

# National Geodetic Survey (NGS) National Spatial Reference System (NSRS) Modernization Project

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# NSRS Modernization Project

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- What's being replaced:

## Horizontal

- NAD 83(2011)
- NAD 83(PA11)
- NAD 83(MA11)

Latitude  
Longitude  
Ellipsoid Height

State Plane Coordinates

## Vertical

- NAVD 88
- PRVD 02
- VIVD09
- ASVD02
- NMVD03
- GUVD04
- IGLD 85

← Heights

# NSRS Modernization Project



**National Geodetic Survey**  
Positioning America for the Future

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## New Datums

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- Policy Decisions
- Track our Progress
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## Events

- Industry Engagement
- 2019 Summit
- 2017 Summit
- 2015 Summit
- 2010 Summit

## New Datums: Replacing NAVD 88 and NAD 83

To improve the National Spatial Reference System (NSRS), NGS will replace the North American Datum of 1983 (NAD 83) and the North American Vertical Datum of 1988 (NAVD 88) with a new geometric reference frame and geopotential datum in 2022.

The new reference frames will rely primarily on Global Navigation Satellite Systems (GNSS), such as the Global Positioning System (GPS), as well as on a gravimetric geoid model resulting from our Gravity for the Redefinition of the American Vertical Datum (GRAV-D) Project.

These new reference frames will be easier to access and to maintain than NAD 83 and NAVD 88, which rely on physical survey marks that deteriorate over time.

Background	What to Expect	Get Prepared
Policy Decisions	Track our Progress	Naming Convention
FAQs	Watch Videos	Related Projects

Website Owner: National Geodetic Survey / Last modified by NGS Infocenter Oct 03 2018

National Geodetic Survey Positioning America for the Future geodesy.noaa.gov

Issue 13, October 2018

## NSRS Modernization News

For all issues of NSRS Modernization News, visit:  
[geodesy.noaa.gov/datums/newdatums/TrackOurProgress.shtml](http://geodesy.noaa.gov/datums/newdatums/TrackOurProgress.shtml)

## Geospatial Summit 2019

The next Geospatial Summit about NSRS Modernization will take place May 6-7, 2019 in Silver Spring, Maryland. Mark your calendars and check the [NGS Geospatial Summit](#) page for more information when it becomes available.

## Updated "New Datums" Web Page

NGS recently refreshed and reorganized the NSRS Modernization content on the [New Datums web page](#). Check out the new updates!

## Progress in Ongoing Projects

There are currently 18 ongoing projects around NGS that directly related to NSRS modernization. Here are highlights from a select few:

### VERTCON 3

Project Manager: Dr. Dru Smith

The VERTCON 3 transformation and error grids are completed, and approved to enter alpha testing within NGS. After alpha testing, they will be placed on the NGS BETA server in both the NCAT and VDatum tools for public testing.

### GRAV-D

Project Manager: Jeffery Johnson (Acting)

The GRAV-D team had a mix of news this quarter. Our project manager, Monica Youngman, has taken a new position within NOAA. Monica has led the GRAV-D team for years and always kept us on budget and ahead of schedule. We wish her the best of luck in her new position! Thankfully our new GRAV-D PM, Jeffery Johnson is equally capable of keeping GRAV-D on track. In fact, under Jeffery's command the GRAV-D airborne gravity survey recently completed mainland Alaska!

### Scoping Study on Organizing Historic GPS Data

Project Manager: Boris Kanazir

For the last three decades, NGS relied heavily upon user-computed vectors from GPS projects in order to populate the NGS Integrated Database. However, this has resulted in inconsistencies due to variations in software over the years. In many cases, the raw GNSS files that created those vectors were turned in, but then just archived without further use.

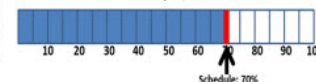
NGS has determined how long it would take to correctly identify raw GNSS files and reprocess them from scratch in order to build the NSRS Database and remove inconsistencies so that rapid, mass reprocessing can be done in the future. The results are staggering: 40 person-years. The majority of that time would be devoted to finding original field logs and resolving the high number of inconsistencies between bluebook submissions, RINEX header files, and field logs.

Based on this assessment, NGS is preparing a plan to prioritize data to load into the NSRS Database so that the most useful passive control information will be available by 2022.

GRAV-D progress last quarter: up 2.4% to 72.1%

Ahead of Schedule!

Recently: TX, OK



# NGS SPC2022 Project

Draft document for public comment

NOAA's National Geodetic Survey

**Official Policy Title:** State Plane Coordinate System of 2022 Policy

**Tracking Number:** NGS 2018-xxxx-01

**Date Reviewed by the Executive Steering Committee (ESC):** (not yet reviewed)

**Effective Date:** (not yet authorized)

**Internal or External:** External

**Associated NGS Documents:**

"Procedures for Design and Modification of the State Plane Coordinate System of 2022", *NGS 2018-xxxx-01-A1*.

[https://geodesy.noaa.gov/INFO/Policy/files/DRAFT\\_SPCS2022\\_Procedures.pdf](https://geodesy.noaa.gov/INFO/Policy/files/DRAFT_SPCS2022_Procedures.pdf)

Dennis, M.L., 2018. "The State Plane Coordinate System: History, Policy, and Future Directions", *NOAA Special Publication NOS NGS 13*, National Oceanic and Atmospheric Administration, National Geodetic Survey, Silver Spring, Maryland.

[https://geodesy.noaa.gov/library/pdfs/NOAA\\_SP\\_NOS\\_NGS\\_0013\\_v01\\_2018-03-06.pdf](https://geodesy.noaa.gov/library/pdfs/NOAA_SP_NOS_NGS_0013_v01_2018-03-06.pdf)

**Authority/Reference:** As original creator of the State Plane Coordinate System and official steward of the National Spatial Reference System (NSRS), NGS has sole authority to define and establish this policy.

**Supersedes:**

"Policy on Changes to State Plane Coordinates", *NGS Policy 08-2012*.

[https://geodesy.noaa.gov/INFO/Policy/files/082012\\_State\\_Plane\\_Coordinate\\_Policy.pdf](https://geodesy.noaa.gov/INFO/Policy/files/082012_State_Plane_Coordinate_Policy.pdf)

"Policy of the National Geodetic Survey Concerning Units of Measure for the State Plane Coordinate System of 1983", *NGS Policy 02-2006*.

[https://geodesy.noaa.gov/INFO/Policy/files/022006\\_Policy\\_on\\_Units\\_of\\_Measure\\_83.pdf](https://geodesy.noaa.gov/INFO/Policy/files/022006_Policy_on_Units_of_Measure_83.pdf)

**Review Schedule:** At least once every two years.

**Purpose/Scope**

This policy provides the framework for defining and maintaining the State Plane Coordinate System of 2022 (SPCS2022). It is divided into the following four sections:

- I. **General SPCS2022 policy.** Specifies overall policy for SPCS2022, including its official name, authority of NGS, scope, uniqueness with respect to previous versions of SPCS, coordination with other federal agencies, and documentation.
- II. **SPCS2022 technical characteristics and requirements.** Fundamental technical attributes of SPCS2022 specified at the *policy* level (i.e., can only be modified with approval of NGS ESC). Other technical details that can be approved by the NGS OAD Chief are in the SPCS2022 procedures associated with this policy.
- III. **SPCS2022 zones, consistency with statute, and support for other systems.** Provides guidance on zone definitions and extents and addresses consistency with state and territory statute.
- IV. **Default SPCS2022 definitions.** Specifies characteristics of SPCS2022 defined in the absence of consensus input from stakeholders for a state or territory. This is necessary to ensure all zones are defined prior to release of the 2022 Terrestrial Reference Frames (TRFs). This section will be removed upon official release of SPCS2022.

Draft document for public comment

NOAA's National Geodetic Survey

**Official Procedure Title:** Procedures for Design and Modification of the State Plane Coordinate System of 2022

**Tracking Number:** NGS 2018-xxxx-01-A1

**Date reviewed by Executive Steering Committee (ESC):** (not yet reviewed)

**Effective Date:** (not yet authorized)

**Internal or External:** External

**Associated NGS Documents:**

"State Plane Coordinate System of 2022 Policy", *NGS 2018-xxxx-01*.

[https://geodesy.noaa.gov/INFO/Policy/files/DRAFT\\_SPCS2022\\_Policy.pdf](https://geodesy.noaa.gov/INFO/Policy/files/DRAFT_SPCS2022_Policy.pdf)

Dennis, M.L., 2018. "The State Plane Coordinate System: History, Policy, and Future Directions", *NOAA Special Publication NOS NGS 13*, National Oceanic and Atmospheric Administration, National Geodetic Survey, Silver Spring, Maryland.

[https://geodesy.noaa.gov/library/pdfs/NOAA\\_SP\\_NOS\\_NGS\\_0013\\_v01\\_2018-03-06.pdf](https://geodesy.noaa.gov/library/pdfs/NOAA_SP_NOS_NGS_0013_v01_2018-03-06.pdf)

**Authority/Reference:** As original creator of the State Plane Coordinate System, the National Geodetic Survey has sole authority to define and establish these procedures.

**Supersedes:** There are no prior procedures for the State Plane Coordinate System. Superseded policies are listed in the policy document associated with these procedures. The superseded policies include information that can be construed as procedures.

**Review Schedule:** At least once every two years.

**Purpose/Scope**

These procedures define the roles and responsibilities for NGS, stakeholders, and contributing partners in defining and modifying State Plane Coordinate System of 2022 (SPCS2022), as well as its technical specifications. The procedures are divided into the following five sections:

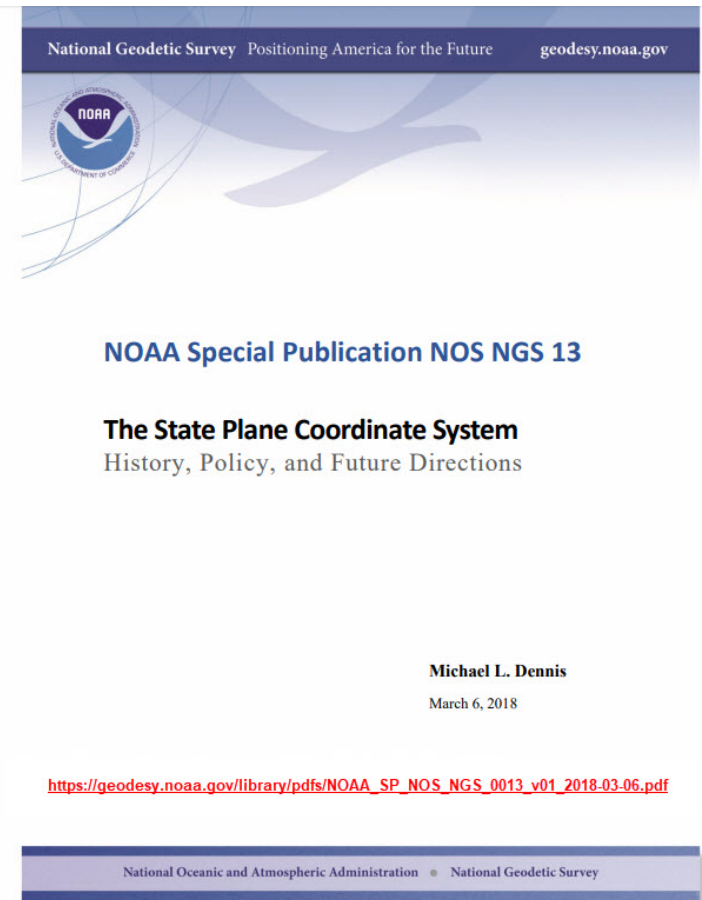
1. **NGS contact information, criteria for stakeholder input, and deadlines.** NGS email and postal addresses for submissions, general submittal requirements, criteria for "consensus" stakeholder input, and deadlines for submitting requests and proposals, and for submitting zone designs.
2. **Requirements for stakeholder requests and proposals of SPCS2022 designs.** What is required of stakeholders for making requests and proposing designs for SPCS2022.
3. **Requirements for submittal of SPCS2022 designs by contributing partners.** What is required of contributing partners when submitting SPCS2022 zone designs.
4. **NGS role and responsibilities for SPCS2022 reviews and designs.** What NGS will do in reviewing requests, design proposals, and submitted designs; the limitations of designs done by NGS; and what will be documented by NGS.
5. **Technical specifications for SPCS2022 design and implementation.** Detailed technical specifications to augment those given in SPCS2022 policy. This section of the procedures is the longest, but must of it will be moved to a technical design manual shortly after these procedure have been approved.



# NGS SPC2022 Project

- Stakeholders. NGS customers and users of SPCS within a state most involved in the use, collection, and distribution of spatial data, and who have a substantial stake in how SPCS2022 is designed. Stakeholders consist of one or more of the following organizations:
  - State departments of transportation
  - State GIS or cartographer offices
  - State professional surveying and engineering societies
  - **State GIS or other professional geospatial organizations**
  - Universities or other post-secondary educational institutions within a state that perform geospatial education or research.
  - Other departments, offices, and organizations within a state with roles and functions similar to those of the organizations listed above.

National organizations can also provide input on SPCS2022 as stakeholders, but they cannot represent a specific state except in cases where one or more of the aforementioned state groups have granted them that authority, as documented in the required submittals for these procedures.





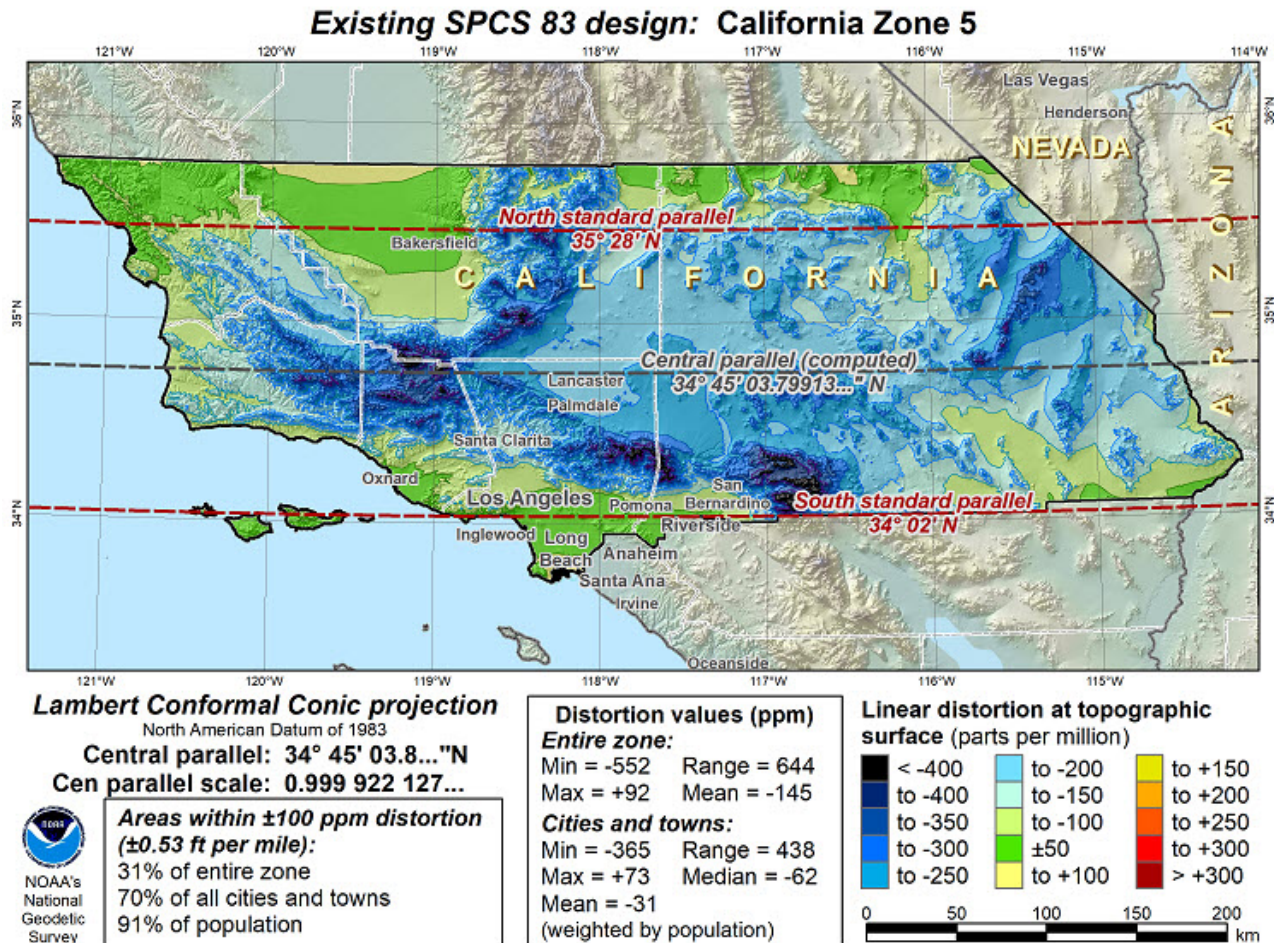


# California Coordinate System 2022 is coming....

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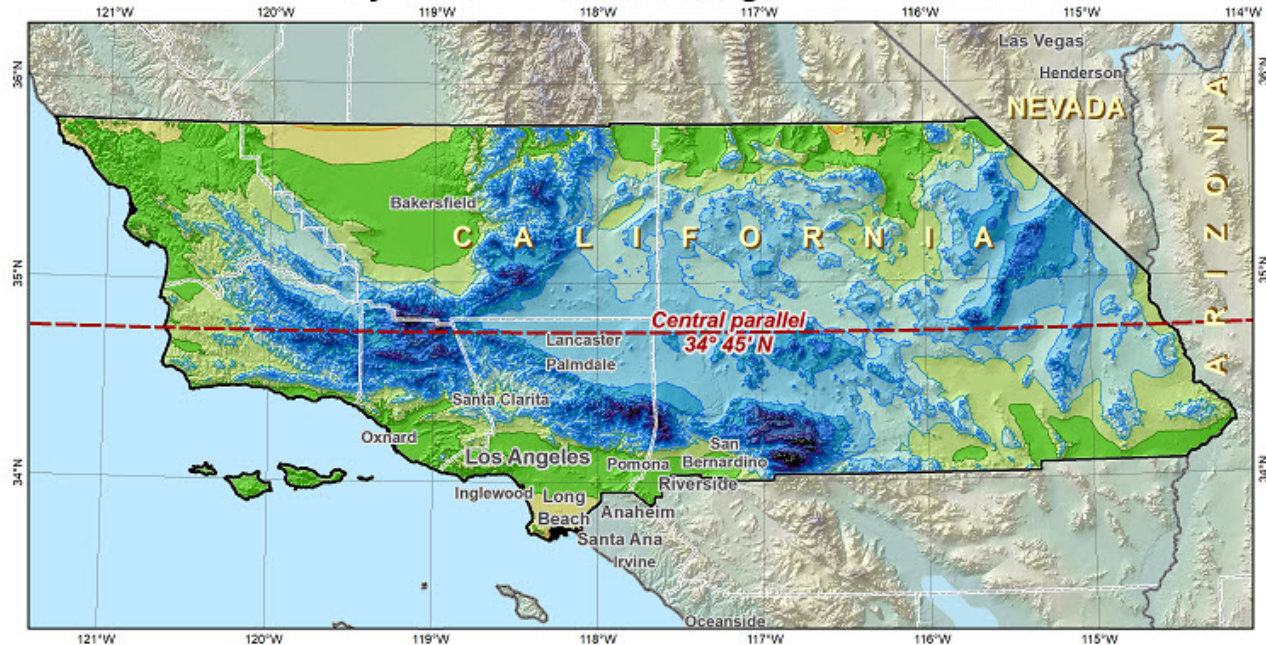
- The default designs are very similar to the existing 6 zones of CCS83
- A “layered zone” option is also being offered for SPC2022. This could be used to develop a single statewide zone in addition to the 6 standard zones
- A single zone, specifically designed to “fit” California, could be very useful for statewide or large regional mapping efforts. Major geospatial companies such as ESRI are already engaged with the NGS on this project.
- All NGS recognized stakeholders must come to a consensus if anything other than the NGS proposed defaults are to be requested and approved by NGS
- States must make their requests to NGS by December 31, 2019 or the defaults will automatically be implemented.

# Examples – CCS 83 Zone 5



# CCS2022 Zone 5 – projection surface weighted to population

**Preliminary SPCS2022 default design: California Zone 5**



**Lambert Conformal Conic projection**

North American Terrestrial Reference Frame of 2022

**Central parallel: 34° 45' N**

**Central parallel scale: 0.999 95 (exact)**



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**Areas within ±100 ppm distortion**

(±0.53 ft per mile):

41% of entire zone

76% of all cities and towns

90% of population

**Distortion values (ppm)**

**Entire zone:**

Min = -524 Range = 645

Max = +121 Mean = -117

**Cities and towns:**

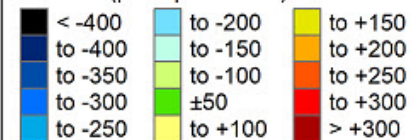
Min = -338 Range = 438

Max = +100 Median = -34

Mean = -3

(weighted by population)

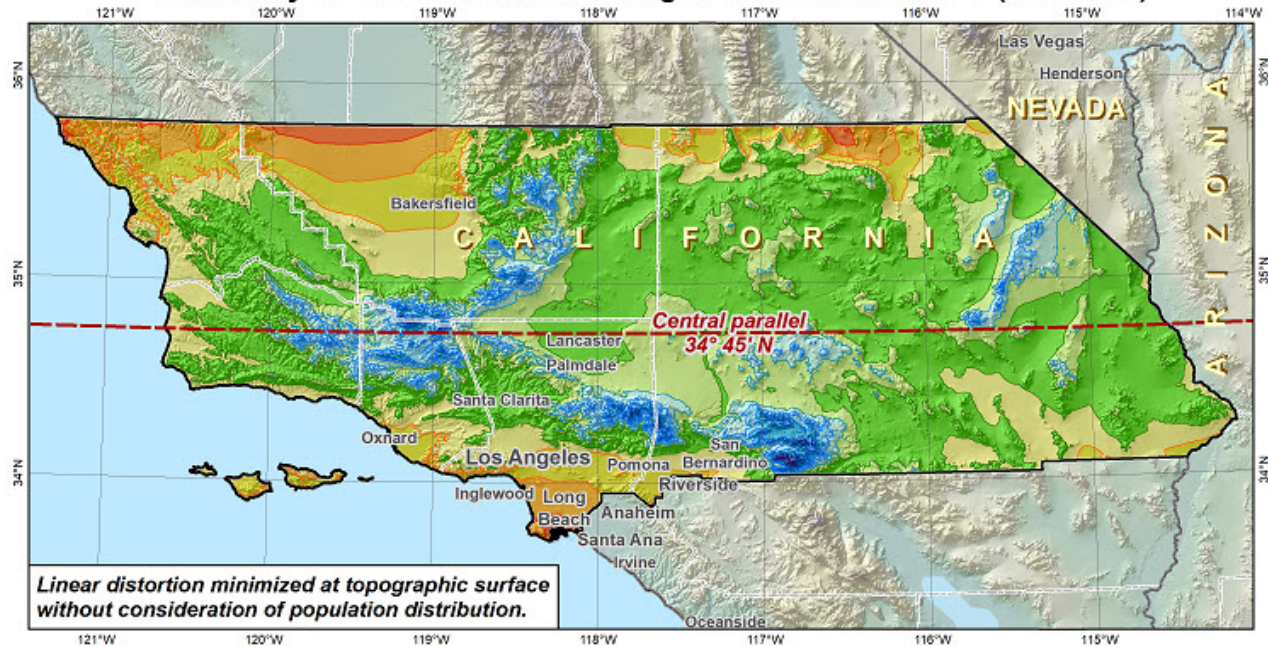
**Linear distortion at topographic surface (parts per million)**





# CCS2022 Zone 5 – projection surface at average elevation across the zone

**Preliminary SPCS2022 default design: California Zone 5 (alternate)**



*Linear distortion minimized at topographic surface without consideration of population distribution.*

**Lambert Conformal Conic projection**

North American Terrestrial Reference Frame of 2022

**Central parallel: 34° 45' N**

**Central parallel scale: 1.000 07 (exact)**



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National  
Geodetic  
Survey

**Areas within ±100 ppm distortion (±0.53 ft per mile):**

- 75% of entire zone
- 56% of all cities and towns
- 28% of population

**Distortion values (ppm)**

**Entire zone:**

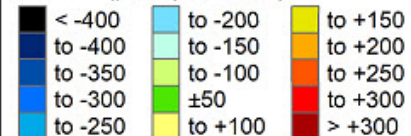
Min = -404    Range = 645  
Max = +241    Mean = +3

**Cities and towns:**

Min = -218    Range = 438  
Max = +220    Median = +86  
Mean = +117

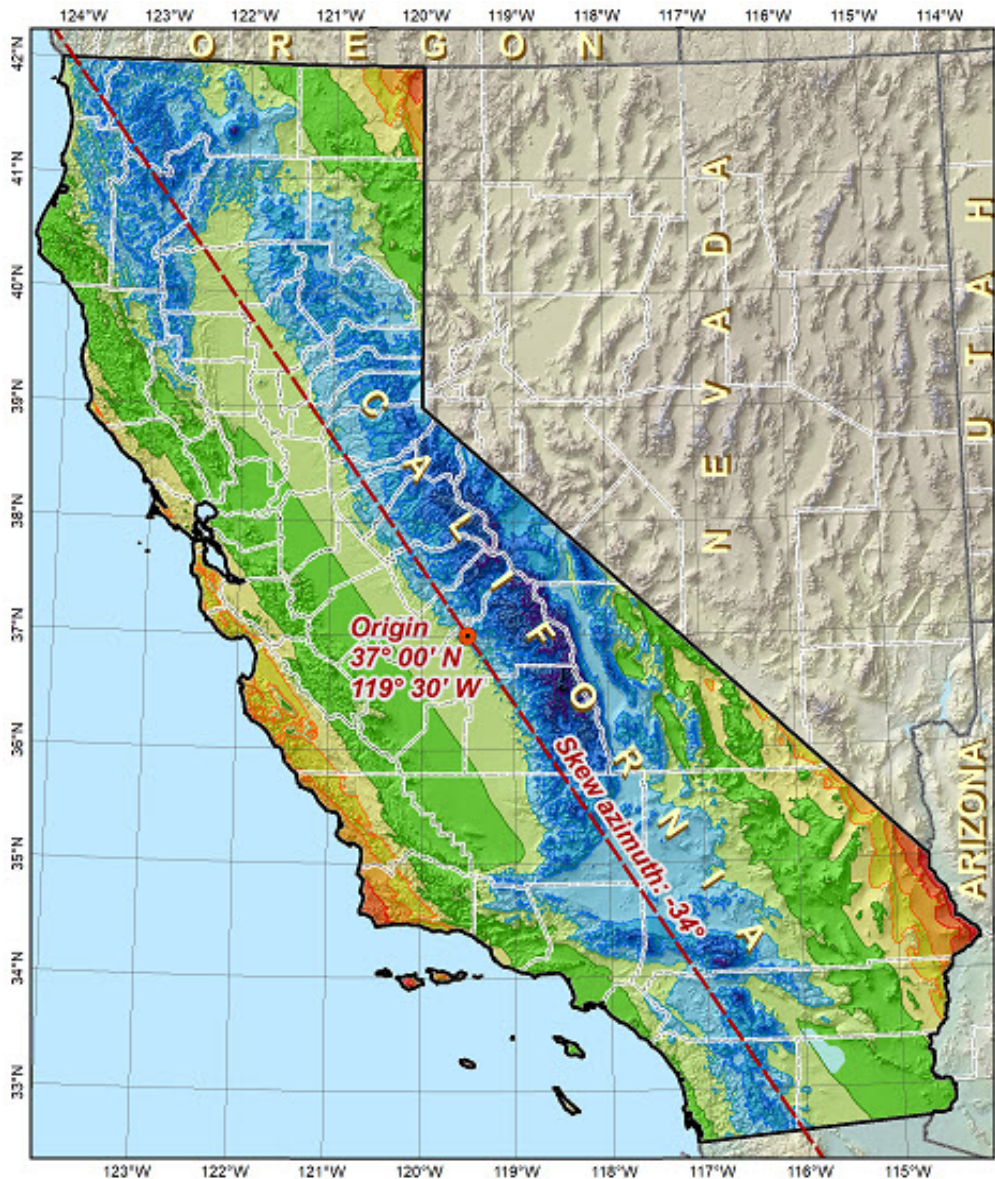
(weighted by population)

**Linear distortion at topographic surface (parts per million)**





# Proposed Single Zone



## Preliminary SPCS2022 statewide zone design: California



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Survey

### Oblique Mercator projection

North American Terrestrial Reference Frame of 2022

Origin latitude: 37° 00' N

Origin longitude: 119° 30' W

Skew axis scale: 0.999 85 (exact)

Skew azimuth: -34°

### Areas within ±400 ppm distortion (±2.11 ft per mile):

92% of entire zone

98% of all cities and towns

99.7% of population

### Distortion values (ppm)

#### Entire zone: Cities and towns:

Min = -749 Min, Max = -474, +559

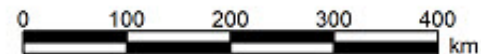
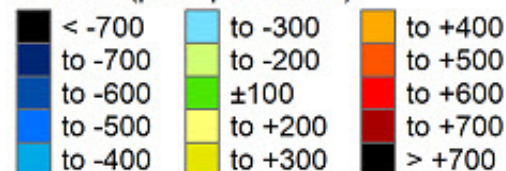
Max = +671 Range = 1032

Range = 1420 Median = -116

Mean = -134 Mean = -46

(weighted by population)

### Linear distortion at topographic surface (parts per million)





# SPC2022 - Recommendations in Preparation

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- Form a SPC2022 Work Group to evaluate the proposals and develop a position on behalf of the GIS Council and GIS community in California
- Be available to coordinate with the other stakeholder groups to address any concerns or verify consensus.
- Prepare the final request for California in conjunction with the other stakeholders and be signatory to the document sent to the NGS by the end of 2019.



# Questions?

