

Permanent station GPS/GNSS antenna monuments and mounts supported by UNAVCO (poster for UNAVCO Science Meeting, 2010)

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Abstract

We compare eight long-term monuments and mounts currently in use in UNAVCO-supported projects. The designs range in height from 0 to 3 meters; substrates into which they are installed include soil, bedrock, and concrete; and costs range from approximately \$30 to \$15000. The more expensive options may be considered more stable, but in many places outside the US, logistical, economical, and material constraints make installation of deep- and shallow-drilled braced monuments at best difficult and at worst impossible. Simpler single-mast or concrete monuments offer less expensive, more portable installation options with acceptable stability.

Summary

The common goal of all monuments and mounts is to provide a stable, long-term reference point for geodesy and geomatics. The design and construction of a monument or mount should be based on the following criteria:

- Long-term stability
- Minimal movement
- Minimal maintenance
- Minimal cost
- Minimal impact on the environment
- Minimal impact on the monument's appearance

When choosing a monument and mount, consider:

- Stability: Is the monument/mount stable over the long term?
- Cost: Is the monument/mount affordable?
- Time: How long will it take to install/maintain?
- Appearance: Does it look professional?
- Maintenance: How easy is it to maintain?
- Availability: Is it readily available?

Requesting support from UNAVCO

UNAVCO is a non-profit, membership-based organization that supports and provides state-of-the-art geodesy and geomatics equipment and services. We are currently accepting applications for the 2011-2012 funding cycle. To request support from UNAVCO, fill out a support request form at www.unavco.org. For questions, contact info@unavco.org. For more information on monuments and mounts, check out www.unavco.org.

Monument	Deep drilled braced	Shallow braced	Concrete pillar	Thermopile	Polar mast	Shallow foundation mast	Stainless steel pin or mast	5/8" all-thread	Custom
Description	A 4" diameter steel pipe is drilled 10-15 feet into bedrock. The pipe is braced with 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter stainless steel pipe is drilled 10-15 feet into bedrock. The pipe is braced with 1/2" diameter stainless steel rods. The monument is constructed from 1/2" diameter stainless steel rods and 1/2" diameter stainless steel nuts and washers.	A 4" diameter concrete pillar is drilled 10-15 feet into bedrock. The pillar is constructed from 4" diameter concrete and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter thermopile is drilled 10-15 feet into bedrock. The thermopile is constructed from 4" diameter thermopile and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter polar mast is drilled 10-15 feet into bedrock. The mast is constructed from 4" diameter polar mast and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter shallow foundation mast is drilled 10-15 feet into bedrock. The mast is constructed from 4" diameter shallow foundation mast and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter stainless steel pin or mast is drilled 10-15 feet into bedrock. The pin or mast is constructed from 4" diameter stainless steel pin or mast and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A 4" diameter 5/8" all-thread is drilled 10-15 feet into bedrock. The all-thread is constructed from 4" diameter 5/8" all-thread and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.	A custom monument is drilled 10-15 feet into bedrock. The monument is constructed from custom materials and 1/2" diameter steel rods. The monument is constructed from 1/2" diameter steel rods and 1/2" diameter steel nuts and washers.
Substrate	Bedrock, unconsolidated	Bedrock (drilled), unconsolidated (grounded)	Bedrock, unconsolidated	Permafrost	Bedrock, concrete	Bedrock	Bedrock, concrete	Bedrock, concrete	Bedrock, concrete
Stability	High	High	Medium	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High
Install Time	1-2 days	1-2 days	1-2 days	1-2 days	1-2 days	1-2 days	1-2 days	1-2 days	1-2 days
Labor	2 people, 1-2 day crew	2 people	2 people	1 person, 1-2 day crew	1 person	1-2 people	1 person	1 person	1 person
Cost	\$1,000-15,000 (incl. drilling)	\$500	\$500-1,000	\$1,000-15,000 (incl. drilling)	\$500	\$500	\$500	\$500	\$500
Site Impact	High	Medium	Medium	High	Low	Low	Low	Low	Low
Drilling Requirements	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)	Power Drilling (Rotary Drilling, Core Drill)
Where Used	Flow Boundary (Geomatics, SURVEY, TIE-IN, Core Drill)	Flow Boundary (Geomatics, SURVEY, TIE-IN, Core Drill)	Non-Flow (GNSS)	Flow Boundary (Geomatics)	TERRA POLARNET (Mounts, Core)	Flow Boundary (GNSS)	Flow Boundary (GNSS)	Flow Boundary (GNSS)	Flow Boundary (GNSS)

Antenna Mounts

SOGN mount
SOGN is a geodesy-grade, non-magnetic, high-precision antenna mount. It is designed for use with GPS/GNSS antennas. SOGN is available through UNAVCO and is also available from the University of Colorado Boulder.

SICO JNT7 series stainless steel adapter
SICO JNT7 series stainless steel adapter is a high-precision, non-magnetic, high-precision antenna adapter. It is designed for use with GPS/GNSS antennas. SICO JNT7 series stainless steel adapter is available through UNAVCO and is also available from the University of Colorado Boulder.

Cup and brass adapter
Cup and brass adapter is a high-precision, non-magnetic, high-precision antenna adapter. It is designed for use with GPS/GNSS antennas. Cup and brass adapter is available through UNAVCO and is also available from the University of Colorado Boulder.

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