Chapter 4
Supersedes Chapter 2

GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS B-FILE) DATA

This chapter provides detailed specifications and instructions for the coding and keying of data related to GNSS surveys. As explained in the Introduction document, three distinct data sets are submitted together for each survey. The data set known as the bluebook file (B-file) consists of observation metadata and final positions and is described in detail in this chapter. The companion “G-file” contains the GNSS observations and is discussed in ANNEX N. The third file contains descriptions and/or recovery notes (desc) for the points in the GNSS survey and is discussed in ANNEX P.

GNSS B-FILE DATA SET RECORDS

The data which constitute a GNSS B-file data set are organized into five categories, as follows:

Project Data
Global Navigation Satellite System Data
Survey Equipment Data
Control Point Data
Accuracy Data

Within these categories, the 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 a GNSS B-file consists of 80 characters or "columns." Within each record, the 80 columns are divided into fixed-length "character fields," where each field is reserved for a specific data item.

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 format type for that record (*10*,*11*,...,*). In the first and last records of the data set (the Data Set Identification Record and the Data Set Termination Record) the second character field (columns 7-10) contains the two-character alphanumeric job code assigned by the submitting organization (*A1*,*A2*,...., *ZZ*). The first character field of every record (columns 1-6) is reserved for the [optional but recommended] record sequence number. The remaining portion of each record (columns 11-80) contains character fields which are unique to each type of record.

STRUCTURE OF THE GNSS B-FILE

The first record of a GNSS B-file must be the Data Set Identification Record. It contains the required information to correlate it with its companion DESC data set - job code, data type (HZTL OBS), name of submitting organization, and date the data set was created. The last record of the data set must be the Data Set Termination Record. It is the only other record in the data set containing the job code that appears in the same field (columns 7-10) on the Data Set Identification Record. More information is available here.

Project Data (*10*-Series) Records:

10,*11*,*12* records

Global Positioning Systems Data (*25-27*-Series) Records:

25,*26*,*27*,*27* for first set of GNSS data
25,*26*,*27*,*27* for second set of GNSS data
::::
25,*26*,*27*,*27* for last set of GNSS data

NOTE: there must be 2 (but can be as many as 3) *27* records per set

Survey Equipment Data (*70* and *72*) Records:

70 for each item of survey equipment used in the project
72 for each GNSS antenna used in the project

Survey Point Data (*80* and *86*) Records:

80, *86* for first control point
80, *86* for second control point
::::
80, *86* for last control point

Accuracy and Variance Factor (*91-93*-Series) Records:

91 all network accuracy record
92 all local accuracy record
93 for the variance factor

PROJECT DATA RECORDS

10 - Project Title Record
11 - Project Title Continuation Record
12 - Project Information Record

The project data records, identified by *10*-series data codes, are listed above; specific formatting is found here.

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 on the *10* record. Do not divide words between the *10* and *11* records. The *12* record, which contains the date and general location of the survey, is required. The following data items are explained in greater detail:

Project Title: The GNSS project title should include the geographic locality of the survey and the type of the survey.

In general, the title by which the project is known to the submitting agency should be used, supplemented to reflect geographic locality, as appropriate. If the project is best described as covering an area network, give the geographic locality covered by the survey (e.g., KING COUNTY). If the project is generally linear then give the geographic localities of its endpoints, in the order of the 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. This information will be coded on the *12* record. Otherwise, use abbreviations listed in ANNEX A. Abbreviate in the interest of fitting the entire title on the *10* record, if possible.

Date and Time: The date the GNSS B-file was created must is reported on the Data Set Identification Record, *aa*, and the dates on which survey operations commenced and terminated is reported on the Project Information Record, *12*. In addition, character fields for the date and time of observation are provided on all observation data records. Throughout the GNSS B-file, date and time are to be coded as follows:

Date: The date for GNSS data will be coded as a six-digit integer number containing three two-digit groups denoting (left to right) the year and the month of the year (YYYYMMDD).

Time: The time for GNSS data is reported in Universal Coordinated Time (UTC), otherwise known as Greenwich Mean Time (GMT) or ZULU time.

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 worldwide 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 (US), 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 DESCRIPT'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.

GLOBAL POSITIONING SYSTEM DATA RECORDS

25 - GNSS Occupation Header Record
26 - GNSS Occupation Comment Record (Optional)
27 - GNSS Occupation Measurement Record

The term "occupation" is used to denote GNSS data records measurements accomplished to quantify geometric relationships among survey points. They are used in conjunction with observational phase measurements to derive the Data Transfer Records. See ANNEX N.

The basic element of an observation is a numerical value expressing the measured quantity. The units of measurements are meters and decimals of a meter. Auxiliary information such as the time of the observation and the height of the instrument are required in order to obtain proper spacial relationships.

GNSS observations containing code and phase data are recorded by the GNSS receiver in a binary format that is unreadable without a translation (e.g., vector reduction) program. The information on the *25* to *27* records and the GNSS code and phase measurements are required to derive the information in the GNSS Data Transfer Format file (G-File) records. See ANNEX N.

For each independent occupation of a control point one *25* and two *27* records must exist. The first *27* record indicates the time when data recording was initiated, plus associated occupation information. The second *27* indicates the time when data recording was completed, plus associated occupation information. Record the time and date referenced to UTC (or Greenwich Mean Time). There are occasions where it may be desirable to record a mid-session resulting in three *27* records.

Station Serial Number: For the purpose of identifying the station on the observation records in a concise manner, each survey point is assigned a job-specific station serial number (SSN) in the range 0001 to 9999.

Job-Specific Instrument Number (GNSS Receiver): The instrument used to accomplish a GNSS control survey observation must be known. In order to identify the instrument in a concise manner, a unique three-digit number in the range 001 to 999 is to be assigned to each unique instrument used in the project.

In a manner analogous to the assignment of station serial numbers, the instrument numbers are to be unique throughout the GNSS project. A *70* record must be prepared for each item of survey equipment which has been assigned an instrument number - see SURVEY EQUIPMENT DATA RECORDS.

Job Specific GNSS Antenna Number: In a manner analogous to the assignment of job specific instrument numbers, the job specific GNSS antenna numbers are to be unique throughout a GNSS project. A *72* record must be prepared for each antenna which has been assigned an antenna number - see SURVEY EQUIPMENT DATA RECORDS.

Height of GNSS Antenna: The height is the vertical distance from the top of the occupied survey mark to the Antenna Reference Point (ARP) of the antenna used with the GNSS receiver. It is possible, though rare, for the ARP to be below the datum point. For such cases this would be indicated by placing a “-“ in the appropriate column.

Control Points: A control point is a GNSS survey point whose geodetic position is to be determined by the survey project, or whose position has been determined in a previous survey.

The SSNs assigned to control points in the OBS data set of a horizontal control job must match those used to identify the same control points in the corresponding DESC data set. Any unobserved survey point for which a recovery note is submitted in the DESC data set must have a unique SSN.

Job-Specific Data Media Data Identifier: Since the GNSS observables (code and phase data) cannot be practically accommodated in the formats of this text, they must be submitted in manufacturer specific or Receiver Independent Exchange data file (RINEX) formats. Depending upon the receiver type, one or more files may be generated. However, it is still necessary to associate a specific set of data file(s) to a specific occupation. This is done by the user who assigns a 10-character identifier for each station occupation. These identifiers are unique to a specific project and reflect information on the physical or digital labels of the phase data files. The main function of the data media identifier is to provide to NGS a one-to-one correspondence between a control point occupation (Bfile) and a GNSS data file (Gfile). The standard format for the data media identifier can be found in ANNEX N.

SURVEY EQUIPMENT DATA RECORDS

70 - Instrument Record
72 - GNSS Antenna Record

The survey equipment data records, identified by *70*-series data codes, are listed above; specific formatting is found here.

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 (JSIN). Submit a *70* record for each item of survey equipment used in the project. Individual *70* records should appear in order of increasing JSIN.). More than one *70* record is required for any instrument used for more than one type of measurement.

Most of the entries on the *70* record are self-explanatory. The following data items are explained in greater detail:

NGS Survey Equipment Code: A three-digit numerical identification code is assigned to the different categories 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 for specific codes.

The purpose of the *72* record is to provide descriptive information pertaining to the GNSS antenna which has been identified by a Job-Specific Antenna Number. Submit a *72* record for each antenna used in the project. Individual *72* records should appear in order of increasing Job-Specific Antenna Numbers (JSAN).

Most of the entries on the *72* record are self-explanatory. The following data items are explained in greater detail:

NGS Antenna Code: An alpha-numeric identification code of up to 16 characters is assigned to each different type of GNSS antenna commonly used with GNSS receivers in the United States. See the Antenna Calibration Web Page.

SURVEY POINT DATA RECORDS

80 - Control Point Record
86 - Orthometric Height, Geoid Height, Ellipsoid Height Record

The survey point data records, identified by *80*-series data codes, are listed above; specific formatting is found beginning here.

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 the definition of "control point" and an explanation of the survey point numbering system.

The group of *80*-series records pertaining to a control point will consist of a *80* record followed by a *86* record.

Most of the entries on the *80*-series records are self-explanatory. The following data items are explained in greater detail:

Station Name: In the United States, it has traditionally been the preferred practice at the National Geodetic Survey (NGS) and its predecessors 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 horizontal control point, which is a desirable property. For data processing purposes, however, the use of station names as primary identifiers does pose some difficulties. Their length must be limited to a specific number of characters, and consistency of use is required--**exactly the** same abbreviation and/or spelling of the respective station name must be used whenever reference is made to a control point in computer-readable media.

The name of a monumented 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., 1995) 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 control point, i.e., with every survey point which is positioned. 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 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 control point are often identical.

For data processing purposes in the GNSS B-file, the length of a station name (including all imbedded blanks) is limited to 30 characters. Accordingly, the name of every control point to be entered on the *80* 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 as stated in Volume II, Chapter 6, pages 6-17 and 6-35, Designation and *30* record).

For some of the lengthier names given to horizontal control points 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 50 characters are allowed for the name of a horizontal control point in the DESC data set (see ANNEX P, Description Header Record, Field Format of Designation). This 50-character station name will be used in the publication of geodetic data sheets, station descriptions, and associated indexes. Two versions of a station name which exceeds 30 characters in length can thus exist - a 30-character version shortened for data processing purposes, and a 50-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 entered on the *80* record should be taken as it appears under "Station Name" in the heading of the respective station description and subsequent recovery notes. For monumented 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" normally appears as a part of the station name in the *80* record. 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 desirable to render the station name unique within the job (see below).

In the same manner as the SSN of a horizontal control point is unique within a job, it is highly desirable to have a station name that is unique within a job. If two or more control points in a job are found to have identical names, 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, or CD as appropriate -
   Examples: 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.

The year the mark was set is considered extraneous to the designation and is not to be carried as a part of a control point name. For marks whose names were not altered when they were reset, the word RESET must be appended to the original designations. This also holds true for control points which have been reset more than once. In such cases the year given in the "year monumented" field of the description / recovery note will be used to distinguish the marks. See ANNEX D for additional information and examples.

Whenever the name of a horizontal control point is modified in this manner in the GNSS B-file 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 DESC data set (see ANNEX P).

When the 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: First, a version up to 50 characters long of the station name is required in the DESC data set submitted concurrently with the GNSS B-file. This full or less drastically contracted version of the station name will be used for publication purposes. Second, the name may need to be shortened for the GNSS B-file.

Name or Designation of Bench Mark: A bench mark (BM) is a monumented (or otherwise permanently marked) vertical control point whose height above mean sea level (MSL) has been 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, or (2) a spur level line connection exists between a horizontal control point and a nearby BM. All bench marks in a project should be positioned, if possible.

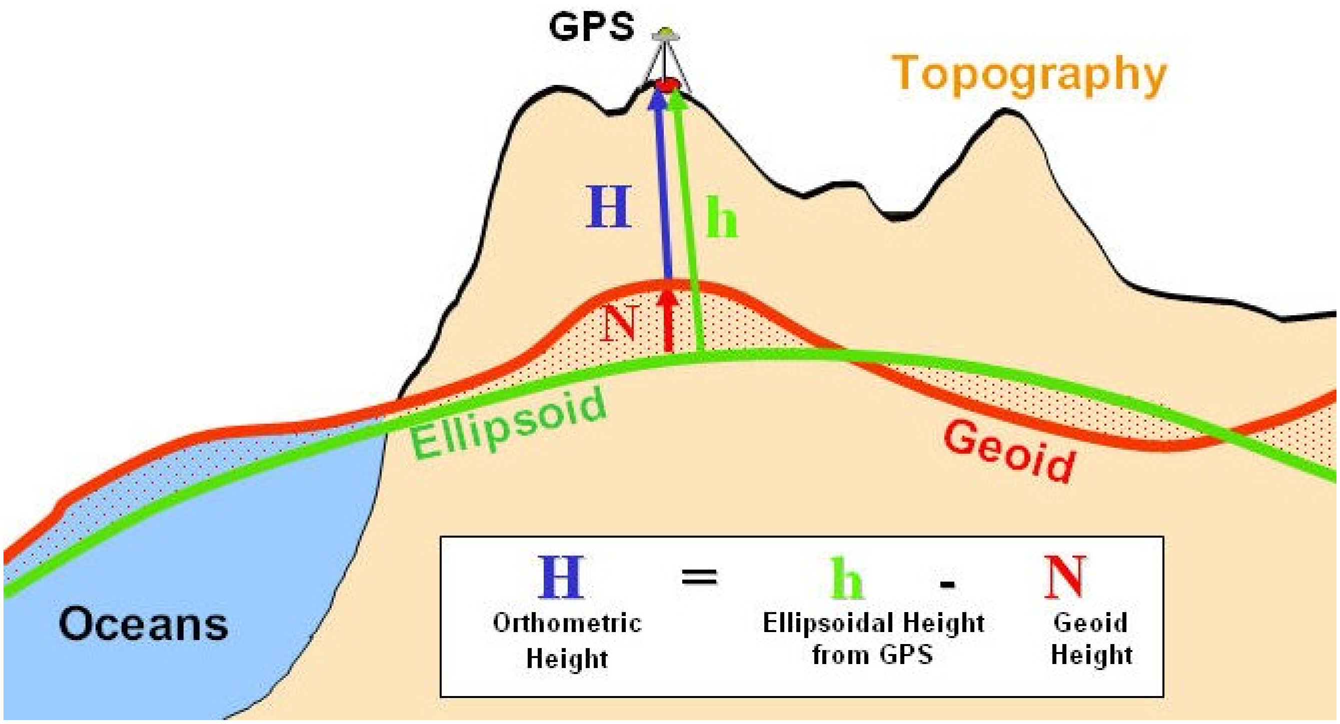
The name or designation of a bench mark entered on the *80* record must not exceed 30 characters in length. It should be taken as it appears in the heading of the bench mark description, which normally is identical to or closely resembles the name or designation stamped on the disk. If the name or designation of a bench mark must be contracted in order to conform to the 30-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* 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 is expressed in terms of geographic coordinates (latitude and longitude) on the *80* record.

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 numeric value (in sexagesimal degrees, minutes, seconds, and decimals of a second), the Direction of Latitude must be specified as "N" or "S", and the Direction of Longitude must be specified as "E" or "W", by a one-letter code adjacent to the latitude and longitude fields.

Station Order and Type: A two-character field is reserved on the *80* and *86* record for the order-and-type and order-class codes respectively. Because local and network accuracies are computed and stored in the IDB, these fields need no longer be populated by the user. Rather, the fields will be automatically populated by the ADJUST program software.

Elevation and Elevation Code: There are three heights defined in the *86* record (1) orthometric height, (2) geoid height, and (3) ellipsoid height. For every *80* record in a GNSS project a corresponding *86* must be provided.



The orthometric height of a survey point is determined most accurately by differential leveling. Another method of determining this height is from GNSS observations. As a last resort, and usually only applicable in very remote regions such as Alaska, an orthometric height can be computed by subtracting the geoid height from the ellipsoidal height.

RECORD FORMATS

For each record which may appear in a GNSS B-file, a field-by-field list follows which specifies and comments on the respective formats. Each record is 80 characters in length and has a fixed format.

The Key to the Field Format are as follows:

A = Alpha character in Caps unless otherwise noted. The number of columns allowed is listed i.e. A(5) would indicate 5 letters, A..Z, are allowed.

9 = Numeric value. All decimals are implied; i.e. 9(2.3) would indicate 99.999.

N = Alphnumeric value A..Z and 0..9.

X = ASCII value. When special characters are allowed but limited, they are listed in the “field range.”

Required Data - In general, only those records which represent actual field observations collected during the survey project should be included in a GNSS B-file. Data items within submitted records are required unless otherwise noted. Records or fields within records which are optional or which may be omitted under certain circumstances are so designated on the instruction sheet for each record type.

Alpha Field - 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 Annex D for guidance on the use of special characters.

Blank Field - to be blank-filled; no data items allowed in these fields.

Constant (Numeric) Field - 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 a 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.

Floating Point Field (ff...fd..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 a negative number is entered, code the minus sign immediately preceding the leading digit. 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. The coded decimal point overrides the implied decimal point position in every case.

Accordingly, a string of numeric characters representing m integer digits followed by n decimal fraction digits with an implied decimal point must be positioned in the floating-point field so that its integer part falls into the m rightmost “f” columns and its decimal fraction part into the n leftmost “d” columns, any unused columns of the data field being blank-filled.

Integer Field - 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.

Specific Character Field - intended to contain a specific alphabetic or numeric special character or a specific group of characters.

Field Format Symbol	Definition
A	Capitalized Alphabetic characters only [A..Z].
9	Numeric, digits, sign and decimal point only [0..9, +, -, .] according to field format picture.
N	Capitalized Alphabetic characters and numeric characters only [A..Z, 0..9].
X	Capitalized Alphabetic characters, numeric characters [A..Z, 0..9], and special characters as specified in the field range.
.	Decimal Point or period.
Ø	Blank

DATA SET IDENTIFICATION RECORD (*aa*)

The first record in a GNSS Data set is the Data Set Identification Record which identifies the data class and type (HTZL OBS), the name of the submitting organization, and date the data set was created. The job code is a two-character alphanumeric code assigned to each horizontal control job submitted by an organization. An asterisk (*) immediately precedes and follows the code and the first character of the code must be a letter. Assign the code A1 to the first job and continue in sequence to the last. (A1, A2..., A9, B1, B2,...etc.) The job code used in this record must be identical to the job code in the Data Set Termination Record which is the last record in the GNSS B-file, and identical to the job code used in both the Data Set Identification Record and the Geodetic Control Point Descriptive (DESC) Data Set. This record is required.

aa FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*aa*	*A(1)N(1)*	A 2-digit code assigned by the submitting organization. First character must be alpha. Second character can be either alpha or numeric.
11-18	Classification and Data Type	A(8) Left Justified	HZTLOBS	Must be “HZTLOBS” (without the quotes), left justified.
19-24	NGS Abbreviation for Submitting Organization	X(6)	A..Z, 0..9, +, - See Annex C, Contributors of Geodetic Control Data	The NGS-defined symbol for the agency or organization whose name is on the marker.
26-66	Submitting Organization’s Full Name	A(41)	A..Z, 0..9, +, - See Annex C, Contributors of Geodetic Control Data	Or if preferred, the organization who performed the observations. Left justified.
67-72	Blank	Ø	{ }	Spacer
73-80	Data Set Creation Date	9(8) where YYYY = year, MM = month, DD = day	YYYYMMDD	The date the data set was created.

PROJECT TITLE RECORD (*10*)

This record identifies the project by name. 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. This record is required.

10 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*10*	N/A	Record Identifier.
11-80	Project Title	X(70)	A..Z 0..9 * , ' =) (- . + \ / space	Title of the project. See Project DATA RECORD section for more information.

PROJECT TITLE CONTINUATION RECORD (*11*)

This record is required only if the project title in the *10* record exceeds the 70-character field allowed. Do not divide words between *10* and *11* records. This record is optional.

11 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*11*	N/A	Record Identifier.
11-80	Project Title (con.t)	X(70)	A..Z 0..9 * , ' =) (- . + \ / space	Title of the project continuation record.

PROJECT INFORMATION RECORD (*12*)

This record identifies the person responsible for the survey (chief of party) by name, provides a record of the dates on which survey operations commenced and terminated, indicates type of survey, and order and class of survey. This record is required.

For a more detailed explanation of the contents of this record see PROJECT DATA RECORDS and DATE AND TIME.

12 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*12*	N/A	Record Identifier.
11-16	Date Field Operations Began	9(6) where YYYY=year MM=month	YYYYMM	Use 4-digit year and two digit month to indicate when field operations began.
17-22	Date Field Operations Ended	9(6) where YYYY=year MM=month	YYYYMM	Use 4-digit year and two digit month to indicate when field operations ended.
23-25	The Initials of the Chief of Party	X(3)	A..Z, space	The initials of the person in charge in the field.
26-43	Name of Chief of Party	X(18)	[A..Z, 0..9, *, ,, ', =, (, -, ., +,), /, space, \n].	The full name of the person in charge in the field.
44-46	The Initials of the second Chief of Party (if applicable)	X(3)	A..Z, space	The initials of the second person in charge in the field (if applicable).
47-64	Name of Second Chief of Party (if applicable)	X(18)	[A..Z, 0..9, *, ,, ', =, (, -, ., +,), /, space, \n].	The full name of the second person in charge in the field (if applicable).
65-75	Blank	Ø	{ }	Spacer
76	Survey Method	9(1)	4	Currently, GPS=4
77-78	Primary State or Country Code	A(2)	See Annex A, NGS Country, State, and County Codes	Use 2-digit state code in which the project mostly resides. If the project is outside the US use the appropriate country code.
79-80	Blank	Ø	{ }	Spacer

GNSS OCCUPATION HEADER RECORD (*25*)

This record is used to define session information and the raw data file name at a station. There must be an occupation header record for each receiver in each session. Use the Comment Record (*26*) immediately following the *25* record for any comments.

It is necessary to identify the instrument employed on each particular observation record in a concise manner. A unique three-digit JSIN (Job-Specific Instrument Number) and JSAN (Job-Specific Antenna Number) in the range 001 to 999 must be assigned to each item of survey equipment used in the job. Each unique number will cross reference a NGS survey equipment code in the *70* and *72* record2. See Job-Specific Instrument Number and Survey Equipment Data Records. This record is required.

25 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*25*	N/A	Record identifier.
11-14	SSN (Station Serial Number) of Control Point	9(4)	0001..9999	A number which uniquely identifies a station within a project.
15-24	Data Media Identifier Code	X(10)	ADDDYSNNNN where **A**=receiver manufacturer **DDD**=DOY (UTC) **Y**=Last digit of year for first epoch **S**=Alpha numeric session observed **NNNN**=4 char abbreviation of station name	See Data Media Identifier in Annex N.
25-27	Observers Initials	A(3)	A..Z, space	The initials of the person performing the observation.
28-30	Job-Specific Instrument Number (JSIN)	9(3)	001..999	A unique 3-digit number assigned to the instrument. See the *70* record.
31-32	Blank	Ø	{ }	Spacer
33-35	Job-Specific Antenna Number (JSAN)	9(3)	001..999	A unique 3-digit number assigned to the antenna. See the *72* record.
36-80	Blank	Ø	{ }	Spacer

GNSS OCCUPATION COMMENT RECORD (*26*)

Use this record for comments pertinent to the GNSS occupation session. This record is optional.

26 FORMAT

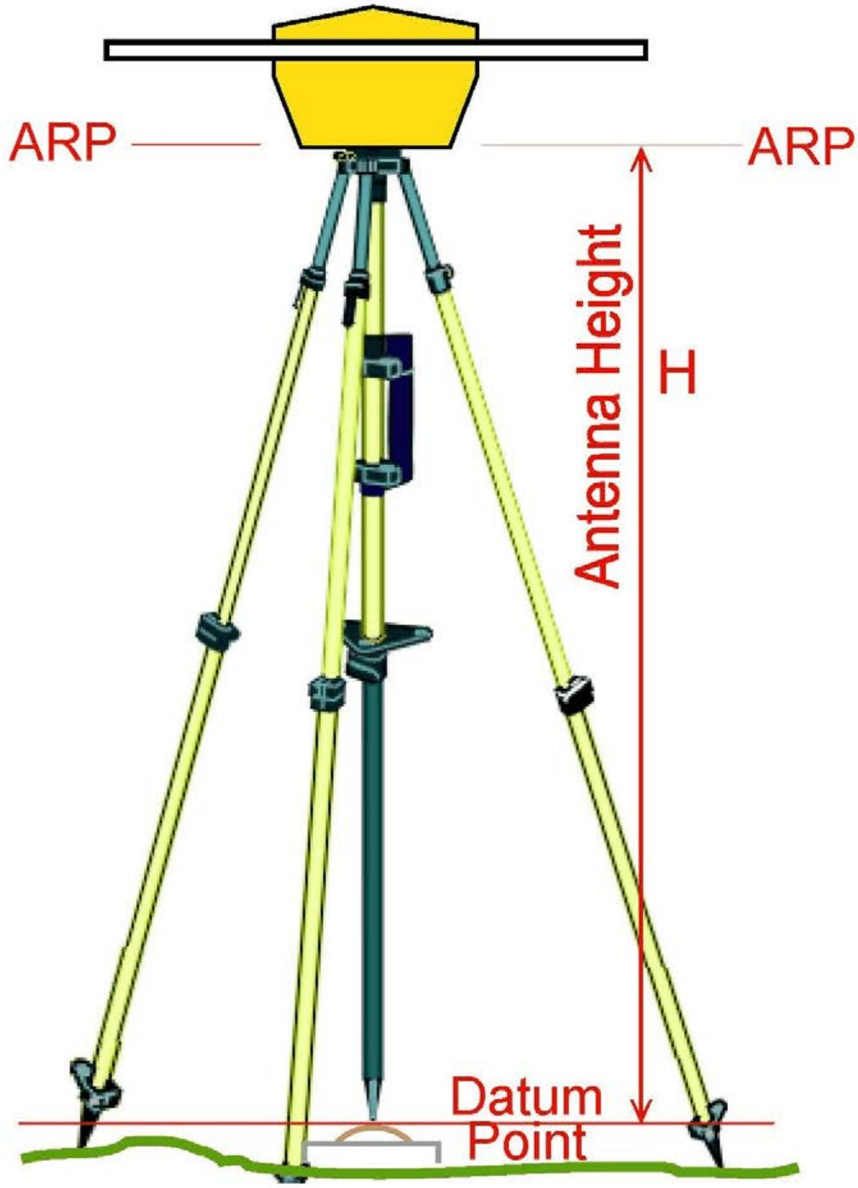
Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*26*	N/A	Record identifier.
11-80	Comment	X(70)	ASCII	For any additional information deemed relevant.

GNSS OCCUPATION MEASUREMENT RECORD (*27*)

To identify the station occupied on each particular observation record in a concise manner, assign a unique four-digit number (Station Serial Number, SSN) in the range 0001 to 9999 to each station occupied in the job. Each SSN will cross-reference a survey station in an *80* record. See Assignment of Station Serial Numbers. At least two *27* Records must be completed for each station in each session, i.e. one begin-session and one end-session record. A record for mid-session may be used. The antenna height is measured from monument Antenna Reference Point (ARP) recorded in cc 56-60. The ARP height will typically be 0.000 for CORS, as few CORS have a monument. These records are required.

27 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*27*	N/A	Record identifier.
11-14	SSN (Station Serial Number) of Control Point	9(4)	0001..9999	A number which uniquely identifies a station within a project.
15-20	Date of Observation	9(6) where YY=year, MM=month, and DD=day	YYMMDD	A date which represents when the first and last observations were taken. See Date and Time Section.
21-24	Time of Observation	9(4) (UTC) where HH=hour and MM=minutes	HHMM	A time which represents when the first and last observations were taken. See Date and Time Section.
25-55	Blank	Ø	{ }	Spacer
56-60	Height of (ARP) Antenna Reference Point	9(1.3)	-.999…9.999	Height is above or below the monument. In Meters. See Diagram below.
61-80	Blank	Ø	{ }	Spacer


ARP
ARP
Antenna Height
H
Datum
Point

INSTRUMENT RECORD (*70*)

Use this record to provide descriptive information for each item of survey equipment used in the job. This information will be used as an accuracy indicator for each observation in the survey. Assign a unique three-digit Job-Specific Instrument Number (JSIN) to each piece of equipment used in the project.

70 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*70*	N/A	Record identifier.
11-13	JSIN (Job Specific Instrument Number)	9(3)	001..999	A number which uniquely identifies an instrument used within a project.
14-16	NGS Equipment Code	A(3)	0001…999	A number which uniquely identifies a receiver. Must agree with the number in the *25* record. See Annex F.
17-22	Blank	Ø	{ }	Spacer
23-40	Manufacturer of Instrument	X(13)	ASCII	Name of manufacturer.
41-62	Blank	Ø	{ }	Spacer
63-70	Model of Instrument	X(8)	**ASCII**	See the GNSS Receiver Web page for specific receivers.
71-80	Serial Number	X(10)	A-Z,a-z, 0-9	Manufacturer assigned serial number. Leave blank if unknown.

GNSS ANTENNA RECORD (*72*)

Use this record to provide descriptive information for each GNSS antenna used in the job. Assign a unique three-digit Job-Specific Antenna Number (JSAN) to each GNSS antenna used in the project. This record will cross-reference the assigned JSAN to the NGS GNSS Antenna Codes found in Antenna Calibration Web page. See Survey Equipment Data Records.

72 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*72*	N/A	Record identifier.
11-13	JSAN (Job Specific Antenna Number)	9(3)	001..999	A number which uniquely identifies an antenna within a project.
14-16	Blank	Ø	{ }	Spacer
17-32	NGS Antenna Code	X(16)	A..Z, 0..9, -, _, /, ., +, space.	See Antenna Calibration. Left justified.
33-36	NGS Antenna Radome Code	A(4)	A..Z	See Antenna Calibration. NOTE: if no radome is used use “NONE” without quotes.
37-44	Blank	Ø	{ }	Spacer
45-64	Serial Number	X(20)	A-Z, 0-9	Manufacturer assigned serial number. If unknown use “UNK” without quotes.
65-80	Blank	Ø	{ }	Spacer

CONTROL POINT RECORD (*80*)

Use this record for the designation (name) and geographic position in geodetic coordinates (latitude and longitude) of each control point in the project. The geodetic position of every horizontal control point for which a *80* record is submitted must be provided in order to serve as either a fixed (constrained) position or as a preliminary position in the adjustment of the horizontal control survey project. Columns 5 and 6 may be used to denote no-check orthometric heights and horizontal positions, respectively. See Constrained Adjustment Guidelines.

80 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*80*	N/A	Record identifier.
11-14	SSN (Station Serial Number) of Control Point	9(4)	0001..9999	A number which uniquely identifies a station within a project.
15-44	Station Name	X(30)	ASCII	See Station Name.
45-55	Latitude	9(2) 9(2) 9(2.5) where DD=degrees MM=minutes SS.SSSSS= seconds	DDMMSSsssss Degrees, Minutes, Seconds, Decimal Seconds	Latitude in Degrees, Minutes, and Seconds
56	Latitude Direction	A(1)	N or S	Northern or Southern Hemisphere
57-68	Longitude	9(3) 9(2) 9(2.5) where DD=degrees MM=minutes SS.SSSSS= seconds	DDDMMSSsssss Degrees, Minutes, Seconds, Decimal Seconds	Longitude in Degrees, Minutes, and Seconds
69	Longitude Direction	A(1)	W or E	West or East Hemisphere
70-76	Blank	Ø	{ }	Spacer
77-78	State or Country Code	A(2)	A-Z	State or country code. See Annex A
79-80	Blank	Ø	{ }	Spacer

ORTHOMETRIC HEIGHT, GEOID HEIGHT, ELLIPSOID HEIGHT RECORD (*86*)

This record gives the values of orthometric height, geoid height, and ellipsoid height of control points in this project.

The Orthometric Height (OHT) NGSIDB Indicator field must be used to say whether the orthometric height came from the NGSIDB or not.

86 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*86*	N/A	Record identifier.
11-14	SSN (Station Serial Number) of Control Point	9999	0001..9999	A number which uniquely identifies a station within a project.
15-16	Blank	Ø	{ }	Spacer
17-23	Orthometric Height (OH)	9(4.3)	-999.999..9999.999 ff...fd..d	Height in Meters
24	OH Code	A	A-Z	See Table
25-26	OH Order and Class	9(2)	0..9	Published Order and Class; otherwise BLANK
27	OH NGSIDB Indicator	A	Y or N	Y – Height obtained from NGSIDB. N – Height is not in the NGSIDB.
28-29	OH Datum	9(2)	A-Z, 0-9	Currently Published Datum. See Table & Policies
30-35	Organization Code	X(6)	ASCII	Abbreviation as Specified in Annex C
36-42	Geoid Height (GH)	99.999	-99.9999…999.999	Height in Meters
43	Geoid Height Code	A	A-Z, 0-9	See Table
44-45	Blank	Ø	{ }	Spacer
46-52	Ellipsoid Height	9999.999	0.000..9999.999	Height in Meters
53	Ellipsoid Height Code	A	A-Z	See Table
54-55	Blank	Ø	{ }	Spacer
56	Ellipsoid Height Datum	A	A-Z	See Table
57-80	Comment	X(24)	ASCII	Spacer or other use

TABLE OF ORTHOMETRIC HEIGHT (OHT) CODES

CODE	EXPLANATION
A	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT DETERMINED USING NGS VERTICAL NETWORK BRANCH PROCEDURES, LEVELING DATA ARE IN THE NGSIDB.
B	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT DETERMINED USING NGS VERTICAL NETWORK BRANCH PROCEDURES, LEVELING DATA ARE NOT IN THE NGSIDB. (USGS, COE, SOME STATE DOT DATA.)
C	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES, ADJUSTED HEIGHT IS 'POSTED'. SEE EXPLANATION IN THE FOOTNOTE (*) BELOW.
D	OHT ESTABLISHED BY DATUM TRANSFORMATIONS.
F	OHT ESTABLISHED BY FLY-LEVELING.
G	OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS WITH DECIMETER ACCURACY.
H	OHT ESTABLISHED USING FGCS LEVELING SPECIFICATIONS AND PROCEDURES EXCEPT FOR THE TWO-MARK LEVELING TIE REQUIREMENT. (HORIZONTAL FIELD PARTY LEVEL TIES, SOME STATE DOTS, SOME GNSS LEVEL TIES.)
J	OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS TIED TO METER ACCURACY CONTROL.
K	OHT ESTABLISHED FROM GPS-OBSERVED HEIGHTS, ACCORDING TO THE 2CM/5CM ELLIPSOID HEIGHT STANDARDS AND A HIGH RESOLUTION NATIONAL GEOID MODEL.
L	OHT ESTABLISHED USING LEVELING RESET SPECIFICATIONS AND PROCEDURES.
M	OHT ESTABLISHED BY SCALING FROM A CONTOURED MAP.
P	OHT ESTABLISHED BY PHOTOGRAMMETRY.
R	OHT ESTABLISHED BY RECIPROCAL VERTICAL ANGLES.
T	OHT ESTABLISHED BY LEVELING BETWEEN CONTROL POINTS WHICH ARE NOT BENCH MARKS.
V	OHT ESTABLISHED BY NON-RECIPROCAL VERTICAL ANGLES.

* DATA FOR LEVEL LINES CONTAINING 'POSTED' BENCH MARKS WERE PURPOSELY NOT INCLUDED IN THE NAVD88 GENERAL ADJUSTMENT. SUBSEQUENTLY, THESE DATA WERE ADJUSTED TO NAVD88 BY FORCING THEM TO FIT THE EXISTING NAVD88 GENERAL ADJUSTMENT HEIGHTS.

TABLE OF ORTHOMETRIC HEIGHT (OHT) DATUMS

CODE	EXPLANATION
88	NORTH AMERICAN VERTICAL DATUM OF 1988
85	INTERNATIONAL GREAT LAKES DATUM OF 1985
AS	AMERICAN SAMOA DATUM OF 2002
LT	LOCAL TIDAL DATUM
NM	NORTHERN MARIANAS VERTICAL DATUM OF 2003
PR	PUERTO RICO VERTICAL DATUM OF 2002
VI	VIRGIN ISLANDS VERTICAL DATUM OF 2009
00	(zero zero) ANY OTHER DATUM. SPECIFY IN COMMENTS.

Table of Geoid Heights and Codes

	Hybrid Geoid Models w/ Bluebook Code	Gravimetric Geoid Models w/ Bluebook Code
CONUS	**6 – GEOID12B** 5 - GEOID12A 2 - GEOID09 W - GEOID03 T - GEOID99 E - GEOID96 See superseded Chapter 2 for earlier models	**4 - USGG2012** 1 - USGG2009 X - USGG2003 U - G99SSS F - G96SSS D - GEOID93 C - GEOID90
Alaska	**6 – GEOID12B** 5 - GEOID12A 2 - GEOID09 Y - GEOID06	**4 - USGG2012** 1 - USGG2009 W - GEOID03 X - USGG2003 T - GEOID99 E - GEOID96
Hawaii	**N/A**	**6 – GEOID12B** **5 - GEOID12A** 4 - USGG2012 2 - GEOID09 1 - USGG2009 W - GEOID03 T - GEOID99 E - GEOID96 D - GEOID93
PR/VI	**6 – GEOID12B** 5 - GEOID12A 2 - GEOID09	**4 - USGG2012** 1 - USGG2009 W - GEOID03 T - GEOID99 E - GEOID96 D - GEOID93
Mexico	**N/A**	**J - MEXICO97**
Caribbean	**N/A**	**H - CARIB97**
Guam/NMI	**6 – GEOID12B** 5 - GEOID12A 2 - GEOID09	**4 - USGG2012** 1 - USGG2009
American Samoa	**6 – GEOID12B** 5 - GEOID12A 2 - GEOID09	**4 - USGG2012** 1 - USGG2009

TABLE OF ELLIPSOID HEIGHT (EHT) CODES

CODE	EXPLANATION
A	EHT determined by GNSS in or tied to a high precision geodetic network.
B	EHT determined by GNSS not tied to a high precision geodetic network.
C	EHT Determined by adding a geoid height to an orthometric height with an OHT code of a, B, C, F, H, OR L.
D	EHT determined by adding a geoid height to an orthometric height with an OHT code of G, R, OR T.
E	EHT determined by adding a geoid height to an orthometric height with an OHT code of V, M, P, OR D.

TABLE OF ELLIPSOID HEIGHT (EHT) DATUMS
(All are referenced to grs80 ellipsoid except possibly z)

CODE	EXPLANATION
A	North American Datum of 1983
B	International Terrestrial Reference Frame of 1989
C	National Earth Orientation Service (NEOS annual report for 1990)
D	International Terrestrial Reference Frame of 1994 (ITRF 94)
E	International Terrestrial Reference Frame of 1996 (ITRF 96)
F	International Terrestrial Reference Frame of 1997 (ITRF 97)
G	International Terrestrial Reference Frame of 2000 (ITRF 00)
Z	Any other datum. Specify in comments.

Network Accuracy Record (*91*)

The network accuracy record is computed by the adjustment software and inserted into the bluebook output file. The network accuracy of a control point is a value that represents the uncertainty of its coordinates with respect to the geodetic datum. The north, east, and ellipsoid height standard deviations (SD) for this record are stored in cm at approximately 68.3% confidence (“one sigma”).

91 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*91*	N/A	Record identifier.
11-14	SSN (Station Serial Number) of Control Point	9(4)	0001..9999	A number which uniquely identifies a station within a project.
15-20	Blank	Ø	{ }	Spacer
21-30	North Horizontal Standard Deviation	9(7.2)	0000000.00.. 9999999.99	Horizontal accuracy/SD in the north component in the position. In cm.
31-40	East Horizontal Standard Deviation	9(7.2)	0000000.00.. 9999999.99	Horizontal accuracy/SD in the east component. In cm.
41-50	Horizontal Correlation Coefficient	9(0.8)	-.9999999.. .99999999	The correlation coefficient between the horizontal accuracy/SD in north and the horizontal accuracy/SD in east. Unitless
51-60	Ellipsoid Height Standard Deviation	9(7.2)	0000000.00.. 9999999.99	In cm.
61-64	Blank	Ø	{ }	Spacer
65	Accuracy Scaled Code	A(1)	Y or N	Y – SD scaled by multiplying them by the *a posteriori* SD of unit weight N – SD not scaled
66-80	Comment	X(15)	ASCII	Spacer or other use

Local Accuracy Record (*92*)

The local accuracy record is computed by the adjustment software and is inserted into the bluebook output file. The local accuracy represents the relative positional uncertainty between a pair of control points connected by observations. The north, east, and ellipsoid height standard deviations (SD) are at approximately 68.3% confidence (“one sigma”).

92 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*92*	N/A	Record identifier.
11-14	Stand Point SSN (Station Serial Number)	9(4)	0001..9999	A number which identifies the station from which observations were made. Unique within the project.
15-16	Blank	Ø	{ }	Spacer
17-20	Fore Point SSN (Station Serial Number)	9(4)	0001..9999	A number which identifies the station being observed. Unique within the project.
21-22	Blank	Ø	{ }	Spacer
23-32	North Horizontal Standard Deviation	9(7.2)	0000000.00.. 9999999.99	Horizontal accuracy/SD in the north component in the position. In cm.
33-42	East Horizontal Standard Deviation	9(7.2)	0000000.00.. 9999999.99	Horizontal accuracy/SD in the east component. In cm.
43-52	Horizontal Correlation Coefficient	9(0.8)	The numeric value ranges from -.9999999 .. .99999999	The correlation coefficient between the horizontal accuracy/SD in north and the horizontal accuracy/SD in east. Unitless
53-62	Ellipsoid Height Standard Deviation	9(7.2)	0000000.00.. 9999999.99	In cm.
63-66	Blank	Ø	{ }	Spacer
67	Accuracy Scaled Code	A(1)	Y = scaled N = not scaled	Y – SD scaled by multiplying them by the *a posteriori* SD of unit weight. N – SD not scaled.
68-80	Comment	X(13)	ASCII	Spacer or other use.

Variance Factor Record (*93*)

For GPS observations (vectors), it is well known that the horizontal component is approximately two to three times more accurate than the vertical (ellipsoid height) component. In order to properly weight the observations, the NGS software "ADJUST" allows re-scaling of weights by separate horizontal and vertical components. The resulting horizontal and vertical variance factors are computed in the free adjustment and stored in the NGSIDB for each project. In addition to correctly scaling the horizontal and vertical errors with respect to one another within a GPS project, these variance factors also ensure a uniform set of weights between projects. This reflects the relative accuracies of the disparate sources of survey data when multiple GPS projects are combined into a single adjustment (such as regional or national readjustments).

93 FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001..999999	Optional.
07-10	Data Code	*93*	N/A	Record identifier.
11-18	Factor by which to multiply horizontal components Units of 0.000	9(4.3)	0001..9999	A number which uniquely identifies a horizontal component factor.
19-26	Factor by which to multiply vertical components Units of 0.000	9(4.3)	0001..9999	A number which uniquely identifies vertical component factor.
27-80	Comment	X(54)	ASCII	Spacer or other use.

DATA SET TERMINATION RECORD (*aa*)

This must be the last record of every data set submitted.

The job code used in this record must be identical to the job code in both the *aa* Data Set Identification Record, the first record in the HZTL OBS data set; and the companion description data set. More detailed explanation of the contents of the record is available here.

aa FORMAT

Columns	*Field Name*	*Field Format*	*Field Range*	*Field Description/Comments*
01-06	Sequence Number	9(6)	000001-999999	Optional.
07-10	Data Code	*aa*	*A(1)X(1)*	Two character Job Code assigned by the submitting organization. First character must be alpha. Second character can be either alpha or numeric. This record must agree with the first record and that assigned in the description file.
11-80	Blank	Ø	{ }	Spacer