

150
 149
 150

821Xf02

SunView Expt

FORM K
 APPROVED FOR USE IN
 PURDUE UNIVERSITY

	6/11	6/13	6/14	6/21	6/23	6/24	7/6	7/9	7/12
hemispheres		9	6	9	5	10	3	2	5
sky									2
soil									3
diffuse									
Student to Jim									
	7/14	7/15	7/16	7/23	7/30	7/31	8/9	8/11	8/12
hemispheres	2	3	1	17	4	7	4	12	25
sky	1	1	+	2	1	1	1	14	3
soil	1	2	1	9	2	4	-	-	-
diffuse									
Student to Jim									
	8/19	8/28	9/4	10/25					
hemispheres	18	7	24	9					
sky	15	-	10	6					
soil	-	-	-	-					
diffuse									
Student to Jim									

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DAY OF YEAR	DATA SET NUMBER	START TIME	END TIME	SOLAR ZENITH ANGLES	SOLAR AZIMUTH ANGLES	CLOUD COVER
820613	1	1724	1732	18-18	162-168	3
820613	2	1749	1756	17-17	181-186	3
820613	4	1844	1854	21-22	219-224	10
820613	5	1915	1922	25-26	233-236	10
820613	6	2002	2010	33-34	249-251	1
820613	7	2025	2031	37-38	254-256	1
820613	9	2059	2108	43-45	262-263	1
820613	10	2121	2127	48-49	266-267	1
820613	11	2149	2158	53-55	270-272	1
820614	1	1558	1605	29-28	118-121	10
820614	2	1618	1625	26-25	125-128	10
820614	3	1644	1655	22-21	137-143	10
820614	4	1707	1714	19-19	150-155	10
820614	5	1732	1741	18-17	168-175	20
820614	6	1754	1801	17-17	185-190	20
820621	1	1452	1501	41-39	101-103	35
820621	2	1521	1528	35-34	107-109	35
820621	3	1551	1607	30-27	115-121	25
820621	4	1619	1626	26-24	125-128	25
820621	5	1644	1654	22-21	136-141	10
820621	6	1717	1724	18-18	156-161	10
820621	8	1752	1802	17-17	182-190	32
820621	9	1823	1830	18-19	205-210	40
820621	10	1901	1916	23-25	227-233	40
820623	1	1655	1703	21-20	142-146	5
820623	2	1720	1726	18-18	157-162	10
820623	3	1745	1752	17-17	176-182	10
820623	4	1805	1811	17-18	192-196	15
820623	5	1836	1845	20-21	213-218	30
820624	1	1407	1418	49-47	92-94	5
820624	2	1429	1440	45-43	96-98	5
820624	4	1504	1514	39-37	103-105	5
820624	5	1525	1536	35-33	108-111	5
820624	7	1601	1612	29-27	118-122	10
820624	8	1624	1631	25-24	127-130	5
820624	9	1636	1707	23-19	132-149	5
820624	10	1722	1728	18-18	159-163	5
820624	12	1812	1819	18-18	197-202	5
820624	13	1831	1838	19-20	210-214	5

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149
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DAY OF YEAR	DATA SET NUMBER	START TIME	END TIME	SOLAR ZENITH ANGLES	SOLAR AZIMUTH ANGLES	CLOUD COVER
820706	1	1510	1516	38-37	105-106	3
820706	2	1546	1552	32-31	114-116	27
820706	3	1755	1821	18-19	182-201	60
820709	1	1526	1531	36-35	109-110	10
820709	2	1600	1614	30-28	119-123	17
820712	1	1430	1435	46-46	97-98	0
820712	2	1435	1500	46-41	98-103	0
820712	4	1530	1536	35-34	110-112	0
820712	5	1551	1558	32-31	116-118	1
820712	7	1633	1643	25-24	131-136	32
820714	1	1459	1504	41-40	103-105	15
820714	2	1515	1521	38-37	107-108	25
820715	1	1507	1513	40-39	105-107	1
820715	2	1526	1533	36-35	110-112	1
820715	4	1559	1611	31-29	119-123	10
820716	1	1658	1707	22-21	144-149	15
820723	1	1425	1430	49-48	98-99	0
820723	2	1443	1450	45-44	102-103	0
820723	4	1516	1522	39-38	109-111	15
820723	5	1536	1542	36-35	114-116	15
820723	6	1602	1611	31-30	122-125	20
820723	7	1629	1638	27-26	132-136	10
820723	8	1701	1707	23-23	147-150	10
820723	9	1849	1900	23-25	214-219	20
820723	10	1921	1927	27-28	229-231	8
820723	11	1949	1955	32-33	239-241	1
820723	12	2012	2018	36-37	246-247	1
820723	13	2029	2035	39-40	250-251	1
820723	15	2100	2106	44-45	257-258	5
820723	16	2118	2124	48-49	261-262	10
820723	17	2144	2155	53-55	265-267	10
820723	18	2210	2215	57-58	270-270	5
820723	19	2234	2242	62-64	273-275	5
820730	1	1401	1408	54-53	96-97	0
820730	2	1422	1429	50-49	99-101	0
820730	4	1501	1507	43-42	107-109	1
820730	5	1522	1527	39-38	112-114	3
820731	1	1346	1351	57-56	93-94	0
820731	2	1406	1412	53-52	97-98	0
820731	4	1439	1444	47-46	103-104	0
820731	5	1457	1503	44-43	107-108	0
820731	6	1519	1524	40-39	112-113	5
820731	7	1549	1603	35-33	120-125	25
820731	8	1624	1650	29-26	132-143	32

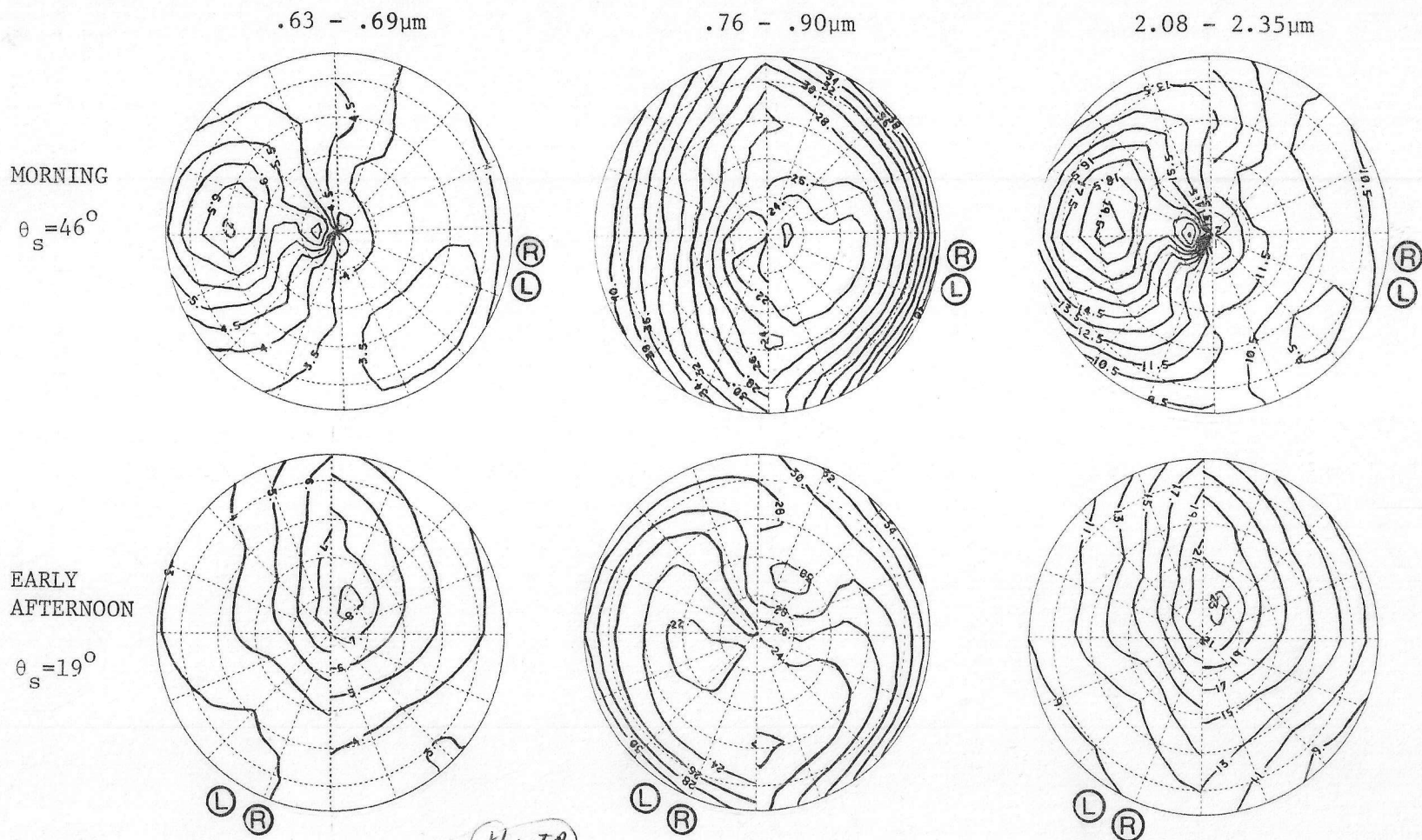


Figure 9. Contours of equal reflectance ^{the IR} factors for a rowed corn canopy in ~~the morning~~ and early afternoon. Data is presented for ~~three~~ wavelength bands, .63-.69 μ m, .76-.90 μ m and ~~2.08-2.35~~ μ m. Bullseye circles represent view zenith angles with 0° at the center and outward to 17.5°, 30°, 45°, 60° and 70°. Radial lines represent view azimuth angles as in Figure 8. Circled letters indicate average solar azimuth position during acquisition of each half hemisphere; R = Right side, L = Left side. Date of data acquisition was June 21, 1982.

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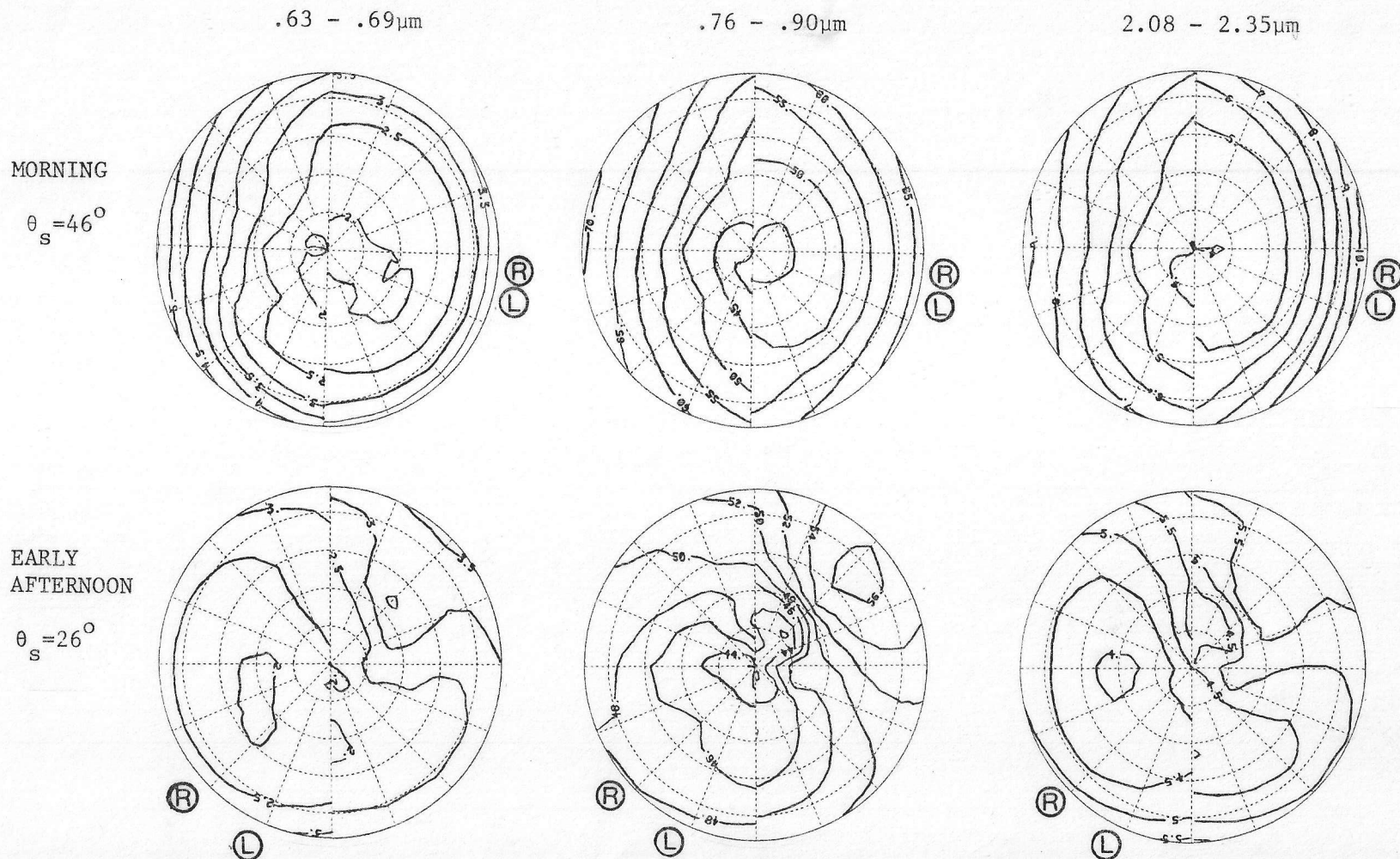


Figure 10. Contours of equal reflectance factors for an overlapping corn canopy in the morning and early afternoon. Data is presented for three wavelengths: .63-.69 μ m, .76-.90 μ m and 2.08-2.35 μ m. Angular coordinates are the same as described in Figure 9. Date of data acquisition was July 23, 1982.

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7/27/62

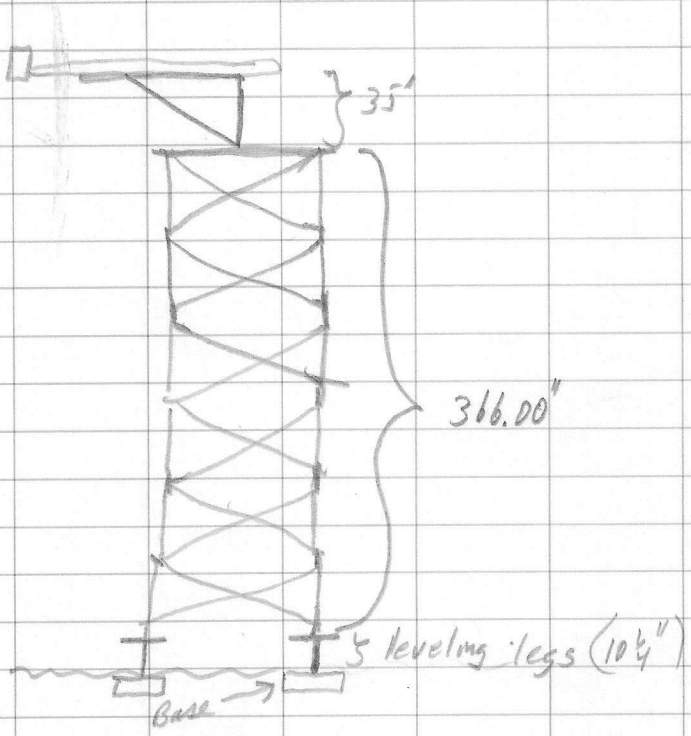
Calculation of Height of Instrument on the Tower

61

Height of each section of tower	61"
Leveling leg	10 1/4"
Base	2 1/4" in ground
Height of boom above platform	35"
Leveling leg - 10 1/4"	10.25"
6 sections scaffolding - 6 x 61"	366.00"
Boom above platform	35.00"
Total	411.25"

or 34.3'

or 10.54 m.



FORM K
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SET UP FOR Sun-View Exp
Field 66

J. KANSON
6/9/82

N

NORTH
CINDER ROAD

E-W ROWS

150'

150'

130'

TOWER FOV LIMIT

45°

270°

315°

90°

225°

130'

135°

180°

180°

TOWER

EAST

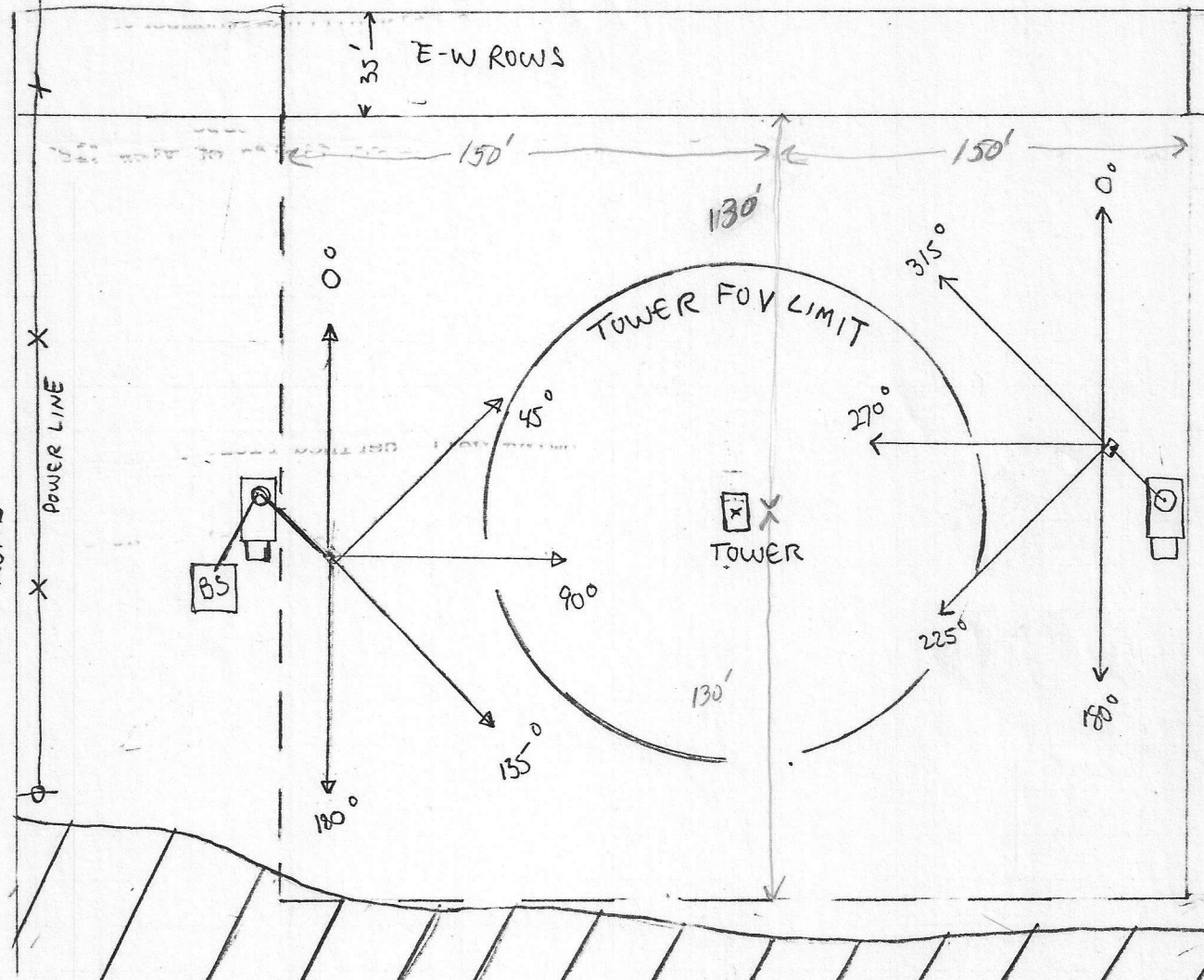
SOUTH

FORM C
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-10002

ROAD

POWER LINE



SE Setup

1982 Angle Study (High Ranger) Date _____

6/21/82 L. Bucht

Sky Condition _____ Time _____ Cloud Cover (%) _____
 Start _____ Stop _____

Target- Truck Boom Az	Instru Boom Azimuth	View Az-Zen	Code-# Obs	Line Time	Target- Truck Boom Az	Instru Boom Azimuth	View Az-Zen	Code-# Obs	Line Time
- 'Are Gains Correct?' -									
Dark-S	180	-	7-2		Corn-SE	180	90-0	90-1	
Box504-S	180	180-0	8-3				7		
Shadow-S	180	180-0	9-2				15		
- Picture of time? -									
Corn-SE	45	135-0	135-1				22		
							30		
							45		
							60		
							70		
	90	D -70	0 -1		Corn-E	90	90-0	3-1	
		-60			Corn-NE	45	45-0	3-1	
		-45			Corn-NW	315	315-0	3-1	
		-30			Corn-W	270	270-0	3-1	
		-22			Soil-SW	225	225-0	2-1	
		-15							
		-7			Box504-S	180		8-3	
		0			Shadow-S	180		9-2	
		180-7	180-1		Dark	-		7-2	
		15			Comments				
		22			Gains -				
		30							
		45							
		60							
		70							
	135	45 0	45-1						
		7							
		15							
		22							
		30							
		45							
		60							
		70							

FORM K
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NW Setup

1982 Angle Study (High Ranger) Date _____

Sky Condition _____

Start Time _____ Stop Time _____ Cloud Cover (%) _____

Picture of Time? →

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Target-Truck Boom Az.	Instru Boom Azimuth	View Az-Zen	Code-#Obs	Line Time	Target-Truck Boom Az	Instru Boom Azimuth	View Az-Zen	Code-#Obs	Line Time
Dark-S	-	-	7-2						
Bas04-S	180	180-0	8-3		Corn-NW	0	270-0	270-1	
Shadow-S	180	180-0	9-2				7		
Corn-SW	225	225-0	3-1				15		
Corn-W	270	270-0	3-1				22		
Corn-NW	225	315-0	315-1				30		
		7					45		
		15					60		
		22					70		
		30							
		45							
		60			Bas04-S	180	180-0	8-3	
		70			Shadow-S	180	180-0	9-2	
					Dark-S	-	-	7-2	
	270	180-70	180-1						
		60							
		45							
		30							
		45							
		60							
		70							
		0-7	0-1						
		15							
		22							
		30							
		45							
		60							
		70							
	315	225-0	225-1						
		7							
		15							
		22							
		30							
		45							
		60							
		70							

Comments

Grains -

Sky Setup

1982 Angle Study (High Ranger)

6/21/82 L. Biedl

Date _____

Sky Condition _____

Start Time _____
 stop _____
 Cloud Cover (%) _____

Target	Instru Boom Azimuth	View Az-Zen	Code-#Obs	Linc Time
"Gains = X.2"				
Sun			50 -1	
Sky	90	0 -75	51 -1	
		-60		
		-45		
		-30		
		-15		
		0		
		180 15	52 -1	
		30		
		45		
		60		
75				
135	45	-75	53 -1	
		-60		
		-45		
		-30		
		-15		
		0		
		225 15	54 -1	
		30		
		45		
		60		
75				
180	90	-75	55 -1	
		-60		
		-45		
		-30		
		-15		
		0		
		270 15	56 -1	
		30		
		45		
		60		
75				

Target	Instru Boom Azimuth	View Az-Zen	Code-#Obs	Linc Time
Sky	225	135 -75	57 -1	
		-60		
		-45		
		-30		
		-15		
		0		
		315 15	58 -1	
		30		
		45		
		60		
75				
Sun			50 -1	

"Change Gains Back For Corn"

Comments

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Codes

Code	Description
0	Corn View - Azimuth = 0, Zen = 7 → 70, 70 → 0
2	Soil
3	1 one verticils
5	
7	dark level
8	BasOy
9	Shadowed BasOy
45	Corn View - Azimuth = 45, Zen = 0 → 70
51	
50	Sum
51	Sky View - Azimuth = 0, Zen = 75 → 0
52	Sky View = 180, Zen = 15 → 75
53	Sky = 45, Zen = 75 → 0
54	Sky = 225, Zen = 15 → 75
55	Sky = 90, Zen = 75 → 0
56	Sky = 270, Zen = 15 → 75
57	Sky = 135, Zen = 75 → 0
58	Sky = 315, Zen = 15 → 75
59	shaded = 140, Zen = 0
190	Corn View - Azimuth = 90, Zen = 0 → 70
135	Corn View - Azimuth = 135, Zen = 0 → 70
180	Corn View - Azimuth = 180, Zen = 7 → 70, 70 → 0
225	Corn View - Azimuth = 225, Zen = 0 → 70
270	Corn View - Azimuth = 270, Zen = 0 → 70
315	Corn View - Azimuth = 315, Zen = 0 → 70

SOYBEAN 1980 Hi-Ranger

SENSOR HEIGHT = 10.00 METERS SENSOR FIELD OF VIEW= 10.00 DEGREES

VIEW ANGLE	NEAR POINT	MID POINT	FAR POINT	DMIN	DMAX	AREA
0.0	-0.875	0.0	0.875	1.750	1.750	2.40
7.0	0.349	1.228	2.126	1.763	1.776	2.46
15.0	1.763	2.679	3.640	1.811	1.876	2.67
22.0	3.057	4.040	5.095	1.887	2.038	3.02
30.0	4.663	5.774	7.002	2.020	2.339	3.71
45.0	8.391	10.000	11.918	2.475	3.527	6.85
60.0	14.281	17.321	21.445	3.500	7.164	19.69
70.0	21.445	27.475	27.321	5.116	15.875	60.79

CORN 1982 Hi-Ranger

SENSOR HEIGHT = 10.00 METERS SENSOR FIELD OF VIEW= 15.00 DEGREES

VIEW ANGLE	NEAR POINT	MID POINT	FAR POINT	DMIN	DMAX	AREA
0.0	-1.317	0.0	1.317	2.633	2.633	5.45
7.0	-0.087	1.228	2.586	2.653	2.673	5.57
15.0	1.317	2.679	4.142	2.726	2.826	6.05
22.0	2.586	4.040	5.658	2.840	3.072	6.85
30.0	4.142	5.774	7.673	3.040	3.531	8.43
45.0	7.673	10.000	13.032	3.724	5.359	15.67
60.0	13.032	17.321	24.142	5.266	11.110	45.95
70.0	19.210	27.475	45.107	7.699	25.897	156.59

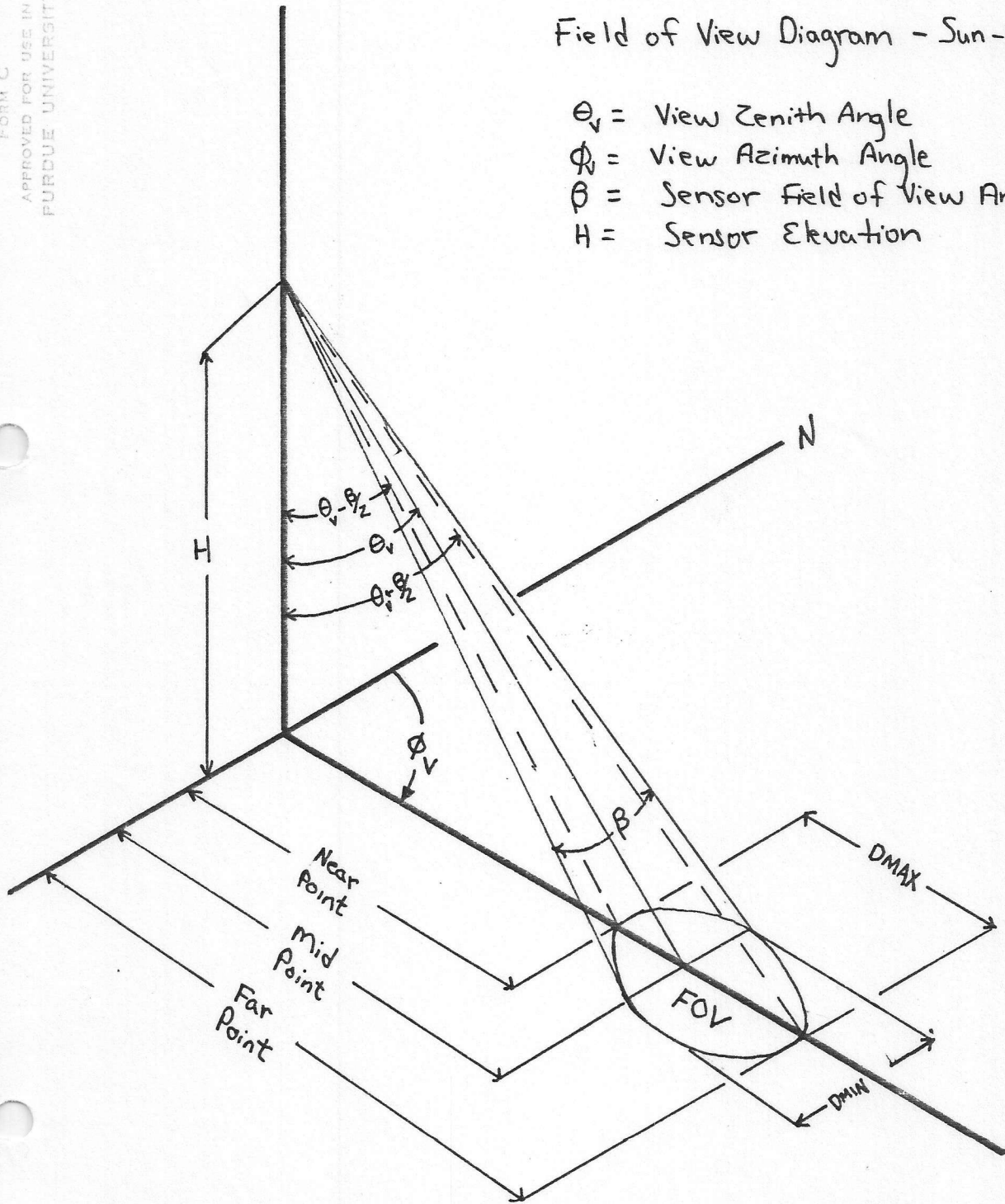
CORN 1982 TOWER

SENSOR HEIGHT = 10.45 METERS SENSOR FIELD OF VIEW= 10.00 DEGREES

VIEW ANGLE	NEAR POINT	MID POINT	FAR POINT	DMIN	DMAX	AREA
0.0	-0.914	0.0	0.914	1.829	1.829	2.63
7.0	0.365	1.283	2.221	1.842	1.856	2.69
15.0	1.843	2.800	3.803	1.893	1.961	2.92
22.0	3.195	4.222	5.325	1.972	2.130	3.30
30.0	4.873	6.033	7.317	2.111	2.444	4.05
45.0	8.769	10.450	12.454	2.586	3.685	7.48
60.0	14.924	18.100	22.410	3.657	7.486	21.50
70.0	22.410	28.711	39.000	5.346	16.590	69.66

Field of View Diagram - Sun-View Angle Exp.

- θ_v = View Zenith Angle
- ϕ_v = View Azimuth Angle
- β = Sensor Field of View Angle
- H = Sensor Elevation

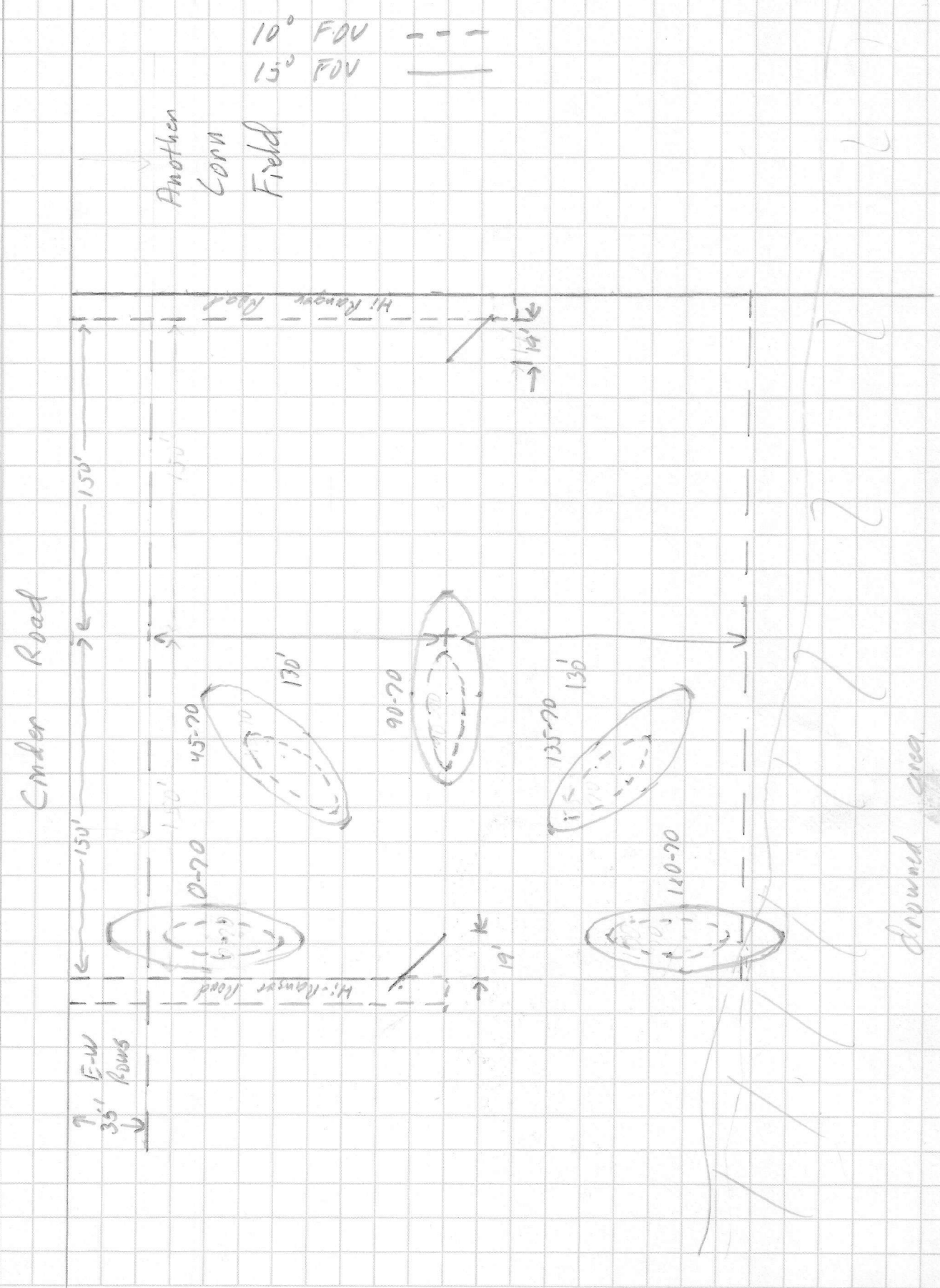


Scale
 $\frac{1}{4}'' = 15'$

6/30/52
K.H. Becht

Plot of 15° FOV limits for 70° View Zenith Angle.

FORM C
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6/30/82
 L. B. ...

Theoretical Location of Barnes FOV within Ektachrome Slide ①

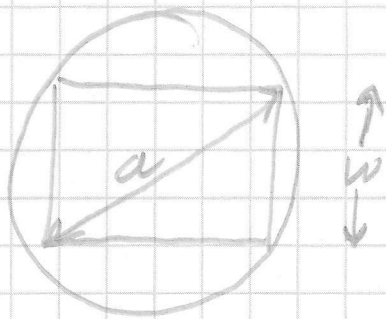
Assumptions

Angular FOV of lens is 46° (from manual).

Angular FOV of slide across length & width (low) as measured from slide taken 10 meters vertically over corner (L)

$$d = 38^\circ$$

$$w = 26^\circ$$



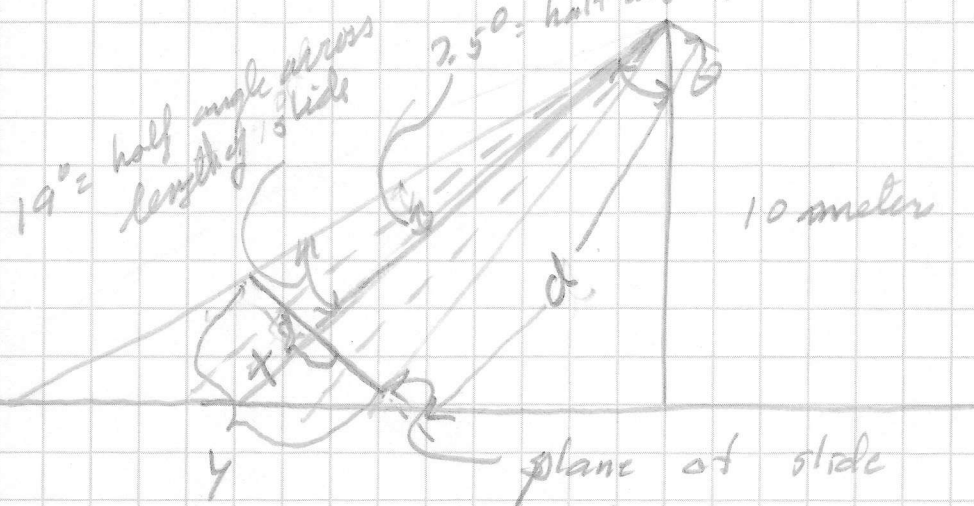
d ← half angle of Barnes FOV

$19^\circ =$ half angle across length of slide

$7.5^\circ =$ half angle of Barnes FOV

- $\theta =$ view zenith angle
- $x =$ Barnes FOV
- $y =$ slide FOV

10 meter



Portion across length of slide taken up by Barnes FOV is

$$\frac{x}{y} = \frac{2d \tan(7.5^\circ)}{2d \tan(19^\circ)} = .38 \quad \text{for } 15^\circ \text{ FOV}$$

Theoretical location -- cont

6/30/82

(2)

L. Bickel

Portion across width of slide taken up by
Barns FOV is

$$\frac{\tan(2.5^\circ)}{\tan(13^\circ)} = .57$$

Note these proportions do not depend on
the view zenith angle

Summary

FOV	FOV Proportion of slide across	
	width	length
15°	.57	.38
10°	.38	.25

This does not take into account that the centers
of the camera lens and the centers of the
Barns are separated by 10.5 inches which
is 4% of the ground area across the midlength of
the slide taken from 10 meters, the worst case in the
sun view angle field