

## Gibraltar Annex to National Report of Great Britain

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Gibraltar has been a British sovereign territory since 1713 (ceded to Britain by the Treaty of Utrecht). Also known as 'The Rock', Gibraltar is little more than a rock isthmus of strategic importance, projecting into the Mediterranean Sea from Spain, surrounded to the north, west and south by the town, airport and dockyard. The rock itself is some 4.8km long by 1.1 km wide, rising to 426m. Including reclaimed land and the harbour moles, the land area of Gibraltar is some 5.2km long by 2.6km wide.

### Horizontal

Current mapping of Gibraltar is referenced to European Datum 1950. The trig network largely dates back to surveys in 1923-4 and 1937-42. The ED50 control was established by resections, determined in 1955, from 7 trig stations in Spain, which were in turn transformed from the Madrid Observatory Datum 1853, Struve ellipsoid. The trig network

is known to contain scale errors of approximately 400ppm (2m over the Peninsula) and a systematic shift of approximately 4m due to errors in the transformation of Spanish control. More recent survey control around the airport is free from the scale errors associated with the main network.

During the EUVN observations at the Gibraltar Tide Gauge GB04, the opportunity was taken to determine the datum transformation to ETRS89 by observing at 3 trig points, and to 4 control points at the airport. The results for the main network are shown below. The transformation determined using only the airport control is  $\ddot{A}X = -116.8\text{m}$ ,  $\ddot{A}Y = -106.4\text{m}$ ,  $\ddot{A}Z = -154.4\text{m}$ . This is deemed to be more useful for international purposes, this transformation was provided to EUREF for CERCO and EUROCONTROL use.

Point	ED50 <sup>†</sup>	ETRS89*	UTM ED50	UTM ETRS89*
GB04		36 07 54.40412 N 05 21 20.91486 W 45.469		
Rock Gun 716	36 08 41.769 N 05 20 29.551 W 411.9	36 08 36.9681 N 05 20 34.2168 W 454.34	289321.9 4002628.5	289211.031 4002418.910
North Mole 191	36 08 43.426 N 05 21 52.466 W 5.7	36 08 38.6109 N 05 21 57.1762 W 47.96	287250.5 4002729.8	287138.574 4002519.825
Europa Point 360	36 06 46.711 N 05 20 55.684 W 36.4	36 06 41.8490 N 05 21 00.3335 W 78.41	288582.9 3999098.3	288472.363 3998886.919
Transformation	ED50 to ETRS89: $\ddot{A}X = -117.0\text{m}$ $\ddot{A}Y = -106.5\text{m}$ $\ddot{A}Z = -154.3\text{m}$  ETRS89 to ED50: $\ddot{A}X = +117.0\text{m}$ $\ddot{A}Y = +106.5\text{m}$ $\ddot{A}Z = +154.3\text{m}$		ED50 to ETRS89: $A(0) = 567.938$ $B(0) = -2151.745$ $A(1) = 1.000470503$ $B(1) = 0.0002036081$  ETRS89 to ED50: $A(0) = -567.233$ $B(0) = 2150.849$ $A(1) = 0.9995296765$ $B(1) = -0.0002034166$	
Accuracy	approximately 1m (mainly due to unmodelled scale error)		approximately 0.1m (mainly due to ED50 precision)	

\* ETRF96 (Epoch 1997.4)

<sup>†</sup> Heights related to Ordnance Datum Gibraltar. Correction to Alicante Datum is -0.138m (see below)

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## Vertical

The height datum for Gibraltar used to be Ordnance Datum Gibraltar. In 1961, the Directorate of Overseas Survey carried out the Geodetic Levelling of Gibraltar to establish a first order levelling network around the rock. It connected the Gibraltar tide gauge to three benchmarks in Spain (NAPH 106, 107 and 108), allowing the establishment heights with respect to Alicante Datum, as used in Spain. The remapping of Gibraltar in 1970 used Alicante Datum for the reference for heighting. The transformation from Ordnance Datum Gibraltar to Alicante Datum is  $-0.138\text{m}$ , as shown below. Chart Datum has had various definitions in the past, and is currently defined as being  $0.09\text{m}$  below Ordnance Datum Gibraltar, and  $0.52\text{m}$  below Mean Sea Level. In 2001 it is anticipated that the Hydrographic Office and Royal Navy will carry out gravity observations in Gibraltar to support the EUVN project.

## References:

1. *Gibraltar and Environs Trig List (1<sup>st</sup> Edition)*, Directorate of Military Survey, 1956
2. *Gibraltar Survey Results – May 1997*, 14 Indep Topo Sqn RE
3. *EUREF Publication No. 7/II*, Bundesamtes für Kartographie und Geodäsie, 1999
4. *Geodetic Levelling of Gibraltar 1961*, Directorate of Overseas Survey
5. *Gibraltar: Sovereignty Disputes and Territorial Waters*, The Hydrographic Journal No.95, Jan 00
6. Correspondence concerning benchmarks in the dockyard (Institute of Geological Sciences, Hydrographic Department, Directorate of Overseas Survey) dated 1980
7. Tides Section, UK Hydrographic Office, 4 Apr 01

## Vertical Datum Relationships in Gibraltar

All heights in metres

