

**2011**

# **Control Network Survey**

**City of Altoona, Iowa**



**SNYDER & ASSOCIATES**  
Engineers and Planners

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## **INTRODUCTION**

This document is an update to the 2006 control network. The City of Altoona, Iowa requested Snyder & Associates, Inc. to implement a control network survey to be used by the City of Altoona and area consultants. The survey will provide a horizontal and vertical network on the state plane coordinate system for surveying and engineering applications throughout the city. The survey control network is to be based on the NGS (National Geodetic Survey) HARN (High Accuracy Reference Network). The survey control network will include fifteen (15) primary horizontal and vertical control points at strategic locations and secondary benchmarks along primary streets. The City of Altoona uses the following coordinate system specifications:

**COORDINATE SYSTEM:** NAD 83 (North American Datum 1983):  
Iowa State Plane South Zone (1402) (US Survey Feet)

**PROJECTION:** Lambert Conformal Conic

**VERTICAL:** NAVD 88 (North American Vertical Datum 1988) (US Survey Feet)

## **PRIMARY SURVEY CONTROL MONUMENTATION**

The City of Altoona control network is comprised of 15 Primary monuments. The criteria used for the placement of the primary monuments, was based upon several factors. The City of Altoona installed all primary monuments.

- Accessibility for use by others
- On public grounds or within public right-of-ways
- Easy access for quick location set-up, and tear down
- Located in areas less likely to be disturbed or constructed upon
- Clear and unobstructed view of the sky for GPS (Geographic Positioning System) observation

The primary monuments were constructed by drilling a 12" diameter hole 5 to 6 feet deep filled with concrete with a ½"x5 foot rebar embedded in the concrete. These control points were capped with a brass survey cap labeled "City of Altoona Control Point". The first primary monument was labeled #1 and the remaining monuments numbered sequentially throughout the city. A permanent fiberglass sign is placed near all primary control points unless otherwise requested by the current caretaker of the property.

The primary monuments were established using Leica's 1200 and 500 dual frequency, geodetic grade receivers. Static GPS surveying techniques were used to produce a geometrically closed network. GPS horizontal measurements are FGCC (Federal Geodetic Control Committee) first order. Leica's GeoOffice V3.0 software package was used to complete the post-processing for the survey control network.

Vertical control is FGCC Second Order Class 2. The leveling of the control network was performed with a Leica DNA 03 and processed with Leica's GeoOffice V3.0.

## **SURVEY ACCURACY**

The City of Altoona Control Network was conducted to conform to FGCC Class I Geodetic Survey standards for the GPS positions of all control monuments. The elevations of the control points were surveyed according to “FGCS Specifications and procedures to incorporate Electronic Digital/Bar-Code Leveling Systems”, Second Order, Class II. Snyder & Associates Inc. completed the GPS survey work within one continuous session in order to properly measure the primary control monuments. The digital level run was also completed as a single session. The primary control points were installed by the City of Altoona.

## **SURVEY EQUIPMENT**

Snyder & Associates, Inc. utilized seven GPS receivers for data collection of the fifteen primary control points surrounding Altoona, Iowa. Please refer to Appendix 8 for a complete list of equipment used for the data collection process. The leveling of the control network was performed with a Leica DNA 03 and processed with Leica’s GeoOffice V3.0. The Leica’s GeoOffice V3.0 software package was used to complete the post-processing for the survey control network.

## **RESULTS**

### **Digital Levels**

The leveling of the City of Altoona 2006 Ground Control Network started at the National Geodetic Survey (NGS) benchmark MH 200, located 2.1 miles southeast along the Chicago, Rock Island and Pacific railway from Altoona, Polk County, Iowa. The level loop proceeded around the City of Altoona and tied back into itself. At the time of the initial level run, Control Point #3 had not been set by the City of Altoona. After Control Point #3 was set, Snyder & Associates went and completed a second level loop to tie it into the system. All points have been adjusted using Leica’s GeoOffice V3.0. Level runs obtained the accuracies required by the Second Order, Class II classification.

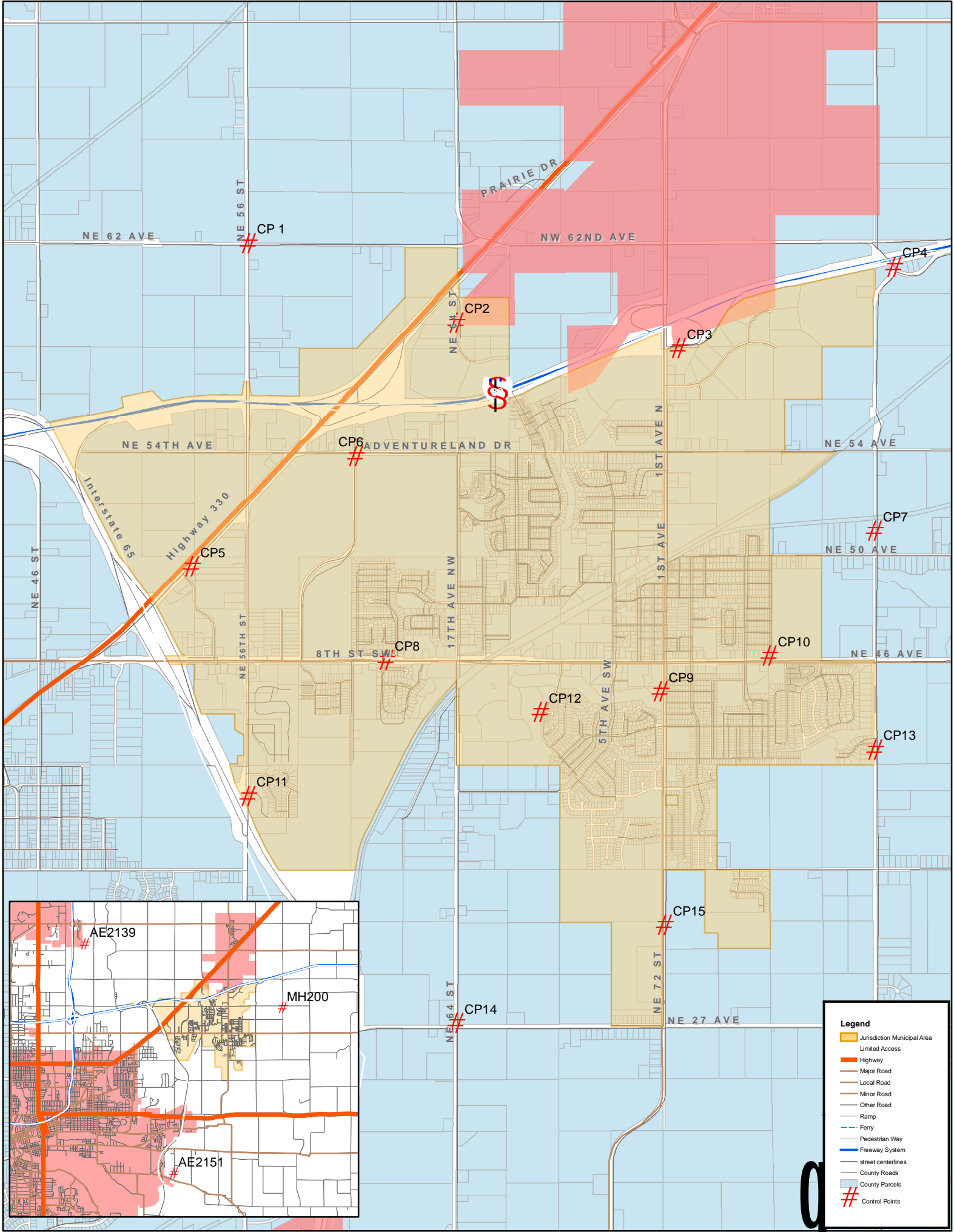
### **Control Point Positions**

CBN (Cooperative Base Network) Monuments “AE 2139” and “AE2151” were held for the horizontal positioning of this survey. An initial check was performed to verify the position of the CBN monuments using an OPUS (Online Positioning User Service) solution. These reference stations were then used to calculate the position on Control Point 9. Control Point 9 was then used to calculate the positions of the rest of the Primary Monuments. All of the baseline information process produced an averaged position for each of the Primary Monuments. Static GPS (Global Positioning System) techniques used produced a geometrically closed network. GPS horizontal measurements are FGCC first order.



# APPENDIX 1

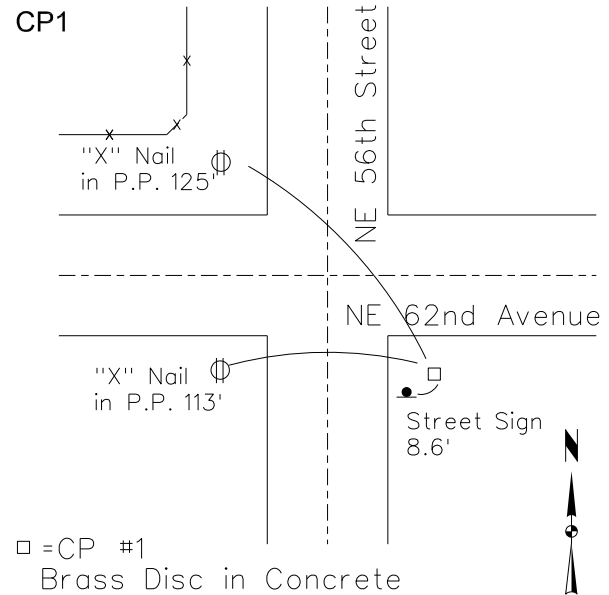
## CONTROL LOCATION MAP



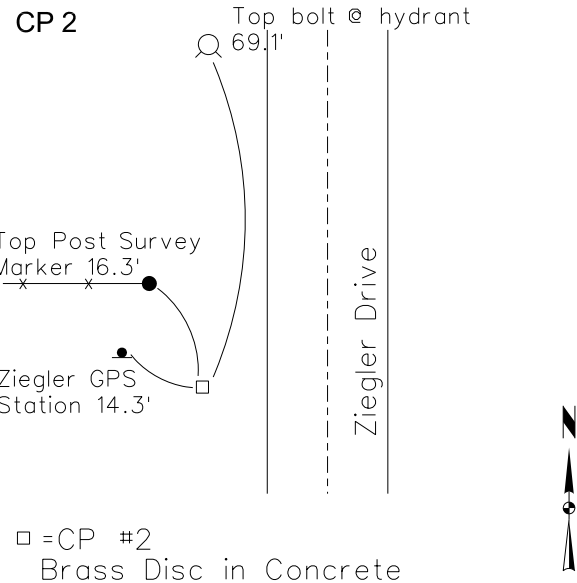
APPENDIX 2  
CONTROL MONUMENT  
TIE SHEETS

# CITY OF ALTOONA CONTROL INFORMATION

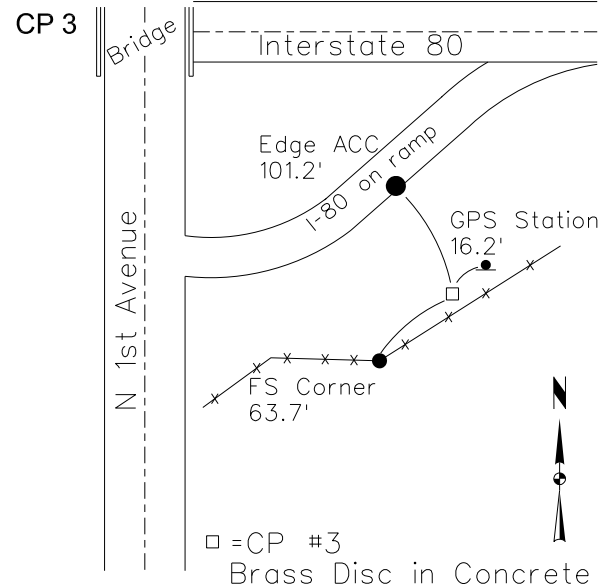
POINT ID				NAD 83 (1996)	
				Degrees Minutes Decimal Seconds	
				LATITUDE	LONGITUDE
CP 1				41°40'22.39971" N	93°30'10.42301" W
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID			
-102.972		857.783			
NAVD88 US SURVEY FT.		SP IOWA SOUTH NAD83(1996) US SURVEY FT.			
LEVELED ELEVATION		NORTHING		EASTING	
960.755		609500.944		1639625.669	



POINT ID				NAD 83 (1996)	
				Degrees Minutes Decimal Seconds	
				LATITUDE	LONGITUDE
CP 2				41°40'02.65542" N	93°29'01.27576" W
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID			
-103.096		866.469			
NAVD88 US SURVEY FT.		SP IOWA SOUTH NAD83(1996) US SURVEY FT.			
LEVELED ELEVATION		NORTHING		EASTING	
969.565		607502.869		1644873.597	



POINT ID				NAD 83 (1996)	
				Degrees Minutes Decimal Seconds	
				LATITUDE	LONGITUDE
CP 3				41°39'56.12851" N	93°27'47.31634" W
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID			
-103.207		873.753			
NAVD88 US SURVEY FT.		SP IOWA SOUTH NAD83(1996) US SURVEY FT.			
LEVELED ELEVATION		NORTHING		EASTING	
976.960		606843.943		1650487.096	

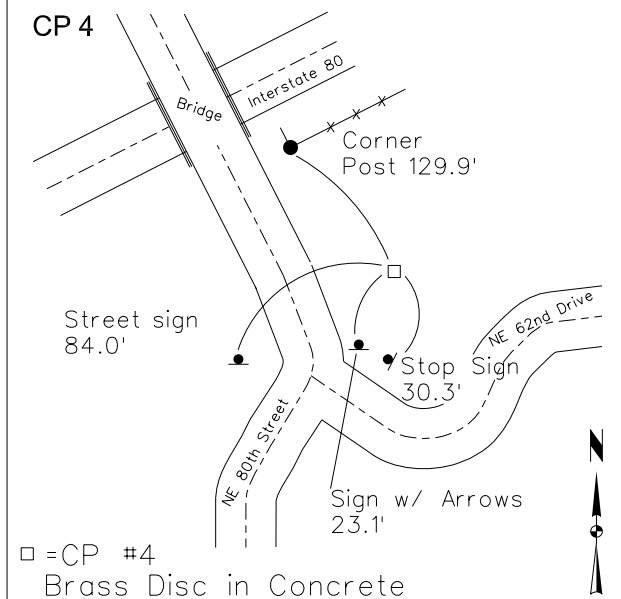


CORDINATE SYSTEM: Iowa South ( US Survey Ft)  
HORIZONTAL DATUM: NAD 83  
VERTICAL DATUM: NAVD 88 (US Survey Ft)

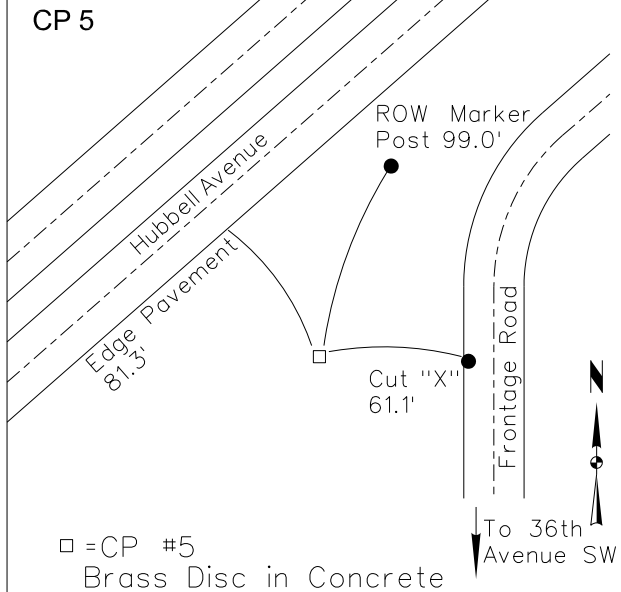
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# CITY OF ALTOONA CONTROL INFORMATION

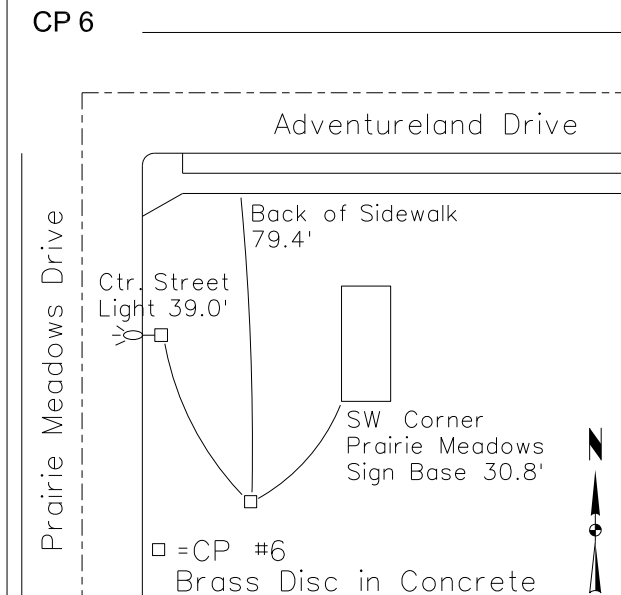
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CP 4	41°40'16.45576" N	93°26'35.65418"W	
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID	
-103.279		858.826	
NAVD88	SP IOWA	SOUTH NAD83(1996)	
US SURVEY FT.	US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING	
962.105	608904.355	1655924.769	



NAD 83 (1996)			
POINT ID	Degrees Minutes Decimal Seconds		
	LATITUDE	LONGITUDE	
CP 5	41°39'01.76841" N	93°30'29.25502"W	
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID	
-103.053		863.905	
NAVD88	SP IOWA	SOUTH NAD83(1996)	
US SURVEY FT.	US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING	
966.958	601339.706	1638195.754	



NAD 83 (1996)			
POINT ID	Degrees Minutes Decimal Seconds		
	LATITUDE	LONGITUDE	
CP 6	41°39'29.33712" N	93°29'34.72605"W	
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID	
-103.093		858.160	
NAVD88	SP IOWA	SOUTH NAD83(1996)	
US SURVEY FT.	US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING	
961.253	604130.119	1642335.129	

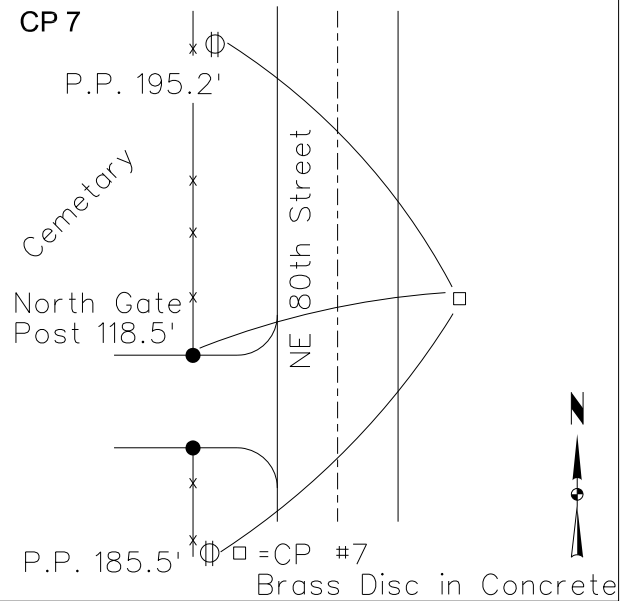


CORDINATE SYSTEM: Iowa South ( US Survey Ft)  
 HORIZONTAL DATUM: NAD 83  
 VERTICAL DATUM: NAVD 88 (US Survey Ft)

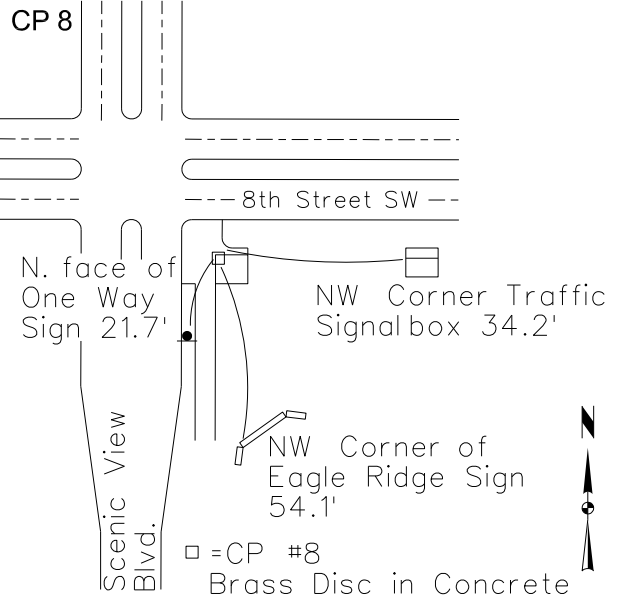
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# CITY OF ALTOONA CONTROL INFORMATION

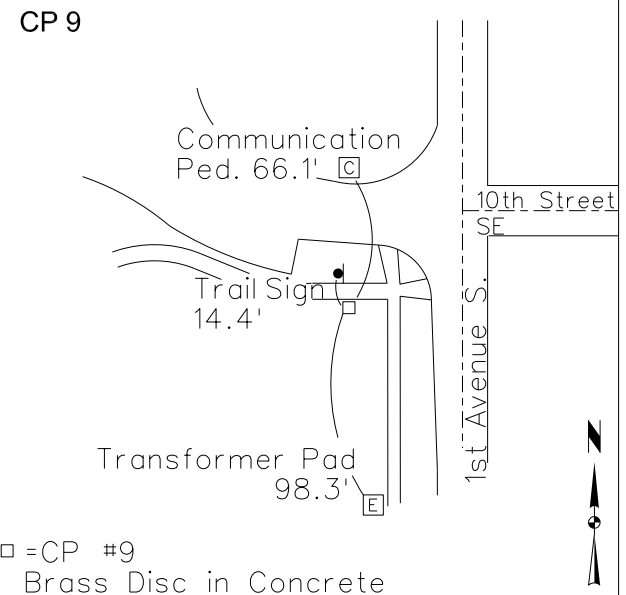
POINT ID			NAD 83 (1996)		
			Degrees Minutes		Decimal Seconds
LATITUDE			LONGITUDE		
CP 7	41°39'10.61357" N		93°26'42.12120" W		
US SURVEY FT.			US SURVEY FT.		
GEOID 03			CALCULATED ELLIPSOID		
-103.345			813.365		
NAVD88			SP IOWA SOUTH NAD83(1996)		
US SURVEY FT.			US SURVEY FT.		
LEVELED ELEVATION			NORTHING		EASTING
916.710			602239.633		1655438.189



NAD 83 (1996)		
POINT ID	Degrees Minutes	Decimal Seconds
	LATITUDE	LONGITUDE
CP 8	41°38'38.33833" N	93°29'24.62021" W
US SURVEY FT.	US SURVEY FT.	
GEOID 03	CALCULATED ELLIPSOID	
-103.167	845.579	
NAVD88	SP IOWA	SOUTH NAD83(1996)
US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING
948.746	598968.222	1643102.813



NAD 83 (1996)		
POINT ID	Degrees Minutes	Decimal Seconds
	LATITUDE	LONGITUDE
CP 9	41°38'30.56641" N	93°27'53.48137" W
US SURVEY FT.	US SURVEY FT.	
GEOID 03	CALCULATED ELLIPSOID	
-103.293	848.568	
NAVD88	SP IOWA	SOUTH NAD83(1996)
US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING
951.861	598183.357	1650022.681



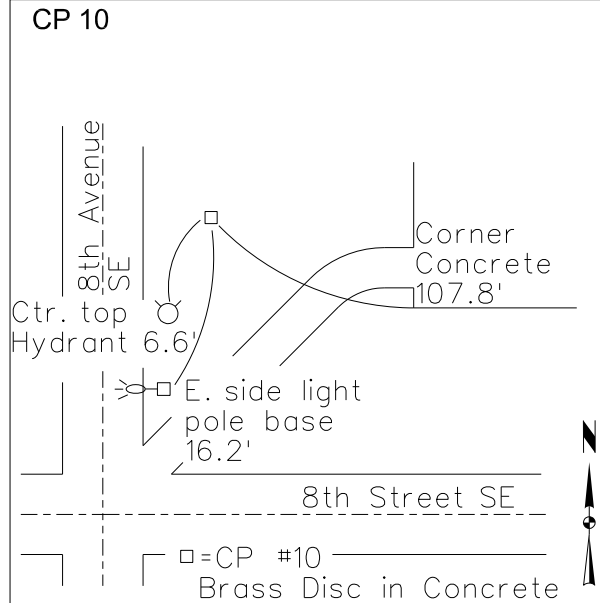
Notes: Monument is approx. 18" below grade.

COORDINATE SYSTEM: Iowa South ( US Survey Ft)  
HORIZONTAL DATUM: NAD 83  
VERTICAL DATUM: NAVD 88 (US Survey Ft)

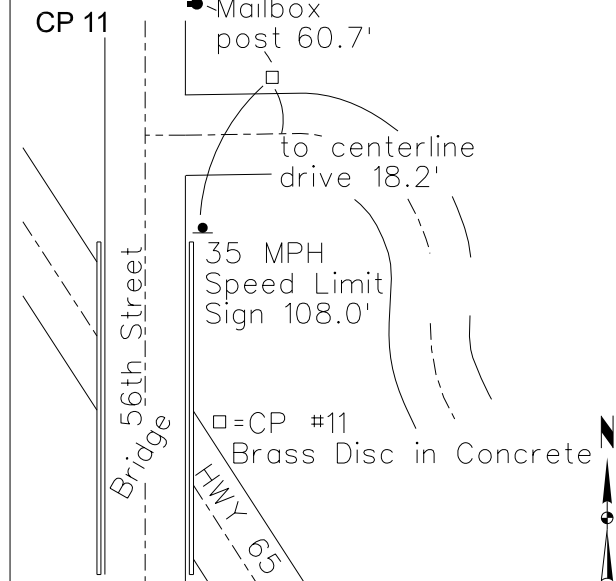
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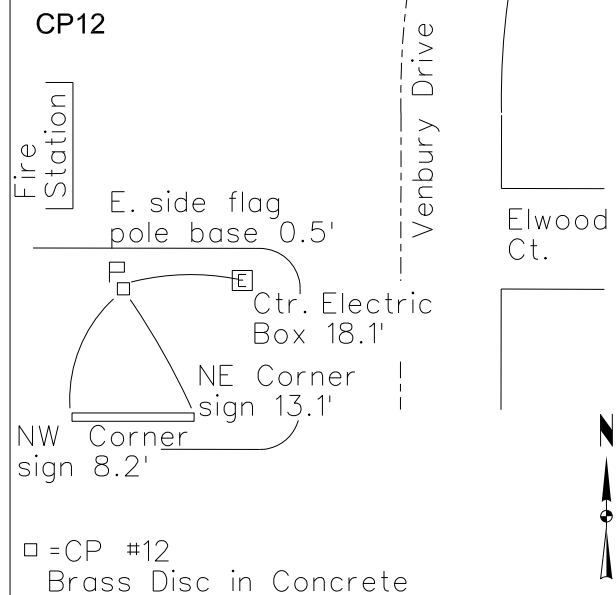
POINT ID			NAD 83 (1996) Degrees Minutes Decimal Seconds		
			LATITUDE		LONGITUDE
CP 10			41°38'39.46070" N		93°27'17.23076" W
US SURVEY FT. GEOID 03			US SURVEY FT. CALCULATED ELLIPSOID		
-103.331			855.448		
NAVD88 US SURVEY FT.			SP IOWA SOUTH NAD83(1996) US SURVEY FT.		
LEVELED ELEVATION			NORTHING		EASTING
958.779			599084.885		1652774.565



POINT ID			NAD 83 (1996) Degrees Minutes Decimal Seconds		
			LATITUDE		LONGITUDE
CP 11			41°38'04.44549" N		93°30'10.50392" W
US SURVEY FT. GEOID 03			US SURVEY FT. CALCULATED ELLIPSOID		
-103.143			810.709		
NAVD88 US SURVEY FT.			SP IOWA SOUTH NAD83(1996) US SURVEY FT.		
LEVELED ELEVATION			NORTHING		EASTING
913.852			595537.545		1639619.061



POINT ID			NAD 83 (1996) Degrees Minutes Decimal Seconds		
			LATITUDE		LONGITUDE
CP 12			41°38'25.44254" N		93°28'33.37901" W
US SURVEY FT. GEOID 03			US SURVEY FT. CALCULATED ELLIPSOID		
-103.247			828.988		
NAVD88 US SURVEY FT.			SP IOWA SOUTH NAD83(1996) US SURVEY FT.		
LEVELED ELEVATION			NORTHING		EASTING
932.235			597663.703		1646993.569



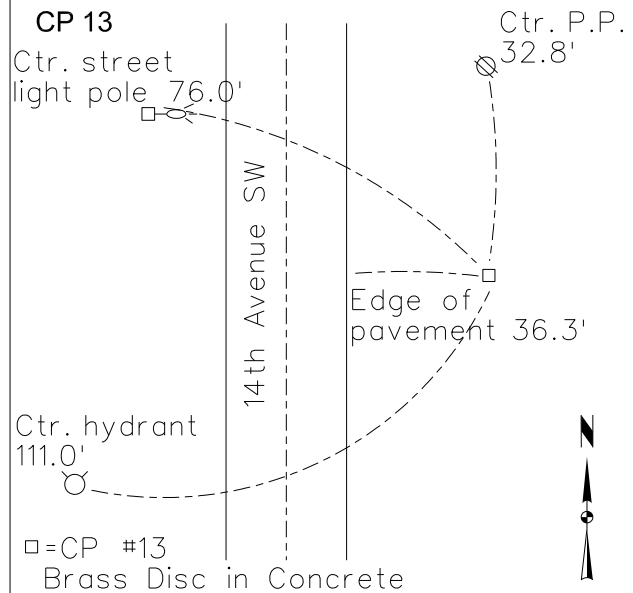
CORDINATE SYSTEM: Iowa South ( US Survey Ft)  
HORIZONTAL DATUM: NAD 83  
VERTICAL DATUM: NAVD 88 (US Survey Ft)

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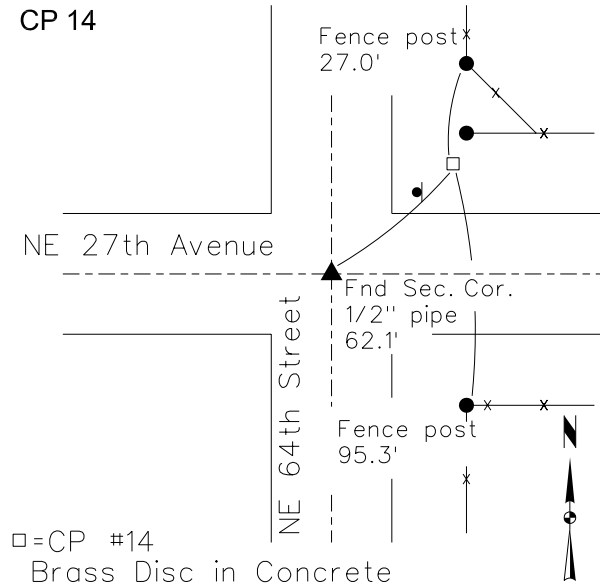


# CITY OF ALTOONA CONTROL INFORMATION

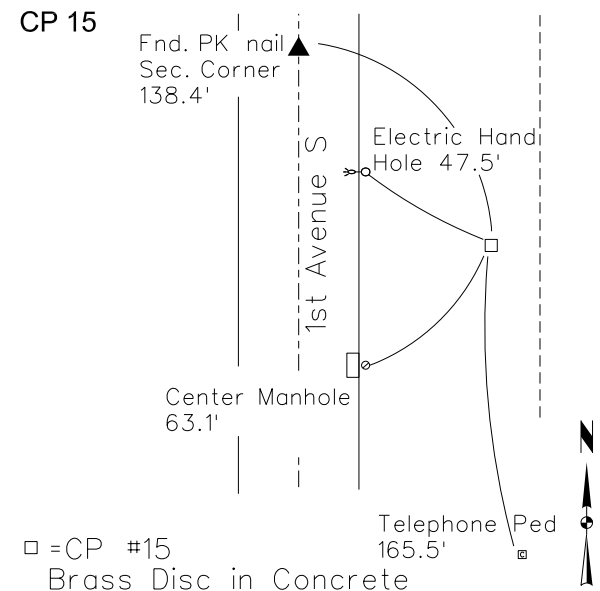
POINT ID			NAD 83 (1996)		
			Degrees Minutes Decimal Seconds		
LATITUDE			LONGITUDE		
CP 13	41°38'16.08576" N		93°26'42.03881" W		
US SURVEY FT. GEOID 03			US SURVEY FT. CALCULATED ELLIPSOID		
-103.394			847.603		
NAVD88			SP IOWA SOUTH NAD83(1996)		
US SURVEY FT.			US SURVEY FT.		
LEVELED ELEVATION			NORTHING		EASTING
950.997			596720.478		1655447.933



NAD 83 (1996)		
POINT ID	Degrees Minutes Decimal Seconds	
	LATITUDE	LONGITUDE
CP 14	41°37'07.78782" N	93°29'01.41512" W
US SURVEY FT. GEOID 03	US SURVEY FT. CALCULATED ELLIPSOID	
-103.279	834.202	
NAVD88	SP IOWA	SOUTH NAD83(1996)
US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING
937.481	589803.242	1644866.331



NAD 83 (1996)		
POINT ID	Degrees Minutes	Decimal Seconds
	LATITUDE	LONGITUDE
CP 15	41°37'32.32627" N	93°27'52.09492" W
US SURVEY FT. GEOID 03		US SURVEY FT. CALCULATED ELLIPSOID
-103.343		856.626
NAVD88	SP IOWA	SOUTH NAD83(1996)
US SURVEY FT.	US SURVEY FT.	
LEVELED ELEVATION	NORTHING	EASTING
959.969	592288.510	1650130.356



CORDINATE SYSTEM: Iowa South ( US Survey Ft)  
HORIZONTAL DATUM: NAD 83  
VERTICAL DATUM: NAVD 88 (US Survey Ft)

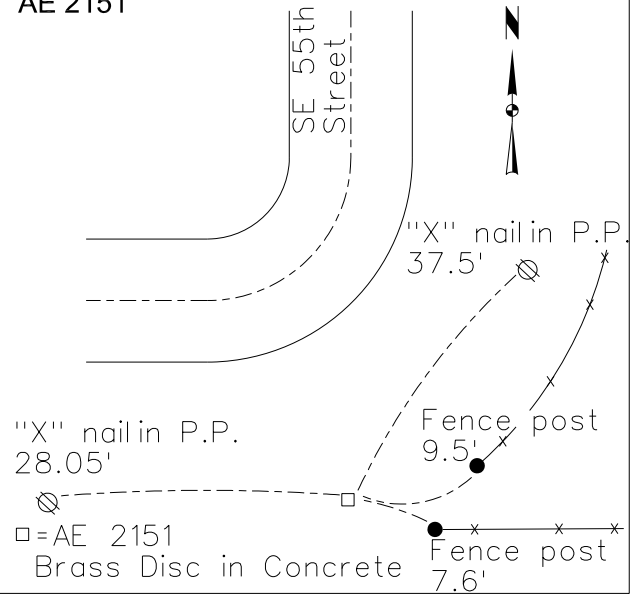
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# CITY OF ALTOONA CONTROL INFORMATION

POINT ID	NAD 83 (1996)	
	Degrees Minutes Decimal Seconds LATITUDE	LONGITUDE
AE 2151	41°34'06.49538" N	93°30'12.40381" W
METRIC GEOID 03	METRIC CALCULATED ELLIPSOID	
-31.49	240.34	
NAVD88 US SURVEY FT.	SPI IOWA NORTHING	SOUTH NAD83(1996) EASTING
892.	174179.280	499712.626

Horizontal Order: B

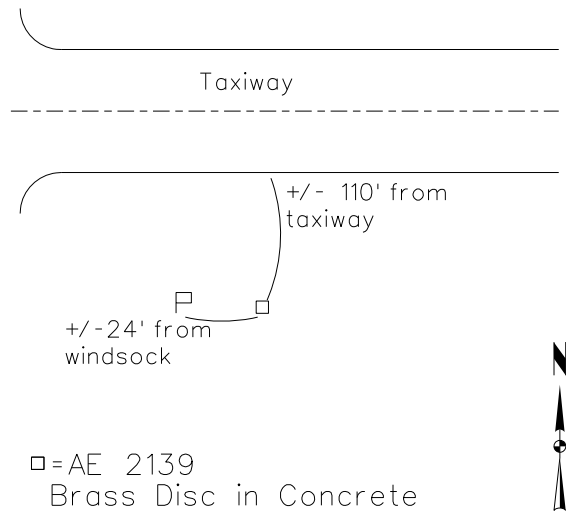
AE 2151



POINT ID	NAD 83 (1996)	
	Degrees Minutes Decimal Seconds LATITUDE	LONGITUDE
AE 2139	41°41'29.93714" N	93°34'00.67478" W
METRIC GEOID 03	METRIC CALCULATED ELLIPSOID	
-31.25	239.41	
NAVD88 US SURVEY FT.	SPI IOWA NORTHING	SOUTH NAD83(1996) EASTING
887.9	187862.023	494434.511

Horizontal Order: B

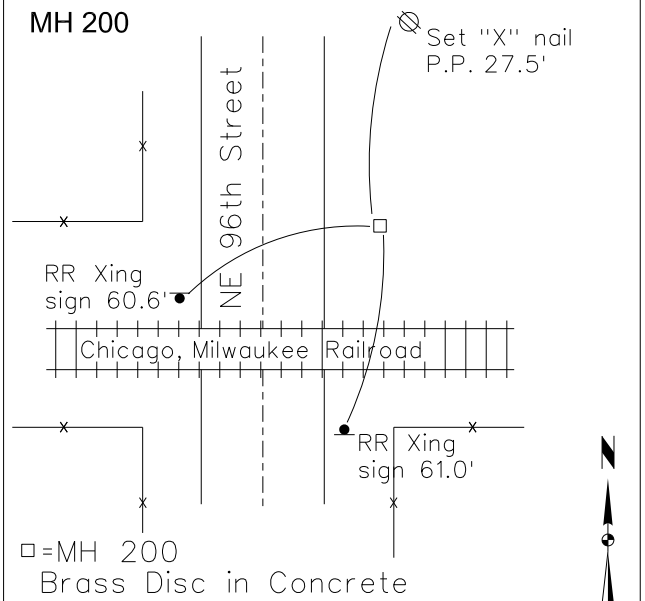
AE 2139



POINT ID	NAD 83 (1996)	
	Degrees Minutes Decimal Seconds LATITUDE	LONGITUDE
MH 200	41°39'25." N	93°25'32." W
US SURVEY FT. GEOID 03	US SURVEY FT. CALCULATED ELLIPSOID	
000.00	000.000	
NAVD88 US SURVEY FT.	SPI IOWA NORTHING	SOUTH NAD83(1996) EASTING
938.57	184041.791	506190.511

Vertical Order: NGS First Order, Class II

MH 200



COORDINATE SYSTEM: Iowa South ( US Survey Ft)  
HORIZONTAL DATUM: NAD 83  
VERTICAL DATUM: NAVD 88 (US Survey Ft)

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# APPENDIX 3

## DIGITAL LEVEL DATA



## Level Summary

### Altoona bench run

04/12/2006 09:03:24

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#### Project Information

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Project name: Altoona bench run  
 Date created: 04/05/2006 11:23:53  
 Application software: LEICA Geo Office 3.0

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#### Line 001

---

Line length: 132805.3398 fts  
 Method: BF  
 Start point id: MH0200  
 Number of stations: 300  
 Date/time: 03/27/2006 14:45:12  
 Number of observations: 600

#### Processing Parameters

Adjustment method: by distance  
 Processed with Staff Corrections: No  
 Height difference: -0.0567 fts

---

#### Points

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Point Id	Epoch	Height [fts]	Delta Hgt. [fts]	Point Class	Sd. Hgt. [fts]
MH0200	03/27/2006 14:45:13	938.5700	-	Control	-
1	03/27/2006 14:45:16	943.1952	4.6252	Measured	0.0010
2	03/27/2006 14:45:20	936.4562	-6.7391	Measured	0.0014
3	03/27/2006 14:45:24	924.0554	-12.4008	Measured	0.0008
4	03/27/2006 14:45:28	917.6947	-6.3607	Measured	0.0021
5	03/27/2006 14:45:32	913.5498	-4.1448	Measured	0.0019
6	03/27/2006 14:45:36	904.7151	-8.8348	Measured	0.0017
7	03/27/2006 14:45:40	892.7558	-11.9593	Measured	0.0010
8	03/27/2006 14:45:44	888.0042	-4.7515	Measured	0.0005
9	03/27/2006 14:45:48	890.3783	2.3741	Measured	0.0013
10	03/27/2006 14:45:52	899.8516	9.4733	Measured	0.0006
11	03/27/2006 14:45:56	909.0686	9.2169	Measured	0.0012
12	03/27/2006 14:46:00	909.4157	0.3472	Measured	0.0033
13	03/27/2006 14:46:04	909.8716	0.4558	Measured	0.0036
14	03/27/2006 14:46:08	912.0420	2.1704	Measured	0.0028
15	03/27/2006 14:46:12	916.7099	4.6679	Measured	0.0019
16	03/27/2006 14:46:16	911.4833	-5.2265	Measured	0.0015
17	03/27/2006 14:46:20	902.7581	-8.7252	Measured	0.0008
18	03/27/2006 14:46:24	912.3350	9.5769	Measured	0.0015
19	03/27/2006 14:46:28	923.2361	10.9012	Measured	0.0009
20	03/27/2006 14:46:32	933.2331	9.9970	Measured	0.0012

21	03/27/2006 14:46:36	943.2425	10.0094	Measured	0.0012
22	03/27/2006 14:46:40	936.5678	-6.6748	Measured	0.0015
23	03/27/2006 14:46:44	928.4087	-8.1591	Measured	0.0008
24	03/27/2006 14:46:48	927.6628	-0.7458	Measured	0.0013
25	03/27/2006 14:46:52	934.5896	6.9268	Measured	0.0109
26	03/27/2006 14:46:56	945.8522	11.2626	Measured	0.0010
27	03/27/2006 14:47:00	945.0492	-0.8030	Measured	0.0012
28	03/27/2006 14:47:04	941.9741	-3.0750	Measured	0.0028
29	03/27/2006 14:47:08	944.1239	2.1498	Measured	0.0007
30	03/27/2006 14:47:12	950.9966	6.8727	Measured	0.0016
31	03/27/2006 14:47:16	943.5245	-7.4721	Measured	0.0022
32	03/27/2006 14:47:20	945.0760	1.5514	Measured	0.0018
33	03/27/2006 14:47:24	945.6070	0.5310	Measured	0.0017
34	03/27/2006 14:47:28	937.9700	-7.6370	Measured	0.0030
35	03/27/2006 14:47:32	928.9883	-8.9817	Measured	0.0006
36	03/27/2006 14:47:36	924.6450	-4.3433	Measured	0.0004
37	03/27/2006 14:47:40	933.5523	8.9073	Measured	0.0014
38	03/27/2006 14:47:44	943.0339	9.4816	Measured	0.0020
39	03/27/2006 14:47:48	945.8679	2.8340	Measured	0.0014
40	03/27/2006 14:47:52	937.8076	-8.0603	Measured	0.0008
41	03/27/2006 14:47:56	931.5646	-6.2430	Measured	0.0011
42	03/27/2006 14:48:00	942.3828	10.8182	Measured	0.0005
43	03/27/2006 14:48:04	953.2579	10.8751	Measured	0.0004
44	03/27/2006 14:48:08	956.6682	3.4103	Measured	0.0013
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48	03/27/2006 14:48:24	958.7791	0.9361	Measured	0.0004
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



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

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290	03/27/2006 15:04:32	962.0127	-3.4622	Measured	0.0016
291	03/27/2006 15:04:36	960.5154	-1.4973	Measured	0.0025
292	03/27/2006 15:04:40	958.5115	-2.0040	Measured	0.0011
293	03/27/2006 15:04:44	955.3991	-3.1124	Measured	0.0007
294	03/27/2006 15:04:48	947.7621	-7.6370	Measured	0.0014
295	03/27/2006 15:04:52	936.0549	-11.7072	Measured	0.0017
296	03/27/2006 15:04:56	934.1582	-1.8966	Measured	0.0009
297	03/27/2006 15:05:00	933.1891	-0.9691	Measured	0.0024
298	03/27/2006 15:05:04	928.2477	-4.9415	Measured	0.0016
299	03/27/2006 15:05:08	937.7991	9.5515	Measured	0.0017
300	03/27/2006 15:05:12	938.5700	0.7709	Control	-















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 MH0200						938.5700	Control	Fixed in Height
 MH0200	7.1038				285.29			
 1				2.4788	247.58			
 1						943.1952	Measured	Processed
 1	1.8876				379.43			
 2				8.6269	203.63			
 2						936.4562	Measured	Processed
 2	0.3323				115.49			
 3				12.7332	139.45			
 3						924.0554	Measured	Processed
 3	0.3181				258.39			
 4				6.6790	256.79			
 4						917.6947	Measured	Processed
 4	4.2997				293.01			
 5				8.4448	279.64			
 5						913.5498	Measured	Processed
 5	3.0140				216.88			
 6				11.8490	268.16			
 6						904.7151	Measured	Processed
 6	1.0679				95.46			
 7				13.0273	122.73			
 7						892.7557	Measured	Processed
 7	0.6697				77.99			
 8				5.4213	131.57			
 8						888.0042	Measured	Processed
 8	3.7856				293.68			
 9				1.4117	201.20			
 9						890.3784	Measured	Processed
 9	11.5059				113.05			
 10				2.0327	114.33			
 10						899.8516	Measured	Processed
 10	10.6176				254.47			
 11				1.4009	242.79			
 11						909.0686	Measured	Processed
 11	5.2495				228.77			
 12				4.9025	213.44			
 12						909.4157	Measured	Processed
 12	4.0872				280.01			
 13				3.6316	229.03			
 13						909.8716	Measured	Processed
 13	6.7820				312.23			
 14				4.6118	243.11			
 14						912.0420	Measured	Processed
 14	7.7967				261.31			
 15				3.1290	193.92			
 15						916.7099	Measured	Processed















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 15	5.0796				298.26			
 16				10.3064	319.71			
 16						911.4834	Measured	Processed
 16	0.3127				157.51			
 17				9.0381	168.90			
 17						902.7581	Measured	Processed
 17	13.0287				256.18			
 18				3.4520	94.35			
 18						912.3350	Measured	Processed
 18	12.0398				114.62			
 19				1.1387	50.51			
 19						923.2361	Measured	Processed
 19	11.1652				106.10			
 20				1.1683	74.77			
 20						933.2331	Measured	Processed
 20	11.7715				144.61			
 21				1.7622	127.81			
 21						943.2425	Measured	Processed
 21	2.7410				256.72			
 22				9.4159	107.88			
 22						936.5678	Measured	Processed
 22	0.4121				119.99			
 23				8.5713	171.88			
 23						928.4087	Measured	Processed
 23	3.6968				245.66			
 24				4.4429	349.19			
 24						927.6628	Measured	Processed
 24	9.7898				314.46			
 25				2.8632	122.59			
 25						934.5896	Measured	Processed
 25	12.3023				206.57			
 26				1.0399	187.08			
 26						945.8522	Measured	Processed
 26	4.0651				254.53			
 27				4.8684	333.09			
 27						945.0492	Measured	Processed
 27	3.1877				320.62			
 28				6.2629	123.87			
 28						941.9741	Measured	Processed
 28	6.1541				268.00			
 29				4.0045	150.81			
 29						944.1239	Measured	Processed
 29	9.8832				274.31			
 30				3.0107	159.36			
 30						950.9966	Measured	Processed
 30	2.4549				182.56			

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001















































Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 31				9.9272	267.85			
 31						943.5245	Measured	Processed
 31	4.9168				227.31			
 32				3.3656	370.24			
 32						945.0760	Measured	Processed
 32	4.9698				310.18			
 33				4.4390	261.66			
 33						945.6070	Measured	Processed
 33	1.7670				207.60			
 34				9.4042	215.55			
 34						937.9700	Measured	Processed
 34	0.7827				108.00			
 35				9.7645	129.04			
 35						928.9883	Measured	Processed
 35	3.1206				72.67			
 36				7.4640	142.26			
 36						924.6450	Measured	Processed
 36	9.9747				165.07			
 37				1.0675	133.96			
 37						933.5523	Measured	Processed
 37	11.3529				216.57			
 38				1.8715	244.64			
 38						943.0339	Measured	Processed
 38	4.6830				106.56			
 39				1.8491	164.51			
 39						945.8679	Measured	Processed
 39	1.8498				164.56			
 40				9.9103	241.52			
 40						937.8076	Measured	Processed
 40	2.9038				190.01			
 41				9.1469	93.36			
 41						931.5646	Measured	Processed
 41	12.4382				293.25			
 42				1.6202	64.97			
 42						942.3828	Measured	Processed
 42	11.6717				202.61			
 43				0.7967	107.46			
 43						953.2579	Measured	Processed
 43	5.6672				150.89			
 44				2.2570	155.21			
 44						956.6682	Measured	Processed
 44	4.8128				338.34			
 45				3.2290	354.16			
 45						958.2523	Measured	Processed
 45	5.0393				226.00			
 46				4.3435	257.92			

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001















































Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 46						958.9483	Measured	Processed
 46	4.4098				187.90			
 47				5.5153	127.37			
 47						957.8430	Measured	Processed
 47	4.8163				156.05			
 48				3.8803	123.20			
 48						958.7791	Measured	Processed
 48	4.3715				240.49			
 49				4.7465	319.37			
 49						958.4043	Measured	Processed
 49	5.2384				265.17			
 50				2.2950	341.39			
 50						961.3480	Measured	Processed
 50	3.5264				194.53			
 51				5.5731	308.64			
 51						959.3015	Measured	Processed
 51	3.0825				242.94			
 52				2.5393	177.27			
 52						959.8449	Measured	Processed
 52	2.0727				215.55			
 53				5.2149	266.54			
 53						956.7029	Measured	Processed
 53	4.2591				163.90			
 54				5.8801	123.83			
 54						955.0820	Measured	Processed
 54	5.8079				171.66			
 55				3.9412	318.64			
 55						956.9489	Measured	Processed
 55	2.4426				258.59			
 56				7.5302	97.04			
 56						951.8615	Measured	Processed
 56	6.6166				234.90			
 57				4.9265	340.56			
 57						953.5518	Measured	Processed
 57	7.9021				199.97			
 58				6.5482	121.48			
 58						954.9058	Measured	Processed
 58	7.6137				109.08			
 59				7.6148	130.90			
 59						954.9048	Measured	Processed
 59	6.6536				169.05			
 60				6.4858	316.79			
 60						955.0729	Measured	Processed
 60	4.7636				200.57			
 61				5.7804	340.78			
 61						954.0563	Measured	Processed

















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 61	2.0139				239.41			
 62				1.9639	254.80			
 62						954.1065	Measured	Processed
 62	7.8025				108.07			
 63				2.5916	59.77			
 63						959.3175	Measured	Processed
 63	3.6716				185.21			
 64				4.7975	326.80			
 64						958.1918	Measured	Processed
 64	6.2899				317.18			
 65				1.1726	375.82			
 65						963.3094	Measured	Processed
 65	2.5836				336.10			
 66				4.9641	320.36			
 66						960.9292	Measured	Processed
 66	3.8167				283.16			
 67				1.2862	203.23			
 67						963.4599	Measured	Processed
 67	1.5685				299.41			
 68				2.3827	193.36			
 68						962.6459	Measured	Processed
 68	2.1364				238.05			
 69				5.3707	254.43			
 69						959.4118	Measured	Processed
 69	4.2459				262.67			
 70				3.6888	346.30			
 70						959.9692	Measured	Processed
 70	5.9697				161.75			
 71				2.9658	301.06			
 71						962.9732	Measured	Processed
 71	0.6248				257.38			
 72				7.4259	200.94			
 72						956.1723	Measured	Processed
 72	3.7250				278.13			
 73				5.3325	328.10			
 73						954.5651	Measured	Processed
 73	1.9298				273.12			
 74				3.1795	303.87			
 74						953.3157	Measured	Processed
 74	3.0684				228.06			
 75				2.4380	250.17			
 75						953.9463	Measured	Processed
 75	2.0827				294.23			
 76				6.6208	282.87			
 76						949.4084	Measured	Processed
 76	0.7093				313.36			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 77				8.6523	348.54			
 77						941.4657	Measured	Processed
 77	1.1084				298.30			
 78				2.8792	353.13			
 78						939.6952	Measured	Processed
 78	8.7096				335.15			
 79				2.9690	366.41			
 79						945.4361	Measured	Processed
 79	5.7086				291.17			
 80				5.5247	206.33			
 80						945.6202	Measured	Processed
 80	8.5835				260.72			
 81				1.1536	332.70			
 81						953.0503	Measured	Processed
 81	6.0746				253.77			
 82				2.8265	354.51			
 82						956.2987	Measured	Processed
 82	0.3756				113.80			
 83				9.5359	196.47			
 83						947.1385	Measured	Processed
 83	0.9056				171.48			
 84				7.8913	193.04			
 84						940.1530	Measured	Processed
 84	2.7478				114.35			
 85				5.4203	110.53			
 85						937.4806	Measured	Processed
 85	10.8018				241.69			
 86				0.8405	228.61			
 86						947.4421	Measured	Processed
 86	2.0542				268.14			
 87				12.0596	380.53			
 87						937.4369	Measured	Processed
 87	0.7408				108.93			
 88				3.8149	65.86			
 88						934.3629	Measured	Processed
 88	0.4295				65.16			
 89				11.4222	118.24			
 89						923.3703	Measured	Processed
 89	0.5861				68.08			
 90				11.7014	108.12			
 90						912.2551	Measured	Processed
 90	1.0845				73.78			
 91				10.9148	275.83			
 91						902.4249	Measured	Processed
 91	9.4623				212.56			
 92				0.6629	96.62			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 92						911.2245	Measured	Processed
 92	12.8492				181.24			
 93				0.9510	140.81			
 93						923.1228	Measured	Processed
 93	9.6520				53.13			
 94				7.4912	71.06			
 94						925.2836	Measured	Processed
 94	12.9348				241.88			
 95				11.0698	236.60			
 95						927.1489	Measured	Processed
 95	0.5438				105.16			
 96				12.0468	164.84			
 96						915.6460	Measured	Processed
 96	0.1359				107.15			
 97				12.0074	165.59			
 97						903.7746	Measured	Processed
 97	2.2540				319.61			
 98				1.0935	110.68			
 98						904.9353	Measured	Processed
 98	12.7953				143.78			
 99				5.4276	53.88			
 99						912.3031	Measured	Processed
 99	12.4767				126.02			
 100				0.8593	95.94			
 100						923.9205	Measured	Processed
 100	12.8139				180.49			
 101				0.8770	149.55			
 101						935.8576	Measured	Processed
 101	8.7390				329.12			
 102				5.7621	378.72			
 102						938.8348	Measured	Processed
 102	0.4232				119.25			
 103				12.2349	163.58			
 103						927.0232	Measured	Processed
 103	1.1664				212.12			
 104				12.1249	86.99			
 104						916.0648	Measured	Processed
 104	12.9540				89.61			
 105				5.0939	68.31			
 105						923.9250	Measured	Processed
 105	12.4299				297.33			
 106				0.7623	367.21			
 106						935.5929	Measured	Processed
 106	12.9596				267.74			
 107				0.3069	131.38			
 107						948.2458	Measured	Processed















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 107	6.0927				300.59			
 108				3.5990	338.85			
 108						950.7397	Measured	Processed
 108	4.1793				306.53			
 109				4.4046	285.92			
 109						950.5147	Measured	Processed
 109	1.7870				210.27			
 110				7.0857	242.48			
 110						945.2162	Measured	Processed
 110	1.8489				110.02			
 111				6.0984	83.47			
 111						940.9668	Measured	Processed
 111	1.3117				217.49			
 112				10.0442	253.74			
 112						932.2345	Measured	Processed
 112	1.3865				326.58			
 113				5.5019	265.63			
 113						928.1193	Measured	Processed
 113	4.0709				309.29			
 114				7.6760	287.43			
 114						924.5145	Measured	Processed
 114	3.9931				260.73			
 115				10.8473	349.67			
 115						917.6605	Measured	Processed
 115	0.3918				234.03			
 116				11.7701	277.00			
 116						906.2824	Measured	Processed
 116	4.3213				365.20			
 117				5.0497	261.68			
 117						905.5543	Measured	Processed
 117	10.7582				262.40			
 118				0.5798	265.11			
 118						915.7329	Measured	Processed
 118	12.3927				294.75			
 119				0.7460	292.50			
 119						927.3799	Measured	Processed
 119	3.7869				323.93			
 120				4.9464	310.14			
 120						926.2207	Measured	Processed
 120	11.7537				269.90			
 121				1.6288	173.20			
 121						936.3458	Measured	Processed
 121	13.1465				271.87			
 122				0.7463	164.80			
 122						948.7461	Measured	Processed
 122	4.1501				321.16			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 123				8.2229	267.43			
 123						944.6736	Measured	Processed
 123	0.8381				266.96			
 124				6.0675	126.62			
 124						939.4444	Measured	Processed
 124	8.9101				287.51			
 125				0.1850	321.52			
 125						948.1697	Measured	Processed
 125	8.9727				356.25			
 126				7.0048	329.12			
 126						950.1379	Measured	Processed
 126	0.7958				270.54			
 127				12.9779	263.57			
 127						937.9560	Measured	Processed
 127	0.5076				134.21			
 128				9.9175	262.94			
 128						928.5463	Measured	Processed
 128	1.0484				183.78			
 129				8.1469	90.74			
 129						921.4479	Measured	Processed
 129	7.5355				207.20			
 130				6.5051	284.96			
 130						922.4785	Measured	Processed
 130	2.4354				228.93			
 131				4.6193	211.89			
 131						920.2948	Measured	Processed
 131	3.3650				273.74			
 132				5.9549	317.15			
 132						917.7052	Measured	Processed
 132	0.8190				187.50			
 133				8.6346	251.21			
 133						909.8898	Measured	Processed
 133	5.2971				292.27			
 134				1.7981	307.38			
 134						913.3890	Measured	Processed
 134	2.9009				199.75			
 135				6.3488	296.63			
 135						909.9413	Measured	Processed
 135	5.9103				338.38			
 136				2.0001	330.16			
 136						913.8518	Measured	Processed
 136	3.6537				139.57			
 137				10.2289	319.19			
 137						907.2768	Measured	Processed
 137	7.4703				308.41			
 138				2.7239	221.13			

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001















































Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 138						912.0234	Measured	Processed
 138	10.1736				59.72			
 139				2.5018	215.77			
 139						919.6954	Measured	Processed
 139	11.7030				286.12			
 140				6.4874	296.55			
 140						924.9112	Measured	Processed
 140	10.1667				303.62			
 141				0.9597	166.00			
 141						934.1184	Measured	Processed
 141	12.4100				283.49			
 142				9.6125	223.79			
 142						936.9161	Measured	Processed
 142	0.2222				256.44			
 143				10.3493	278.08			
 143						926.7893	Measured	Processed
 143	1.0310				107.74			
 144				1.7732	351.24			
 144						926.0472	Measured	Processed
 144	9.4185				213.95			
 145				9.6465	359.64			
 145						925.8195	Measured	Processed
 145	0.2527				197.38			
 146				9.1978	248.21			
 146						916.8746	Measured	Processed
 146	1.0377				294.85			
 147				4.0103	279.73			
 147						913.9022	Measured	Processed
 147	13.0182				235.43			
 148				0.8254	115.14			
 148						926.0952	Measured	Processed
 148	12.6018				347.95			
 149				3.9585	288.55			
 149						934.7387	Measured	Processed
 149	9.9304				364.97			
 150				1.7198	339.38			
 150						942.9496	Measured	Processed
 150	3.8309				273.23			
 151				13.1687	309.22			
 151						933.6121	Measured	Processed
 151	4.6265				312.41			
 152				-0.0251	348.89			
 152						938.2640	Measured	Processed
 152	7.9748				244.55			
 153				10.3777	269.99			
 153						935.8613	Measured	Processed

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001















































Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 153	2.5546				120.32			
 154				4.8168	147.94			
 154						933.5992	Measured	Processed
 154	0.6847				170.47			
 155				11.8720	336.41			
 155						922.4121	Measured	Processed
 155	1.5971				284.29			
 156				6.8003	329.54			
 156						917.2092	Measured	Processed
 156	1.8398				322.15			
 157				10.1577	255.77			
 157						908.8915	Measured	Processed
 157	0.3086				154.05			
 158				10.6267	207.07			
 158						898.5736	Measured	Processed
 158	0.2959				84.57			
 159				12.0180	195.80			
 159						886.8516	Measured	Processed
 159	2.1680				100.01			
 160				10.0671	158.85			
 160						878.9526	Measured	Processed
 160	0.6966				154.64			
 161				12.0543	188.56			
 161						867.5951	Measured	Processed
 161	0.9968				86.76			
 162				11.4733	220.48			
 162						857.1187	Measured	Processed
 162	0.3480				97.68			
 163				11.6730	172.98			
 163						845.7938	Measured	Processed
 163	0.9721				108.12			
 164				12.6176	182.38			
 164						834.1484	Measured	Processed
 164	0.1652				112.27			
 165				10.4028	239.09			
 165						823.9110	Measured	Processed
 165	5.0916				323.52			
 166				6.2447	148.24			
 166						822.7581	Measured	Processed
 166	6.1941				193.34			
 167				5.3189	223.46			
 167						823.6335	Measured	Processed
 167	9.0381				263.10			
 168				0.5831	96.32			
 168						832.0886	Measured	Processed
 168	12.2920				179.76			

















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 169				0.0438	105.32			
 169						844.3369	Measured	Processed
 169	11.2509				159.56			
 170				1.0193	87.03			
 170						854.5687	Measured	Processed
 170	13.1832				193.14			
 171				0.1993	100.21			
 171						867.5527	Measured	Processed
 171	11.9578				187.52			
 172				0.7281	90.13			
 172						878.7825	Measured	Processed
 172	12.0068				182.00			
 173				0.2740	121.85			
 173						890.5154	Measured	Processed
 173	7.8765				288.34			
 174				8.4704	203.87			
 174						889.9217	Measured	Processed
 174	0.2171				271.44			
 175				12.0370	123.73			
 175						878.1020	Measured	Processed
 175	2.5592				298.35			
 176				0.3234	136.31			
 176						880.3380	Measured	Processed
 176	11.6165				150.82			
 177				0.3228	101.79			
 177						891.6318	Measured	Processed
 177	11.4034				138.08			
 178				0.1433	134.85			
 178						902.8920	Measured	Processed
 178	12.6887				245.38			
 179				0.8475	134.08			
 179						914.7334	Measured	Processed
 179	7.7906				153.91			
 180				0.6673	169.56			
 180						921.8568	Measured	Processed
 180	10.4746				240.32			
 181				3.3474	47.02			
 181						928.9841	Measured	Processed
 181	5.5657				70.55			
 182				1.6794	101.00			
 182						932.8705	Measured	Processed
 182	5.0240				297.38			
 183				9.1927	298.06			
 183						928.7021	Measured	Processed
 183	0.0757				196.15			
 184				9.5699	139.48			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 184						919.2080	Measured	Processed
 184	1.0982				122.51			
 185				11.0310	211.35			
 185						909.2753	Measured	Processed
 185	0.2521				128.96			
 186				5.8425	228.29			
 186						903.6851	Measured	Processed
 186	6.3178				271.40			
 187				1.0605	194.39			
 187						908.9426	Measured	Processed
 187	11.9198				151.93			
 188				0.6595	77.09			
 188						920.2030	Measured	Processed
 188	8.4785				225.00			
 189				4.6675	251.00			
 189						924.0142	Measured	Processed
 189	3.0115				265.81			
 190				8.1348	321.58			
 190						918.8912	Measured	Processed
 190	7.0073				320.21			
 191				0.5210	177.12			
 191						925.3777	Measured	Processed
 191	12.1971				350.11			
 192				0.0791	196.67			
 192						937.4959	Measured	Processed
 192	5.0827				302.04			
 193				1.4808	301.45			
 193						941.0981	Measured	Processed
 193	10.7674				370.88			
 194				3.4168	273.91			
 194						948.4489	Measured	Processed
 194	8.0948				288.40			
 195				1.6060	312.90			
 195						954.9380	Measured	Processed
 195	6.7409				196.50			
 196				1.8504	261.25			
 196						959.8287	Measured	Processed
 196	5.9526				266.49			
 197				3.0049	339.24			
 197						962.7766	Measured	Processed
 197	5.2653				275.85			
 198				3.8733	255.83			
 198						964.1689	Measured	Processed
 198	5.3987				239.87			
 199				5.0853	222.33			
 199						964.4825	Measured	Processed















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 199	5.8995				249.72			
 200				3.4238	111.64			
 200						966.9583	Measured	Processed
 200	3.4682				221.86			
 201				5.8352	254.02			
 201						964.5915	Measured	Processed
 201	4.2877				272.00			
 202				3.0416	238.87			
 202						965.8378	Measured	Processed
 202	6.0799				138.86			
 203				2.5015	120.18			
 203						969.4164	Measured	Processed
 203	5.2144				284.25			
 204				6.2616	268.99			
 204						968.3694	Measured	Processed
 204	1.1179				275.75			
 205				8.1382	245.03			
 205						961.3493	Measured	Processed
 205	1.5508				265.19			
 206				5.6215	314.41			
 206						957.2789	Measured	Processed
 206	3.6606				286.99			
 207				1.7547	249.35			
 207						959.1850	Measured	Processed
 207	6.4601				358.53			
 208				5.3265	325.37			
 208						960.3189	Measured	Processed
 208	3.1565				257.27			
 209				4.3977	288.89			
 209						959.0779	Measured	Processed
 209	4.3223				300.33			
 210				4.3781	148.06			
 210						959.0223	Measured	Processed
 210	5.8321				55.48			
 211				3.6015	108.67			
 211						961.2530	Measured	Processed
 211	6.5649				239.49			
 212				4.2772	196.60			
 212						963.5409	Measured	Processed
 212	4.4731				176.16			
 213				3.4701	264.82			
 213						964.5440	Measured	Processed
 213	7.3496				282.96			
 214				2.0659	216.64			
 214						969.8280	Measured	Processed
 214	10.0125				307.23			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 215				2.8242	288.68			
 215						977.0165	Measured	Processed
 215	4.7204				267.00			
 216				8.1242	255.62			
 216						973.6129	Measured	Processed
 216	9.1285				332.03			
 217				6.1978	226.43			
 217						976.5439	Measured	Processed
 217	3.9798				374.36			
 218				1.1638	260.69			
 218						979.3601	Measured	Processed
 218	6.0385				182.97			
 219				4.5987	252.84			
 219						980.8001	Measured	Processed
 219	4.9483				302.69			
 220				5.7973	309.18			
 220						979.9514	Measured	Processed
 220	4.4877				262.49			
 221				9.5170	254.73			
 221						974.9223	Measured	Processed
 221	1.4922				222.08			
 222				5.5265	237.27			
 222						970.8882	Measured	Processed
 222	6.1607				208.80			
 223				2.2902	276.68			
 223						974.7589	Measured	Processed
 223	2.5690				321.38			
 224				6.8504	267.30			
 224						970.4778	Measured	Processed
 224	6.2581				204.59			
 225				10.3971	270.97			
 225						966.3390	Measured	Processed
 225	9.7892				348.09			
 226				11.8116	285.64			
 226						964.3168	Measured	Processed
 226	2.7656				47.24			
 227				6.3276	57.88			
 227						960.7549	Measured	Processed
 227	6.3167				54.48			
 228				4.2638	141.13			
 228						962.8079	Measured	Processed
 228	10.5121				260.55			
 229				4.3887	256.42			
 229						968.9315	Measured	Processed
 229	1.9455				257.86			
 230				2.2824	143.69			















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 230						968.5948	Measured	Processed
 230	8.8464				155.10			
 231				7.2774	244.95			
 231						970.1639	Measured	Processed
 231	5.4481				109.86			
 232				5.4786	304.94			
 232						970.1336	Measured	Processed
 232	6.5546				219.90			
 233				5.5921	329.02			
 233						971.0963	Measured	Processed
 233	6.2983				175.88			
 234				2.1116	246.45			
 234						975.2832	Measured	Processed
 234	3.0927				123.05			
 235				5.4282	51.42			
 235						972.9478	Measured	Processed
 235	4.1881				281.37			
 236				3.3146	275.92			
 236						973.8215	Measured	Processed
 236	4.4841				185.29			
 237				4.0728	54.93			
 237						974.2329	Measured	Processed
 237	1.3651				312.66			
 238				7.5856	253.53			
 238						968.0127	Measured	Processed
 238	9.2459				297.09			
 239				4.0258	244.20			
 239						973.2330	Measured	Processed
 239	4.9777				255.52			
 240				5.9475	262.96			
 240						972.2634	Measured	Processed
 240	5.6201				203.11			
 241				5.5942	277.25			
 241						972.2895	Measured	Processed
 241	1.4247				215.57			
 242				5.1816	150.44			
 242						968.5328	Measured	Processed
 242	5.5691				234.19			
 243				4.5371	176.32			
 243						969.5650	Measured	Processed
 243	3.3252				296.03			
 244				3.0785	310.49			
 244						969.8119	Measured	Processed
 244	4.8994				205.85			
 245				6.4117	252.01			
 245						968.2998	Measured	Processed















































Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 245	1.9222				233.54			
 246				6.0548	215.67			
 246						964.1674	Measured	Processed
 246	3.3062				181.04			
 247				10.7577	269.19			
 247						956.7161	Measured	Processed
 247	6.8320				204.03			
 248				1.2396	292.18			
 248						962.3087	Measured	Processed
 248	9.8290				206.76			
 249				3.1307	208.36			
 249						969.0072	Measured	Processed
 249	5.8062				249.17			
 250				4.6862	317.45			
 250						970.1274	Measured	Processed
 250	3.9118				100.06			
 251				5.6434	194.27			
 251						968.3960	Measured	Processed
 251	8.5566				349.21			
 252				3.6034	256.16			
 252						973.3494	Measured	Processed
 252	7.4403				226.55			
 253				3.9906	228.31			
 253						976.7993	Measured	Processed
 253	3.4429				277.05			
 254				6.4793	325.82			
 254						973.7632	Measured	Processed
 254	3.3479				338.67			
 255				10.9454	327.55			
 255						966.1660	Measured	Processed
 255	0.5808				172.78			
 256				12.2964	295.08			
 256						954.4506	Measured	Processed
 256	3.6176				174.65			
 257				12.4010	179.54			
 257						945.6673	Measured	Processed
 257	0.4155				223.21			
 258				0.6130	244.05			
 258						945.4700	Measured	Processed
 258	11.6802				146.10			
 259				2.6979	183.79			
 259						954.4525	Measured	Processed
 259	2.2041				183.80			
 260				12.4727	223.10			
 260						944.1840	Measured	Processed
 260	0.4846				238.26			

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 261				7.4659	300.41			
 261						937.2030	Measured	Processed
 261	1.3166				127.87			
 262				7.8205	193.61			
 262						930.6992	Measured	Processed
 262	2.2097				138.93			
 263				8.3102	204.89			
 263						924.5988	Measured	Processed
 263	4.9255				247.28			
 264				5.4212	235.10			
 264						924.1033	Measured	Processed
 264	2.2935				283.63			
 265				5.7502	213.85			
 265						920.6469	Measured	Processed
 265	4.9189				149.21			
 266				5.7871	71.41			
 266						919.7788	Measured	Processed
 266	12.6100				197.21			
 267				1.5468	57.14			
 267						930.8421	Measured	Processed
 267	10.7435				153.43			
 268				0.6588	199.83			
 268						940.9269	Measured	Processed
 268	2.9686				240.06			
 269				5.6872	317.84			
 269						938.2086	Measured	Processed
 269	4.6055				219.10			
 270				0.7819	194.11			
 270						942.0323	Measured	Processed
 270	12.1827				235.70			
 271				0.7498	223.63			
 271						953.4654	Measured	Processed
 271	6.2868				218.55			
 272				1.1045	140.78			
 272						958.6479	Measured	Processed
 272	5.4642				120.97			
 273				3.1495	169.87			
 273						960.9627	Measured	Processed
 273	7.7558				332.52			
 274				1.4146	78.24			
 274						967.3041	Measured	Processed
 274	5.4145				352.46			
 275				10.6142	133.50			
 275						962.1046	Measured	Processed
 275	6.0254				268.81			
 276				0.7773	203.46			

Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 276						967.3529	Measured	Processed
 276	8.2235				227.20			
 277				1.5761	204.89			
 277						974.0005	Measured	Processed
 277	4.8476				118.58			
 278				4.7650	188.18			
 278						974.0832	Measured	Processed
 278	6.4240				173.67			
 279				6.6919	225.57			
 279						973.8155	Measured	Processed
 279	2.7242				199.08			
 280				2.9861	275.46			
 280						973.5538	Measured	Processed
 280	6.9364				250.43			
 281				3.2351	260.86			
 281						977.2553	Measured	Processed
 281	6.2143				120.71			
 282				2.8490	165.74			
 282						980.6207	Measured	Processed
 282	5.9445				238.35			
 283				4.3292	253.67			
 283						982.2362	Measured	Processed
 283	4.8791				181.56			
 284				9.3116	209.70			
 284						977.8039	Measured	Processed
 284	1.7679				120.47			
 285				7.4119	174.47			
 285						972.1600	Measured	Processed
 285	4.8784				240.36			
 286				5.0900	284.77			
 286						971.9486	Measured	Processed
 286	4.5162				218.23			
 287				4.2879	301.74			
 287						972.1772	Measured	Processed
 287	5.0254				148.28			
 288				9.9784	244.30			
 288						967.2243	Measured	Processed
 288	4.4468				259.28			
 289				6.1965	381.00			
 289						965.4749	Measured	Processed
 289	2.4324				231.14			
 290				5.8948	259.62			
 290						962.0127	Measured	Processed
 290	3.6066				146.60			
 291				5.1040	146.05			
 291						960.5154	Measured	Processed



Level Measurements of Project Altoona bench run Job ALTLEVRU Line Line 001

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 291	4.0972				233.35			
 292				6.1014	302.11			
 292						958.5115	Measured	Processed
 292	3.6512				254.34			
 293				6.7638	294.47			
 293						955.3991	Measured	Processed
 293	1.5551				208.89			
 294				9.1923	196.46			
 294						947.7621	Measured	Processed
 294	0.0103				193.64			
 295				11.7177	220.08			
 295						936.0549	Measured	Processed
 295	0.5275				225.71			
 296				2.4243	233.19			
 296						934.1583	Measured	Processed
 296	6.5335				194.04			
 297				7.5028	259.91			
 297						933.1891	Measured	Processed
 297	0.9417				226.37			
 298				5.8834	272.24			
 298						928.2477	Measured	Processed
 298	12.3556				303.52			
 299				2.8043	147.83			
 299						937.7991	Measured	Processed
 299	4.9179				31.37			
 300				4.1471	86.05			
 300						938.5700	Control	Fixed in Height



## Level Summary

### 106-0160D Altoona Level Run CP3

04/12/2006 10:25:08

#### Project Information

Project name: 106-0160D Altoona Level Run CP3  
 Date created: 04/12/2006 10:23:00  
 Application software: LEICA Geo Office 3.0

#### Line 001

Line length: 12641.6451 fts  
 Method: BF  
 Start point id: BM29  
 Number of stations: 31  
 Date/time: 04/11/2006 20:55:33  
 Number of observations: 62

#### Processing Parameters













































Adjustment method: by distance  
 Processed with Staff Corrections: No  
 Height difference: 6.7796 fts

#### Points

Point Id	Epoch	Height [fts]	Delta Hgt. [fts]	Point Class	Sd. Hgt. [fts]
BM29	04/11/2006 20:55:34	954.4506	-	Control	-
1	04/11/2006 20:55:37	956.4700	2.0195	Measured	0.0018
2	04/11/2006 20:55:41	964.7177	8.2476	Measured	0.0011
3	04/11/2006 20:55:45	974.7019	9.9842	Measured	0.0032
4	04/11/2006 20:55:49	985.9891	11.2872	Measured	0.0013
5	04/11/2006 20:55:53	989.9737	3.9847	Measured	0.0003
6	04/11/2006 20:55:57	982.1646	-7.8091	Measured	0.0009
7	04/11/2006 20:56:01	971.4276	-10.7370	Measured	0.0008
8	04/11/2006 20:56:05	976.9605	5.5329	Measured	0.0004
9	04/11/2006 20:56:09	968.1754	-8.7851	Measured	0.0002
10	04/11/2006 20:56:13	964.2029	-3.9725	Measured	0.0004
11	04/11/2006 20:56:17	960.2113	-3.9916	Measured	0.0008
12	04/11/2006 20:56:21	958.5591	-1.6522	Measured	0.0005
13	04/11/2006 20:56:25	961.0767	2.5176	Measured	0.0003
14	04/11/2006 20:56:29	964.7757	3.6990	Measured	0.0008
15	04/11/2006 20:56:33	971.8321	7.0565	Measured	0.0004
16	04/11/2006 20:56:37	968.6596	-3.1726	Measured	0.0006
17	04/11/2006 20:56:41	963.1629	-5.4966	Measured	0.0004
18	04/11/2006 20:56:45	959.4167	-3.7463	Measured	0.0006
19	04/11/2006 20:56:49	957.9689	-1.4478	Measured	0.0002
20	04/11/2006 20:56:53	946.4618	-11.5071	Measured	0.0021













































21	04/11/2006 20:56:57	949.3107	2.8489	Measured	0.0003
22	04/11/2006 20:57:01	955.6429	6.3322	Measured	0.0011
23	04/11/2006 20:57:05	967.2994	11.6565	Measured	0.0012
24	04/11/2006 20:57:09	975.3170	8.0176	Measured	0.0013
25	04/11/2006 20:57:13	975.5952	0.2782	Measured	0.0028
26	04/11/2006 20:57:17	981.5437	5.9485	Measured	0.0022
27	04/11/2006 20:57:21	982.0615	0.5177	Measured	0.0014
28	04/11/2006 20:57:25	980.4738	-1.5877	Measured	0.0013
29	04/11/2006 20:57:29	971.5203	-8.9535	Measured	0.0010
30	04/11/2006 20:57:33	966.0179	-5.5024	Measured	0.0030
31	04/11/2006 20:57:37	961.2530	-4.7649	Control	-

Level Measurements of Project 106-0160D Altoona Level Run CP3 Job MODALTBLEVE (2) Line Line 001  
Huxley Benches

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 BM29						954.4506	Control	Fixed in Height
 BM29	5.9113				262.77			
 1				3.8928	256.93			
 1						956.4700	Measured	Processed
 1	8.9133				286.74			
 2				0.6666	216.07			
 2						964.7176	Measured	Processed
 2	10.2886				276.97			
 3				0.3053	235.04			
 3						974.7019	Measured	Processed
 3	13.0469				222.17			
 4				1.7602	68.13			
 4						985.9891	Measured	Processed
 4	7.6817				96.03			
 5				3.6973	47.37			
 5						989.9737	Measured	Processed
 5	4.4348				313.64			
 6				12.2449	224.32			
 6						982.1646	Measured	Processed
 6	0.1790				107.18			
 7				10.9165	167.51			
 7						971.4276	Measured	Processed
 7	7.4493				196.36			
 8				1.9169	62.13			
 8						976.9605	Measured	Processed
 8	1.4355				62.11			
 9				10.2209	84.52			
 9						968.1753	Measured	Processed
 9	7.0940				187.31			
 10				11.0672	215.44			
 10						964.2029	Measured	Processed
 10	2.1288				183.54			
 11				6.1211	220.98			
 11						960.2113	Measured	Processed
 11	3.4627				204.15			
 12				5.1157	243.69			
 12						958.5591	Measured	Processed
 12	5.2125				136.75			
 13				2.6953	79.12			
 13						961.0767	Measured	Processed
 13	5.2790				258.70			
 14				1.5809	222.41			
 14						964.7757	Measured	Processed
 14	8.3881				246.90			

End

Level Measurements of Project 106-0160D Altoona Level Run CP3 Job MODALTBLEVE (2) Line Line 001  
Huxley Benches

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
 15				1.3324	182.97			
 15						971.8321	Measured	Processed
 15	3.5986				225.14			
 16				6.7720	244.38			
 16						968.6596	Measured	Processed
 16	1.3996				182.42			
 17				6.8969	184.36			
 17						963.1630	Measured	Processed
 17	2.2830				172.04			
 18				6.0298	117.96			
 18						959.4167	Measured	Processed
 18	2.0742				194.62			
 19				3.5225	93.88			
 19						957.9689	Measured	Processed
 19	1.3273				271.07			
 20				12.8354	274.34			
 20						946.4618	Measured	Processed
 20	3.6493				126.71			
 21				0.8010	197.49			
 21						949.3107	Measured	Processed
 21	7.2373				196.06			
 22				0.9058	198.85			
 22						955.6429	Measured	Processed
 22	12.8660				184.90			
 23				1.2100	117.39			
 23						967.2994	Measured	Processed
 23	12.9744				206.93			
 24				4.9576	220.56			
 24						975.3170	Measured	Processed
 24	8.1250				229.96			
 25				7.8477	284.27			
 25						975.5952	Measured	Processed
 25	8.1130				272.57			
 26				2.1656	349.28			
 26						981.5437	Measured	Processed
 26	3.8861				323.58			
 27				3.3694	234.51			
 27						982.0614	Measured	Processed
 27	5.0768				290.89			
 28				6.6656	341.49			
 28						980.4738	Measured	Processed
 28	0.4131				250.62			
 29				9.3674	221.09			
 29						971.5203	Measured	Processed

End

Level Measurements of Project 106-0160D Altoona Level Run CP3 Job MODALTBLEVE (2) Line Line 001  
Huxley Benches

Point Id	Back	Intm.	Intm. Type	Fore	Distance	Height	Point Class	Point Subclass
<input checked="" type="checkbox"/> 29	0.7362				268.52			
<input checked="" type="checkbox"/> 30				6.2396	272.38			
<input checked="" type="checkbox"/> 30						966.0179	Measured	Processed
<input checked="" type="checkbox"/> 30	4.1799				139.55			
<input checked="" type="checkbox"/> 31				8.9454	185.91			
<input checked="" type="checkbox"/> 31						961.2530	Control	Fixed in Height

End

## APPENDIX 4

### OPUS REPORTS

OPUS solution AE21510.06o 000460594.txt  
 From: opus@ngs.noaa.gov  
 Sent: Friday, April 07, 2006 11:49 AM  
 To: Greg Cory  
 Subject: OPUS solution : AE21510.06o 000460594

FILE: AE21510.06o 000460594

2005 NOTE: The IGS precise and IGS rapid orbits were not available  
 2005 at processing time. The IGS ultra-rapid orbit was/will be used to  
 2005 process the data.

# NGS OPUS SOLUTION REPORT

USER: gacory@snyder-associates.com  
 RINEX FILE: ae21096r.06o

DATE: April 07, 2006  
 TIME: 16:49:09 UTC

SOFTWARE: page5 0601.10 master30.pl  
 EPHEMERIS: i gu13694.eph [ultra-rapid]  
 NAV FILE: brdc0960.06n  
 ANT NAME: LEIAT502 NONE  
 ARP HEIGHT: 2.0

START: 2006/04/06 17:30:00  
 STOP: 2006/04/06 21:15:00  
 OBS USED: 8896 / 9551 : 93%  
 # FIXED AMB: 48 / 65 : 74%  
 OVERALL RMS: 0.023(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2625)

X:	-292044.897(m)	0.053(m)	-292045.593(m)	0.053(m)
Y:	-4770183.914(m)	0.043(m)	-4770182.569(m)	0.043(m)
Z:	4210024.284(m)	0.027(m)	4210024.196(m)	0.027(m)

LAT:	41 34 6.49529	0.010(m)	41 34 6.52112	0.010(m)
E LON:	266 29 47.59536	0.050(m)	266 29 47.56183	0.050(m)
W LON:	93 30 12.40464	0.050(m)	93 30 12.43817	0.050(m)
EL HGT:	240.351(m)	0.052(m)	239.320(m)	0.052(m)
ORTHO HGT:	271.841(m)	0.058(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 I A S)
Northing (Y) [meters]	4601988.212	174179.277
Easting (X) [meters]	458025.248	499712.607
Convergence [degrees]	-0.33404847	-0.00226971
Point Scale	0.99962168	0.99996891
Combined Factor	0.99958400	0.99993121

US NATIONAL GRID DESIGNATOR: 15TVG5802501988(NAD 83)

PID	DESIGNATION	BASE STATIONS USED	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP		N414641.765	W0955440.671	201853.6
AH9088	LTHM LATHROP CORS ARP		N393433.425	W0941012.528	228343.7
AI2153	SLAI SLATER CORS ARP		N415402.072	W0934155.905	40311.7

	NEAREST NGS PUBLISHED CONTROL POINT	
AE2151	GPS 15	N413406.495 W0933012.403 0.0

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.



OPUS solution AE21510.06o 000460594.txt  
 From: opus@ngs.noaa.gov  
 Sent: Friday, April 07, 2006 11:49 AM  
 To: Greg Cory  
 Subject: OPUS solution : AE21510.06o 000460594

FILE: AE21510.06o 000460594

2005 NOTE: The IGS precise and IGS rapid orbits were not available  
 2005 at processing time. The IGS ultra-rapid orbit was/will be used to  
 2005 process the data.

# NGS OPUS SOLUTION REPORT

USER: gacory@snyder-associates.com  
 RINEX FILE: ae21096r.06o

DATE: April 07, 2006  
 TIME: 16:49:09 UTC

SOFTWARE: page5 0601.10 master30.pl  
 EPHEMERIS: i gu13694.eph [ultra-rapid]  
 NAV FILE: brdc0960.06n  
 ANT NAME: LEIAT502 NONE  
 ARP HEIGHT: 2.0

START: 2006/04/06 17:30:00  
 STOP: 2006/04/06 21:15:00  
 OBS USED: 8896 / 9551 : 93%  
 # FIXED AMB: 48 / 65 : 74%  
 OVERALL RMS: 0.023(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2625)

X:	-292044.897(m)	0.053(m)	-292045.593(m)	0.053(m)
Y:	-4770183.914(m)	0.043(m)	-4770182.569(m)	0.043(m)
Z:	4210024.284(m)	0.027(m)	4210024.196(m)	0.027(m)

LAT:	41 34 6.49529	0.010(m)	41 34 6.52112	0.010(m)
E LON:	266 29 47.59536	0.050(m)	266 29 47.56183	0.050(m)
W LON:	93 30 12.40464	0.050(m)	93 30 12.43817	0.050(m)
EL HGT:	240.351(m)	0.052(m)	239.320(m)	0.052(m)
ORTHO HGT:	271.841(m)	0.058(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 I A S)
Northing (Y) [meters]	4601988.212	174179.277
Easting (X) [meters]	458025.248	499712.607
Convergence [degrees]	-0.33404847	-0.00226971
Point Scale	0.99962168	0.99996891
Combined Factor	0.99958400	0.99993121

US NATIONAL GRID DESIGNATOR: 15TVG5802501988(NAD 83)

PID	DESIGNATION	BASE STATIONS USED	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP		N414641.765	W0955440.671	201853.6
AH9088	LTHM LATHROP CORS ARP		N393433.425	W0941012.528	228343.7
AI2153	SLAI SLATER CORS ARP		N415402.072	W0934155.905	40311.7

	NEAREST NGS PUBLISHED CONTROL POINT	
AE2151	GPS 15	N413406.495 W0933012.403 0.0

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS solution CP90.06o 000460601.txt

From: opus@ngs.noaa.gov  
Sent: Friday, April 07, 2006 11:47 AM  
To: Greg Cory  
Subject: OPUS solution : CP90.06o 000460601

FILE: CP90.06o 000460601

2005 NOTE: The IGS precise and IGS rapid orbits were not available  
2005 at processing time. The IGS ultra-rapid orbit was/will be used to  
2005 process the data.

# NGS OPUS SOLUTION REPORT

=====

USER: gacory@snyder-associates.com  
RINEX FILE: cp90096t.06o

DATE: April 07, 2006  
TIME: 16:46:56 UTC

SOFTWARE: page5 0601.10 master10.pl  
EPHEMERIS: igu13694.eph [ultra-rapid]  
NAV FILE: brdc0960.06n  
ANT NAME: LEIAX1202 NONE  
ARP HEIGHT: 2.0

START: 2006/04/06 19:05:00  
STOP: 2006/04/06 21:39:00  
OBS USED: 6510 / 6954 : 94%  
# FIXED AMB: 43 / 45 : 96%  
OVERALL RMS: 0.022(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2626)

X:	-288505.904(m)	0.013(m)	-288506.600(m)	0.013(m)
Y:	-4764993.309(m)	0.052(m)	-4764991.964(m)	0.052(m)
Z:	4216128.493(m)	0.067(m)	4216128.405(m)	0.067(m)

LAT:	41 38 30.56612	0.019(m)	41 38 30.59199	0.019(m)
E LON:	266 32 6.51855	0.010(m)	266 32 6.48501	0.010(m)
W LON:	93 27 53.48145	0.010(m)	93 27 53.51499	0.010(m)
EL HGT:	258.646(m)	0.084(m)	257.615(m)	0.084(m)
ORTHO HGT:	290.130(m)	0.087(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 IAS)
Northing (Y) [meters]	4610113.943	182326.643
Easting (X) [meters]	461286.549	502927.917
Convergence [degrees]	-0.30888755	0.02314941
Point Scale	0.99961844	0.99997794
Combined Factor	0.99957789	0.99993737

US NATIONAL GRID DESIGNATOR: 15TVG6128710114(NAD 83)

## BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP	N414641.765	W0955440.671	204165.2
AH9088	LTHM LATHROP CORS ARP	N393433.425	W0941012.528	237039.1
AI2153	SLAI SLATER CORS ARP	N415402.072	W0934155.905	34707.6

## NEAREST NGS PUBLISHED CONTROL POINT

MH0199	S 4	N413902.	W0932752.	972.6
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This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS solution Old\_CP90.06o 000460580.txt  
 From: opus@ngs.noaa.gov  
 Sent: Friday, April 07, 2006 11:37 AM  
 To: Greg Cory  
 Subject: OPUS solution : Old\_CP90.06o 000460580

FILE: Old\_CP90.06o 000460580

# NGS OPUS SOLUTION REPORT =====

USER: gacory@snyder-associates.com  
 RINEX FILE: old\_084o.06o

DATE: April 07, 2006  
 TIME: 16:37:26 UTC

SOFTWARE: page5\_0601.10 master4.pl  
 EPHEMERIS: igr13676.eph [rapid]  
 NAV FILE: brdc0840.06n  
 ANT NAME: LEIAT502 NONE  
 ARP HEIGHT: 2.0

START: 2006/03/25 14:48:00  
 STOP: 2006/03/25 19:28:00  
 OBS USED: 7433 / 8086 : 92%  
 # FIXED AMB: 62 / 65 : 95%  
 OVERALL RMS: 0.022(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2294)

X:	-288505.887(m)	0.007(m)	-288506.582(m)	0.007(m)
Y:	-4764992.988(m)	0.010(m)	-4764991.643(m)	0.010(m)
Z:	4216128.208(m)	0.011(m)	4216128.120(m)	0.011(m)

LAT:	41 38 30.56614	0.006(m)	41 38 30.59201	0.006(m)
E LON:	266 32 6.51844	0.007(m)	266 32 6.48495	0.007(m)
W LON:	93 27 53.48156	0.007(m)	93 27 53.51505	0.007(m)
EL HGT:	258.216(m)	0.015(m)	257.186(m)	0.015(m)
ORTHO HGT:	289.700(m)	0.029(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 IAS)
Northing (Y) [meters]	4610113.944	182326.644
Easting (X) [meters]	461286.547	502927.915
Convergence [degrees]	-0.30888757	0.02314940
Point Scale	0.99961844	0.99997794
Combined Factor	0.99957796	0.99993744

US NATIONAL GRID DESIGNATOR: 15TVG6128710114(NAD 83)

PID	DESIGNATION	BASE STATIONS USED	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP		N414641.765	W0955440.671	204165.2
AH9088	LTHM LATHROP CORS ARP		N393433.425	W0941012.528	237039.0
AI2153	SLAI SLATER CORS ARP		N415402.072	W0934155.905	34707.6

	NEAREST NGS PUBLISHED CONTROL POINT			
MH0199	S 4	N413902.	W0932752.	972.6

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS solution MH2000.06o 000460602.txt

From: opus@ngs.noaa.gov  
Sent: Friday, April 07, 2006 11:53 AM  
To: Greg Cory  
Subject: OPUS solution : MH2000.06o 000460602

FILE: MH2000.06o 000460602

2005 NOTE: The IGS precise and IGS rapid orbits were not available  
2005 at processing time. The IGS ultra-rapid orbit was/will be used to  
2005 process the data.  
2005

NGS OPUS SOLUTION REPORT

=====

USER: gacory@snyder-associates.com  
RINEX FILE: mh20096r.06o

DATE: April 07, 2006  
TIME: 16:52:52 UTC

SOFTWARE: page5 0601.10 master.pl  
EPHEMERIS: i gu13694.eph [ultra-rapid]  
NAV FILE: brdc0960.06n  
ANT NAME: LEIAT502 NONE  
ARP HEIGHT: 2.0

START: 2006/04/06 17:59:00  
STOP: 2006/04/06 21:32:00  
OBS USED: 8935 / 9254 : 97%  
# FIXED AMB: 57 / 69 : 83%  
OVERALL RMS: 0.023(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2625)

X:	-285179.346(m)	0.025(m)	-285180.042(m)	0.025(m)
Y:	-4764049.989(m)	0.095(m)	-4764048.644(m)	0.095(m)
Z:	4217405.964(m)	0.059(m)	4217405.876(m)	0.059(m)

LAT:	41 39 26.09330	0.019(m)	41 39 26.11920	0.019(m)
E LON:	266 34 27.56147	0.020(m)	266 34 27.52797	0.020(m)
W LON:	93 25 32.43853	0.020(m)	93 25 32.47203	0.020(m)
EL HGT:	254.643(m)	0.111(m)	253.613(m)	0.111(m)
ORTHO HGT:	286.164(m)	0.114(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 IAS)
Northing (Y) [meters]	4611809.528	184041.774
Easting (X) [meters]	464557.825	506190.496
Convergence [degrees]	-0.28293922	0.04895639
Point Scale	0.99961546	0.99998004
Combined Factor	0.99957553	0.99994011

US NATIONAL GRID DESIGNATOR: 15TVG6455811810(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP	N414641.765	W0955440.671	207273.6
AH9088	LTHM LATHROP CORS ARP	N393433.425	W0941012.528	239545.4
AI2153	SLAI SLATER CORS ARP	N415402.072	W0934155.905	35303.5

NEAREST NGS PUBLISHED CONTROL POINT

MH0200	T 4	N413925.	W0932532.	35.3
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This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS solution OLD MH200.06o 000460614.txt

From: opus@ngs.noaa.gov  
Sent: Friday, April 07, 2006 12:00 PM  
To: Greg Cory  
Subject: OPUS solution : OLD MH200.06o 000460614

FILE: OLD MH200.06o 000460614

# NGS OPUS SOLUTION REPORT

=====

USER: gacory@snyder-associates.com  
RI NEX FILE: ol dm084p.06o

DATE: April 07, 2006  
TIME: 16:59:42 UTC

SOFTWARE: page5\_0601.10 master13.pl  
EPHEMERIS: i gr13676.eph [rapi d]  
NAV FILE: brdc0840.06n  
ANT NAME: LEI AT502 NONE  
ARP HEIGHT: 1.75

START: 2006/03/25 15:04:00  
STOP: 2006/03/25 19:18:00  
OBS USED: 6776 / 7392 : 92%  
# FIXED AMB: 58 / 74 : 78%  
OVERALL RMS: 0.024(m)

REF FRAME: NAD\_83(CORS96) (EPOCH: 2002.0000)

ITRF00 (EPOCH: 2006.2294)

X:	-285179.328(m)	0.056(m)	-285180.023(m)	0.056(m)
Y:	-4764050.145(m)	0.096(m)	-4764048.800(m)	0.096(m)
Z:	4217406.108(m)	0.055(m)	4217406.020(m)	0.055(m)

LAT:	41 39 26.09345	0.020(m)	41 39 26.11935	0.020(m)
E LON:	266 34 27.56265	0.060(m)	266 34 27.52919	0.060(m)
W LON:	93 25 32.43735	0.060(m)	93 25 32.47081	0.060(m)
EL HGT:	254.855(m)	0.105(m)	253.824(m)	0.105(m)
ORTHO HGT:	286.376(m)	0.108(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 15)	SPC (1402 I A S)
Northing (Y) [meters]	4611809.533	184041.779
Easting (X) [meters]	464557.853	506190.523
Convergence [degrees]	-0.28293900	0.04895661
Point Scale	0.99961546	0.99998004
Combined Factor	0.99957550	0.99994007

US NATIONAL GRID DESIGNATOR: 15TVG6455811810(NAD 83)

## BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
AH5054	OMH1 OMAHA 1 CORS ARP	N414641.765	W0955440.671	207273.6
AH9088	LTHM LATHROP CORS ARP	N393433.425	W0941012.528	239545.4
AI2153	SLAI SLATER CORS ARP	N415402.072	W0934155.905	35303.5

## NEAREST NGS PUBLISHED CONTROL POINT

MH0200	T 4	N413925.	W0932532.	35.3
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This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

# APPENDIX 5

## NGS DATASHEETS

```

MH0200 *****
MH0200 DESIGNATION - T 4
MH0200 PID - MH0200
MH0200 STATE/COUNTY- IA/POLK
MH0200 USGS QUAD - ALTOONA (1972)
MH0200
MH0200 *CURRENT SURVEY CONTROL
MH0200
MH0200* NAD 83(1986)- 41 39 25. (N) 093 25 32. (W) SCALED
MH0200* NAVD 88 - 286.077 (meters) 938.57 (feet) ADJUSTED
MH0200
MH0200 GEOID HEIGHT- -31.52 (meters) GEOID03
MH0200 DYNAMIC HT - 285.955 (meters) 938.17 (feet) COMP
MH0200 MODELED GRAV- 980,190.3 (mgal) NAVD 88
MH0200
MH0200 VERT ORDER - FIRST CLASS II
MH0200
MH0200.The horizontal coordinates were scaled from a topographic map and have
MH0200.an estimated accuracy of +/- 6 seconds.
MH0200
MH0200.The orthometric height was determined by differential leveling
MH0200.and adjusted by the National Geodetic Survey in June 1991..
MH0200
MH0200.The geoid height was determined by GEOID03.
MH0200
MH0200.The dynamic height is computed by dividing the NAVD 88
MH0200.geopotential number by the normal gravity value computed on the
MH0200.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
MH0200.degrees latitude (g = 980.6199 gals.).
MH0200
MH0200.The modeled gravity was interpolated from observed gravity values.
MH0200
MH0200; North East Units Estimated Accuracy
MH0200;SPC IA S - 184,010. 506,200. MT (+/- 180 meters Scaled)
MH0200
MH0200 SUPERSEDED SURVEY CONTROL
MH0200
MH0200 NGVD 29 (??/??/92) 286.037 (m) 938.44 (f) ADJ UNCH 1 2
MH0200
MH0200.Superseded values are not recommended for survey control.
MH0200.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
MH0200.See file dsdata.txt to determine how the superseded data were derived.
MH0200
MH0200_U.S. NATIONAL GRID SPATIAL ADDRESS: 15TVG645117(NAD 83)
MH0200_MARKER: DB = BENCH MARK DISK
MH0200_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
MH0200_SP_SET: SET IN TOP OF CONCRETE MONUMENT
MH0200_STAMPING: 938.440 T 1930
MH0200_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
MH0200+STABILITY: SURFACE MOTION
MH0200
MH0200 HISTORY - Date Condition Report By
MH0200 HISTORY - 1930 MONUMENTED CGS
MH0200 HISTORY - 1934 GOOD NGS
MH0200 HISTORY - 19950804 MARK NOT FOUND USPSQD
MH0200

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MH0200 STATION DESCRIPTION  
MH0200  
MH0200'DESCRIBED BY NATIONAL GEODETIC SURVEY 1934  
MH0200'2.1 MI SE FROM ALTOONA.  
MH0200'2.1 MILES SOUTHEAST ALONG THE CHICAGO, ROCK ISLAND AND PACIFIC  
MH0200'RAILWAY FROM ALTOONA, POLK COUNTY, 8 FEET EAST OF THE EAST FENCE  
MH0200'LINE OF A NORTH-AND-SOUTH ROAD FENCED 48 FEET WIDE, AND 32 FEET  
MH0200'NORTH OF THE CENTERLINE OF THE TRACK. A STANDARD DISK, STAMPED  
MH0200'938.440 T 1930 AND SET IN THE TOP OF A CONCRETE POST.  
MH0200  
MH0200 STATION RECOVERY (1995)  
MH0200  
MH0200'RECOVERY NOTE BY US POWER SQUADRON 1995  
MH0200'MARK NOT FOUND.

\*\*\* retrieval complete.  
Elapsed Time = 00:00:00



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AE2151 *****
AE2151 CBN - This is a Cooperative Base Network Control Station.
AE2151 DESIGNATION - GPS 15
AE2151 PID - AE2151
AE2151 STATE/COUNTY- IA/POLK
AE2151 USGS QUAD - DES MOINES SE (1976)
AE2151
AE2151 *CURRENT SURVEY CONTROL
AE2151
AE2151* NAD 83(1996)- 41 34 06.49538(N) 093 30 12.40381(W) ADJUSTED
AE2151* NAVD 88 - 271.8 (meters) 892. (feet) GPS OBS
AE2151
AE2151 X - -292,044.877 (meters) COMP
AE2151 Y - -4,770,183.905 (meters) COMP
AE2151 Z - 4,210,024.279 (meters) COMP
AE2151 LAPLACE CORR- -2.58 (seconds) DEFLEC99
AE2151 ELLIP HEIGHT- 240.34 (meters) (06/15/04) GPS OBS
AE2151 GEOID HEIGHT- -31.49 (meters) GEOID03
AE2151
AE2151 HORZ ORDER - B
AE2151 ELLP ORDER - FOURTH CLASS I
AE2151
AE2151.The horizontal coordinates were established by GPS observations
AE2151.and adjusted by the National Geodetic Survey in August 1997..
AE2151
AE2151.The orthometric height was determined by GPS observations and a
AE2151.high-resolution geoid model.
AE2151
AE2151.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AE2151
AE2151.The Laplace correction was computed from DEFLEC99 derived deflections.
AE2151
AE2151.The ellipsoidal height was determined by GPS observations
AE2151.and is referenced to NAD 83.
AE2151
AE2151.The geoid height was determined by GEOID03.
AE2151
AE2151; North East Units Scale Factor Converg.
AE2151;SPC IA S - 174,179.280 499,712.626 MT 0.99996891 -0 00 08.2
AE2151;UTM 15 - 4,601,988.215 458,025.267 MT 0.99962168 -0 20 02.6
AE2151
AE2151! - Elev Factor x Scale Factor = Combined Factor
AE2151!SPC IA S - 0.99996230 x 0.99996891 = 0.99993122
AE2151!UTM 15 - 0.99996230 x 0.99962168 = 0.99958400
AE2151
AE2151 SUPERSEDED SURVEY CONTROL
AE2151
AE2151 ELLIP H (08/25/97) 240.38 (m) GP( ) 4 1
AE2151
AE2151.Superseded values are not recommended for survey control.
AE2151.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AE2151.See file dsdata.txt to determine how the superseded data were derived.
AE2151
AE2151_U.S. NATIONAL GRID SPATIAL ADDRESS: 15TVG5802501988(NAD 83)
AE2151_MARKER: DD = SURVEY DISK

```

AE2151\_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT  
AE2151\_STAMPING: GPS 15  
AE2151\_MARK LOGO: MJH  
AE2151\_MAGNETIC: N = NO MAGNETIC MATERIAL  
AE2151\_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO  
AE2151+STABILITY: SURFACE MOTION  
AE2151\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
AE2151+SATELLITE: SATELLITE OBSERVATIONS - November 06, 2003

AE2151

AE2151	HISTORY	- Date	Condition	Report By
AE2151	HISTORY	- 1987	MONUMENTED	MJH
AE2151	HISTORY	- 19970129	GOOD	IADT
AE2151	HISTORY	- 20020308	GOOD	JCLS
AE2151	HISTORY	- 20020315	GOOD	JCLS
AE2151	HISTORY	- 20031106	GOOD	JCLS

AE2151

AE2151 STATION DESCRIPTION

AE2151

AE2151'DESCRIBED BY IOWA DEPARTMENT OF TRANSPORTATION 1997 (DMO)  
AE2151'TO REACH THE STATION FROM THE INTERSECTION OF STATE HWY 163  
AE2151'(UNIVERSITY AVE.) AND STATE HWY 46 (EAST 30TH ST.) IN DES MOINES, GO  
AE2151'SOUTH ON STATE HWY 46 FOR 1.8 KM (1.10 MI) TO SCOTT AVE., TURN LEFT  
AE2151'AND GO EAST ON SCOTT AVENUE FOR 2.15 KM (1.35 MI) TO A FORK IN THE  
AE2151'ROAD. CONTINUE ON THE SOUTH FORK (PARKRIDGE AVE.) IN THE TOWN OF  
AE2151'PLEASANT HILL FOR 1.85 KM (1.15 MI) TO ANOTHER FORK IN THE ROAD.  
AE2151'CONTINUE ON THE SOUTH FORK (S.E. 6TH AVE.) FOR 0.5 KM (0.30 MI) TO  
AE2151'S.E. 55TH ST. TURN RIGHT AND GO SOUTH ON S.E. 55TH ST. FOR 2.1 KM  
AE2151'(1.30 MI) TO THE STATION ON THE LEFT AT THE 90 DEGREE BEND IN THE ROAD  
AE2151'TO THE WEST. THE STATION IS A CONCRETE MONUMENT WITH A BRASS DISK AND  
AE2151'IS LOCATED 37.5 FT (11.4 M) S.W. OF X NAILS IN WEST FACE OF A POWER  
AE2151'POLE, 28.05 FT (8.55 M) N.E. OF X NAILS IN NORTH FACE OF A 3 INCH  
AE2151'DIAM. FENCE POST, 89.5 FT (27.3 M) S.E. OF X NAILS IN THE EAST FACE  
AE2151'OF A POWER POLE, AND 8.05 FT (2.45 M) N.W. OF X NAILS IN THE WEST  
AE2151'FACE OF A 12 IN. DIAM. FENCE CORNER POST. IT IS SET 0.3 FT (9.1 CM)  
AE2151'BELOW THE GROUND SURFACE. A PINK STATE HARN SURVEY SIGN WAS SET 1 M  
AE2151'(3.3 FT) SOUTH OF THE MONUMENT.

AE2151

AE2151 STATION RECOVERY (2002)

AE2151

AE2151'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2002 (MRY)  
AE2151'DESCRIPTION IS ADEQUATE

AE2151

AE2151 STATION RECOVERY (2002)

AE2151

AE2151'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2002  
AE2151'RECOVERED IN GOOD CONDITION.

AE2151

AE2151 STATION RECOVERY (2003)

AE2151

AE2151'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2003 (MRY)  
AE2151'RECOVERED IN GOOD CONDITION.

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AE2139 *****
AE2139 CBN - This is a Cooperative Base Network Control Station.
AE2139 PACS - This is a Primary Airport Control Station.
AE2139 DESIGNATION - IKV A
AE2139 PID - AE2139
AE2139 STATE/COUNTY- IA/POLK
AE2139 USGS QUAD - DES MOINES NE (1976)
AE2139
AE2139 *CURRENT SURVEY CONTROL
AE2139
AE2139* NAD 83(1996)- 41 41 29.93714(N) 093 34 00.67478(W) ADJUSTED
AE2139* NAVD 88 - 270.64 (meters) 887.9 (feet) GPS OBS
AE2139
AE2139 X - -296,758.318 (meters) COMP
AE2139 Y - -4,760,785.858 (meters) COMP
AE2139 Z - 4,220,249.851 (meters) COMP
AE2139 LAPLACE CORR- -4.15 (seconds) DEFLEC99
AE2139 ELLIP HEIGHT- 239.41 (meters) (06/15/04) GPS OBS
AE2139 GEOID HEIGHT- -31.25 (meters) GEOID03
AE2139
AE2139 HORZ ORDER - B
AE2139 ELLP ORDER - FOURTH CLASS I
AE2139
AE2139.This mark is at Ankeny Regional Airport (IKV)
AE2139
AE2139.The horizontal coordinates were established by GPS observations
AE2139.and adjusted by the National Geodetic Survey in August 1997..
AE2139
AE2139.The orthometric height was determined by GPS observations and a
AE2139.high-resolution geoid model.
AE2139
AE2139.GPS derived orthometric heights for airport stations designated as
AE2139.PACS or SACS are published to 2 decimal places. This maintains
AE2139.centimeter relative accuracy between the PACS and SACS. It does
AE2139.not indicate centimeter accuracy relative to other marks which are
AE2139.part of the NAVD 88 network.
AE2139
AE2139.Photographs are available for this station.
AE2139
AE2139.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AE2139
AE2139.The Laplace correction was computed from DEFLEC99 derived deflections.
AE2139
AE2139.The ellipsoidal height was determined by GPS observations
AE2139.and is referenced to NAD 83.
AE2139
AE2139.The geoid height was determined by GEOID03.
AE2139
AE2139; North East Units Scale Factor Converg.
AE2139;SPC IA S - 187,862.023 494,434.511 MT 0.99998501 -0 02 38.5
AE2139;UTM 15 - 4,615,696.517 452,828.444 MT 0.99962738 -0 22 37.3
AE2139
AE2139! - Elev Factor x Scale Factor = Combined Factor
AE2139!SPC IA S - 0.99996245 x 0.99998501 = 0.99994746

```

AE2139!UTM 15 - 0.99996245 x 0.99962738 = 0.99958984  
 AE2139  
 AE2139 SUPERSEDED SURVEY CONTROL  
 AE2139  
 AE2139 ELLIP H (08/25/97) 239.45 (m) GP( ) 4 1  
 AE2139  
 AE2139.Superseded values are not recommended for survey control.  
 AE2139.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
 AE2139.See file dsdata.txt to determine how the superseded data were derived.  
 AE2139  
 AE2139\_U.S. NATIONAL GRID SPATIAL ADDRESS: 15TVG5282815697(NAD 83)  
 AE2139\_MARKER: I = METAL ROD  
 AE2139\_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)   
 AE2139\_STAMPING: IKV A 1996  
 AE2139\_MARK LOGO: NGS  
 AE2139\_PROJECTION: FLUSH  
 AE2139\_MAGNETIC: N = NO MAGNETIC MATERIAL  
 AE2139\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL  
 AE2139\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AE2139+SATELLITE: SATELLITE OBSERVATIONS - June 16, 2004  
 AE2139\_ROD/PIPE-DEPTH: 6.3 meters  
 AE2139\_SLEEVE-DEPTH : 0.9 meters  
 AE2139  

AE2139	HISTORY	- Date	Condition	Report By
AE2139	HISTORY	- 1996	MONUMENTED	NGS
AE2139	HISTORY	- 20021031	GOOD	JCLS
AE2139	HISTORY	- 20031106	GOOD	JCLS
AE2139	HISTORY	- 20040616	GOOD	NGS

 AE2139  
 AE2139 STATION DESCRIPTION  
 AE2139  
 AE2139'DESCRIBED BY NATIONAL GEODETIC SURVEY 1996 (SFH)  
 AE2139'THE STATION IS LOCATED ABOUT 3.5 KM (2.15 MI) SOUTHEAST OF ANKENY,  
 AE2139'IA., AT THE ANKENY REGIONAL AIRPORT. NEAR THE CENTER OF THE AIRPORT,  
 AE2139'IN THE GRASS AREA INSIDE THE SEGMENTED CIRCLE, EAST OF THE WINDSOCK  
 AE2139'ABOUT HALFWAY BETWEEN THE WINDSOCK AND THE INSIDE OF THE CIRCLE  
 AE2139'BLOCKS. OWNERSHIP--POLK COUNTY, 3700 CONVENIENCE BOULEVARD, ANKENY,  
 AE2139'IA. 50021. AIRPORT MANAGER DAVID E. BRECKENRIDGE, LINE SERVICE  
 AE2139'MANAGER DON STASAK, PHONE 515-965-1020. NOTE--THIS STATION IS THE  
 AE2139'(PACS AND CBN STATION) . TO REACH THE STATION FROM THE JUNCTION OF  
 AE2139'INTERSTATE HIGHWAY 35 AND STATE HIGHWAY 160 (S.E. ORALABOR ROAD) ,  
 AE2139'(EXIT 90) NEAR THE SOUTHEAST CORNER OF ANKENY, GO EAST, 0.3 KM (0.20  
 AE2139'MI) ALONG ORALABOR ROAD TO THE INTERSECTION OF CONVENIENCE BOULEVARD.  
 AE2139'TURN RIGHT, SOUTHERLY, 1.1 KM (0.70 MI) ALONG THE BOULEVARD TO THE  
 AE2139'AIRPORT OFFICE AND GATE. PASS THROUGH THE GATE, EAST, 0.08 KM (0.05  
 AE2139'MI) ACROSS THE APRON TO A TAXI. TURN RIGHT, SOUTH THEN SOUTHEAST,  
 AE2139'0.40 KM (0.25 MI) ALONG THE TAXI TO THE WINDSOCK INSIDE THE SEGMENTED  
 AE2139'CIRCLE AND THE STATION JUST EAST OF THE WINDSOCK. STATION IS 85.6 M  
 AE2139'(280.8 FT) WEST OF THE RUNWAY CENTERLINE, 39.0 M (128.0 FT) SOUTH OF  
 AE2139'THE TAXI/RAMP CENTERLINE AND IN LINE WITH AN EXPANSION JOINT, 7.9 M  
 AE2139'(25.9 FT) WEST OF THE INSIDE OF THE CIRCLES EAST SIDE, 7.2 M (23.6 FT)  
 AE2139'EAST OF THE WINDSOCK POLE AND WITNESS POST, AND THE STATION IS ABOUT  
 AE2139'0.3 M (1.0 FT) BELOW THE WINDSOCK BASE AND FLUSH WITH THE GROUND  
 AE2139'SURFACE. NOTE--ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH LOGO  
 AE2139'CAP. BY R.G. HAYES  
 AE2139

AE2139 STATION RECOVERY (2002)  
AE2139  
AE2139'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2002 (FJO)  
AE2139'RECOVERED IN GOOD CONDITION.  
AE2139  
AE2139 STATION RECOVERY (2003)  
AE2139  
AE2139'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2003 (MRY)  
AE2139'RECOVERED IN GOOD CONDITION.  
AE2139  
AE2139 STATION RECOVERY (2004)  
AE2139  
AE2139'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2004 (TGW)  
AE2139'RECOVERED AS DESCRIBED.

# APPENDIX 6

## SURVEY EQUIPMENT LIST

<u>Static Rovers:</u>	<u>Serial #</u>
Leica System 1200	5825
Leica System 1200	5660
Leica System 1200	6783

CBN (Cooperative Base Network Control Station)

Leica System 500	2201
Leica System 500	3463
Leica System 500	4893
Leica System 1200	5429

Digital Level

Leica DNA 03	330861
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## APPENDIX 7

### PHOTOS





CP01-2/28/2011 3:23 PM



CP01-South-2/28/2011 3:29 PM



CP2-2/28/2011 4:07 PM



CP2-West-2/28/2011 4:07 PM



CP3-2/28/2011 4:28 PM



CP3-South-2/28/2011 4:24 PM





CP4-2/28/2011 3:12 PM



CP4-North-2/28/2011 3:12 PM



CP5-2/28/2011 4:00 PM



CP5-East-2/28/2011 4:00 PM



CP6-3/11/2011 9:22 AM



CP6-North-3/11/2011 9:22 AM





CP7-2/28/2011 3:02 PM



CP7-East-2/28/2011 3:02 PM



CP8-2/28/2011 5:01 PM



CP8-North-2/28/2011 5:01 PM



CP9-2/28/2011 2:23 PM



CP9-2/28/2011 2:23 PM





CP10-2/28/2011 2:29 PM



CP10-East-2/28/2011 2:29 PM



CP11-2/28/2011 5:06 PM



CP11-North-2/28/2011 5:06 PM



CP12-2/28/2011 4:56 PM



CP12-2/28/2011 4:56 PM





CP13-2/28/2011 2:57 PM



CP13-East-2/28/2011 2:57 PM



CP14-2/28/2011 5:16 PM



CP14-North-2/28/2011 5:15 PM



CP15-2/28/2011 1:59 PM



CP15-East-2/28/2011 1:59 PM

# APPENDIX 8

## SECONDARY BENCHMARKS

# Altoona Secondary Bench Marks

Report Date:	5/5/2006
Vertical Datum:	NAVD88
Minimum Vertical Tolerance:	Second Order, Class II
Type Of Leveling:	Differential Using Leica DNA 03 Digital Level
Prepared By:	Snyder & Associates, Inc.

BENCH MARK #	ELEVATION	LATITUDE	LONGITUDE	DESCRIPTION
MH 200	938.570			2.1 miles SE from Altoona along the Chicago, Rock Island and Pacific Railway +/- 32 feet north of centerline of track on the east side of road. Disk, stamped 938.440 T930 set in concrete monument.
1	909.069			R.R. spike in P.P. Northside of NE 50th Avenue, third p.p east of NE 80th street.
2	945.852			Set R.R. Spike in P.P., Forth P.P. south of 8th street, east side of road on 80th street.
3	941.974			Set R.R. Spike in P.P., Forth P.P. north of Lakeshore Drive. On SE 14th Street, east side of road.
4	954.905			NW upper flange bolt w/ bury tag #60 on fire hydrant NE corner of 13th & 2nd Ave.
5	954.107			R.R. spike in P.P. Forth P.P. north of 17th street East side of road on 1st Avenue.
6	963.459			arrow on hydrant. First hydrant east of 1st. Avenue @ the south side of the road on 38th Avenue.
7	953.946			Arrow on hydrant @ NW corner of 1st Avenue S. (NE 72nd Street) & 36th Street SW (NE 27th Avenue). Arrow on fire hydrant north side of road
8	949.408			Arrow on fire hydrant north side of road on SW 36th Street (NE 27th Avenue between houses 235 & 225.
9	941.466			Arrow on fire hydrant north side of road on SW 36th Street in front of house #425.
10	945.620			Set R.R. spike in P.P. south side road on SW 36th Street (NE 27th Avenue), eleven P.P. east of NE 64th Street.
11	956.299			R.R. spike in P.P. west of transformer on the south side of the road on 36th Street SW (NE 27th Avenue), six P.P. east.
12	934.363			R.R. spike in P.P. west side of road on NE 64th Street north of 36th Street SW (NE 27th Avenue), 1st P.P. south of house # 3100.
13	927.149			Set R.R. Spike in P.P. west side of road on NE 64th Street on the north side of 36th Street SW (NE 27th AVE), first P.P. north of house #3430.
14	912.303			R.R. spike in P.P. west of transformer on the west side of the road on NE 64th Street. First P.P. north of house # 3840.
15	923.925			Set R.R. spike in P.P. northside of road on NE 42nd Avenue, first P.P. east of NE 64th Street.
16	940.967			NE upper flange bolt with bury tag @ NE corner of Lindsay CT & Venbury Drive.
17	928.119			NE flange bolt with bury tag on fire hydrant @ SE corner of Venbury Drive & Maplewood Ct.
18	920.295			SE upper flange bolt with bury tag on fire hydrant @ west side of road on NE 56th Street. +/- 50 feet north of Target @ NE bld. Corner.
19	917.705			NW upper flange bolt on fire hydrant @ west side of road on NE 56th Street, SE of target bld. Corner +/- 200 feet.
20	909.941			NW upper flange bolt on fire hydrant @first hydrant east of Rutherford Drive & NE 56th Street.
21	926.047			SW upper flange bolt on fire hydrant @ first hydrant east Douglas Avenue & Brook Run Drive.
22	933.599			NW upper bolt on fire hydrant @ SE corner of east Douglas Avenue & E. 42nd Street.
23	932.871			R.R. spike in P.P. @ SW corner of E. 42nd Street & Hubbell Avenue.
24	937.496			West upper flange bolt on fire hydrant @ south side Hubbell in front of house #4735, SW of NE Broadway Avenue.
25	972.948			Cut triangle in the NE corner of concrete telephone pad @ south of 62nd Avenue +/- 30 feet west on the NE fenced at Gas facility east on NE 56th Street +/- 1/2 miles.
26	972.290			SSE upper flange bolt with bury tag @ first hydrant on the SE corner of Hubbell Ave. South side Zeigler Drive.
27	968.533			SSW upper flange bolt with bury tag @ second fire hydrant on SE Hubbell & west side of Zeigler Drive.
28	966.166			R.R. spike in third P.P. west of N. 1st Street @ north side of 62nd Avenue.
29	954.451			R.R. spike in first P.P. @ NW corner of N. 1st Street & E. 62nd Avenue.
30	937.203			R.R. spike in fifth P.P. @ east side of N. 1st Street & north side of 62nd Avenue.
31	924.599			R.R. spike in eighth P.P. east on N. 1st Street on north side of 62nd Avenue.
32	919.779			R.R. spike in P.P +/- 1/2 mile east of N. 1st Street @ north side of 62nd Avenue, first P.P. east of box culvert.
33	938.209			R.R. spike in P.P. @ north side of 62nd AVE., fifth P.P. west of NE 80th Street.
34	960.963			R.R. spike in P.P. @ NE corner of 62nd Ave & NE 80th Street.
35	974.083			R.O.W. rail @ north side 62nd AVE. east of NE 80th ST., east of house #8190 +/- 150 feet along fence line.
36	980.621			R.O.W. rail @ north side 62nd AVE. east of NE 80th ST., south of rest area sign along fence line.
37	972.160			R.R. spike in P.P. @ north side of NE 62nd Drive, east of NE 80th Street +/- 3/4 mile., first P.P. east of house #8615.
38	972.177			R.R. spike in P.P. @ NE corner of NE 88th street & NE 62nd Drive south of interstate.
39	965.475			R.R. spike in P.P. @ third P.P. south of E. 62nd Drive east side of road on NE 88th Street.
40	960.515			R.R. spike in P.P. @ east side of NE 88th street, five P.P. south of NE 62nd Drive.
41	955.399			R.R. spike in P.P. @ east side of Ne 88th street, north of NE 54th Avenue in front of House # 5729.
42	963.309			sw uper flange bolt on fire hydrant NE corner of 1st. Avenue & 21st Street.
43	961.077			West of N. 1st AVE @ southside of new Adventureland Drive.
44	957.969			Sw upper flange bolt with bury to NW corner Adventureland Drive & 8th Avenue.
45	949.311			Center of top small bolt "not working bolt", on center hydrant SE corner Adventureland Drive & 10th Avenue NW.
46	969.416			Cut triangle in the N.W. corner of the concrete base of the Heartland Inn sign @ the S.W. corner of Hubbell Avenue & N.E. 56th Street.
47	963.541			Cut triangle in the N.E. corner of the concrete base of the traffic signal control box @ the S.E. corner of Adventureland Drive and Prairie Meadows Drive.
48	924.645			Top of the S.E. bolt cap of the street light @ the N.W. corner of N.E. 80th Street (14th Avenue S.E.) & 8th Street S.E. (N.E. 46th Avenue.
49	956.668			S.E. upper flange bolt hydrant on the S. side of 8th Street S.E. @ address: 1034 8th Street S.E.
50	957.843			Cut triangle in the S.E. corner of the concrete flagpole base @ the S.E. corner of the Altoona War Memorial @ the N.E. corner of 8th Street S.E. & 8th Avenue S.E.
51	959.845			Arrow hydrant @ the S.W. corner of 8th Street S.E. & 3rd Avenue S.E.
52	955.082			Cut "X" in the N.E. side of the concrete traffic signal base @ the S.W. corner of 8th Street S.W. & 1st Avenue S. @ the N.E. corner of HyVee.
53	906.282			Cut "X" in the top center of the RCBC headwall on the S. side of 8th Street S.W. between the driveway to the Waste Water Treatment Plant & the driveway to the Altoona Community Service Campus.
54	939.444			Triangle in the center of a 6'x6' concrete slab @ the N.E. corner of 8th Street S.W. & 25th Avenue S.W. +/- 45' N. of the N. edge of 8th St. S.W. & 40', more or less, E. of the centerline of 25th Avenue S.W.
55	921.448			Cut triangle in the top center headwall of the RCBC under 8th Street S.W. @ the S.E. corner of 8th Street S.W. and N.E. 56th Street @ the N.E. corner of Casey's.
56	962.808			Cut "X" in the large steel bolt in the S.E. corner of the transmission tower base @ the N.E. corner of N.E. 56th Street and N.E. 62nd Avenue.
57	974.233			R.R. spike in a power pole on the N. side of N.E. 62nd Avenue @ the N. end of the driveway to address: 6131 N.E. 62nd Avenue, the 12th pole W. of Hwy. 65.
58	968.396			R.R. spike in a power pole on the N. side of N.E. 62nd Avenue, the 6th pole E. of Hwy. 65.
59	925.284			Spike in corner post west side of road on NE 64th Street. North of 36th Street SW (NE 27th AVE).



