

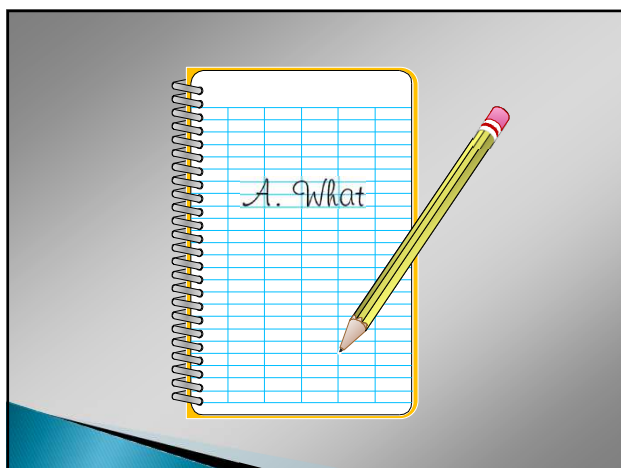
Western Regional Survey Conference 2022

Measurement Documentation: *Field Notes*



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The Geoholics
*Field note Fundamentals: How to
Prepare them & What to Include*



A. What

Written record of field:

Measurements
Conditions
Equipment
Personnel

} Error Sources

Ancillary information

- Sketches
- Corrective notes
- Description
- Etc



A. What

Why written notes in the day of digital data collection?

- They're slow to compile
- Cumbersome in the field
- Survey process slows to a snail's pace
- Less efficient data collection
- Less data "mass"
- Penmanship is a lost art
- They take up a lot of storage space
- Etc

Lots of reasons/excuses



A. What

On the other hand...

- For new technician
- Reinforces procedure
- Measurement visualization

More effective capture for some info types

- Descriptions; sketches
- Evidence recordation; signed parol statements

Flexibility

- Digital data collection may not accommodate special situations

Permanent field operations record

- Can last forever with simple care
- Alterations more difficult to conceal

A. What

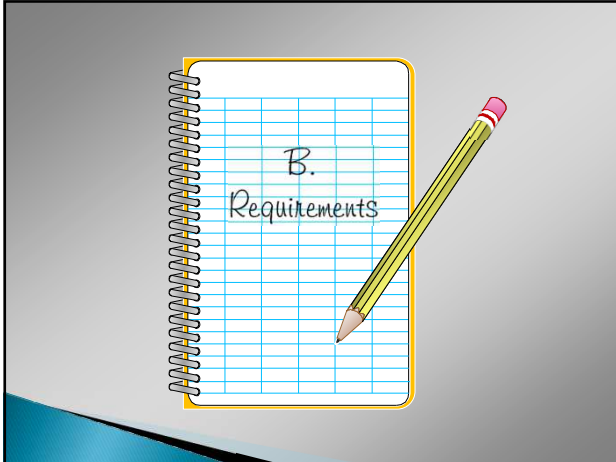
On the other hand...

- They are the original measurements and conditions
- "Follow in the footsteps"
- Quality assessment

And...

- No software compatibility issues






B. Requirements

Field notes should be stand-alone
Minimal explanation necessary

Data might be used by third party.
User should be able to understand
How the data was collected
By whom
Under what conditions
To assess their quality



B. Requirements


Field notes must be:

Complete: all measurement and support data included
The good, the bad, and the ugly

Accurate: true record with no "filtering"

Understandable: for a knowledgeable user

Unaltered: data must not be obscured nor unjustifiably modified.



[illegible]

Diagram illustrating three types of notebook binders:

- Book:** A notebook with a traditional book binding.
- Spiral:** A notebook with a spiral binding.
- Six-ring binder:** A notebook with a six-ring binder.

[illegible][illegible]

C. Physical Format

2. Page and Plate

Measurements;
Running comps

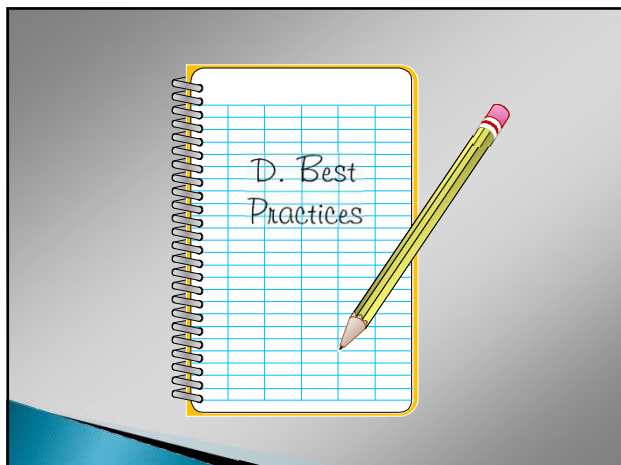
Math check

Environment
Major equipment;
Crew
Description
Sketch
Connection to
other information

Page number

Closure omgs

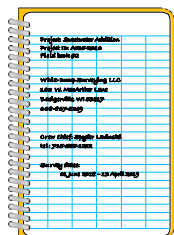
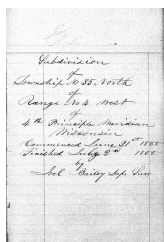
Station	BS (ft)	IS	FS (ft)	Elev
BM 1	5.44			800.00
A	5.20		5.10	800.20
B		5.10		800.40
C		5.10		800.60
D		5.10		800.80
E		5.10		801.00
F		5.10		801.20
G		5.10		801.40
H		5.10		801.60
I		5.10		801.80
J		5.10		802.00
K		5.10		802.20
L		5.10		802.40
M		5.10		802.60
N		5.10		802.80
O		5.10		803.00
P		5.10		803.20
Q		5.10		803.40
R		5.10		803.60
S		5.10		803.80
T		5.10		804.00
U		5.10		804.20
V		5.10		804.40
W		5.10		804.60
X		5.10		804.80
Y		5.10		805.00
Z		5.10		805.20
AA		5.10		805.40
AB		5.10		805.60
AC		5.10		805.80
AD		5.10		806.00
AE		5.10		806.20
AF		5.10		806.40
AG		5.10		806.60
AH		5.10		806.80
AI		5.10		807.00
AJ		5.10		807.20
AK		5.10		807.40
AL		5.10		807.60
AM		5.10		807.80
AN		5.10		808.00
AO		5.10		808.20
AP		5.10		808.40
AQ		5.10		808.60
AR		5.10		808.80
AS		5.10		809.00
AT		5.10		809.20
AU		5.10		809.40
AV		5.10		809.60
AW		5.10		809.80
AX		5.10		810.00
AY		5.10		810.20
AZ		5.10		810.40
BA		5.10		810.60
BB		5.10		810.80
BC		5.10		811.00
BD		5.10		811.20
BE		5.10		811.40
BF		5.10		811.60
BG		5.10		811.80
BH		5.10		812.00
BI		5.10		812.20
BJ		5.10		812.40
BK		5.10		812.60
BL		5.10		812.80
BM		5.10		813.00
BN		5.10		813.20
BO		5.10		813.40
BP		5.10		813.60
BQ		5.10		813.80
BR		5.10		814.00
BS		5.10		814.20
BT		5.10		814.40
BU		5.10		814.60
BV		5.10		814.80
BW		5.10		815.00
BX		5.10		815.20
BY		5.10		815.40
BZ		5.10		815.60
CA		5.10		815.80
CB		5.10		816.00
CC		5.10		816.20
CD		5.10		816.40
CE		5.10		816.60
CF		5.10		816.80
CG		5.10		817.00
CH		5.10		817.20
CI		5.10		817.40
CJ		5.10		817.60
CK		5.10		817.80
CL		5.10		818.00
CM		5.10		818.20
CN		5.10		818.40
CO		5.10		818.60
CP		5.10		818.80
CQ		5.10		819.00
CR		5.10		819.20
CS		5.10		819.40
CT		5.10		819.60
CU		5.10		819.80
CV		5.10		820.00
CW		5.10		820.20
CX		5.10		820.40
CY		5.10		820.60
CZ		5.10		820.80
DA		5.10		821.00
DB		5.10		821.20
DC		5.10		821.40
DD		5.10		821.60
DE		5.10		821.80
DF		5.10		822.00
DG		5.10		822.20
DH		5.10		822.40
DI		5.10		822.60
DJ		5.10		822.80
DK		5.10		823.00
DL		5.10		823.20
DM		5.10		823.40
DN		5.10		823.60
DO		5.10		823.80
DP		5.10		824.00
DQ		5.10		824.20
DR		5.10		824.40
DS		5.10		824.60
DT		5.10		824.80
DU		5.10		825.00
DV		5.10		825.20
DW		5.10		825.40
DX		5.10		825.60
DY		5.10		825.80
DZ		5.10		826.00
EA		5.10		826.20
EB		5.10		826.40
EC		5.10		826.60
ED		5.10		826.80
EE		5.10		827.00
EF		5.10		827.20
EG		5.10		827.40
EH		5.10		827.60
EI		5.10		827.80
EJ		5.10		828.00
EK		5.10		828.20
EL		5.10		828.40
EM		5.10		828.60
EN		5.10		828.80
EO		5.10		829.00
EP		5.10		829.20
EQ		5.10		829.40
ER		5.10		829.60
ES		5.10		829.80
ET		5.10		830.00
EU		5.10		830.20
EV		5.10		830.40
EW		5.10		830.60
EX		5.10		830.80
EY		5.10		831.00
EZ		5.10		831.20
FA		5.10		831.40
FB		5.10		831.60
FC		5.10		831.80
FD		5.10		832.00
FE		5.10		832.20
FF		5.10		832.40
FG		5.10		832.60
FH		5.10		832.80
FI		5.10		833.00
FJ		5.10		833.20
FK		5.10		833.40
FL		5.10		833.60
FM		5.10		833.80
FN		5.10		834.00
FO		5.10		834.20
FP		5.10		834.40
FQ		5.10		834.60
FR		5.10		834.80
FS		5.10		835.00
FT		5.10		835.20
FU		5.10		835.40
FV		5.10		835.60
FW		5.10		835.80
FX		5.10		836.00
FY		5.10		836.20
FZ		5.10		836.40
GA		5.10		836.60
GB		5.10		836.80
GC		5.10		837.00
GD		5.10		837.20
GE		5.10		837.40
GF		5.10		837.60
GG		5.10		837.80
GH		5.10		838.00
GI		5.10		838.20
GJ		5.10		838.40
GK		5.10		838.60
GL		5.10		838.80
GM		5.10		839.00
GN		5.10		839.20
GO		5.10		839.40
GP		5.10		839.60
GQ		5.10		839.80
GR		5.10		840.00
GS		5.10		840.20
GT		5.10		840.40
GU		5.10		840.60
GV		5.10		840.80
GW		5.10		841.00
GX		5.10		841.20
GY		5.10		841.40
GZ		5.10		841.60
HA		5.10		841.80
HB		5.10		842.00
HC		5.10		842.20
HD		5.10		842.40
HE		5.10		842.60
HF		5.10		842.80
HG		5.10		843.00
HH		5.10		843.20
HI		5.10		843.40
HJ		5.10		843.60
HK		5.10		843.80
HL		5.10		844.00
HM		5.10		844.20
HN		5.10		844.40
HO		5.10		844.60
HP		5.10		844.80
HQ		5.10		845.00
HR		5.10		845.20
HS		5.10		845.40
HT		5.10		845.60
HU		5.10		845.80
HV		5.10		846.00
HW		5.10		846.20
HX		5.10		846.40
HY		5.10		846.60
HZ		5.10		846.80
IA		5.10		847.00
IB		5.10		847.20
IC		5.10		847.40
ID		5.10		847.60
IE		5.10		847.80
IF		5.10		848.00
IG		5.10		848.20
IH		5.10		848.40
II		5.10		848.60
IJ		5.10		848.80
IK		5.10		849.00
IL		5.10		849.20
IM		5.10		849.40
IN		5.10		849.60
IO		5.10		849.80
IP		5.10		850.00
IQ		5.10		850.20
IR		5.10		850.40
IS		5.10		850.60
IT		5.10		850.80
IU		5.10		851.00
IV		5.10		851.20
IW		5.10		851.40
IX		5.10		851.60
IY		5.10		851.80
IZ		5.10		852.00
JA		5.10		852.20



D. Best Practices

1. Field book Setup

a. Title Page: Project or Job



D. Best Practices

1. Field book Setup

a. Title Page: Project or Job

b. Table of Contents

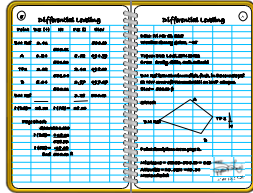
Page numbers of projects added as completed.

Table of Contents	
	Page
Project Description	1
Difficulties Encountered	2
Training	3
Transportation	4
Construction	5
Costs	6
Remarks	7
Summary	8

D. Best Practices

1. Field book Setup

- Title Page: Project or Job
- Table of Contents
- Use consistent page format
Use format that ensures complete data capture.

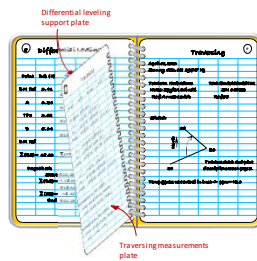


D. Best Practices

1. Field book Setup

- Title Page: Project or Job
- Table of Contents
- Use consistent page format
- Do not remove pages or plates

Original data alteration.
Left plate is back of previous
right vice versa.



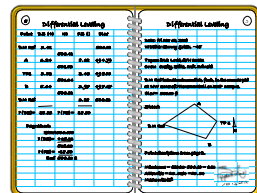
D. Best Practices

2. Taking Notes

Small writing surface, lousy conditions, and sometimes it's *cold*.

- Use pencil with hard sharp lead
Paper has tighter bond - ink and pencil lead smears.
4H generally good compromise.
Use dry thumb smear test
Mechanical pencil 0.5 mm

- Legibility
Printed, not written.
Slow & deliberate.



D. Best Practices

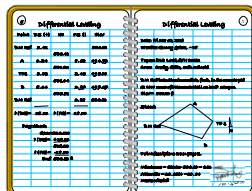
2. Taking Notes

c. Page and Plate Titles

Identifies project
Use for Table of Contents

d. Record immediately

Write down each measurement,
warts and all.
Do not preselect what will be
saved.



D. Best Practices

2. Taking Notes

e. Reasonable & Consistent Accuracy

Reflect equipment resolution
Do not imply unsupported
accuracy.

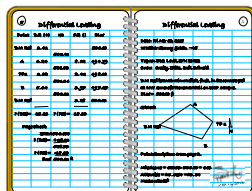
Do not degrade leaving out
space holders.

135°00'00" not 135°

125.00 not 125

0.51 not .51

Review significant figures



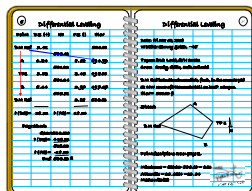
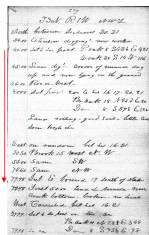
D. Best Practices

2. Taking Notes

f. Layout reflects measurement order

Top-down, left-right

Systematic measurement and recording.



- g. Running Calculations:
 - identify or isolate errors
 - check intermediate results

[illegible]

- h. Math checks
Usually performed at end of a page or project.

Differential Loading

Point	W/L	HT	W/L	HT
W/L Head	6.46	8.60	8.00	8.00
A	2.26	8.00	6.46	6.46
B	2.26	8.00	6.46	6.46
TP	2.26	8.00	6.46	6.46
C	2.26	8.00	6.46	6.46
W/L Tail	6.46	8.00	8.00	8.00

Page 3 of 4
 X (mm) = 200.00
 Y (mm) = 200.00
 Z (mm) = 200.00
 W (mm) = 200.00

Differential Loading

W/L Head: 6.46, HT: 8.60
 W/L Tail: 8.00, HT: 8.00

Types: W/L Lead, W/L Drive
 Case: Drilling, Milling, Machining

Tail stock is a mechanical device used to support the end of a workpiece during machining. It is used to support the workpiece when the cutting tool is not in contact with the workpiece.

W/L Head: 6.46, HT: 8.60
 W/L Tail: 8.00, HT: 8.00

Tail stock is a mechanical device used to support the end of a workpiece during machining. It is used to support the workpiece when the cutting tool is not in contact with the workpiece.

Machine: 100.00, W/L: 200.00
 Machine: 100.00, W/L: 200.00

Page check:
Verification for
page comps.

Circuit closure.

- i. Correcting recording mistakes
Single-strike through incorrectly recorded value.

11/3/25

412.75
~~412.57~~
 No!

412.75
~~412.75~~
 No!

412.75
~~412.57~~
 Yes



DO NOT ERASE!

Surveyor's field notes in pencil are generally admissible as evidence in court.

BUT

Data alteration can affect credibility of entire field book.

Tough habit to break.



D. Best Practices

2. Taking Notes

i. Correcting recording mistakes

Multiple mistakes

Void entire page

Recompile on new page

Each page should identify the other

The image shows four pages of 'Differential Leveling' field notes. The first page shows multiple mistakes and a note to 'void entire page'. The second page shows a note to 'Recompile on new page'. The third and fourth pages show the continuation of the leveling process after corrections.

D. Best Practices

2. Taking Notes

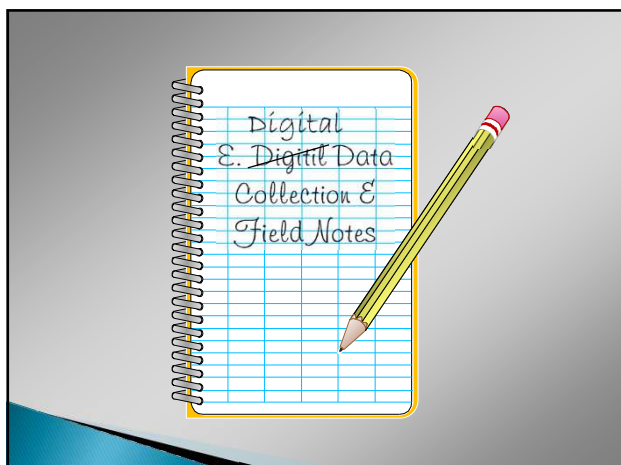
i. Sign and date

Each page on completion.

Data completeness

Data validity

The image shows a page of 'Differential Leveling' field notes. It includes a diagram of a leveling staff and a note to 'Sign and date each page on completion'. The page is signed and dated.



E. Digital Data Collection & Field Notes

Augmentation not Replacement

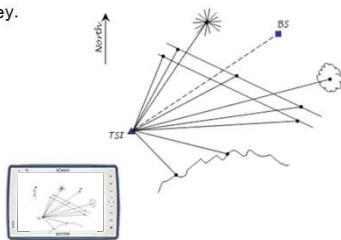


E. Digital Data Collection & Field Notes

Example: Topographic survey.

Data collectors simplify:
field setup
measurement
reductions

Once set up, operator
point
press a button
enter a feature code.



Data collector does the rest, even creating the map.

E. Digital Data Collection & Field Notes

Example: Topographic survey.

Two ~~Two~~ Three common errors:

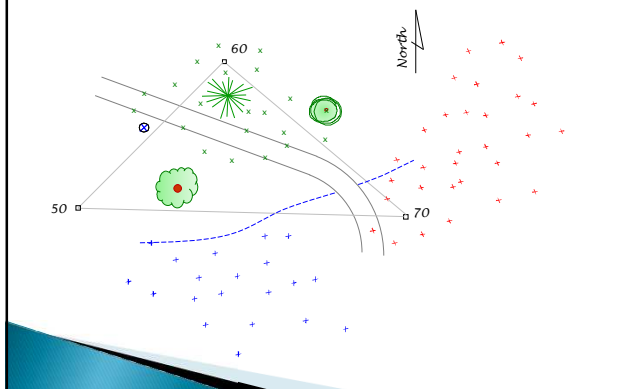
- Using an incorrect feature code
- Instrument setup is disturbed
- Wrong control points

Editing a feature code may or may not be simple.

Disturbed instrument set up and
Using wrong control points } May not be apparent until
combined with other data later.

E. Digital Data Collection & Field Notes

Example: Topographic survey.



E. Digital Data Collection & Field Notes

Example: Topographic survey.
Augmenting field notes

10	Topographic Survey	10	Topographic Survey
101	Start	101	Start
102	End	102	End
103	Code should be 101	103	Code should be 101
104	101 should be 7.00 for this shot only	104	101 should be 7.00 for this shot only
105	101	105	101
106	101	106	101
107	101	107	101
108	101	108	101
109	101	109	101
110	101	110	101
111	101	111	101
112	101	112	101
113	101	113	101
114	101	114	101
115	101	115	101
116	101	116	101
117	101	117	101
118	101	118	101
119	101	119	101
120	101	120	101
121	101	121	101
122	101	122	101
123	101	123	101
124	101	124	101
125	101	125	101
126	101	126	101
127	101	127	101
128	101	128	101
129	101	129	101
130	101	130	101
131	101	131	101
132	101	132	101
133	101	133	101
134	101	134	101
135	101	135	101
136	101	136	101
137	101	137	101
138	101	138	101
139	101	139	101
140	101	140	101
141	101	141	101
142	101	142	101
143	101	143	101
144	101	144	101
145	101	145	101
146	101	146	101
147	101	147	101
148	101	148	101
149	101	149	101
150	101	150	101

E. Digital Data Collection & Field Notes

Example: Topographic survey.
Augmenting field notes

10	Topographic Survey	10	Topographic Survey
101	Start	101	Start
102	End	102	End
103	Code should be 101	103	Code should be 101
104	101 should be 7.00 for this shot only	104	101 should be 7.00 for this shot only
105	101	105	101
106	101	106	101
107	101	107	101
108	101	108	101
109	101	109	101
110	101	110	101
111	101	111	101
112	101	112	101
113	101	113	101
114	101	114	101
115	101	115	101
116	101	116	101
117	101	117	101
118	101	118	101
119	101	119	101
120	101	120	101
121	101	121	101
122	101	122	101
123	101	123	101
124	101	124	101
125	101	125	101
126	101	126	101
127	101	127	101
128	101	128	101
129	101	129	101
130	101	130	101
131	101	131	101
132	101	132	101
133	101	133	101
134	101	134	101
135	101	135	101
136	101	136	101
137	101	137	101
138	101	138	101
139	101	139	101
140	101	140	101
141	101	141	101
142	101	142	101
143	101	143	101
144	101	144	101
145	101	145	101
146	101	146	101
147	101	147	101
148	101	148	101
149	101	149	101
150	101	150	101



F. Not Just for Collecting Data

Traditional infrastructure stake out operations
Still common in construction related projects.
Example: Curve Stakeout

Why is the curve table upside down?

Station	Deflection Angle	Radial Chord
EC 28+85.855	39°09'00"	406.93
28+00	31°25'13"	336.90
27+00	22°25'13"	242.83
26+00	13°25'13"	147.78
25+00	4°25'13"	49.10
BC 24+50.855	0°00'00"	0.000

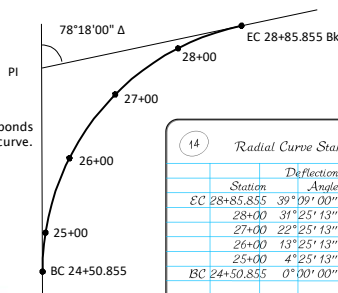
Curve Components:
 $R = 148.26$ $T = 355.14$
 $L = 400.000$ $\Delta = 78^{\circ}18'00"$
 $M = 55.855$ $M' = 24.500$
 $\text{def angle} = 0.00000476$

Notes:
 1. Stationing starts from the BC station to the EC station.
 2. The curve was created from the BC station to the EC station.
 3. The angle 25'13" is the deflection angle from the BC station.

F. Not Just for Collecting Data

Traditional infrastructure stake out operations
Example: Curve Stakeout

Visually corresponds to the curve.



Station	Deflection Angle	Radial Chord
EC 28+85.855	39°09'00"	406.93
28+00	31°25'13"	336.90
27+00	22°25'13"	242.83
26+00	13°25'13"	147.78
25+00	4°25'13"	49.10
BC 24+50.855	0°00'00"	0.000

F. Not Just for Collecting Data

Traditional infrastructure stake out operations

Example: Sanitary Sewer Stakeout

Part of the field notes are precomputed, part completed in the field.

Sanitary Sewer Stakeout		
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