

Grids & Datums

STATE OF QATAR

by Clifford J. Mugnier, C.P., C.M.S.

“Human habitation of the Qatar Peninsula dates as far back as 50,000 years, when small groups of Stone Age inhabitants built coastal encampments, settlements, and sites for working flint, according to recent archaeological evidence. Other finds have included pottery from the Al Ubaid culture of Mesopotamia and northern Arabia (*circa* 5000 *B.C.*), rock carvings, burial mounds, and a large town that dates from about 500 *B.C.* at Wusail, some twenty kilometers north of Doha” (*Library of Congress Country Studies*).

Ruled by the al-Thani family since the mid-1800s, Qatar transformed itself from a poor British protectorate noted mainly for pearling into an independent state with significant oil and natural gas revenues. During the late 1980s and early 1990s, the Qatari economy was crippled by a continuous siphoning off of petroleum revenues by the Amir, who had ruled the country since 1972. His son, the current Amir HAMAD bin Khalifa al-Thani, overthrew him in a bloodless coup in 1995. Oil

any coordinates available for the 1946 datum. (The ellipsoid of reference is likely the Clarke 1880.)

The Qatar National Datum of 1970 has its origin at Station *G2, Balad Ibrahim* where: $\Phi_o = 25^{\circ} 16' 10.6570''$ N, and $\Lambda_o = 51^{\circ} 36' 20.6227''$ East of Greenwich, and the ellipsoid of reference is the International 1924 where: $a = 6,378,388$ meters and $1/f = 297$. The projection associated with this datum is the Gauss-Krüger Transverse Mercator for the Qatar National Local Grid where the Latitude of Origin (ϕ_o) = $24^{\circ} 27'$ N, the Central Meridian (λ_o) = $51^{\circ} 13'$ E, the Scale Factor at Origin (m_o) = 0.99999, and the False Northing = the False Easting = 300 km.

I am informed by Gener Bajao that for offshore Qatar, the UTM Grid is used as referenced to the first major geodetic Datum of the Persian Gulf area established by W.E. Browne of the Iraq Petroleum Company in 1927-1931 at the South End Base at station Nahrwan (East of

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and natural gas revenues enable Qatar to have one of the highest per capita incomes in the world. With a coastline on the Persian Gulf of 563 km, Qatar is slightly smaller than Connecticut and borders Saudi Arabia (60 km). International boundaries have been signed with Bahrain (*PE&RS*, October 2007), Iran, Saudi Arabia, and Abu Dhabi of the United Arab Emirates, (*PE&RS* September 2001). The lowest point is the Persian Gulf (0 m), and the highest point is Qurayn Abu al Bawl (103 m). The climate is arid and mild, with pleasant winters and very hot, humid summers. The terrain is mostly flat and barren desert covered with loose sand and gravel (*CIA World Factbook*).

It seems that the oldest Astronomical Station recorded for Qatar is at *Om, Al Da'asa* the origin of the 1941 datum and coincident with the Cassini-Soldner Grid referenced to the Helmert 1906 ellipsoid where $a = 6,378,200$ meters and $1/f = 298.3$. The Latitude of Origin (ϕ_o) = $\Phi_o = 25^{\circ} 22' 56.50''$ N, the Central Meridian (λ_o) = $\Lambda_o = 50^{\circ} 45' 41.00''$ East of Greenwich, the Scale Factor at Origin by definition is unity, the False Northing = the False Easting = 100 km; sometimes the False Easting and False Northing are found to have been doubled. This was apparently the first plane coordinate system used for the Dukhan Oil Field. Another Astro Station local datum is reported to be at *Al Busayyir*, but there do not seem to be

Baghdad) such that: $\Phi_o = 33^{\circ} 19' 10.87''$ North, $\Lambda_o = +44^{\circ} 43' 25.54''$ East of Greenwich, and the Clarke 1880 is the ellipsoid of reference where: $a = 6,378,300.782$ m, and $1/f = 293.4663077$.

“Hunting Surveys, Ltd. performed a survey of Qatar that was completed in 1972. First Order Tellurometer (EDM) traverses were performed over the entire country that comprised 92 traverse stations forming 10 closed loops and 2 junction figures. [Nine hundred thirty-seven] 937 line kilometers were measured with an average distance between stations of 8.76 km. Traverse observations at each station consisted of 10 or 12 rounds of horizontal angles, half of which were measured in the evening and half in the following morning. Eight sets of Tellurometer measurement, 4 in each direction were taken at different times on different days. Three sets of simultaneous reciprocal vertical angles were measured in the middle of the day. The average standard deviation for the observed horizontal angles was 0.41” and the worst value obtained for a full set of observations was 0.86”. The average standard deviation for the measured distances was 1:876,000 and the worst value obtained was 1:198,000. Standard deviations were not calculated in the case of vertical angles where spreads of up to 10 seconds of arc were accepted. LaPlace azimuth control was provided by 16 star Black’s azimuth programs at twelve traverse

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stations spaced at approximately 60 to 70 km intervals around the network. The average standard deviation for the azimuths obtained was 0.41" and the worst value obtained was 0.63".

"The Qatar Local system coordinates were converted to Ain el Abd Datum by means of a datum and spheroid change by Cartesian shifts. The comparison of the values obtained from the two survey systems is given for Station 'G16,' the common station. ... The Qatar value: $\phi = 24^{\circ} 40' 21.6345''$ N, $\lambda = 50^{\circ} 51' 37.0981''$ E, and the Saudi value: $\phi = 24^{\circ} 40' 22.4297$ N, $\lambda = 50^{\circ} 51' 35.7352$ E" (*National Geodetic Survey Final Report, September 1972, Hunting Surveys Limited*).

Thanks to a complete report on the Qatar National Datum of 1995 that I received from Alistair Strachan back in July of 1996, the 3-parameter transformation from WGS84 Datum to QND 95 is: $\Delta X = -127.781$ m, $\Delta Y = -283.375$ m, and $\Delta Z = +21.241$ m, and the Qatar National Local Grid on the QND95 is where the Latitude of Origin (ϕ_o) = $24^{\circ} 27'$ N, the Central Meridian (λ_o) = $51^{\circ} 13'$ E, the Scale Factor at Origin (m_o) = 0.99999, the False Northing = 300 km, and the False Easting = 200 km. The ellipsoid of reference is again

the International 1924. A coordinate transformation package called "QTRANS" is available from the government that includes the local geoid relations. Although a 7-parameter transformation is available from the Qatar Geographic Information Systems Centre, the three parameters given above are estimated to be good to about one meter. Extensive geodetic documentation is available freely from the government and nothing geodetic appears to be considered a military secret – a most enlightened philosophy that should be practiced by many larger nations throughout the world.



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