DLC STAKEHOLDER MEETING 2018

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ANSI / IES TM-33

A New Standard for Luminaire Optical Data

Panelist

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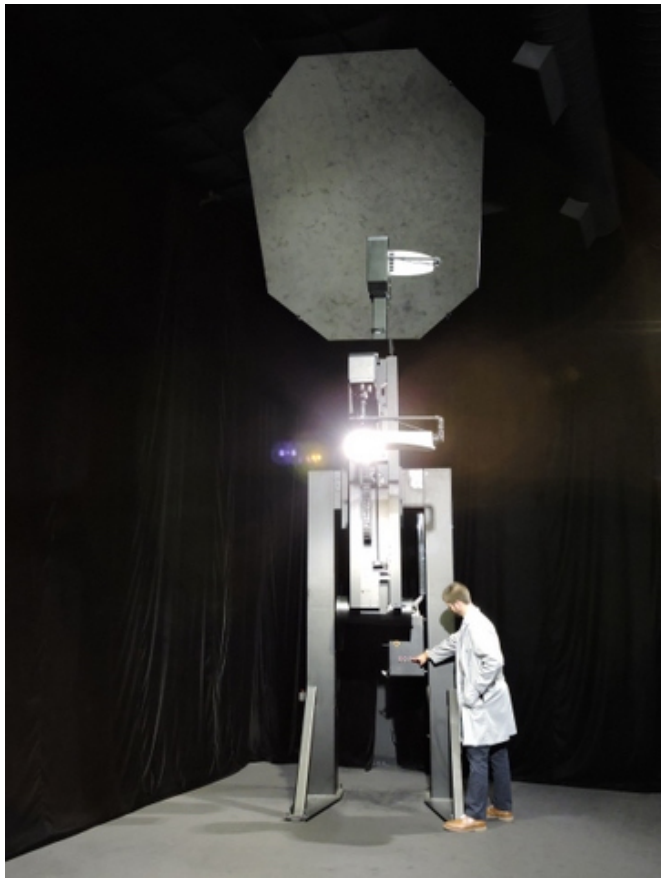
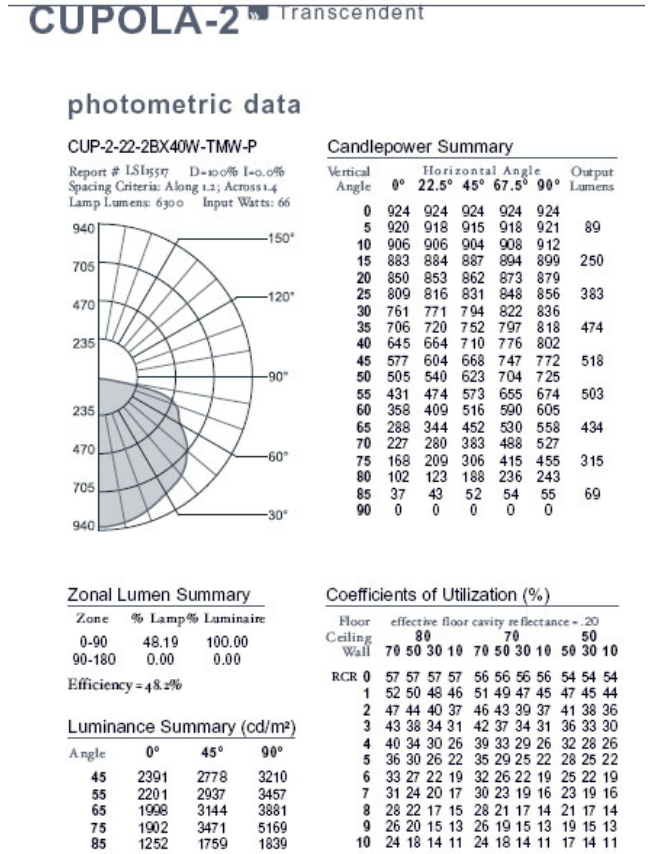
Photometric Data Files

- Luminous intensity
- Luminous flux
- Input watts
- Luminous opening

Popular Formats
ANSI/IES LM-63 (1986)
EULUMDAT (1990)
CIBSE TM14 (1988)





CUPOLA-2 Transcendent

photometric data

CUP-2-22-2BX40W-TMW-P

Report # LSI1557 D=100% I=0.0%
Spacing Criteria: Along 1.2; Across 1.4
Lamp Lumens: 6300 Input Watts: 66

Candlepower Summary

Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Output Lumens
0	924	924	924	924	924	
5	920	918	915	918	921	89
10	906	906	904	908	912	
15	883	884	887	894	899	250
20	850	853	862	873	879	
25	809	816	831	848	856	383
30	761	771	794	822	836	
35	706	720	752	797	818	474
40	645	664	710	776	802	
45	577	604	668	747	772	518
50	505	540	623	704	725	
55	431	474	573	655	674	503
60	358	409	516	590	605	
65	288	344	452	530	558	434
70	227	280	383	488	527	
75	168	209	306	415	455	315
80	102	123	188	236	243	
85	37	43	52	54	55	69
90	0	0	0	0	0	

Zonal Lumen Summary

Zone	% Lamp	% Luminaire
0-90	48.19	100.00
90-180	0.00	0.00

Efficiency = 48.2%

Luminance Summary (cd/m²)

Angle	0°	45°	90°
45	2391	2778	3210
55	2201	2937	3457
65	1998	3144	3881
75	1902	3471	5169
85	1252	1759	1839

Coefficients of Utilization (%)

Floor	effective floor cavity reflectance = .20									
Ceiling	80				70				50	
Wall	70	50	30	10	70	50	30	10	50	30	10
RCR 0	57	57	57	57	56	56	56	56	54	54	54
1	52	50	48	46	51	49	47	45	47	45	44
2	47	44	40	37	46	43	39	37	41	38	36
3	43	38	34	31	42	37	34	31	36	33	30
4	40	34	30	26	39	33	29	26	32	28	26
5	36	30	26	22	35	29	25	22	28	25	22
6	33	27	22	19	32	26	22	19	25	22	19
7	31	24	20	17	30	23	19	16	23	19	16
8	28	22	17	15	28	21	17	14	21	17	14
9	26	20	15	13	26	19	15	13	19	15	13
10	24	18	14	11	24	18	14	11	17	14	11

Other Photometric Data Files

- CIE 102-1993
- CEN EN 13032-1
- LTLI (Ly & Optik, Denmark)
- TBT (Toshiba, Japan)
- Others … *three decades old!*

Communications technology circa 1986

Luminaire Component Files

- EULUMDAT/2 (1998)
- ANSI/IES LM-74-05 (2005)
- BIM Standards
  - gbXML (Photometry)
  - IFC (IfcLightFixtureType)
  - Other national standards
- **Overly broad scope**
- **Insufficient detail**

Luminaire Optical Data

- Focus exclusively on luminaire optical data
- Subsume existing photometric data file formats
- Include support for:
  - Photometric metrics (architectural and roadway)
  - Radiometric metrics (industrial and scientific)
  - Photon flux metrics (horticultural)
  - Spectral metrics (human-centric and horticultural)
- Must be extensible (industry-standard XML)

Understanding XML

- XML is acronym for e**X**tensible **M**arkup **L**anguage
- XML document consists of text strings called “elements”
- Elements can be arranged in a hierarchy, for example:

```
<person>
  <name>Alfred E. Neuman</name>
</person>
```

- Unrecognized elements are simply ignored
- Document can be included in larger BIM document (e.g., gbXML)

TM-33 Hierarchy

- Header
  - Luminaire identification
- Luminaire
  - Luminaire dimensions and shape
- Equipment
  - Laboratory measurement equipment
- Light Emitter
  - Light source measurements

Header Element

Element	Element
Manufacturer	Document Creator
Catalog Number	Document Creation Date
Description	Unique Identifier (UUID)
Laboratory	Comment
Report Number	Reference
Report Date	More Information URI

- Equivalent to signed and sealed engineering drawing

Luminaire Element

Element
Dimensions
Shape
Number of Light Sources

- Axis-aligned enclosing box
- Rectangular / elliptical shapes
- Any number of light emitters (sources)

Equipment Element

Element
Gonioradiometer
Integrating sphere
Spectroradiometer

- Radiometric sensor can be spectrally weighted
  - Luminous
  - Photosynthetically Active Radiation (PAR)
  - Ultraviolet and infrared

Light Emitter Element

Element	Element	Element
Quantity	Color Temperature	Illuminance Data
Description	Color Rendering	Irradiance Data
Catalog Number	S/P Ratio	Photon Flux Density
Rated Lumens	Data Generation	Spectral Irradiance
Input Wattage	Luminous Data	Channels
Power Factor	Radiant Data	Emission Areas
Ballast Factor	Photon Data	Light Center
Tilt Angles	Spectral Data	Regulatory

Intensity Data Elements

- Luminous intensity distribution required for photometric data reports
- Radiant intensity distribution required for industrial and scientific applications (e.g., near-infrared security lighting)
- Photon intensity (e.g., PAR) required for horticultural lighting
- Arbitrary order of horizontal and vertical angles allowed

Spectral Data Element

- Spectral power distribution
  - Required for calculating non-standard metrics such as melanopic lumens
  - Essential for horticultural lighting design
- Angular spectral intensity
  - Useful for characterizing color shifts with changes in viewing angle of phosphor-coated white light LEDs
  - Disadvantage is comparatively large documents

Application Distance Data Element

- Application distance radiometry measures irradiance on a plane
- IES currently developing IES C303 application distance radiometry measurement standard (based on deprecated IES LM-70, Approved Guide to Near-field Photometry)
- IES working with American Society of Agricultural and Biological Engineers (ASABE) on development of IES C303 for horticultural applications
- IES TM-33 specifically designed to support application distance photometry, radiometry, and photon flux density measurements

Channels Element

- Designed for luminaires with multiple light emitters having different spectral power distributions
- Useful for representing theatrical and color-changing luminaires

Custom Data Element

- TM-33 was purposely designed to be extensible
- Any organization or company can define custom data elements
  - Name
  - Universal Unique Identifier (UUID)
  - Any data
- Base document readable by any TM-33 parser
- No need for central repository or controlling organization due to UUID (e.g., 123e4567-e89b-12d3-a456-426655440000)

XML Documents

- XML schema formally defines TM-33 XML documents
- Many TM-33 elements are optional and can be omitted
- Sample photometric TM-33 document not much larger than equivalent IES LM-63 or EULUMDAT file

Applications

- Architectural
  - Human-centric
  - Theatrical
- Roadway
- Horticultural
- Industrial
  - UV sterilization
  - Industrial infrared ovens






Current Status

- ANSI/IES TM-33 (USA) – standard finalization
- UNI 1603054 (Italy) – standard finalization
- ABNT (Brazil) – inclusion in BIM standard under development
- UNE (Spain) – under consideration for adoption
- CIE/ISO (ISO/TC274) – CIE Division 2 Technical Committee
- UMSUG (UK) – proposed custom data definition
- LED Lighting Facts (USA) – awaiting publication for adoption

Conclusions

- "The wonderful things about standards is there are so many to choose from."

  Andrew Tanenbaum, Computer Networks, 1981

- Adoption of TM-33 / UNI 603054 standard is critically dependent on:
  - Luminaire manufacturers
  - Test laboratories
  - Lighting design software companies
- Europe likely to adopt standard first