

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

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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 permanent station GPS/GNSS antenna monuments and mounts currently in use in the continental United States are heterogeneous, ranging in design, size, and material. This poster provides information on the design, construction, and maintenance of these monuments and mounts. It also provides information on the design, construction, and maintenance of the antenna mounts. The poster is intended for use by scientists, engineers, and technicians who are involved in the design, construction, and maintenance of these monuments and mounts.

When choosing a monument and mount, consider:

- Stability (location, ground, material)
- Cost (materials, labor)
- Time (time to install, time to maintain)
- Size (size of monument, size of mount)
- Material (material of monument, material of mount)
- Site (site conditions, site 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, UNAVCO can provide assistance with design, construction, and maintenance of permanent monuments to GPS and GNSS stations. To request support from UNAVCO, fill out a support request form at <http://www.unavco.org>. For questions, contact info@unavco.org. The poster information on monuments and mounts, which can be found at <http://www.unavco.org>.

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 6" diameter steel pipe is drilled into the bedrock to a depth of 10 feet. The pipe is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the pipe. The pin is then secured with a nut and washer.	A 4" x 12" diameter stainless steel pipe is drilled into the bedrock to a depth of 10 feet. The pipe is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the pipe. The pin is then secured with a nut and washer.	A 12" diameter concrete pillar is drilled into the bedrock to a depth of 10 feet. The pillar is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the pillar. The pin is then secured with a nut and washer.	A 12" diameter thermopile is drilled into the bedrock to a depth of 10 feet. The thermopile is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the thermopile. The pin is then secured with a nut and washer.	A 12" diameter polar mast is drilled into the bedrock to a depth of 10 feet. The mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the mast. The pin is then secured with a nut and washer.	A 12" diameter shallow foundation mast is drilled into the bedrock to a depth of 10 feet. The mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the mast. The pin is then secured with a nut and washer.	A 12" diameter stainless steel pin or mast is drilled into the bedrock to a depth of 10 feet. The pin or mast is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the pin or mast. The pin is then secured with a nut and washer.	A 5/8" all-thread is drilled into the bedrock to a depth of 10 feet. The all-thread is then filled with concrete and a 1/2" diameter stainless steel pin is inserted into the all-thread. The pin is then secured with a nut and washer.	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	1-4 days	1-4 days	1-4 days	1-4 days	1-4 days	1-4 days	1-4 days	1-4 days	1-4 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	\$1,000-15,000 (incl. drilling)	\$500	\$500-1,000	\$1,000-15,000 (incl. drilling)	\$500	\$1,000	\$1,000	\$1,000	\$1,000
Site Impact	High	Medium	Medium	High	Low	Low	Low	Low	Low
Drilling Requirements	Large diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep	Small diameter drill bit, 10 feet deep
Where Used	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy	Plate Boundary Observations, Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy	Earthquake Monitoring, Geodesy

Antenna Mounts

GNSS mount
A diagram showing a GNSS mount with a stainless steel pin or mast. The mount is designed to be installed in a bedrock or concrete substrate. It is made of stainless steel and is resistant to corrosion. It is also resistant to theft and vandalism. The mount is available in two sizes: 1/2" and 5/8".

3073 series stainless steel adapter
A diagram showing a 3073 series stainless steel adapter. The adapter is designed to be installed in a bedrock or concrete substrate. It is made of stainless steel and is resistant to corrosion. It is also resistant to theft and vandalism. The adapter is available in two sizes: 1/2" and 5/8".

Cup and brass adapter
A diagram showing a cup and brass adapter. The adapter is designed to be installed in a bedrock or concrete substrate. It is made of brass and is resistant to corrosion. It is also resistant to theft and vandalism. The adapter is available in two sizes: 1/2" and 5/8".



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