

Grids & Datums

REPUBLIC OF LITHUANIA

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"Lithuanian lands were united under *Mindaugas* in 1236; over the next century, through alliances and conquest, Lithuania extended its territory to include most of present-day Belarus and Ukraine. By the end of the 14th century Lithuania was the largest state in Europe. An alliance with Poland in 1386 led the two countries into a union through the person of a common ruler. In 1569, Lithuania and Poland formally united into a single dual state, the Polish-Lithuanian Commonwealth. This entity survived until 1795, when its remnants were partitioned by surrounding countries. Lithuania regained its independence following World War I but was annexed by the USSR in 1940 - an action never recognized by the US and many other countries. On 11 March 1990, Lithuania became the first of the Soviet republics to declare its independence, but Moscow did not recognize this proclamation until September of 1991 (following the abortive coup in Moscow). The last Russian troops withdrew in 1993. Lithuania subsequently restructured its economy for integration into Western European institutions; it joined both NATO and the EU in the spring of 2004" (*CIA World Factbook, 2008*).

Slightly larger than West Virginia, Lithuania is bordered by Belarus (502 km), Latvia (453 km) (*PE&RS, September 2002*), Poland (91 km) (*PE&RS, September 2000*), and Russia (Kaliningrad Oblast) (227 km). The country is mostly lowland with many scattered small lakes; the lowest point is the Baltic Sea (0 m), and the highest point is Juozapine Kalnas (292 m).

The earliest geodetic survey of Lithuanian lands was executed by Zhylynskiy between 1889-1890 and was based on the Warsaw 1875 Datum referenced to the "Adjustment Spheroid" where: $a = 6,380,880\text{m}$ and $1/f = 263.597$. "The (*Lithuanian - Ed.*) original coordinates derive from lower-order surveys of the years 1879-1880, 1886-1901, 1902-1903, 1905-1909, 1911-1912, 1917, and 1930. In the vicinity of the meridian of Dorpat, Struve's Arc (variously called the Russo-Scandinavian Arc or Gradmessung, or Tenner's Arcs), for which results were published in *L'arc de Meridian entre le Danube et la Mer d'iesicle (sic), Struve, W., St. Petersburg, 1860*, provided the sides later utilized in lieu of base and principal azimuth lines. These were used either by the Imperial government, but provinces (e.g. Courland, Livonia) or by guberniyas (e.g. Wilno). To this end Struve's Arc sometimes was locally extended. The configuration of first-order lines is shown by a diagram supplied with the *Catalog of Points Determined by the Triangulation of the West Border States 1886-1901* in which are given also the principal points of the local systems associated with Struve's Arc, and disagreements due to varying plans of adjustment" (*Army Map Service Geodetic Memo No. 880, 30 November 1951*). In 1938, *Bulletin Géodésique, No. 57* published the Lithuanian National Report by Colonel Ing. A. Krikščiūnas which contained the astronomical coordinates of the Kaunas Observatory as determined by the method of *Horrebow-Talcott* being: $\Phi = 54^{\circ} 53' 43.99'' \text{ N} \pm 0.05''$, $\Lambda = 1^{\text{h}} 35^{\text{m}} 29.504^{\text{s}} \pm 0.0014$ East of Greenwich. (Note that the dual-bubble method was simultaneously published by Horrebow, a Captain in the British Royal Engineers and by Talcott, a Captain in the U.S. Army Corps of Engineers.- Ed.) The historical grid systems used locally in Lithuania on the Potsdam Datum were the Lithuanian Gauss-Krüger Transverse Mercator Belts where:

the Central Meridian for the West Belt is $\lambda_0 = 21^{\circ}\text{E}$ with a False Easting of 1,500 km, for the Central Belt is $\lambda_0 = 24^{\circ}\text{E}$ with a False Easting of 2,500 km, and for the East Belt is $\lambda_0 = 27^{\circ}\text{E}$ with a False Easting of 3,500 km. All three belts have a scale factor at origin $m_0 = 1.0$, and all are referenced to the Bessel 1841 ellipsoid where: $a = 6,377,397.155 \text{ m}$ and $1/f = 299.1528$.

"The Soviet occupation of Lithuania before WWII referenced topographic maps to the Pulkovo 32 System where: $\Phi_0 = 59^{\circ} 46' 18.71'' \text{ N}$, $\Lambda_0 = 30^{\circ} 19' 39.55'' \text{ East of Greenwich}$ and retained the Bessel 1841 ellipsoid of reference. Soviet maps published after WWII were converted to the single coordinate system, System 42. The origin of the system is the center of Pulkovo Observatory with corrected coordinates $\Phi_0 = 59^{\circ} 46' 18.55'' \text{ N}$, $\Lambda_0 = 30^{\circ} 19' 42.09'' \text{ East of Greenwich}$ and azimuth from point Bugry to Sablino $\alpha_0 = 121^{\circ} 06' 38.79''$. The Krasovskiy ellipsoid with dimensions $a = 6,378,245 \text{ m}$ and $1/f = 298.3$ replaced the Bessel 1841 ellipsoid. The projection and military grid remained the same. The mean sea level of the Baltic Sea at the Kronshtadt tidal gauge (*St. Petersburg - Ed.*) was accepted as zero altitude. Coordinates are not reduced to sea level but to the reference ellipsoid, which is tangent to the geoid only at Pulkovo." (*Foreign Maps, TM 5-248, 1963*). The military grid mentioned is the Russia Belts with identical parameters to the UTM except that $m_0 = 1.0$, and is referenced to the Krasovskiy ellipsoid.

As reported in the first paragraph, Lithuania was the first country to declare its independence from the Soviets in 1990. By 1994, the Lithuanian Coordinate System (*Lietvos Koordinacijų Sistema*) or LKS 94 was established and the entire Soviet System 42 was dumped. Introduced on 30 September 1994, the LKS 94 coincides with EUREF 89 Coordinate System ETRS89, and was transferred with points: Akmeniškiai (0311), Meškonys (0312), Šašeliai (0408), and Dainavūlū (0409). The reference ellipsoid is the GRS 1980 where $a = 6,378,137 \text{ m}$ and $1/f = 298.257 222 101 \dots$ "Lithuanian GPS Network coordinates are computed in the Coordinate System LKS94. Coordinates of triangulation and traverse points were recomputed in the new Coordinate system. This System will be used in various activities: geodetic, cartographic, land managing, cadastre and creation of Information Systems." (*National Report of Lithuania, Kumentaitis, Z. and Petroškevičius, P., Munich 1995*).

The current national mapping is based upon the Gauss Kruger implementation of the Transverse Mercator projection and one zone is in use, with a central meridian of 24 degrees east. The False easting is 500000, False Northing 0, Latitude of Origin 0 degrees north. The Central Meridian scale factor is 0.9998 not the 1.0 value often associated with eastern European Gauss-Kruger projections. The national Mapping agency is: Valstybinė Geodezijos ir Kartografijos Tarnyba, Ukmerges 41, LT-2600 Vilnius.



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