Getting Started

Step 1

Identify if Network GPS is right for your project. Review your project's contractual requirements; horizontal and vertical accuracy requirements; existing ground control; project size; site conditions; vertical relief; multi-path issues; time constraints; amount of field work to complete; and the deliverables.

Note any items that prohibit you from using Network GPS – go to next step.

Step 2

Identify if Network GPS is available for your project. Plot your project area on the CSRN network map to identify network coverage and if your project is within the limits of one or more networks.

Note the networks you plan to use and any items that prohibit you from using Network GPS – go to next step.

Step 3

Identify how you will communicate with the network. If cellular communication will be used determine if cellular data service is available from local cellular providers. Identify if you have one or more cellular data service plans that provide you with service for your project area. You may need to consider multiple cellular data service providers to ensure complete cellular data coverage for your project. If cellular data service is not available for all or a portion of your project other communication options may be available from the Network GPS service providers listed on the back of this flyer such as low band radios and cellular bridges.

Note any items that prohibit you from using Network GPS – go to next step.

Step 4

Identify any physical limitations for your project. Visit your project area in person after you have researched it using online geospatial applications.

Note any items that prohibit you from using Network GPS – go to next step.

Step 5

The CSRN recommends that If there are no items identified above that prohibit you from using Network GPS to contact the Network GPS service providers listed on the back of this flyer to gain access to the network or networks you identified and plan to use in Step 2 for your project area.

Real Time Positioning with Network GPS

Equipment

Your project's horizontal and vertical accuracy requirements will dictate the make and model of GPS equipment you will need to use as defined by one of three equipment types:

- ❖ Survey Grade
- ❖ Mapping Grade
- ❖ Resource Grade

Survey Grade Equipment

Survey grade equipment is defined by a manufacturer's horizontal and vertical accuracy specification equal to or less than 1 cm and 2 cm +1 ppm respectively.

Mapping Grade Equipment

Mapping grade equipment is defined by a manufacturer's horizontal accuracy specification equal to or less than 1 meter to 10 cm +2 ppm.

Resource Grade Equipment

Resource grade equipment is defined by a manufacturer's horizontal accuracy specification greater than 5 meters.

To receive the full benefits of Network GPS the CSRN recommends your equipment is:

- ✓ State of the art Global Navigation Satellite System (GNSS) equipment.
- ✓ Capable of working with L1 and L2 GNSS signals and L2C and L5 GPS signals.
- ✓ Capable of working with RTCM 2.X through 3.X and CMR, CMR+ input/output protocols.
- ✓ Bluetooth enabled with multiple channels.
- ✓ Updated with the most current firmware.

The CSRN recommends you contact the Network GPS service providers listed on the back of this flyer to identify your specific equipment needs and expected performance, and to gain additional information about the equipment and network support they each provide.

Validating Network GPS Real Time Positioning

To validate Network GPS the CSRN recommends a modified version of National Geodetic Survey's (NGS) "Seven C's" modified as follows:

The CSRN recommends full and complete documentation for each of the "Seven C's"

1) **Check your equipment**
   a. Know what your equipment is capable of
   b. Performance expectations vs. reality
   c. Against proven control you trust
   d. Batteries fully charged and connected
   e. Cables are connected and not broken
   f. Bubble in adjustment at all times
   g. Height of pole measured correctly
   h. Use a bi-pod or ti-pod for greater stability
2) **Communications**
   a. Data cell service in your project area
   b. Bluetooth connected and tethered
   c. Batteries fully charged and connected
   d. Know your Network's static IP address
   e. Know your login user name and password
3) **Conditions**
   a. Atmospheric effects on network modeling
   b. Weather effects on network modeling
   c. Plan according to current conditions
   d. Minimize your equipments' multi-path
   e. Minimize your Dilution of Precision (DOP)
   f. Minimum of five common satellites
4) **Calibration** (a.k.a. Localization)
   a. Minimum of four calibration ground marks
   b. Hold horizontal and vertical ground marks
   c. Eliminate outliers and blunders
   d. Minimize residuals
   e. Consistent calibration used by all
5) **Coordinates**
   a. Common datum and epoch with network
   b. Consistent State Plane Projection
   c. Consistent Modified State Plane
   d. Consistent Meters and U.S. Survey Feet
   e. Consistent project coordinate truncation
   f. Consistent Geoid Model
6) **Collection**
   a. Elevation mask common to network
   b. Check known marks with calibration
   c. Set precision per project requirements
   d. Double occupy to check important points
   e. Re-initialize and re-check before and after
7) **Confidence**
   a. Consistent reporting of error sigma values
   b. QA/QC enabled and documented
   c. Collect redundant occupations
   d. Use more GNSS satellites when possible
   e. Shorten your baselines when possible
   f. Stay within the outer limits of the network

Frequently Asked Questions

Single Base GPS positioning vs. Network GPS:

Single base Global Positioning System (GPS) is a radial positioning method where all positions are referenced to a common datum point via a single reference station whereby each position is independent of the other reference stations.

Network GPS is a network positioning method where all positions are referenced to a common datum via a network of reference stations whereby each position is dependent upon other reference stations in the network.

What are the advantages of Network GPS? *

- ✓ *Increased efficiencies and field production*
- ✓ *Simultaneous access by multiple field crews*
- ✓ *Available on demand 24/7/365*
- ✓ *Accessible by a wide variety of GPS equipment*
- ✓ *Improved accuracy over longer distances*
- ✓ *Increased uniformity at various distances*
- ✓ *Reduced parts per million (ppm's)*
- ✓ *Improved reliability of ambiguity resolution*
- ✓ *Faster initializations and positions*
- ✓ *Continuous atmospheric modeling*
- ✓ *Reduced atmospheric errors*
- ✓ *Continuous network monitoring*
- ✓ *Continuous field crew monitoring*

Where Network GPS is available how will it save me time and money in the field? *

- ✓ *Eliminates the need to purchase a base station*
- ✓ *Eliminates the need to setup a base station*
- ✓ *Eliminates the need to tear down a base station*
- ✓ *Eliminates the need to purchase a base radio*
- ✓ *Eliminates the need to operate a base radio*
- ✓ *Eliminates base station batteries and security*
- ✓ *Eliminates base radio line-of-sight restrictions*
- ✓ *Eliminates the need to acquire FCC licenses*
- ✓ *Reduces the need to post process GPS data*
- ✓ *Reduces the reliance upon existing control*
- ✓ *Reduces the need to recover existing control*
- ✓ *Reduces the need to establish control marks*
- ✓ *Reduces the need to perform control surveys*
- ✓ *Reduces the filing of control survey records*

* Individual results may vary.

Network GPS located in Colorado

Leica SmartNet
Service provided by:
Hixon Manufacturing & Supply Co.
(303) 694-0012

Mesa County RTVRN
Service provided by:
Mesa County Public Works
(970) 244-1826

Trimble VRSNow
Service provided by:

Advanced Geodetic Applications
(303) 271-0077

CompassTools
(303) 627-1810

Frontier Precision
(720) 214-3500

Vectors
(303) 283-0343

CSRN

A chapter of the Professional Land Surveyors of Colorado, Inc.

www.CSRN.us

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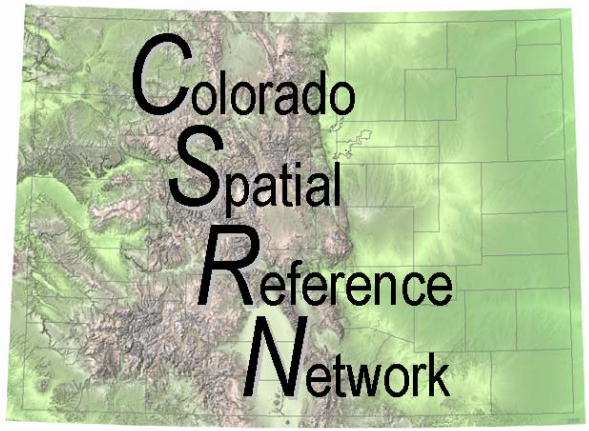

Network GPS Real Time Positioning Best Practices

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CDOT
City of Aurora
Clark Land Surveying
CompassTools
David Evans & Associates
Flatirons Surveying
Frontier Precision
Hixon Manufacturing & Supply Co.
King Surveyors
Leica
Merrick & Company
Mesa County
NOAA National Geodetic Survey
Nolte & Associates
O'Neill's Positioning Services
Rocky Mountain Lasers
Sky Research
SurvTech Solutions
TopCon
Trimble
Vectors