THE REPUBLIC OF KOREA

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The ancient kingdom of Chosôn was established in the northern part of the peninsula during the third millennium B.C. Buddhism was introduced in the fourth century A.D., which the Koreans then carried to Japan. The Yi dynasty ruled the kingdom from the capital at Seoul from 1392-1910. Korea was forced to grant a treaty opening its ports to Japan in 1876. In resisting Chinese control, Korea was the focus of the Chinese-Japanese War of 1894-95, and further rivalry over Chinese control, Korea was the focus of the Russo-Japanese War of 1904-05. (Someday I’ll write about some fascinating geodetic history from that latter war.) Korea became a Japanese protectorate in 1905 and was annexed as a province of the Chinese-Japanese War of 1904-05. (Someday I’ll write about some fascinating geodetic history from that latter war.) Korea was forced to Japan in 1876. In resisting Chinese control, Korea was the focus of the Chinese-Japanese War of 1894-95, and further rivalry over Chinese control, Korea was the focus of the Russo-Japanese War of 1904-05. (Someday I’ll write about some fascinating geodetic history from that latter war.) Korea became a Japanese protectorate in 1905 and was annexed as a province of Japan. The two zones of occupation were divided at the 38th parallel, and that line continues to divide the peninsula’s politics.

The first geodetic datum used in Korea was the Tokyo Datum of 1892 where: $\Phi = 35^\circ 39' 17.515"$ North, $\Lambda = 139^\circ 44' 30.097"$ East of Greenwich. The defining azimuth was determined from the old Tokyo Observatory at Azabu to station Kanoyama (Kano Mountain) as: $\xi = 156^\circ 25' 28.44"$. The Tokyo Datum of 1892 is referenced to the Bessel 1841 ellipsoid where the semi-major axis (a) = 6,377,397.155 meters and the reciprocal of flattening $(1/f) = 299.1528128$.

Geodetic surveys started in Korea in 1910, and 13 baseline measurements were completed by 1918. During this time, 400 first-order, 2,401 second-order, and 31,646 third-order triangulation stations were established in all of the Korean Peninsula. The number of stations in South Korea totaled 16,089. Five tide stations were used for the establishment of the vertical datum to local mean sea level, and 6,629 kilometers of leveling were run. The original triangulation was the Datum for the Old Cadastral Grids based on the Gauss – Schreiber Transverse Mercator formulae. The three belts were East, Central, and West with Central Meridians ($\lambda_e = 129^\circ, 127^\circ, 125^\circ$ East of Greenwich, respectively. The False Northing Latitude of Origin was $38^\circ$ North, the False Northing = 500 km., the False Easting = 200 km. For all three belts, the Scale Factor at Origin ($m_0$) = 1.0. Note that these narrow belts used the simpler Gauss – Schreiber formulae for the Transverse Mercator, the same as the U.S. Coast and Geodetic Survey later did in the 1930’s for the NAD 1927 State Plane Coordinate Systems. The Tokyo Datum of 1918 was later adopted for use in Korea, but the Cadastral Grids were NOT changed to accommodate that new system. The only difference between the two datums is that the 1918 re-determination of longitude is: $\Lambda = 139^\circ 44' 40.502"$ East of Greenwich, which is an increase of 10.405”. The latitude was the same for both years. In Korea, the geographic coordinates of the triangulation stations are on the Tokyo Datum of 1918, but the Grid coordinates are on the Tokyo Datum of 1898. This is a little-known fact of Korean mapping that has led some cartographers to question their own sanity!

The number of triangulation stations lost or destroyed during World War II and the Korean War was about 12,000, or approximately 80% of the marks in South Korea. The rearrangement and reconstruction of the triangulation stations were begun in 1957. Rearrangement in this context means that work is done to build the stone marker to coincide with the recovered footing of the original triangulation station. Reconstruction work refers to rebuilding the footing and marker at the original site, or nearby, and performing the triangulation observations anew. All of this work was completed by 1986. In 1975, electro-optical distance meters (EDM) were introduced to the observational techniques. The re-survey has been of 1,291 existing first- and second-order stations as well as 14,798 third- and fourth-order stations. This has resulted in a new geodetic network being established where the accuracy specification is $\pm 3$ cm horizontal, $\pm 5$ cm vertical.

The Korean Datum of 1985 origin is at station Suwon on the grounds of the National Geographic Institute (NGI) where: $\Phi = 37^\circ 16' 31.9034"$ North, $\Lambda = 127^\circ 03' 05.1451"$ East of Greenwich. The defining azimuth to station Donghak-san is: $\xi = 170^\circ 58' 18.190"$. The ellipsoid of reference did not change. The 40 Laplace stations established for this new datum were planned for a density of one station per 5,000 km$^2$. By 1996, 37 Laplace station observations were completed. The civilian Cadastral Grid system will continue on the new datum with no change in parameters other than the ellipsoid.

The leveling net in Korea was initially established between 1910-15, but the Korean War virtually destroyed all existing marks in the
south. Since 1960, NGI started the re-
survey of its network and by 1986
completed the first-order net. This is
composed of 16 loops and 38 routes
with a total length of 3,400 km and
2,030 benchmarks spaced at 2–4 km in-
tervals. The primary benchmark of
the Republic of Korea is at Inha Univer-
sity in the city of Inchon. Second-
order benchmarks total 4,035 points
along 7,600 km of leveling routes.

NGI has used satellite surveying
techniques since 1979. Two
Magnavox 1502 receivers were em-
ployed at Pusan, Kyeongju, and Cheju-
do through co-operation with Japan
until 1982. Twenty islands have been
occupied for Transit satellite observa-
tions as of 1991. Since 1991, NGI has
been using GPS receivers to
strengthen the classical network.

Plans to establish 20 permanent GPS
observation stations in a Continu-
ously Operating Reference Station
(CORS) network started with the first
station called SUWN using a
TurboRogue™ SNR-8000 receiver on

Gravity surveys have been con-
ducted by NGI since 1975. The origi-
nal design plan called for 25 first-or-
der stations and 2,000 second-order
stations. By 1996, 1,709 second-order
relative gravity stations had been ob-
served at existing bench marks. The
initial point for the Korean gravimetric
datum is also at station Suwon in con-
nection with the international gravity
datum at the Geographical Survey In-
stitute of Japan. Auxiliary first-order
stations are located at Seoul National
University (\( \phi = 37° 27.1' \) N,
\( \lambda = 126° 57.0' \) E), at Kyeongbuk Na-
tional University (\( \phi = 35° 53.2' \) N,
\( \lambda = 128° 36.9' \) E), at Pusan National
University (\( \phi = 35° 13.0' \) N,
\( \lambda = 129° 05.0' \) E), and at the Korean
Standards Institute (\( \phi = 36° 23.1' \) N,
\( \lambda = 127° 22.4' \) E).

On August 20, 1888, Russia and
Korea signed an agreement providing
for freedom of navigation on the
tumen River for coasting-vessels of
both nationalities. The treaty also
spoke of the river as “their common
frontier.” However, since Japan an-
nexed Korea in 1910 the status of that
common boundary is not clear. By
1914, Japan submitted a plan for the
delimitation of the boundary by using
the Rule of the Thalweg, but World
War I and the Russian Revolution
prevented any action.

The Korea “Demarcation
Line” at the 38th parallel represents
the partitioning of Korea effected by
the July 27, 1953 Panmunjom Agree-
ment ending the Korean hostilities.
Approximately 238 km long (148.5
miles), the line follows a sinuous path
over rugged terrain.

The China – Korea boundary
received attention in November of
1961 when magazines published in
both countries carried features on the
Ch’ang-pai mountain range and spe-
cifically “The Pond of Heaven” which
is a volcanic lake. Both countries
claimed the same lake. The first at-
ttempt by both countries to define
their common border in this region
dates back to 1713, but disputes and
confusion obviously continue.

On January 30, 1974 the gov-
ernments of Japan and Korea signed
two maritime agreements that estab-
lished a continental shelf boundary in
the northern part of the maritime re-
 gion adjacent to the countries. The
boundary is defined by a series of
elipsoidai loxodromes (rhumb lines) be-
tween points referenced to the Tokyo
Datum of 1918. On September 20,
1978 the Republic of Korea promul-
gated a system of “straight
baselines” by Presidential Decree No.
9162. These straight lines are also de-
 fined as loxodromes on the Tokyo Da-
tum of 1918, and Korea defers its
boundary claim of territorial waters in
narrow water bodies such as the Ko-
 rean Strait and Cheju Hachyop.

DMA/NIMA lists the three-param-
eter datum shift from Tokyo Datum of
1918 to WGS 84 Datum in the Repub-
lic of Korea as: \( \Delta X = -147m \), \( \Delta Y = +506m \), \( \Delta Z = +687m \), and is based on a
29-station solution. However, my so-
lution for nine well distributed first-or-
der points (N’pyong, Hainam, Namhai,
Bangejin, Sokcho, Hansan, Sangju,
Uljin, and Kangwa) is: \( \Delta X = -323m \),
\( \Delta Y = +309m \), \( \Delta Z = +653m \).

The actual rms fit of my solution to test points is:

\[
\text{Latitude} = \frac{2.20m}{7.87m}, \quad \text{Longitude} = \frac{1.26m}{0.84m}, \quad \text{Height} = \frac{2.20m}{0.65m}.
\]

For example, test point “N’pyong 21” on
Tokyo 1918 Datum: \( X = 498,278.75 \),
\( Y = 269,683.64 \), \( \phi = 37° 58’ 54.538 \) N,
\( \lambda = 127° 47’ 35.747 \) E, \( H = 784.65m \).

On WGS 84 Datum:

\( \phi = 37° 59’ 04.483 \) N,
\( \lambda = 127° 47’ 38.404 \), \( h = 812.007m \).

Thanks for the geodetic his-
tory of Korea and data go to Mr.
Heungmuk Cho of the Geodesy Divi-
sion, National Geography Institute in
Suwon-shi, Republic of Korea.