NigeriaGeo Pro

User Manual

Web-Based Coordinate Transformation for Nigerian Geodetic Systems

Version	2.1.0 — Prototype Release
Audience	Surveyors, GIS Analysts, Engineers, Geologists, Students
Access	Free — runs in any modern web browser, no installation needed
Parameters	Sourced from EPSG Geodetic Parameter Registry — EPSG:1061, GN7.2
Developer	Kafewo Ajiguabom Titus(Kafecodes)
Disclaimer	NigeriaGeo Pro is provided as a prototype tool for educational and professional assistance purposes. Users are responsible for verifying coordinates outputs before use in official surveying or engineering work.

All transformation parameters sourced from the EPSG Geodetic Parameter Registry.
Formulas follow IOGP Guidance Note 7 Part 2 (2019).

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1. Introduction

What Is NigeriaGeo Pro?

NigeriaGeo Pro is a web-based geospatial tool designed to assist surveyors, GIS professionals, engineers and students in performing coordinate transformations between different spatial reference systems used in Nigeria.

> **Think of it as a translator**
>
> Not a translator for languages like English and Yoruba — but a translator for coordinate languages. Different instruments and different eras of mapping describe the same physical location using completely different numbers. NigeriaGeo Pro converts between those number systems so they all point to the same place on the ground.

What Problem Does It Solve?

Nigeria has two different address books for the same locations. Both are correct. But they give different numbers for the same place — and the difference is not small. It is roughly 100 to 200 meters.

> **⚠ The 150-Metre Problem**
>
> The Minna datum origin and the WGS84 origin are separated by about 92 m in one direction, 93 m in another, and 122 m in a third direction in three-dimensional space. On Nigerian soil this appears as a ~150 m gap between old and new coordinates for the same physical point.
>
> This is NOT an error. Both readings are correct. They just speak different languages — and NigeriaGeo Pro provides the translation.

Here is what happens when this goes unresolved in real life:

- A surveyor compares GPS coordinates to an old survey plan without converting. The corner appears 150 m from where it should be. They assume there is a boundary dispute — but there is not.
- A construction team programs their GPS machine from an old government road survey without converting. The machine starts digging 150 m from the correct location.
- A farmer checks their farm boundary with a smartphone GPS against their Certificate of Occupancy. Every corner appears in the wrong place. They think the C of O is fraudulent — it is not.

- A geologist searches for an old mineral prospect site using GPS coordinates from a 1970s map. They are 150 m from the actual site and find nothing.

> ✓ **NigeriaGeo Pro solves this**
>
> By applying the internationally registered EPSG:1061 datum transformation parameters (ΔX = −92 m, ΔY = −93 m, ΔZ = +122 m) plus full Transverse Mercator projection formulas, NigeriaGeo Pro bridges the 150-metre gap accurately — to within approximately 3 meters, which is good enough for all practical surveying and mapping work.

Who Is It Designed For?

NigeriaGeo Pro is designed for anyone in Nigeria whose work involves location data especially anyone who regularly deals with both old records and new GPS technology.

User	How They Use It
Licensed Surveyors	Convert GNSS WGS84 field readings to Minna datum belt projections for SURCON plan submission
GIS Analysts	Normalize spatial data from different sources into one coordinate system before analysis
Geologists	Match old NGSA geological maps (Minna) with modern GPS field observations (WGS84)
Engineers	Verify coordinate consistency between design drawings and GNSS site surveys
Urban Planners	Integrate legacy cadastral maps with modern satellite imagery and infrastructure datasets
Health & Emergency Workers	Align GPS-collected field data with government boundary maps in legacy coordinate systems
Students	Learn coordinate systems practically — watch the pipeline explain every step in real time

2. System Requirements

System requirements are the things you need in place before using the tool. For NigeriaGeo Pro these are intentionally minimal — there is nothing to install, no license to buy, and no powerful computer needed.

1 — A Web Browser

NigeriaGeo Pro runs entirely inside a web browser. Simply open your browser, visit the application, and it is ready to use.

Browser	Notes	Recommendation
Google Chrome	Fastest JavaScript engine, best rendering	☑ Most Recommended
Mozilla Firefox	Excellent alternative, free on all devices	☑ Fully Supported
Microsoft Edge	Pre-installed on Windows 10/11	☑ Fully Supported
Safari	iPhone, iPad, Mac — adequate support	☑ Supported
Internet Explorer	Old, outdated — does not support modern JavaScript	✕ Do NOT Use

i Minimum versions

Chrome 80+ | Firefox 75+ | Edge 80+ | Safari 13+. Most browsers update automatically — if you have used your browser recently, you are almost certainly on a compatible version.

2 — A Device

NigeriaGeo Pro works on any device with a modern browser:

- **Desktop / Laptop Windows**, Mac, or Linux — most comfortable for office use. Both panels (form and map) are visible side by side.
- **Smartphone Android** or iPhone — fully mobile-responsive. A toggle button switches between the form and map views. Ideal for field use.
- **Tablet Android**, iPad, or Windows tablet — larger screen than a phone while remaining portable in the field.

No minimum processor speed or RAM is required — all calculations complete in milliseconds even on low-end devices.

3 — Internet Connection

> **Important — Read This Carefully**
>
> You need internet to LOAD the application for the first time.
>
> After loading, you do NOT need internet for coordinate transformations — all math's runs locally in your browser.
>
> The ONLY feature that always needs internet is the map tile display. If you lose signal in the field, transformations still work perfectly — only the map background may go grey.

Any connection that can load a normal webpage is enough. The app files are under 200 KB. Even a 2G mobile data connection is adequate for the initial load.

4 — Basic Understanding of Coordinates

You do not need to be a geodesy expert. But knowing these basics will help you use the tool confidently:

- **What a coordinate system is:** A framework that assigns numbers to locations. Different systems give different numbers for the same place.
- **Geographic vs projected:** WGS84 uses degrees (latitude/longitude). Belt projections use meters (Easting/Northing).
- **Which belt covers where:** West Belt = Lagos/Ibadan area. Mid Belt = Abuja/Kano area. East Belt = Maiduguri/Yola area.
- **Decimal degrees:** 9° 03' 24" N = 9.0567° in decimal form. Formula: DD = Degrees + (Minutes ÷ 60) + (Seconds ÷ 3600).

5 — Your Coordinate Data

You need the coordinates you want to transform, from one of these sources:

- From a GPS device or smartphone — WGS84 latitude and longitude in decimal degrees.
- From a survey plan — Easting and Northing in meters, with the belt projection noted on the plan.
- From a GIS shapefile — copied from the attribute table or coordinate display.
- From a field notebook — transcribed carefully, double-checking all digits.

> **⚠ Most Common Input Mistake**
>
> Swapping Easting and Northing, or swapping Longitude and Latitude. Always put the first coordinate value (Easting or Longitude) in the first field and the second value (Northing or Latitude) in the second field.

6 — CSV File for Batch Processing

Only needed if you want to convert many coordinates at once. A CSV file must have: a header row, then one row per point with three columns — ID, Easting/Longitude, Northing/Latitude. A ready-made template is available for download inside the app.

3. A Brief View of Coordinate Systems

What Is a Coordinate?

A coordinate is a set of numbers that describes a location on the Earth precisely enough that anyone, anywhere can find it — without relying on landmarks or local knowledge. The most familiar example is latitude and longitude.

> **i Real-World Example**
>
> The coordinates 9.0579°N, 7.4951°E describe Abuja, the capital of Nigeria. No matter who reads those numbers — a pilot in Germany, a sailor in Japan, or a GIS analyst in Lagos — they will all arrive at exactly the same spot. That is the power of a coordinate system.

The Earth Is Not a Perfect Sphere

The Earth is slightly squashed at the poles and wider at the equator — a shape called an oblate spheroid or ellipsoid. The equatorial radius is about 21 kilometers wider than the polar radius. This matters enormously for surveyors because all coordinate calculations depend on what shape of Earth is being assumed.

Ellipsoid	Clarke 1880	WGS84
Semi-major axis (equator)	6,378,249.145 m	6,378,137.000 m
Semi-minor axis (poles)	6,356,514.870 m	6,356,752.314 m
Used by	Minna datum — all Nigerian belt projections	GPS, Google Maps, all modern instruments

> **⚠ Why this matters for Nigerian surveyors**
>
> A coordinate measured on Clarke 1880 and a coordinate measured on WGS84 at the exact same physical location will have DIFFERENT numbers. The difference in Nigeria is roughly 100–200 meters — enough to put you in the wrong plot of land on a cadastral plan.

What Is a Datum?

An ellipsoid alone does not tell you where the coordinate system is anchored to the real Earth. A datum is an ellipsoid PLUS a set of rules for exactly how to align that ellipsoid to the physical Earth.

	Minna Datum	WGS84
Ellipsoid	Clarke 1880	WGS84 Ellipsoid
Anchored to	Physical monument in Minna, Niger State	Earth's center of mass (via satellite)
Era	Early 1900s — colonial survey	1984 — satellite geodesy
Used in	All legacy Nigerian survey plans & Land Registry	All GPS devices, satellite images, online maps

Simple Analogy

Imagine two rulers measuring the same table. One was made in 1920 and starts from a slightly different point — it reads 153.4 cm. The modern ruler reads 153.6 cm. Both rulers are correct. The datum shift is the calculation that converts between those two starting points so you always know the true measurement.

The Datum Shift — Bridging the Gap

Because the Minna datum and WGS84 are anchored differently, there is a constant offset between them. This offset is registered in the EPSG database as EPSG:1061:

Parameter	Value	What It Means
ΔX	−92 meters	Minna center is 92 m offset from WGS84 in the X direction
ΔY	−93 meters	Minna center is 93 m offset from WGS84 in the Y direction
ΔZ	+122 meters	Minna center is 122 m offset from WGS84 in the Z direction

Map Projections — Flattening the Earth

A coordinate like 9.0579°N, 7.4951°E describes a point on the curved Earth. But surveyors need flat maps, distances in meters, and areas in square meters. A map projection is a mathematical method for flattening the Earth's surface onto a flat plane.

The fundamental challenge: you cannot flatten a curved surface without distortion. All map projections are a compromise. Nigerian belt projections and UTM both use the Transverse Mercator — a conformal projection that preserves angles precisely, making it ideal for survey work.

i Easting and Northing Explained

Once projected flat, every location gets two measurements in meters. Easting (E) is the horizontal distance from the central meridian. Northing (N) is the vertical distance from the origin latitude (4°N for all Nigerian belts).

False Easting is a large number added to all Eastings to prevent negative values. For Mid Belt it is 670,553.98 m — so the central meridian itself records as E = 670,553.98 m.

4. Overview of the Interface

When you first open NigeriaGeo Pro you see a clean, professional layout in dark green and gold. Everything you need is visible on one screen. There are no pop-up windows, no sign-in forms, and no confusing menus.

The Header Bar

At the very top sits the dark green header bar showing the application name NigeriaGeo Pro in gold text, with a subtitle describing it as a coordinate transformation system. The header is always visible on every tab.

The Two-Panel Layout

Below the header the screen splits into two main panels:

	Left Panel — Input & Control	Right Panel — Results & Map
Contains	CRS selection, coordinate input, Transform button	Transformation summary card and interactive map
You do here	Enter your coordinates and select systems	View results, warnings, and visual map confirmation

On Mobile Phones

The two panels cannot sit side by side on a small screen. A toggle bar appears with two buttons — Form and Map. Tap Form to enter coordinates. Tap Map to see results and the map. The active button is highlighted in gold.

The Left Panel — Tabs

The left panel has three tabs at the top:

- **Single Point Tab** — Convert one coordinate at a time. This is the main tab most users will use.
- **Batch CSV Tab** — Convert many coordinates at once by uploading a CSV file.
- **CRS Reference Tab** — Look up information about any supported coordinate system.

Source CRS Dropdown

The first control in the Single Point tab. Select the coordinate system your INPUT coordinates are currently in. For GPS readings select WGS84. For an old survey plan select the appropriate belt — West, Mid, or East.

Target CRS Dropdown

Select the coordinate system you want to CONVERT TO. The application will compute the mathematically equivalent coordinate in this system.

Transformation Pipeline Display

As soon as you choose both CRS, a visual chain of boxes with arrows appears showing exactly what operations will be applied. For example:

> **i Example Pipeline — Mid Belt to UTM Zone 32N**
>
> Mid Belt (E/N) → TM Inverse → Minna Lat/Lon → Molodensky Shift → WGS84 Lat/Lon → TM Forward UTM 32N → UTM 32N (E/N)
>
> Each box is one mathematical operation. This updates automatically every time you change a CRS selection.

Coordinate Input Fields

Below the pipeline are the fields where you type your numbers. Labels change automatically depending on your Source CRS:

- **Projected CRS selected** → fields show Easting (m) and Northing (m)
- **Geographic CRS selected** → fields show Longitude (°) and Latitude (°)

Each field shows placeholder example text so you can see the expected format before typing.

The Transform Button

The large green Transform button runs the calculation. Results appear in under one second.

The Results Section

Below the Transform button the following appear:

- **Transformed coordinates in** the correct unit for your target CRS (meters or decimal degrees).
- **WGS84 intermediate coordinates always** shown so you can verify the position in Google Maps.
- **Warning messages in** clear English if the result needs your attention.

- **Datum shift notification confirms** the Molodensky shift was applied when converting between Minna and WGS84 systems.

The Batch CSV Tab

For converting many coordinates at once. Contains the same CRS dropdowns as the Single Point tab, plus:

- **File upload zone** — drag and drop your CSV here, or click to browse.
- **Download Template button** — downloads a ready-made CSV with correct headers and example data.
- **Progress bar** — fills left to right as each row is processed.
- **Results table** — shows each point's ID, input, output, WGS84 position, and OK/ERROR status.
- **Export Results button** — downloads the complete results as a new CSV file.

The CRS Reference Tab

A reference library of all eight supported coordinate systems. Each system has its own colour-coded card showing EPSG code, datum, ellipsoid, valid area, and typical coordinate ranges. Useful for identifying which system an unknown dataset belongs to.

The Right Panel — Map and Summary

Transformation Summary Card: Shows a formatted record of the most recent conversion — source CRS, target CRS, inputs, outputs, WGS84 position, and timestamp.

Interactive Map: A full OpenStreetMap base map of Nigeria. After every transformation a gold circular marker appears at the WGS84 result position. The map zooms to that marker automatically. Clicking the marker shows full coordinate details. The Nigeria Overview button resets to a full-country view.

5. Supported Coordinate Systems

NigeriaGeo Pro supports eight coordinate reference systems — all actively used in Nigerian professional practice. You can convert between any two of these eight systems in any direction.

1. Nigerian National Origin (NNO) *EPSG:26391*

Datum Minna

Ellipsoid Clarke 1880 (RGS)

Central Meridian 4° 30' East

False Easting 230,738.26 m

Valid Area Western Nigeria — longitude 2.5°E to 6.5°E

Typical Users Professionals using old colonial-era survey plans and maps labelled NNO

Sample Coordinates Easting ~108,000–160,000 m | Northing ~250,000–370,000 m (for Lagos area)

i NNO = West Belt

NNO and Nigeria West Belt share the exact same EPSG code (26391) because they are geodetically identical — same datum, ellipsoid, central meridian, False Easting, and scale factor. The only difference is the name. NNO is the older colonial-era label for the same projection.

2. Nigeria West Belt *EPSG:26391*

Datum Minna

Ellipsoid Clarke 1880 (RGS)

Central Meridian 4° 30' East

False Easting 230,738.26 m

Valid Area Western Nigeria — longitude 2.5°E to 6.5°E

Typical Users Licensed Surveyors, Land Registry officers, urban planners — Lagos, Ogun, Oyo, Osun, Ondo, Kwara, Kebbi, Sokoto, Zamfara

Sample Coordinates Easting ~108,000–230,000 m | Northing ~250,000–520,000 m

3. Nigeria Mid Belt *EPSG:26392*

Datum Minna

Ellipsoid Clarke 1880 (RGS)

Central Meridian 8° 30' East

False Easting 670,553.98 m

Valid Area Central Nigeria — longitude 6.5°E to 10.5°E

Typical Users Surveyors and GIS professionals across Abuja FCT, Kano, Kaduna, Niger, Plateau, Rivers, Enugu, Anambra, Delta, Edo and surrounding states

Sample Coordinates Easting ~550,000–750,000 m | Northing ~280,000–900,000 m

4. Nigeria East Belt *EPSG:26393*

Datum Minna

Ellipsoid Clarke 1880 (RGS)

Central Meridian 12° 30' East

False Easting 1,110,369.70 m

Valid Area Northeastern Nigeria — longitude 10.5°E to 14.5°E

Typical Users Surveyors working in Borno, Yobe, Gombe, Adamawa, and Taraba states

Sample Coordinates Easting ~1,100,000–1,200,000 m | Northing ~500,000–900,000 m (large values are distinctive)

5. WGS84 Geographic *EPSG:4326*

Datum WGS84

Ellipsoid WGS84 Ellipsoid

Central Meridian Prime Meridian (global)

False Easting N/A — geographic coordinates

Valid Area Global — covers the entire Earth

Typical Users Everyone using GPS devices, GNSS equipment, drones, satellite imagery, Google Maps, OpenStreetMap

Sample Coordinates Nigeria longitudes ~2.5°E–15°E | Latitudes ~4°N–14°N

6. UTM Zone 31N *EPSG:32631*

Datum WGS84

Ellipsoid WGS84 Ellipsoid

Central Meridian 3° East

False Easting 500,000 m

Valid Area	Longitude 0°E to 6°E — western Nigeria on WGS84 datum
Typical Users	GIS professionals, remote sensing analysts, engineers working with global or international datasets
Sample Coordinates	Easting ~300,000–500,000 m | Northing ~700,000–1,600,000 m (for Nigerian latitudes)

7. UTM Zone 32N *EPSG:32632*

Datum	WGS84
Ellipsoid	WGS84 Ellipsoid
Central Meridian	9° East
False Easting	500,000 m
Valid Area	Longitude 6°E to 12°E — central Nigeria on WGS84 datum
Typical Users	GIS professionals and engineers needing WGS84-compatible projected coordinates for central Nigeria
Sample Coordinates	Easting ~200,000–700,000 m | Northing ~500,000–1,600,000 m

8. Web Mercator *EPSG:3857*

Datum	WGS84 (sphere)*
Ellipsoid	WGS84 semi-major axis as sphere radius
Central Meridian	N/A — spherical projection
False Easting	N/A
Valid Area	Global web mapping — Google Maps, OpenStreetMap, Bing Maps tile services
Typical Users	Web developers and GIS analysts placing data on web map backgrounds
Sample Coordinates	X ≈ 300,000–1,600,000 m | Y ≈ 450,000–1,600,000 m (for Nigeria)

⚠ Web Mercator Warning

Web Mercator introduces errors up to 0.7% in distances and areas because it treats the Earth as a sphere. For a 1,000 m² plot, that is a 7 m² error — unacceptable for cadastral work.

Use Web Mercator for VISUAL DISPLAY ONLY. Never use it for survey plan preparation or boundary measurement.

The Key Distinction to Remember

Group	Systems	What happens when converting within the group
Minna Datum Group	NNO, West Belt, Mid Belt, East Belt	Projection calculation only — no datum shift needed
WGS84 Group	WGS84 Geographic, UTM 31N, UTM 32N, Web Mercator	Projection calculation only — no datum shift needed
CROSS-GROUP	Any Minna system ↔ Any WGS84 system	**Projection + Molodensky Datum Shift (EPSG:1061) required**

6. How to Use — Step by Step

Single Point Transformation

Follow these steps to convert one coordinate at a time:

Step 1 Open the Application — Open your web browser (Chrome recommended) and navigate to the NigeriaGeo Pro URL.

Step 2 Select the Single Point Tab — This is the default tab. If not already selected, click it at the top of the left panel.

Step 3 Choose Your Source CRS — Click the Source CRS dropdown and select the coordinate system your INPUT coordinates are in. If they came from a GPS, select WGS84. If from an old survey plan, select the correct belt.

Step 4 Choose Your Target CRS — Click the Target CRS dropdown and select the system you want to CONVERT TO.

Step 5 Observe the Pipeline — The Transformation Pipeline display updates immediately to show what operations will be applied. Review this to confirm the correct transformation is set up.

Step 6 Enter Your Coordinates — Type your coordinate values into the input fields. For projected systems enter Easting then Northing. For WGS84 enter Longitude then Latitude in decimal degrees.

Step 7 Click Transform — Click the green Transform button. The result appears in under one second.

Step 8 Read Your Results — The transformed coordinates appear below the button. Check any warning messages. Confirm the map marker appears in the correct location in Nigeria.

Step 9 Copy or Export — Copy the result manually, or use the Export button to download a CSV record of the transformation.

Converting Degrees-Minutes-Seconds to Decimal Degrees

WGS84 inputs must be in decimal degrees. If your GPS shows degrees-minutes-seconds, convert first:

✓ Conversion Formula

Decimal Degrees = Degrees + (Minutes ÷ 60) + (Seconds ÷ 3600)

Example: 9° 03' 24" N = 9 + (3 ÷ 60) + (24 ÷ 3600) = 9.05667°N

7. Transformation Pipeline Explained

The Transformation Pipeline is the chain of boxes with arrows that appears when you select your source and target CRS. It shows you exactly what mathematical steps the application will perform — not just the answer, but how the answer was reached.

Operation in the Chain	What It Does
TM Inverse	Converts projected Easting/Northing back to geographic latitude/longitude using the Transverse Mercator inverse formula
Molodensky Shift	Applies the EPSG:1061 three-parameter shift (ΔX=−92m, ΔY=−93m, ΔZ=+122m) to move between Minna datum and WGS84
TM Forward	Converts geographic latitude/longitude to projected Easting/Northing using the Transverse Mercator forward formula
Spherical Mercator	Special formula for Web Mercator — converts using WGS84 semi-major axis as sphere radius
Pass Through	No operation needed — source and target are both WGS84 geographic coordinates

For students

The pipeline makes abstract geodesy tangible. Before clicking Transform, look at the pipeline and predict: will a datum shift be applied? Will a projection be inverted? Then check your prediction against the datum shift notification in the results. This is a powerful way to build your understanding of how coordinate systems relate to each other.

8. Batch CSV Processing

The Batch CSV feature converts many coordinates at once — ideal for databases of survey points, geological sample locations, infrastructure positions, or any large coordinate dataset.

Required CSV Format

Column	Column 1	Column 2	Column 3
Contains	Point ID or Name	Easting or Longitude	Northing or Latitude
Example	BDY_001	560171.842	559137.484
Row 1	Header row (any text — ignored by app)	—	—

Download the ready-made template from inside the Batch CSV tab by clicking Download Template. Replace the example data with your own and save as .csv (not .xlsx).

Batch Processing Workflow

1. Select the Batch CSV tab.
2. Choose Source CRS and Target CRS for your whole batch.
3. Upload your CSV file — drag and drop or click to browse.
4. Watch the progress bar fill as each row is processed.
5. Review the results table — OK rows in green, ERROR rows in red.
6. Click Export Results to download the completed CSV.

9. Map Viewer

The interactive map panel provides a visual confirmation of every transformation result. It uses OpenStreetMap tiles and is powered by the Leaflet.js library.

Feature	What It Does
Gold marker	Placed at the WGS84 position of every transformation result — automatically zooms to the point
Marker popup	Click the marker to see source CRS, target CRS, lat/lon to 8 decimal places, and timestamp
Nigeria Overview button	Resets the map to show the full country — useful after zooming into a survey site
Pan and zoom	Scroll wheel or pinch to zoom. Click and drag to pan in any direction

Use the map as a sanity check

After every transformation, glance at the map marker. If you entered coordinates for a point in Lagos but the marker appears in the Sahara Desert, something was entered incorrectly — the wrong CRS was selected or the coordinates were swapped. The map catches these mistakes instantly before they cause problems downstream.

10. Use Cases

A use case is a real-world situation where NigeriaGeo Pro is genuinely helpful. Below are the most important ones, explained clearly.

1. Survey Coordinate Conversions

Most common use. A Licensed Surveyor collects GNSS field data in WGS84 but must submit survey plans to SURCON in Minna datum belt projections. Enter WGS84 GPS readings, select the correct belt as target, click Transform — instantly get the Easting and Northing values needed for the plan. The reverse works too: convert old plan coordinates to WGS84 for staking out corners in the field with a GPS device.

Who uses this: *Surveyors, Cadastral Officers*

2. GIS Data Preparation

GIS analysts receive data from different sources in different coordinate systems. Before layers can be overlaid and analyzed, all must be in one system. Use the Batch CSV feature to convert entire datasets, then import corrected coordinates into QGIS or ArcGIS — eliminating the 150-metre offset between misregistered layers.

Who uses this: *GIS Analysts, Data Managers*

3. Petroleum Geology & Geophysics

Vintage 2D seismic shot points from the 1960s–80s are in Minna datum. Modern 3D seismic data and well positions are in WGS84. Without conversion, old and new data appear offset in interpretation software. Batch-convert historical shot point databases from belt projection to WGS84 for correct subsurface integration.

Who uses this: *Petroleum Geologists, Geophysicists*

4. Mineral Exploration & Mining

NGSA geological maps and historical prospect records are in Minna datum. Modern GPS field observations are in WGS84. Convert old prospect coordinates to WGS84 for GPS-guided navigation to historical sites, or convert new GNSS observations to belt projection for integration with legacy records.

Who uses this: *Geologists, Exploration Companies*

5. Urban Planning

City planners combine old cadastral parcel maps (Minna datum) with modern satellite imagery (WGS84). Without transformation, parcel boundaries appear 150 m from the buildings they should enclose. NigeriaGeo Pro enables correct coordinate normalization for planning analysis, land use mapping, and infrastructure design.

Who uses this: *Urban Planners, Smart City Developers*

6. Field Data Validation

After a field campaign, verify that GPS observations are plausible — that they fall in the right part of Nigeria and agree with known control. Convert field GPS readings to the expected belt projection and confirm the Easting/Northing values are in the correct numerical range for the survey area.

Who uses this: *All Field Professionals*

7. Disaster Response

Field responders report GPS positions in WGS84. Available maps may be in legacy Minna datum. Convert field-reported positions to match the map coordinate system — enabling accurate navigation and resource deployment without specialist GIS software.

Who uses this: *NEMA, Emergency Coordinators*

8. Public Health & Disease Surveillance

Health workers collect GPS-referenced disease data in WGS84. Administrative boundary maps for LGA-level analysis may be in Minna datum. Align datasets before spatial joins to ensure disease cases are attributed to the correct LGA.

Who uses this: *NCDC, Public Health GIS Teams*

9. Academic Research

Students and researchers work with Nigerian spatial datasets that mix coordinate systems. NigeriaGeo Pro converts research data and teaches coordinate system theory in action through its pipeline display — making lectures tangible.

Who uses this: *Students, University Researchers*

11. Limitations of the Prototype

NigeriaGeo Pro performs its core function — horizontal coordinate transformation between eight Nigerian coordinate reference systems — correctly and reliably. However, users should understand the following limitations before applying it to professional or legal work.

⚠ Horizontal Coordinates Only — No Height Transformation

NigeriaGeo Pro converts latitude, longitude, Easting, and Northing only. It does not convert heights. GPS records ellipsoidal height (above the WGS84 ellipsoid surface) but engineering and flood modelling need orthometric height (above Mean Sea Level). Converting between them requires a Nigerian geoid model that is not yet publicly available at national scale.

Guidance: *Engineers, hydrologists, and flood modellers needing height conversion should use specialist geodetic software with a geoid model when one becomes available.*

⚠ Accuracy Limited to ~3 Metres

The Standard Molodensky method (EPSG:1061) has an inherent accuracy of approximately 1–5 meters, with ~3 m RMSE. This is adequate for cadastral, engineering, and GIS work — but not for First Order geodetic control surveys which need centimeter-level accuracy.

Guidance: *For high-precision geodetic control work, use a 7-parameter Helmert transformation with precisely determined Nigerian-specific parameters.*

⚠ Not Certified for Official Cadastral Submissions

NigeriaGeo Pro has not been formally reviewed or certified by SURCON or any State Surveyor General's office. While the parameters are sourced from the EPSG Registry, the application carries no official professional certification. A Licensed Surveyor remains personally responsible for all coordinates on a signed and sealed survey plan.

Guidance: *Use NigeriaGeo Pro as a professional calculation aid. Always verify results independently before signing any official document.*

⚠ No NTv2 Grid Shift Support

The most accurate method for Minna-to-WGS84 transformation is the NTv2 grid-based approach, which can achieve sub-meter accuracy using a pre-computed national shift grid. NigeriaGeo Pro uses the Standard Molodensky method because a validated NTv2 grid for Nigeria is not yet publicly available.

Guidance: *When a national NTv2 grid becomes available, a future version of NigeriaGeo Pro can incorporate it for improved accuracy.*

⚠ No Offline Installation Package

Calculations work offline after the page loads, but the app is not yet packaged as a Progressive Web App (PWA) or mobile app that can be permanently installed for guaranteed offline use. Users cannot open it for the first time without internet.

Guidance: *Save the app page to your browser before going to a remote location. A future version will be installable as an offline app.*

⚠ No UTM Zone 33N Support

A small area of extreme northeastern Nigeria near the Lake Chad basin technically falls in UTM Zone 33N (12°E–18°E). Zone 33N is not currently supported because the East Belt projection already covers that area for all practical Nigerian survey work.

Guidance: *For the small area of Nigeria in Zone 33N territory, use the East Belt projection instead — or use WGS84 geographic coordinates as a universal intermediate.*

12. Troubleshooting

Most problems with NigeriaGeo Pro are simple and easy to fix. Here are the most common issues users encounter, with clear step-by-step solutions.

Problem 1 — Result Appears 150 Meters from Expected Location

What it looks like: You enter coordinates and the gold marker appears far from where the point should physically be.

Why it happens: Almost always means the wrong Source CRS was selected. For example, you entered Mid Belt Easting/Northing values but selected WGS84 as source — the app treated meter values as decimal degree coordinates.

Solution: Double-check your Source CRS. If coordinates are from a GPS, select WGS84. If from a survey plan, identify the correct belt zone (West, Mid, or East) based on the geographic location and select that belt.

Problem 2 — Belt Mismatch Warning Appears

What it looks like: A yellow/orange warning says the point falls outside the valid area for the selected belt projection.

Why it happens: You selected a target belt that does not cover the geographic area of your point — for example East Belt selected but the point is in Lagos (West Belt territory).

Solution: Check the point's longitude. Use West Belt for 2.5°E–6.5°E, Mid Belt for 6.5°E–10.5°E, East Belt for 10.5°E–14.5°E. The CRS Reference tab lists valid ranges for each belt.

Problem 3 — UTM Zone Mismatch Warning Appears

What it looks like: A warning says the point falls outside the valid longitude range for the selected UTM zone.

Why it happens: You selected UTM Zone 31N but your point is east of 6°E (Zone 32N territory), or vice versa.

Solution: Switch to the other UTM zone. Zone 31N covers 0°E–6°E. Zone 32N covers 6°E–12°E. Check your point's longitude and select the matching zone.

Problem 4 — Transform Button Does Nothing or Shows NaN

What it looks like: You click Transform and nothing happens, an error appears, or result fields show NaN (Not a Number).

Why it happens: Coordinate values are in the wrong format — common causes: a letter in a number field, degrees-minutes-seconds format instead of decimal degrees, comma used as decimal separator (9,0566 instead of 9.0566), or an empty input field.

Solution: Check all values carefully. Use decimal degrees for WGS84 input. Use a full stop (.) as the decimal point — not a comma. Ensure both fields contain numbers and neither is blank. Convert DMS to decimal using: DD = Degrees + (Minutes ÷ 60) + (Seconds ÷ 3600).

Problem 5 — CSV Upload Fails or Shows No Results

What it looks like: You upload a CSV file and nothing happens, an error appears, or the results table is empty.

Why it happens: Most common causes: file saved as .xlsx instead of .csv, missing header row, coordinate values in the wrong columns, or extra columns confusing the parser.

Solution: Download the sample template from the Batch CSV tab and compare its structure to your file. Save your file as CSV (not Excel). Ensure a header row exists as line 1. Each data row must have exactly three comma-separated values: ID, Easting/Longitude, Northing/Latitude.

Problem 6 — Some CSV Rows Show ERROR in Results Table

What it looks like: Batch processing completes but some rows are highlighted red with ERROR status.

Why it happens: Those specific rows contain invalid coordinate values — blank cells, text where numbers are expected, or extreme values far outside any Nigerian coordinate range.

Solution: Download the results CSV, identify which point IDs show ERROR, go back to your original file and correct those rows — check for blank cells, dashes, N/A entries, or obviously wrong values. Re-upload the corrected file.

Problem 7 — Map Shows Grey Tiles Instead of the Map Image

What it looks like: The map panel is visible but shows grey squares or a blank grey background instead of the Nigeria map.

Why it happens: Map tiles could not be loaded — no internet connection or connection too slow.

Solution: Check your internet connection. All coordinate transformations still work perfectly offline — only the map background requires connectivity. When internet is restored the map will load normally.

Problem 8 — Map Is Blank on Mobile After Toggling

What it looks like: On a smartphone you tap the Map toggle button but the map area appears blank or completely empty.

Why it happens: Known behavior when the map container is hidden during page load on mobile. The mapping library needs to be told the map container is now visible so it can measure its dimensions and load tiles.

Solution: Tap the Map toggle button again, or rotate the phone between portrait and landscape. If the problem persists, close the browser tab completely and reopen the application — the map will display correctly on the next load.

Problem 9 — Result Differs Slightly from Another Tool

What it looks like: You transform a coordinate and compare to QGIS, ArcGIS, or another converter — results differ by a few meters.

Why it happens: Normal and expected. The Standard Molodensky transformation has ~3 m inherent accuracy. Different tools may implement the same formula with minor rounding differences.

Solution: If the difference is less than 5 m, this is within the normal accuracy specification and is not a concern for cadastral or engineering work. If the difference is 50+ meters, check that both tools are using the same source and target CRS — a large discrepancy almost always means the wrong CRS was selected in one tool.

Quick Troubleshooting Reference

Problem	Most Likely Cause	Quick Fix
Marker 150 m from expected	Wrong Source CRS selected	Correct the Source CRS
Belt mismatch warning	Wrong belt for that longitude	Use correct belt for location
UTM zone mismatch warning	Point in the other UTM zone	Switch between 31N and 32N
Transform does nothing / NaN	Invalid number format in fields	Remove letters, use full stop, fill both fields

CSV upload fails	Wrong format or column structure	Follow sample template exactly
CSV rows show ERROR	Invalid values in specific rows	Find and fix those rows, re-upload
Map grey tiles	No internet connection	Check connectivity — math's still works
Map blank on mobile	Map not initialized after toggle	Tap Map button again or reload page
Small diff from other tool	Normal ~3 m transformation accuracy	Under 5 m difference is within spec

13 References

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