



Application Workshop

Application

Light Source, Color Temperature and CRI

Design Technique

Luminaires

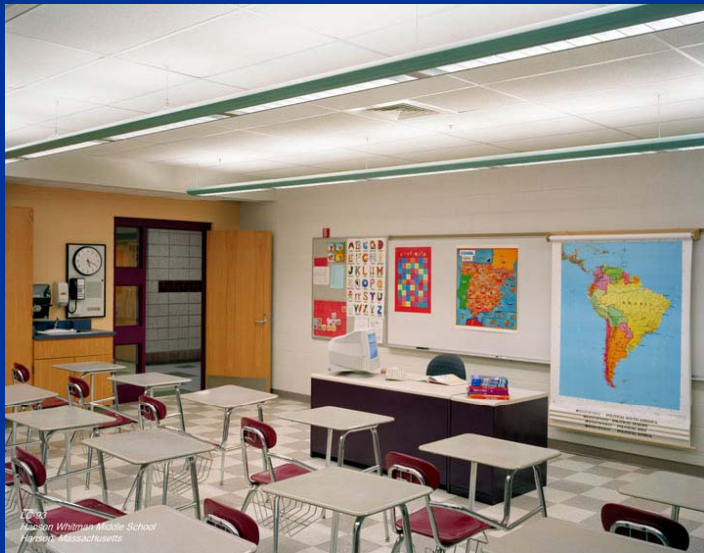
Controls



Presenter: Bob Henderson, LC, CLEP

1. School Classroom

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent; 4100K (3500K and 5000K opt); 85 CRI
- Uniform 50% Direct/50% Indirect preferred; Direct or Indirect OK
- Suspended Direct /Indirect Steel, Volumetric or ES Large Cell Parabolic or Suspended Steel Indirect
- Dual Occ/Vac Sensors



2. School Gymnasium

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent or Induction; 4100K (5000K opt); ≥ 80 CRI
- Direct
- T5HO or T8 w/HBF or Induction Hi-Bay
- Manual switch and Digital Timer for bi-level control



3. High School Computer Lab

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent; 4100K (5000K); 85 CRI
- Indirect or Direct
- T8 Steel Indirect - 95% up; 5% down light; Volumetric
- Dual Occ/Vac Sensor





4. Industrial General Space 40' MH – Dark Ceiling

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide; 4100K; ≥ 65 CRI; Consider Fluorescent T5HO and Induction
- Direct
- Industrial with aluminum reflector; $< 5\%$ up-light; Compare T5HO Ind. w/Hi-Temp Ballast and Amalgam Lamps or Induction
- Time Clock with override or Sweep with override; consider bi-level with sensor, manual timer or laser zone control.





5. Industrial General Space

30' MH - Medium Color Ceiling

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent, LED or Induction; 4100K (5000K to 6000K opt); ≥ 80 CRI
- Direct
- Industrial T5HO or T8 w/ HBF – both w/Hi-temp ballast; Consider LED Hi-Bay and Induction with Acrylic, Alum, or Glass Reflector - Refractor
- Time Clock with override or Sweep with override; consider bi-level with sensor, manual digital timer or laser zone control.





Industrial T5HO vs. Metal Halide



Compare the energy savings

	400W Metal Halide (probe start)	Four lamp, 54W, T5HO Fluorescent
Total system wattage	455	240
Initial Lamp Lumen output	35,000	17,600
Lamp Lumen output @ 60% of rated life (12,000 hrs.)	19,250	16,000
Lamp Lumen output @ rated life (20,000 hrs.)	14,700	15,840
Annual wattage used per fixture	1183 kw	624 kw
Annual energy cost per fixture*	\$94.64	\$49.92
Annual energy saved per fixture	-	559 kw-hrs
Annual Saving	-	\$44.72

* based on 260 days of annual usage at 10 hours of operation per day @ \$0.08/kWh

Savings of an additional \$30.00 can be achieved in warehouse installations using integrated 2-level control.



6. Industrial 20' White Ceiling

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent , LED or Induction; 4100K (5000K to 6000K opt) ; ≥ 80 CRI
- Direct
- Industrial T8 – customize Ballast Factor , Induction or LED Hi-bay
- Time Clock with override or Sweep with override; consider bi-level with sensor, manual digital timer or laser zone control.





7. Retail – Big Box – Low Price

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Fluorescent , Ceramic MH or Induction; 3500 to 4100 K; ≥ 80 CRI
 - Direct or Direct/Indirect; add Daylighting w/dimming ballast if possible
 - T8 Strip, Channel or Recessed Prismatic; Ceramic MH or Induction: Industrial w/Acrylic/Glass Refractor or 50 up/50 down Glass HID Suspended
 - Time Clock or sweep; Sensor and dimming with day lighting



8. Retail – Dept. Store – Med Price

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Fluorescent; CFL, Ceramic MH, Halogen IR (120v or 12v) or LED; 3000K or 3500 K; 85 to 100 CRI
 - Direct and Accent
 - T8 large cell parabolic or volumetric; CFL recessed DL; Track CFL, PAR Halogen IR, LED; or MR 16; Recessed lens fluorescent for security
 - Time Clock or sweep with override





9. Retail – Specialty – High Price

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Halogen IR, Ceramic MH or LED ; 2700K to 3200K; 85 to 100 CRI
 - Directional
 - Accent PAR30, PAR38 or MR 16 (Adjustable Accents or Track) 120v and/or 12v; T8 Fluorescent lens recessed for security
 - Time Clock or manual





10a. Restaurant – Fast Food – Standard Look

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent, CFL and LED; 2700K to 4100 K (5000K opt); 85 CRI
- Direct; add Daylighting w/dimming ballast if possible
- Fluorescent T8 Recessed Prismatic or LED PAR Lamps
- Time Clock or sweep with override



10b. Restaurant – Fast Food – Trendy Look

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Fluorescent, LED, CFL, 2700K to 4100 K (5000K opt); 85 CRI
 - Direct and Decorative; add daylighting w/ dimming ballast if possible
 - Fluorescent T8 Prismatic or Volumetric; LED 2' x 2' and/or DLs and PARs.
 - Time clock with scene dimming with override



11. Restaurant - Family

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent, CFL; Halogen IR; LED; 2700K – 3200K, 85 to 100 CRI
- Direct, Decorative and Accent
- CFL or LED recessed DLs and decorative; Track PAR Halogen IR or PAR LED accent
- Time Clock and/or scene dimming with clock and override



12. Restaurant – High End

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Halogen IR or LED 120V and 12v; 2700K to 3000K, 85 to 100 CRI
 - Direct, Decorative and Accent
 - PAR 36 Halogen Spots in Adjustable DL; Track PAR Halogen IR or LED and/or MR 16 Halogen IR or LED; Fluorescent recessed lens for security
 - Time Clock and/or scene dimming with clock with override





13. Open Office with Cubicles

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent , LED and CFL; 3500K to 5000K; 85 CRI
- Direct or Indirect, Accent
- Large cell ES parabolic, volumetric or suspended indirect, LED 2' x 2', wall wash
- Occ/Vac Sensors or Sweep with override



14. Office – Hard Wall

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent , LED and CFL; 3500K to 5000K; 85 CRI
- Direct, Direct/Indirect or Indirect and Accent
- Large cell ES parabolic, volumetric, recessed direct/indirect, suspended indirect, LED 2' x 2'; wall wash
- Occ/Vac Sensors or Sweep with override



15. Office Corridor

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent , CFL or LED; 3500K to 5000K; 85 CRI
- Direct, Direct/Indirect, Indirect, Wall Wash or Accent
- Large cell ES parabolic, volumetric, indirect/direct or suspended indirect, wall wash with wall slot or smooth asymmetric; accent 120v or 12v ; LED DL
- PIR Occ/Vac Sensors or Sweep with override



16. Office Conference Room

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls



- Fluorescent, CFL, Halogen IR 12v or LED; 3000K to 5000K; 85 CRI
- **Layers:** Indirect, Wall Wash, Direct and Accent
- Large cell ES parabolic, or suspended indirect, wall wash on boards and DL accent 12v over table; 2'x2' LED
- Occ/Vac Sensors: PIR (small) and Dual (large) rooms; manual dimmers



17. Office Rest Room

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Fluorescent , CFL or LED; 3500K to 5000K; 85 CRI
 - Direct and Decorative
 - Large cell ES parabolic or Volumetric or 2'x2' LED and wall mount above mirror and/or ceiling vanity in ceiling over mirror with Program Start ballasts, CFL or LED DLs
 - Ultrasonic Occupancy Sensor(s) properly placed and commissioned (sensitivity and time delay settings)



18. Warehouse ($\leq 40'$ MH)

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent (consider Induction, PSMH and LED) ; 3500K to 6000 K; ≥ 80 CRI
- Direct
- T5HO Hi-Bay (consider Induction, PSMH and LED industrial)
- Bi-level with PIR occupancy sensor





T5HO vs. T8 Industrial Application

Rules of Thumb

- $\leq 20'$ – use T8
- $\geq 30'$ – Use T5HO
- 20' to 30' – Either T8 or T5HO can be used successfully
- Over 50 types of 4' T8 lamps available
- Two T5 lamps; 28w T5 and 54w T5HO
- To get T5HO performance out of T8 lamps, use high-lumen/high performance T8 lamps
- T8 electronic ballast factors range from .72 to 1.2
- **Rule of Thumb**: Use T8 unless there is a good reason not to, such as high MH; Vertical lighting, etc.

19. Warehouse ($\geq 40'$ MH)

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide or HPS (consider Fluorescent T5HO and Induction); 2100K to 5000K; 21 to 85 CRI
- Direct
- Industrial Hi-bay HID (glass, acrylic or aluminum reflector) or consider T5HO Hi-bay w/amalgam lamp and Hi-temp ballasts
- Bi-level with PIR occupancy sensor



20. Retail - Accent Entire Wall

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- CFL or LED (Consider CMH or Halogen IR) 2700K to 3500K, 80 to 100 CRI
- Wall Wash Accent
- Track CFL or LED preferred; Consider Halogen IR and CMH depending on the application
- Time Clock or sweep with manual override



21. Retail – Accent Specialty Display

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Halogen IR or LED (120v or 12v); 3000K to 3200K, 100 CRI
- Accent
- Track preferred; Consider Accent Cluster or Adj. DL for High End Retail; Use lamp beam spread to provide 5:1 Accent to ambient FC ratio
- Time Clock or sweep with manual override



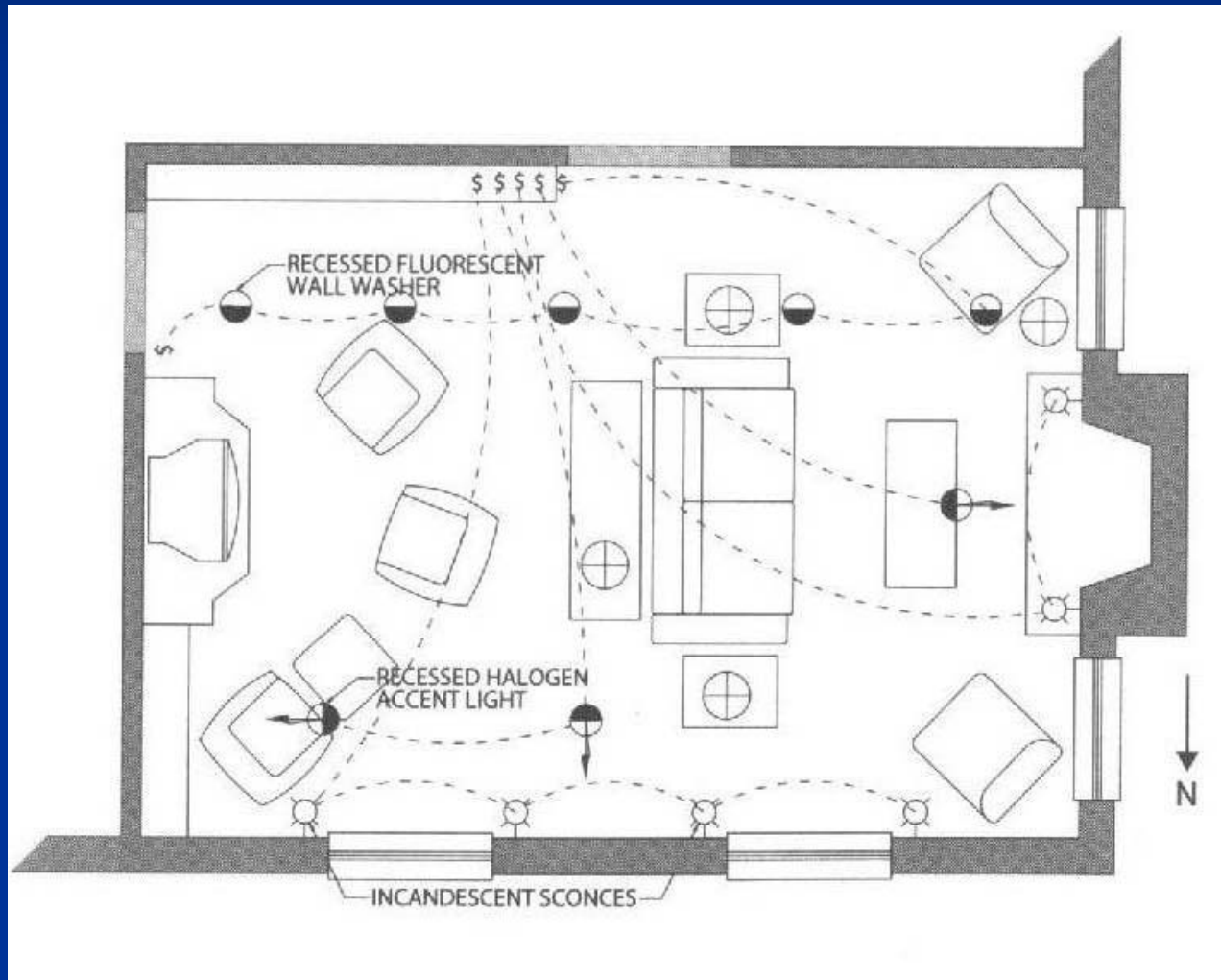
22. Home – Living Room/Den

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Halogen “A”, LED or CFL; 2700K to 3200K, ≥ 85 CRI
 - Layers: Direct, Indirect, Direct/Indirect, Decorative
 - DLs, Sconces, Cove, Portable lamps, table lamps, track
 - Manual with dimmers or Occ/Vac sensor or central system





Living Room with Wall Wash to Provide Indirect Lighting



23. Home - Kitchen

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Halogen “A”, LED, CFL, Xenon or Fluorescent, 2700K to 3200K, ≥ 85 CRI
- Layers: Direct
- DLs, Surface Fluorescent, LED or Xenon strip under cabinets
- Manual switch or dimming, central system (Consider occupancy sensor)



24. Home - Bath

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Halogen “A”, LED, CFL, 2700K to 3200K, ≥ 85 CRI
- Direct (with vertical light for mirror)
- DLs, Sconces and Decorative
- Manual with dimmers as appropriate



25. Home - Dining Room

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls



- Halogen, Halogen IR or LED; 2700K – 3200K; 85 to 100 CRI
- Layers: Direct, Decorative, Indirect, Indirect/Direct, DLs,
- Adjustable DLs, Decorative
- Manual with dimmers as appropriate

26. Home - Bedroom

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Halogen “A”, Halogen IR or LED; 2700K to 3200K; 85 to 100 CRI
 - Layers: Direct, Decorative, Indirect, Accent
 - DLs, Wall Wash, Track, Decorative
 - Manual with dimmers as appropriate





27. Office Parking Area

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide or HPS (Consider Induction and LED); 2100K to 6000K; 21 to 65 CRI+
- Direct
- Decorative Pole or Post Luminaires (i.e. shoebox, cube, dec. acorn, etc.)
- Photocell (dusk to dawn or part-night), smart PE or time clock



28. Roadway

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide , LED or HPS, 2100K to 6000K; 21 to 65 CRI
- Direct
- Traditional or Decorative Pole and/or Post Luminaires (i.e. roadway, shoebox, acorn, etc.)
- Photocell (dusk to dawn) or Smart PE





29. Commercial Building Facade Lighting

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide, LED, Halogen IR MR16 or Fluorescent 3000K to 4100K; ≥ 65 CRI
- Direct
- Flood or Low Voltage Bullet with Narrow Spot Lamp with Linear Spread Lens
- Time Clock





30. Landscape Lighting for the Home

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Halogen IR MR16 12v or LED; 3000K; 85 to 100 CRI
- Graze Direct, Non-uniform
- Various Landscape Luminaires: Flood, Bullet with Narrow Spot Lamp Spread Lens, Mushroom, Deck, etc.
- Time Clock



31. Apartment Parking Area

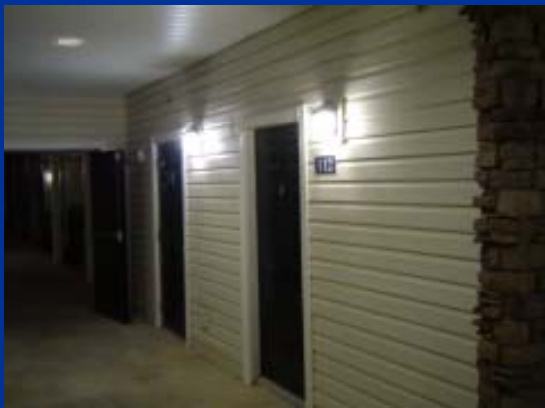
- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- PS Metal Halide, HPS, LED or Induction, 2100K to 6000K; 21 to 65 CRI
- Direct or Indirect with low glare vertical light for pedestrians
- Decorative Pole or Post Luminaires (i.e. shoebox, lantern, acorn, etc.)
- Photocell , Part night PE or Smart PE





32. Apartment Entrance & Public Areas

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- CFL, LED, Cold Cathode or Halogen “A”; 2700K – 4100K; 80 to 100 CRI
- Direct, Decorative
- Wall mount, sconces, DLs, ceiling surface mount
- Time Clock, Photocell



33. Drug Store

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Fluorescent; 3500 to 5000K; 85 CRI
- Direct
- Strips, Channel, Recessed Prismatic, Large Cell ES Parabolic, Strips with louvers
- Time Clock or Sweep with override



34. Small Jewelry Store

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- Halogen IR, CMH or LED (120v and 12v); 3000K to 3500K, 85 to 100 CRI
- Accent, Decorative
- Track PAR30 or PAR38 NFL and MR16 over display cases, Light Strips inside display case; candelabra base lamps
- Manual





35. Small Jewelry Store



PAR38 NFL, Halogen Case Lighting,
Decorative Incandescent Sconce and
Chandelier

**Note: All of
this halogen
can be replaced
with LEDs**



Halogen Strip
Case Lighting



MR 16
NFL,
Halogen
Case
Lighting



36. Supermarket

- Light Source, Color Temperature and CRI
 - Design Technique
 - Luminaires
 - Controls
- Fluorescent , CFL, LED, CMH and Halogen IR, 2700K to 3000K for meat, 3500K to 4100K for general areas and vegetables, 85 CRI
 - Direct, Accent
 - Strips, Strips with louvers or Channel: Track, Cove (vegetables and meat); Industrial
 - Time Clock or Sweep with manual override; Manual controls for specific tasks



37. Parking Garage

- Light Source, Color Temperature and CRI
- Design Technique
- Luminaires
- Controls
- LED, Induction, or Fluorescent; 4100 to 6000K; ≥ 80 CRI
- Direct; Direct/Indirect
- Parking Garage fixture for LED or Induction; Vapor tight T8 fluorescent with cold weather ballast
- PIR sensor for bi-level or sensor with daylight harvesting





Questions?

Thank You!

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