PRELIMINARY PHOTOMETRIC REPORT

HAL-LC-24-LED-R1-3K

LM-63 point-by-point analysis from supplied IES data

Preliminary Photometric Analysis Based on Assumed Installation Conditions.

LUMINAIRE LUMENS	MAXIMUM CANDELA	INPUT POWER	PRIMARY HEIGHT
7,252 lm	3,478 cd	50.83 W	20 ft

Required Disclaimer
This report is a preliminary photometric analysis generated from the supplied IES photometric data using assumed installation conditions. It is intended only for conceptual planning and fixture evaluation. Actual lighting performance will vary depending on mounting height, aiming, room geometry, surface reflectance, obstructions, maintenance factors and environmental conditions. Final lighting layouts should be performed using project-specific dimensions and requirements.

Manufacturer metadata: LARSON | Test date: 2023.03.30 | Report generated from IES file only

1. Fixture Summary

Parameter	Result	Basis / note
Fixture model	HAL-LC-24-LED-R1-3K	[LUMINAIRE] field
Manufacturer	LARSON	[MANUFAC] field
Lamp lumens	7,251.81 lm	1 lamp x 7,251.81 lm in LM-63 data
Total luminaire lumens	7,251.58 lm	Numerically integrated from all candela values
Luminaire efficiency	99.997%	Photometric ratio only; not an independently verified optical efficiency
Input power	50.83 W	LM-63 input watts field
Calculated efficacy	142.7 lm/W	Integrated lumens divided by input watts
Maximum candela (CBCP)	3,477.84 cd	C158 at 0.5 degrees
Beam angle (50% CBCP)	113.1 x 79.1 deg	Major C0/C180 x minor C90/C270 planes
Field angle (10% CBCP)	153.6 x 115.3 deg	Major C0/C180 x minor C90/C270 planes
Photometric type	Type C (LM-63 Type 1)	Vertical angles referenced from nadir
Distribution classification	Direct; IES roadway Type I-V not assigned	99.97% downward flux; no Type I-V tag in file
Symmetry description	Asymmetric full 360-degree distribution	17 C-planes; elongated C0/C180 major axis

IES metadata observation

The supplied [ISSUEDATE] value (2009-01-01 01:47:36) predates the [TESTDATE] value (2023.03.30). Both are reproduced as supplied. The issue date was not used in any calculation.

Assumptions and Calculation Method

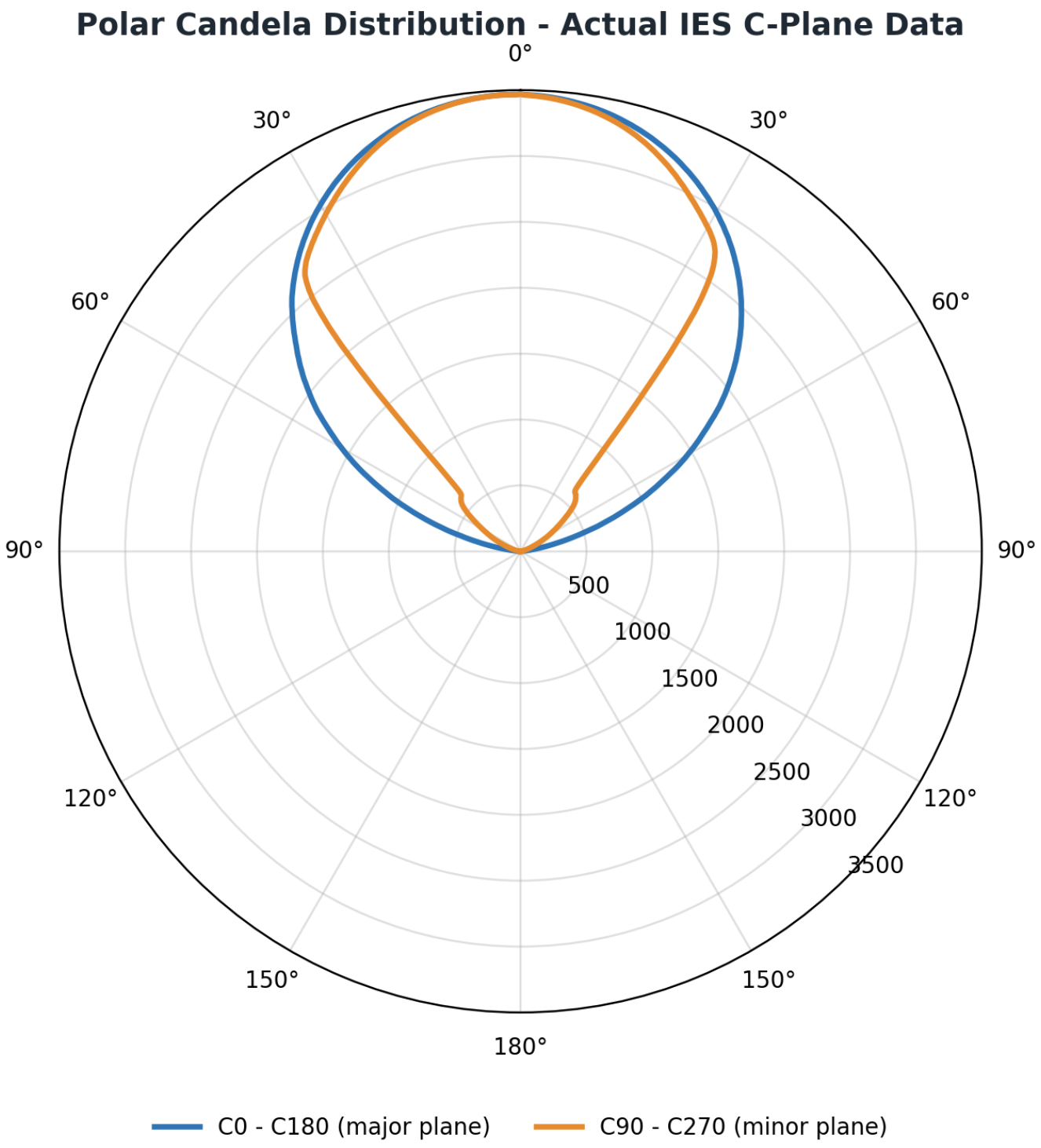
1. Fixture mounted 20 ft (6.1 m) above the horizontal calculation plane for the primary analysis.
2. Additional comparison calculations at 10, 15, 25 and 30 ft.
3. Fixture aimed straight downward at 0-degree tilt; CBCP aligned with nadir.
4. Single fixture centered in a flat, unobstructed 50 ft x 50 ft area.
5. 2 ft grid spacing with calculation points 1 ft inside each boundary (25 x 25 points).
6. No reflected light from walls, ceiling, floor or surrounding objects; direct component only.
7. Light Loss Factor (LLF) = 0.80 applied uniformly to all calculated illuminance values.
8. Foot-candle output units; standard atmospheric conditions; no obstructions.
9. C0/C180 is treated as the report X-axis and C90/C270 as the Y-axis.

Point-by-point method

At each calculation point, the horizontal distance and azimuth to the luminaire are converted to a vertical angle and C-plane. Candela is bilinearly interpolated from the actual LM-63 values. Horizontal illuminance is then calculated as **E = I(C,gamma) x cos(gamma) / d^2 x LLF**, where d is the slant distance in feet. Because candela divided by square feet yields foot-candles, no unit conversion is required. No reflected component is added.

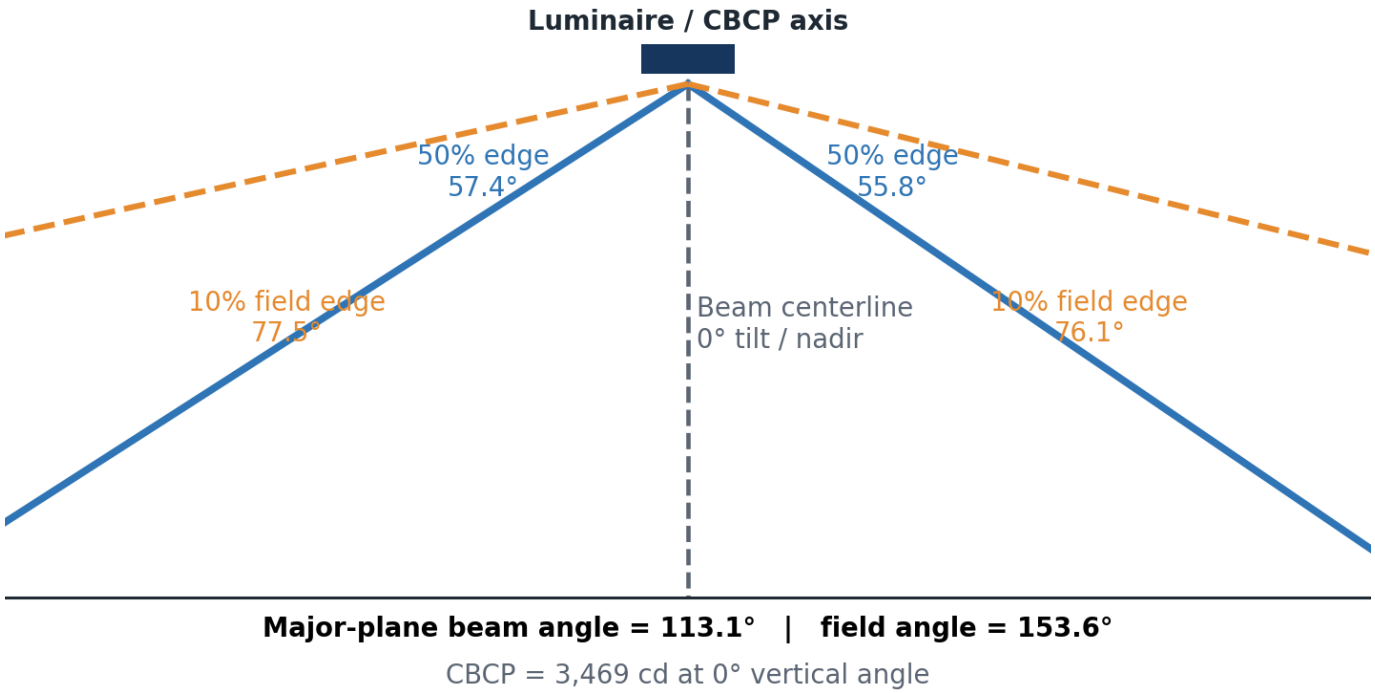
Important: Every layout and spacing example in this report is conceptual and based on assumed conditions. It is not a certified or site-specific lighting design.

2. Polar Candela Distribution



The plot uses the measured C0/C180 and C90/C270 principal-plane values. The unequal curves confirm that a rotationally symmetric approximation would be inappropriate.

3. Beam Angle Diagram



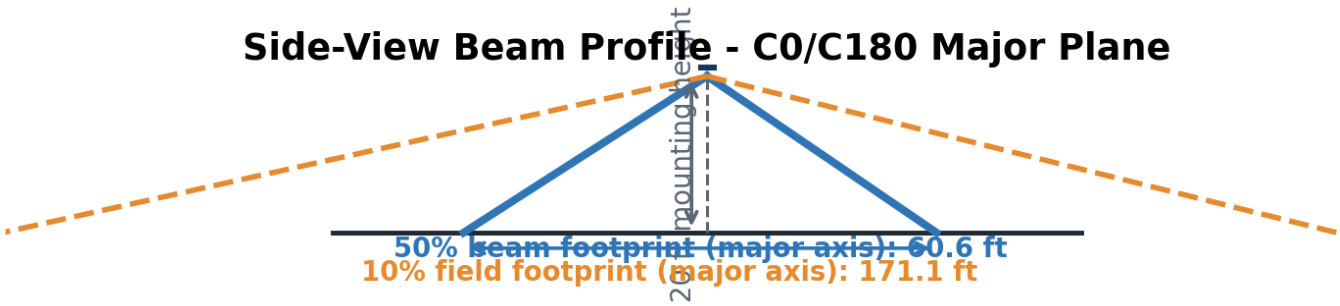
Major-plane beam angle = 113.1° | field angle = 153.6°

CBCP = 3,469 cd at 0° vertical angle

Plane pair	50% beam angle	10% field angle	Interpretation
C0 / C180	113.1 deg	153.6 deg	Major / elongated axis
C90 / C270	79.1 deg	115.3 deg	Minor / narrower axis

Beam and field angles were determined by interpolating the first candela crossing at 50% and 10% of the global CBCP on each side of the nadir axis. Opposite side angles were added; they were not forced to be equal.

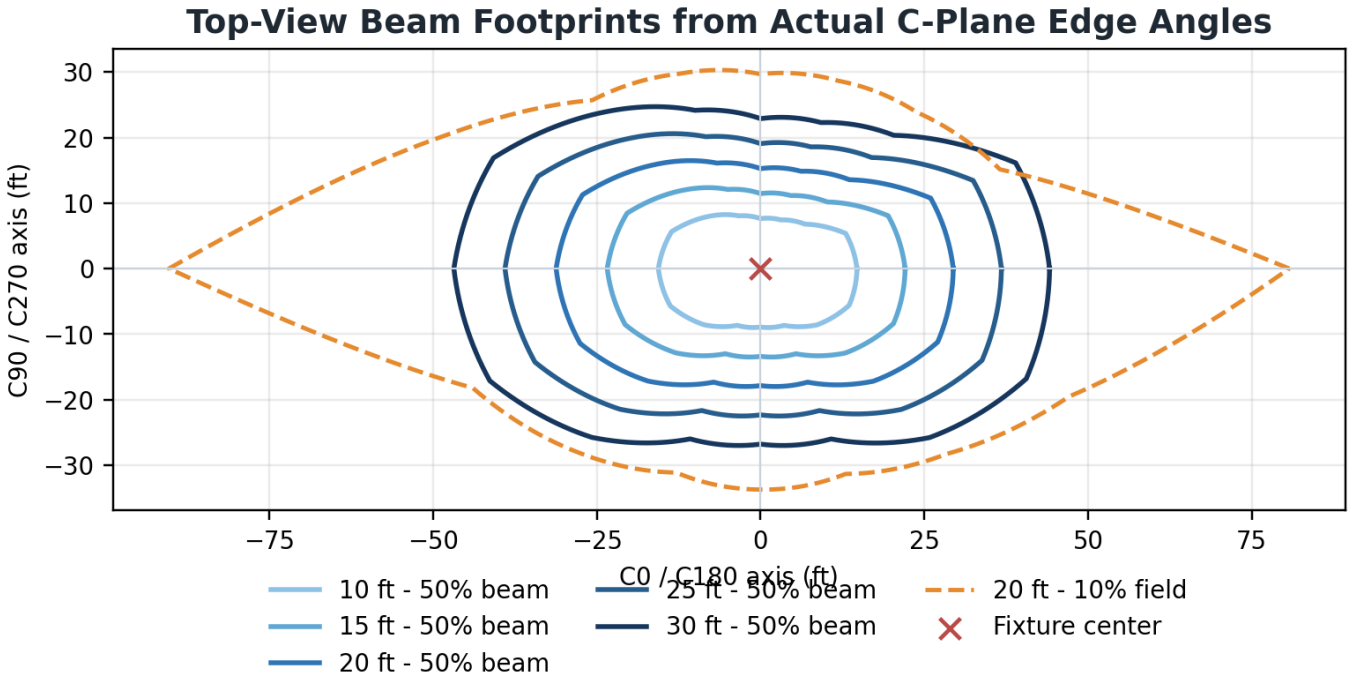
4. Side-View Beam Profile



At 20 ft mounting height	Major axis	Minor axis
50% beam footprint	60.6 ft	34.5 ft
10% field footprint	171.1 ft	64.0 ft

The side elevation illustrates the C0/C180 major plane. Footprint dimensions are based on actual side-specific edge angles, so the beam is allowed to be slightly offset/asymmetric about the nominal centerline.

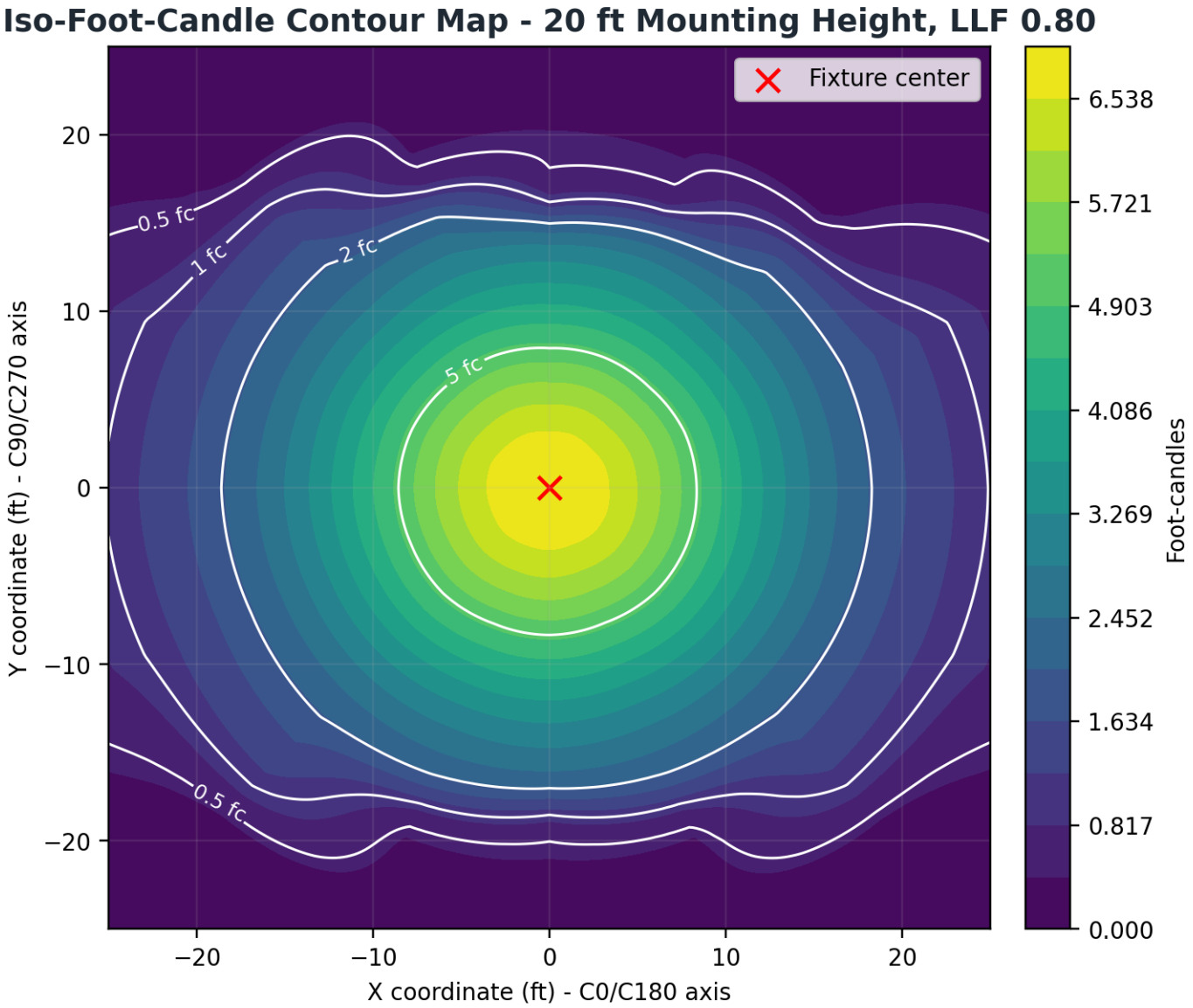
5. Top-View Beam Footprint



Height	50% footprint L x W	50% area	10% field L x W
10 ft	30.3 x 17.2 ft	442 sq ft	85.5 x 32.0 ft
15 ft	45.5 x 25.9 ft	995 sq ft	128.3 x 48.0 ft
20 ft	60.6 x 34.5 ft	1,769 sq ft	171.1 x 64.0 ft
25 ft	75.8 x 43.1 ft	2,765 sq ft	213.9 x 80.0 ft
30 ft	91.0 x 51.7 ft	3,981 sq ft	256.6 x 96.0 ft

Footprints are polygonal projections derived from the 50% and 10% candela crossing angle in every measured C-plane. Dimensions are bounding extents, not assumed circular diameters.

6. Iso-Foot-Candle Contour Map - Primary 20 ft Case



Visible contour levels at 20 ft: **0.5, 1, 2, 5 fc**. Requested higher levels **10, 15, 20 fc** are not reached because the calculated maximum is 6.95 fc.

The asymmetric contour shape is calculated from all C-planes. It is not mirrored or converted to a circular beam.

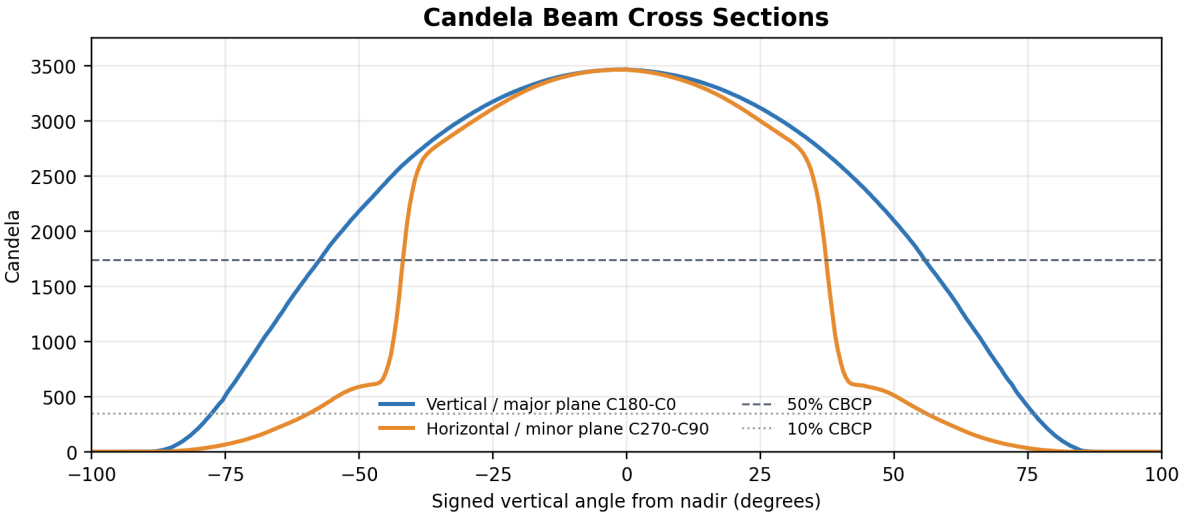
7. Foot-Candle Grid - 20 ft Mounting Height

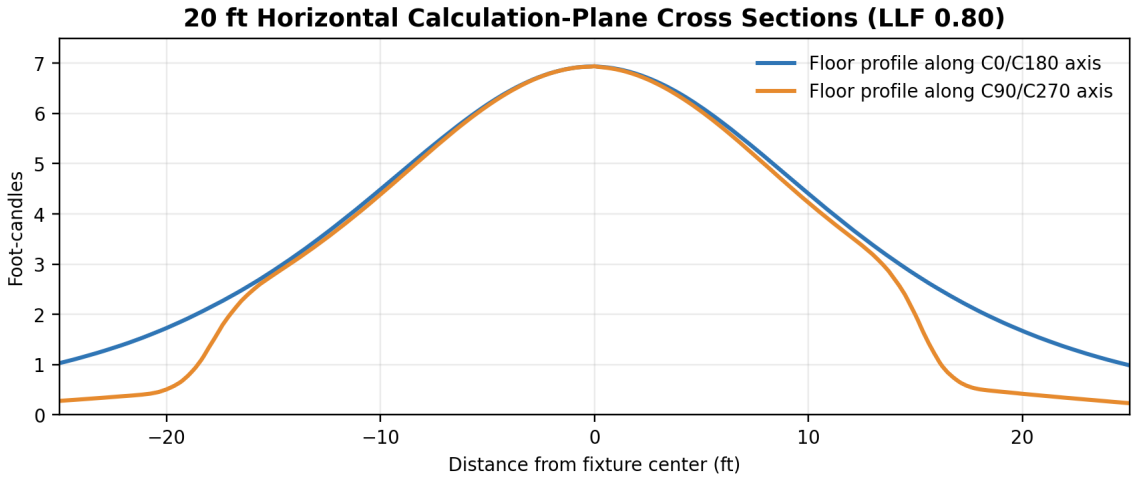
MAXIMUM	MINIMUM	AVERAGE	AVG/MIN	MAX/MIN
6.94 fc	0.09 fc	1.96 fc	21.8:1	77.2:1

Y/X	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24
24	0.10	0.12	0.13	0.15	0.16	0.18	0.21	0.23	0.24	0.25	0.26	0.27	0.27	0.27	0.26	0.25	0.23	0.22	0.20	0.18	0.16	0.14	0.12	0.11	0.090
22	0.15	0.14	0.15	0.17	0.20	0.25	0.29	0.30	0.30	0.32	0.33	0.34	0.34	0.34	0.33	0.31	0.30	0.27	0.24	0.22	0.19	0.17	0.15	0.13	0.14
20	0.22	0.21	0.18	0.21	0.29	0.40	0.48	0.47	0.36	0.38	0.41	0.42	0.42	0.41	0.40	0.38	0.36	0.33	0.29	0.26	0.23	0.20	0.17	0.20	0.20
18	0.31	0.31	0.29	0.32	0.53	0.74	0.80	0.71	0.57	0.62	0.70	0.65	0.51	0.52	0.50	0.46	0.47	0.49	0.40	0.31	0.26	0.23	0.28	0.29	0.29
16	0.41	0.43	0.48	0.65	0.99	1.17	1.18	1.16	1.33	1.61	1.60	1.42	1.13	1.22	1.15	0.92	0.85	0.88	0.76	0.50	0.32	0.38	0.41	0.41	0.40
14	0.54	0.61	0.74	1.03	1.35	1.62	1.69	1.93	2.29	2.59	2.67	2.74	2.72	2.70	2.54	2.26	1.84	1.55	1.40	1.04	0.67	0.59	0.59	0.56	0.52
12	0.70	0.81	1.02	1.32	1.62	1.91	2.20	2.51	2.85	3.15	3.37	3.51	3.54	3.49	3.34	3.09	2.74	2.35	2.10	1.67	1.19	0.90	0.81	0.75	0.67
10	0.88	1.02	1.25	1.54	1.85	2.19	2.56	2.94	3.35	3.72	4.01	4.19	4.22	4.16	3.97	3.66	3.28	2.87	2.49	2.09	1.66	1.28	1.08	0.96	0.84
8	0.96	1.16	1.42	1.72	2.08	2.48	2.92	3.39	3.86	4.32	4.70	4.92	4.97	4.90	4.65	4.25	3.78	3.31	2.84	2.40	1.98	1.63	1.36	1.12	0.92
6	1.02	1.25	1.53	1.88	2.28	2.75	3.26	3.82	4.38	4.90	5.35	5.64	5.71	5.62	5.30	4.83	4.30	3.73	3.18	2.67	2.21	1.81	1.48	1.21	0.98
4	1.08	1.32	1.63	2.00	2.44	2.96	3.54	4.17	4.81	5.41	5.90	6.25	6.33	6.23	5.85	5.35	4.74	4.10	3.46	2.87	2.37	1.93	1.57	1.28	1.04
2	1.12	1.37	1.69	2.09	2.55	3.10	3.72	4.40	5.10	5.76	6.31	6.65	6.76	6.62	6.25	5.69	5.02	4.31	3.63	3.02	2.47	2.02	1.64	1.33	1.07
0	1.14	1.40	1.73	2.13	2.60	3.16	3.79	4.49	5.20	5.88	6.44	6.81	6.94	6.78	6.39	5.81	5.12	4.40	3.71	3.08	2.52	2.06	1.67	1.35	1.09
-2	1.12	1.37	1.70	2.09	2.55	3.10	3.72	4.40	5.09	5.76	6.31	6.69	6.81	6.69	6.30	5.73	5.05	4.34	3.66	3.04	2.49	2.03	1.65	1.34	1.08
-4	1.08	1.33	1.63	2.00	2.44	2.96	3.54	4.17	4.83	5.46	5.98	6.30	6.42	6.28	5.96	5.44	4.81	4.15	3.51	2.92	2.40	1.96	1.60	1.30	1.05
-6	1.03	1.25	1.54	1.88	2.28	2.75	3.28	3.86	4.45	5.00	5.43	5.72	5.84	5.71	5.41	4.98	4.42	3.83	3.26	2.73	2.26	1.86	1.52	1.24	1.01
-8	0.96	1.17	1.42	1.73	2.10	2.51	2.98	3.47	3.97	4.42	4.78	5.03	5.13	5.02	4.76	4.39	3.94	3.44	2.95	2.49	2.07	1.72	1.41	1.16	0.95
-10	0.88	1.06	1.30	1.58	1.90	2.25	2.64	3.05	3.45	3.81	4.10	4.31	4.38	4.30	4.07	3.78	3.42	3.02	2.60	2.22	1.87	1.56	1.29	1.05	0.88
-12	0.72	0.90	1.15	1.42	1.69	1.98	2.30	2.63	2.95	3.23	3.46	3.63	3.69	3.61	3.44	3.20	2.92	2.59	2.26	1.95	1.66	1.39	1.14	0.90	0.72
-14	0.57	0.68	0.94	1.23	1.48	1.73	1.90	2.20	2.48	2.71	2.89	3.02	3.07	3.01	2.87	2.68	2.45	2.16	1.86	1.69	1.45	1.20	0.94	0.70	0.57
-16	0.43	0.48	0.65	0.96	1.25	1.31	1.33	1.54	1.89	2.16	2.33	2.44	2.47	2.43	2.31	2.13	1.86	1.53	1.32	1.27	1.22	0.96	0.68	0.50	0.42
-18	0.32	0.33	0.38	0.58	0.85	0.94	0.90	0.84	0.88	1.14	1.32	1.40	1.35	1.39	1.32	1.15	0.90	0.84	0.88	0.92	0.85	0.63	0.41	0.33	0.31
-20	0.24	0.22	0.21	0.30	0.46	0.61	0.62	0.52	0.39	0.46	0.51	0.53	0.51	0.54	0.52	0.47	0.40	0.51	0.61	0.61	0.50	0.33	0.22	0.22	0.23
-22	0.17	0.15	0.17	0.20	0.26	0.33	0.38	0.35	0.32	0.34	0.35	0.37	0.37	0.37	0.35	0.33	0.31	0.35	0.39	0.35	0.27	0.21	0.16	0.15	0.16
-24	0.12	0.13	0.14	0.16	0.18	0.21	0.24	0.25	0.26	0.28	0.29	0.30	0.31	0.30	0.29	0.28	0.26	0.24	0.25	0.22	0.18	0.16	0.14	0.13	0.11

Grid coordinates in feet; values in foot-candles; 2 ft spacing; LLF 0.80

8. Beam Cross Sections and Mounting Height Comparison





Height	Max FC	Min FC	Average FC	Avg/Min	Max/Min
10 ft	27.76	0.011	2.27	209.5:1	2566.3:1
15 ft	12.34	0.043	2.14	50.3:1	290.1:1
20 ft	6.94	0.090	1.96	21.8:1	77.2:1
25 ft	4.44	0.125	1.76	14.1:1	35.4:1
30 ft	3.08	0.143	1.56	10.9:1	21.6:1

Statistics use the same 50 ft x 50 ft calculation area at every height. The lower mounting heights produce higher center levels but very low corner values; higher mounting heights improve single-fixture coverage uniformity while reducing peak illuminance.

9. Spacing Recommendations - Engineering Estimates

Spacing item	C0/C180 major axis	C90/C270 minor axis	Basis
Maximum spacing for contiguous 50% beams	60.6 ft	34.5 ft	20 ft beam footprint; edges approximately meet
Recommended conceptual uniform spacing	40 ft	22 ft	Approximately 66% of the 50% footprint spans
Directional spacing criterion estimate	3.03	1.72	50% footprint span divided by mounting height
Equivalent geometric SC estimate	2.29	-	sqrt(SC major x SC minor)

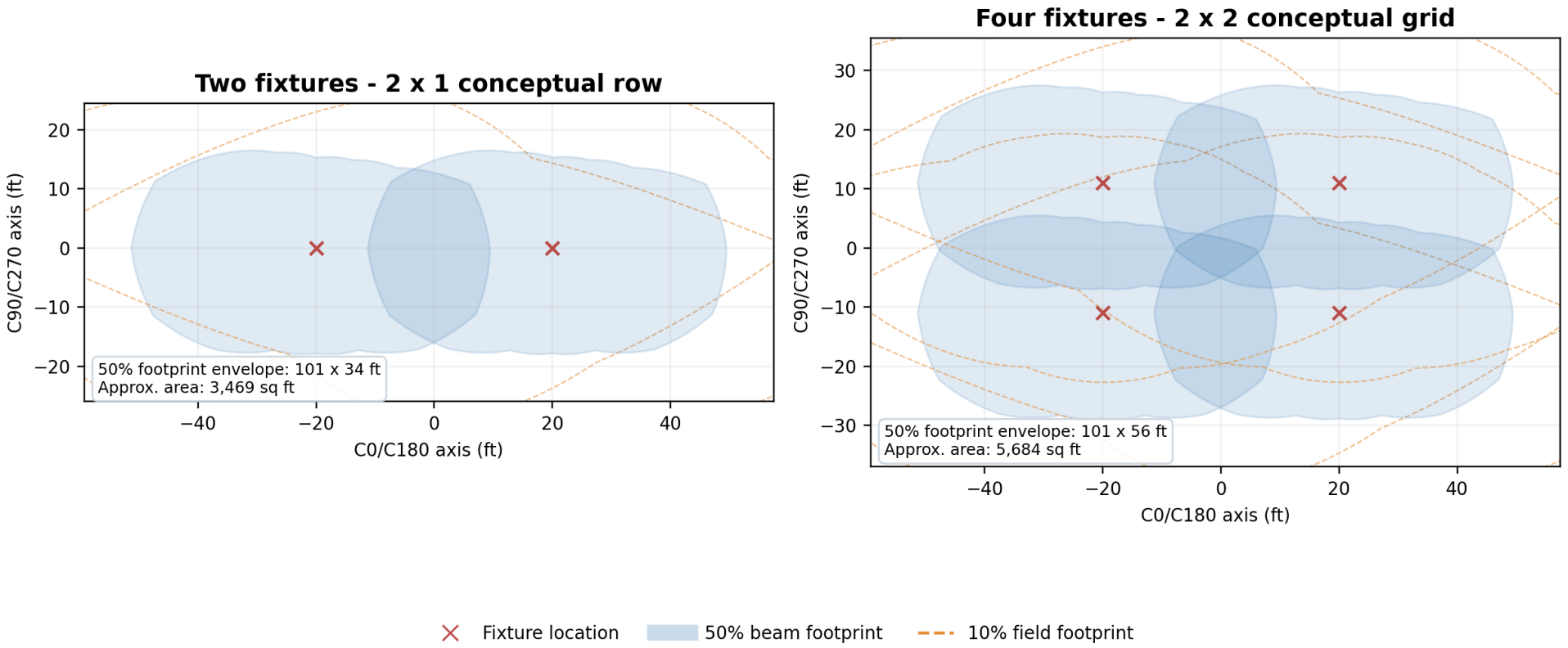
Conceptual repeating-array check at 40 ft x 22 ft spacing

Using a repeating same-orientation fixture array at 20 ft and LLF 0.80, an engineering calculation over one typical spacing cell produced approximately **4.24 fc minimum, 6.55 fc average and 9.22 fc maximum**, with average/minimum = 1.54:1 and maximum/minimum = 2.17:1. This is a conceptual infinite-array estimate and does not include perimeter effects.

Spacing limitations and required project checks

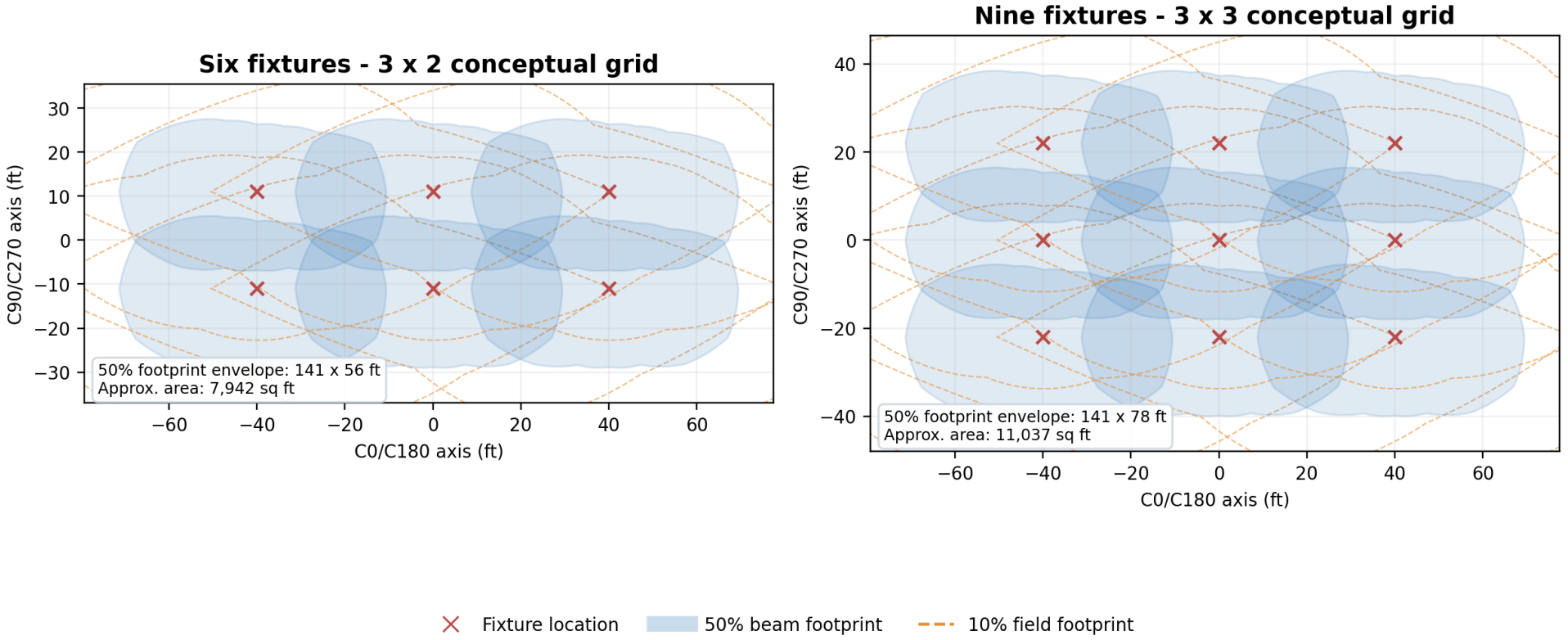
Spacing must be recalculated for actual target illuminance, mounting geometry, fixture orientation, property boundaries, glare criteria, code requirements, surface reflectance, obstructions and maintenance conditions. The file does not contain a manufacturer-published spacing criterion, so the SC values above are directional estimates derived from the measured 50% beam footprint. They should not be substituted for a site-specific AGi32 or equivalent design.

10. Multiple Fixture Layout Examples - Two and Four Fixtures



Conceptual same-orientation layouts at 20 ft mounting height using 40 ft major-axis and 22 ft minor-axis spacing. Filled regions represent 50% beam footprints; dashed outlines represent 10% field footprints. These are not site-specific lighting designs.

10. Multiple Fixture Layout Examples - Six and Nine Fixtures



Approximate illuminated areas shown in the diagrams are bounding envelopes of the 50% beam polygons. Actual usable area depends on required minimum illuminance and perimeter conditions.

11. Performance Summary

BEAM TYPE	Broad asymmetric rectangular/flood distribution; 113.1 x 79.1 degree 50% beam.
WIDE VS. NARROW	Wide on the C0/C180 axis and moderately wide on the C90/C270 axis; not rotationally symmetric.
BEST MOUNTING-HEIGHT RANGE	Estimated 15-25 ft for broad general coverage. Use 10-15 ft when higher center illuminance is needed; 25-30 ft produces lower, more spread-out levels.
TYPICAL APPLICATIONS (ESTIMATE)	Open-area, canopy, aisle, perimeter or general downlighting where an elongated rectangular footprint is advantageous.
STRENGTHS	High downward utilization, broad major-axis coverage, negligible uplight in the supplied data, and high calculated lumen-per-watt ratio.
LIMITATIONS	Strong edge falloff and directional asymmetry; single-fixture uniformity is poor over a full 50 ft x 50 ft area at lower heights; no reflected component or glare evaluation.

Interpretation boundary

Applications and mounting-height guidance are engineering interpretations of the photometric distribution only. The IES file does not establish environmental rating, optical shielding, color quality, electrical suitability, mounting hardware, code compliance or customer acceptance criteria.

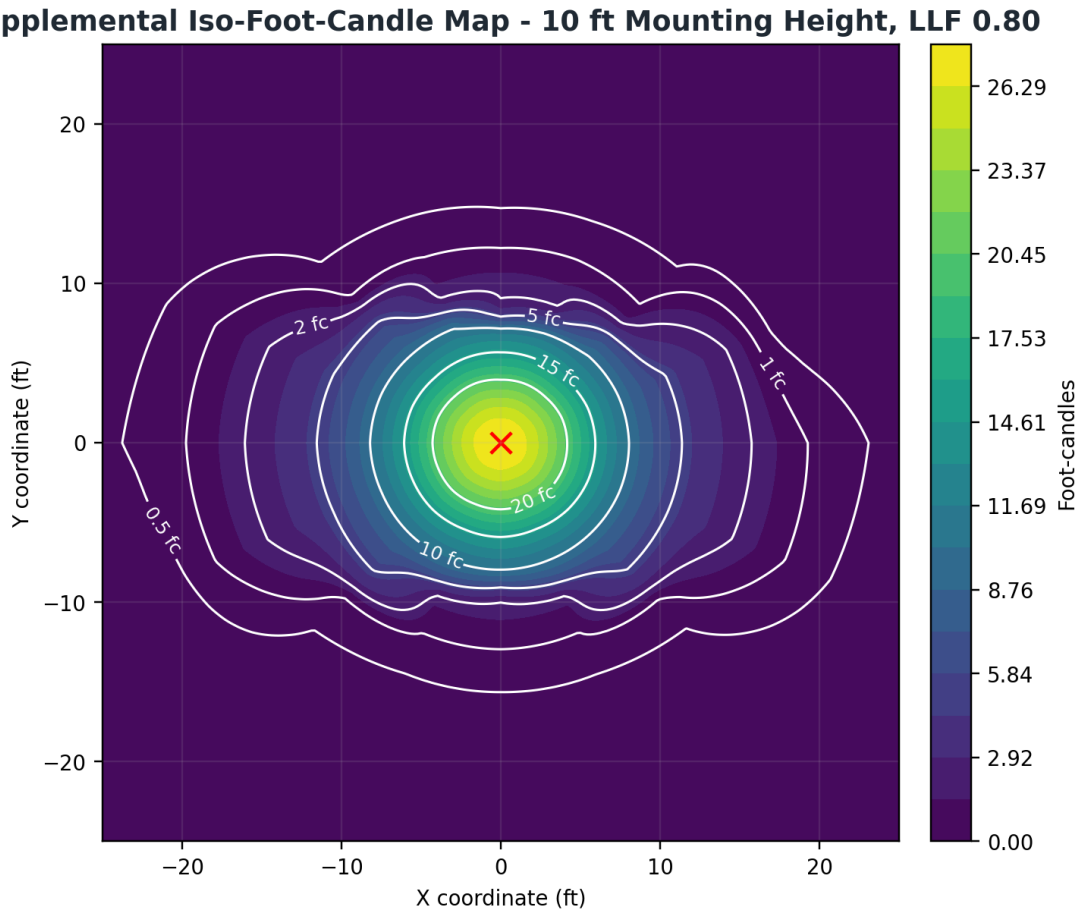
Appendix A - C-Plane Beam and Field Edge Data

C-plane	50% edge	10% edge	Opposite plane
C0	55.79 deg	76.09 deg	C180
C22.5	54.56 deg	63.18 deg	C202.5
C45	43.80 deg	59.34 deg	C225
C67.5	38.80 deg	57.18 deg	C247.5
C90	37.33 deg	56.02 deg	C270
C112.5	41.06 deg	58.14 deg	C292.5
C135	48.38 deg	61.18 deg	C315
C157.5	55.80 deg	69.19 deg	C337.5
C180	57.36 deg	77.52 deg	C0
C202.5	56.17 deg	67.20 deg	C22.5
C225	50.53 deg	63.20 deg	C45
C247.5	43.16 deg	59.31 deg	C67.5
C270	41.77 deg	59.33 deg	C90
C292.5	43.17 deg	59.47 deg	C112.5
C315	50.56 deg	63.46 deg	C135
C337.5	55.66 deg	68.59 deg	C157.5

Zonal flux summary

Integrated total: 7,251.58 lm. Downward 0-90 degrees: 7,249.25 lm (99.968%). Upward 90-180 degrees: 2.32 lm (0.032%). Within 0-30 degrees: 2,699 lm; within 0-60 degrees: 6,623 lm.

Appendix B - Supplemental 10 ft Contours and Final Disclaimer



The supplemental 10 ft map is included because this height reaches the requested 10, 15 and 20 fc contour levels. It uses the same 50 ft x 50 ft area and LLF 0.80 assumptions.

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