

West Bank and Gaza Real Estate Registration Project

Terms of Reference for the Development of National Palestinian Geodetic Reference Framework -- Reference No.: GZ-PLA-250392-CS-QCBS

1. Introduction

The Palestinian Liberation Organization, for the benefit of the Palestinian Authority, has received financing from the World Bank, and co-financing from the Global Partnership for Results-Based Aid (GPRBA), and the Palestinian Partnership for Infrastructure Development Multi-Donor Trust Fund (PID MDTF) in the amount of USD12.6M towards the cost of the West Bank & Gaza Real Estate Registration Project (RERP). RERP, which was approved in July 2019 and became effective on March 5, 2020, is being implemented by the two land agencies, the Palestine Land Authority (PLA) and Land and Water Settlement Commission (LWSC).

The project development objective (PDO) is to enhance tenure security and improve real estate registration services. These objectives will be achieved through (i) advancing the registration of properties in the Palestinian territories in Areas A and B; and (ii) support the automation of the real estate registration system and related services for citizens and businesses. The project has three components: Component 1: Systematic Land and Property Registration; Component 2: Institutional Modernization of the Palestinian Land Authority (PLA); and Component 3: Project Management.

In regarding to the Component 2 which is carried out by the PLA; the sub-component 2.2: Palestinian Geodetic Reference Framework (PAL-GRF) will finance the development of a National Palestinian Geodetic Reference Framework (PAL-GRF).

The RERP also aims to improve, facilitate and speed up the services to the citizens and residents of the West Bank & Gaza by adopting modern tools of Imaging, Mapping, Geographical Information Systems (GIS), and Global Navigation Satellite Systems (GNSS) based surveys and advanced ground survey tools. This initiative is planned to meet the geospatial and geomatics needs of the PLA and for coordination between PLA and other developmental agencies (in the public and private sectors).

2. Background:

Palestine Geodetic Control Network Current Status:

Historical Information about Coordinates System Used Palestine:

Palestine Grid 1923 (EPSG: 281911) is the coordinate system used by the Survey Department of Palestine during the British mandate period. The system was chosen by the Survey Department of the Government of Palestine in 1922. The projection used was the Cassini-Soldner projection. The central meridian (the line of longitude along which there is no local distortion) was chosen as that passing through a marker on the hill of Mar Elias Monastery south of Jerusalem. The false origin (zero point) of the grid was placed 100 km to the south and west of the Ali el-Muntar hill that overlooks Gaza city.

At the time the grid was established, there was no intention of mapping the lower reaches of the Negev Desert, but this did not remain true. The fact that those southern regions would have negative north-south coordinate then became a source of confusion, which was solved by adding 1000 to the northern coordinate in that case. For some military purposes, 1000 was added to the north-south coordinates of all locations, so that they then ranged uniformly from about 900 to about 1300.

Establishment of the State of Israel, the Palestine grid continued to be used under the name of the Israel Grid or the Israeli Cassini Soldner (ICS) grid, now called the "Old Israeli Grid", with 1000km added to the northing component to make the north-south range continuous. It was replaced by the Israeli Transverse Mercator grid in 1994. The Palestine grid is still commonly used to specify locations in the historical and archaeological literature.

The geodetic network consisting of (91000) Ground Control Points (GCPS) -bolts fixed on hills or top of mountains- most of them were destroyed or disturbed, These GCPS were established by British Government and it can be recognized & identified in maps or archive by a number followed by one capital English Letter (e.g. 186-D), The other set of GCPS are "Jordanian control points" and it can be identified by a number followed by two letters. In addition to that there are sets of Continuous Operation Reference Stations (CORS) operated by private sectors.

The accuracy and homogeneity of the existing network is uncertain due to improper archiving, lack of reliable information and records and many other factors, this is can be clearly recognized while performing the regular survey works, measurement in the region, and mapping, so the need of developing a homogeneous Geodetic Reference Framework, including the establishment of the National Geodetic Control Network become very essential.

3. Purpose:

¹ <https://epsg.io/28191>

The project will support the establishing of a National Palestinian Geodetic Reference Framework (PAL-GRF) in WGS84-UTM latest² ITRF Coordinates system linked to the local coordinates system which is Palestine Grid 1923 -EPSG: 28191. The project will cover the following:

- Providing the spatial reference foundation for all surveying, mapping, and location-based applications and services in the West Bank.
- PAL-GRF will also help to generate the land-related geospatial data and information that is needed for incorporating climate change adaptation in land-use planning, as requested in the National Climate Change Adaptation Strategy. The information it will produce will contribute to the future development of geospatial datasets for the West Bank related to elevation, flood levels, and topography. These would improve disaster risk management and help expedite post-disaster recovery in the event of natural disasters or extreme weather.
- Taking up the project for Master Plan Unification in GIS that will not only encapsulate the existing geospatial data, including georeferenced images and maps, AutoCAD holdings in the West Bank but also will help establishing a proper GIS infrastructure.
- The existing data of West Bank and Gaza in many forms and co-ordinate systems can be transformed into a single coordinate reference system. Also, the same spatial framework would be used for all other survey works of West Bank and for all government / semi government entities or public and private sectors.
- Establishing new Geospatial Reference Framework (GRF) that help to improve related organizations works.
- Achieving required accuracy and quality of all survey and mapping works, as well as ensuring accurate demarcation for all properties & boundaries in West Bank.
- Managing, monitoring & ensuring required quality of all works performed by the private sector entities by controlling the mismatching & errors in measurement between the services providers / companies using homogenous geodetic control network.
- Keep aligned with World Geodetic System (WGS) and International Terrestrial Reference Frame (ITRF).
- Providing strong base for computation of the Local Geoid Model for Palestine (PALG).

² ITRF 2014, if ITRF 2020 is approved it should be used.

4. Objective:

The core purpose of the project is establishing the Palestinian National Geodetic Reference Framework for Gaza & West Bank improving the services, business quality and increasing the overall productivity to keep aligned with the future development projects.

5. Scope of Work:

In order to achieve the objective, the consultancy firm will need to achieve the following tasks:

1. Preparation and finalization of the Project Implementation Plan for PAL-GRF document including the technical specifications for “Field Survey and Data Acquisition” and Geodetic Control Network design.
2. Development of the technical specification and tender documents which required for the selecting & assigning a qualified geodetic surveying contractor to select the points and perform field survey works & data acquisition.
3. Guide PLA of the recommended software/hardware provision for the establishment of the Operational and Analysis Centers (one in West Bank and one in Gaza) for the PAL-GRF at the PLA.
4. Develop technical specifications/TOR for the establishment of the Operational and Analysis Centers (one in West Bank and one in Gaza) for the PAL-GRF at the PLA.
5. Support the PLA with the review of the raw data collected from the field and other deliverables (deliverables from task 2).
6. Geodetic Network computation with reference to the IGS Global stations that has two parts:
 - (a) Post Processing the static Raw Data (RINEX files) observation (resulting from activity 2) using an appropriate software (e.g., Bernese GNSS software), and;
 - (b) Align the resulting PAL-GRF stations coordinates to the latest ITRF³.
7. Analyzing verifying the reliability and homogeneity of the existing Palestine Grid 1923 (EPSG: 28191) system for determining the transformation parameters between that system and the new PAL-GRF.
8. Computation of transformation parameters between Palestine Grid 1923 and the PAL-GRF, i.e., the new Palestinian CRS.
9. Knowledge transfer, training. And capacity building for PLA staff to maintain and update PAL-GRF (about 5 PLA staff) according to a training plan provided by the consultant.

³ ITRF 2014, if ITRF 2020 is approved it should be used.

6. Deliverables:

1. Project Implementation Plan for PAL-GRF including project technical specifications and Geodetic Control Network design.
2. Specifications and tender documents for the field survey works & data acquisition.
3. Preliminary Survey Reports & Testing report including the signal quality and data flow stability.
4. Review and acceptance of Stations Observation files (Tracking files) & the raw data in RINEX format provided by the Surveying Company.
5. Review and acceptance of the preliminary and final survey.
6. Final Coordinates list in PAL.GRF and Old System (Palestine Grid 1923) - Approved by PLA.
7. Technical specifications/TOR for the establishment of the Operational and Analysis Centers, including hardware and software.
8. Transformation parameters between Palestine Grid 1923 and the PAL-GRF, i.e., the new Palestinian CRS
9. Knowledge transfer, training and capacity building for 10 PLA staff.

7. Qualifications:

Given the scope of the work, a qualified consultancy firm is required. The Consultancy firm should have the capacity to carry out the assignment in the number of months required (which should be demonstrated) and should have qualifications and experience in the following areas:

- Previous track record of similar assignments and projects.
- Well established geomatics firm with at least 10 years' experience in the area.

The consultancy team should comprise as a minimum the following key team member:

Task Team Leader:

- Post-graduate (Ph.D. or M.Sc.) degree in Surveying/Geomatics.
- Extensible theoretical knowledge and min 10 years of practical experience in Geodetic Reference Frameworks, GNSS (Global Navigation Satellite Systems), Theory of Adjustment, and Geodetic Networks Design and Adjustment.
- Proven knowledge and experience with Bernese GNSS or equivalent software
- Experience in Geo-information systems.
- Proven experience in similar assignments and projects.
- Excellent writing and reporting skills.
- Experience in working directly with different kinds of relevant stakeholders.
- Demonstrated interpersonal skills, including the ability to work effectively in a team or task force as participant or team leader.
- Experience working with the World Bank or other development partners is an advantage.

- Familiarity in working in different work environments in foreign countries.
- Working knowledge in Arabic is highly desired.

Geodetic Expert:

- At least M.Sc. degree in Surveying/Geomatics.
- Extensible theoretical knowledge and min 5 years of practical experience in Geodetic Reference Frameworks, GNSS (Global Navigation Satellite Systems), Theory of Adjustment, and Geodetic Networks Design and Adjustment.
- Proven knowledge and experience with Bernese GNSS or equivalent software
- Proven experience in similar assignments and projects.
- Excellent writing and reporting skills.
- Experience in working directly with different kinds of relevant stakeholders.
- Demonstrated interpersonal skills, including the ability to work effectively in a team or task force as participant or team leader.
- Experience working with the World Bank or other development partners is an advantage.
- Familiarity in working in different work environments in foreign countries.
- Working knowledge in Arabic is highly desired.
- Experience in training (ToT).

Field Control and Quality Assurance Engineer:

- Bachelor's degree in Surveying Engineering / Geomatics.
- 5 years' experience in Surveying.
- Ability to work in the field and travel in West Bank and Gaza areas.

Supporting Team members to be proposed by the firm.

8. Contract and Payments:

The contract will be Lump-sum contract; the expected duration for the assignment is **18 calendar month** and payments will be based upon the approved deliverables as follows:

- **30% of contract value** after the acceptance of the Project Implementation Plan for PAL-GRF including project technical specifications and Geodetic Control Network design.
- **10% of contract value** after the acceptance of the Specifications and tender documents for the field survey works & data acquisition.
- **20% of contract value** after the acceptance of the Preliminary Survey Reports & Testing report including the signal quality and data flow stability.

- **20 % of contract value** after the acceptance of the Review and acceptance of the preliminary and final survey.
- **20 % of contract value** after the acceptance of delivered Knowledge transfer, training and capacity building.

9. Selection Method:

A firm will be selected in accordance with the World Bank's Guidelines based on Quality and Cost Based Selection (QCBS) set out in the Procurement Regulations.

10. Assignment duration and level of effort:

The expected duration for the assignment is 18 calendar months and the level of effort is 240 days.

Annex 1

Assignment Implementation Steps

1. Site selection & Access Permission:

- Reference Stations selection (Selection from existing Ground Control Point Stations) is dependent on many factors, Firstly the site must be well positioned and well located relative to each other facilities that are contributing to the same efforts.
- A range of local government acts, regulations of survey department policies may apply to the proposed reference station sites to start the work.
- With respect to the existing Reference stations, baseline length and technical requirements, the bidder should propose initial site locations for the new reference stations considering the current condition & future extension of the networks (Densification of the ground control points or CORS establishment). Based on those the old system verification activities can be conducted.
- The bidder should be responsible following up coordinating with PLA to obtain all the permits/NOCs & Approvals (After the selection of the Survey company and before preliminary site selection) to access the selected locations if applicable to perform the required field activity.
- Basic utilities such as electrical power and a telephone line or computer network connection are essential for the future CORS operation (The locations of the points should have the required infrastructure to support it).
- Reference stations site must be accessed for maintenance or inspection and reachable with a minimum of logistical complications.

2. Mobilization/Demobilization:

Mobilization includes the movement of all equipment, personnel, and material to the site. Demobilization includes the removal of all equipment, personnel, and material from the site at the completion of the defined scope of-work. This is will be part of the scope of works & under the responsibility of the Geodetic Survey Contractor (Task 2 of this assignment) Including Old System Verification field activities.

3. Preliminary Survey:

After obtaining sites access permit /NOC(S) for the selected sites a Preliminary Survey should be performed by the consultant to confirm the site suitability and the Reconnaissance Report, a technical document explains how the testing will be performed and all other requirements related to the testing procedures shall be part of it.

The stations selection requires recommendations from specialist to advice on the location selection keeping on mind the network and internet availability for the site and the site accessibility.

4. PAL-GRF Network Design & Implementation:

The local grid coordinates used in PLA is **Palestine Grid 1923 -EPSG:28191**, the final coordinates results should be the same, the technical proposal should contain a detailed description (under methodology clause) and the network design, how the post-processing will be performed & which International GNSS Services (IGS) stations will be used for computation, observation duration, observation rate and geometrical design of the network shall all baselines that will be included in the project implementation document.

At least Three Military Survey Department (MSD) Geodetic Points should be included in network computation in order to tie PAL-GRF with National Network if applicable and the final coordinates should be compared with the given coordinates for confirmation. In case if not possible to have MSD points Three GCPS will be provided by PLA for cross checking purposes.

Cross Checking (RTK observation for specific positions using the new established CRS from two different reference stations) should be performed by the consultant along with PLA supervising engineer.

The GNSS antenna heights should be measured from the ground level and considered in computation, & Orthometric height should be provided with reference to three control point provided by PLA.