

Walmart
Store

Interior Lighting



Walmart 

CLTC
CONSTRUCTION LIGHTING TECHNOLOGY CENTER

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Current Lighting Strategy

Linear fluorescent lighting in direct pendant luminaires for uniform illumination across the whole store

Key Problem

- Dark appearance of merchandise displayed on shelves

Current Strategy

- Increase light output of existing light sources
- It will not work unless the surface brightness distribution changes. Adjusting light intensity while maintaining relative distribution will not change brightness perception, as we perceive brightness in relative terms



Shelf Lighting Prototype: Current Illumination

Simulation Validation

Photograph



Simulation



Proposed Overall Strategy

Reconsider light source placement & direction

- Use existing luminaires only for ambient lighting and illuminating the ceiling
- Bring light sources closer to what needs to be illuminated & from a direction that minimizes incident angle of radiation & shadows of customers

Expected results

- Brighter surfaces of merchandise on shelves & horizontal displays
- Lower energy requirements & associated cost



Shelf Lighting Prototype: Proposed Illumination

Ceiling Lighting at 100%
Shelf Lighting Off



Ceiling Lighting at 100%
Shelf Lighting On



Ceiling Lighting at 50%
Shelf Lighting On



Ceiling Lighting at 25%
Shelf Lighting at 0.25W/ft



Ceiling Lighting at 25%
Shelf Lighting at 0.25W/ft



Ceiling Lighting at 100%
Shelf Lighting at 0.25W/ft



Lighting Simulation

Data Analysis

Energy Savings Scenario (1.5 W/sf baseline)
Ceiling + Shelf Lighting

Ceiling Lighting Only (whole store)					
Super Center Square Foot	177,863				sf
Lighting Watts per Square Foot	1.50				W / sf
Ceiling Lighting Watts at 100% (Baseline)	266,795				W
Shelf Lighting for Vertical Displays Only (half store)					
Watts per linear foot of shelf lighting	0.25	0.5	0.75	1	W / Linear Foot
Linear feet of shelves per store	35,372				Linear Feet
Watts for all shelves in store	8,843	17,606	26,429	35,372	W
Watts per square foot (whole store)	0.03	0.07	0.10	0.13	W / sf
Ceiling at 50% (half store) + Shelf lighting (same half store)					
Half of Ceiling Lighting at 50%	133,397				W
Watts for Ceiling & Shelf Lighting	205,639	217,762	229,825	236,460	W
Lighting Power Savings	0.33	0.28	0.23	0.18	W / sf
Ceiling at 25% (half store) + Shelf lighting (same half store)					
Half of Ceiling Lighting at 25%	166,747				W
Watts for Ceiling & Shelf Lighting	175,090	184,433	193,276	202,119	W
Lighting Power Savings	0.51	0.46	0.41	0.36	W / sf

Energy Savings Scenario (1.5 W/sf baseline)
Ceiling + Shelf + Grid Lighting

Ceiling Lighting					
Super Center Square Feet	177,863				sf
Lighting Watts per Square Foot	1.50				W / sf
Ceiling Lighting Watts at 100% (Baseline)	266,795				W
Shelf Lighting for Vertical Displays					
Watts per linear foot of shelf lighting	0.245	0.5	0.75	1	W / Linear Feet
Linear feet of shelves per store	35,372				Linear Feet
Watts for all shelves in store	8,665	17,606	26,529	35,372	W
Watts per square foot (whole store)	0.03	0.07	0.10	0.13	W / sf
Grid Lighting for Horizontal Displays (half store)					
Grid Lighting Watts (half distance)	33,348				W
Watts per square foot (whole store)	0.19				W / sf
Ceiling at 50% (whole store) + Shelf (half store) + Grid (half store)					
All Ceiling Lighting at 50%	133,397				W
Watts for Ceiling + Shelf + Grid	175,413	184,433	193,276	202,119	W
Lighting Power Savings	0.51	0.46	0.41	0.36	W / sf
Ceiling at 25% (whole store) + Shelf (half store) + Grid (half store)					
All Ceiling Lighting at 25%	66,699				W
Watts for Ceiling + Shelf + Grid	105,714	117,734	128,577	135,420	W
Lighting Power Savings	0.59	0.54	0.49	0.44	W / sf

Energy Savings Scenario (1 W/sf baseline)
Ceiling + Shelf + Grid Lighting

Ceiling Lighting Only (whole store)					
Super Center Square Foot	177,863				sf
Lighting Watts per Square Foot	1.00				W / sf
Ceiling Lighting Watts at 100% (Baseline)	177,863				W
Shelf Lighting for Vertical Displays Only (half store)					
Watts per linear foot of shelf lighting	0.25	0.5	0.75	1	W / Linear Foot
Linear feet of shelves per store	35,372				Linear Feet
Watts for all shelves in store	8,843	17,606	26,429	35,372	W
Watts per square foot (whole store)	0.05	0.10	0.15	0.20	W / sf
Ceiling at 50% (half store) + Shelf lighting (same half store)					
Half of Ceiling Lighting at 50%	133,397				W
Watts for Ceiling & Shelf Lighting	142,340	151,803	159,825	166,799	W
Lighting Power Savings	0.20	0.15	0.10	0.06	W / sf
Ceiling at 25% (half store) + Shelf lighting (same half store)					
Half of Ceiling Lighting at 25%	111,164				W
Watts for Ceiling & Shelf Lighting	130,007	138,950	147,893	148,526	W
Lighting Power Savings	0.33	0.28	0.23	0.18	W / sf

Energy Savings Scenario (1 W/sf baseline)
Ceiling + Shelf + Grid Lighting

Ceiling Lighting					
Super Center Square Feet	177,863				sf
Lighting Watts per Square Foot	1.00				W / sf
Ceiling Lighting Watts at 100% (Baseline)	177,863				W
Shelf Lighting for Vertical Displays					
Watts per linear foot of shelf lighting	0.245	0.5	0.75	1	W / Linear Feet
Linear feet of shelves per store	35,372				Linear Feet
Watts for all shelves in store	8,665	17,606	26,529	35,372	W
Watts per square foot (whole store)	0.05	0.10	0.15	0.20	W / sf
Grid Lighting for Horizontal Displays (half store)					
Grid Lighting Watts (half distance)	33,330				W
Watts per square foot (whole store)	0.15				W / sf
Ceiling at 50% (whole store) + Shelf (half store) + Grid (half store)					
All Ceiling Lighting at 50%	88,932				W
Watts for Ceiling + Shelf + Grid	119,531	128,950	137,893	146,506	W
Lighting Power Savings	0.33	0.28	0.23	0.18	W / sf
Ceiling at 25% (whole store) + Shelf (half store) + Grid (half store)					
All Ceiling Lighting at 25%	44,466				W
Watts for Ceiling + Shelf + Grid	75,365	84,306	93,228	102,071	W
Lighting Power Savings	0.55	0.53	0.48	0.43	W / sf