A U.S. GEOLOGICAL SURVEY DATA STANDARD

Specifications for Representation of Geographic Point Locations for Information Interchange

GEOLOGICAL SURVEY CIRCULAR 878–B

This report describes one of a series of data standards adopted and implemented by the U.S. Geological Survey for the standardization of data elements and representations used in automated Earth-science systems. Earth sciences are those scientific disciplines especially required to carry out the mission of the Geological Survey and are concerned with the material and morphology of the Earth and the physical forces relating to the Earth. These disciplines include geology, topography, geography, and hydrology.

The Geological Survey has assumed the leadership in developing and maintaining Earth-science data element and representation standards for use in the Federal establishment under the terms of a Memorandum of Understanding signed in February 1980 by the National Bureau of Standards, Department of Commerce, and the Geological Survey, Department of Interior. As such, in addition to developing and maintaining standards, the Geological Survey reviews and processes all requests referred by the National Bureau of Standards for exceptions, deferments, and revision of standards applicable to Federal Earth-science information systems; assists the National Bureau of Standards in assessing the need, impact, benefits, and problems related to the implementation of standards being considered for development, or developed, for use in the Earth sciences; and works with other agencies in developing new data standards in the Earth sciences.

The standard described in this report has been specifically approved for use within the U.S. Geological Survey. If the standard has been approved for use throughout the Federal establishment, it is also published by the National Bureau of Standards as a Federal Information Processing Standard.

Name of Standard: Specifications for Representation of Geographic Point Locations for Information Interchange.

Date of Approval: April 1983

Maintenance Organization: U.S. Geological Survey
National Mapping Division
Office of Systems and Techniques Development
525 National Center
Reston, VA 22092

Questions concerning the specifications should be addressed to the Office of Systems and Techniques Development which will make all necessary amendments to the standard.

Implementation: All Geological Survey data standards are effective immediately upon the date of approval. Their use is mandatory for all new and developing systems within the Geological Survey that utilize data elements and representations described by the standards. All existing data systems will be modified in accordance with the standards at such time that future redesign and modifications to the systems take place.

Additional information about Geological Survey data standards and copies of published standards may be obtained from:

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1983

United States Department of the Interior
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Representation of Geographic Point Locations

for Information Interchange

Abstract

This standard establishes uniform formats for geographic point location data. Geographic point location refers to the use of a coordinate system to define the position of a point that may be on, above, or below the Earth's surface. It provides a means for representing these data in digital form for the purpose of interchanging information among data systems and improving clarity and accuracy of interpersonal communications.

This document is an expansion and clarification of National Bureau of Standards FIPS PUB 70, issued October 24, 1980. There are minor editorial changes, plus the following additions and modifications:

(1) The representation of latitude and longitude using radian measure was added.

(2) Alternate 2 for Representation of Hemispheric Information was deleted.

(3) Use of the maximum precision for all numerical values was emphasized. The Alternate Representation of Precision was deleted.

(4) The length of the zone representation for the State Plane Coordinate System was standardized.

(5) The term altitude was substituted for elevation throughout to conform with international usage.

(6) Section 3, Specifications for Altitude Data, was expanded and upgraded significantly to the same level of detail as for the horizontal values.

(7) A table delineating the coverage of Universal Transverse Mercator zones and the longitudes of the Central Meridians was added and the other tables renumbered.

(8) The total length of the representation of point location data at maximum precision was standardized.

1. Purpose and Scope

Geographic point location refers to the use of a coordinate system to define the position of a point that may be on, above, or below the Earth's surface.

This standard is designed to establish uniform formats for geographic point location data. It provides a means for representing these data in digital form for the purpose of interchanging information among data systems and for improving clarity and accuracy in interpersonal communications.

Specifically, this standard is intended to:

(1) Provide for uniform representation of geographic point location data.

(2) Minimize the amount of human intervention required for communicating geographic point location data.

(3) Reduce the time required to format and transmit the elements of geographic point location data.

There are many systems available for indicating point locations. This standard is applicable only to the three most widely used in the United States: Latitude and Longitude, Universal Transverse Mercator (UTM) System, and State Plane Coordinate Systems (SPCS). These systems are mathematically interconvertible and are also officially recognized by the many surveying and mapping agencies of Federal and State governments. This standard does not provide a methodology for use of the three systems covered, nor does it recommend any particular system.

This standard applies to uniquely identified locations and does not necessarily apply to a series of coordinates at small intervals, such as digital cartographic data used to represent linear map features, terrain profiles, or elevation models.

Use of altitude data is not required for defining points on the Earth's surface. However, for defining points either above or below the Earth's surface or for describing the topography, altitude is required. Therefore, specifications for altitude data are provided as an optional feature of this standard. For consistency with international usage, the word altitude is used in preference to elevation.

Determination of specific geographic point location information is the user's responsibility, as is the accuracy and reliability of the information. This standard does not prescribe file sequences, storage media, programming languages, or other features of information processing to be used in its implementation.

A list of references is provided in section 4 for detailed information on the methodology, techniques, and applications of the three systems.

2. Specifications for Geographic Point Location Systems

2.1 Representations for Latitude and Longitude. Latitude and longitude are coordinate representations that show locations on the surface of the Earth using the Earth's Equator and the prime meridian (Greenwich, England) as the respective latitudinal and longitudinal origins.

Although there are applications in which only latitude or longitude needs to be recorded, both are usually stated. The sequencing of latitude and longitude then becomes important and is addressed in this standard. Because latitude and longitude are angular quantities, they are expressed in degrees, minutes, and seconds, or, optionally, in radians. The standard provides for the representation of latitude and longitude in decimal fractions of degrees, minutes, seconds, or radians. The designation of the Northern, Southern, Eastern and Western Hemispheres is also treated.

2.1.1 Sequencing of Latitude and Longitude. Latitude shall be given first--to the left when inscribed with longitude on one line, or above when latitude and longitude are given vertically in relationship to each other. Sequencing shall be from high order to low order (left-to-right direction) in expressing degrees, minutes, and seconds in either latitude or longitude. When a decimal fraction of a degree is used, neither minutes nor seconds may be expressed; similarly, when a decimal fraction of a minute is used, no seconds may be expressed.

2.1.2 Use of Separators. Separators are permissible to enhance understanding of the contents of data files. When separators are used, the following guidelines are to be followed.

(1) Separators between latitude and longitude: latitude shall be separated from longitude by either a comma or a blank. No other symbol shall be used as a separator between these items.

(2) Separators between elements within latitude or longitude: no separators shall be used other than the decimal point, as specified in sections 2.1.3, 2.1.4, 2.1.5, and 2.1.6.

It is recognized that degrees, minutes, and seconds are conventionally denoted and separated by using superscripts. For this standard, such designations have not been included as permissible primarily because many data processing machines cannot recognize or reproduce the conventional superscripts.

2.1.3 Representation of Degrees. For both latitude and longitude, when a decimal fraction of a degree is specified, it shall be separated from the whole number of degrees by a decimal point and expressed numerically to the number of places required by the desired precision.

2.1.3.1 Latitude. The degrees of latitude shall be represented by a decimal number ranging from 0 through 90. For all values, leading zeros and (or) blanks shall be given (for example, 001, b15, or bb3, where b represents a blank or space).

2.1.3.2 Longitude. The degrees of longitude shall be represented by a decimal number ranging from 0 through 180. For values less than 100, leading zero(s) and (or) blanks shall be given (for example, 001, 027, b18, or bb3).

2.1.4 Representation of Minutes. For both latitude and longitude, the minutes shall be represented by a two-digit decimal number ranging from 00 through 59. For values less than 10, a leading zero shall be given. When a location is indicated by degrees, minutes, and decimal fractions of a minute, the decimal fraction shall be separated from the whole number of minutes by a decimal point and expressed numerically to the number of places required by the desired precision.

2.1.5 Representation of Seconds. For both latitude and longitude, seconds shall be represented by a two-digit decimal number ranging from 00 through 59. For values less than 10, a leading zero shall be given. When a location is indicated by degrees, minutes, seconds, and decimal fractions of a second, the decimal fraction shall be separated from the whole number of seconds by a decimal point and expressed numerically to the number of places required by the desired precision.

2.1.6 Representation of Radians. Another way of representing latitude and longitude is by converting degrees to radians. One degree is equal to 0.01745 32925 19943 radians.

2.1.6.1 Latitude. Radians of latitude shall be expressed as a one digit number (0 or 1) followed by a decimal fraction. The maximum value of latitude in radians should not exceed one-half PI or 1.57079 63268. See section 2.1.8 for a discussion of the necessary precision.

2.1.6.2 Longitude. Radians of longitude shall be expressed as a one digit number (0, 1, 2, or 3) followed by a decimal fraction. The maximum value of longitude should not exceed PI or 3.14159 26536. See section 2.1.8 for a discussion of the necessary precision.

2.1.7 Representation of Hemispheric Information. Two methods of representing the hemisphere are permitted. If the alternate representation, as described in section 2.1.7.1, is used, that information must be included in the documentation accompanying the interchange.

With the exception of radian values, latitudes north of the Equator may be specified by an uppercase "N" immediately following the last digit for latitude. Latitudes south of the Equator may be designated by an uppercase "S" immediately following the last digit for latitude. A point on the Equator shall be assigned to the Northern Hemisphere.

With the exception of radian values, longitudes east of the prime meridian may be specified by an uppercase "E" immediately following the last digit for longitude. Longitudes west of the prime meridian may be designated by an uppercase "W" immediately following the last digit for longitude. A point on the prime meridian shall be assigned to the Eastern Hemisphere. A point on the 180th meridian shall be assigned to the Western Hemisphere.

All radian values shall use the alternate representation following.

2.1.7.1 Alternate Representation of Hemispheric Information. Latitudes north of the Equator may be specified by a plus sign (+) immediately preceding the digits designating degrees. Latitudes south of the Equator may be designated by a minus sign (-) preceding the digits designating degrees. A point on the Equator shall be assigned to the Northern Hemisphere. Longitudes east of the prime meridian may be specified by a plus sign (+) immediately preceding the digits designating degrees of longitude. Longitudes west of the meridian may be designated by a minus sign (-) preceding the digits designating degrees. A point on the prime meridian shall be assigned to the Eastern Hemisphere. A point on the 180th meridian shall be assigned to the Western Hemisphere.

2.1.8 Precision. A point can be represented at various levels of precision, as illustrated in the numbered examples below. (Separation is shown by using a comma, with the understanding that a space [blank] could have been used instead of a comma.) The number of digits does not necessarily imply precision.

(1) Degrees and decimal fractions of a degree:

040.20364N,075.00420W or +040.20364,-075.00420

(2) Degrees and minutes:

04012N,07500W or +04012,-07500

(3) Degrees, minutes, and decimal fractions of a minute:

04012.22N,07500.25W +b4012.22,-b7500.25

(4) Degrees, minutes, and seconds:

0401213N,0750015W +b401213,-b75015

(5) Degrees, minutes, seconds and decimal fractions of a second:

0401213.1N,0750015.1W +b401213.1,-b750015.1

(6) Radians:

+0.7017,-1.3091

2.1.8.1 **Maximum Precision.** For longitude at the Equator, and for latitude anywhere on the Earth, the location of a point to the level of precision of 0.01 foot (0.003 meter) on the face of the Earth corresponds approximately to angular values (on a great circle) of 0.0000000048 radian, 0.000000028 degree, 0.0000017 minute, or 0.00010 second. This accuracy is the preferred representation and is accomplished by use of the maximum precision in this standard.

Using these values, the preceding examples of latitude and longitude at this level of precision are as follow:

(1) Degrees and decimal fractions of a degree:

040.20364255N,075.00420039W   +b40.20364255,-b75.00420039

(3) Degrees, minutes and decimal fractions of a minute:

04012.218553N,07500.252023W   +b4012.218553,-b7500.252023

(5) Degrees, minutes, seconds, and decimal fractions of a second:

0401213.1132N,0750015.1214W   +b401213.1132,-b750015.1214

(6) Radians:

+0.7016859338,-1.3090702496

The number of decimal places to which any representation of latitude or is carried must, of course, depend on the user's requirements, the accuracy of measuring instruments, and similar factors.

2.2 **Representation for Universal Transverse Mercator System (UTM).** The Universal Transverse Mercator (UTM) System provides rectangular coordinates that may be used to indicate locations of points on the surface of the Earth. The unit of measure is the meter. A point is located by specifying a hemispheric indicator, a zone number, an easting value, and a northing value.

UTM is designed for world use between 80 degrees south latitude and 84 degrees north latitude. The globe is divided into narrow zones, 6 degrees of longitude in width, starting at the 180 degree meridian of longitude and progressing eastward. The zones are numbered 1 through 60. Each zone has, as its east and west limits, a meridian of longitude. Each zone also has a central meridian passing through the center of the zone. Table 1 demonstrates the coverage and central meridian of each zone.

A value of 500,000 meters is assigned to the central meridian of each zone to avoid negative numbers at the west edge of the zone. The values increase toward the east. For north-south values in the Northern Hemisphere, the Equator is assigned 0 meters, and the numbers increase toward the North Pole. In the Southern Hemisphere, the Equator is assigned 10,000,000 meters, and the numbers decrease toward the South Pole.

The location of any point within a zone is given in relation to the central meridian within that zone and the Equator. The zone system yields positive values for the identification of a point on the Earth's surface by first assigning numeric values to the Equator and to the central meridian. Then, a point's north-south location is obtained by either adding or subtracting the point's distance north or south of the Equator. Similarly, a point's east-west location is obtained by either adding or subtracting the point's distance east or west of the central meridian.

A point on the Equator, if not otherwise specified, is assigned a default value of zero for its northing and is treated as if it were in the Northern Hemisphere. The default zone assignment for a point on a boundary meridian is the number for the zone to the east of the point.

Specification of the ellipsoid used for the UTM projection depends on the portion of the Earth's surface being referenced. No provision is made within this standard to define ellipsoid codes or parameters. This information must be communicated within the documentation accompanying the data interchange.

2.2.1 Sequencing of UTM and Hemisphere Codes. The first item of information shall be a code to indicate the hemisphere in which the point is located. A plus sign (+) shall be used to indicate the Northern Hemisphere, and a minus sign (-) to indicate the Southern Hemisphere. The second item of information shall be zone number indicating the six-degree longitudinal band in which the point is located (01, 02,...60). The third item of information shall be the easting in meters. The last item of information shall be the northing in meters.

2.2.2 Precision. In order to provide the precision equivalent to that used with the Latitude and Longitude and State Plane Coordinate Systems, UTM shall be recorded to three decimal places. Leading zeros or blanks shall be used in numbers with fewer digits than the permissible maximum.

2.2.3 Use of Separators. Optional separators are permissible to enhance understanding of the contents of data files. When separators are used, the following guidelines shall be followed:

(1) Separators between hemisphere code and zone number: the hemisphere code shall not be separated from the zone number.

(2) Separators between zone number and easting value: the zone number shall be separated from the easting value by a comma or a blank.

(3) Separators between elements of UTM measurements: the easting value shall be separated from the northing value by a comma or a blank.

(4) Separators for precision: for both easting and northing values, when a decimal fraction of a meter is specified, it shall be separated from the unit value by a decimal point followed by as many as three digits to provide the necessary precision. The following are examples of the use of UTM positional information:

+18,0520381.516,3684572.632   -18, 520381.516,6315427.368

The above examples illustrate two points within the same zone that are equidistant from the Equator--one in the Northern Hemisphere and one in the Southern Hemisphere.

Examples of UTM geographic point location codes. The b represents a blank space.

Alaska:

+05,b426453.473,6596814.917
+05,0426453.473,6596814.917

Point on the Equator in Colombia, South America:

+18,0593681.510,0000000.000

A point one millimeter south of the one designated immediately above:

-18,0593681.510,9999999.999

2.3 Representations for State Plane Coordinate Systems. The State Plane Coordinate Systems (SPCS) are designed to define the locations of points within a geographic grid system. Similar systems were used in the 19th century and the first formal use was in 1932. There are now State Plane Coordinate Systems in use in each of the 50 United States, as well as in the Commonwealth of Puerto Rico, the U.S. Virgin Islands, American Samoa, and Guam. The District of Columbia is included with the State of Maryland. State Plane Coordinate Systems represent separate, distinct systems for the political jurisdictions involved, as opposed to the universally applicable Latitude and Longitude (see section 2.1) and Universal Transverse Mercator (UTM) systems (see section 2.2).

Nine States, Puerto Rico, American Samoa, and Guam are covered individually by one State Plane Coordinate System or projection. The nine states are: Connecticut, Delaware, Maryland, New Hampshire, New Jersey, North Carolina, Rhode Island, Tennessee, and Vermont. The remaining 41 States and the Virgin Islands are covered individually by from two to ten SPCS projection zones. These systems fall into three general categories, based upon the conformal mapping projection methods utilized.

(1) the Lambert Projection;

(2) the Transverse Mercator (TM) Projection (not to be confused with the UTM);

(3) the Oblique Mercator Projection in southeastern Alaska.

A zone may be defined in one of three ways. In each of these three methods, an arbitrary point of origin in latitude and longitude is one element of the definition of the zone. The other element of definition varies with the conformal mapping projection system used in the zone:

(1) Lambert Projection--two standard parallels of latitude bounding the zone;

(2) Transverse Mercator Projection--one central (longitudinal) meridian at a designated longitude;

(3) Alaska Oblique Mercator Projection--as defined in detailed Alaska State Plane Coordinate System specifications. See section 4.

The arbitrary point of origin for each zone is typically located outside the geographic area it covers. This is designed to meet the objective that no coordinate may have a negative value.

2.3.1 Jurisdictional Representation. This representation identifies the 50 States that comprise the United States, as well as the Commonwealth of Puerto Rico, the U.S. Virgin Islands, American Samoa, and Guam. There are two alternative methods for representation of jurisdictions: a two-character abbreviation and a two-digit numeric code. These representations can be found in table 4 and are derived from FIPS PUB 5-1, "States and Outlying Areas of the United States (including the District of Columbia)." This representation is not used when the four character zone representation is used (see 2.3.2.2).

2.3.2 Zone Representation. This representation uniquely identifies each of the zones or State Plane Coordinate Systems found within a jurisdiction as represented in accordance with section 2.3.1. Two methods are provided.

2.3.2.1 One or Two Character Representation. The first method for zone or SPCS representation provides for a left-justified code of one or two characters which may be alphabetic or numeric. This code will accommodate all zones in the jurisdictions using SPCS; it is mnemonic and is based on standard, common nomenclature used in the jurisdictions to indicate specific zones. Table 2 shows this code; a "b" represents a blank (space) in the individual code entry. Table 3 is a summary listing of representations for the State Plane Coordinate Systems and zones within all jurisdictions.

2.3.2.2 Four Character Representation. In this representation, each of the zones or SPCS in each jurisdiction is uniquely identified by a four character numeric code. Table 4 is a summary listing of the alternate representations for State Plane Coordinate Systems and zone codes within all jurisdictions. This representation uniquely identifies the jurisdiction as well as the zone.

2.3.3 Sequencing of X Coordinates and Y Coordinates. The X coordinate, which is the east-west location indicator, shall precede (be to the left of when on one line and be above when shown vertically) the Y coordinate, which is the north-south location indicator.

2.3.4 Use of Separators. Separators are permissible to enhance understanding of the contents of data files. When separators are used, the following guidelines shall be followed.

When a choice is indicated between a pair of separator symbols, one symbol alone shall be chosen, so that the same symbol is used as a separator between every field in a record where a separator is used. This is intended to facilitate data interchange. The items described in sections 2.3.1, 2.3.2, 2.3.5, and 2.3.6 shall be used in left-to-right sequence.

(1) Separator between jurisdictional representation (2.3.1) and the one or two character zone representation (2.3.2): a single comma or blank shall be used. If the four character representation is chosen, it is preceded by a blank.

(2) Separator between zone representation (2.3.2) and X coordinate representation (2.3.5): a single comma or blank shall be used.

(3) Separator between X coordinate representation (2.3.5) and Y coordinate representation (2.3.6): a single comma or blank shall be used.

2.3.5 X Coordinate Representation. Three methods are available for the designation of this east-west location indicator: (1) the Lambert Projection, (2) the Transverse Mercator Projection, and (3) the Oblique Mercator Projection used in Alaska.

For each of these three methods, the precision requirements shall be the same as those for the Latitude and Longitude (section 2.1) and Universal Transverse Mercator (section 2.2) systems. This shall be at the maximum level of precision of 0.01 foot (0.003 meter).

The notation for an X coordinate in an existing SPCS may be expressed by a number of the general magnitude of NNNNNNN.NN. This will suffice for a range of X of not less than 0.01 foot and not more than 9,999,999.99 feet and is considered to be appropriate for this standard.

As many digits as are required may be used for purposes of internal processing and storage of X coordinate data. For interchange purposes, the following conventions shall apply to the X coordinate representation.

(1) Leading zeros or blanks shall be used in numbers with fewer digits than the permissible maximum.

(2) Where a decimal fraction is used, it shall be one or two positions in length, as required (for example, .1, .15).

(3) Where a decimal fraction is not used, the X coordinate shall be not less than 0000001 foot, and not more than 9999999 feet.

Therefore, for interchange purposes, the maximum sized coordinate shall consist of seven high-order decimal digits, that is, NNNNNNN.NN.

2.3.6 Y Coordinate Representation. The requirements for this coordinate shall be the same as those set forth in section 2.3.5 for X coordinate representation.

2.3.7 Examples of SPCS Representation. The b represents a blank space.

A point in the Virginia North zone:

VA,Nb,2178364.86,0408632.16
b4501,2178364.86,0408632.16
51,Nb,2178364.86,0408632.16

A point in the Wyoming West Central zone:

WY,WC,0496132.81,3467187.28
b4901,0496132.81,3467187.28
56,WC,0496132.81,3467187.28

2.3.8 Z Coordinate Representation. The altitude coordinate is utilized in some applications, although it is not part of an official SPCS. See section 3 for formatting of altitude data.

2.3.9 Conversion Computations. Publications containing projection tables for the State Plane Coordinate Systems are available to assist with conversion computations. These are listed in section 4.

3. Specifications for Altitude Data (Optional)

3.1 General. Altitude of a point, as used in this standard, is defined as the vertical distance in meters either above or below a reference surface. In the United States, this reference surface is the National Geodetic Vertical Datum of 1929, which approximates mean sea level.

If altitude data are included in the representation of the point, those data shall follow the geographic data. They shall be separated by a comma or blank, whichever is used for the geographic portion.

3.2 Representation of Altitude.

3.2.1 Precision. Representation of altitude may or may not contain a decimal point. If a representation for an altitude contains a decimal point, the number of places after the decimal point should reflect the inherent precision of the measurement. The number of digits in an integer does not necessarily imply precision.

3.2.2 Altitude Data. All altitude measurements shall include a character specifying sign. All altitude measurements below the reference datum shall be designated by a minus sign (-) preceding the number. Measurements at or above the reference datum may be designated by a blank or a plus sign (+), but usage should be consistent throughout a set of data.

3.2.3 Unit of Measurement. When the point data are given in the State Plane Coordinate System, feet are used as the unit measure. Otherwise, the meter is assumed to be the unit measure and the use of feet is optional. When feet are used optionally, this information will be specified in the documentation associated with the interchange.

3.2.4 Representation of Numbers. The representation for maximum precision in meters will consist of four (optionally five for ocean subsurface data) digits before the decimal point and three digits after the decimal point for a total of nine (optionally ten) characters including the character for the sign. The representation for maximum precision in feet will consist of five digits before the decimal point and two digits after the decimal point for a total of nine characters including the character for the sign. Leading zeros are required for use in numbers that are less than the prescribed maximum number of digits when the maximum precision is specified.

The following are examples of altitude data (b represents a blank space):

Less than maximum precision: +45
-130
b200
b10.5

Maximum precision: +0132.417
-2067.008
b1054.020

3.2.5 Sequencing of Data. When present, the altitude data shall follow and be separated from the geographic coordinate data by either a comma or a blank, whichever is used within the geographic coordinate data or shall be shown below when displayed vertically.

3.2.6 Examples of Altitude Data Using Feet as the Optional Unit of Measure. The b represents a blank space.

Less than maximum precision: +125
-390
31625
31.5

Maximum precision: +13396.22
-16201.02
b13152.07

3.2.7 Examples of Altitude Data with Point Coordinate Data. The b represents a blank space.

0352215.2417N,0800000.1234W,+1000.467
+0352215.2417b-0800000.1234bb1000.467
WY,WC,0496132.81,3467187.28,+06172.53
+05,b426453.473,6596814.917,b1000.467
+b435698.2402,-1031213.5568,+bb45.663

4. Selected References

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U.S. Department of the Army, 1958, Universal Transverse Mercator grid: Technical Report TR 5-241-8.

U.S. Department of Commerce, 1973, Geographic base file system; correction-update-extension: Bureau of the Census Procedural Manual for the review and correction of the addresses range edit (ADDEDIT) Listing (GEO-MT 502).

List of publications necessary for conversion computations on the State Plane Coordinate Systems

Coast and Geodetic Survey Special Publication Number	Publication Title
304	Plane Coordinate Projection Tables — Alabama
65-1	Plane Coordinate Intersection Tables — Alaska
257	Plane Coordinate Projection Tables — Arizona
289	Plane Coordinate Projection Tables — Arkansas
253	Plane Coordinate Projection Tables — California
276	Plane Coordinate Projection Tables — Colorado
266	Plane Coordinate Projection Tables — Connecticut
305	Plane Coordinate Projection Tables — Delaware
255	Plane Coordinate Projection Tables — Florida
322	Plane Coordinate Projection Tables — Georgia
302	Plane Coordinate Projection Tables — Hawaiian Islands
306	Plane Coordinate Projection Tables — Idaho
303	Plane Coordinate Projection Tables — Illinois
259	Plane Coordinate Projection Tables — Indiana
284	Plane Coordinate Projection Tables — Iowa
285	Plane Coordinate Projection Tables — Kansas
290	Plane Coordinate Projection Tables — Kentucky
291	Plane Coordinate Projection Tables — Louisiana (Revised)
256	Plane Coordinate Projection Tables — Maine
292	Plane Coordinate Projection Tables — Maryland (includes D.C.)
274	Plane Coordinate Projection Tables — Massachusetts
65-3	Plane Coordinate Projection Tables — Michigan
264	Plane Coordinate Projection Tables — Minnesota
321	Plane Coordinate Projection Tables — Mississippi
319	Plane Coordinate Projection Tables — Missouri
261	Plane Coordinate Projection Tables — Montana
286	Plane Coordinate Projection Tables — Nebraska
318	Plane Coordinate Projection Tables — Nevada
317	Plane Coordinate Projection Tables — New Hampshire
316	Plane Coordinate Projection Tables — New Jersey
324	Plane Coordinate Projection Tables — New Mexico
323	Plane Coordinate Projection Tables — New York
272	Plane Coordinate Projection Tables — North Carolina
262	Plane Coordinate Projection Tables — North Dakota
269	Plane Coordinate Projection Tables — Ohio
287	Plane Coordinate Projection Tables — Oklahoma
270	Plane Coordinate Projection Tables — Oregon
267	Plane Coordinate Projection Tables — Pennsylvania
G-59	Plane Coordinate Projection Tables — Philippine Islands
65-2	Plane Coordinate Projection Tables — Puerto Rico and Virgin Is.
315	Plane Coordinate Projection Tables — Rhode Island
273	Plane Coordinate Projection Tables — South Carolina
263	Plane Coordinate Projection Tables — South Dakota

4. Selected References— continued

List of publications necessary for conversion computations on the State Plane Coordinate Systems

Coast and Geodetic Survey Special Publication Number	Publication Title
268	Plane Coordinate Projection Tables — Tennessee
252	Plane Coordinate Projection Tables — Texas
277	Plane Coordinate Projection Tables — Utah
314	Plane Coordinate Projection Tables — Vermont
293	Plane Coordinate Projection Tables — Virginia
271	Plane Coordinate Projection Tables — Washington
275	Plane Coordinate Projection Tables — West Virginia
288	Plane Coordinate Projection Tables — Wisconsin
258	Plane Coordinate Projection Tables — Wyoming

Table 1--Universal Transverse Mercator Zone Locations and Central Meridians

Zone	C.M.	Range	Zone	C.M.	Range
01	177W	180W-174W	31	003E	000E-006E
02	171W	174W-168W	32	009E	006E-012E
03	165W	168W-162W	33	015E	012E-018E
04	159W	162W-156W	34	021E	018E-024E
05	153W	156W-150W	35	027E	024E-030E
06	147W	150W-144W	36	033E	030E-036E
07	141W	144W-138W	37	039E	036E-042E
08	135W	138W-132W	38	045E	042E-048E
09	129W	132W-126W	39	051E	048E-054E
10	123W	126W-120W	40	057E	054E-060E
11	117W	120W-114W	41	063E	060E-066E
12	111W	114W-108W	42	069E	066E-072E
13	105W	108W-102W	43	075E	072E-078E
14	099W	102W-096W	44	081E	078E-084E
15	093W	096W-090W	45	087E	084E-090E
16	087W	090W-084W	46	093E	090E-096E
17	081W	084W-078W	47	099E	096E-102E
18	075W	078W-072W	48	105E	102E-108E
19	069W	072W-066W	49	111E	108E-114E
20	063W	066W-060W	50	117E	114E-120E
21	057W	060W-054W	51	123E	120E-126E
22	051W	054W-048W	52	129E	126E-132E
23	045W	048W-042W	53	135E	132E-138E
24	039W	042W-036W	54	141E	138E-144E
25	033W	036W-030W	55	147E	144E-150E
26	027W	030W-024W	56	153E	150E-156E
27	021W	024W-018W	57	159E	156E-162E
28	015W	018W-012W	58	165E	162E-168E
29	009W	012W-006W	59	171E	168E-174E
30	003W	006W-000E	60	177E	174E-180W

Table 2—Zone Representation Codes

Code(s)	SPCS/Zone Represented	Jurisdiction(s) Concerned
bb	Single zone in a state	Nine States, which have only one SPCS/zone American Samoa, Guam
SH	Offshore	Louisiana
Mb	Mainland	Massachusetts (one of two zones)
Ib	Island	Massachusetts (one of two zones)
CM	Central (TM)	Michigan See note 4.
Lb	Long Island	New York (one of four zones)
NC	North Central	Texas (one of five zones)
SC	South Central	Texas (one of five zones)
EC	East Central	Wyoming (one of four zones) See notes 1 and 2.
WC	West Central	Wyoming (one of four zones)
Eb	East	Many (see table 4)
Sb	South	Many (see table 4)
Wb	West	Many (see table 4)
Nb	North	Many (see table 4)
Cb	Central	Many (see table 4)
01-10	Numerically designated zones	For the following States, as shown: Alaska—01 through 10 California—01 through 07 Hawaii—01 through 05 Wyoming—01 through 04 See notes 1 and 2.
Z1	Zone 1	Puerto Rico and Virgin Islands (St. John, St. Thomas) See note 3.
SX	Zone 2	Virgin Islands (St. Croix) See note 3.

NOTES:

(1) Wyoming is shown with two designations; it is shown in table 3 in the same fashion. It is the only State with both alphabetic and numeric official zone designations.

(2) The codes indicated in sections 2.3.1 and 2.3.2 shall be applied to the zones indicated in table 3. For Wyoming only, the numeric zone designations or the alphabetic zone designations are expected to be used separately, without intermixing of codes.

(3) The Commonwealth of Puerto Rico and the Territory of the U.S. Virgin Islands share one zone, except for the island of St. Croix which is a second, separate zone.

(4) Although three Transverse Mercator zones were originally devised for Michigan by the U. S. Coast and Geodetic Survey, the State has mandated use of Lambert zones devised by Prof. R. M. Berry of the University of Michigan. The Lambert zones are designed for a special spheroid that, although related to the Clarke Spheroid of 1866, is a reference surface above that spheroid. Use of the Lambert zones has supplanted use of the Mercator.

Table 3—Jurisdictions and State Plane Coordinate Systems

Jurisdictions	Abbrev	Num. Code	E	S	W	N	C	CM	EC	SC	WC	NC	M	I	Z1	SX	L	SH	Blank (One)	Num.
Alabama	AL	01	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Alaska	AK	02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	01-10
Arizona	AZ	04	X	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Arkansas	AR	05	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
California	CA	06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	01-07
Colorado	CO	08	–	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Connecticut	CT	09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
Delaware	DE	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
District of Columbia	(See Maryland)																			
Florida	FL	12	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Georgia	GA	13	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Hawaii	HI	15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	01-05
Idaho	ID	16	X	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Illinois	IL	17	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Indiana	IN	18	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Iowa	IA	19	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Kansas	KS	20	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Kentucky	KY	21	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Louisiana	LA	22	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	X	–	—
Maine	ME	23	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Maryland	MD	24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
Massachusetts	MA	25	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	—
Michigan	MI	26	X	X	X	X	X	X	–	–	–	–	–	–	–	–	–	–	–	—
Minnesota	MN	27	–	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Mississippi	MS	28	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Missouri	MO	29	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Montana	MT	30	–	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Nebraska	NE	31	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Nevada	NV	32	X	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	—
New Hampshire	NH	33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
New Jersey	NJ	34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
New Mexico	NM	35	X	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	—
New York	NY	36	X	–	X	–	X	–	–	–	–	–	–	–	–	–	X	–	–	—
North Carolina	NC	37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
North Dakota	ND	38	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Ohio	OH	39	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Oklahoma	OK	40	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Oregon	OR	41	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Pennsylvania	PA	42	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Rhode Island	RI	44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
South Carolina	SC	45	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
South Dakota	SD	46	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Tennessee	TN	47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
Texas	TX	48	–	X	–	X	X	–	–	X	–	X	–	–	–	–	–	–	–	—
Utah	UT	49	–	X	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	—
Vermont	VT	50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	—
Virginia	VA	51	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—
Washington	WA	53	–	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	—

Table 3—Jurisdictions and State Plane Coordinate Systems—continued

Jurisdictions	Abbrev	Num. Code	E	S	W	N	C	C M	E C	S C	W C	N C	M	I	Z 1	S X	L	S H	Blank (One)	Num.
West Virginia	WV	54	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	—
Wisconsin	WI	55	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	—
Wyoming	WY	56	X	-	X	-	-	-	X	-	X	-	-	-	-	-	-	-	-	01-04
American Samoa	AS	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	—
Guam	GU	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	—
Puerto Rico **	PR	72	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	—
Virgin Islands	VI	78	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	—

** See note 3, table 2.

Table 4—Jurisdictions, State Plane Coordinate Systems, and Alternate Zone Representations

Jurisdiction Zone name or number	Abbrev	Numeric Code	Zone Code
Alabama	AL	01	
East			0101
West			0102
Alaska	AK	02	
01 through 10			5001 through 5010
Arizona	AZ	04	
East			0201
Central			0202
West			0203
Arkansas	AR	05	
North			0301
South			0302
California	CA	06	
01 through 07			0401 through 0407
Colorado	CO	08	
North			0501
Central			0502
South			0503
Connecticut	CT	09	0600
Delaware	DE	10	0700
District of Columbia (See Maryland)			
Florida	FL	12	
East			0901
West			0902
North			0903
Georgia	GA	13	
East			1001
West			1002
Hawaii	HI	15	
01 through 05			5101 through 5105
Idaho	ID	16	
East			1101
Central			1102
West			1103
Illinois	IL	17	
East			1201
West			1202
Indiana	IN	18	
East			1301
West			1302
Iowa	IA	19	
North			1401
South			1402
Kansas	KS	20	
North			1501
South			1502

Table 4—Jurisdictions, State Plane Coordinate Systems, and Alternate Zone Representations—continued

Jurisdiction Zone name or number	Abbrev	Numeric Code	Zone Code
Kentucky	KY	21	
North			1601
South			1602
Louisiana	LA	22	
North			1701
South			1702
Offshore			1703
Maine	ME	23	
East			1801
West			1802
Maryland	MD	24	1900
Massachusetts	MA	25	
Mainland			2001
Island			2002
Michigan	MI	26	
East			2101
Central (Transverse Mercator)			2102
West			2103
North			2111
Central (Lambert)			2112
South			2113
Minnesota	MN	27	
North			2201
Central			2202
South			2203
Mississippi	MS	28	
East			2301
West			2302
Missouri	MO	29	
East			2401
Central			2402
West			2403
Montana	MT	30	
North			2501
Central			2502
South			2503
Nebraska	NE	31	
North			2601
South			2602
Nevada	NV	32	
East			2701
Central			2702
West			2703
New Hampshire	NH	33	2800
New Jersey	NJ	34	2900

Table 4—Jurisdictions, State Plane Coordinate Systems, and Alternate Zone Representations—continued

Jurisdiction Zone name or number	Abbrev	Numeric Code	Zone Code
New Mexico	NM	35	
East			3001
Central			3002
West			3003
New York	NY	36	
East			3101
Central			3102
West			3103
Long Island			3104
North Carolina	NC	37	3200
North Dakota	ND	38	
North			3301
South			3302
Ohio	OH	39	
North			3401
South			3402
Oklahoma	OK	40	
North			3501
South			3502
Oregon	OR	41	
North			3601
South			3602
Pennsylvania	PA	42	
North			3701
South			3702
Rhode Island	RI	44	3800
South Carolina	SC	45	
North			3901
South			3902
South Dakota	SD	46	
North			4001
South			4002
Tennessee	TN	47	4100
Texas	TX	48	
North			4201
North Central			4202
Central			4203
South Central			4204
South			4205
Utah	UT	49	
North			4301
Central			4302
South			4303
Vermont	VT	50	4400

Table 4—Jurisdictions, State Plane Coordinate Systems, and Alternate Zone Representations—continued

Jurisdiction Zone name or number	Abbrev	Numeric Code	Zone Code
Virginia	VA	51	
North			4501
South			4502
Washington	WA	53	
North			4601
South			4602
West Virginia	WV	54	
North			4701
South			4702
Wisconsin	WI	55	
North			4801
Central			4802
South			4803
Wyoming	WY	56	
East (01)			4901
East Central (02)			4902
West Central (03)			4903
West (04)			4904
Puerto Rico	PR	72	5201
Virgin Islands	VI	78	
St. John, St. Thomas			5201
St. Croix			5202
American Samoa	AS	60	5300
Guam	GU	66	5400

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