Republic of Colombia

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The City of Santa Fé de Bogotá was founded in 1538, the region Gran Colombia (modern Panamá, Colombia, Venezuela, and Ecuador) achieved independence from Spain in 1819 and reorganized as a republic in 1886. The Instituto Geográfico Militar was founded in 1935 and later renamed in 1950 as the Instituto Geográfico "Agustín Codazzi" - IGAC, the national mapping agency of Colombia that is responsible for all civilian and military mapping. The cartographer, Agustín Codazzi, produced early nineteenth century maps of Gran Colombia. In fact, these famous maps have even appeared on Venezuelan postage stamps. Furthermore, IGAC provides training services in the mapping sciences for many Latin American countries, a service previously provided solely by the U.S. Inter American Geodetic Survey (IAGS).

The first classical geodetic datum established in Colombia is the Bogotá Datum of 1941. The defining parameters are referenced to the International ellipsoid (also called the Hayford 1909 and the Madrid 1924) where a = 6,378,388 meters, $^1/_f$ = 297, with an origin of ϕ_o = 4° 35' 56.57"N, λ_o = 74° 04' 51.30"W, and h_o = 2,633.6 meters, corresponding to the National Astronomic Observatory in Bogotá as of 1935. The azimuth to station Suba, α_o = 359° 30'10.0", and the initial defining adjustment of the datum included 5 invar baselines, 133 geodetic stations, 12 astro stations, and "the ellipsoid normal is coincident with the direction of the plumb line."

In 1946, the country was divided into four tangent meridian belts, each belt three degrees wide as measured from the observatory. For each belt, the False Eastings and False Northings are equal to 1,000 kilometers each at the intersections of the central meridians (λ_o) and the latitude of the observatory. The belts are lettered as "B" (Bogotá), "Ec" (East central or Este central), "E" (East or Este), and "O" (West or Oeste). There may be a new belt "OO" (Western West or Oeste Occidente) to cover *Isla del Malpelo* in the Pacific Ocean and *Isla de San Andrés* in the Caribbean Sea. The projection system used in Colombia by definition is the Gauss Conform Transverse Mercator, a particular truncation of the Gauss Schreiber which was used in the U.S. for the North American Datum of 1927.

The boundary treaty between Colombia and Panamá was ratified and mutually exchanged on 31 January 1925. There is no indication of the geodetic datum used to provide the geodetic coordinates listed to a tenth of an arc second. Fortunately, the fourteen boundary points are physically marked and are presumably recoverable.

The boundary history between Colombia and Brazil is considerably older, dating back to 1494. The latest treaty with Brazil was signed in 1928, but the coordinates of the boundary markers were not published until 1946, presumably on the Bogotá Datum of 1941.

The land boundary with Venezuela is apparently stable; it is straddled largely by a continuous chain of quadrilaterals. However, the territorial limits of the sea seem to be in dispute, particularly with respect to fishing rights.

Other datums that exist in Colombia (at least theoretically) include the Provisional South American Datum of 1956 (PSAD 56) and the South American Datum of 1969 (SAD 69). Both PSAD 56 and SAD 69 seem to be largely ignored by Colombia although both datums are extended into other countries through Colombia and are extensively used elsewhere. The majority network of Colombia, which had consisted of 21 fixed stations and 679 adjustable stations, was adjusted to the SAD 69 in 1972. However, a free adjustment was also done in 1972 to the total network, which consisted of 1 fixed station and 950 adjustable stations. This free adjustment appears to be the system currently in use under the original name of the Bogotá Datum of 1941. The World Geodetic System of 1984 datum is used extensively in Colombia, albeit just a tool to extend the classical datum.

In 1980, IGAC established a special "city grid" projection for the City of Santa Marta, the oldest city in Colombia (1525). This special system was similar in philosophy to the systems developed for counties in Wisconsin and Minnesota for the convenience of the local surveyors and GIS applications. Specifically, this "city grid" was established at a particular elevation that corresponded to the average elevation of the city. Local surveyors could then ignore the reduction to sea level correction

when transferring measured field distances to the city maps. The system was still based on the Gauss Conform Transverse Mercator, but the False Eastings and False Northings were modified by truncating to only five digits from the observatory at Bogotá.

The reference ellipsoid (International) was modified to have its semi-major axis increased by 29 meters, corresponding to the average elevation of the city above mean sea level determined at Buenaventura. Curiously, the system was reversed back to the standard national coordinate system in 1994, while other cities were published with their own special plane coordinate systems such as Villavicencio 1994 (450 meters), Leticia 1994 (100 meters), and Armenia 1995 (1,470 meters).

Although the Colombian definition uses the Gauss Conform Transverse Mercator for these systems, the Local Space Rectangular sometimes used in analytical photogrammetric calculations could just as easily be used with identical results. We commonly use such systems for analytical rectification projects if the project area is free of relief such as a plateau or a flood plain.

Note that these new city systems were orthophoto projects and not just rectified photos. Grids used in Colombia without special modifications to the ellipsoid include the Ciudad de Bogotá (City) Grid and the Ciudad de Medellín (City) Grid. The Grid System used for the Ciudad de Cartagena is the standard "B" belt of the National System.