Lighting Applications Guideline for LEDs

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ASSIST *program*

Alliance for Solid-State Illumination Systems and Technologies

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Lighting Research Center

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Lighting Application Guidelines

This guide is designed to assist the user in identifying potential interior and exterior architectural applications for LEDs by giving specific design examples typically found in residential and commercial categories. Rather than provide lighting design "templates," this guide identifies lumen packages that would be necessary for various applications.

Lighting applications are categorized as a function of lumens required for achieving the illuminance levels. The lumen values were derived from IES recommendations for horizontal and vertical illuminance on task areas. To calculate horizontal lumens, typical room dimensions were used to provide horizontal area in square feet. To calculate vertical lumens, typical task area heights were used to provide wall area in square feet.

As the amount of lumens per LED improves with time, this document will aid in identifying the potential applications for LED lighting.

Lighting Application Guidelines

This guide is divided into two main sections. Each main section is then divided into smaller sections and specific task areas.

- **Residential:** Bedroom, Kitchen, Living Room, Bathroom, Residential Exterior
- **Commercial**: Restaurant, Retail Store, Office

Sample format

Each section includes:

- Cover sheet with section identification image
- Graph illustrating the application as a function of required lumens
- Composite sheet: *
    - individual graph
    - plan
    - perspective
    - important design criteria chart (i.e. CRI may be important in jewelry display, but vibration resistance may be more important in an elevator)
    - illustration of task areas

*Commercial section shows individual graph separately from composite sheet for readability

Bar graphs

Each individual bar on a graph represents a range of required lumens. The lower end of the bar represents the minimum amount of lumens required to meet the illuminance level recommended for the application by the Illuminating Engineering Society of North America (IESNA). In practice, most fixtures have efficiencies in the range of 50% to 95%. Therefore the higher end of the bar represents the required lamp lumens to meet the same criteria assuming a fixture efficiency of 50%.

NOTE: In practice, there may be situations in which the lumen levels may be lower for a given application. In such cases, the application will not meet the IESNA recommended illuminance levels.

Sample Page

Bar graph showing lumen ranges based on IES recommended levels at 100 percent efficiency down to 50 percent efficiency. Lumen values are arranged in ascending order and include a general area and its associated task areas.

Perspective of space

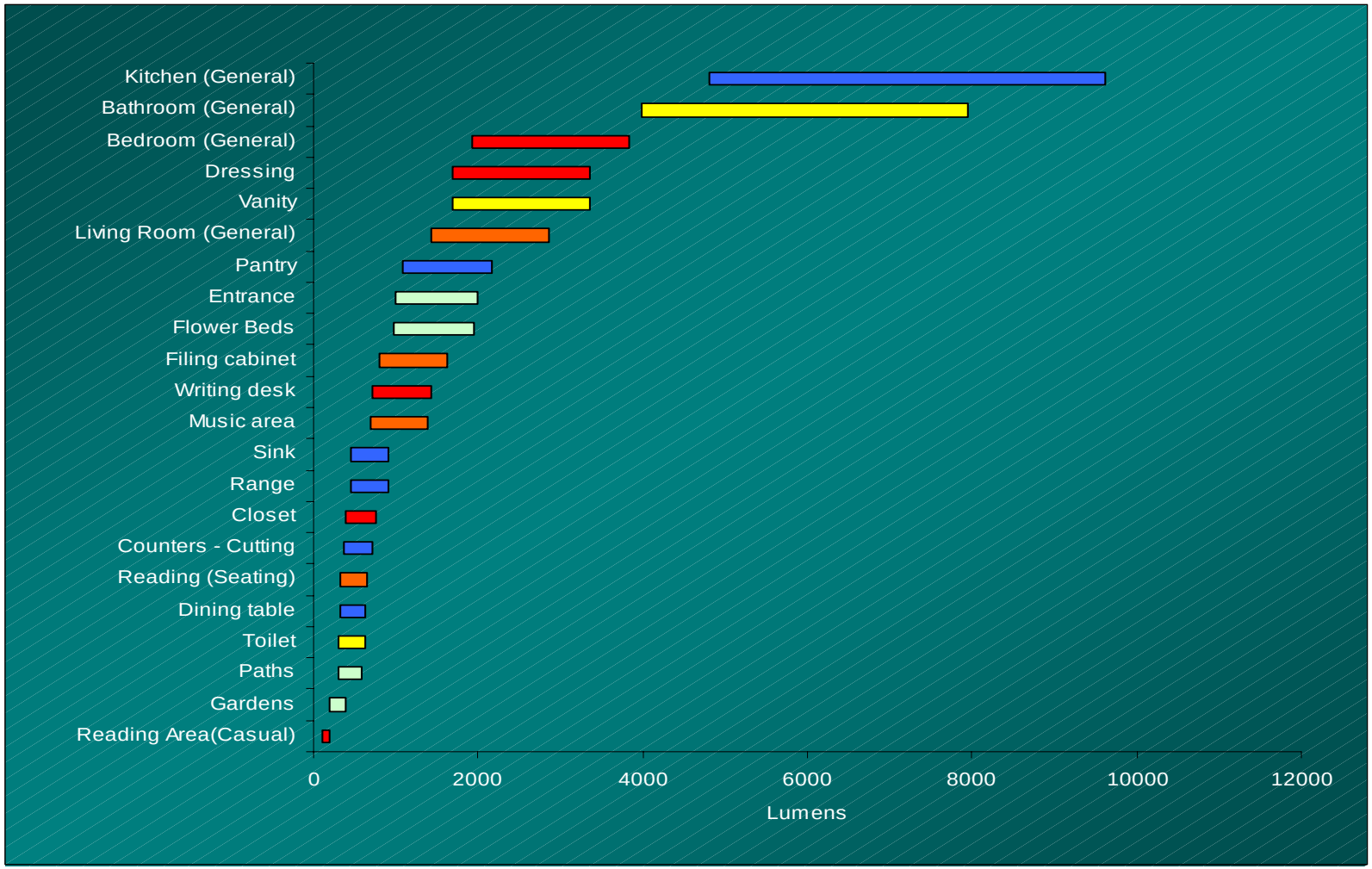
Tabulated information describing recommended lighting levels, assumed horizontal and/or vertical area, minimum required lumens for that area, and important design criteria.

Plan of space

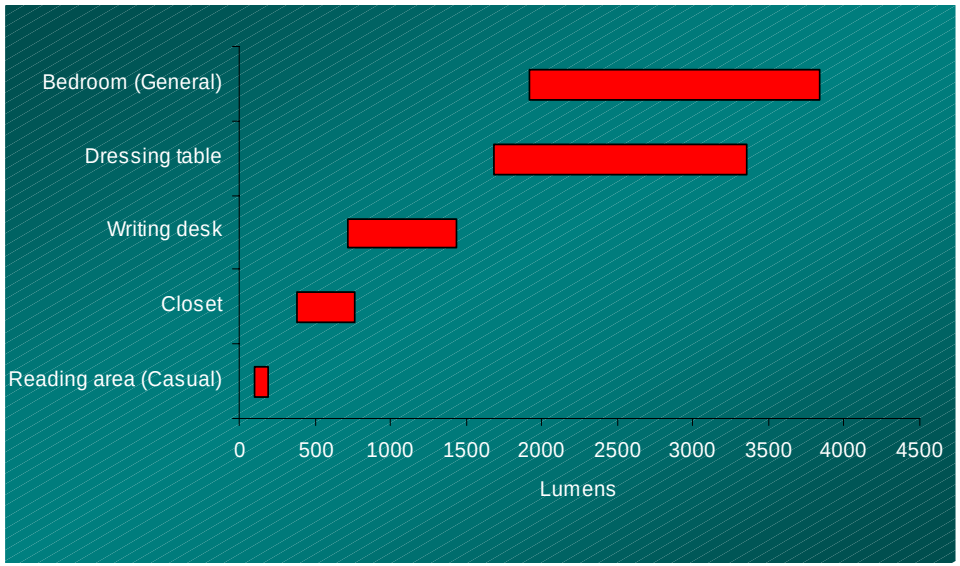
Color band relating to particular space

Residential Applications

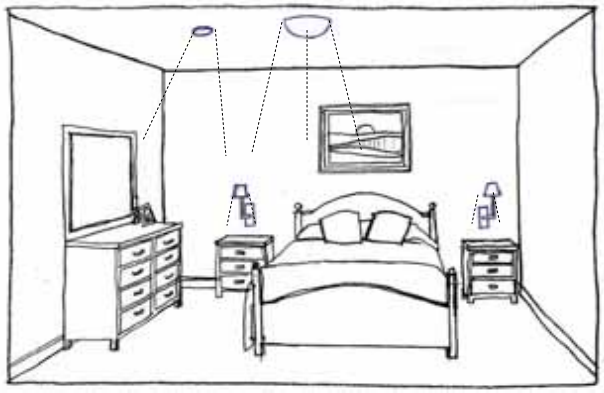
Residential – General Applications



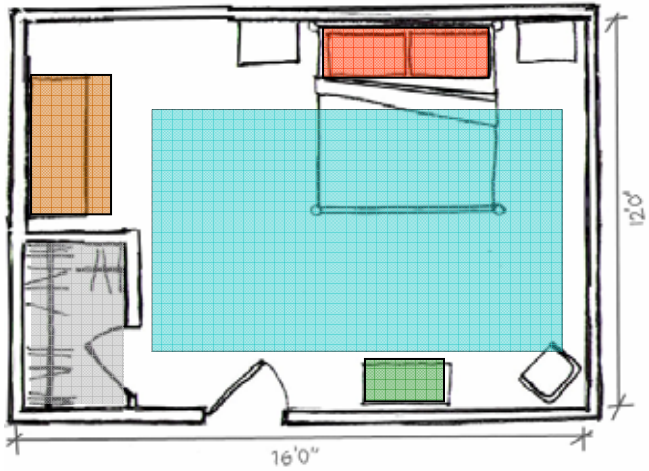
Residential – Bedroom



Typical Application



Task Areas

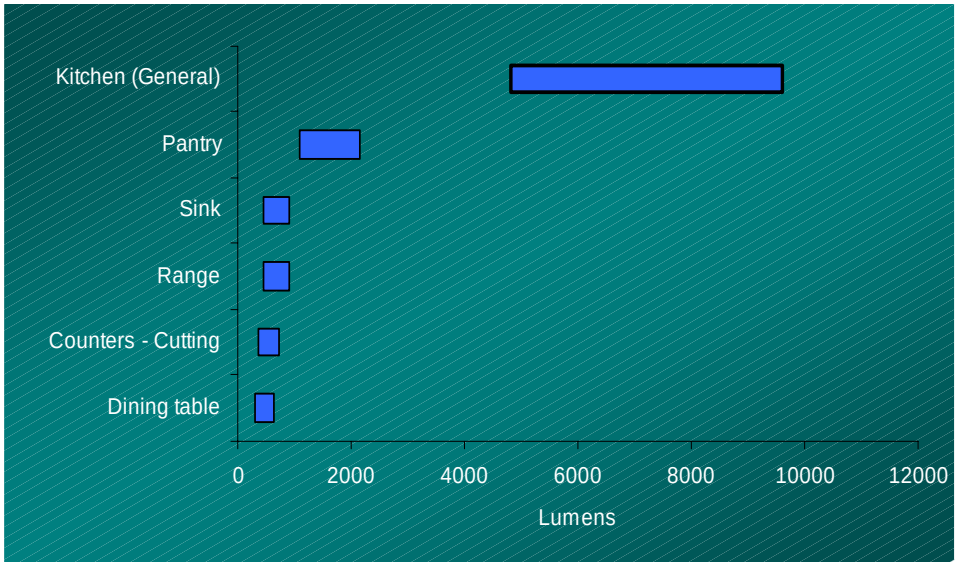


Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Reading	2	6	30	5	98	yes
Closet	15	102	5	3	381	
Writing	24	0	30	3	720	yes
Dressing	32	144	30	5	1680	
Bedroom (Gen)	192	308	10	NA	1920	yes

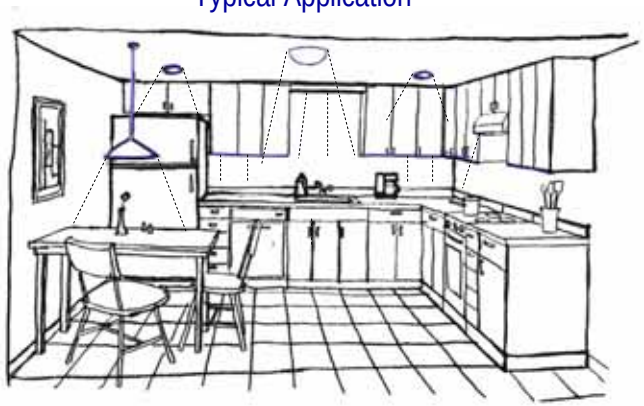
Recommended: CRI > 80 CCT 2800-3500K

All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

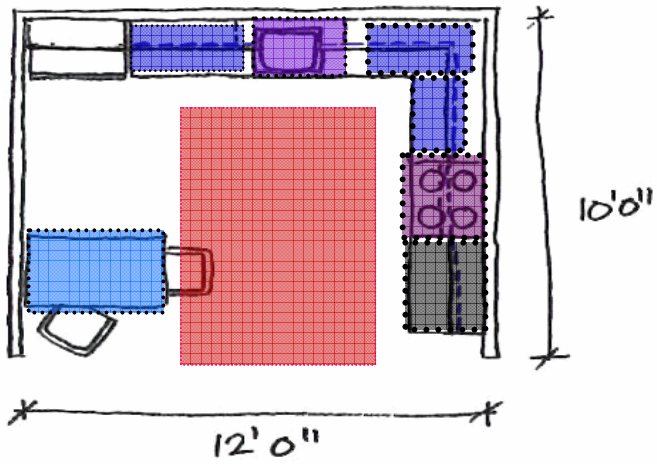
Residential – Kitchen



Typical Application



Task Areas

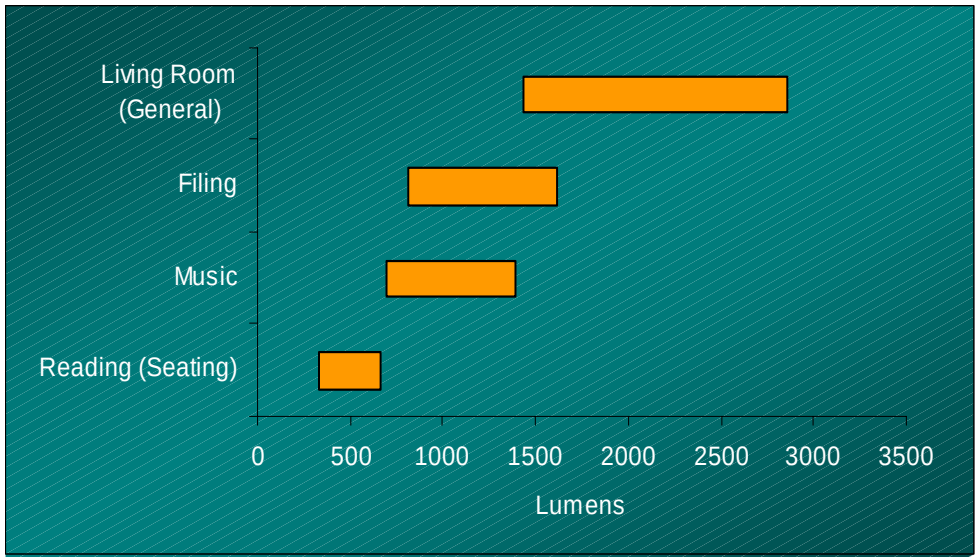


Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Dining table	63	64	5	NA	315	yes
Counters - Cutting	4.5	13.5	50	10	360	
Range	6	15	50	10	450	
Sink	6	15	50	10	450	
Pantry	24	120	30	3	1080	
Kitchen (General)	120	242	30	5	4810	yes

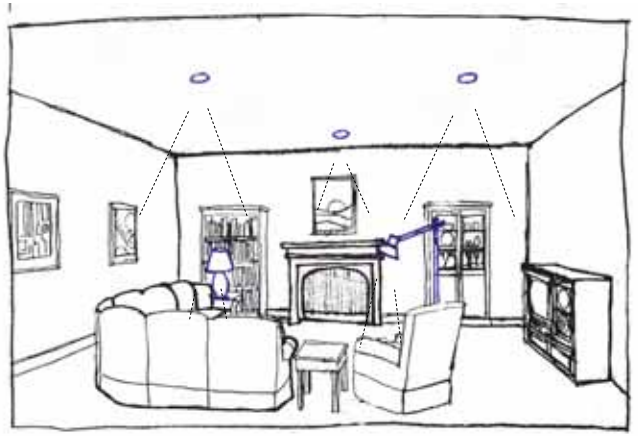
Recommended: CRI > 80 CCT 2800-3500K

All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

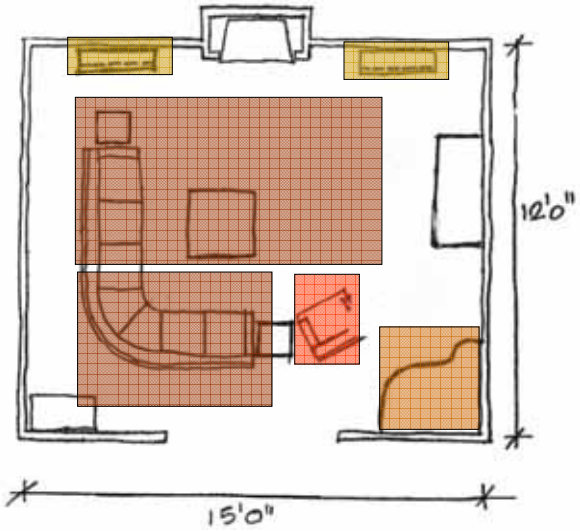
Residential – Living Room



Typical Application



Task Areas

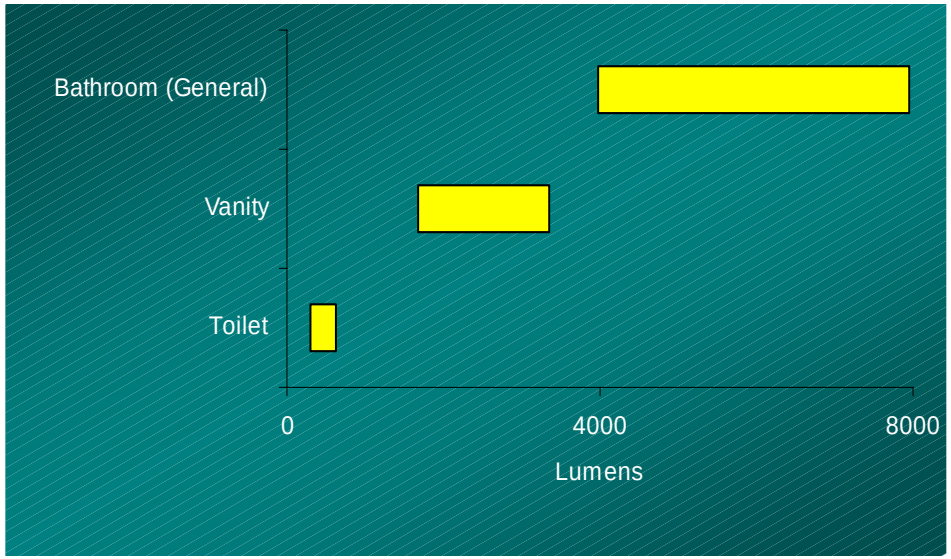


Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Reading (Seating)	9	12	30	5	330	yes
Music	12	32	50	3	696	
Filing	9	36	50	10	810	
Living Room (General)	180	297	3	3	1430	yes

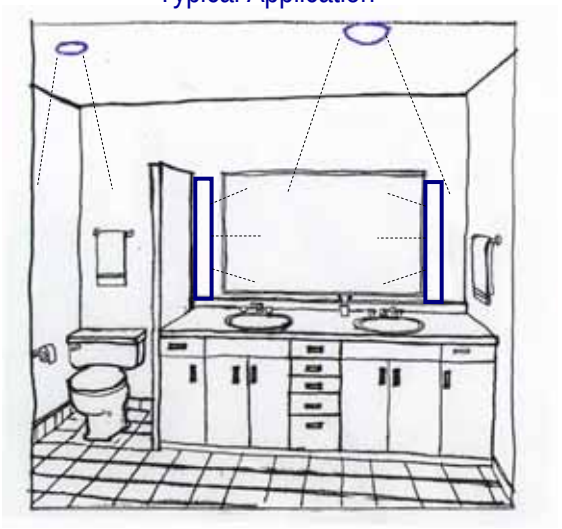
Recommended: CRI > 80 CCT 2800-3500

All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

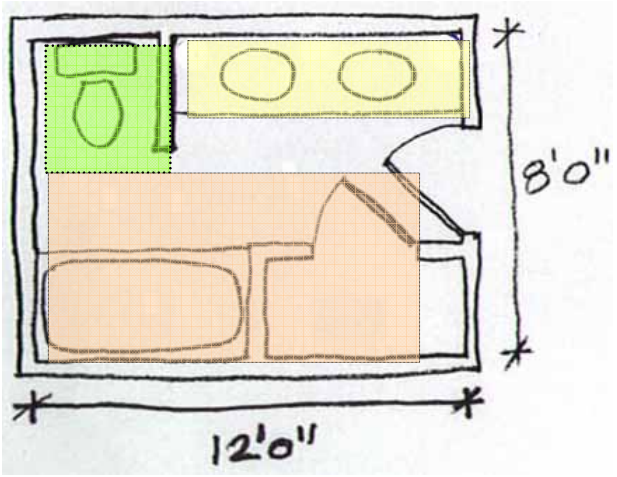
Residential – Bathroom



Typical Application



Task Areas

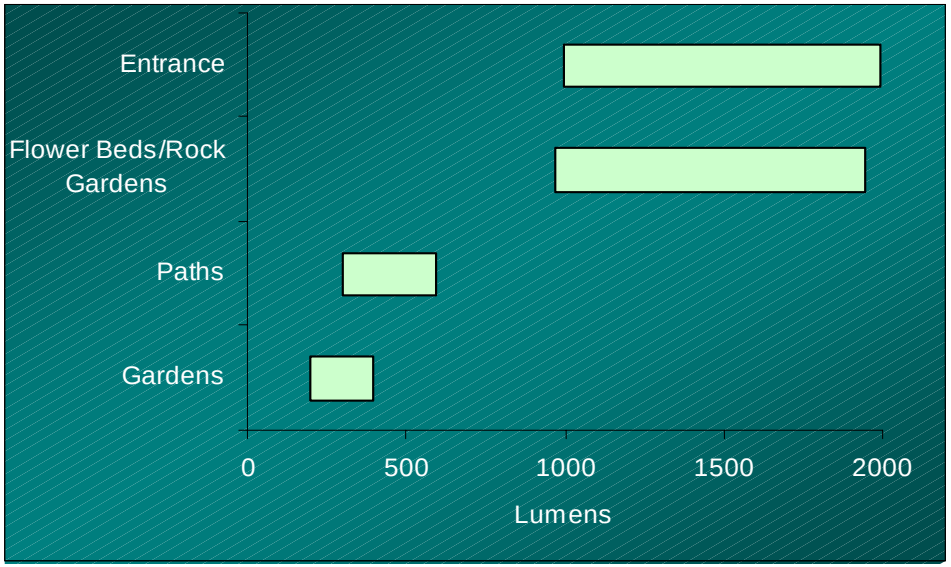


Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Toilet	10	3	25	20	45	
Vanity	30	5	32	144	1680	yes
Bathroom (General)	96	220	30	5	3980	

Recommended: CRI > 80 CCT 2800-3500K

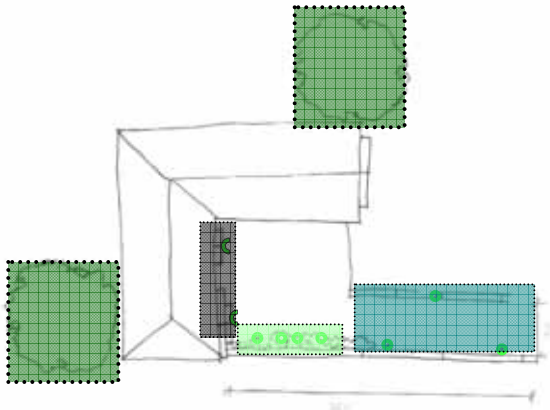
All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

Residential – Exterior



Typical Application

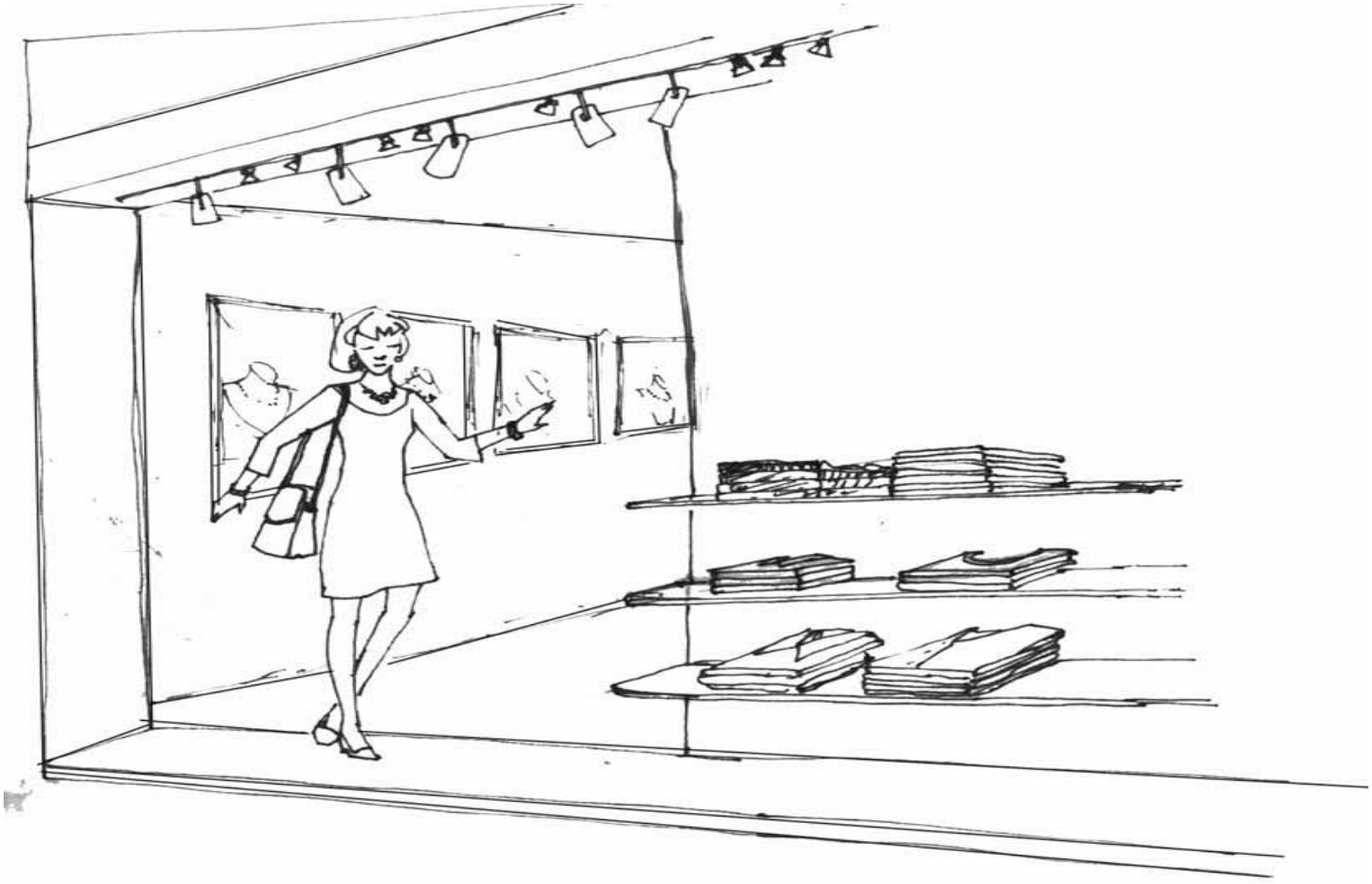
Task Areas



Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Gardens	300	792	0.5	0.2	198	
Entrance	48	3984	5	3	996	
Paths	200	1189	1	0.3	297	
Flower Beds	144	3888	3	3	972	

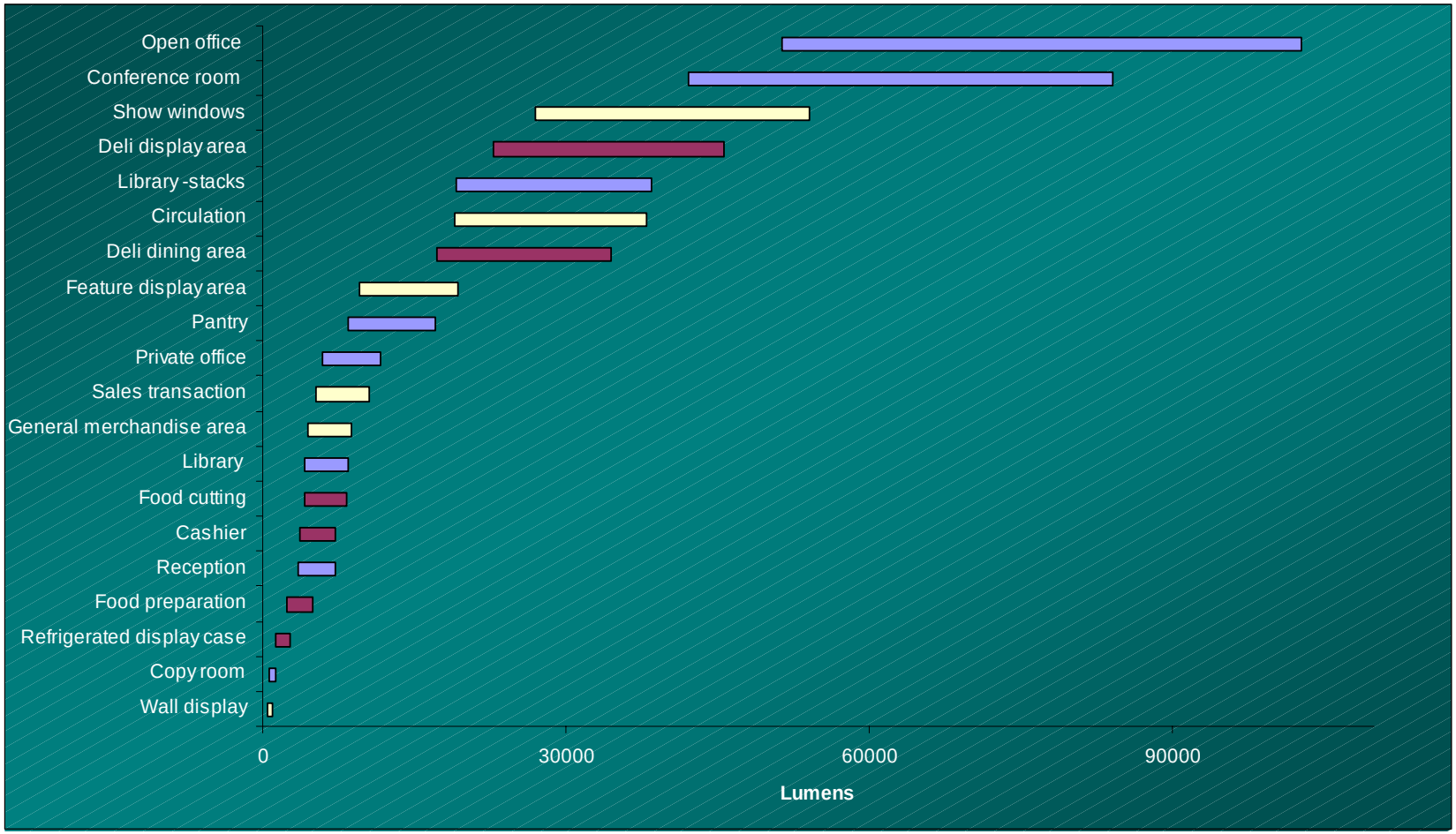
Recommended: CRI > 75 CCT 2800-3500K

All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

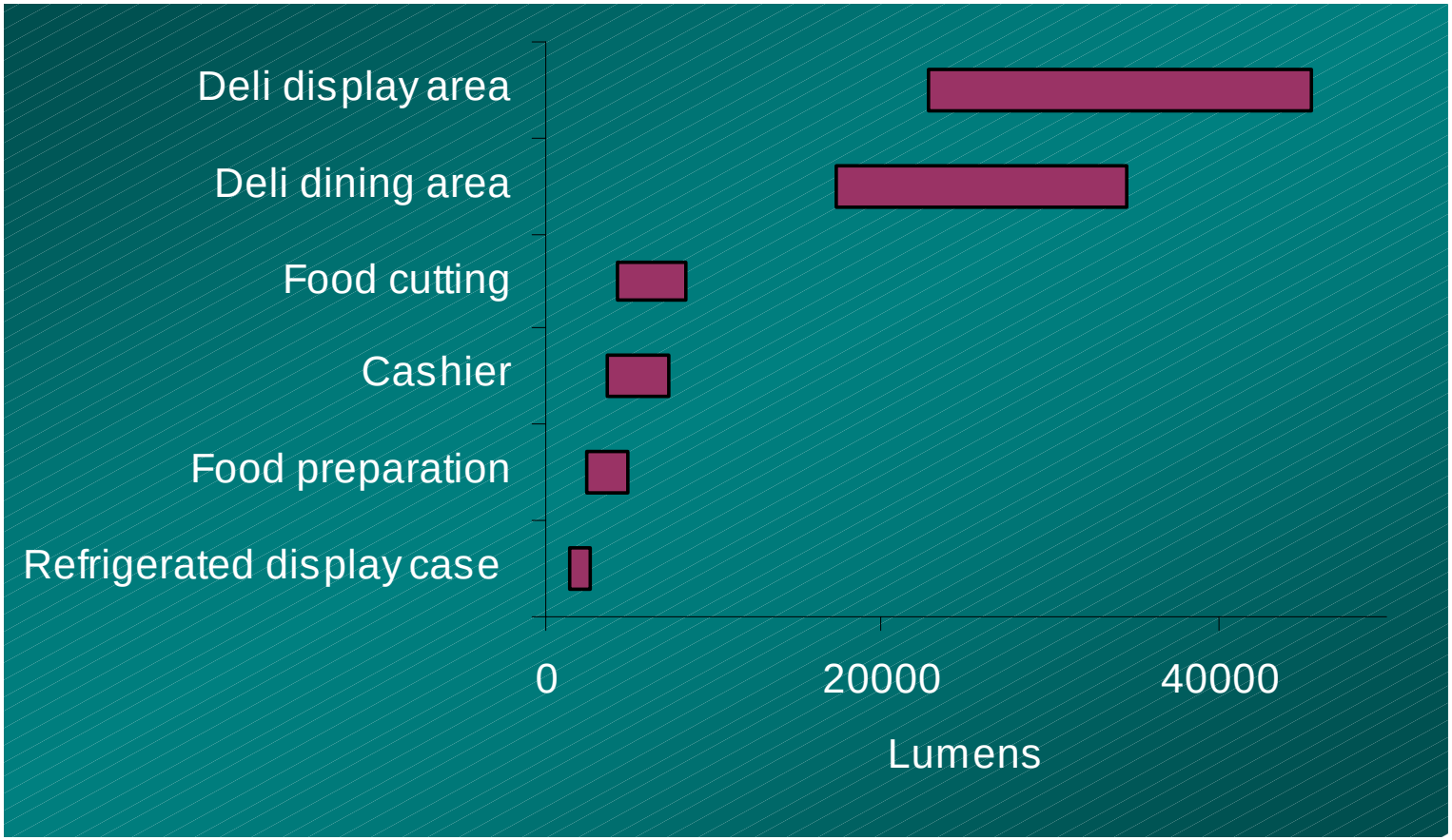


Commercial Applications

Commercial – General Applications

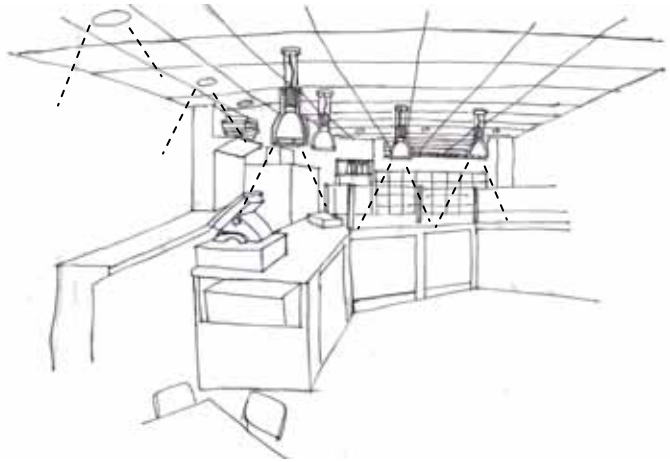


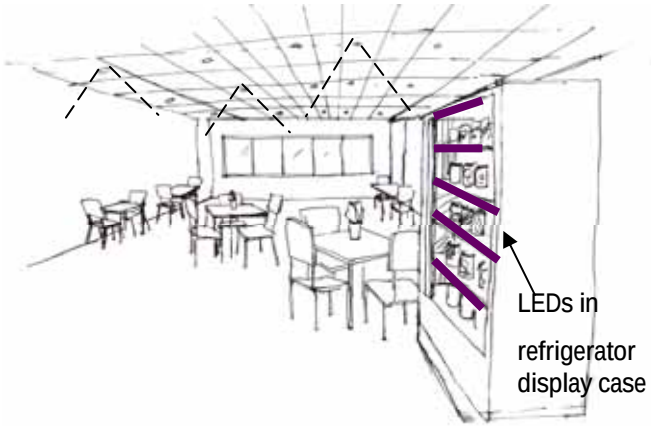
Commercial – Restaurant



Commercial – Restaurant: Deli Displays & Dining

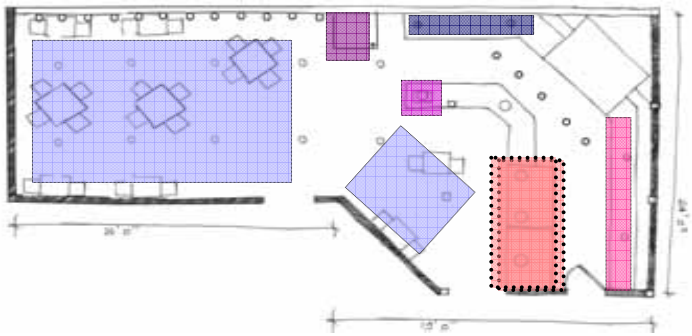
Typical Applications





Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Deli Display	456	774	50	NA	22800	yes
Deli Dining Area	546	282	30	3	17226	yes
Food Cutting	70	68	50	10	4180	
Food Preparation	70	68	30	5	2440	
Cashier	112	88	30	3	3624	
Refrigerated Display Case	4	32	NA	50	1600	

Task Areas

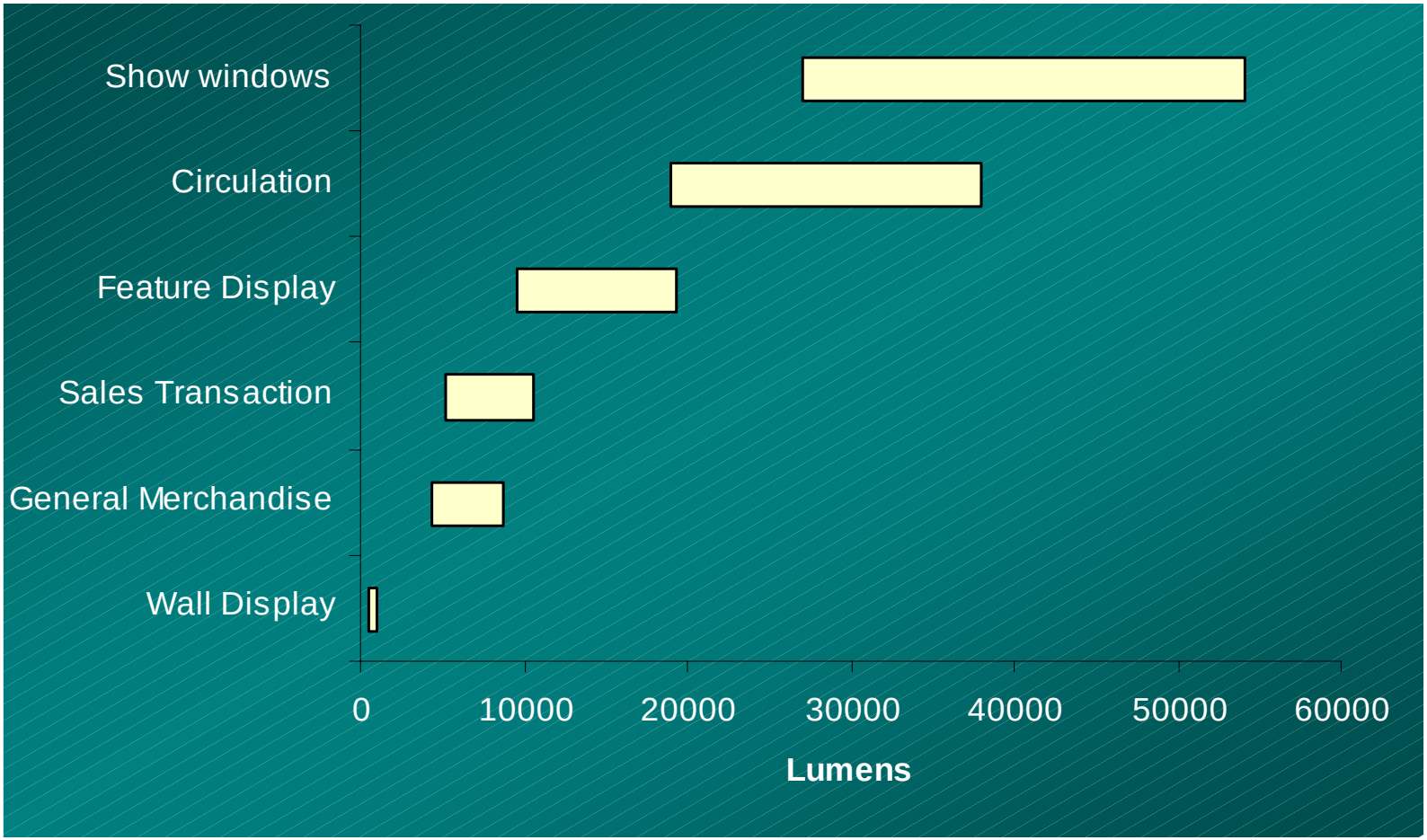


Recommended: CRI > 80 CCT 2800-3500K

CRI > 80 CCT 5300-6500K for Refrig. Display Case

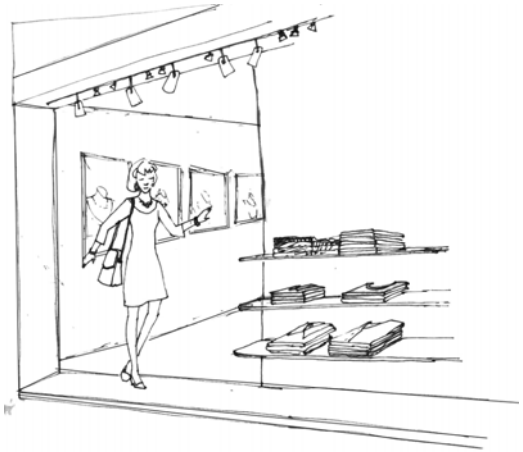
All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

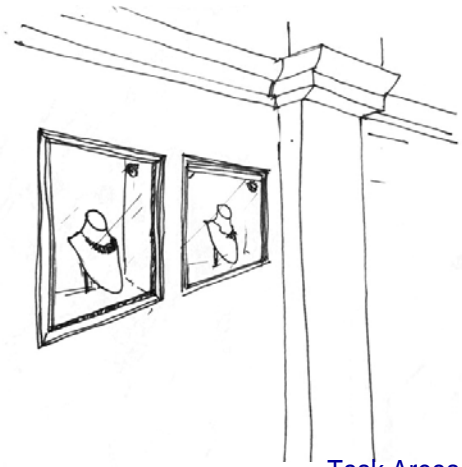
Commercial – Retail Store



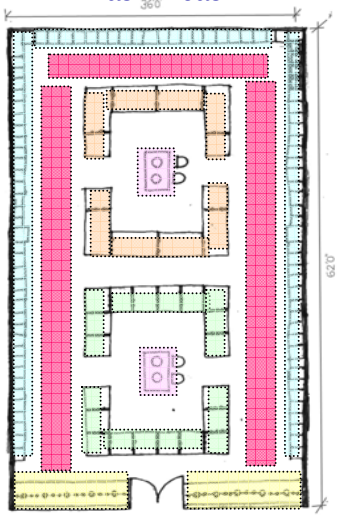
Commercial – Retail Store: Displays & Show Windows

Typical Applications





Task Areas

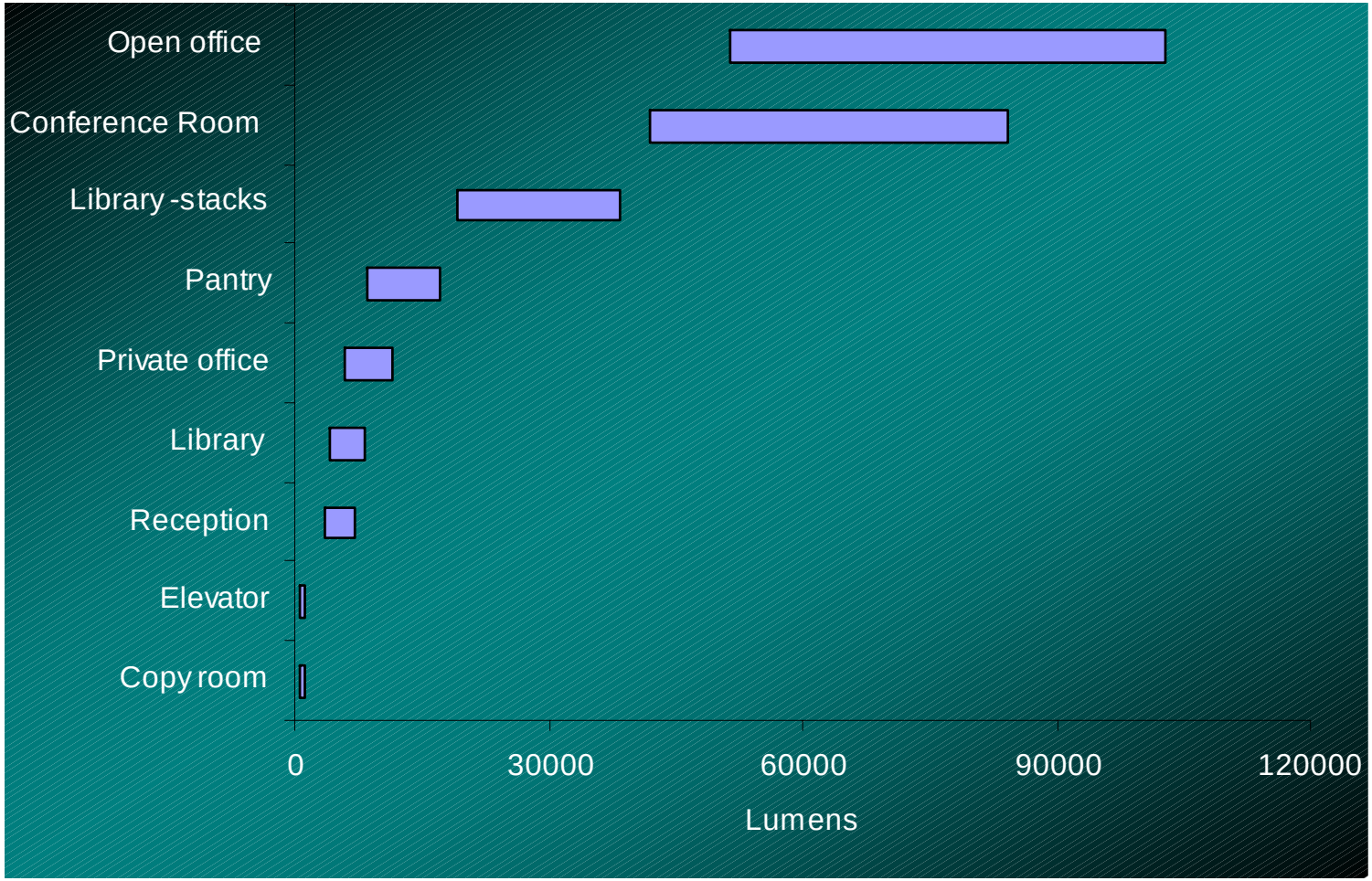


Task Area	Horiz Area (ft^2)	Vert Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Sales Transaction	176	10	30	NA	5280	
Circulation	1898	10	10	NA	18975	
Display - Jewelry	72	2	100	30	9630	
Handbags/Gift items	72	2	50	10	4410	
Wall Display	2	2	100	30	496	
Show windows	44	8	300	50	27050	yes

Recommended: CRI > 80 CCT 2800-3500K

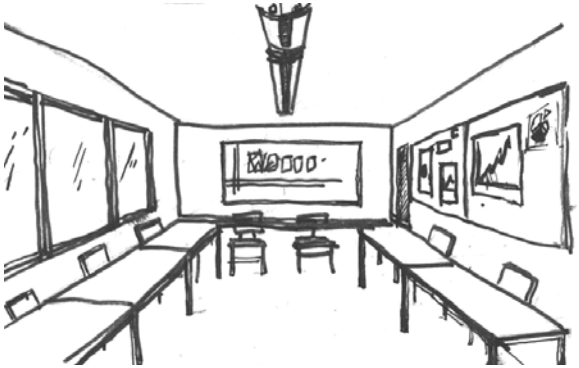
All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

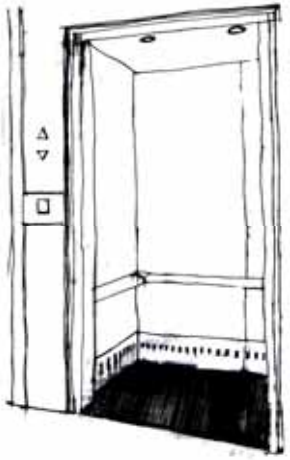
Commercial – Office



Commercial – Office Spaces

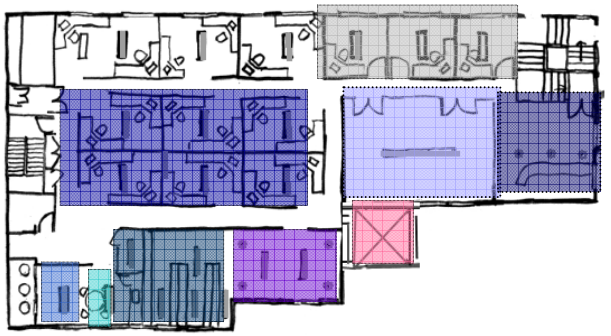
Typical Applications





Task Area	Horiz Area (ft2)	Vertical Area (ft^2)	Horizontal (fc)	Vertical (fc)	Min Lumens	Dimming
Reception	228	434	10	3	3582	yes
Private Office-Intensive VDT Use	90	266	50	5	5830	yes
Open Office-Intensive VDT Use	1530	1106	30	5	51430	yes
Conference Room-Video	464	630	50	30	42100	yes
Library Book Stacks	252	640	0	30	19200	yes
Library Reading Area	140	96	30	0	4200	yes
Pantry	224	600	30	3	8520	
Elevator	25	180	5	3	665	
Copy Room	24	140	10	3	660	

Task Areas



Recommended: CRI > 80 CCT 2800-3500K

All minimum lumen values are a product of IES recommended illuminance level values and the horizontal and vertical task areas

Conclusion

Although an LED lighting solution may not be practical for the overall application at the present time, it may be an excellent choice for a portion of the application. Compared to traditional light sources, for example, LEDs may provide a better lighting solution for areas such as elevators, refrigerated display cases, and jewelry displays.

NOTE:
This document does not cover all possible lighting applications within residential and commercial sectors. However, those selected and described here can be used to infer the lighting requirements for other similar applications.

Lighting Application Guidelines

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