

Grids & Datums

ISLAMIC REPUBLIC OF PAKISTAN

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Pakistan has a history that can be dated back to the Indus Valley civilization (ca. 2500-1600 B.C.), the principal sites of which lay in present-day Sindh and Punjab provinces. Pakistan was later the entryway for the migrating pastoral tribes known as Indo-Aryans, or simply Aryans, who brought with them and developed the rudiments of the religious-philosophical system of what later evolved into Hinduism. They also brought an early version of Sanskrit, the base of Urdu, Punjabi, and Sindhi languages that are spoken in much of Pakistan today. Hindu rulers were eventually displaced by Muslim invaders, who, in the tenth, 11th, and 12th centuries, entered northwestern India through the same passes in the mountains used earlier by the Indo-Aryans. The culmination of Muslim rule in the Mughal Empire (1526-1858, with effective rule between 1560 and 1707) encompassed much of the area that is today Pakistan. Sikhism, another religious movement that arose partially on the soil of present-day Pakistan, was briefly dominant in Punjab and in the northwest in the early 19th century. All of these regimes subsequently fell to the expanding power of the British, whose empire lasted from the 18th century to the mid-20th century, until they too left the scene, yielding power to the successor states of India and Pakistan. The Muslim-majority areas in northwestern and eastern India were separated and became Pakistan, divided into the West Wing and East Wing, respectively. The placement of two widely separated regions within a single state did not last, and in 1971 the East Wing broke away and achieved independence as Bangladesh. The pride that Pakistan displayed after independence in its long and multicultural history has disappeared in many of its officially sponsored textbooks and other material used for teaching history (although the Indus Valley sites remain high on the list of the directors of tourism). As noted anthropologist Akbar S. Ahmed has written in *History Today*, "In Pakistan the Hindu past simply does not exist. History only begins in the seventh century after the advent of Islam and the Muslim invasion of Sindh" (*Library of Congress Country Study*, 2009).

"Pakistan occupies a position of great geostrategic importance, bordered by Iran on the west, Afghanistan on the northwest, China on the northeast, India on the east, and the Arabian Sea on the south. The total land area is estimated at 803,940 square kilometers. The boundary with Iran, some 800 kilometers in length, was first delimited by a British commission in 1893, separating Iran from what was then British Indian Balochistan. In 1957 Pakistan signed a frontier agreement with Iran, and since then the border between the two countries has not been a subject of serious dispute.

"Pakistan's boundary with Afghanistan is about 2,250 kilometers long. In the north, it runs along the ridges of the Hindu Kush (meaning Hindu Killer) mountains and the Pamirs, where a narrow strip of

Afghan territory called the Wakhan Corridor extends between Pakistan and Tajikistan. The Hindu Kush was traditionally regarded as the last northwestern outpost where Hindus could venture in safety. The boundary line with Afghanistan was drawn in 1893 by Sir Mortimer Durand, then foreign secretary in British India, and was acceded to by the amir of Afghanistan that same year. This boundary, called the Durand Line, was not in doubt when Pakistan became independent in 1947, although its legitimacy was in later years disputed periodically by the Afghan government as well as by Pakhtun tribes straddling the Pakistan-Afghanistan border. On the one hand, Afghanistan claimed that the Durand Line had been imposed by a stronger power upon a weaker one, and it favored the establishment of still another state to be called Pashtunistan or Pakhtunistan. On the other hand, Pakistan, as the legatee of the British in the region, insisted on the legality and permanence of the boundary. The Durand Line remained in effect in 1994.

"In the northeastern tip of the country, Pakistan controls about 84,159 square kilometers of the former princely state of Jammu and Kashmir. This area, consisting of Azad Kashmir (11,639 square kilometers) and most of the Northern Areas (72,520 square kilometers),

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which includes Gilgit and Baltistan, is the most visually stunning of Pakistan. The Northern Areas has five of the world's 17 highest mountains. It also has such extensive glaciers that it has sometimes been called the 'third pole'. The boundary line has been a matter of pivotal dispute between Pakistan and India since 1947, and the Siachen Glacier in northern Kashmir has been an important arena for fighting between the two sides since 1984, although far more soldiers have died of exposure to the cold than from any skirmishes in the conflict.

"From the eastern end of the Afghanistan-Pakistan border, a boundary of about 520 kilometers runs generally southeast between China and Pakistan, ending near the Karakoram Pass. This line was determined from 1961 to 1965 in a series of agreements between China and Pakistan. By mutual agreement, a new boundary treaty is to be negotiated between China and Pakistan when the dispute over Kashmir is finally resolved between India and Pakistan.

The Pakistan-India cease-fire line runs from the Karakoram Pass west-southwest to a point about 130 kilometers northeast of Lahore. This line, about 770 kilometers long, was arranged with United Nations

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(UN) assistance at the end of the Indo-Pakistani War of 1947-48. The cease-fire line came into effect on January 1, 1949, after 18 months of fighting and was last adjusted and agreed upon by the two countries in the Simla Agreement of July 1972. Since then, it has been generally known as the Line of Control.

“The Pakistan-India boundary continues irregularly southward for about 1,280 kilometers, following the line of the 1947 Radcliffe Award, named for Sir Cyril Radcliffe, the head of the British boundary commission on the partition of Punjab and Bengal in 1947. Although this boundary with India is not formally disputed, passions still run high on both sides of the border. Many Indians had expected the original boundary line to run farther to the west, thereby ceding Lahore to India; Pakistanis had expected the line to run much farther east, possibly granting them control of Delhi, the imperial capital of the Mughal Empire.

“The southern borders are far less contentious than those in the north. The Thar Desert in the province of Sindh is separated in the south from the salt flats of the Rann of Kutch by a boundary that was first delineated in 1923-24. After partition, Pakistan contested the southern boundary of Sindh, and a succession of border incidents resulted. They were less dangerous and less widespread, however, than the conflict that erupted in Kashmir in the Indo-Pakistani War of August 1965. These southern hostilities were ended by British mediation, and both sides accepted the award of the Indo-Pakistan Western Boundary Case Tribunal designated by the UN secretary general. The tribunal made its award on February 19, 1968, delimiting a line of 403 kilometers that was later demarcated by joint survey teams. Of its original claim of some 9,100 square kilometers, Pakistan was awarded only about 780 square kilometers. Beyond the western terminus of the tribunal’s award, the final stretch of Pakistan’s border with India is about 80 kilometers long, running west and southwest to an inlet of the Arabian Sea” (*Library of Congress Country Study, 2009*).

Geodetic control and mapping of India, Pakistan and Bangladesh was introduced by the British in the 18th and 19th centuries during the Great Trigonometrical Survey of India (*Mapping an Empire, The Geographical Construction of British India 1765-1843, M.H. Edney 1997*). The arduous process of mapping the subcontinent of India was finally put on a firm footing by Sir George Everest, and Pakistan still relies on the Everest 1830 ellipsoid (modified) for its reference surface, as well as the Indian Datum of 1916 with origin at Kalianpur Hill in India where: $\Phi_0 = 24^{\circ} 07' 11.26''$ N, $\Lambda_0 = 77^{\circ} 39' 17.57''$ East of Greenwich, and the ellipsoid of reference is the Everest 1830, where: $a = 6,974,310.600$ Indian Yards, and $1/f = 300.8017$. The original topographic mapping of Pakistan by the British Survey of India (SOI) was based on the Lambert Conical Orthomorphic projection, India Zone I where: the central meridian, $\lambda_0 = 68^{\circ}$ E, the latitude of origin $\phi_0 = 32^{\circ} 30'$ N, the scale factor at the latitude of origin $m_0 = 823/824 = 0.998786408$, and False Easting = 3,000,000 Indian Yards, and the False Northing = 1,000,000 Indian Yards. The scale factor at origin, m_0 , should be of particular interest. The British way of doing things (back then) has been overlooked by most authors in recent years, and one penchant of the *Old Masters* was to express m_0 as a fraction with one component being a prime number, in this case 823. Who were the *Old Masters*? Names such as DeGraff-Hunter, McCaw, Bomford, and Hotine – some of the most illustrious names in Geodesy for the 20th century! The limits of Zone I are: North Limit: 2,160,000 yd Northing line of India Zone 0; East Limit: Meridian of 78° E, southwards to 31° N, thence along this parallel to 81° E,

thence along this meridian to 29° N, thence along this parallel to 79° E, thence along this meridian to 28° N; South Limit: Parallel of 28° N; to the West Limit: Meridian of 60° E to the point of beginning (*Lambert Conical Orthomorphic Projection Tables, India Zone I, issued by Office of the Chief of Engineers, Washington, D.C., Second Edition 1944*). Also used in Pakistan, particularly in the offshore areas, is India Zone IIA where: the central meridian, $\lambda_0 = 74^{\circ}$ E, the latitude of origin $\phi_0 = 26^{\circ}$ N, the scale factor at the latitude of origin $m_0 = 823/824 = 0.998786408$, and False Easting = 3,000,000 Indian Yards, and the False Northing = 1,000,000 Indian Yards. The original limits of Zone IIA were: North Limit: Parallel of 28° N, eastwards to 79° E, thence along this meridian to 29° N, thence along this parallel to 82° E.; East Limit: Meridian of 82° E, southwards to 28° N, thence along this parallel to 83° E, thence along this meridian to 26° N, thence along this parallel to 82° E, thence along this meridian to 22° N; South Limit: Parallel of 22° N, westwards to 72° N, thence along this meridian to 20° E, thence along this parallel to 60° N; to the West Limit: Meridian of 60° E, northwards to 24° N, thence along an (*ellipsoidal – Ed.*) loxodrome to 25° N, 57° E, and finally, thence along the meridian of 57° E, to 28° N, being the point of beginning (*Lambert Conical Orthomorphic Projection Tables, India Zone IIA, issued by Office of the Chief of Engineers, Washington, D.C., 1943*).

The Indian Datum of 1960, as it is called in Pakistan, is a local adjustment that has changed the original parameters of the ellipsoid of reference for Everest 1830 (modified for Pakistan), where: $a = 6,377,309.613$ m, and $1/f = 300.8017$ as a result of adoption of a new yard to meter conversion factor (*TR 8350.2, Appendix A.1*). The Lambert Conical Orthomorphic Zones I and IIA parameters have been changed to meters as the basic unit for Pakistan. *TR 8350.2* does not list any transformation parameters from Indian 1960 to WGS84. However, offshore oil exploration surveys in Pakistan have yielded a couple of 3-parameter transformations that are plausibly similar **from** Indian 1960 Datum **to** WGS 84 Datum: for “Middle Indus Region,” $\Delta X = +270$ m, $\Delta Y = +664$ m, $\Delta Z = +225$ m, as determined at Station Routi, and for “Bela North Block,” $\Delta X = +272$ m, $\Delta Y = +670$ m, $\Delta Z = +231$ m, as determined at Station Chitrawala. There are no accuracy estimates available for either of these transformations, so they should be used with caution. Thanks to Dr. S.M. Shuaib of Karachi, for his letter of 18 March 1985 and the reference materials received regarding Pakistan’s Offshore Lease Block limits.



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