

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

NEW MEXICO BOARD OF LICENSURE FOR PROFESSIONAL ENGINEERS AND PROFESSIONAL SURVEYORS

PROFESSIONAL SURVEYORS COMMITTEE

PERRY M. VALDEZ, EXECUTIVE DIRECTOR

MEMBERS:

CLIFF A. SPIROCK, NMPS #4972, CHAIR

GLEN W. THUROW, NMPS #11394

DAVID E. COOPER, NMPS #9052

AUGUSTA MEYERS, PUBLIC MEMBER

Photos and discussion excerpts:

GNSS and the Surveyor: Take Me to School

March 1, 2017 - By [Tim Burch](http://gpsworld.com/gnss-and-the-surveyor-take-me-to-school/) GPS World (online),

<http://gpsworld.com/gnss-and-the-surveyor-take-me-to-school/>

Arizona Professional Land Surveyors Conference

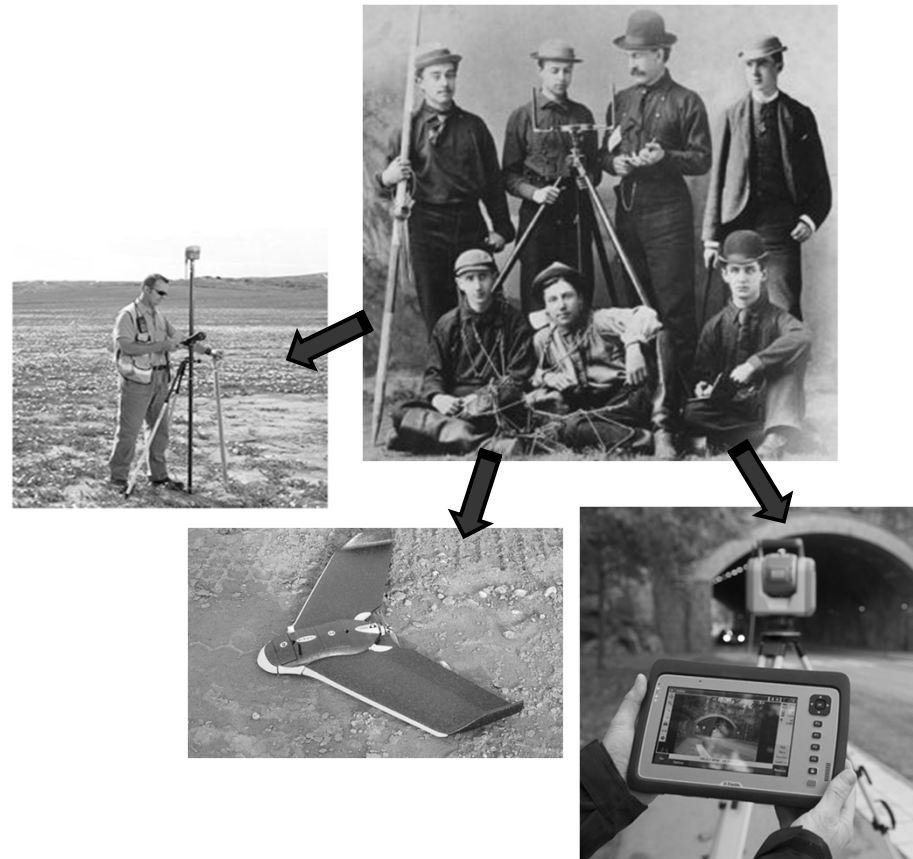
Tucson, Arizona • May 19, 2017

Michael L. Dennis, RLS, PE

Geodetic Analysis, LLC

Chris Pappas, RLS, NMDOT

New Mexico Professional Surveyors



**"change is the only
constant in life"**

Heraclitus, a Greek philosopher

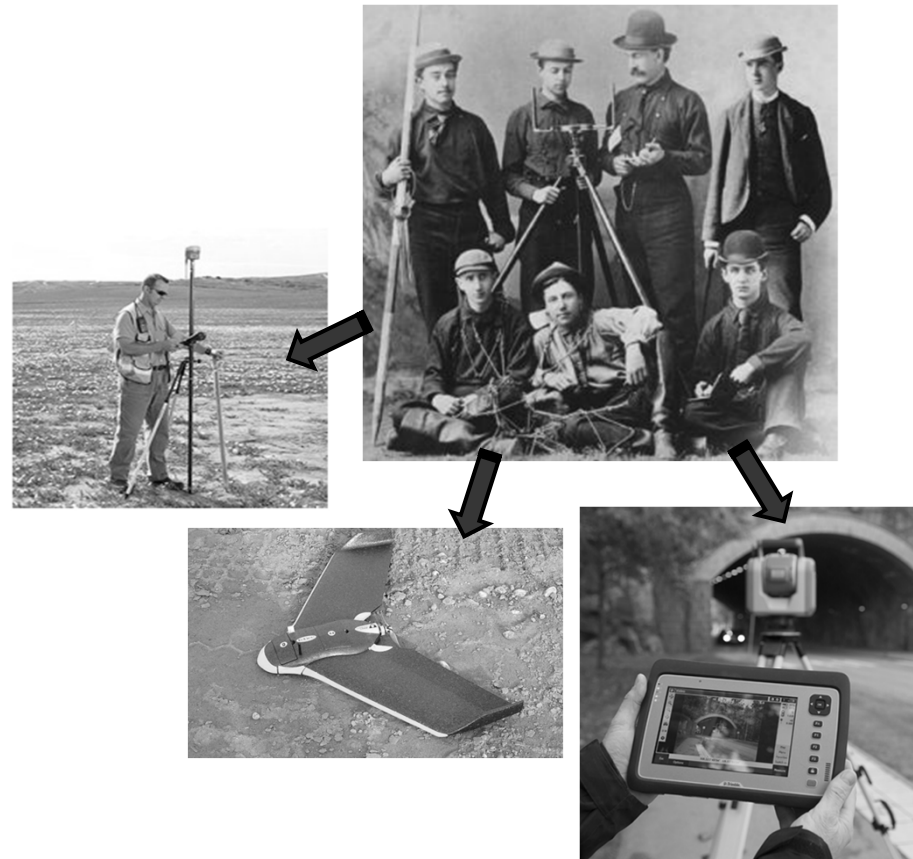
Perhaps more appropriate quotations:

Mr. Tom Patrick, NMLS # 12651
when this topic was reviewed
in-house at Community
Sciences Corporation:

**“why isn’t this change a more
practical transition for a
surveyor instead
of such a wide-ranging
and scientific approach?”**

... and Mr. Cliff A. Spirock, NMLS # 4972
when preparing this presentation:

**“ oh (expletive) -- this is not
even close to the changes
we experienced going from
NAD27 to NAD83!” (1986)**



← **“change is the only
constant in life”**
Heraclitus, a Greek philosopher

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TAILORED FOR THE QUESTION(S)

**WHAT DOES THIS MEAN FOR
ENGINEERS?**

**WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?**

TOPICS TO BE PRESENTED:

A PRIMER ON LOW-DISTORTION GROUND PLANE PROJECTIONS

1. As non-technical as possible to keep the Board informed

A NEW DATUM FOR NOAA AND NGS (IN ADDITION TO NAD27, NAD83, WGS84, ETC.)

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022)

IMPACTS ON NEW MEXICO LAWS AND CONVENTIONS

**(AS THEY ARE REFERENCED IN VARIOUS
STATUTES)**

4. A new 2022 State Plane system? A new "foot"? A new longitude reference?

A PRIMER ON LOW-DISTORTION GROUND PLANE PROJECTIONS

1. As non-technical as possible to keep the Board informed

NEXT SECTION:

WHAT DOES THIS MEAN FOR ENGINEERS?

SUFFER THROUGH THE FOLLOWING BRIEF HISTORY, PRIMER AND PRESENTATION OF PROPOSED CHANGES.

PAY PARTICULAR ATTENTION TO POSSIBLE CHANGES IN FOOT UNIT AND NEW VERTICAL DATUM WHICH WILL IMPACT ALL BENCHMARKS AND THE NEW MEXICO STATE PLANE SYSTEM.

DON'T DWELL ON THE DETAILS OF THIS SLIDE SHOW AND NARRATIVE. HARDCOPY PRINTOUTS AND LINKS TO ON-LINE RESOURCES ARE INCLUDED FOR LATER REFERENCING.

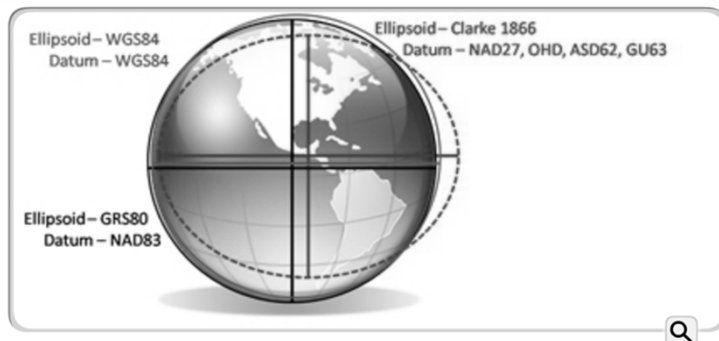
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WHAT'S THE DIFFERENCE BETWEEN A PROJECTION AND A DATUM?

A DATUM IS A SPECIFIC, KNOWN POINT ON OR IN THE EARTH THAT IS USED FOR REFERENCE. A PROJECTION USES THE DATUM AS A POINT OF REFERENCE (AND THEN DERIVES A REFERENCE SURFACE).

Geodetic datums like the North American Datum 1983 (NAD83) form the basis of coordinates of all horizontal positions for Canada and the United States.

The North American Datum of 1983 (NAD 83) is a unified horizontal or geometric datum and successor to NAD27 providing a spatial reference for Canada and the United States.

NAD83 corrects some of the distortions from NAD27 over distance by using a more dense set of positions from terrestrial and Doppler satellite data. NAD83 (and WGS84) is a geocentric datum (referenced to the center of Earth's mass) offset by about 2 meters. Even today, geodesists are continually improving horizontal geodetic datums.

<https://www.youtube.com/watch?v=VeBRflu5jZ8>
"Geodetic Surfaces and Datums" by Dave Doyle, NGS, Chief
Geodetic Surveyor (Retired)

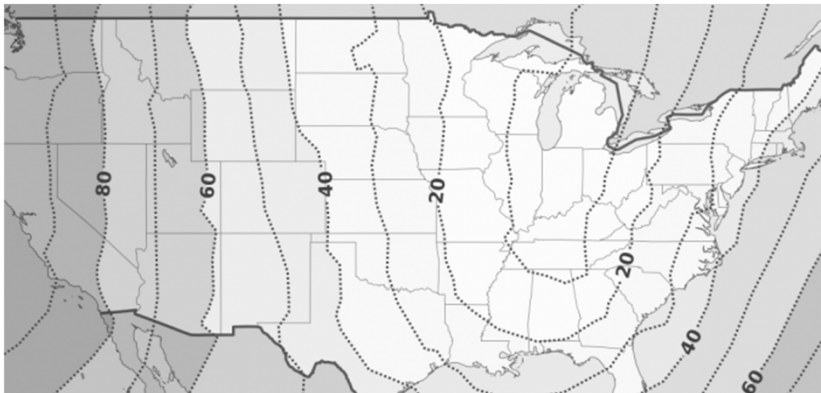
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NAD27 Shift to NAD83 (Image credit: NADCON - North American Datum Conversion Utility)
Last Updated: March 4, 2019 in Feet

WHAT'S THE DIFFERENCE BETWEEN A PROJECTION AND A DATUM? (CONTINUED):

Geodetic Datums: NAD 27, NAD 83 and WGS84

There are a number of difference between the NAD83 and the WGS84 datum. One is the reference ellipsoid. The North American 1983 datum (NAD83) uses the Geodetic Reference System (GRS80) ellipsoid while the World Geodetic System of 1984 (WGS84) uses the WGS 84 ellipsoid. The dimensions of these ellipsoids differ slightly.

Horizontal Reference Datum:

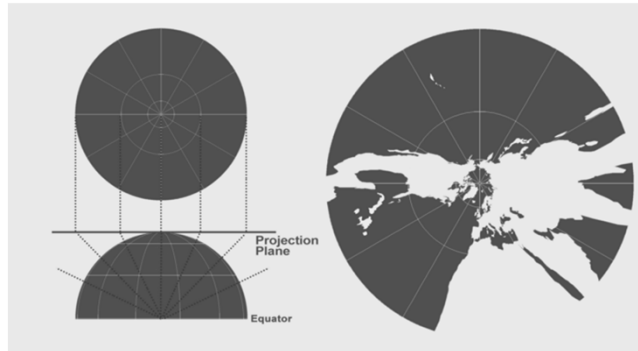
When you need to accurately enter latitude and longitude coordinates in a GIS, the first step is to give it a datum. A geodetic datum uniquely defines all locations on Earth with coordinates.

Because the Earth is curved and in GIS we deal with flat map projections, we need to accommodate both the curved and flat views of the world. In surveying and geodesy, we accurately define these properties with geodetic datums.

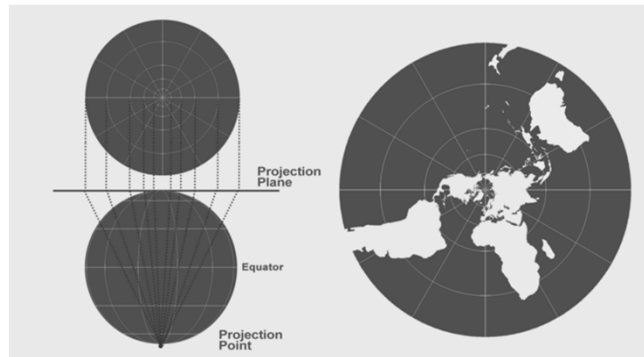
We begin modelling the Earth with a sphere or ellipsoid. Over time, surveyors have gathered a massive collection of surface measurements to more reliably estimate the ellipsoid.

When you combine these measurements, we arrive at a geodetic datum. Datums can precisely specify each location on Earth's surface in latitude and longitude. For example, NAD27, NAD83 and WGS84 are geodetic datums.

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)



The Gnomonic projection light source is located at the sphere center. This means that it can only present less than a hemisphere at a time. THIS IS THE BASIS FOR THE NEW MEXICO STATE PLANE SYSTEM, BY DEFINED ZONE.



The stereographic projection is conformal but distortion of area and distance increases away from the center point of projection. THIS SYSTEM IS USED BY THE NAVAJO HOUSING AUTHORITY IN NEW MEXICO (Double Stereographic).

WHAT'S THE DIFFERENCE BETWEEN A PROJECTION AND A DATUM?

A PROJECTION USES THE DATUM AS A POINT OF REFERENCE, IT'S LOCATION ON EARTH

Local Ground-Based Coordinates from a Tangent Plane

Tangent plane projections are formed by bringing a flat plane into contact with a point of tangency on an ellipsoid and transferring features from the ellipsoid onto the plane. To define the projection, the surveyor must specify the point of tangency and the orientation of the projection. The tangent point becomes the center of the projection and is usually chosen near the center of the project site.

The meridian of the plane is usually set as true (geodetic) north. The orientation of the tangent plane can be chosen to align with a map grid such as the NM State Plane zone meridian, previous survey plans in the area, or some other convenient meridian. If aligning to NMSP the rotation angle to geodetic north will be equal to the grid convergence (a.k.a. delta alpha angle).

To minimize scale factors, **the tangent plane may be raised up to the average height of the project and thereby becomes a local ground-based coordinate system.** It is also common to choose appropriate false Easting and Northing values of the central point to avoid confusion with other coordinate systems.

**THIS IS AN OBJECTIVE FOR NEW STATE
PLANE DEFINITIONS! (NOAA / NGS)**

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HORIZONTAL DATUM

NAD 27

GROUND SURVEY DERIVED:

What is North American Datum 1927 (NAD27)?

NAD27 stands for North American Datum of 1927. NAD27 is the adjustment of long-baseline surveys. Overall, it established a network of standardized horizontal positions on North America. Most historical USGS topographic maps and projects by the US Army Corps of Engineers used NAD27 as a reference system.

A horizontal datum provides a frame of reference as a basis for placing specific locations at specific points on the spheroid. Geodesists use a horizontal datum as the model to translate a spheroid / ellipsoid into locations on Earth with latitude and longitude lines. Geodetic datums form the basis of coordinates of all horizontal positions on Earth. All coordinates on Earth are referenced to a horizontal datum. The North American Datum of 1927 (NAD27) is one of the main three geodetic datums used in North America.

NAD27 uses all horizontal geodetic surveys collected at this time using a least-square adjustment. This datum uses the Clarke Ellipsoid of 1866 with a fixed latitude and longitude at Meade's Ranch, Kansas. ($39^{\circ}13'26.686''$ north latitude, $98^{\circ}32'30.506''$ west longitude)

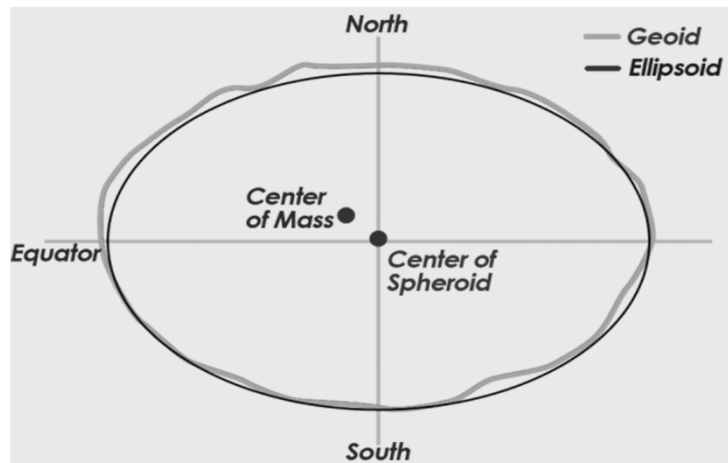
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HORIZONTAL DATUM

NAD 83

GROUND SURVEYS ADJUSTED BY SATELLITE AND MASS:

What is North American Datum 1983 (NAD83)?

The North American Datum of 1983 (NAD 83) is the most current datum being used in North America. It provides latitude and longitude and some height information using the reference ellipsoid GRS80. Geodetic datums like the North American Datum 1983 (NAD83) form the basis of coordinates of all horizontal positions for Canada and the United States.

The North American Datum of 1983 (NAD 83) is a unified horizontal or geometric datum and successor to NAD27 providing a spatial reference for Canada and the United States.

NAD83 corrects some of the distortions from NAD27 over distance by using a more dense set of positions from terrestrial and Doppler satellite data. NAD83 is a geocentric datum (referenced to the center of Earth's mass) offset by about 2 meters. Even today, geodesists are continually improving horizontal geodetic datums.

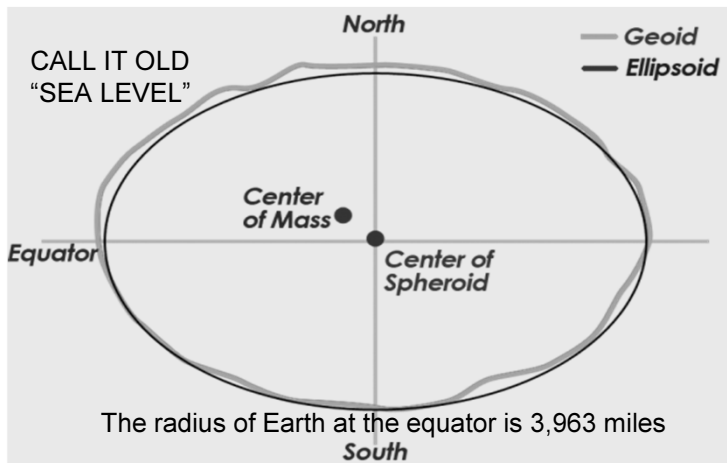
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NOTE: GEOID = GEOPOTENTIAL SURFACE

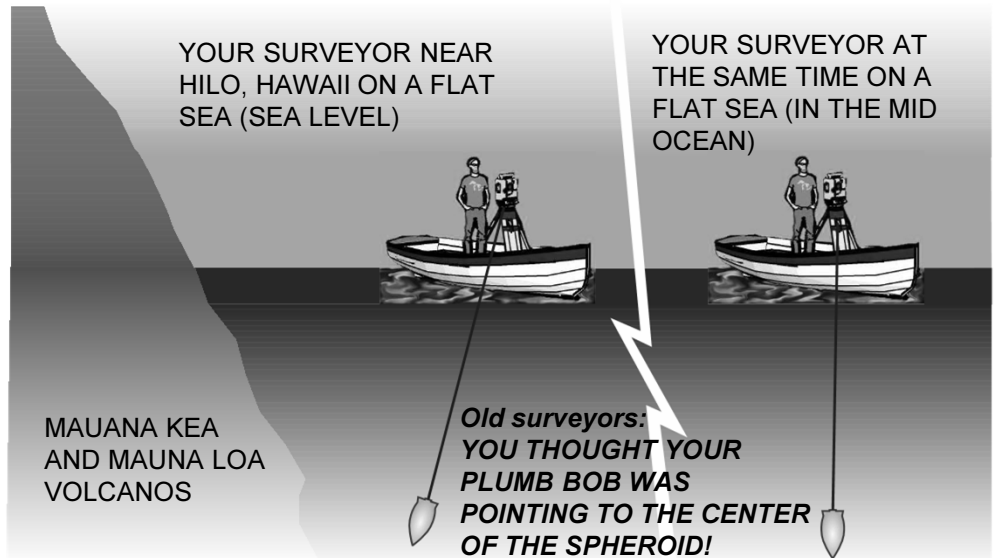
HORIZONTAL DATUM

NAD 83

GROUND SURVEYS ADJUSTED BY SATELLITE AND MASS:

Why the importance of the center of mass?

Remember, your answer affects all the calculations for all earth surface satellite positioning and any projections such as state plane systems!



Newton's law of universal gravitation:

Newton's law of gravitation, statement that any particle of matter in the universe attracts any other with a force varying directly as the product of the masses and inversely as the square of the distance between them

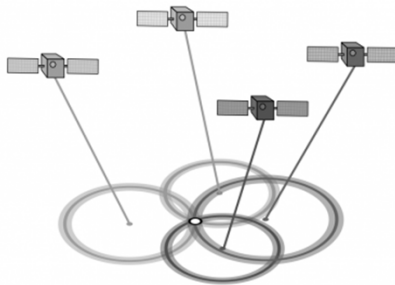
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Archimedes is famous for the quote: **Give me a place to stand** on ...
-- now we have GPS satellites! We can figuratively “stand” in outer space.
Our “lever” is the collective number and precision of signals available to the surveyor.

HORIZONTAL DATUM WGS84

SATELLITES AND MASS:

WGS84: Unifying a Global Ellipsoid Model with GPS

It wasn't until the mainstream use of Global Positioning Systems (GPS) that a unified global ellipsoid model was developed. The radio waves transmitted by GPS satellites enable extremely precise Earth measurements across continents and oceans. Global ellipsoid models have been created because of the enhancement of computing capabilities and GPS technology.

This has led to the development of global ellipsoid models such as WGS72, GRS80 and WGS84 (current). The World Geodetic System (WGS84) is the reference coordinate system used by the Global Positioning System.

Never before have we've been able to estimate the ellipsoid with such precision because of the global set of measurements provided by GPS. It is comprised of a reference ellipsoid, a standard coordinate system, altitude data and a geoid. Similar to NAD 83, it uses the Earth's center mass as the coordinate origin.

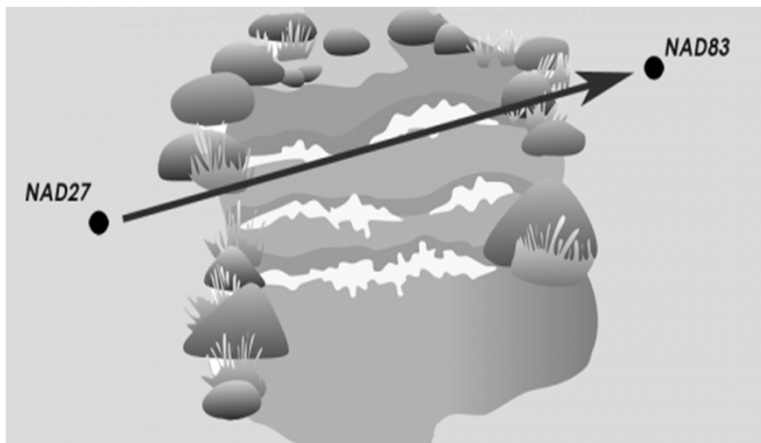
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DATUM SHIFT AND TRANSFORMATIONS:

Differences in datums:

Depending on where you are in North America, NAD27 and NAD83 may differ in tens of meters for horizontal accuracy. The average correction between NAD27 and NAD83 is an average of 0.349" (arc seconds) northward and 1.822" eastward.

It's important to note that the physical location has not changed. To be clear, most monuments have not moved. Datum shifts happen because survey measurements improve. Also, it happens when there are more of them and methods of geodesy change. This results in more accurate geodetic datums over time. The horizontal datums that form the basis of coordinates of all horizontal positions in North America improve.

The National Geodetic Survey has adjusted the NAD83 datum four times (realizations) since the original geodetic datum estimation in 1986. NAD83 (1986) version was intended to be geocentric and used the GRS80 ellipsoid.

Acronyms and "realizations":

NAD83 (1991, HARN, HPGN): High Accuracy Reference Network (HARN) and High Precision Geodetic Network

NAD83 (CORS96): Continually Operating Reference Stations (CORS) are composed of permanently operating Global Positioning System (GPS) receivers

NAD83 (CSRS, CACS): Canadian Spatial Reference System and Canadian Active Control System with GPS processing.

NAD83 (NSRS 2007, 2011): National Spatial Reference System and current survey standard using multi-year adjusted locations based on GNSS from the CORS.

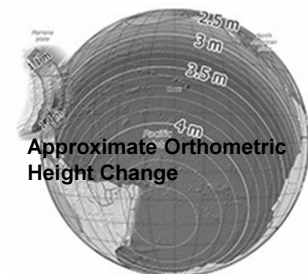
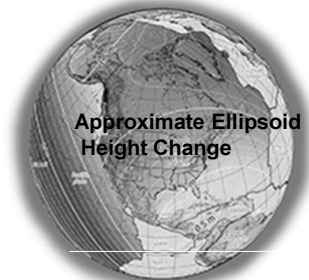
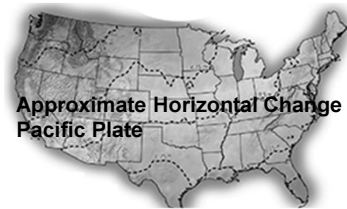
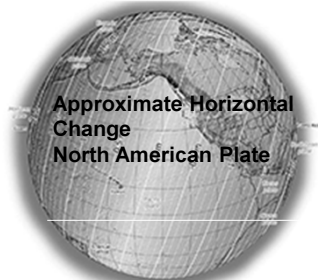
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NATRF2022 A HORIZONTAL DATUM (NOW CALLED A TERRESTRIAL REFERENCE FRAME):

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 the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) Project: **North America-Pacific Geopotential Datum of 2022**

According to NOAA) 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.

What to expect: Your coordinates will change!

The magnitude of change will vary based on the datum you are using and your geographic location. The maps show the approximate horizontal and height changes when the new reference frames are adopted.

NOTE: Orthometric Height is the ground altitude (bench mark elevation) at your location.

A PRIMER ON LOW-DISTORTION GROUND PLANE PROJECTIONS

1. As non-technical as possible to keep the Board informed

WHAT DOES THIS MEAN FOR ENGINEERS?

FOR THE ENGINEER MANAGER OR PRINCIPAL:

REMEMBER SOME OF THE BASIC ACRONYMS AND CONCEPTS FOR THE AREA OF YOUR PROJECT AND ITS HISTORY OF SOURCE DATA (E.G. CONTROL MONUMENTS, PRIOR SURVEYS AND BENCHMARKS).

REQUIRE METADATA FROM CLIENT OR SURVEYOR – ESPECIALLY FROM FURNISHED DIGITAL-ONLY DATA. YOU SHOULD PUBLISH MORE DATA ON PLANS AND A SURVEYOR TO CONTACT.

PROVIDE TRAINING FOR CAD OPERATORS AND DESIGNERS.

KNOW WHEN TO EMPLOY A SURVEYOR REQUIRED BY THE CODE – OR WHEN TO EMPLOY THEM ANYWAY ON A COMPLICATED JOB.

FOR THE ENGINEER DESIGNER / CAD TECH / DRAFTSMAN:

REMAIN (OR BECOME) AWARE OF THE NATURE OF THE NOAA CHANGES AND THE EFFECT ON THE NEW MEXICO STATE PLANE PROJECTIONS.

CHECK AND DOUBLE CHECK THE SETTINGS OF THE SOFTWARE YOU ARE USING. TAKE THE TIME TO AT LEAST IMPORT TWO POINTS WITH KNOWN AND HISTORIC VALUES AND INVERSE BETWEEN THEM!

CHECK BASIC SETTINGS FOR UNITS USED FOR DIMENSIONING AND CALCULATIONS (METERS VERSUS INTERNATIONAL OR U.S. STANDARD FEET)

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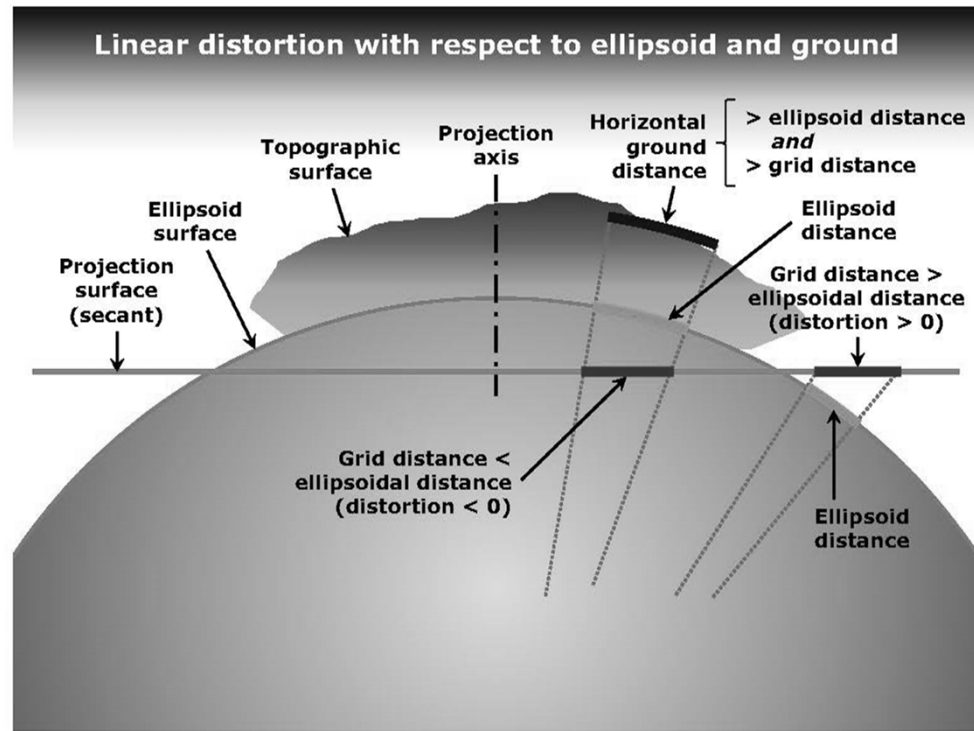
1. As non-technical as possible to keep the Board informed

The user of the data must understand the distortion associated with projecting ellipsoidal coordinates onto a plane surface.

THIS IS REPRESENTATIVE OF OUR
EXISTING STATE PLANE
DEFINITIONS BY EACH "ZONE".

EXISTING PROBLEM: CONSEQUENCE FOR
GROUND – TO – GRID MEASUREMENT:
MAP DISTANCE \neq "GROUND" DISTANCE
DUE TO MAP PROJECTION - *LINEAR DISTORTION*

Often called "grid vs. ground" problem
A PROBLEM FOR SOME GEOSPATIAL PRODUCTS
Engineering & construction plans
Survey plats and legal descriptions
As-built surveys and facilities management



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The most common “distortion” you will encounter is the ground-to-grid factor.

THIS IS WHAT YOUR SURVEYOR CAN
GENERATE WITH MODERN COLLECTION
EQUIPMENT AND COMPUTERS.

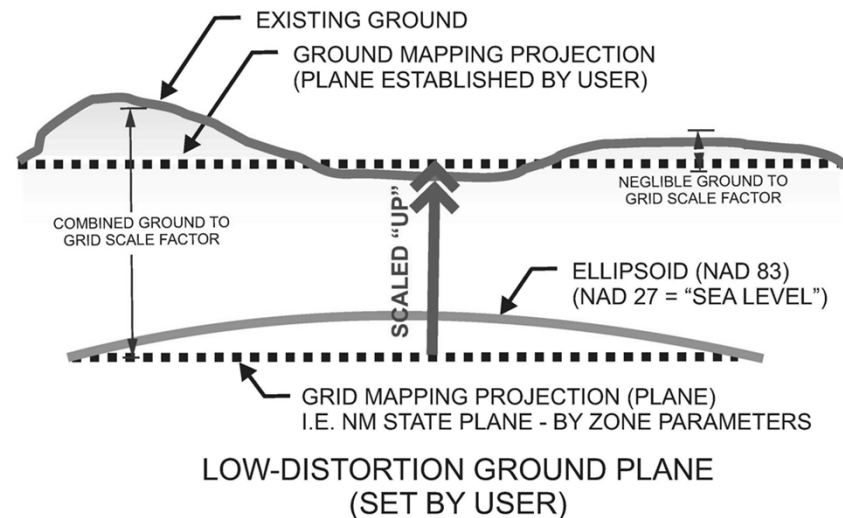
EXISTING PROBLEM: CONVENTIONS USED
BY MODERN GPS EQUIPMENT AND VIRTUAL
REFERENCE DATA COLLECTION SERVICES

ARE IMPACTED BY GEODETIC PROJECTIONS:

Creates a ground plane on a site basis (Often called
“MODIFIED GROUND COORDINATES “ on plans.)
Publishes values that are difficult to retrace by others
Usually lacks Metadata when delivered to engineer.

PRODUCES RESULTS THAT ARE “COMPUTER DRIVEN”

Survey data collectors reduce GPS data, and/or
Survey and Engineering programs could re-project, or
GIS software can re-project (and are subject to
careful data setup and conversion parameters).



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**EXISTING PROBLEM: CONVENTIONS USED
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ARE IMPACTED BY GEODETIC PROJECTIONS:**

Creates a ground plane on a site basis
Publishes values that are difficult to retrace by others
Usually lacks Metadata when delivered to engineer.

FOR THE ENGINEER MANAGER OR PRINCIPAL:

**FOR PROJECTS INITIATED WITH LOCAL BENCHMARKS AND CONTROL
ESTABLISHED – NOTHING!. FOR NEW PROJECTS, DEVELOP PROCEDURES
INCORPORATING AND PUBLISHING MORE DATA ON THE GROUND PLANE
USED.**

**IF YOU HAVE BEEN USING NM STATE PLANE REFERENCES, YOU HAVE BEEN
USING A GROUND PLANE.**

KEEP SOFTWARE CURRENT AND HAVE CAD / GIS OPERATORS TRAINED.

**ALWAYS PUBLISH A GEODETIC REFERENCE TO AT LEAST ONE KNOWN
CONTROL MONUMENT. DEMAND THIS FROM SURVEYOR USED ON THE JOB.**

FOR THE ENGINEER DESIGNER / CAD TECH / DRAFTSMAN:

**PLANSETS SHOULD PUBLISH NAME OF THE SURVEYOR AND AS MUCH
METADATA NECESSARY FOR AN ADJACENT PROJECT TO VERIFY.**

**NEW PROJECTS SHOULD DOUBLE-PUBLISH ANY REFERENCES TO YOUR
PROJECT CONTROL, I.E. DATUMS AND PROJECTIONS ON THE NEW
NATRF2022 AND NMSPS22 BASIS AND ESPECIALLY BENCHMARK
ELEVATIONS. ADD LATITUDE AND LONGITUDE TO MONUMENT DATA.**

**IDENTIFY INTERNATIONAL OR US STANDARD FOOT WHEN PUBLISHING THE
SITE SURVEY CONTROL INFORMATION (AND IN METERS).**

A PRIMER ON LOW-DISTORTION GROUND PLANE PROJECTIONS

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NEXT SECTION:

WHAT DOES THIS MEAN FOR ENGINEERS?

SOFTWARE, PROJECT SETUP, “GHOST GLITCHES” AND COMPLEXITIES.

**INCREASED COSTS TO SURVEYOR / PROVIDERS AND INTERNAL COSTS FOR
UPGRADES AND MAINTENANCE.**

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

EXISTING PROBLEM:
CONVENTIONS USED ...

PRODUCES RESULTS THAT ARE “
COMPUTER DRIVEN”:

It's not intuitive!

“GROUND PROJECTIONS:

POB Magazine, November 20, 2000 pobonline.com/articles/84998-8220-modified-to-ground to grid coordinates.

Surveyors and engineers most often elect to work with “ground coordinates.” In order to easily accomplish this with GPS, a relationship between the ellipsoid and average project elevation must be established. “Grid coordinates” are reduced to a common ellipsoid or sea level surface. A ground projection is merely the rescaling of a published “grid” mapping projection, up to average project elevation, to produce “near ground values.” ...

Setting up a ground projection as described **can be expedited by copying and editing a published grid coordinate system from the geodetic library found within many GPS software packages.**

It is imperative, though, to understand exactly what parameters are being applied in the coordinate transformation. Some other small actions or tricks may be necessary. For example, in TG Office Software (Trimble Navigation Ltd., Sunnyvale, Calif.), **it is necessary to multiply the ground zones centroid scale factor (reciprocal of the combined factor) by the grid zones central meridian scale factor. The product of this formula is the actual value entered as the ground projections defining scale factor. Caution must be exercised here because this is not an intuitive act.**”

WHAT ? (this caution is also true for Autocad 3D, ArcGIS, MicroSurvey, TBC, etc.)

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SOFTWARE PACKAGES HAVE OPTIONS FOR SETTING A SOURCE OR “BASE” DATUM THAT THE ENGINEERING AND SURVEYING TECHNICIANS USE:



“GROUND PROJECTIONS:
(from an earlier POB article) ...
“Setting up a ground projection as described can be expedited by copying and editing a published grid coordinate system from the geodetic library found within many GPS software packages.”

These fellows, and surveyors up to the 1970's, did not have a computer in their survey process. One or two people were responsible for the math.



Modern equipment and techniques have computers everywhere!

Responsibilities for the math is vested in the programs themselves and the operators who input or set up the data for a product. Most could unintentionally modify a geospatial result:

- The GPS unit and its RTK/RTN “connection”, if used,
- The data collector connected to the GPS unit and “pre-loaded” with initial positional data,
- The drone and its software, including any onboard GPS,
- The office software which ultimately produces the desired product(s) be it GIS (e.g. ArcGIS / Arcview), Surveys and Engineering transitional programs (e.g. Pix 4D, Trimble Business Center) or final plans (e.g. Autocad 3D, Microsurvey).

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

SOFTWARE PACKAGES HAVE OPTIONS FOR SETTING A SOURCE OR “BASE” DATUM THAT THE ENGINEERING AND SURVEYING TECHNICIANS USE:

ONCE THE SOURCE (OR BASE) DATUM IS SELECTED, IMPORTED DATA IS USUALLY “TRANSFORMED” INTO THAT SYSTEM BY THE SOFTWARE.

EXAMPLE:

In the ArcView (GIS) program, you initially set a projected coordinate system and datum for the work you will be doing (e.g. Data Frame = NM State Plane NAD83, Central Zone, code 3002).

Then you import data done by others (such as City / County parcels in a “geodetic” format (Lat. / Long.)

The program then projects the imported data (points or polygons) into the initially set datum and projection.

“GROUND PROJECTIONS:
(from an earlier POB article) ...
“Setting up a ground projection as described can be expedited by copying and editing a published grid coordinate system from the geodetic library found within many GPS software packages.”

The screenshot shows the 'Data Frame Properties' dialog box in ArcGIS. The 'General' tab is active, displaying 'Survey Control Station Data' for 'AMAFCA'. The 'Current coordinate system' is set to 'NAD_1983_StatePlane_New_Mexico_Central_FIPS_3002'. The 'Select a coordinate system' list is open, showing various options like 'Abidjan 1987 TM 5 NW', 'Accra Ghana Grid', etc. An arrow points to the bottom of this list.

SURVEY CONTROL STATION DATA
AMAFCA
SW AREA (ADERA VICINITY) DATE: DECEMBER, 2018
NAME OF STATION: AMOLE MONUMENT NO. 1 STATE: NM. COUNTY: BERNAILLO
SURVEYED BY: COMMUNITY SCIENCES CORP. YEAR: 2018 RECOVERED SURVEYOR: TIM PATRICK #1261
SECTION: 19 TOWNSHIP: 10N RANGE: 2E NMPM(PROJ) ATLAS GRID NO. K7
DESCRIPTION:
AMOLE MONUMENT "MOLE MONUMENT NO. 1" (MOLE MONUMENT) WAS RECOVERED BY CSC IN DECEMBER, 2018 FOR THE PURPOSE OF ESTABLISHING BAGW AND FACILITY MONITORING FOR SUSTAINANCE.
STATION IS A 1 1/2" BRASS CAP SET IN CONCRETE STAFFED 2" DIA. FLOOD CONTROL PIN APPROXIMATELY 4.5 METERS WEST FROM 1/2" ALONG 140 AND IS APPROX. 170 FT NORTH OF THE 140 ACCESS CONTROL FENCE. IT IS APPROX. 180 FT EAST OF BRISCO WEA DRIVE ALONG THE GRAVEL FRONTAGE ROAD (SUBSTATE). CONTACT AMAFCA AS THIS ROAD MAY BE DEVELOPED.
DIRECTIONS:
FROM INTERSTATE 425 AND 140, DRIVE EAST ON 140 FOR 0.5 MILES TO ARRIBO MESA DRIVE. TURN NORTH ON 02 MILES TO BRISCO WEA DRIVE. THEN NORTH ON 02 MILES TO THE GRAVEL FRONTAGE ROAD. GATES FACE FRONTAGE ROAD. LOOKED WITH ME FROM AMAFCA.
HORIZONTAL DATA:
FIELD METHOD: TRAVERSE ___ TRIANGULATION: ___ TRLATERATION: ___ GPS (STATIC) ___ GPS (RTK OR RTN):
GEOGRAPHIC POSITION (N.A.D. 83): LATITUDE: 36°04'29.1245" N LONGITUDE: 106°49'19.8082" W
N.M. STATE PLANE COORDINATES, 1983, CENTRAL ZONE (CODE 3002 HARN) BASED ON: NGS "EAGLE AIR", "REWARD" AND CITY CONTROL - GPS CALIBRATED
X: 1687808.199 X Y: 1684173.881 Y OND TO GRID FACTOR: 0.9999999999999999
ELEVATION DATA:
FIELD METHOD: SPLIT LEVEL TRIGONOMETRIC: ___ GPS (STATIC) GPS (RTK OR RTN): ___ DATUM: GEOID 08
ELEVATION: STAMPED 6326.02 FEET, 1985.26 METERS ORDER: 150, ELLIPSOID HT.: 1683.468
AZIMUTH DATA: DELTA ALPHA ANGLE: -9°12'00.0"
IN LIEU OF SPECIFIC BACKSIGHTS AND AZIMUTH ANGLES ANY RECOVERY SHOULD BE BY GPS METHODS OR BY USING OTHER ADJACENT CONTROL INCLUDING ALL ADJ. N.D. A.A. AND CITY A.S.S. MONUMENTS IN THE VICINITY. SEE COVER SHEET AND INDEX FOR THIS SET OF MONUMENTATION DATA FOR OTHER MONUMENT POSITIONAL VALUES THAT COULD BE USED.

Data Frame Properties
Annotation Groups | Extent Rectangles | Frame
General | Data Frame | Coordinate System | Illumination
Current coordinate system:
NAD_1983_StatePlane_New_Mexico_Central_FIPS_3002
Projection: Transverse_Mercator
False_Easting: 1640416.666667
False_Northing: 0.000000
Central_Meridian: -106.250000
Scale_Factor: 0.999900
Latitude_Of_Origin: 31.000000
Linear Unit: Foot_US
GCS_North_American_1983
Datum: D_North_American_1983
Select a coordinate system:
Abidjan 1987 TM 5 NW
Accra Ghana Grid
Accra TM 1 NW
Ain el Abd Aramco Lambert
American Samoa 1962 Samoa Lambert
Anguilla 1957 British West Indies Grid
Antigua 1943 British West Indies Grid
Bab South Palau Azimuthal Equidistant
Bahrain State Grid
Barbados 1938 Barbados Grid
Barbados 1938 British West Indies Grid

SOFTWARE OPTIONS ? (datum choices go way beyond Geographic or Projected - WGS84 vs. NAD 27 vs. NAD83 vs. UTM, etc.)

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

**EXISTING PROBLEM: CONVENTIONS USED
BY MODERN GPS EQUIPMENT AND VIRTUAL
REFERENCE DATA COLLECTION SERVICES
ARE IMPACTED BY GEODETIC PROJECTIONS:**

WHAT DOES THIS MEAN FOR ENGINEERS?

**Creates a ground plane on a site-by-site basis
Publishes values that are difficult to retrace by others
Usually lacks Metadata when delivered to engineer.**

FOR THE ENGINEER MANAGER OR PRINCIPAL:

KEEP SOFTWARE CURRENT AND HAVE CAD / GIS OPERATORS TRAINED.

**IDENTIFY AND AVOID SOFTWARE THAT DOES NOT HAVE SETTINGS THAT
CONFORM TO THE ADOPTED SYSTEM(S) IN THEIR UPDATES.**

FOR THE ENGINEER DESIGNER / CAD TECH / DRAFTSMAN:

**ALWAYS BE CERTAIN THAT “GHOST GLITCHES” ARE NOT AFFECTING THE
INTENDED RESULTS.**

- THAT PROGRAM “CHECK BOX” OR DEFAULT SETTING THAT SHOULD BE
USED FOR YOUR OFFICE PROCEDURES.**
- BEWARE OF GEODETIC CONVERSIONS AS A PROGRAM OPTION. DO NOT
INADVERTENTLY CALIBRATE A CALIBRATED SITE’S DATA OR
INADVERTENTLY PROJECT A PROJECTION (ALREADY DONE).**

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

WHAT DOES THIS MEAN FOR ENGINEERS?

**FOR THE ENGINEER
MANAGER OR
PRINCIPAL:**

STICKER SHOCK!

**OUR SMALL COMPANY (4+ GPS
STATIONS / ROVERS DATA
COLLECTORS) ESTIMATES THAT
TRIMBLE DIRECT COSTS WILL
EXCEED \$12,000 JUST IN
EQUIPMENT SOFTWARE – NOT TO
MENTION FIRMWARE AND
COMPATIBILITY UPGRADES WITH
DATA COLLECTORS AND GPS
BASE RECEIVERS.**

**EXISTING PROBLEM: CONVENTIONS USED
BY MODERN GPS EQUIPMENT AND VIRTUAL
REFERENCE DATA COLLECTION SERVICES
ARE IMPACTED BY GEODETIC PROJECTIONS:**

KEEP SOFTWARE CURRENT - BE PREPARED FOR INTERNAL COSTS!

- **SOFTWARE UPGRADE COSTS**
- **SUBSCRIPTION FEE INCREASES (TRIMBLE VRS EXAMPLE)**
- **FIRMWARE UPGRADES**
- **TRAINING AND JOB CONVERSION OVERHEAD**
- **COSTS FOR UPGRADING OFFICE SOFTWARE (AUTOCAD)**
- **DEBUGGING NEW VENDOR-PROVIDED DATUM CONVERSIONS**



A PRIMER ON LOW-DISTORTION GROUND PLANE PROJECTIONS

1. As non-technical as possible to keep the Board informed

NEXT SECTION:

WHAT DOES THIS MEAN FOR ENGINEERS?

DATA SHEETS AND CONTROL POSITIONS WILL BE REPUBLISHED:

- **NOAA AND NGS**
- **LOCAL GOVERNMENT (CITY OF ALBUQUERQUE)**
- **MAYBE OTHER GOVERNMENTAL UNITS (E.G. AMAFCA AND SSCAFCA)**

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

CONTROL STATION
DATA DOES NOT
CHANGE FOR
GEODETIC POSITIONS
(LATITUDE AND
LONGITUDE):

But they may be
republished as
different projected
systems (and
realizations) are
adopted.

If associated
Metadata is attached
to a control position, it
should not be too
difficult to re-project
to a different ground
projection.

“GROUND PROJECTIONS:
Control Station (monument) data changes

DATASHEETS Page 1 of 4

The NGS Data Sheet

See file [ddata.pdf](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.5.2
1 National Geodetic Survey, Retrieval Date = MARCH 14, 2019
FO1401 *****
FO1401 DESIGNATION = SAGE
FO1401 FID = FO1401
FO1401 STATE/COUNTY = NM/SANDOVAL
FO1401 COUNTRY = US
FO1401 USGS QUAD = LOS GRIEGOS (1990)
FO1401
FO1401 *CURRENT SURVEY CONTROL
FO1401
FO1401 NAD 83(1992) POSITION= 35 14 50.06187(N) 106 43 21.94169(W) ADJUSTED
FO1401 NAVD 88 ORTHO HEIGHT = 1730.1 (meters) 5676. (feet) VERTCON
FO1401
FO1401 GROUND HEIGHT = -21.288 (meters) GEOID12B
FO1401 LAPLACE CORR = 0.41 (seconds) DEFLEC12B
FO1401 HORZ ORDER = FIRST
FO1401
FO1401 The horizontal coordinates were established by classical geodetic methods
FO1401 and adjusted by the National Geodetic Survey in December 1993.
FO1401
FO1401 The NAVD 88 height was computed by applying the VERTCON shift value to
FO1401 the NGVD 29 height (displayed under SUPERSEDED SURVEY CONTROL.)
FO1401
FO1401 Significant digits in the geoid height do not necessarily reflect accuracy.
FO1401 GEOID12B height accuracy estimate available here.
FO1401
FO1401 The Laplace correction was computed from DEFLEC12B derived deflections.
FO1401
FO1401 The following values were computed from the NAD 83(1992) position.
FO1401
FO1401:
FO1401:SPC NM C - North East Units Scale Factor Converg.
FO1401:SPC NM C - 471,103.352 456,976.814 MT 0.99992280 -0 16 22.2
FO1401:SPC NM C - 1,545,611.58 1,499,264.76 sFT 0.99992280 -0 16 22.2
FO1401:UTM 13 - 3,901,821.666 343,261.522 MT 0.99990277 -0 59 39.9
FO1401
FO1401: - Elev Factor x Scale Factor = Combined Factor
FO1401:SPC NM C - 0.99973185 x 0.99992280 = 0.99965468
FO1401:UTM 13 - 0.99973185 x 0.99990277 = 0.99963465
FO1401
FO1401: Primary Azimuth Mark Grid Az
FO1401:SPC NM C - SAGE A2 MK 297 07 23.6
FO1401:UTM 13 - SAGE A2 MK 297 50 41.3
FO1401
FO1401 U.S. NATIONAL GRID SPATIAL ADDRESS: 13CV4326101821 (NAD 83)
FO1401
FO1401:
FO1401: Reference Object Distance Geod. Az
FO1401:
FO1401: CD4818 SAGE RM 2 11.786 METERS 00108
FO1401: FO1370 RIO RANCHO ESTATE WATER TANK APPROX. 4.1 KM 1020332.2
```

https://www.ngs.noaa.gov/cgi-bin/ds_desig.pl 3/14/2019

SSCAFCA SOUTHERN SANDOVAL COUNTY ARROYO
FLOOD CONTROL AUTHORITY

**SURVEY CONTROL
STATION DATA** DATE: MAY, 2014


NAME OF STATION: **BLACKS ARROYO GPS PT_253** STATE: N.M. COUNTY: SANDOVAL

SURVEYED BY: **COMMUNITY SCIENCES CORP. (SET)** YEAR: 2013 SURVEYOR: T.PATRICK #12651

SECTION: **PROJ. SEC. 35 TOWNSHIP: T 12 N** RANGE: R 2 E NMPM GRID NO. R.R. ATLAS 3 PG. 38

DESCRIPTION:
Establishment of photogrammetry panel positions (Cooper Aerial Surveys, May, 2014) and SSCAFCA monumentation May, 2014 (CSC). Two sets of control points have been established for this project. Panel points for aerial photography were set around the perimeter. The new Mason State Plane coordinate values for these points were derived from the solutions provided by the National Geodetic Survey Online Positioning User Service (OPUS). These horizontal coordinates were scaled up by a combined scale factor to produce modified ground coordinates for the project. Orthometric elevations were assigned to these points per the OPUS solutions.

The points were then collected by GPS-RTK method using the local Vectros Real-Time Network. These collected GPS points were then calibrated (adjusted) horizontally and vertically to the modified ground coordinates. This calibration is the basis for all subsequent data collection. Geoidic coordinates and state plane coordinates are on the NAD83 (2011) horizontal datum. Orthometric elevations are on the NAVD88 vertical datum. These SSCAFCA monuments were also independently collected and submitted for OPUS solutions as a check against the calibrated site Station is a 3-1/2" Brass Disk set in concrete stamped "SSCAFCA CONTROL MONUMENT", PS12651



DIRECTIONS:
FROM THE INTERSECTION OF SOUTHERN BOULEVARD AND USNER BOULEVARD, CITY OF RIO RANCHO, COMMENCE WESTERLY APPROX. 0.36 MILES TO VERANDA ROAD SE, THEN SOUTHERLY 0.38 MILES APPROX. 170 FEET PAST DOVE PL. SE, THEN LEAVING THE ROADWAY, WESTERLY APPROX. 130 FEET TO THE STATION.

HORIZONTAL DATA: CSC DERIVED NAD83 FROM MODIFIED GROUND COORDINATES JAN., 2015
FIELD METHOD: TRANSVERSE TRIANGULATION: TRILATERATION: GPS (STATIC) GPS (RTK OR RTN):

GEOGRAPHIC POSITION (N.A.D. 83): LATITUDE: **N 35° 14' 10.99221"** LONGITUDE: **W 106° 42' 03.58169"**

N.M. STATE PLANE COORDINATES, 1983, CENTRAL ZONE (CODE 3002 HARN) BASED ON: **OPUS RAPID STATIC OBSERVATION**
X = **1,505,745.72' sFT** Y = **1,541,631.41' sFT** GND TO GRID FACTOR: **0.99966662 (COMB.)**
JAN., 2015; MODIFIED GROUND COORDINATES (SURVEY BASIS): X=1,505,745.14 sFT, Y=1,541,631.56 sFT

ELEVATION DATA: GEOID 12A
FIELD METHOD: SPIRIT LEVEL: TRIGONOMETRIC: GPS (STATIC) GPS (RTK OR RTN): DATUM: **NAVD 88**

ELEVATION: **5383.76 NAVD 88 FEET, 1640.973 METERS** ORDER: **3 RD** ELLIPSOID HT. **5313.73 sFT**

AZIMUTH DATA: DELTA ALPHA ANGLE: **-0° 15' 36.74"**

STATION: **SSCAFCA CONTROL BLACKS PT-255 S 24° 59' 12" E** DISTANCE (FT.) 1833.52
SE COR LOT 11 AT VERANDA W R/W **S 65° 07' 35" E** DISTANCE (M) 558.858
187.87 57.264

NGS DATA SHEETS? (future publications will likely NOT include a list of State Plane values. For other local agencies (AMAFCA example above) it is up to the agency to provide any new publication.) New NGS data sheets will also consider the velocities of control positions.

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

METADATA WILL BE
CRITICAL FOR THE
SURVEYOR AND
ENGINEER WHEN
DIFFERING SYSTEMS
OF PROJECTED GRIDS
ARE ADOPTED:

This example file was
created by a software
program (ArcGIS) and is
filled-in by the creator
(.XML BY C. SPIROCK).
IT SHOULD BE
“ATTACHED” TO THE
DELIVERABLE
FILE(S)!

Since authoritative Digital
Geospatial Data is
governed by the NM
E&P Act, this type of data
augments the traditional
“signed and sealed”
paper documents.

“GROUND PROJECTIONS:
The importance of Metadata

Page 2 of 9

Other citation details:
Part of a monument survey including data for subsidence

Larger work citation:
Citation information:
Originators: Commu

Title:
AMAFCA control

Publication date: Au

Geospatial data pre

Other citation detail
Part of a monum
settlement for A

Spatial domain:
Bounding coordinates:
West bounding coordinate
East bounding coordinate
North bounding coordinate
South bounding coordinate

Minimum altitude: 5046
Maximum altitude: 5047
Altitude units: U.S. Ft.

Keywords:
Theme:
Theme keywords: AMAFCA
Theme keyword thesauru

Place:
Place keywords: AMAFCA

Stratum:
Stratum keywords: NW All

Access constraints: Client and author
Use constraints:
Client and authorized persons,

Point of contact:
Contact information:
Contact organization prim
Contact person: Cliff
Contact organization
Contact position: COB
Contact voice telephone:
Contact facsimile telepho
Contact electronic mail ad

Contact instructions:
PO Box 1328
Corrales, NM 87048
(505) 897-0000 ex. 10

Browse graphic:
Browse graphic file name: \\NIG
GIS AND DATA*.PDF PRINTS
Browse graphic file description:
Series of control monument
Browse graphic file type: PDF

Data set credit:
C.A. Spirock NMPLS #4972

Security information:
Security classification system: None

file:///C:/Users/caspirock.CSC/AppData/Local/Temp/metadata20.htm 9/25/2018

Description:
Abstract:
This monument station is part of
AMAFCA to determine geodetic po
monument control sheets for use
Albuquerque, NM area, NW area

Purpose:
This is one monument as part of
the Albuquerque Metropolitan Ar
Sciences Corporation, Thomas W.
prepared for control monument d
Dam Basin control system vicinity
monuments, City of Albuquerque,
MRCOG Bernalillo County orthoph

Supplemental information:
This is one monument extracted fr
Monument" data sheet. The proje
found and verified. Other control
data table. Also, the cover sheet
methodology used and contains a
Consulting) circa. 2012.

*Language of dataset: en

Time period of content:
Time period information:
Single date/time:
Calendar date: 7/31/2018

Currentness reference:
August, 2018

Status:
Progress: Complete
Maintenance and update frequency:

file:///C:/Users/caspirock.CSC/AppData/Local/Temp/metadata20.htm 9/25/2018

Page 1 of 9

AMAFCA NW CONTROL COVER PIEDRAS MARCARDAS 2018.mxd

Data format: Map

File or table name: AMAFCA NW CONTROL COVER PIEDRAS MARCARDAS 2018.mxd

Coordinate system: Geographic

Theme keywords: AMAFCA, Control monuments

Abstract: This monument station is part of a survey to revisit control monuments for AMAFCA to determine geodetic positions, verify elevations and to create monument control sheets for use by the agency and others. The sites are in the Albuquerque, NM area, NW area quadrant.

FGDC and ESRI Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

Metadata elements shown with blue text are defined in the Federal Geographic Data Committee's (FGDC) [Content Standard for Digital Geospatial Metadata \(CSGDM\)](#). Elements shown with green text are defined in the [ISDS Profile of the CSGDM](#). Elements shown with a green asterisk (*) will be automatically updated by ArcCatalog. ArcCatalog adds hints indicating which FGDC elements are mandatory; these are shown with gray text.

Identification Information:

Citation:
Citation information:
Originators: Community Sciences Corporation

*Title:
AMAFCA NW CONTROL COVER PIEDRAS MARCARDAS 2018.mxd
*File or table name: AMAFCA NW CONTROL COVER PIEDRAS MARCARDAS 2018.mxd

Publication date: August 31, 2018
Geospatial data presentation form: map

Series information:
Series name: Control Monument detail sheets.
Issue identification: CSC surveys (these data)

Publication information:
Publisher: Community Sciences Corporation

file:///C:/Users/caspirock.CSC/AppData/Local/Temp/metadata20.htm 9/25/2018

METADATA? (the Data about the Data.)

This should be expected from your surveyor

A NEW DATUM FOR NOAA AND NGS (IN ADDITION TO NAD27, NAD83, WGS84, ETC.)

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022)

WHAT DOES THIS MEAN FOR ENGINEERS?

LEARN ABOUT MODIFIED GROUND PLANES IN USE TODAY.

PAY PARTICULAR ATTENTION TO SOFTWARE AVAILABLE FOR DATUM SHIFTS AND THE ABILITY TO ACCEPT THE NEW PROJECTIONS TO NMSP2022.

LOOK FOR REVISIONS TO CONTROL STATION DATA SHEETS (SUCH AS NOAA, CITY OF ALBUQUERQUE, AMAFCA, ETC.)

WATCH OUT FOR NEW VERTICAL (ELEVATION) COMPONENTS AFFECTING ORTHOMETRIC HEIGHTS (BENCHMARK ELEVATIONS) FOR YOUR PROJECTS.

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

**WHAT DOES THIS MEAN FOR
ENGINEERS?**

**WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?**

**A NEW DATUM FOR NOAA AND
NGS:**

**(IN ADDITION TO NAD27, NAD83,
WGS84, ETC.)**

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022).
4. Geoid 18 (Beta now)
5. Changes to OPUS procedures

WHY ?

Why is NGS replacing NAD 83 and NAVD 88?

NAD 83 and NAVD 88, although still the official horizontal and vertical datums of the National Spatial Reference System (NSRS), have been identified as having shortcomings that are best addressed through defining new horizontal and vertical datums. Specifically:

- NAD 83 is non-geocentric by about 2.2 meters.
- NAVD 88 is both biased (by about one-half meter) and tilted (about 1 meter coast to coast) relative to the best global geoid models available today.

These issues derive from the fact that both datums were defined primarily using terrestrial surveying techniques at passive geodetic survey marks. This network of survey marks deteriorates over time (both through unchecked physical movement and simple removal), and resources are not available to maintain them.

More: <https://geodesy.noaa.gov/geospatial-summit/2019/presentations.shtml>

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

WHAT DOES THIS MEAN FOR
ENGINEERS?




WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?

A NEW DATUM FOR NOAA AND
NGS:

(IN ADDITION TO NAD27, NAD83,
WGS84, ETC.)

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022).

NOTE: COMMENT PERIOD CLOSING.



Your NAD 83-Based State Plane-Legislated Coordinates Will Not Be Maintained after 2022!

What will you and your fellow professionals do?
Panic? Ignore the Issue? or Act?
Please let us know!

What is changing?
The North American Datum of 1983 (NAD 83) will be replaced in 2022. The new datum will have a different name.
The North American Vertical Datum of 1988 (NAVD 88) will also be replaced in 2022. Its replacement will also have a new name.

Expected horizontal shifts from NAD 83 to the new datum are in the 1-2 meter range. The National Geodetic Survey will provide a coarse, map-grade transformation tool (such as NADCON and GEOCON) to connect NAD 83 with the new datum.

Who will be affected?
All states and territories will be transitioned to the new datums. Forty-eight states have a state-specific coordinate system law tied to NAD 83. **Your state law will not reflect the National Spatial Reference System after 2022.**

Who can help?
The National Geodetic Survey (NGS), the National Society of Professional Surveyors (NSPS) and the American Association for Geodetic Surveying (AAGS) are here to help your state make these changes in legislation!

You can help by understanding your own state's laws and how these changes will impact you.

The Federal Register Notice (83 FR 17149) states:

NOAA's National Geodetic Survey (NGS) will establish the State Plane Coordinate System of 2022 (SPCS2022) as part of the transition to the 2022 Terrestrial Reference Frames (TRFs). SPCS2022 is the successor to previous versions referenced to the North American Datums of 1983 and 1927....NGS has developed draft policy and procedures that propose defining characteristics and requirements for SPCS2022. These documents also provide mechanisms for user input on initial design of SPCS2022 and subsequent changes. The aim is for SPCS2022 to meet the needs of NGS customers for the future NSRS. To achieve that goal, NGS is inviting written comments on the draft SPCS2022 policy.

(due August, 2019) for the comment period.

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

WHAT DOES THIS MEAN FOR
ENGINEERS?

WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?

A NEW DATUM FOR NOAA AND
NGS:

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022)

**2022 VERTICAL CHANGES AND
FUTURE 5-YR CHANGES FROM NOAA
MONITORING INCLUDING FEEDBACK**

EXISTING PROBLEM: ORTHOMETRIC HEIGHTS CHANGES AND MASS MOVEMENT = GEOID MONITORING SERVICE (GEMS)

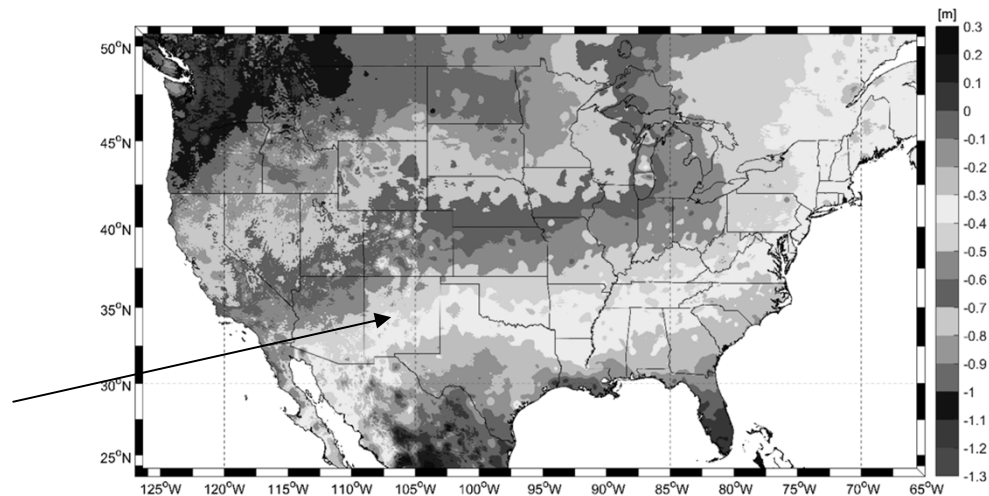
OUT: NAVD 88, DATUMS FOR ISLANDS, GRAVITY MODELS, IGLD 85, ETC.

IN: NAPGD2022

- CAN DETERMINE GEOID HEIGHTS, ORTHOMETRIC HEIGHTS, GRAVITY, DOV, ETC.
- ALL RELATED THROUGH FIVE ARCMINUTE REFERENCE FIELD
- HIGHER RESOLUTION PRODUCTS (ONE ARCMINUTE) FOR GEOID, DOV, GRAVITY

GEMS TO ACCOUNT FOR TIME VARIABILITY OF GEOPOTENTIAL FIELD

- MASS VARIATIONS DUE TO SECULAR, EPISODIC AND PERIODIC CHANGES
- APPLY A TIME VARYING FIELD TO ACCOUNT FOR CHANGES IN POSITION/DATUM
- WORKS IN CONJUNCTION WITH VERTICAL COMPONENT OF IFVM



THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

WHAT DOES THIS MEAN FOR
ENGINEERS?

WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?

A NEW DATUM FOR NOAA AND
NGS:

(IN ADDITION TO NAD27, NAD83,
WGS84, ETC.)

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022)

EXISTING PROBLEM: NEW MEXICO STATE PLANE ZONES:

TRANSVERSE MERCATOR PROJECTION

Now 3 Zones conforming to County lines.

THEY CAN CHANGE WITH NEW DATUMS (REALIZATIONS)

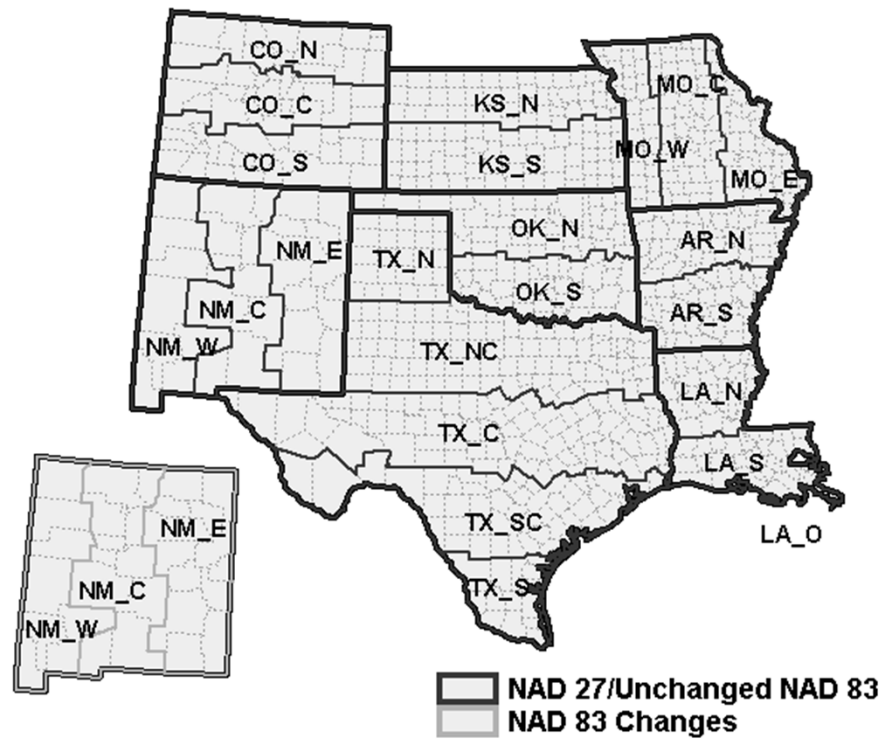
Map shows changes resulting from NAD27 to NAD 83

Nad83 has four current realizations.

ASIDE: NAVAJO HOUSING AUTHORITY USES A DOUBLE STEREOGRAPHIC PROJECTION

In addition to NMSP, AZSP, UTM and other projections.

Developed due to scaling and distortion resulting from reservation size.



THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

**WHAT DOES THIS MEAN FOR
ENGINEERS?**

**WHAT CAN THE BOLPEPS EXPECT FOR
NEW LEGISLATION AND RULES?**

**A NEW DATUM FOR NOAA AND
NGS:**

**(IN ADDITION TO NAD27, NAD83,
WGS84, ETC.)**

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022)

**EXISTING PROBLEM: NEW MEXICO
STATE PLANE ZONES:**

**THE INDIVIDUAL STATES ARE DELIBERATING AND
RECOMMENDING A STATE PLANE SYSTEM TO FIT
THEIR NEEDS.**

And notes from NMPS (Chris Pappas):

- The NGS is defining a new state plane coordinate system. Over the years with continuous observation of the earth a new center of mass of the earth has been calculated. It is approximately 2 meters or 6 feet different from the currently used center. The new coordinate system addresses this difference.
- Currently there is confusion as to which foot definition to use, NGS's proposed solution is to use the international foot. This will eliminate some of the confusion going forward.
- The new SPC 2022 will be a closer approximation of the surface of the earth and will have less distortion than the old system.

and you may want to mention... **that the longitude will change to an east based system with 0 starting at the current 180 longitude in the pacific and continuing east to Greenwich making it 180 degree longitude (no longer zero).**

So New Mexico will be at 74 degrees longitude east and not 106 degrees west longitude!

CHANGE IN LONGITUDE?

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MINUTES OF PUBLIC MEETING OF THE ARIZONA
GEOGRAPHIC INFORMATION COUNCIL DATA
COMMITTEE – State Plane Coordinates 2022 Work
Group (note costs if not using NOAA defaults):

- Selection of linear unit and outreach efforts to other States The discussion continued regarding response considerations, such as official linear unit. Presently Arizona is an international foot state; this is a minority in the country. ...
NGS will only support a 'default' approach for design of new SPCS. States will need to pay for their own development tools (discuss outreach to other States to partner on LDP design software). NGS will only commit resources to default approach; they are not creating special purpose zones. They may allow a state to produce and submit their own designs for review, but we will have to pay for it as a state; potential for cost sharing. LDP software may be available from a previous company Michael Dennis created. ...
Grants available? NGS does not have money to provide software for individual state design; \$40,000 for turning on the mentioned software for a year ...

**CHANGE IN A FOOT UNIT?
(International foot (3.28084 Ft / Meter) vs.
U.S. Survey foot (3.28083 Ft / Meter)**

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**Fate of the U.S. Survey Foot after 2022: A Conversation with
NGS**

April 25, 2019, 2 pm, Eastern Time

Dr. Michael Dennis, National Geodetic Survey:

Having two feet is great for people, but not so good for standards. Since 1959, two definitions of the foot have been used in the U.S. One is the "international foot", adopted nationwide at that time. The other is the "U.S. survey foot", a renamed perpetuation of the 1893 definition that was intended as temporary. Although the U.S. survey foot is longer by only 2 parts per million (0.01 foot per mile), having both in use at the same time creates real problems with real costs. The result is decades of confusion and chaos in fields where large distances and coordinates are used, such as surveying and mapping. NGS missed an opportunity to fix this problem in 1986, with the change from the NAD 27 to NAD 83 datums. Another opportunity is in 2022 with the modernization of the National Spatial Reference System. The referenced webinar reviews the history of the foot, discusses the vital importance of standards, and gives examples of problems created by having two feet

https://www.ngs.noaa.gov/web/science_edu/webinar_series/fate-of-us-survey-foot.shtml

CHANGE IN A FOOT UNIT?

A NEW DATUM FOR NOAA AND NGS (IN ADDITION TO NAD27, NAD83, WGS84, ETC.)

2. North America Terrestrial Reference Frame of 2022 (NATRF2022) (NGS)
3. Simultaneous release of new vertical datum: North America-Pacific Geopotential Datum of 2022 (NAPGD2022).
4. Geoid 18 (Beta now)
5. Changes to OPUS procedures

WHAT DOES THIS MEAN FOR ENGINEERS?

NOW FOR THE “ELEPHANT IN THE ROOM”

STATE PLANE ZONES AND LOW-DISTORTION GROUND PLANE SURFACES!

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

TAILORED FOR THE QUESTION(S)

WHAT DOES THIS MEAN FOR
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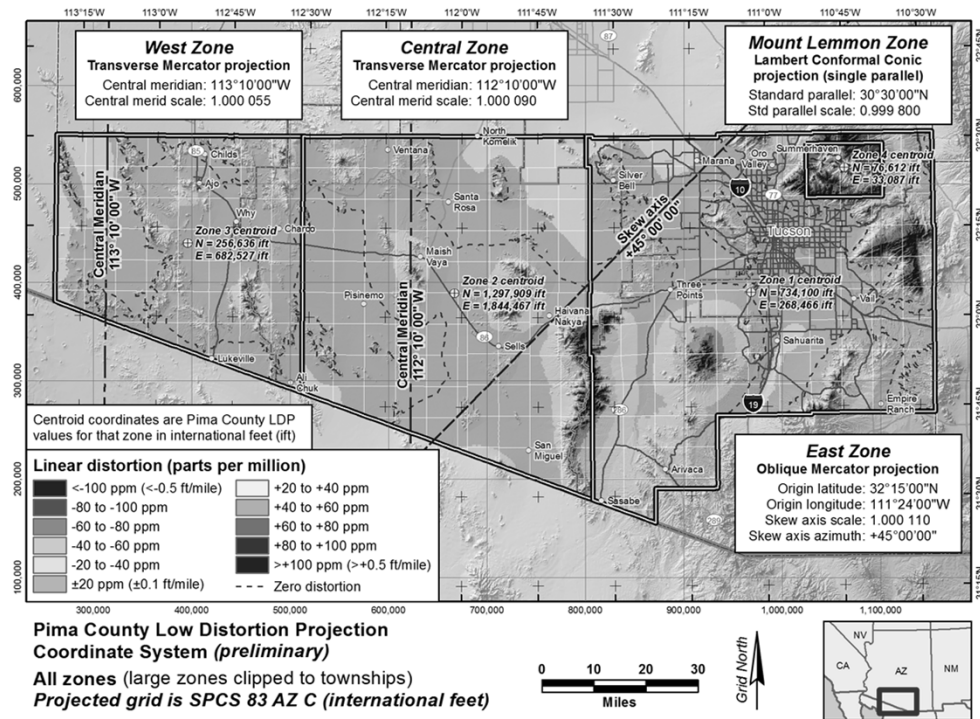
A NEW DATUM FOR NOAA AND
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EXISTING PROBLEM: NEW MEXICO
STATE PLANE ZONES:

THE INDIVIDUAL STATES ARE DELIBERATING AND
RECOMMENDING A STATE PLANE SYSTEM TO FIT
THEIR NEEDS (SAMPLE FROM ARIZONA):



PIMA CO. ARIZONA - (example of LDP system (M. Dennis): 4 Zones for one county! Colorado considering even more zones per county (and changing from Lambert Conformal to Transverse Mercator). Bernalillo County, NM may end up with multiple zones!

THE FUTURE OF SURVEYING (2019 RETREAT PRESENTATION)

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ADDITIONAL RESOURCES:

[HTTPS://GEODESY.NOAA.GOV/WEB/SCIENCE_EDU/PRESENTATIONS_LIBRARY/FILES/STONE_NMGIC_2019_UPLOAD.PDF](https://geodesy.noaa.gov/web/science_edu/presentations_library/files/stone_nmgic_2019_upload.pdf)

[\(HTTPS://GEODESY.NOAA.GOV/WEB/SCIENCE_EDU/PRESENTATIONS_LIBRARY/\)](https://geodesy.noaa.gov/web/science_edu/presentations_library/),

LIST OF RECORDED WEBINARS

[HTTPS://GEODESY.NOAA.GOV/WEB/SCIENCE_EDU/WEBINAR_SERIES/2019-WEBINARS.SHTML](https://geodesy.noaa.gov/web/science_edu/webinar_series/2019-webinars.shtml),

WEB PAGES ABOUT STATE PLANE AT

[HTTPS://GEODESY.NOAA.GOV/SPCS/INDEX.SHTML](https://geodesy.noaa.gov/spcs/index.shtml).

UNDER THE "STATE PLANE POLICY" QUICK LINK ON THE LEFT (IN THE SITE), YOU WILL FIND THE CURRENT VERSION OF SPCS2022 POLICY AND PROCEDURES

IMPACTS ON NEW MEXICO LAWS AND CONVENTIONS (AS THEY ARE REFERENCED IN VARIOUS STATUTES)

NEXT SECTION:

WHAT DOES THIS MEAN FOR ENGINEERS?



YOUR STATE BOARD OF LICENSURE WILL HAVE TO PLOW THROUGH A LOT OF EXISTING LEGISLATION FOR ANY RECOMMEND REVISIONS TO THE E&P ACT, ADMINISTRATIVE CODE, AND MINIMUM STANDARDS. FORTUNATELY, MY QUICK RESEARCH, SO FAR, DOES NOT INDICATE ANY REVISIONS TO THIS PART OF THE LAW.

IN ADDITION TO THE LAWS WE ARE NORMALLY FAMILIARIZED WITH, WE MAY BE ASKED TO RECOMMEND CHANGES TO OTHER LAWS AND CODES (SUCH AS):

- **PROPERTY LAW**
- **SUBDIVISION ACT**
- **CONDOMINIUM ACT**
- **CLERK AND RECORDING PROVISIONS**

NOT TO MENTION EDUCATIONAL SESSIONS WITH LEGISLATORS, STATE EXECUTIVES AND ADMINISTRATORS, ETC.

TOPIC: TO CHANGE THE EXISTING STATUTES AND RULES!

Examples of Legislative changes:

Obviously, Statute sections like these must be carefully reworded

2017 New Mexico Statutes
Chapter 47 - Property Law
Article 1 - Conveyances and General Provisions
Section 47-1-53 - Definition of coordinate survey.

Universal Citation: NM Stat § 47-1-53 (2017)

47-1-53. Definition of coordinate survey.

A. For purposes of more precisely geodetic survey is adopted:

- (1) the New Mexico coordinate system, west zone, which meridian the scale is set at one part in 12,000 of the parallel 31 00' north latitude;
- (2) the New Mexico coordinate system, central zone, which meridian the scale is set at one part in 12,000 of the parallel 31 00' north latitude;
- (3) the New Mexico coordinate system, east zone, which meridian the scale is set at one part in 12,000 of the parallel 31 00' north latitude; and
- (4) the origin for each zone is assigned the coordinates: for the west zone $x = 830,000$ meters and $y = 0$ meters; for the central zone $x = 0$ meters and $y = 0$ meters; and for the east zone $x = 0$ meters and $y = 0$ meters.

B. The position of the New Mexico coordinate system shall be determined by the standards adopted by the national ocean survey and national geodetic survey. Any such station may be used for establishing a survey connection with the New Mexico coordinate system.

History: 1953 Comp., 70-1-51, enacted by Laws 1957, ch. 147, 5; 1989, ch. 104, 5.

Section 47-1-49 — New Mexico coordinate system; zones.

47-1-49. New Mexico coordinate system; zones.

The system of plane coordinates which has been established by the national ocean survey and national geodetic survey for defining and stating the positions or locations of points on the surface of the earth within the state of New Mexico shall be known and designated as the "New Mexico coordinate system."

For the purpose of this section, the area of the state shall be divided into three zones, to be known as the "west zone," the "central zone," and the "east zone." The area of the west zone shall be that part of the state lying west of a meridian passing through the point of intersection of the parallel 31 00' north latitude and the meridian of longitude 106 30' west of Greenwich. The area of the central zone shall be that part of the state lying east of the meridian of longitude 106 30' west of Greenwich and west of the meridian of longitude 105 30' west of Greenwich. The area of the east zone shall be that part of the state lying east of the meridian of longitude 105 30' west of Greenwich.

2017 New Mexico Statutes
Chapter 47 - Property Law

Article 1 - Conveyances and General Provisions

Section 47-1-51 - Plane coordinates, x and y; definition.

Universal Citation: NM Stat § 47-1-51 (2017)

47-1-51. Plane coordinates, x and y; definition.

The plane coordinates of a point on the earth's surface, to be used in expressing the position or location of the point, shall be expressed in feet and inches, and shall be designated as "x" and "y" coordinates, on the national ocean survey datum of 1983. One of the coordinates shall be the east-and-west direction, and the other shall be the north-and-south direction. The origin of the coordinates shall be determined by the national ocean survey and national geodetic survey, and shall be divided by 3937 exact parts.

History: 1953 Comp., 70-1-48, enacted by Laws 1957, ch. 147, 2; 1989, ch. 104, 2.

Article 1 - Conveyances and General Provisions

Section 47-1-50 - Zone designations.

Universal Citation: NM Stat § 47-1-50 (2017)

47-1-50. Zone designations.

As established for use in the east zone, the New Mexico coordinate system shall be named and in any land description in which it is used it shall be designated the "New Mexico coordinate system of 1927, east zone" or the "New Mexico coordinate system of 1983, east zone".

As established for use in the central zone, the New Mexico coordinate system shall be named and in any land description in which it is used it shall be designated the "New Mexico coordinate system of 1927, central zone" or the "New Mexico coordinate system of 1983, central zone".

As established for use in the west zone, the New Mexico coordinate system shall be named and in any land description in which it is used it shall be designated the "New Mexico coordinate system of 1927, west zone [zone]" or the "New Mexico coordinate system of 1983, west zone".

History: 1953 Comp., 70-1-48, enacted by Laws 1957, ch. 147, 2; 1989, ch. 104, 2.

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TOPIC:

TO CHANGE THE EXISTING STATUTES AND RULES!

Current NSPS Template for Legislative changes:

Possible NMBOLPEPS Committee to review and draft model for introduction?

Template Draft NSRS Legislation (NSPS - Oct, 2019):

How to use this template:

- 1) Whenever the word “state” is used below, it should be taken to mean “state or territory”
- 2) The intent of this template is to augment, not fully replace, existing state laws dealing with a state-specific coordinate system and its relationship to existing or prior datums of the National Spatial Reference System (NSRS).
- 3) The National Geodetic Survey (NGS) intends to release a new State Plane Coordinate System (SPCS) as part of the release of any new geometric datum, including that planned for release in 2022. As such, it is imperative that each state do the following:
 - a. Ensure that any changes from the 1983 SPCS which the majority of geospatial professionals in the state wish to make, be agreed
 - b. at the state level and communicated to NGS, prior to 2022 and
 - b. Ensure that any law naming the state-specific coordinate system contains a definition of how that state-specific coordinate system relates to the SPCS.

For example, if Michigan wishes to legislate that the “Michigan Plane Coordinate System” be used in the state of Michigan, then the law should specify that the “Michigan Plane Coordinate System” is identical to (or in some other way, defined in the law, related to) the “Michigan portion of the State Plane Coordinate System as defined by the National Geodetic Survey”.
- 4) Related to #2 above, language should *connect* the state-desired coordinate system to the federally-defined SPCS, while leaving state and federal responsibilities independent.

For example, both NGS and the California Spatial Reference Center (CSRC) cannot be *jointly* responsible for the California Plane Coordinate System (if that is the name chosen by California). If the CSRC is going to define the California Plane Coordinate System, they should solely define it, and have the law reflect how it relates to the federal (NGS-specified) SPCS.
- 5) Reference to specific years or datum names within the NSRS should be avoided, as the intent of the template is to provide legislation that will be accurate and relevant both today (under NAD 83), through the new datum (in 2022) and beyond to whatever datums come after 2022.
- 6) Wherever the phrase “<state>” is used in the template below, insert the name of your specific state or territory.
- 7) Sections which are considered optional are set aside (in parentheses and in red)
- 8) Sections which are explanatory and not to be copied into the law are in ***bold and italic***.
- 9) Parts of the law where a choice of options must be made are set <in brackets and highlighted>
- 10) While most states legislate the use of a *planar* coordinate system, this template addresses both *planar* and *geodetic* coordinates, to provide the greatest flexibility across all states

TOPIC: TO CHANGE THE EXISTING STATUTES AND RULES!

Possible NMBOLPEPS
Committee to review
and draft model for
introduction?

Template Draft NSRS Legislation (NSPS - Oct, 2019) Continued:

I. Acronyms

The following acronyms will be used throughout this law in order to increase conciseness.

NSRS = The National Spatial Reference System or its successors

NGS = The National Geodetic Survey or its successors

SPCS = State Plane Coordinate System or its successors

*PCS = <state> Plane Coordinate System (*where * is the first letter of the state*)

(If a state feels clarity about the above terms is necessary, then insert a possible hierarchical section here, outlining that the NSRS is the overarching system, and that below that are various datums. Below the datums are projected coordinates within the datums, including the SPCS)

II. The <state> Plane Coordinate System

The most recent system of plane coordinates which has been established by NGS, based on the NSRS, and known as the SPCS, for defining and stating the positions or locations of points on the surface of the earth within the State of <state> shall be known as the "<state> Plane Coordinate System." ***This paragraph should serve, provided states do not wish to deviate from the SPCS.***

If they do, see the third parenthetical below.

(Details how such a system should be used within your state)

(Keep existing 27/83 definitions in place)

(Any state or territory wishing to define other projections besides those found in NGS's SPCS should do so here. If the state-specific Plane Coordinate System will include anything like this, which is outside the scope of the SPCS, make sure not to attribute any aspects of it to NGS nor to the SPCS, but only to whatever state agency is going to define this exo-SPCS component of the state-specific Plane Coordinate System)

The plane coordinates of a point on the earth's surface, to be used in expressing the position or location of the point in the appropriate zone of the *PCS, shall consist of two distances, expressed in feet and decimals of a foot or meters and decimals of a meter. When the values are expressed in feet, the <define which foot to be used. Either "U.S. Survey foot," (one U.S. Survey foot = 1200/3937 meters) or "International foot," (one International foot = 0.3048 meters)> shall be used as the standard foot for *PCS. One of these distances, to be known as the "East x-coordinate," shall give the distance east of the Y axis; the other, to be known as the "North y-coordinate," shall give the distance north of the X axis. The Y axis of any zone shall be parallel with the central meridian of that zone. The X axis of any zone shall be at right angles to the central meridian of that zone.

(insert text about accuracy and use of points in the system)

TOPIC: TO CHANGE THE EXISTING STATUTES AND RULES!

**Possible NMBOLPEPS
Committee to review
and draft model for
introduction?**

Template Draft NSRS Legislation (NSPS - Oct, 2019) Continued:

III. Geodetic Coordinates

This section would only be inserted for those states specifically wishing to legislate the use of geodetic coordinates.

The official geodetic datums to which geodetic coordinates (including, but not limited to, latitude, longitude, ellipsoid height, orthometric height or dynamic height) are referenced within the State of <state> shall be as defined for the NSRS (insert any state specific information about how the NSRS is realized or accessed). ***The use of dynamic height in the above sentence is optional.***

(Statement about other geodetic work)

The provisions of this chapter shall not be construed to prohibit the appropriate use of other datums and other geodetic reference networks.

(Possible wording about “state specific geodetic coordinates” to include heights – note, the committee does not endorse this approach, but does not feel it must be prohibited. However, any state-specific geodetic coordinate which differs from the NSRS, is not part of the NSRS. **No attribution of *state-specific* geodetic coordinates should be made to NGS or to the NSRS).**

FOR THE NMBOLPEPS:

**DO WE ADOPT TEMPLATE CHANGES REFERING ALL TO NGS/NOAA (AS RECOMMENDED)
INCLUDING THE ADOPTION OF THE INTERNATIONAL FOOT?**

DO WE RECOMMEND SPECIALIZED, TAILORED SYSTEMS AND PROVIDE DEFINITIONS?

**DO WE USE CURRENT DEFINITIONS FOR NAD27 AND NAD83 AS NOW STATED (KEEP FOR
PRE-2022 POSTERITY) AND ADD NEW LANGUAGE FOR SYSTEMS ADOPTED IN 2022?**

**WHAT TO DO ABOUT OFFICIAL NMSP “ZONES” (POSSIBLY 35 COUNTIES X 3 = ESTIMATED
>100 ZONES)?**

TOPIC: THE FUTURE OF SURVEYING TO CHANGE THE EXISTING STATUTES AND RULES!

BOARD MEMBERS MUST RESPECT THREE PRIMARY
LAWS AND "RULES" AND THEIR HIERARCHY

1. THE ENGINEERING AND PRACTICE ACT

THIS IS THE LEGISLATIVE ACT THAT WE RECENTLY LOBBIED FOR IN
THE 2019 SESSION

OUR BOARD SHOULD HAVE LANGUAGE CHANGES TO OUR ACT IN
PLACE AND REVIEWED ABOUT 4 MONTHS PRIOR TO BILL
SPONSORSHIP.



**CHANGES CAN ONLY
OCCUR BY LEGISLATIVE
SESSION DEBATE, TESTIMONY
AND ENACTMENT
(GOVERNOR SIGNS BILL)**

2. THE STATE ADMINISTRATIVE CODE

OCCUPATIONAL AND PROFESSIONAL LICENSING CHAPTER 39
ENGINEERING AND SURVEYING PRACTITIONERS .

TITLE 12, CHAPTER 8, PART 2, NEW MEXICO ADMINISTRATIVE CODE

MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO



**CHANGES REQUIRE A "RULES
HEARING" WHICH MUST BE
ADVERTISED, SCHEDULED
AND HEARD WITH WRITTEN
OR ORAL TESTIMONY FROM
PUBLIC**

3. POLICIES ADOPTED BY OUR BOARD

SHOULD BE REVIEWED FOR INCONSISTENCIES AFTER RULE CHANGES.

EXAMPLE: ADVISORY OPINIONS

NOTE:

**OUR BOARD MAY BE REQUESTED TO COORDINATE
LANGUAGE OR OTHER CHANGES TO STATUTES, SUCH AS
CH. 47 NMSA, PROPERTY LAW AND THE SUBDIVISION ACT.**



**CHANGES REQUIRE AN
AGENDA ITEM AT A PUBLIC
COMMITTEE HEARING WITH AN
INITIAL DRAFT OF THE CHANGES
AND A RESOLUTION TO ADOPT
OR MODIFY AN EXISTING
POLICY**

IMPACTS ON NEW MEXICO LAWS AND CONVENTIONS (AS THEY ARE REFERENCED IN VARIOUS STATUTES)

PRESENTER'S RECOMMENDATIONS:



- NCEES PARTICIPANTS SHOULD INQUIRE AND MONITOR WHAT OTHER STATES ARE FORMATTING FOR LEGISLATIVE LANGUAGE.
- THIS BOARD SHOULD BEGIN INQUIRIES FROM NM LEGISLATIVE ANALYSISTS AND LEADERSHIP ABOUT THE STRUCTURE AND RIPPLE-EFFECT OF NEW LANGUAGE IN OTHER NMSA SECTIONS (SUCH AS PROPERTY LAW).
- SOMEONE SHOULD RECOMMEND THE ADOPTION OF NSPS LANGUAGE *OR* – THE PUBLICATION OF A “BLUE BOOK” OR SIMILAR DESCRIPTIVE STATE PLANE HANDBOOK WHICH COULD BE ADOPTED BY THE BOARD, AND THEN REFERRED TO IN THE LEGISLATIVE LANGUAGE CHANGES.
- REMEMBER, THE “OLD” NM STATE PLANE SYSTEM DOESN’T JUST “GO AWAY”. THE VALUES WE NOW USE WILL GRADUALLY BECOME A REFERENCE THAT IS STILL VALID FOR DATA PUBLISHED ON CURRENT PLATS, MAPS, CONTROL SHEETS, ETC.
- RECONSIDER DEFINING AND REQUIRING METADATA IN THE NMAC AS AN INCLUDED RESPONSIBILITY PARTICULARLY FOR DIGITAL GEOSPATIAL DATA WHERE A SEAL AND SIGNATURE MAY NOT BE PRACTICAL.

TOPIC: THE FUTURE OF SURVEYING

- **YOUR BOARD APPRECIATES THE OPPORTUNITY TO FOR THE AUDIENCE TO PARTICIPATE IN OUR RETREAT !**
- **ANY ADVICE OR THOUGHTS SHOULD BE DIRECTED TO OUR STAFF:**
PERRY M. VALDEZ, EXECUTIVE DIRECTOR Perry.Valdez@state.nm.us

THANK YOU !

SLIDESHOW ORGANIZATION:

CLIFF A. SPIROCK, NMPLS 4972, BOARD CHAIR 2019

SPECIAL THANKS TO WM. STONE AND MICHAEL DENNIS, NOAA.