

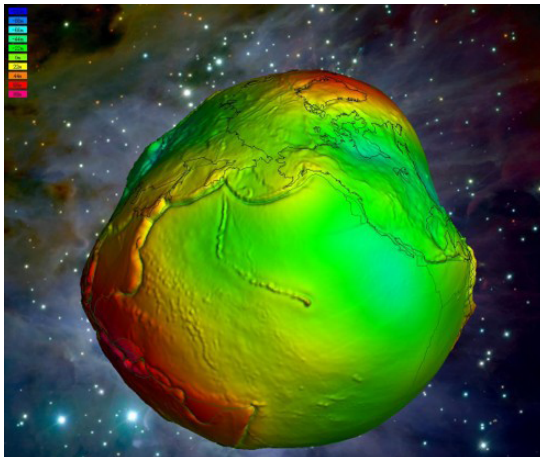
National Spatial Reference System 2022 Modernization

BE AWARE SO YOU CAN PLAN AHEAD TO BE PREPARED

BACKGROUND

NATIONAL SPATIAL REFERENCE SYSTEM (NSRS)

- The official and best coordinate systems of the U.S. defined by the National Geodetic Survey (NGS), an agency within the National Oceanic and Atmospheric Administration (NOAA). **It is the basis for positioning in the United States.**
- Defines where things are, how high and far apart they are, direction between things, their accuracy, and how things change with time. **It defines where “zero” is and how to measure from zero.**
- Widely used by state and local government agencies and private industry.
www.legis.iowa.gov/docs/code/355.16.pdf
- Use of the NSRS is required for all civilian federal government agencies (e.g., OMB A-16, Geospatial Data Act 2018).
- Federal Geodetic Control Subcommittee (FGCS) will approve the NSRS 2022 adoption.



KEY TERMS

Datum

The underlying reference system that defines: origin, orientation, and shape. ***If the datum shifts - everything shifts***

Geospatial (Geodetic) Datum or Reference Frame

A reference for “where”, such as the sea level, to provide known locations to begin surveys and create maps.

Global Navigation Satellite Systems (GNSS)

Satellite constellations orbiting earth that provide precise, global positioning, velocity, and timing data to receivers.

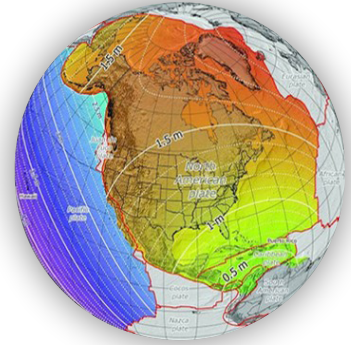
Iowa Real-Time Network (IaRTN)

Iowa's global navigation satellite system (GNSS) reference station network. The network consists of 83 continually operating reference stations (CORS) strategically placed across the state at Iowa Department of Transportation's maintenance facilities.

KEY CHANGES

Horizontal (NAD 83) and vertical (NAVD 88) datums have known errors:

- Sudden "SHIFT"
 - Horizontal change of about 0.5–4 m (1.5–12 ft)
 - Elevation change of about ± 2 m (± 6 ft)
- Continuous "DRIFT" due to crustal motion
 - Up to about 8 cm/yr (4 in/yr) for tectonic plates
 - Able to remove most by modeling crustal motion



- **Coordinates in modernized NSRS will always have a date.**

New datums (e.g., State Plan Coordinate System (SPCS) 2022) are transitioning to international feet as a unit of measure. U.S. survey feet will only be supported for legacy applications (e.g., SPCS 1983).

- Change in coordinates can be minimized (most "drift" can be removed)
- Can determine coordinates at a specific time (to keep datasets consistent)
- **With the move to international feet for SPCS2022, it's important to not mix the foot unit with the incorrect mapping projection.**

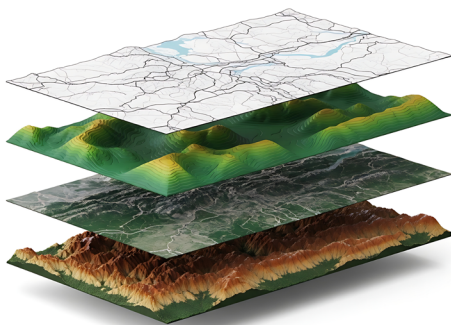
Vertical datums currently in the NSRS are defined from geodetic leveling, including the NAVD 88. Orthometric heights, what we typically call 'elevations,' will be defined from GNSS-determined ellipsoid heights and this geoid model. NAVD88 will not be a simple arithmetic conversion to GEOID2022 orthometric heights.

PRACTICAL IMPACTS FOR CAD, GIS, ENGINEERING & PLANNING

- **Expect location shifts** up to ~2 meters in the continental U.S., less shift in Iowa as compared to other States
- **Elevation values will change** due to improved pure gravity-based geoid. This results in a more accurate determination of where “zero” is.
- **Legacy data, maps, and CAD files will not automatically align** with new GNSS measurements unless transformed.
- **Software, GPS equipment, and workflows will require updates** to support the new datums and coordinate types.

TYPES OF DATA AFFECTED:

- Water
- Geology
- Soils
- Cultural
- Address
- Biodiversity & Ecosystems
- Land use/cover
- Climate & Weather
- Property
- Utilities



WHY IT MATTERS?

- Accurate navigation
- Reliable mapping and surveying
- Consistent data integration across agencies

USE OF THE IOWA DOT REAL TIME NETWORK (IARTN)

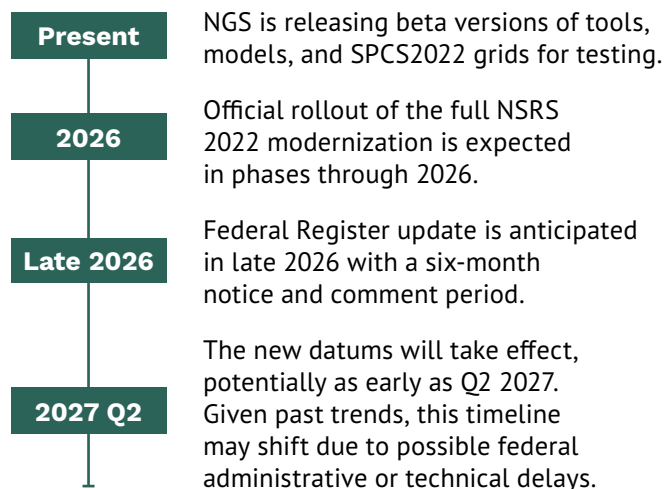
- **Real-time corrections will switch to new reference frames**
 - NATRF2022 coordinates will automatically be produced once the IARTN transitions.
- **Legacy control points will no longer match**
 - Benchmarks and monuments set under NAD83/NAVD88 will not align without applying transformation tools.
- **Mixed-datum environments will be common for a while**
 - For a brief time after the data is released, two networks (NAD83 and NATRF2022) will be hosted to support the transition.

RESOURCES

New Datums: Replacing NAVD 88 and NAD 83 (NGS): <https://geodesy.noaa.gov/datums/newdatums/index.shtml>

Prepare your data for the NSRS modernization of 2022 in the U.S. (ESRI ArcGIS Blog): <https://www.esri.com/arcgis-blog/products/arcgis-pro/data-management/prepare-your-data-for-the-nsrs-2022>

TIMELINE



PREPARATION STEPS

- 1 **EVALUATE YOUR EXISTING DATASETS** to see where the current datums (NAD 83 and NAVD 88) are embedded in your work.
- 2 **BEGIN TESTING TRANSFORMATIONS** using the available NGS beta tools to understand impacts on active projects.
- 3 **ENSURE YOUR GIS/CAD SOFTWARE AND GPS/GNSS DEVICES ARE PREPARED** for NATRF2022, NAPGD2022, and SPCS2022 zone support.
- 4 **UPDATE SPECIFICATIONS, TEMPLATES, AND CONTRACTS** to reference the new datums and coordinate types.
- 5 **TRAIN TEAMS AND EDUCATE STAKEHOLDERS** so they understand the changes and how they affect workflows.

