

PHOTO-IDENTIFIABLE GROUND CONTROL PROPOSAL

David Davis, USDA-FSA-APFO

FGCS Meeting

July 24, 2014

Aerial Photography Inspection

FSA uses photo-identifiable ground control points to inspect the horizontal accuracy of NAIP and other imagery programs. Prior to 2006 NAIP accuracy was determined by comparing new imagery to mosaicked USGS DOQQs.

For nearly 10 years FSA has coordinated at the national, state, tribal, and local level as well as individual research to gather available GCPs for image inspection. A small number of GCPs were purchased. Non-survey grade GCPs are also being acquired by FSA personnel. The data accuracy is suitable for checkpoints and not engineering or survey level work.

GCP data is not made public. We do not want the imagery vendors to know the precise locations used to inspect the data.

Aerial Photography Inspection

NAIP GCP basic requirements:

1. Location identifiable on 1-m aerial photography
2. Accuracy of 30-cm or better (will accept up to 1-m)
3. Support data for positive identification of the GCP (description, site photos, maps, sketches, screen shots, reports, metadata, etc.)

The inspection process is built on ArcGIS. The difference between GCP locations and the same spot on the imagery are measured and statistics run to determine compliance with contract specifications (“all well-defined points tested shall fall within 6 meters of true ground at a 95% confidence level”). 10-20 people are directly or indirectly involved with the inspection process.

NAIP National Agriculture Imagery Program

NAIP used by all levels of government, academia, & private sector

Accurate NAIP and imagery is a benefit to many

Widely available photo-identifiable GCP data could be a valuable resource for inspecting not only NAIP imagery but also programs for other federal, state, tribal, and local agencies and organizations

The idea is not to increase workload or make site selection more difficult. Only slight changes to traditional GCP collection processes would likely be needed to make possible a major increase in photo-identifiable data. The proposal would add value to the GCP data, making it usable from the ground and from the air.

GCP Examples



THE CITY AND COUNTY OF BROOMFIELD SURVEY SHEET
GPS CONTROL POINTS
June 2010

Designation – GPS No. 20
State/County – CO/Broomfield
USGS Quad – Lafayette (1984)



GPS Monument

Horizontal Datum - NAD 83/92 - HARN (High Accuracy Reference Network) Based
(SPCS) State Plane Coordinate System Colorado North Zone 0501 US Survey Feet
Ellipsoid GRS 80 – (Geodetic Reference System of 1980)
Vertical Datum - NAVD 88 – (North American Vertical Datum of 1988)

★ NGS Unpublished *Broomfield Surveyed Point*

Position	Latitude 39°56'57.07881" N	Longitude 105°02'26.20838" W
NSPCS	Northing 1224671.207	Easting 3128794.107
Height (Orthometric)	1613.354 Meters	5293.155 (US) Feet (Adjusted)
Scale Factor	0.999970618	



Contact—The City and County of Broomfield, GIS Division,
One DesCombes Dr., Broomfield, CO 80020, 303-464-5834.

The station is located in The City and County of Broomfield, in the
Southeast 1/4 of Section 19, T1S, R68W, of the 6th Principal Meridian.

To reach the station from the intersection of Lowell Blvd. and W. 136th
Ave. in Broomfield, travel North on Lowell Blvd. to Broadlands Ln. Then
travel Northwest on Broadlands Ln. to Broadlands Dr. The marker is
located on the Southwest corner of the intersection of Broadlands Ln.
and Broadlands Dr.



Typical GCP:

1. Majority are visible from the ground only
2. May or may not be marked with a temporary target during image acquisition
3. Often difficult to find on the ground and impossible to see on aerial imagery
4. Meet the needs of ground based projects
5. Many are located near a photo-identifiable feature and possibly could have been placed there with little or no additional workload

GCP Examples



THE CITY AND COUNTY OF BROOMFIELD SURVEY SHEET
GPS CONTROL POINTS

May 2006



Designation – FC - 2
 State/County – CO/Boulder
 USGS Quad – Lafayette (1994)

GPS Monument

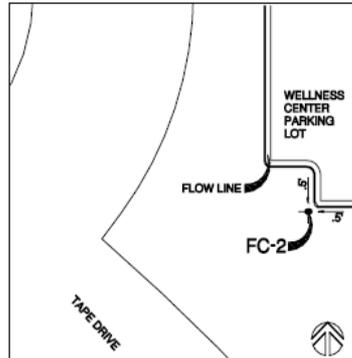
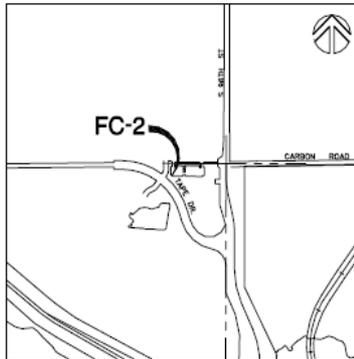
Horizontal Datum - NAD 83/92 - HARN (High Accuracy Reference Network) Based
 (SPCS) State Plane Coordinate System Colorado North Zone 0501 US Survey Feet

Ellipsoid GRS 80 – (Geodetic Reference System of 1980)

Vertical Datum - NAVD 88 – (North American Vertical Datum of 1988)

★NGS Unpublished *Broomfield Surveyed Point*

Position	Latitude 39° 56' 34.40560"N	Longitude 105° 07' 49.37680"W
NSPCS	Northing 1222259.355	Easting 3103636.099
Height (Orthometric)	1642.59 Meters	5389.07 (US) Feet (Adjusted)
Scale Factor	0.999971199	



Contact—The City and County of Broomfield, GIS Division,
 One DesCombes Dr., Broomfield, CO 80020, 303-464-5834.

The station is located in The City of Louisville in the Southeast 1/4 of Section 20, T1S R69W. To reach the station from the intersection of US 36 and 96th St, travel North on 96th St. to the intersection of Tape Dr. and 96th St. Travel West on Tape Dr. to the parking lot of the StorageTek Wellness Center.

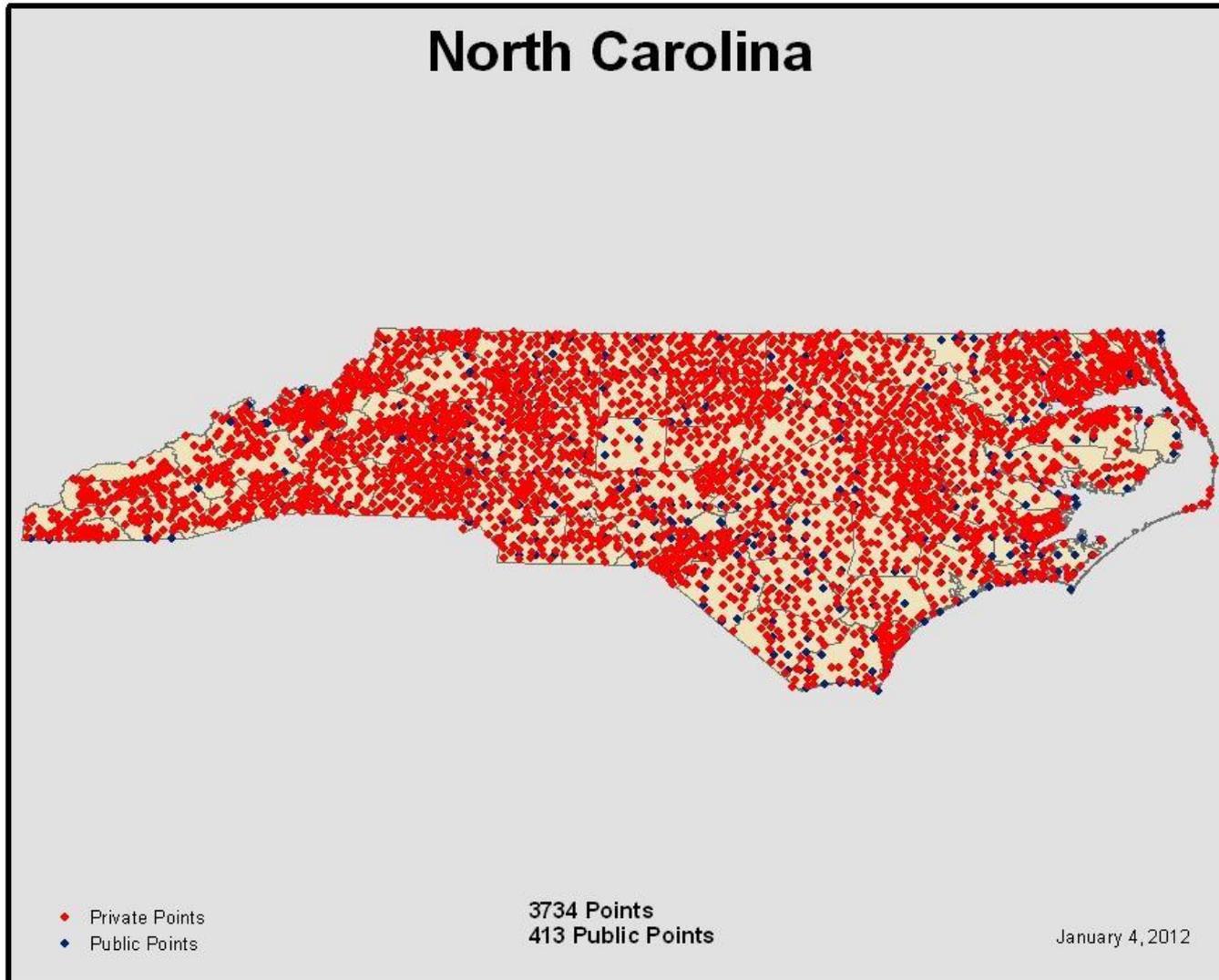
The mark is in the Southwest corner of the parking lot and is 0.5' West of the parking lot flow line and 0.5' South of the parking lot flow line. FC-2 is a 2" round cap set in the concrete curb.



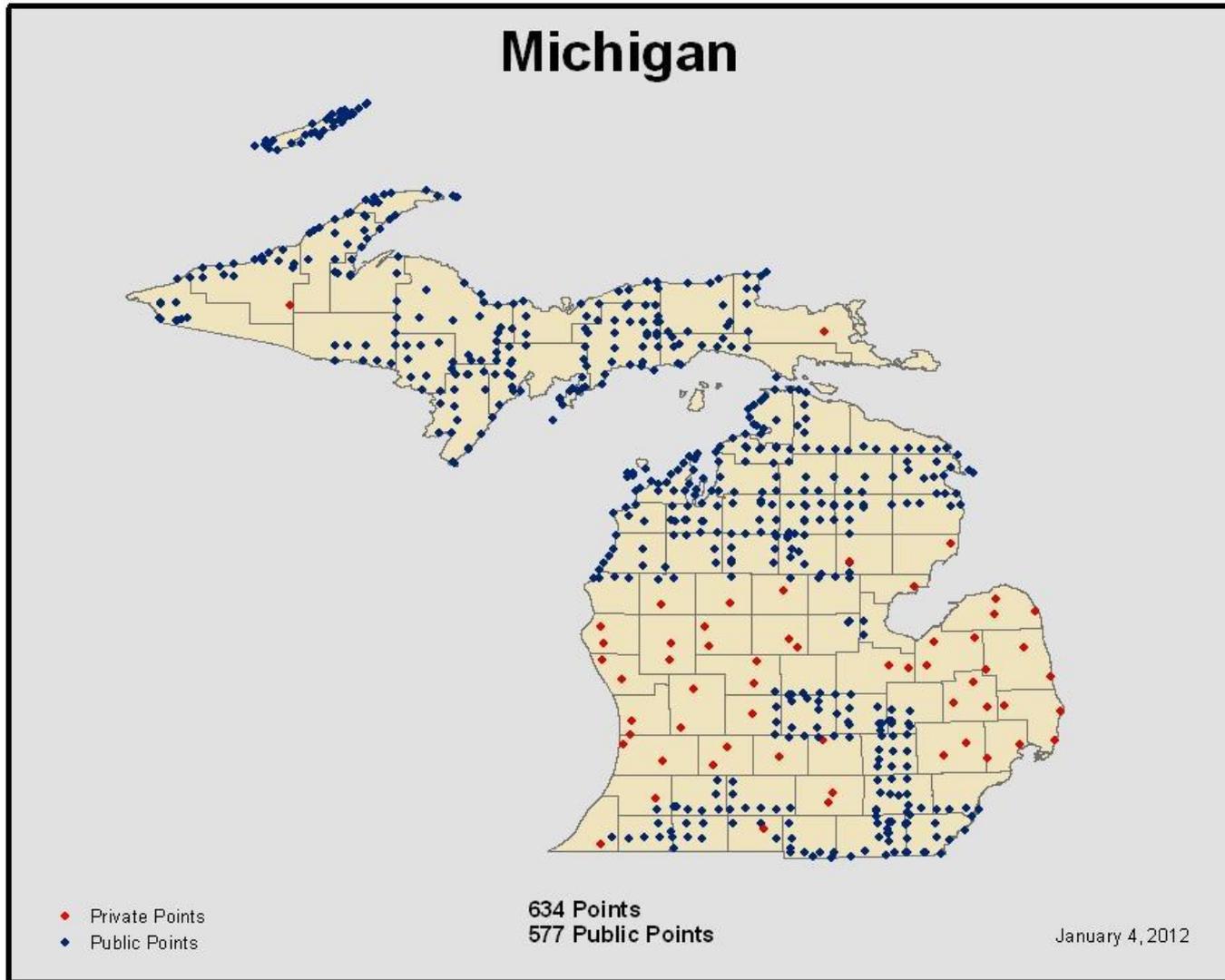
Less Common GCP:

1. Visible from the ground AND on aerial imagery
2. May or may not be marked with a temporary target during image acquisition
3. Easier to find on the ground and to see on aerial imagery
4. Little or no additional effort to select and create location that is also photo-identifiable.
5. Meets the needs of both on ground projects and aerial imagery inspection and/or orthorectification
6. Even if only a small percentage of new GCPs were placed at photo-identifiable locations the total amount could be substantial

State GCP Coverage Examples

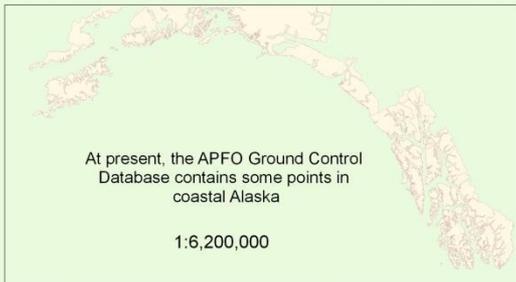
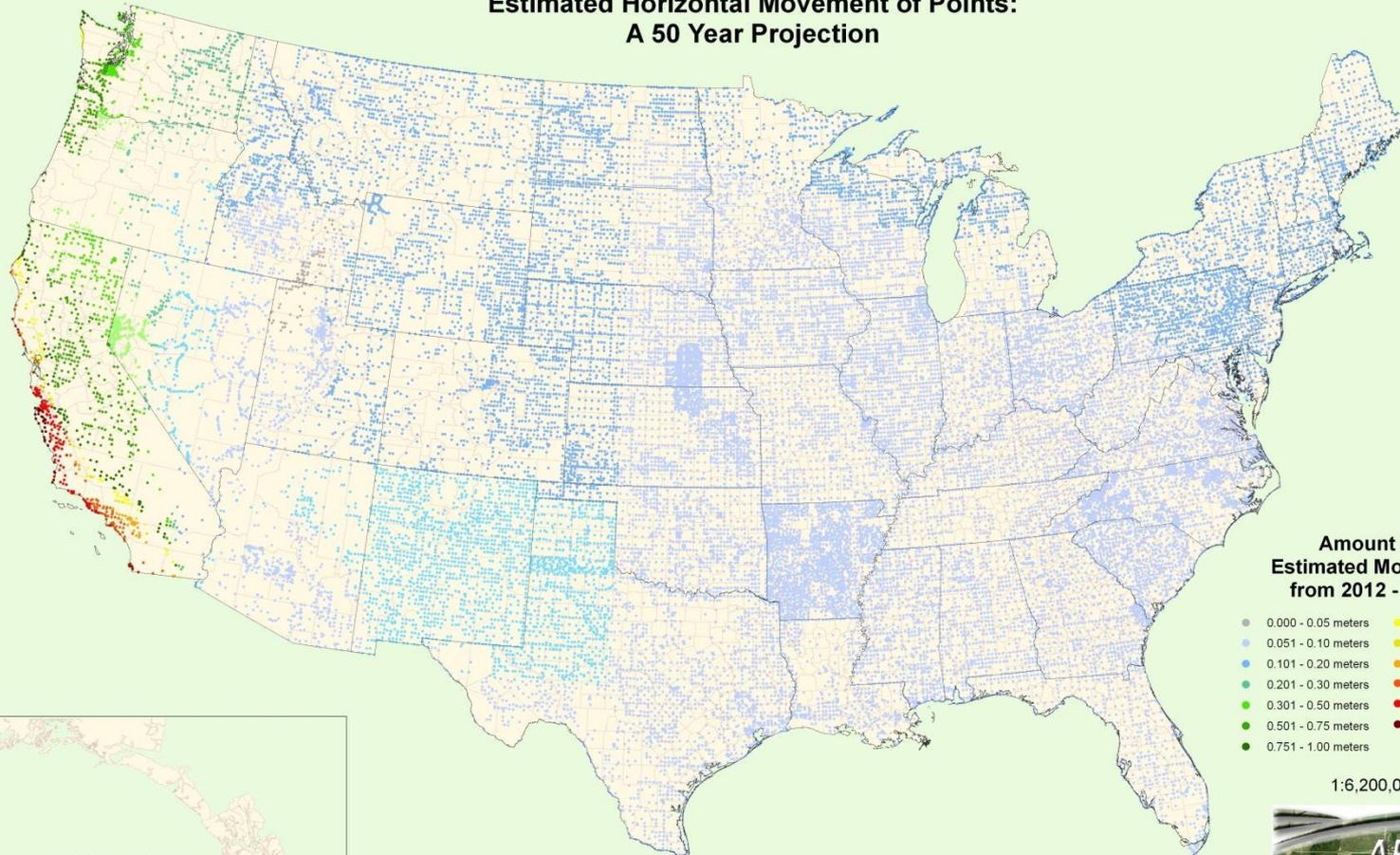


State GCP Coverage Examples



More & Better GCPs Always Needed

Aerial Photography Field Office (APFO) Ground Control Database Estimated Horizontal Movement of Points: A 50 Year Projection



APFO is concerned about horizontal movement of the Ground Control Points (GCPs) used for accuracy checks of the National Agriculture Imagery Program (NAIP) and other imagery acquisitions.

A test of all points in the GCP database using the Horizontal Time Dependent Positioning (HTDP) software from the National Geodetic Survey shows that most of the country can expect a change of less than 0.3 meters over 50 years. The largest projected changes, of over 2 meters, would be in Southern California and Alaska.

Most of the country has a projected movement which rounds to 0.1 meters. There are smaller gradations in values within the lower end of the range. An interesting pattern is a "line" running down the middle of several prairie states. The projected movements for these states fall into two clusters; this obviously reflects a difference in the model calculations for these areas.

Amount of Estimated Movement from 2012 - 2062

- 0.000 - 0.05 meters
- 0.051 - 0.10 meters
- 0.101 - 0.20 meters
- 0.201 - 0.30 meters
- 0.301 - 0.50 meters
- 0.501 - 0.75 meters
- 0.751 - 1.00 meters
- 1.001 - 1.25 meters
- 1.251 - 1.50 meters
- 1.501 - 1.75 meters
- 1.751 - 2.00 meters
- 2.001 - 2.25 meters
- 2.251 - 2.80 meters

1:6,200,000



The Aerial Photography Field Office is a part of the United States Department of Agriculture, Farm Service Agency

Discussion Points

Select photo-identifiable locations when possible or practical. If a point is collected in the middle of the grass or along a road is it possible to move it a few feet to coincide with a photo-identifiable feature? Are there reasons for not doing this?

How many new points are collected in comparison to updating existing points? New points could be selected on identifiable features but existing points would probably not be moved. Is this a true statement?

Coordination with NSGIC, NACO, surveying groups, state, county, local, tribal, or others

- Existing coordination groups
- Existing coordination with FGDC
- Existing standards & processes for location selection

Create templates, instructions, naming conventions, standards for creating photo-identifiable GCPs

Create search and attribute standards and methods for finding photo-identifiable GCPs

Discussion Points

Indicator, data field to show if photo-identifiable or not

-OPUS or other reports

-State, County, Local, other websites and databases

System for announcing and finding new or updated GCPs

Possible sub-team within FGCS for initial and/or long term development/coordination

Other?