

NGS POLICY 04-2000



FBN Station Selection Guidelines

National Geodetic Survey

Approved by the Executive Steering Committee

13 December 2000

This policy has been retired and is no longer in effect

FEDERAL BASE NETWORK (FBN) DEFINITION AND STATION SELECTION GUIDELINES

DEFINITION

The Federal Base Network (FBN) is a very high accuracy network of permanently marked (monumented) control points at approximately 1-degree-by-1-degree (100-km) spacing throughout the United States and its territories. FBN contains additional, more densely spaced stations as needed for safe aircraft navigation, and in areas of crustal motion. FBN provides the Nation with spatial reference control having some of the highest accuracies available today. Developing and maintaining FBN is one of the primary responsibilities of the National Geodetic Survey (NGS).

The "goal" of FBN is to supply local accuracies of at least:

- 2 cm (95% confidence level) for geodetic latitudes and longitudes,
- 2 cm (95% confidence level) for ellipsoidal heights and
- 3 cm (95% confidence level) for orthometric heights,
- 50-microgal accuracy for gravity values, and
- 1 mm/year relative accuracy for horizontal and vertical crustal motion.

The interim "goal" of FBN is to supply network accuracies of at least:

- 5 cm (95% confidence level) for geodetic latitudes and longitudes,
- 5 cm (95% confidence level) for ellipsoidal heights and
- 7 cm (95% confidence level) for orthometric heights,
- 100-microgal accuracy for gravity values, and
- 5 mm/year relative accuracy for horizontal and vertical crustal motion.

This document provides the guidelines to be used to select additional FBN stations. These guidelines address the issues of selection priorities, station spacing, monumentation and station environment, stability, and accessibility.

SELECTION PRIORITIES

Station selection shall be based on the following priorities, which are given in the order of highest priority first. Within each priority category, preference should be given to selection of appropriate older stations having a known history of prior stability as indicated by previous observations.

Each FBN station should be selected from:

1. Existing A- or B-order station, where possible. At special survey sites such as Continuously Operating Reference Stations (CORS), WAAS, and VLBI, where several

high-accuracy monumented stations exist, only one of the monumented stations shall be selected as a FBN. In cases where a protected area exists at the site, the most accessible station shall be selected as the FBN. Other stations at the site shall be designated as CBNs, with the appropriate agency being responsible (FAA, USCG, or State agency).

2. Primary Airport Control Stations (PACS) will be candidates for FBN station selection. Those PACS that are not selected as FBNs will be designated as Cooperative Base Network (CBN) stations, with the responsible agency being FAA. The Secondary Airport Control Stations (SACS) will be designated as User Densification Network (UDN) stations; the responsible agency again being FAA. Where necessary, an additional nearby station, a CBN, which is easily accessible by the public, will be established and directly connected to the airport station.

3. Existing National Spatial Reference System (NSRS) station with a first- or second-order elevation AND first- or second-order horizontal coordinates, with higher-accuracy classification being preferred both vertically and horizontally (giving vertical accuracy top priority).

4. Existing NSRS station with first- or second-order elevation, again the higher accuracy classification being preferred.

5. Existing NSRS station with first- or second-order horizontal coordinates which would require a minimum amount of first- or second-order leveling (within 10 km) to establish a precise elevation.

6. New station or existing station not in NSRS, suitable for GPS observations, set in bedrock, which would require a minimum amount of first- or second-order leveling (within 10 km) to establish a precise elevation.

7. New station or existing station not in NSRS, suitable for GPS observations, established by setting a 3D monument, which would require a minimum amount of first- or second- order leveling (within 10 km) to establish a precise elevation.

STATION SPACING

Unless specified otherwise, the overall FBN shall consist of stations spaced on average approximately 100-km apart. The actual station spacing shall be flexible enough (from 50 km to 150 km) to allow for optimum station selection. In addition, existing horizontal NSRS stations should be selected in a pattern so that overall, these stations are located in each one-degree block throughout the project. When impossible to meet the above criteria, an additional first- or second-order horizontal NSRS station must be recovered that is suitable for GPS observations. These additional stations shall be selected approximately midway between FBN stations.

MONUMENTATION AND STATION ENVIRONMENT

The following is a list of considerations for each station in FBN. The intent is to ensure that station monuments will be locally stable and remain usable indefinitely. Each of these considerations is important.

Adequate GPS satellite visibility (unrestricted at 15 degrees and higher above the horizon). Minor obstructions may be acceptable, but must be depicted on the Visibility Obstruction Diagram.

Accessible by vehicle (two-wheel drive preferred).

Stability; bedrock mark being most preferred. (See STABILITY.)

Permanency.

Ease of recovery.

Avoid known multi-path sources.

Appropriate geographic location and spacing.

Location allows efficient use by surveying community.

Accessible by public. (See ACCESSIBILITY.)

No known potential conflict with future development.

Open area for possible aerial-photo paneling.

Avoid electronic interference where possible.

STABILITY

Station monument stability is often difficult to assess in the field with limited resources. For existing NSRS station monumentation, the NGS data base contains stability qualifiers which were assigned for the majority of marks when they were set. For FBN stations, existing NSRS stations must have a stability Quality Code of "C" or better. Quality Codes A and B are preferred. New monuments will have a stability Quality Code of B or better.

Quality Codes are as follow:

- Quality Code A - most reliable; are expected to hold a precise elevation. Examples: rock outcrops; rock ledges; rock cuts; bedrock; massive structures with deep

foundations; large structures with foundations on bedrock; or sleeved deep settings (10 ft or more) with galvanized steel pipe or galvanized steel, stainless steel, or aluminum rods.

- Quality Code B - will probably hold a precise elevation. Examples: unsleeved deep settings (10 ft or more) with galvanized steel pipe or galvanized steel, stainless steel, or aluminum rods; massive structures other than those listed under Quality Code A; massive retaining walls; abutments and piers of large bridges or tunnels; unspecified rods or pipe in a sleeve less than 10 ft; or sleeved copper-clad steel rods.
- Quality Code C - may hold precise elevation, but subject to ground movement. Examples: metal rods with base plates less than 10 ft deep; concrete posts (3 ft or more deep); unspecified rods or pipe more than 10 ft deep; large boulders; retaining walls for culverts or small bridges; footings or foundation walls of small to medium-size structures; or foundations such as landings, platforms, or steps. (See Quality Code C Exception, below.)
- Quality Code D - of questionable stability. Examples: generally, objects of unknown character; shallow set rods or pipe (less than 10 ft); light structures; pavements such as street, curbs, or aprons; piles and poles such as spikes in utility poles; masses of concrete; or concrete posts less than 3 ft deep.
- Quality Code C Exception - when selecting FBN stations, only Quality Codes A and B are recommended. However, concrete posts may be selected with a C stability if the mark is deemed stable from review of historical releveling, soil type, and frost depth. Final selection is subjective, and is based on local knowledge of soil and frost heave, plus knowledge of how well the mark has held its horizontal and vertical positions over the years.

ACCESSIBILITY

Accessible public property should be utilized where feasible. If the station is located on private property, permission must be obtained from the land owner for station accessibility. Include the name, address, and, if public ownership, the telephone number of the responsible party. Do not include telephone numbers of private property owners.

FIELD WORK IS UNDERWAY

NGS is conducting field surveys to complete the ellipsoidal height and horizontal components of FBN stations in order to attain coordinate accuracies of 2 cm in three dimensions (95% confidence level). The task began in September 1997.

FOR ADDITIONAL INFORMATION, CONTACT:

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