

Public Testimony on Interior Lighting Power Allowances: C405.2

12 June 2019

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I urge the SBCC to adopt space-by-space lighting power allowances no higher than the 90.1-2019 lighting power allowances. ASHRAE 90.1 is the national standard and is the product of conservative detailed analysis and public review. It is recommended that lighting levels be taken from the published 90.1-2019 which will be available in October 2019. If timing does not allow waiting until October then allowances from the most recently proposed 90.1 addenda should be adopted. By limiting the WSEC to values no higher than 90.1-2019 we ensure that the WSEC, enforced from July 2020 to July 2023, is not behind 90.1-2019 which will be published in October 2019 and whose values will likely be adopted by the 2021 IECC.

The current options 1-3 are based upon the first draft values proposed for 90.1-2019 which the proposers then modified. Option 1 increased 21 category allowances and decrease 7 category allowances decreased from the original 90.1 addendum. Option 1 reduces average lighting power 1.6% from the WSEC 2015 code versus the 3.8% that the un-amended integrated draft represented.

Since that time the 90.1 lighting subcommittee has published two successive drafts of proposed space-by-space allowances based upon public comment of previous iteration and further analysis. Each round reduced allowances in several categories and increased them in one or two. With two rounds of public review completed and another 6 months of analysis by the 90.1 lighting subcommittee I have much greater confidence in the proposed 90.1 values and think they should be adopted in full with no increased allowances. The 90.1 addendum bb 3rd public release allowances represent a 10.9% reduction in floor area weighted average lighting power from WSEC 2015 vs 1.6% for Option 1. Option 1 will be 9.3% less stringent than the national standard at the beginning of the code cycle and the national standard will see an additional revision with 90.1-2022, midway in the code cycle. A 10.9% increase in efficiency is a conservative increment step in response to 4 years of LED lighting improvements.

Attached at the end of this comment is the current allowance table with the addendum 3rd public review values inserted as Option 4.

Specific Comments on Options 1, 2, and 3

- Footnotes m through r should be removed. They increase lighting allowance budgets up to 30% in spaces representing 24% of total floor area and introduce unneeded complexity to compliance verification. Looking at enclosed offices < 250sf the proposed values for options 1 and 2 are 1% lower than current code but have an extra 20% allowance added for furniture lighting. Note that ASHRAE 90.1 specifically includes task lighting in their allowance budgets already. Additionally these footnotes are included for all three options but were not present in the minority reports nor discussed in the TAG process for options 1 and 3.
- Extra allowances for decorative and/or accent lighting have the potential to increase installed lighting power in all cases including adopting 90.1-2019 values. This will reduce savings from the already small step these options represent and will force code official to arbitrate what constitutes a decorative or accent light.
- The review document has a new lighting category "Parking Facility, dedicated ramp" that does not appear in any of the minority reports or in 90.1. This category represents a 66% increase in lighting power over WSEC 2015 in parking structures and it should not be included. The current code covers parking garages including parking spots and driving areas. This new category introduces confusion in that some may apply it to the whole parking facility if the facility has a dedicated ramp anywhere. It is further ambiguous in that most drive areas in garages are dedicated even as they pass between parking spots. I would delete this category. If it stays at least make it clear what it applies to. 90.1 uses the term "ramps without parking" to exempt some areas from parking controls. I'm not sure whether this is the area intended to be covered by this new category but if it is, then the category should be changed to the ASHRAE language.
- Atrium titles: The atrium space titles state the allowances are "per foot" but the allowances for options 1 and 3 are the total allowance. Remove "(per foot)" from the title and make per foot part of the option 2 allowance.
- Atrium titles: "First 40 feet in height" should be revised to "40 feet or less in height" to clarify that it does not apply in any way to atriums over 40 feet.
- Atrium titles: "Above 40 feet in height" should be revised to "more than 40 feet in height" to clarify that it is the sole allowance for atriums over 40 feet in height.
- The engine bay category, proposed as part of option 1, and included in options 2 and 3 in the review document, conflicts with the existing specific allowance for Emergency Vehicle Garage. At a minimum the two categories should have the same allowance.

Revised Average Lighting Power Reductions

The average lighting power reduction of each option and the 90.1 proposals are summarized in the table below. These are calculated with the same spreadsheet used during the TAG process but subsequently an error in the space assignments was found. The error has been corrected and the corrected average reduction for options 1 through 3 shown here. The individual space allowances are weighted by the estimated amount of floor area represented by each category. The floor area estimate results from combining building type floor area forecast information from the Northwest Power Planning and Conservation Council with space type distribution information from the IES/ASHRAE worksheets.

| Proposal | Average LPA Reduction ¹ |
|---|------------------------------------|
| Integrated draft | 3.8% |
| Option 1 | 1.6% ² |
| Option 2 | 9.4% ² |
| Option 3 | 8.4% ² |
| ASHRAE 90.1 addendum bb 1 st PR Draft | 3.5% |
| ASHRAE 90.1 addendum bb 2 nd PR Draft | 6.2% |
| ASHRAE 90.1 addendum 3 rd PR Draft (Proposed Option 4) | 10.9% |

1 - These do not include the impact of footnotes m-r. The footnotes impact several very common space types and will noticeably reduce LPD savings.

2 - Average reduction differs from minority report due to space assignment error in original spreadsheet used during the TAG process. These are corrected values. New footnotes m through r have not been accounted for and would decrease the average reduction significantly for these options.

Proposed Space-by-space Lighting Power Allowances – New Option 4 (taken from 90.1 addendum bb 3rd public review document. Does not include suggested changes to options 1, 2 and 3 discussed in “Specific Comments on Options 1, 2, and 3” discussed above)

TABLE C405.4.2(2)

INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

| COMMON SPACE-BY-SPACE TYPES ^a | LPD ^d (w/ft ²) | LPD ^d (w/ft ²) Option 1 | LPD ^d (w/ft ²) Option 2 | LPD ^d (w/ft ²) Option 3 | LPD (w/ft ²) Option 4 |
|---|---------------------------------------|---|---|---|--------------------------------------|
| Atrium - First 40 feet in height ^e (per foot) | 0.02 per ft. ht. | 0.48 | 0.02 | 0.48 | |
| Atrium – less than 20 feet in height | | | | | 0.39 |
| Atrium – 20 to 40 feet in height | | | | | 0.48 |
| Atrium - Above 40 feet in height ^e (per foot) | 0.3 + 0.02 per ft. in total ht. | 0.70 | 0.02 | 0.70 | 0.60 |
| Audience/seating area - Permanent | | | | | |
| In an auditorium | 0.50 | 0.61 | 0.61 | 0.61 | 0.61 |
| In a convention center | 0.66 | 0.65 | 0.25 | 0.25 | Deleted |
| In a gymnasium | 0.34 | 0.34 | 0.23 | 0.23 | 0.23 |
| In an motion picture theater | 0.91 | 0.82 | 0.27 | 0.27 | 0.27 |
| In a penitentiary | 0.22 | 0.67 | 0.44 | 0.67 | 0.67 |
| In an performing arts theater | 1.94 | 1.06 | 1.06 | 1.06 | 1.16 |
| In a religious building | 1.22 | 1.22 | 0.72 | 0.72 | 0.72 |
| In a sports arena | 0.34 | 0.33 | 0.33 | 0.33 | 0.33 |
| Otherwise | 0.34 | 0.23 | 0.23 | 0.23 | 0.23 |
| Banking activity area | 0.81 | 0.79 | 0.61 | 0.61 | 0.61 |
| Beauty salon, barber area | | 1.00 | 1.00 | 1.00 | 1.00 |
| Breakroom (see Lounge/breakroom) | | | | | |
| Classroom/lecture/training | | | | | |
| In a penitentiary | 1.07 | 1.38 | 1.07 | 1.38 | 0.89 |

Comment [BK(2)]: Jonlin MR

Comment [BK(3)]: Baylon MR

Comment [BK(1)]: EL119-2018

Comment [MK4]: ASHRAE 90.1 addendum bb 3rd Public Review

Comment [MK5]: Category not in 90.1 but seems like a good addition

| | | | | | |
|--|-----------------------------|------------------------------|------------------------------|------------------------------|--------------------|
| Otherwise | 1.00 <u>0.96</u> | 0.84 ^h | 0.84 ^m | 0.74 ^m | 0.71 |
| Computer room, <u>data center</u> | 1.37 <u>1.33</u> | 1.33 | 1.00 | 1.00 | 0.94 |
| Conference/meeting/multipurpose | 0.98 | 0.97 | 0.97 | 0.97 | 0.97 |
| <u>Confinement cell</u> | | 0.70 | 0.70 | 0.70 | 0.70 |
| Copy/print room | 0.58 <u>0.56</u> | 0.70 | 0.50 | 0.31 | 0.31 |
| Corridor | | | | | |
| In a facility for the visually impaired (and not used primarily by the staff) ^b | 0.74 | 0.71 | 0.71 | 0.71 | 0.71 |
| In a hospital | 0.63 | 0.71 | 0.63 | 0.71 | 0.71 |
| In a manufacturing facility | 0.33 <u>0.29</u> | 0.41 | 0.29 | 0.41 | Deleted |
| Otherwise | 0.53 | 0.41 | 0.41 | 0.41 | 0.41 |
| Courtroom | 1.38 | 1.25 | 1.25 | 1.25 | 1.20 |
| Dining area | | | | | |
| In a penitentiary | 0.77 | 0.42 | 0.42 | 0.42 | 0.42 |
| In a facility for the visually impaired (and not used primarily by the staff) ^b | 1.52 | 1.38 | 1.38 | 1.38 | 1.27 |
| In a bar/lounge or leisure dining | 0.86 | 0.86 ^h | 0.86 ⁿ | 0.86 ⁿ | 0.86 |
| <u>In cafeteria or fast food dining</u> | | 0.63 | 0.40 | 0.40 | 0.40 |
| In a family dining area | 0.71 | 0.71 ^h | 0.60 ⁿ | 0.60 ⁿ | 0.60 |
| Otherwise | 0.52 | 0.52 | 0.43 | 0.43 | 0.43 |
| Electrical/mechanical | 0.76 <u>0.43</u> | 0.42 | 0.42 | 0.42 | 0.43 |
| Emergency vehicle garage | 0.45 <u>0.41</u> | 0.52 | 0.41 | 0.52 | 0.52 |
| Food preparation | 0.79 | 1.29 | 0.92 | 1.29 | 1.09 |
| Guest room ^{g,h} | 0.38 | 0.41 | 0.41 | 0.41 | 0.41 |
| Laboratory | | | | | |
| In or as a classrooms | 1.02 | 1.17 | 1.02 | 1.17 | 1.11 |
| Otherwise | 1.45 | 1.70 ^h | 1.45 ^o | 1.70 ^o | 1.33 |
| Laundry/washing area | 0.48 <u>0.43</u> | 0.59 | 0.43 | 0.59 | 0.53 |
| Loading dock, interior | 0.38 | 0.38 | 0.38 | 0.38 | 0.88 |
| Lobby ^c | | | | | |
| In a facility for the visually impaired (and not used primarily by the staff) ^b | 1.44 | 2.49 | 1.44 | 2.49 | 1.69 |
| For an elevator | 0.51 | 0.71 | 0.51 | 0.71 | 0.65 |
| In a hotel | 0.85 | 0.51 | 0.51 | 0.51 | 0.51 |
| In a motion picture theater | 0.42 | 0.23 | 0.23 | 0.23 | 0.23 |
| In a performing arts theater | 1.60 | 1.25 | 1.25 | 1.25 | 1.25 |
| Otherwise | 0.72 | 1.11 | 0.72 | 1.11 | 0.84 |
| Locker room | 0.60 <u>0.48</u> | 0.52 | 0.86 | 0.52 | 0.52 |
| Lounge /breakroom | | | | | |
| <u>In a health care facility</u> | 0.74 | | | 0.42 | 0.42 |
| Otherwise | 0.58 | | | 0.59 | 0.59 |
| Office ^f | | | | | |

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| Enclosed < 250 | 0.89 | 0.88 ^h | 0.88 ^p | 0.70 ^p | 0.74 |
| Enclosed > 250 | | 0.79 ^h | 0.79 ^p | 0.70 ^p | 0.66 |
| Open plan | 0.78 | 0.67 ^h | 0.67 ^p | 0.60 ^p | 0.61 |
| Parking area, interior | 0.150.14 | 0.15 | 0.15 | 0.15 | 0.15 |
| Parking facility, dedicated ramp | | 0.25 | 0.25 | 0.25 | ----- |
| Pharmacy area | 0.91 | 1.90 | 1.23 | 1.90 | 1.66 |
| Restroom | | | | | |
| In a facility for the visually impaired (and not used primarily by the staff) ^b | 0.970.96 | 1.26 | 0.96 | 1.26 | 1.26 |
| Otherwise | 0.78 | 0.78 ^{h,d} | 0.75 ^{q,r} | 0.63 ^{q,r} | 0.63 |
| Sales area | 1.271.22 | 1.12 | 1.12 | 1.04 | 1.05 |
| Sales area, grocery | | 1.05 | 1.05 | 1.05 | ----- |
| Seating area, general | 0.430.42 | 0.23 | 0.23 | 0.23 | 0.23 |
| Stairway (See space containing stairway) | | | | | |
| Stairwell | 0.55 | 0.55 ^{h,d} | 0.49 ^{q,r} | 0.49 ^{q,r} | 0.49 |
| Storage room | 0.500.46 | | | | |
| < 50 ft ² | | 0.40 | 0.40 | 0.40 | 0.51 |
| 50-100 ft ² | | 0.38 | 0.38 | 0.38 | 0.38 |
| All other storage | | 0.38 | 0.38 | 0.38 | 0.38 |
| Vehicular maintenance | 0.54 | 0.60 | 0.54 | 0.60 | 0.60 |
| Workshop | 1.271.14 | 1.26 | 1.14 | 1.26 | 1.26 |

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BUILDING SPECIFIC SPACE-BY-SPACE TYPES

| BUILDING SPECIFIC SPACE-BY-SPACE TYPES ^a | LPD ^d (w/ft ²) | LPD ^d (w/ft ²) Option 1 | LPD ^d (w/ft ²) Option 2 | LPD ^d (w/ft ²) Option 3 | LPD (w/ft ²) Option 4 |
|---|---------------------------------------|---|---|---|--------------------------------------|
| Automotive (see Vehicular maintenance, above) | | 0.60 | 0.54 | 0.60 | 0.60 |
| Convention center - Exhibit space | 1.160.88 | 0.50 | 0.50 | 0.50 | 0.61 |
| Dormitory living quarters ^{g,h} | 0.30 | 0.84 | 0.46 | 0.46 | 0.50 |
| Facility for the visually impaired ^b | | | | | |
| In a chapel (and not used primarily by the staff) ^b | 1.771.06 | 0.70 | 0.70 | 0.70 | 0.70 |
| In a recreation room (and not used primarily by the staff) ^b | 1.931.80 | 1.77 | 1.77 | 1.77 | 1.77 |
| Fire stations ^e | | | | | |
| Engine rooms | 0.45 | 0.45 | 0.45 | 0.45 | 0.52 |
| Sleeping quarters | 0.18 | 0.20 | 0.18 | 0.20 | 0.23 |
| Gymnasium/fitness center | | | | | |
| In an exercise area | 0.580.50 | 0.90 | 0.50 | 0.90 | 0.90 |

- Comment [BK(17)]: EL119-2018
- Comment [BK(18)]: Jonlin MR
- Comment [BK(19)]: Baylon MR
- Comment [MK(20)]: Category is not in 90.1.1. This is value from emergency vehicle garage category

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|-------------------|-----------------------------|-------------|-------------|-------------|-------------|
| In a playing area | 0.96 <u>0.82</u> | <u>0.85</u> | <u>0.82</u> | <u>0.85</u> | <u>0.85</u> |
|-------------------|-----------------------------|-------------|-------------|-------------|-------------|

BUILDING SPECIFIC SPACE-BY-SPACE TYPES--Continued

| BUILDING SPECIFIC SPACE-BY-SPACE TYPES ^a | LPD ^d (w/ft ²) | LPD ^d (w/ft ²) Option 1 | LPD ^d (w/ft ²) Option 2 | LPD ^d (w/ft ²) Option 3 | LPD (w/ft ²) Option 4 |
|---|---------------------------------------|---|---|---|--------------------------------------|
| Health care facility | | | | | |
| In an exam/treatment room | 1.33 | <u>1.40</u> | <u>1.33</u> | <u>1.40</u> | <u>1.40</u> |
| In an imaging room | 1.06 | <u>0.85</u> | <u>0.85</u> | <u>0.85</u> | <u>0.94</u> |
| In a medical supply room | 0.59 <u>0.54</u> | <u>0.62</u> | <u>0.54</u> | <u>0.62</u> | <u>0.62</u> |
| In a nursery | 0.70 | <u>1.37</u> | <u>0.94</u> | <u>1.37</u> | <u>0.92</u> |
| In a nurse's station | 0.57 | <u>1.11</u> | <u>0.75</u> | <u>1.11</u> | <u>1.17</u> |
| In an operating room | 1.51 | <u>2.26</u> | <u>1.90</u> | <u>2.26</u> | <u>2.26</u> |
| In a patient room ^g | 0.50 | <u>1.15</u> | <u>0.68</u> | <u>0.68</u> | <u>0.68</u> |
| In a physical therapy room | 0.73 | <u>0.91</u> | <u>0.85</u> | <u>0.91</u> | <u>0.91</u> |
| In a recovery room | 0.92 | <u>1.25</u> | <u>0.92</u> | <u>1.25</u> | <u>1.25</u> |
| Library ^f | | | | | |
| In a reading area | <u>0.74</u> | <u>0.96</u> | <u>0.80</u> | <u>0.96</u> | <u>0.96</u> |
| In the stacks | 1.37 <u>1.20</u> | <u>1.16</u> | <u>1.16</u> | <u>1.16</u> | <u>1.18</u> |
| Manufacturing facility | | | | | |
| In a detailed manufacturing area | 1.03 <u>0.93</u> | <u>0.80</u> | <u>0.80</u> | <u>0.80</u> | <u>0.80</u> |
| In an equipment room | 0.59 | <u>0.76</u> | <u>0.65</u> | <u>0.76</u> | <u>0.76</u> |
| In an extra high bay area (> 50-foot floor-ceiling height) | <u>0.84</u> | <u>1.42</u> | <u>0.84</u> | <u>1.42</u> | <u>1.42</u> |
| In a high bay area (25 - 50-foot floor-ceiling height) | 0.98 <u>0.75</u> | <u>1.24</u> | <u>0.75</u> | <u>1.24</u> | <u>1.24</u> |
| In a low bay area (< 25-foot floor-ceiling height) | 0.95 | <u>0.86</u> | <u>0.86</u> | <u>0.86</u> | <u>0.86</u> |
| Museum | | | | | |
| In a general exhibition area | 0.84 | <u>0.84</u> | <u>0.31</u> | <u>0.31</u> | <u>0.31</u> |
| In a restoration room | 0.82 | <u>1.10</u> | <u>1.10</u> | <u>1.10</u> | <u>1.10</u> |
| Performing arts theater dressing/fitting room | 0.32 | <u>0.41</u> | <u>0.41</u> | <u>0.41</u> | <u>0.41</u> |
| Post office—Sorting area | 0.75 <u>0.68</u> | <u>0.76</u> | <u>0.68</u> | <u>0.76</u> | <u>0.76</u> |
| Religious building | | | | | |
| In a fellowship hall | 0.51 | <u>0.54</u> | <u>0.51</u> | <u>0.54</u> | <u>0.54</u> |
| In a worship pulpit/choir area | 1.22 | <u>0.85</u> | <u>0.85</u> | <u>0.84</u> | <u>0.85</u> |
| Retail | | | | | |
| In a dressing/fitting room | 0.57 <u>0.50</u> | <u>0.51</u> | <u>0.50</u> | <u>0.51</u> | <u>0.51</u> |
| In a mall concourse | 0.88 | <u>1.03</u> | <u>0.88</u> | <u>1.03</u> | <u>0.82</u> |
| Sports arena—Playing area | | | | | |
| For a Class 1 facility ^h | <u>2.41</u> | <u>2.94</u> | <u>2.41</u> | <u>2.94</u> | <u>2.94</u> |
| For a Class 2 facility ^h | 1.54 | <u>2.01</u> | <u>2.01</u> | <u>2.01</u> | <u>2.01</u> |
| For a Class 3 facility ^k | <u>0.96</u> | <u>1.30</u> | <u>0.96</u> | <u>1.30</u> | <u>1.30</u> |
| For a Class 4 facility ^l | 0.58 | <u>0.86</u> | <u>0.72</u> | <u>0.86</u> | <u>0.86</u> |

Comment [BK(21)]: EL119--2018

Comment [BK(22)]: Jonlin MR

Comment [BK(23)]: Baylon MR

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|--------------------------------------|---------------------------------|-------------|-------------|-------------|-------------|
| Transportation | | | | | |
| In a baggage/carousel area | 0.42 | <u>0.39</u> | <u>0.39</u> | <u>0.39</u> | <u>0.39</u> |
| In an airport concourse | 0.29 | <u>0.25</u> | <u>0.25</u> | <u>0.25</u> | <u>0.25</u> |
| At a terminal ticket counter | 0.64 0.62 | <u>0.51</u> | <u>0.51</u> | <u>0.51</u> | <u>0.51</u> |
| Warehouse—Storage area | | | | | |
| For medium to bulky palletized items | 0.46 0.35 | <u>0.33</u> | <u>0.33</u> | <u>0.33</u> | <u>0.33</u> |
| For smaller, hand-carried items | 0.76 0.69 | <u>0.69</u> | <u>0.69</u> | <u>0.69</u> | <u>0.69</u> |

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 11 W/m².

- a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply.
- b. A "Facility for the visually impaired" is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.
- c. For spaces in which lighting is specified to be installed in addition to, and controlled separately from, the general lighting for the purpose of highlighting art or exhibits, provided that the additional lighting power shall not exceed 0.5 W/ft² of such spaces.
- d. ~~The watts per square foot may be increased by 2 percent per foot of ceiling height above 20 feet, unless specifically directed otherwise by subsequent footnotes.~~ RESERVED.
- e. ~~Footnote d may not be used for these occupancy types.~~ RESERVED.
- f. ~~The watts per square foot may be increased by 2 percent per foot of ceiling height above 9 feet. Footnote d may not be used for these occupancy types.~~ RESERVED.
- g. Where sleeping units are excluded from lighting power calculations by application of Section R404.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.
- h. Where dwelling units are excluded from lighting power calculations by application of Section R404.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
- i. Class I facilities consist of professional facilities; and semi-professional, collegiate or club facilities with seating for 5,000 or more spectators.
- j. Class II facilities consist of collegiate and semi-professional facilities with seating for fewer than 5,000 spectators; club facilities with seating between 2,000 and 5,000 spectators; and amateur league and high school facilities with seating for more than 2,000 spectators.
- k. Class III facilities consist of club, amateur league and high school facilities with seating for 2,000 or fewer spectators.
- l. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high school facilities without provisions for spectators.
- m. For classrooms, additional lighting power allowance of 4.50 W/lineal foot of white or chalk boards for directional lighting dedicated to white or chalk boards.
- n. Additional lighting power allowance of 0.30 W/square foot for ornamental lighting. Qualifying ornamental lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.
- o. For scientific laboratories, additional lighting power allowance of 0.35 Watts per square foot for specialized task work — lighting that provides for small-scale, cognitive or fast performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical/laboratorial activities.
- p. For offices, additional lighting power allowance of 0.20 W/square foot for portable lighting, which includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.
- q. Additional lighting power allowance of 0.15 W/square foot for decorative lighting. Primary function shall be decorative and not to provide general lighting.
- r. Additional lighting power allowance of 0.20 W/square foot for accent, display and feature lighting -luminaires shall be adjustable or directional.

Comment [BK(24)]: EL119-2018

Comment [BK(25)]: EL121-2018

