BREVARD COUNTY

PUBLIC WORKS

DEPARTMENT OF SURVEYING AND MAPPING

VERTICAL CONTROL MANUAL FOR SUBDIVISION PLATS, ROADWAY, PEDWAYS AND UTILITY EXPANSION PLANS

October 2023

Revision VCM2023.3

By: Samuel R. Vanderwarker

VERTICAL CONTROL MANUAL
TABLE OF CONTENTS

EFFECTIVE: August 1, 2004
OFFICE: Surveying and Mapping
Revised: October 2023

Vertical Control Network
Bench Levels

General Purpose:

These are the minimum guidelines and requirements comprising the **Brevard County Vertical Control Manual.** This manual has been created to establish standardized procedures for densification of the County's vertical control network. As the vertical data is processed and adjusted, all control information will be added to the County's GIS database and linked to the web site to furnish vertical control to the public for all surveying and mapping operations.

This manual establishes minimum requirements and does not exclude or prohibit the Surveyor & Mapper from adherence to more stringent procedures when required by Federal or State agencies.

These guidelines and requirements are applicable, but are not limited, to all subdivision plats, subdivision and commercial asbuilts, topographic surveys, control surveys, prepared for Brevard County and/or submitted to Brevard County for developmental review.

General Instructions:

The following procedures are a hybrid form of various standards and specifications. (FGCS Specifications and Procedures FGCSVERT - ver. 4.1 5/27/2004)

The field procedures as outlined have been developed by Brevard County to establish consistency in obtaining the required accuracy listed for the County's Vertical Control Network.

a) Required accuracy:

Maximum allowable error of level run in miles = $0.05 \text{ Ft } \sqrt{\text{Miles}}$

b) Leveling Equipment:

1) Automatic Level
2) Automatic Level with Micrometer
3) Electronic Digital Level
4) Level Rods – Philadelphia type or precise rod with invar strip or similar. (Fiberglass Rod in **NOT** acceptable)

c) Calibrations and Adjustments:

Prior to running a bench line or loop the level shall be peg tested. The results of the peg test shall be shown in the field book. Any adjustments made shall be shown and have a second peg test performed to check adjustment. (See Example B, Page 9)

d) Benchmark Monumentation:

"Permanent Monuments" are Brevard County engraved brass or aluminum disk uniquely stamped and set in concrete that is recognizable, durable, and immovable. Disks cemented or epoxied in concrete head wall and storm drain structures are acceptable. Each "Permanent Monument" must have a proper stamping which will be provided by the Surveying and Mapping Department. The stamping will be the P.I.D number for the GIS database.

Example of Stamping: (See Example C Page 10)

Examples of Acceptable Benchmark Location:

1) Brevard County Domed Brass or Aluminum Disk cemented or epoxied into a Drill Hole on Top of a level Concrete Headwall. (NOT RIP RAP)
2) Brevard County Domed Brass or Aluminum Disk cemented or epoxied into a Drill Hole on Top of Concrete Drainage Structures.
3) Poured in Place 12" round Concrete Monument with a Brevard County Domed Brass or Aluminum Disk. (See Example D, Page 11)
4) Deep Rod Monument. (Driven to Refusal) (See Example E, Page 12)

e) Acceptable Primary Control Benchmarks

1) USC&GS
2) NGS
3) FLDOT or FDOT (with documentation) *
4) Brevard County BM (set after Sept. 2002)**

f) NON Acceptable Benchmark Monumentation:

Chiseled squares in sidewalks, fire hydrants, nails in telephone poles, "PK or MAG nails" in pavements, etc. are not "Permanent Monuments."

Also please be advised that a turning point is not an acceptable Benchmark for future vertical densification. Should future densification be required as with a multi-phase subdivision acceptable permanent Benchmark would need to be set along the primary level route. These permanent Benchmarks would then be used to densify into each phase.

g) Maximum Foresight and Backsight Distance:

The maximum length of sight shall not exceed 196 feet. There maybe situations where the maximum length cannot be met due to the safety of the field crew in which case safety will always prevail.

The backsight and foresight distance at each setup shall be balanced within 10 feet.

h) Leveling Monumentation: (Turning Point)

Hard and stable objects that are available on the ground may be used as turning points provided they have a **distinct high point** and fall within the allowable backsight / foresight distance. If existing objects are not available, then set PK or MAG Nails in asphalt or a bridge spike or iron rod driven firmly into the ground at the required distance.

Non-Acceptable objects are: Asphalt, Box-Cuts or Chiseled Squares in Sidewalks, Nails in Power Poles, Fire Hydrants

I) Field Notes:

All Field Notes shall be kept in a standard hard cover field book. Field Notes must contain the following:

1) Level Notes:

- Project Name
- County's subdivision name / number (If BM is for platting purposes)
- Name of Field Personnel
- Date
- Conditions: Wind, Temp. and Sky
- Section, Township and Range
- Complete description and elevation of primary and secondary Benchmark utilized in the level circuit.
- Type, Model and Serial Number of Leveling Instrument
- 3 – wire format read to the thousandth of a foot (three decimal places)
- Type and Model of Sighting or Bar Code Rod
- Elevation's Datum being used
- Page reference to sketch of control point

All notes shall be submitted to Brevard County Surveying and Mapping Dept. and shall be incorporated into the GIS as metadata associated with each Benchmark (s).

Example of Notes: (See Example F and G, Page 13 and 14)

All Reference Notes shall be kept in a standard hard cover field book. Reference notes must contain the following:

2) Benchmark Reference Notes:

- Project Name
- County's subdivision name / number (If BM is for platting purposes)
- Name of Field Personnel
- Date
- Conditions: Wind, Temp. and Sky
- Section, Township and Range
- Approximant Latitude and Longitude (WGS84)
- All information about the control Benchmark including Agency of Publication and P.I.D.
- Description how to reach the Benchmark
- (3) Three references to existing features; I.E. trees, fences, power poles, manholes, EP, and ect..

All notes shall be submitted to Brevard County Surveying and Mapping Dept. and shall be incorporated into the County GIS database as metadata associated with each Benchmark (s).

Example of Reference Notes: BM Control (See Example H Page 15)
BM Set (See Example I Page 16)

j) Datum:

The Datum which will normally be used on all County projects is the North American Vertical Datum of 1988 unless otherwise directed by the County Surveyor's Office.

k) Rod Reading Procedures:

The 3-wire method shall be the utilized and read to the thousandth of a foot for all County projects unless otherwise authorized by the County Surveyor's Office.

The users of this Manual are encouraged to assist in the maintenance of the Vertical Control Network by notifying the County Survey Department in case of disturbance or obliteration of Benchmarks and/or apparent mistakes in descriptions of elevations. For updates and changes see Appendix A Page 17.

Benchmarks. Plats shall have a minimum of two Benchmarks established on site in an accessible location.

•Plats that contain 20 acres or less require a minimum of two Benchmarks.

•Plats that contain more than 20 acres and less than 40 acres require a minimum of three Benchmarks.

•Plats that contain over 40 acres require a minimum of three Benchmarks or one Benchmark per one-quarter mile of roadway, whichever is greater.

1. The Benchmarks shall be a one and one-half-inch stamped brass disk and shall be provided to the surveyor of record by the county survey section.

2. The Benchmarks shall be tied to NAVD 88 and shall be established*** in accordance with the standards and procedures outlined in the county vertical control manual which can be found on the county website.

3. Field notes that comply with the county vertical control manual shall be submitted with final plat submittal if a performance bond is not in place. If there is a performance bond, the field notes shall be submitted 30 days prior to the final inspection of the subdivision improvements.

4. The plat notes shall contain the following standard note: "Benchmark(s) PID # are located within the boundaries and/or vicinity of the plat. Please call the county surveying office or visit the website to obtain the vertical data.

5. Regarding multiphase subdivisions only, when the surveyor of record can show the above requirements of Benchmarks to be excessive, the county shall waive the minimum Benchmark requirement. This rule considers Benchmarks set in previous phases of the development and is not to be used to circumvent the established minimum requirement of Benchmarks.

ADDITIONAL INFORMATION:

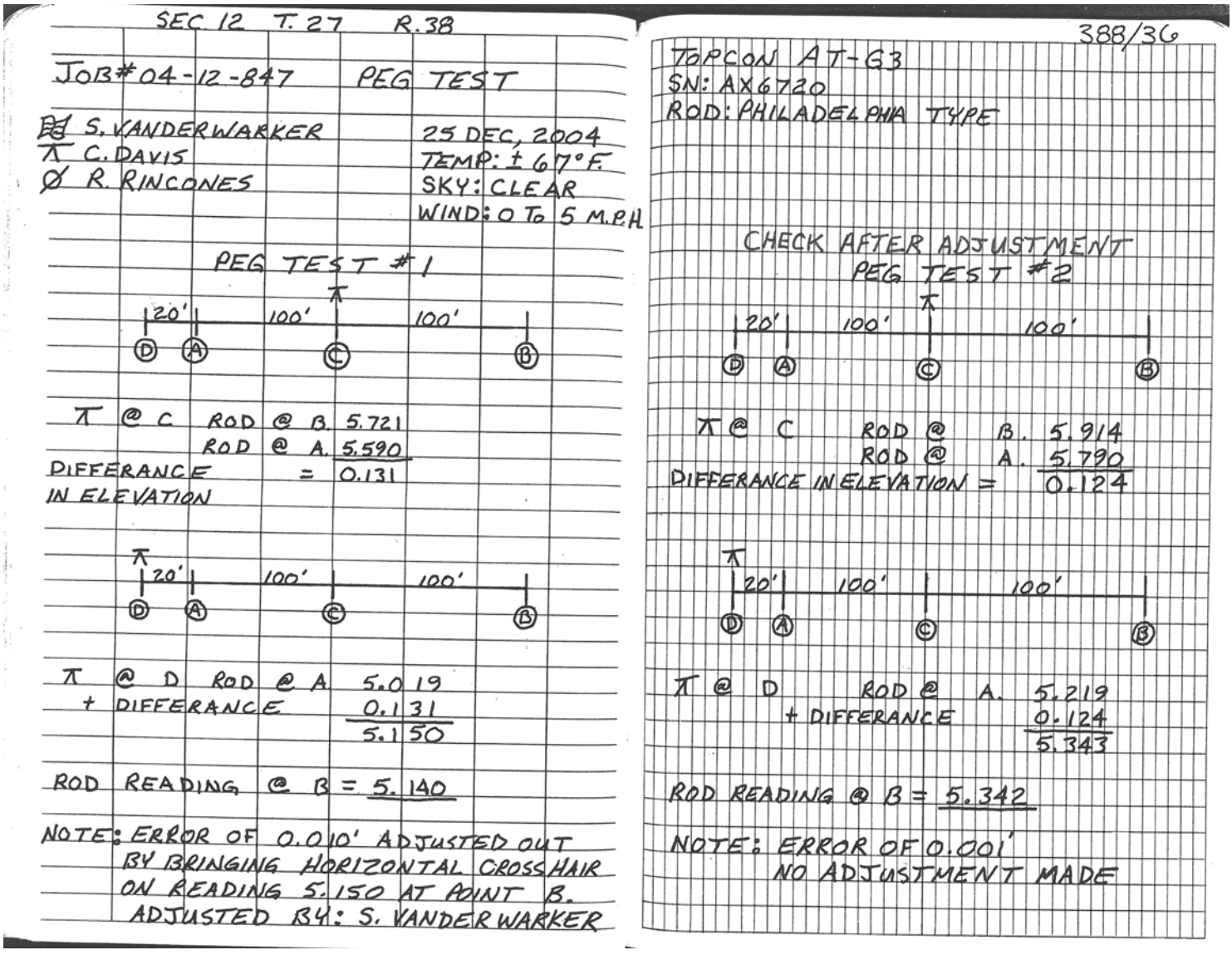
*FLDOT or FDOT Benchmarks must be accompanied with digital or printed vertical control documentation.

**Brevard County Benchmarks established Prior to September 2002 are not acceptable for control Benchmarks.

***Two (2) published Benchmarks shall be used in all vertical control projects; starting on a published Benchmark and checking into a different published Benchmark, unless otherwise authorized by the County Surveyor’s office.

Example B:

Peg Test Notes



SEC 12 T. 27 R. 38

JOB# 04-12-847 PEG TEST

S. VANDERWARKER
C. DAVIS
R. RINCONES

25 DEC, 2004
TEMP: ± 67° F.
SKY: CLEAR
WIND: 0 TO 5 M.P.H.

PEG TEST #1

T @ C ROD @ B. 5.721
ROD @ A. 5.590
DIFFERANCE IN ELEVATION = 0.131

T @ D ROD @ A 5.019
+ DIFFERANCE 0.131
5.150

ROD READING @ B = 5.140

NOTE: ERROR OF 0.010' ADJUSTED OUT BY BRINGING HORIZONTAL CROSSHAIR ON READING 5.150 AT POINT B.
ADJUSTED BY: S. VANDERWARKER

388/36

TOPCON AT-G3
SN: AX6720
ROD: PHILADELPHIA TYPE

CHECK AFTER ADJUSTMENT
PEG TEST #2

T @ C ROD @ B. 5.914
ROD @ A. 5.790
DIFFERANCE IN ELEVATION = 0.124

T @ D ROD @ A. 5.219
+ DIFFERANCE 0.124
5.343

ROD READING @ B = 5.342

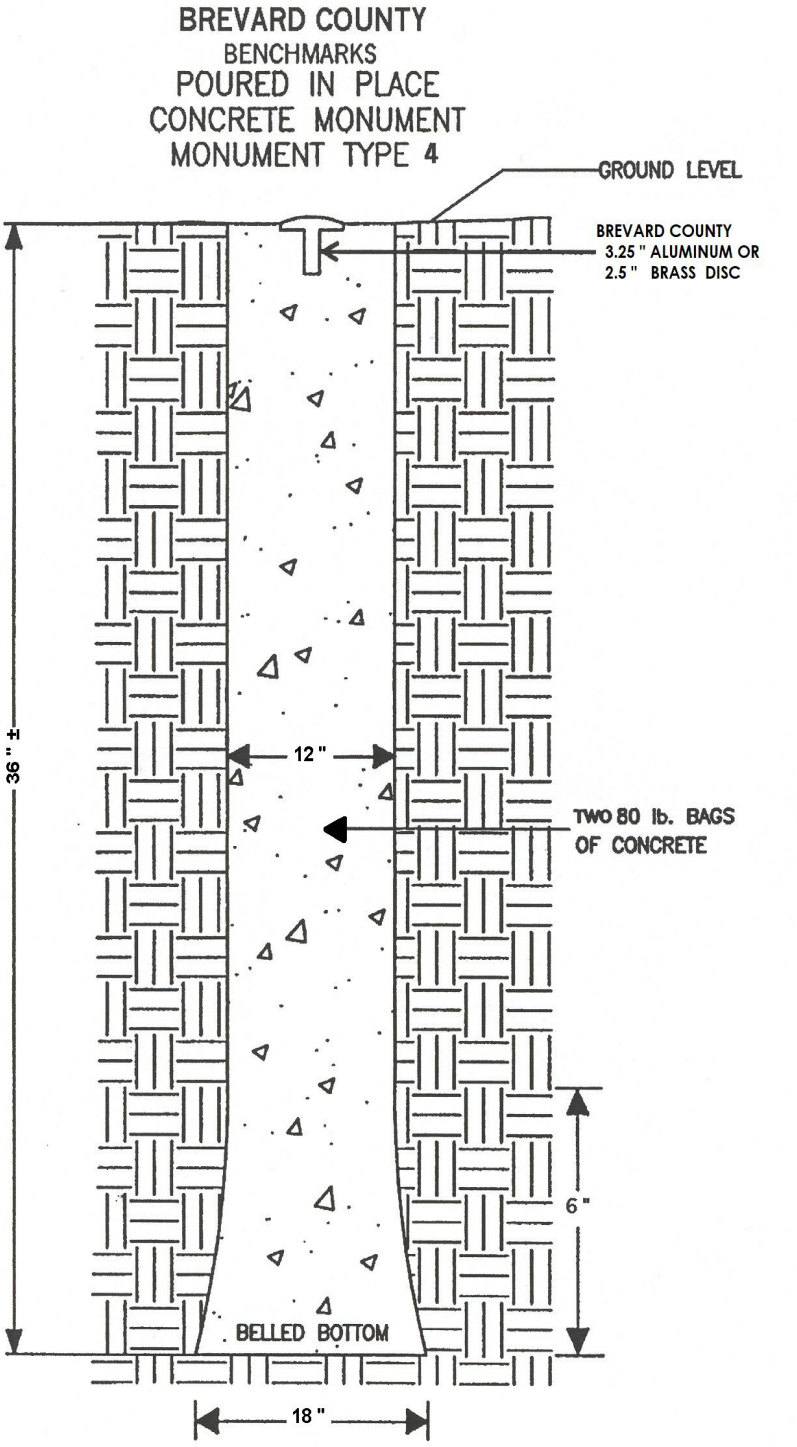
NOTE: ERROR OF 0.001'
NO ADJUSTMENT MADE

Example C:

STANDARD STAMPING FOR BENCHMARKS

Example D:

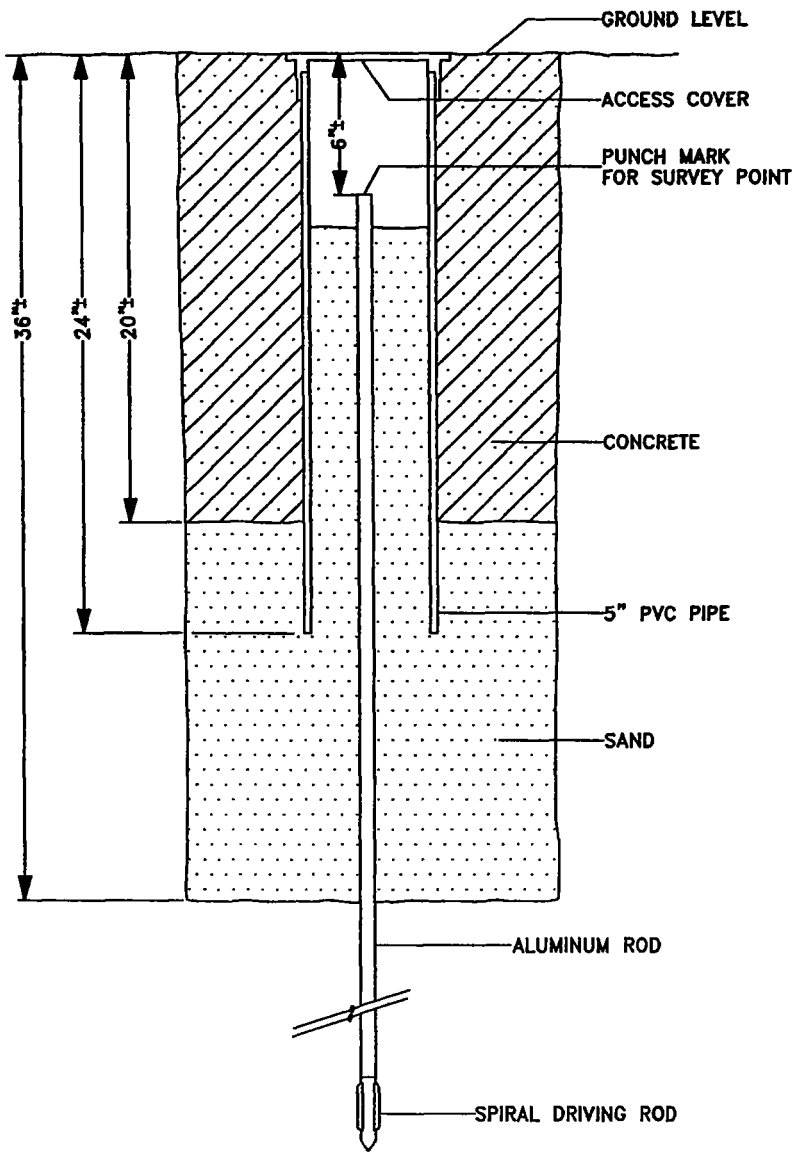
BREVARD COUNTY'S CONCRETE MONUMENT



Example E:

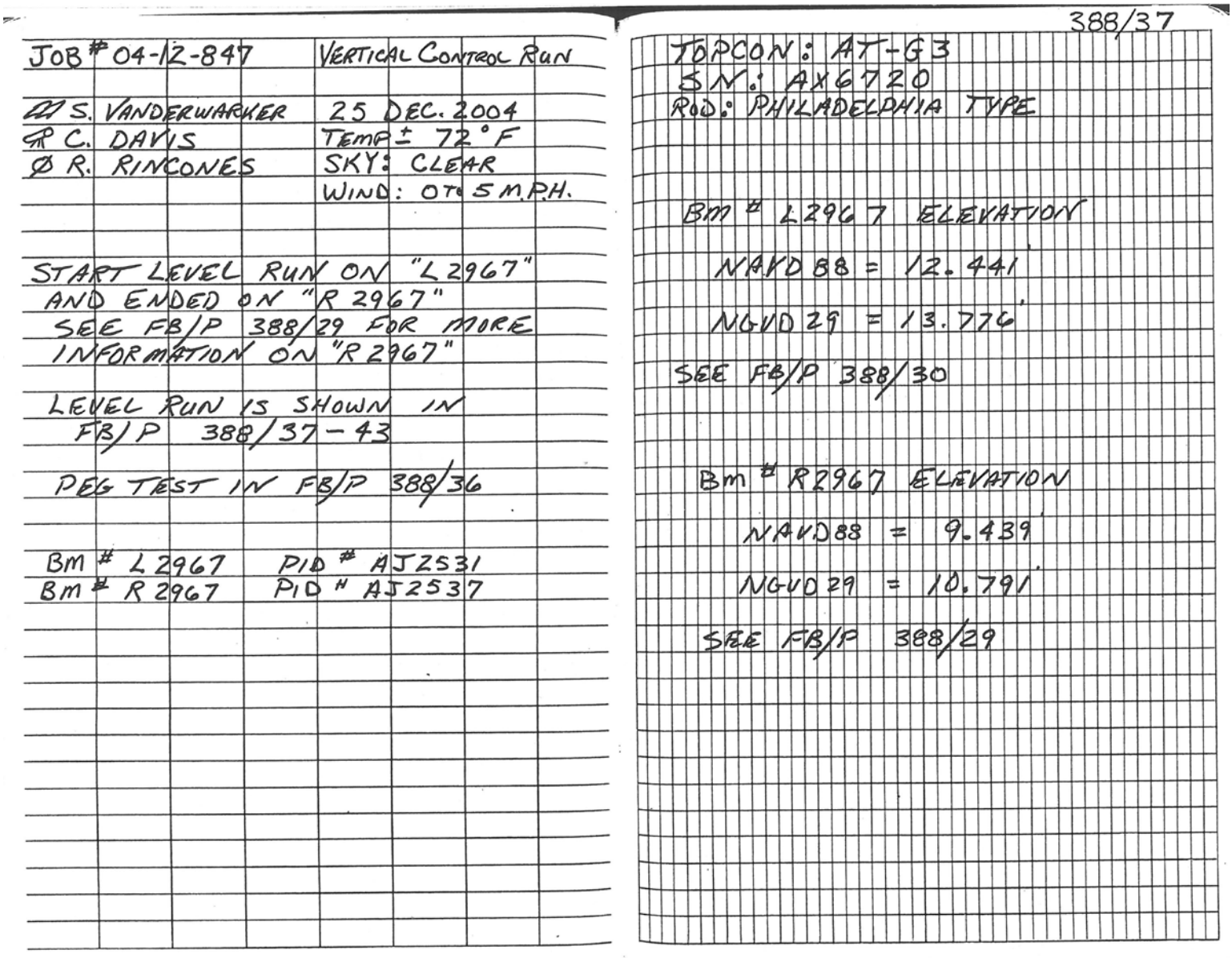
Deep Rod Monument

SCHEMATIC OF
DEEP ROD MONUMENT SYSTEM
MONUMENT TYPE 1



Example F:

3 Wire Set-up Notes



JOB # 04-12-847 VERTICAL CONTROL RUN

S. VANDERWARKER 25 DEC. 2004
C. DAVIS TEMP ± 72° F
R. RINCONES SKY: CLEAR
WIND: 0 TO 5 M.P.H.

START LEVEL RUN ON "L 2967"
AND ENDED ON "R 2967"
SEE FB/P 388/29 FOR MORE
INFORMATION ON "R 2967"

LEVEL RUN IS SHOWN IN
FB/P 388/37 - 43

PEG TEST IN FB/P 388/36

BM # L 2967 PID # AJ2531
BM # R 2967 PID # AJ2537

388/37

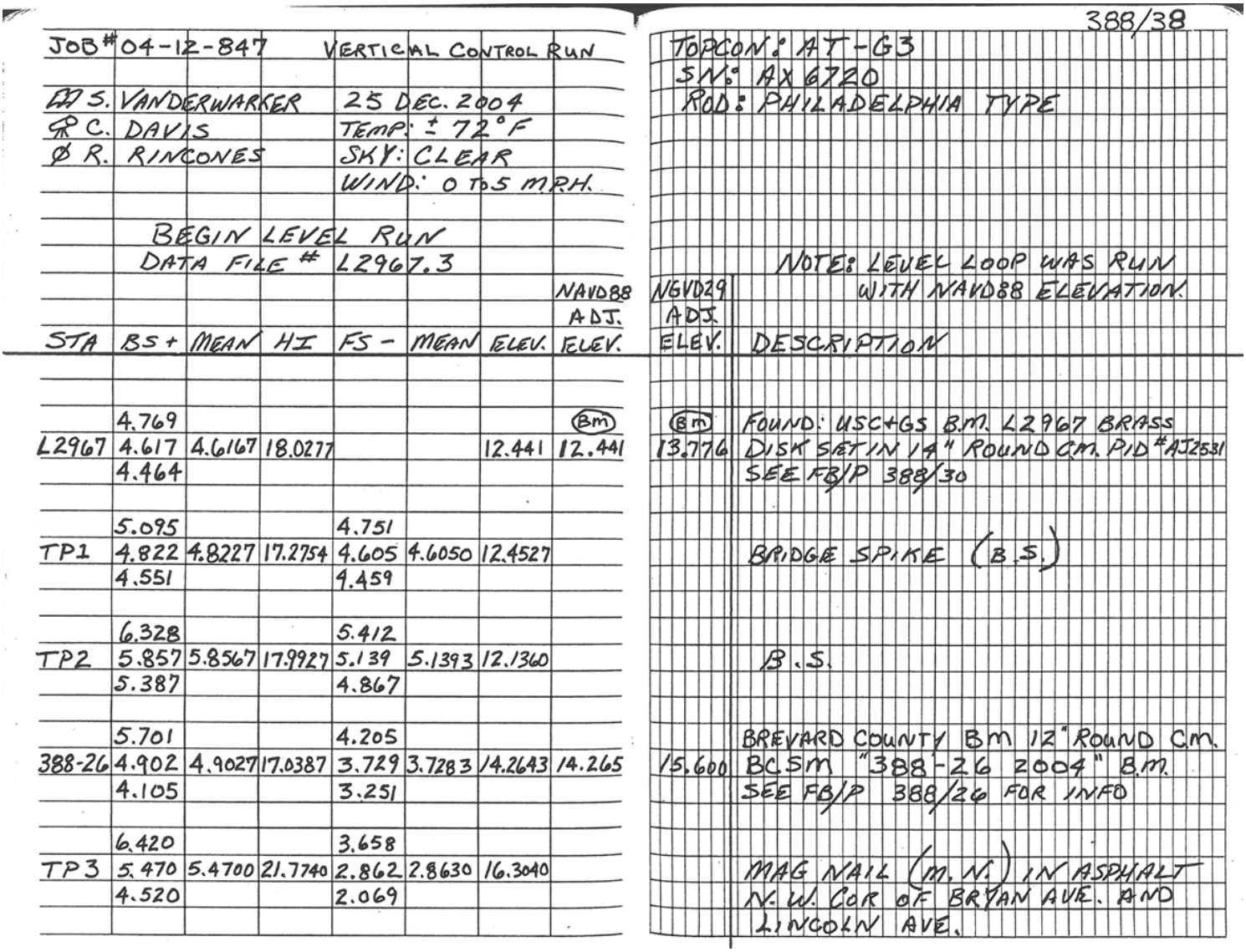
TOPCON: AT-G3
SN: AX6720
ROD: PHILADELPHIA TYPE

BM # L2967 ELEVATION
NAVD 88 = 12.441'
NGVD 29 = 13.776'
SEE FB/P 388/30

BM # R2967 ELEVATION
NAVD 88 = 9.439'
NGVD 29 = 10.791'
SEE FB/P 388/29

Example G:

3 Wire Notes



388/38

JOB# 04-12-847 VERTICAL CONTROL RUN

S. VANDERWARKER 25 DEC. 2004
C. DAVIS TEMP: ± 72°F
R. RINCONES SKY: CLEAR
WIND: 0 TO 5 M.P.H.

BEGIN LEVEL RUN
DATA FILE # L2967.3

TOPCON: AT-G3
SN: AX6720
ROD: PHILADELPHIA TYPE

NOTE: LEVEL LOOP WAS RUN WITH NAVD88 ELEVATION.

STA	BS +	MEAN	HI	FS -	MEAN	ELEV.	NAVD88 ADJ. ELEV.	NGVD29 ADJ. ELEV.	DESCRIPTION
	4.769						(BM)	(BM)	FOUND: USC+GS B.M. L2967 BRASS
L2967	4.617	4.6167	18.0277			12.441	12.441	13.776	DISK SET IN 14" ROUND C.M. PID #AJ2531
	4.464								SEE FB/P 388/30
	5.095			4.751					
TP1	4.822	4.8227	17.2754	4.605	4.6050	12.4527			BRIDGE SPIKE (B.S.)
	4.551			4.459					
	6.328			5.412					
TP2	5.857	5.8567	17.9927	5.139	5.1393	12.1360			B.S.
	5.387			4.867					
	5.701			4.205					BREVARD COUNTY BM 12" ROUND C.M.
388-26	4.902	4.9027	17.0387	3.729	3.7283	14.2643	14.265	15.600	BC SM "388-26 2004" B.M.
	4.105			3.251					SEE FB/P 388/26 FOR INFO
	6.420			3.658					
TP3	5.470	5.4700	21.7740	2.862	2.8630	16.3040			MAG NAIL (M.N.) IN ASPHALT
	4.520			2.069					N.W. COR OF BRYAN AVE. AND
									LINCOLN AVE.

Example H:

BENCH MARK CONTROL
REFERENCE NOTES

JOB # 04-12-847

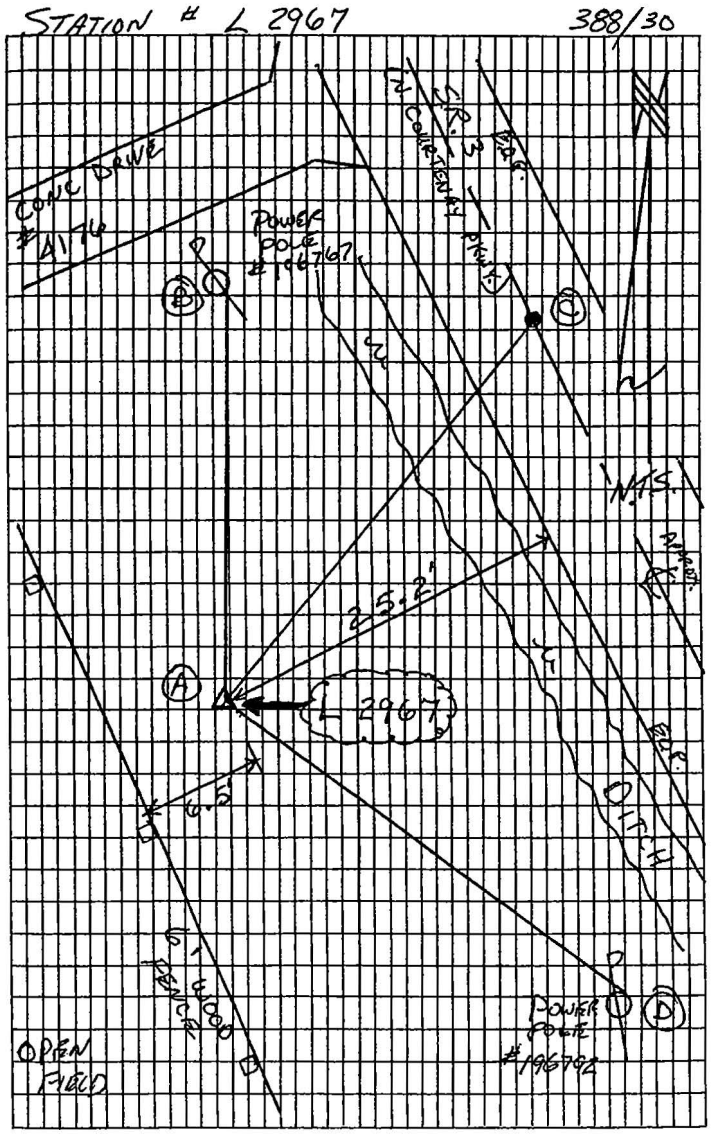
S. VANDERWARKER — 22 DEC. 2004
TEMP: ± 74° F.
SKY: OVERCAST
APPROX. WIND: 0 TO 5 MPH
LAT: 28-23-01.6N.
LONG: 080-42-09.3W.
(WGS-84)

SEC. 23 - TWN 24 - RNG 36

FOUND AS DESCRIBED
SEE NGS. PID # AJ2531

(A) FND 12" ROUND CM. W/A USC+GS 3" BRASS BM. DISK "L 2967 1992" 0.4' BELOW N.G.
(B) FND: POWER POLE # 196767
(C) FND: MAG NAIL + DISK "LB 4211" IN ASPHALT ROAD
(D) FND: POWER POLE # 196792

STATION	AZIMUTH	DISTANCE
FROM (A) TO (B)	5°	27.6'
(A) TO (C)	40°	34.7'
(A) TO (D)	125°	30.1'



Example I:

SET BENCH MARK
REFERENCE NOTES

JOB # 04-12-847

S. VANDERWARKER — 20 DEC. 2004
R. RINEONIES — TEMP: +71°F
SKY: CLEAR
WIND: 0 TO 5 M.P.H.

APPROX.
LAT: 28-23-55.2N.
LONG: 080-42-19.9W.
(WGS-84)

SEC 14 - TWN 24 RNG 36

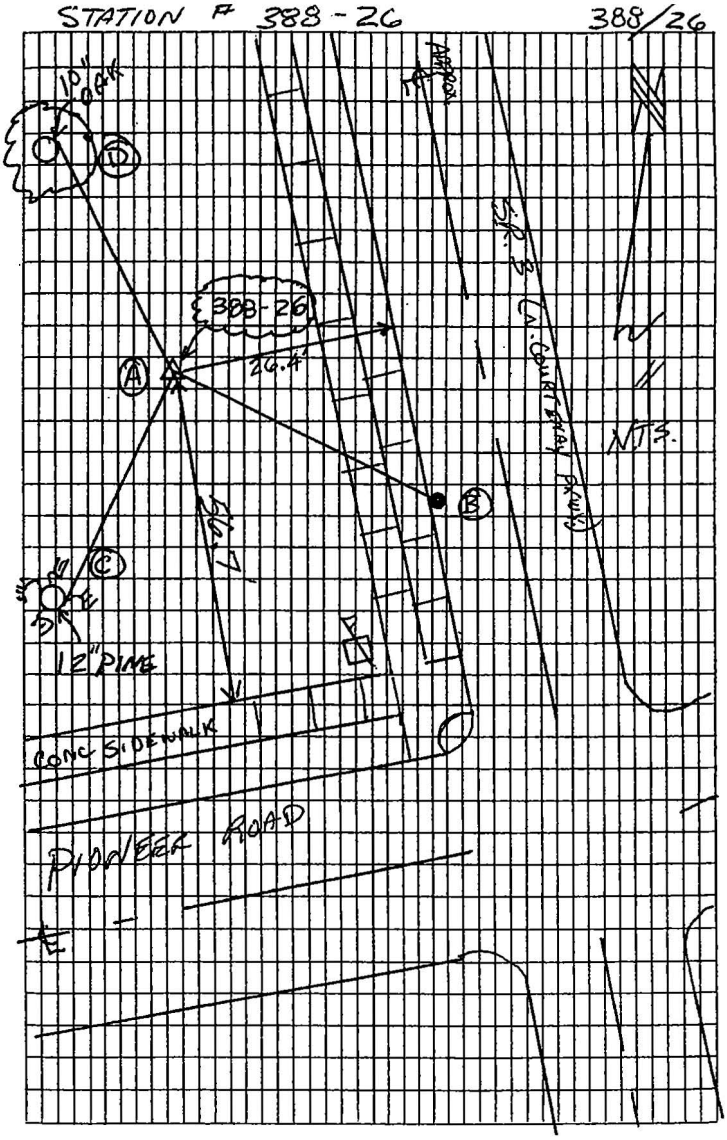
TO REACH STATION FROM INTERSECTION OF STATE ROAD 528 AND STATE ROAD 3, GO SOUTH ON SR 3 FOR 0.85 MILES TO PIONEER ROAD AND STATION AT THE NORTHWEST CORNER OF INTERSECTION.

(A) SET 10" ROUND C.M. W/ BREVARD COUNTY SURVEYING & MAPPING VERTICAL CONTROL MARK 2.5" BRASS DISK "388-26 2004" AT 0.5' BELOW N.G.

(B) FND: PK NAIL & DISK "LB 4214" IN ASPHALT ROAD.
(C) 12" PINE TREE.
(D) 10" OAK TREE.

STATION			AZIMUTH	DISTANCE
FROM (A)	TO	(B)	115°	38.1'
(A)	TO	(C)	215°	38.6'
(A)	TO	(D)	334°	36.2'

STATION # 388-26 — 388/26



Appendix A

This Single publication is designed to establish General Specifications of Vertical Control Surveys set by Brevard County issued in the Subdivision Ordinance Section 62-2841 (d) (6)l. Because requirements and methods for acquisition of Vertical Control are changing rapidly, this publication is being released in loose-leaf format so that it can be updated more conveniently and efficiently. Recipients of this publication wishing to receive updated information should complete and mail, fax of e-mail the form below. Comments on the contents and format of this publication are welcomed and should be addressed to:

BCS&M, V-Control (Survey Department)
2725 Judge Fran Jamieson Way
BLDG. – A, Suite 220
Viera, Fl 32940

☐ Please inform me of updated information for General Specifications of Vertical Control Surveys.

Name:_____

Address: _____

_____

E-Mail: _____

Phone # _____

Fax # _____