

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 permanent station GPS/GNSS antenna monuments and mounts currently in use in the geodetic community. The design, range of application, and the advantages and disadvantages of each are discussed. The design, range of application, and the advantages and disadvantages of each are discussed. The design, range of application, and the advantages and disadvantages of each are discussed.

When choosing a monument and mount, consider:

- Stability (location, ground, material)
- Cost (equipment, labor, materials)
- Time (time to install, time to maintain)
- Size (weight, volume)
- Reliability (durability, maintenance)
- Site (location, access)

Requesting support from UNAVCO

UNAVCO is a non-profit, membership-based organization that supports and provides Earth science research with high-precision geodesy. For the measurement and understanding of deformation.

Monument	Deep drilled bedrock	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 into the bedrock to a depth of 10-15 feet. The pipe is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pipe.	A 4" x 17" diameter stainless steel pipe is drilled into the bedrock to a depth of 10-15 feet. The pipe is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pipe.	A 12" diameter concrete pillar is drilled into the bedrock to a depth of 10-15 feet. The pillar is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pillar.	A 12" diameter thermopile is drilled into the bedrock to a depth of 10-15 feet. The thermopile is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the thermopile.	A 12" diameter polar mast is drilled into the bedrock to a depth of 10-15 feet. The mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the mast.	A 12" diameter shallow foundation mast is drilled into the bedrock to a depth of 10-15 feet. The mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the mast.	A 12" diameter stainless steel pin or mast is drilled into the bedrock to a depth of 10-15 feet. The pin or mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pin or mast.	A 5/8" all-thread is drilled into the bedrock to a depth of 10-15 feet. The all-thread is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the all-thread.	Custom
Substrate	Bedrock, unconsolidated	Bedrock (drilled), unconsolidated (grounded)	Bedrock, unconsolidated	Permafrost	Bedrock, concrete	Bedrock	Bedrock, concrete	Bedrock, concrete	Custom
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	2-3 people, 1 day	2-3 people, 1 day	2-3 people, 1 day	1 person, 1 day	1 person, 1 day	1-2 people, 1 day	1 person, 1 day	1 person, 1 day	1 person, 1 day
Cost	\$10,000-15,000 (incl. drilling)	\$500	\$500-1000	\$5,000-10,000 (incl. drilling)	\$500	\$500	\$500	\$500	\$500
Site Impact	High	Medium	Medium	High	Low	Low	Low	Low	Low
Drilling Requirements	Large diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep	Small diameter drill bit, 10-15 feet deep
Where Used	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy

Antenna Mounts



SOIGN mount
A stainless steel pin or mast is drilled into the bedrock to a depth of 10-15 feet. The pin or mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pin or mast.



SSICO 3073 series stainless steel adapter
A stainless steel pin or mast is drilled into the bedrock to a depth of 10-15 feet. The pin or mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pin or mast.



Cup and brass adapter
A stainless steel pin or mast is drilled into the bedrock to a depth of 10-15 feet. The pin or mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the center of the pin or mast.



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