLEMENTAL CONTROL POINTS			
Any-Order Traverse	Supplemental	43	Low-Order
Any-Order Intersection	Supplemental	47	Low-Order
Any-Order Resection	Supplemental	48	Low-Order

ANNEX F

NGS SURVEY EQUIPMENT CODES

000-099 - Special Instrumentation
100-199 - Theodolites and Transists
200-299 - Leveling Instruments
300-399 - Leveling Rods and Staves
400-499 - Steel and Invar Tapes
500-599 - Lightwave Distance-Measuring Equipment
600-699 - Infrared Distance-Measuring Equipment
700-799 - Retro-Reflectors
800-899 - Microwave Distance-Measuring Equipment
900-999 - Unassigned

The purpose of the National Geodetic Survey (NGS) Survey Equipment Code is to provide a three-digit identifier for each item of survey equipment commonly used in connection with horizontal and vertical control surveys in the United States. The code has been devised in such a manner that the first digit of the three-digit identifier would indicate a specific category of survey equipment. Accordingly, there are ten broad survey equipment categories, the first of which (000-099) is reserved for special instrumentation, and the last (900-999) is as yet unassigned. The ten survey equipment categories are listed above.

Within each category, specific items and/or classes of survey equipment have been grouped into subcategories and assigned unique three-digit code numbers. The grouping of survey equipment into subcategories is intended to reflect the level of accuracy attained in common usage of the specific items or classes of survey equipment in question and not necessarily their intrinsic or potential accuracy. In each category and subcategory, a code is provided for items of survey equipment which do not appear among the items listed or which are not specifically identified. The respective lists of survey equipment are not all-inclusive, and series of numbers have been skipped in each category and/or subcategory to allow for additions.

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	000-099 - SPECIAL INSTRUMENTATION	
000	Unspecified	Unknown Instrument or System
	001-009 - Reserved for Absolute Gravity Devices	
	010-029 - Gravimeters	
010	Unspecified	Gravimeter
011	Frost	Frost Gravimeter
012	North American	North American Gravimeter
013	LaCoste-Romberg	Early Models
014	LaCoste-Romberg	G-Meter
015	LaCoste-Romberg	D-Meter
016	Worden	Unspecified
017	Worden	Uncompensated Model
018	Worden	Temperature-Compensated Model
019	Scintrex	CG-2
	030-049 - Doppler Satellite Tracking Systems	
030	Unspecified	Doppler Satellite Tracking System
031	Magnavox	Geoceiver or Geoceiver II
032	JMR	JMR-1
033	ITT	ITT 5500
034	Magnavox	MX-702A
035	APL	Tranet
036	Canadian Marconi	CMA 722A
037	Canadian Marconi	CMA 722B
038	Magnavox	MX-1502
	100-199 - THEODOLITES AND TRANSITS	
100	Unspecified	Theodolite or Transit
	101-199 - Instruments of Geodetic Astronomy	
101	Various	Zenith Telescope
102	Various	Meridian Telescope, Transit, or Circle
103	Various	Bamberg-Type Astronomic Transit
104	Wild	T-4
105	Kern	DKM3-A
106	Gigas-Askania	TPR
107	Zeiss/Jena	Theo-002

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	120-139 - First-Order (Geodetic) Theodolites	
120	Unspecified	0".1, 0".2, 0".5 Direct-Reading Theodolite
121	Various	Ramsden-Type 30, 24, 12-inch Theodolite
122	Various	USC&GS Parkhurst
123	Wild	T-3
124	Kern	DKM3
125	CTS/Vickers	Geodetic Tavistock
126	Hilger-Watts	Microptic No. 3
	140-159 - Second-Order (Universal) Theodolites	
140	Unspecified	1", 2", 5" Direct-Reading Theodolite
141	Various	USC&GS 7-inch Repeating Theodolite
142	Wild	T-2 or T-2E
143	Kern	DKM2 or DKM2-A
144	CTS/Vickers	V-400 Series
145	Hilger-Watts	Microptic No. 2
146	Dietzgen/Askania	A2 or A2E
147	Zeiss/Oberkochen	Th2
148	Zeiss/Jena	Theo-010 or Theo-010A
149	Nikon	NT-3 or NT-5
150	Sokkisha	TM-1A
151	Geotec	TH-01
	160-169 - Third-Order (Construction) Theodolites	
160	Unspecified	Construction Theodolite or Transit
161	Various	10" Direct-Reading Theodolite or Transit
162	Various	20" Direct-Reading Theodolite or Transit
163	Various	30" Direct-Reading Theodolite or Transit
164	Various	1' Direct-Reading Theodolite or Transit
	170-179 - 30' or Coarser Angulation Devices	
170	Unspecified	30' or Coarser Angulation Device
171	Various	30' or Coarser Theodolite or Transit
172	Various	30' or Coarser Compass Device
173	Various	30' or Coarser Protractor
	180-199 - Gyroscopic Theodolites	
180	Unspecified	Gyro-Theodolite

	CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
		200-299 - LEVELING INSTRUMENTS	
	200	Unspecified	Leveling Instrument
		210-249 - Precise (Geodetic) Levels	
	210	Unspecified	Precise Level
		211-230 - Precise Spirit (Bubble-Vial) Levels	
	211	Various	USC&GS Fischer
	212	USC&GS	Stampfer-Type (1877-1899)
	213	Buff & Berger	Van Orden or Mendenhall
	214	Various	Kern-Type (US Engineers)
	215	Zeiss	Ni-III or Ni-A
	216	Zeiss/Jena	Ni-004
	217	Wild	N-3
	218	Kern	NK3-M
	219	Breithaupt	NABON
	220	Fennel	Precise Level
	221	Hilger-Watts	Precise Level
	222	CTS/Vickers	Geodetic Level
	223	Sokkisha	PL-5
*	224	Keuffel & Esser	Precise Level
*		231-249 - Precise Compensator (Self-Aligning) Levels	
	231	Zeiss/Oberkochen	Ni1
	232	Zeiss/Oberkochen	Ni2
	233	Zeiss/Jena	Ni-002
	234	Zeiss/Jena	Ni-007
	235	Wild	NA-2 or NAK-2
	236	Salmoiraghi	5190
	237	MOM	Ni-A31
	238	Sokkisha	B-1
		250-289 - Engineer's (Universal) Levels	
	250	Unspecified	Engineer's Level
		251-270 - Engineer's Spirit (Bubble-Vial) Levels	
	251	Various	18-inch Dumpy-Type Level
	252	Various	18-inch Wye-Type Level
	253	Zeiss	Ni-II or Ni-B
	254	Zeiss/Jena	Ni-030

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	251-270 - Engineer's Spirit Levels - Continued	
255	Wild	N-2 or NK-2
256	Kern	NK3
257	Kern	NK2
258	Kern	GK23
259	Breithaupt	NAKRE
260	Fennel	Engineer's Level
261	Hilger-Watts	Engineer's Level
262	CTS/Vickers	Engineer's Level
263	Salmoiraghi	5160 Series
264	Nikon	S2
265	Sokkisha	TTL-5 or TTL-6
266	Geotec	L-11 or L-21
	271-289 - Engineer's Compensator (Self-Aligning) Levels	*
271	Zeiss/Oberkochen	Ni22
272	Zeiss/Jena	Ni-025
273	Kern	GK1-A
274	Breithaupt	AUTOM or AUCIR
275	Fennel	AUING
276	Hilger-Watts	AUTOSET
277	Salmoiraghi	5173, 5175, or 5180
278	Ertel	INA
279	Nikon	AE Series
280	Sokkisha	B-2
281	Geotec	AL-2 or AL-23
	290-299 - Builder's (Construction) Levels	
290	Unspecified	Builder's Level
291	Various	Builder's Dumpy-Type Spirit Level
292	Various	Builder's Tilting Spirit Level
293	Various	Builder's Compensator Level *
	300-399 - LEVELING RODS AND STAVES	
300	Unspecified	Leveling Rod or Stave
	310-349 - Precise (Graduated) Metal-Scale Rods	
310	Unspecified	Precise Metal-Scale Rod

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	310-349 - Precise Metal-Scale Rods - Continued	
311	USC&GS	USC&GS Pre-Invar Rods
312	USC&GS	Invar (Introduced in 1916)
313	Zeiss/Oberkochen	Invar
314	Zeiss/Jena	Invar
315	Wild	Invar
316	Kern	Invar
317	Breithaupt	Invar
318	Fennel	Invar
319	Hilger-Watts	Invar
320	CTS/Vickers	Nilex
321	Salmoiraghi	Invar
322	Keuffel & Esser	Lovar
323	Gurley	Invar
	350-389 - Engineer's Wooden Rods and Staves	
350	Unspecified	Engineer's Wooden Rod or Stave
351	Various	US Engineers 12-foor Rigid Rod
352	Various	US Geological Survey 12-foot Rigid Rod
	390-399 - Builder's Rods and Staves	
390	Unspecified	Builder's Rod or Stave
391	Various	Philadelphia Rod
392	Various	Chicago Rod
393	Various	California Rod
394	Various	12-foot Folding Rod
	400-499 - STEEL AND INVAR TAPES	
400	Unspecified	Steel or Invar Tape
	420-439 - Calibrated Invar Tapes	
420	Unspecified	Calibrated Invar Tape
421	Various	25-meter Calibrated Invar Tape
422	Various	50-meter Calibrated Invar Tape

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	440-459 - Calibrated Steel Tapes	
440	Unspecified	Calibrated Steel Tape
441	Various	30-meter Calibrated Steel Tape
442	Various	100-foot Calibrated Steel Tape
443	Various	300-foor Calibrated Steel Tape
	460-479 - Uncalibrated Steel Tapes	
460	Unspecified	Uncalibrated Steel Tape or Ruler
461	Various	30-meter Uncalibrated Steel Tape
462	Various	100-foot Uncalibrated Steel Tape
463	Various	300-foot Uncalibrated Steel Tape
	500-599 - LIGHTWAVE DISTANCE-MEASURING EQUIPMENT	
500	Unspecified	Lightwave Electro-Optical DME
501	AGA	Geodimeter Model 1
502	AGA	Geodimeter Model 2 or 2A
503	AGA	Geodimeter Model 3
504	AGA	Geodimeter Model 4A, 4B, or 4D
505	AGA	Geodimeter Model 4L
506	AGA	Geodimeter Model 6
507	AGA	Geodimeter Model 6A
508	AGA	Geodimeter Model 6B
509	AGA	Geodimeter Model 6BL
510	AGA	Geodimeter Model 7T
511	AGA	Geodimeter Model 700 or 710
512	AGA	Geodimeter Model 76 or 78
513	AGA	Geodimeter Model 8
531	Keuffel & Esser	LSE Ranger I, II, or III
532	Keuffel & Esser	LSE Ranger IV
533	Keuffel & Esser	LSE Ranger V
534	Keuffel & Esser	LSE Rangemaster
541	Spectra-Physics	Geodolite 3G
542	Spectra-Physics	Transitlite LT-3
551	Kern	ME-3000 Mekometer

CODE	MANUFACTURER	INSTRUMENT MODEL OR TYPE
	600-699 - INFRARED DISTANCE-MEASURING EQUIPMENT	
600	Unspecified	Infrared Electro-Optical DME
601	AGA	Geodimeter Model 12
611	Plessey	Tellurometer CD-6
612	Plessey	Tellurometer MA-100
621	Wild	Distomat DI-3 Series
622	Wild	Distomat DI-10 Series
631	Kern	DM-500
632	Kern	DM-1000 or DM-2000
641	Zeiss/Oberkochen	SM 11 or RegElta 14
642	Zeiss/Oberkochen	Eldi Series
643	Zeiss/Oberkochen	SM 4
651	Keuffel & Esser	LSE Microranger or Microranger II
652	Keuffel & Esser	LSE Autoranger
661	Hewlett-Packard	3800
662	Hewlett-Packard	3805 or 3810
671	Cubic	Cubitape DM-60
672	Cubic	HDM-70
681	Carrol & Reed	Akkuranger Mark I
691	Nikon	Beetle 500 or 500S
692	Nikon	Beetle 1000 or 1000S
	700-799 - RETRO-REFLECTORS	
700	Unspecified	Retro-Reflector
	800-899 - MICROWAVE DISTANCE-MEASURING EQUIPMENT	
800	Unspecified	Microwave Electro-Magnetic DME
801	Plessey	Tellurometer MRA-1
802	Plessey	Tellurometer MRA-2
803	Plessey	Tellurometer MRA-3
804	Plessey	Tellurometer MRA-4
805	Plessey	Tellurometer MRA-5
809	Plessey	Tellurometer CA-1000
831	Wild	Distomat DI-50
832	Wild	Distomat DI-60
841	Cubic	Electrotape DM-20
851	Fairchild	Microchain

ANNEX G

WEATHER CODE FOR HORIZONTAL OBSERVATIONS

TO BE COMPILED. Sufficient information concerning the weather code to be used in connection with horizontal control survey observations will be found in Chapter 2, pp 2-9 - 2-10.

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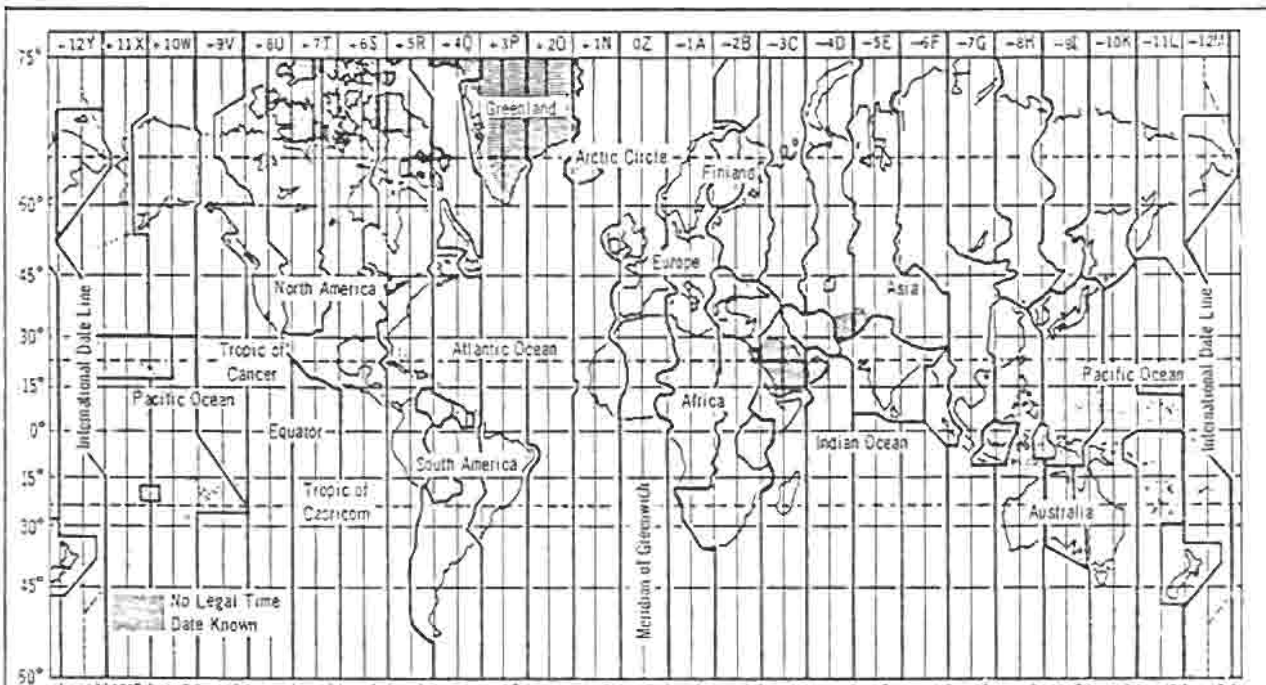
ANNEX H

STANDARD TIME ZONES



Previous Day																									Same Day
1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	
1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	
2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	
2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	
2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	
2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	
Same Day																									Next Day
0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	
0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	
0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	
0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	
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0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	
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1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	
1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	
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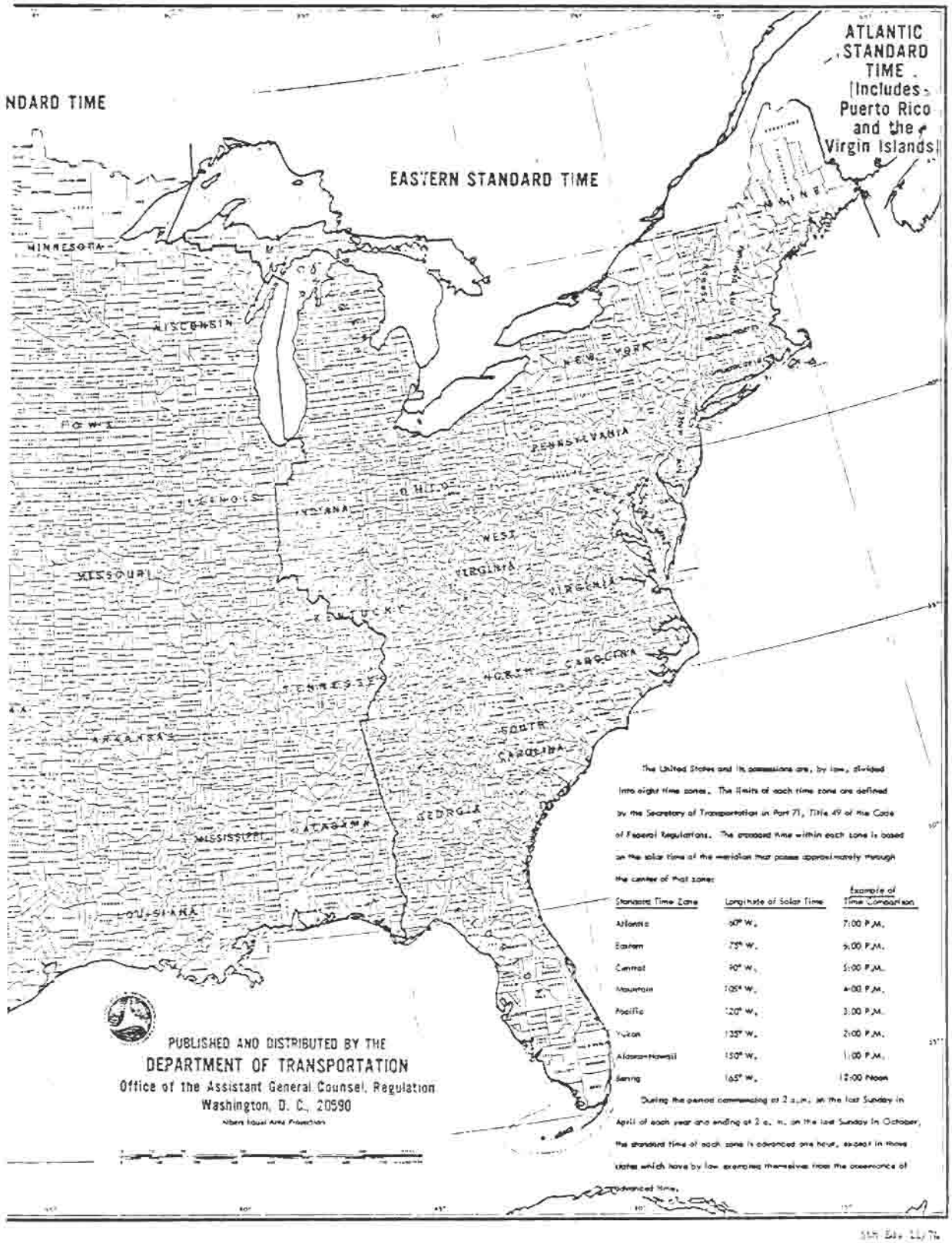
1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	
1600	1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	
1700	1800	1900	2000	2100	2200	2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	
-12Y	-11X	-10W	-9V	-8U	-7T	-6S	-5R	-4Q	-3P	-2O	-1N	0Z	+1A	+2B	+3C	+4D	+5E	+6F	+7G	+8H	+9I	+10K	+11L	+12M	

STANDARD TIME ZONES

OF THE UNITED STATES



The United States and its possessions are, by law, divided into eight time zones. The limits of each time zone are defined by the Secretary of Transportation in Part 71, Title 49 of the Code of Federal Regulations. The standard time within each zone is based on the solar time of the meridian that passes approximately through the center of that zone:

Standard Time Zone	Longitude of Solar Time	Example of Time Comparison
Atlantic	60° W.	7:00 P.M.
Eastern	75° W.	6:00 P.M.
Central	90° W.	5:00 P.M.
Mountain	105° W.	4:00 P.M.
Pacific	120° W.	3:00 P.M.
Yukon	135° W.	2:00 P.M.
Alaska-Hawaii	150° W.	1:00 P.M.
Bering	165° W.	12:00 Noon

During the period commencing at 2 a.m. on the last Sunday in April of each year and ending at 2 a. m. on the last Sunday in October, the standard time of each zone is advanced one hour, except in those states which have by law exempted themselves from the observance of advanced time.

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ANNEX I

SUMMARY OF CODES USED IN STATION DESCRIPTIONS

This ANNEX contains lists of codes which are used in the preparation of station descriptions and recovery notes pertaining to horizontal control points. The use of these codes is explained in Chapter 3, entitled HORIZONTAL DESCRIPTIVE (HZTL DESC) DATA. See ANNEX J for a summary of codes used in connection with original and recovery descriptions of vertical control points.

DRC CODE - used to identify the descriptive data as to its type.

D - self-standing station description
R - self-standing recovery note
C - combined set consisting of one complete station description or recovery note followed by abridged subsequent recovery note(s) for the same station.

MARK CODE - to be used as a prefix for the SETTING CODE (all except L) or LANDMARK CODE (L only).

A - aluminum marker	I - metal rod	R - rivet
B - bolt	J - earthenware jug	S - spike
C - cap-and-bolt	K - clay tile pipe	T - chiseled triangle
D - survey disk (any type)	L - landmark	U - concrete post
	M - ammo shell casing	V - stone monument
E - earthenware pot	N - nail	X - chiseled cross
F - flange-encased rod	O - chiseled circle	Y - drill hole in brick
G - glass bottle	P - pipe cap	Z - see description
H - drill hole	Q - chiseled square	

SETTING CODE - to be used with all MARK CODE prefixes other than L.

00 - setting not listed - see description

01 - driven into the ground
02 - imbedded in the ground
03 - surrounded by a mass of concrete
04 - set into the top of an irregular mass of concrete
05 - set into a drill hole in bedrock
06 - set into a drill hole in a concrete slab
07 - set into a drill hole in a concrete ledge
08 - set into the top of a round concrete monument
09 - set into the top of a square concrete monument

10 - crimped onto a metal rod driven into the ground *

```
*          set into the top of a metal pipe ...
        11 - ... driven into the ground
        12 - ... imbedded in the ground
surrounded 13 - ... serrounded by a mass of concrete
        14 - ... imbedded in a mass of concrete
           set in concrete at the center of a clay tile pipe ...
        20 - ... cemented to a wooden pile driven into marsh
        22 - ... imbedded in the ground
        23 - ... surrounded by a mass of concrete
        24 - ... imbedded in a mass of concrete
           set into a prefabricated concrete block ...
        32 - ... imbedded in the ground
        33 - ... surrounded by a mass of concrete
        34 - ... imbedded in a mass of concrete
           set into the top of a prefabricated concrete post ...
        42 - ... imbedded in the ground
        43 - ... surrounded by a mass of concrete
        44 - ... imbedded in a mass of concrete

        50 - in rock outcrop
        55 - set into a drill hole in rock outcrop
        56 - ... at the intersection of two chiseled lines
        57 - ... and surrounded by a chiseled triangle
        58 - ... and surrounded by a chiseled circle
        59 - ... and surrounded by a chiseled square
        60 - in a rock ledge
        65 - set into a drill hole in a rock ledge
        66 - ... at the intersection of two chiseled lines
        67 - ... and surrounded by a chiseled triangle
        68 - ... and surrounded by a chiseled circle
        69 - ... and surrounded by a chiseled square
        70 - in a boulder
        75 - set into a drill hole in a boulder
        76 - ... at the intersection of two chiseled lines
        77 - ... and surrounded by a chiseled triangle
        78 - ... and surrounded by a chiseled circle
        79 - ... and surrounded by a chiseled square
        80 - in a partially exposed boulder
        85 - set into a drill hole in a partially exposed boulder
        86 - ... at the intersection of two chiseled lines
        87 - ... and surrounded by a chiseled triangle
        88 - ... and surrounded by a chiseled circle
        89 - ... and surrounded by a chiseled square
        90 - in bedrock

           set into a mass of concrete ...
        95 - ... in a depression in rock outcrop
        96 - ... in a depression in a rock ledge
        97 - ... in a depression in a boulder
        98 - ... in a depression in a partially exposed boulder
        99 - ... in a depression in the bedrock
```

LANDMARK CODE - to be used with MARK CODE prefix L (landmark) only.

Landmarks Not Listed:

00 - see description

Natural Objects:

01 - lone tree
02 - cospicuous rock
03 - mountain peak
04 - rock pinnacle
05 - rock awash

Waterfront Landmarks and Visual Aids to Navigation:

11 - piling
12 - dolphin
13 - lighthouse
14 - navigation light
15 - range marker
16 - daybeacon
17 - flag tower
18 - signal mast

Aeronautical and Electronic Aids to Navigation:

21 - airport beacon
22 - airway beacon
23 - VOR antenna
24 - RBN antenna
25 - radar antenna
26 - spherical radome
27 - radio range mast
28 - LORAN mast

Broadcast and Communications Facilities:

41 - antenna mast
42 - radio/TV mast
43 - radio/TV tower
44 - microwave mast
45 - microwave tower

Tanks and Towers:

51 - tank
52 - standpipe tank
53 - elevated tank
54 - water tower
55 - tower
56 - skeleton tower
57 - lookout tower
58 - control tower

Miscellaneous Landmarks:

61 - pole
62 - flagpole
63 - stack
64 - silo
65 - grain elevator
66 - windmill
67 - oil derrick
68 - commercial sign
69 - regulatory sign
70 - monument
71 - boundary monument
72 - cairn
73 - lookout house
74 - large cross
75 - belfry

Features of a Building:

81 - gable
82 - finial
83 - flagstaff
84 - lightning rod
85 - chimney
86 - cupola
87 - dome
88 - observatory dome
89 - spire
90 - church spire
91 - church cross
92 - antenna
93 - microwave antenna
94 - rooftop ventilator
95 - rooftop blockhouse

M-CODE - used to indicate the magnetic property of the mark or monument.

A - steel rod adjacent to monument
B - bar magnet imbedded in monument
H - bar magnet set in drill hole
I - marker is a steel rod
M - marker equipped with bar magnet
N - no magnetic material
O - other - see description
P - marker is a steel pipe
R - steel rod imbedded in monument
S - steel spike imbedded in monument
T - steel spike adjacent to monument

AGENCY CODE - used to indicate the type of survey organization which established or recovered the horizontal control point.

* 0 - unknown
1 - NGS or CGS (USC&GS)
2 - U.S. Geological Survey (USGS)
3 - U.S. Department of Defense (DOD)
4 - other federal or interstate agency
5 - state agency
6 - county, city, or regional agency
* 7 - commercial organization or private firm
8 - National Ocean Survey (NOS)
9 - foreign government agency

MARKER TYPE - used to indicate the specific type of survey disk which marks the horizontal control point, or the type of certain other special-purpose survey markers, intended as an additional clarifier of MARK CODE.

A - astro pier
B - bench mark (BM) disk
C - chiseled mark
D - survey disk (not listed)
E - traverse station disk
G - gravity station disk
H - horizontal control disk
L - landmark
M - magnetic station disk
O - other - see description
P - base line pier
Q - calibration base line disk
R - reference mark (RM) disk
S - triangulation station disk
T - topographic station disk
U - boundary marker
V - vertical control disk
Z - azimuth mark (Az Mk) disk

CONDITION CODE - used to indicate the condition of the station mark or monument as determined upon the recovery of the horizontal control point.

G - good, fair
N - not recovered, not found, lost
O - other (see recovery text)
P - poor, disturbed, mutilated
X - destroyed

TRANSPORTATION CODE - used to indicate the mode of transportation used (or to be used) to reach the station or to reach the location where packing begins, if packing to the station site is required.

A - light airplane
B - boat
C - car (or station wagon)
F - float airplane
H - helicopter
O - other (see descriptive text)
P - light truck (pickup, caryall, etc.)
T - truck (larger than 3/4 ton)
W - tracked vehicle (weasel, snowcat, etc.)
X - four-wheel drive vehicle

HSV CODE - dual-purpose code used in connection with reference objects to (1) indicate the type of measured distance, or (2) indicate that a distant reference object is (or is not) visible from ground level. *

H - measured distance is horizontal distance *
S - measured distance is ground-slope distance *
V - distant reference object is visible from ground *
N - distant reference object is not visible from ground *

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ANNEX K

DATA TRANSMITTAL INSTRUCTIONS

Introduction

Information concerning data preparation and transmittal to NGS is also found in Chapter 1, HORIZONTAL CONTROL (HZTL) DATA, in Chapter 5, VERTICAL CONTROL (VERT) DATA, and in Chapter 9, GRAVITY CONTROL (GRAV) DATA. The section titled "Media for Submitting Data" describes procedures for packaging of the data and describes information required in the letter of transmittal pertaining to the punched cards or magnetic tape. In addition, the transmittal letter should inventory the total contents of the shipment.

The most important supporting document that should be included with the shipment is the project report. The project report is the permanent hard-copy record that summarizes project accomplishments. It describes the general project goals and the equipment and procedures employed to meet specific conditions and requirements. The report provides information useful for verification and adjustment, including detailed explanation of unusual or special features of the project. The recommended content of a project report follows. The project sketch is an attachment to the report. For projects totally or partially supported by NGS, a different report may be required.

Report Outline for a Horizontal Control Project

I. Title page. List the type of report (Horizontal Control), order-class of survey, project title including the state, any appropriate identifying control number, beginning and ending dates of field work, agency name, and the name of the project director (supervisor). The project title should include the locality of the survey (e.g., Brainerd to Crosby, MN).

II. The report should address the following topics:

A. Location. Briefly describe the project area, indicating the state and counties in which it is located.

B. Scope.

1. Purpose. State the purpose of the survey and the extent to which the requirements were satisfied.

2. Specifications. State the specifications which were followed and the methods which were used.

3. Monumentation. Describe the monumentation that was established and recovered.

4. Instrumentation. List the instruments and equipment used, and for EDM, describe the instrument calibration and how

the calibration and refractive index corrections were applied. Include model and serial numbers of all instrumentation.

5. Special equipment. List any special equipment used. Examples are: Bilby towers, helicopters, wooden stands, Peck towers, etc.

6. Existing control. List all existing horizontal control contained in the project area, NGS-published or otherwise. For NGS control, list the quadrangle and station numbers. Also, include the bench marks used to control the elevations. For existing horizontal control not connected to the new survey, include an explanation of why connections were not made.

C. Comments. (THIS IS THE MOST IMPORTANT SECTION OF THE REPORT!)

1. Reconnaissance. If a reconnaissance plan was submitted and approved by NGS prior to beginning the field measurements, describe any changes from the original reconnaissance and the reasons for the changes.

2. Specifications. Describe any deviations from the specifications used and the reason for such deviations.

3. Computations. Describe which computations were performed, the coordinate system used (e.g., latitude and longitude, state plane, or local rectangular grid), and what type of adjustment, if any, was performed.

4. Problems. Describe any problems encountered such as: moved or suspect marks; bad check angles; and poor position, azimuth, and length checks.

5. Recommendations. Describe any recommendations for future field measurements and/or recomputation of published data.

D. Statistics.

1. Points. List the number of points positioned grouped by type of mark such as: new main scheme; old main scheme; azimuth, reference, or bench marks; and/or landmark stations.

2. Observations. List the number of observations and their precision groupedby type of observation such as: horizontal directions, zenith distances, vertical angles, distances, and astronomic azimuths.

3. Closures.

a. Triangle. List the number of triangles, the average triangle closure, and the maximum triangle closure. For the maximum triangle closure, identify the three vertices.

b. Traverse. For each traverse closure, identify the traverse segment and list the azimuth closure, the position closure, the total length, the number of courses, and the minimum course length.

4. Reoccupations. List any reoccupied stations, the lines reobserved, the reason for the remeasurement.

5. Check measurements. List comparisons between previously observed angles (check angles) and/or distances with current observations. Also, list the average and maximum disagreements.

6. Fixed measurements. List comparisons between computed observations (computed from existing coordinate data) and current observations. Also, list the average and maximum disagreements.

E. Status.

1. Records. Describe the current status and future disposition of the station and observation records. If submitted to NGS, they will be archived in a Federal records center.

2. Contact. Provide the name and telephone number of a person to contact regarding questions which may arise during NGS processing of the data.

III. Attachment to the report. Include as an attachment to the project report a sketch of the project area showing station names and lines which were observed for angles and distances. To insure that reproductions and film reductions of sketches are of optimum quality, sketches should not be drawn on maps. Although linen, mylar or vellum would be desired, it is not required. A size of 24" x 36" is preferred but should not exceed 36" x 48". An overview of the project geometry is one objective of the sketch, and therefore, a scaled drawing with tick marks is required. Symbols and notations explained in C&GS Special Publication 247, pages 6 and 191, are suggested. The names of main scheme stations will be placed adjacent to the station symbol. Supplemental stations may be numbered for reference to a list of names. Submitting agency name should appear in a title block. The sketch may be handlettered.

Report Outline for a Vertical Control Project

I. Title page. List the type of report (Vertical Control), order and class of survey, project title including the state, any appropriate identifying number (for projects that have been assigned HGZ accession numbers by NGS, the numbers should be listed on the title page), beginning and ending dates of both mark setting and leveling, agency name, and the name of the project director (supervisor). The project title should include the locality of the project.

II. The report should address the following topics:

A. Location. Briefly describe the project area, including the state or states in which it is located. Note the number of lines, their general configuration, and their total distance.

B. Scope.

1. Purpose. State the purpose of the survey and the extent to which the requirements were satisfied.

2. Specifications. State the specifications which were followed and the methods which were used.

3. Monumentation. Describe the monumentation that was established and recovered.

4. Instrumentation. Describe the equipment, including a list of instruments, rods (including calibration information), and recording equipment. Include model and serial numbers of all equipment and the dates they were in use. Note the reasons for return of equipment for repairs or adjustment. For rod calibrations, cite which previously submitted calibration data are to be used to process the project. If none were submitted previously, include such calibration data with the leveling data submitted with this report.

C. Comments. (THIS IS THE MOST IMPORTANT SECTION OF THE REPORT!)

1. Reconnaissance. If a reconnaissance plan was submitted and approved by NGS prior to beginning the field measurements, describe any changes from the original reconnaissance and the reasons for the changes.

2. Specifications. Describe any deviations from the specifications used and the reason for such deviations.

3. Routes. Briefly describe each line, including line number or other identification, topography and climate, features of the routing such as control point spacing and frequency of connections, unusual points leveled, unusual procedures, river or valley crossings, and ties established.

4. Problems. Describe all problems encountered, such as: moved or suspect marks, systematic new-minus-old comparisons, poor ground or atmospheric conditions, etc.

5. Recommendations. Mention specific sections that required additional work as a result of preliminary analysis. Describe areas which may require additional leveling in the future.

D. Statistics.

1. Closures. List loop closures for all loops of concurrent surveys. State the accumulated forward-backward difference for each line.

2. Check-measurements. Compute and list new-minus-old tabulations for all releveling of previously leveled lines. Also, list the average and maximum disagreements.

3. Progress. (Needed only if submitting organization is supported by NGS funding and/or equipment). Total progress along lines, double-run progress, single-run progress, total distance leveled, distance leveled as reruns, and number of sections.

4. Reruns. For all sections that were releveled for any reason other than those exceeding the tolerance limit, list the sections and the reasons for releveling.

E. Status.

1. Records. Describe the current status and future disposition of the station and observation records. If submitted to NGS, they will be archived in a Federal records center.

2. Contact. Provide the name and telephone number of a person to contact regarding questions which may arise during NGS processing of the data.

III. Attachments to the report. Include as an attachment to the report a simple sketch of the project area showing completed lines, junctions, and loops. A section of the State Index Map of Control Leveling is sufficient with progress marked and lines clearly labeled. Also, attach copies of sketches showing loop closure computations.

Assistance and Mailing Information

The point of contact at NGS for questions concerning the Input Formats and Specifications of the National Geodetic Survey Data Base is Mr. James E. Stem. His address and telephone number are:

James E. Stem
National Geodetic Survey, N/CG1x4
6001 Executive Boulevard
Rockville, Maryland 20852
Telephone: (301) 443-8749

Data sent to NGS via U.S. Postal Service should be addressed:

Chief, National Geodetic Survey
Attn: N/CG164

Data sent to NGS via United Parcel Service or similar commercial carrier should be addressed:

Chief, National Geodetic Survey
Attn: N/CG164
Rockwall Building, Room 26
11400 Rockville Pike
Rockville, Maryland 20852

ANNEX K

DATA TRANSMITTAL INSTRUCTIONS

TO BE COMPILED. Sufficient information concerning data preparation and transmittal to NGS will be found in Chapter 1, HORIZONTAL CONTROL (HZTL) DATA, and in Chapter 5, VERTICAL CONTROL (VERT) DATA. The point of contact at NGS for questions concerning the User's Guide to the Formats and Specifications of the National Geodetic Survey Data Base is Mr. James E. Stem (301-443-8749) or Lt. Cdr. Ludvik Pfeifer (301-443-8168). Data sent to NGS via U.S. Postal Service should be addressed to:

Director, National Geodetic Survey
Attn: C13x4
Rockville, MD 20852

Data sent to NGS via United Parcel Service or similar commercial carrier should be addressed as follows:

Director, National Geodetic Survey
Attn: C13x4
The Rockwall Building, Room 14
11400 Rockville Pike
Rockville, MD 20852

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