

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

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Permanent station GPS/GNSS antenna monuments and mounts supported by UNAVCO

Normandeau, J., Meertens, C., Bartel, B.
UNAVCO

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 currently in use is to provide a stable, long-term reference point for geodesy and geodynamics. The design and construction of a monument or mount should be based on the following criteria:

- Long-term stability
- Minimal thermal expansion/contraction
- Minimal moisture expansion/contraction
- Minimal wind expansion/contraction
- Minimal seismic expansion/contraction
- Minimal magnetic expansion/contraction
- Minimal magnetic susceptibility
- Minimal magnetic permeability
- Minimal magnetic susceptibility
- Minimal magnetic permeability
- Minimal magnetic susceptibility
- Minimal magnetic permeability

When choosing a monument and mount, consider:

- Stability (long-term precision needed)
- Cost (budget)
- Time (months for installation)
- Availability
- Materials available (e.g., international work)
- Site accessibility
- Site location

Requesting support from UNAVCO

UNAVCO is a non-profit, membership governed consortium that supports and provides Earth science geodesy, high-precision techniques for the measurement and understanding of Earth's deformation.

UNAVCO can provide assistance with design, availability, and construction of permanent monuments to GPS and GNSS total stations.

To request support from UNAVCO, fill out a support request form at: <http://www.unavco.org>. For questions, contact unavco@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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	A 4" diameter stainless 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.	UNAVCO works with customers to design and construct monuments and mounts that meet their specific needs. We offer a wide range of options, including 1/2" diameter steel rods, 1/2" diameter stainless steel rods, and 1/2" diameter stainless steel rods.
Substrate	Bedrock, unconsolidated	Bedrock (drilled), unconsolidated (grounded)	Bedrock, unconsolidated	Permafrost	Bedrock, concrete	Bedrock	Bedrock, concrete	Bedrock, concrete	Bedrock, concrete	
Stability	High	High	High	High	High	High	High	High	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 cost	2 people	2 people	1 person, 1-2 day cost	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 (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	Flow Boundary (Geodesy, SURVEY, TIGER, Core Drill)	


Antenna Mounts



SOGN mount
2 mounting options. One needed for SOGN antenna.



SOGN JNT7 series stainless steel adapter
Low expansion and also proven used in the US National Geodetic Survey's CORS network.



Cup and brass adapter
Inexpensive but no leveling ability, unless the antenna is adjusted to work.

SOGN custom mounts



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