



ISBN 978-3-902842-44-2

COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

PROCEEDINGS of CIE Centenary Conference „Towards a New Century of Light“

April 15/16, 2013

Paris, France

CIE x038:2013

(including Addendum 1)

UDC: 628.9

Descriptor: Lighting. Illuminating engineering

THE INTERNATIONAL COMMISSION ON ILLUMINATION

The International Commission on Illumination (CIE) is an organisation devoted to international co-operation and exchange of information among its member countries on all matters relating to the art and science of lighting. Its membership consists of the National Committees in about 40 countries.

The objectives of the CIE are:

1. To provide an international forum for the discussion of all matters relating to the science, technology and art in the fields of light and lighting and for the interchange of information in these fields between countries.
2. To develop basic standards and procedures of metrology in the fields of light and lighting.
3. To provide guidance in the application of principles and procedures in the development of international and national standards in the fields of light and lighting.
4. To prepare and publish standards, reports and other publications concerned with all matters relating to the science, technology and art in the fields of light and lighting.
5. To maintain liaison and technical interaction with other international organisations concerned with matters related to the science, technology, standardisation and art in the fields of light and lighting.

The work of the CIE is carried on by seven Divisions each with about 20 Technical Committees. This work covers subjects ranging from fundamental matters to all types of lighting applications. The standards and technical reports developed by these international Divisions of the CIE are accepted throughout the world.

A plenary session is held every four years, at which the work of the Divisions and Technical Committees is reviewed, reported and plans are made for the future. The CIE is recognised as the authority on all aspects of light and lighting. As such it occupies an important position among international organisations.

LA COMMISSION INTERNATIONALE DE L'ECLAIRAGE

La Commission Internationale de l'Eclairage (CIE) est une organisation qui se donne pour but la coopération internationale et l'échange d'informations entre les Pays membres sur toutes les questions relatives à l'art et à la science de l'éclairage. Elle est composée de Comités Nationaux représentant environ 40 pays.

Les objectifs de la CIE sont :

1. De constituer un centre d'étude international pour toute matière relevant de la science, de la technologie et de l'art de la lumière et de l'éclairage et pour l'échange entre pays d'informations dans ces domaines.
2. D'élaborer des normes et des méthodes de base pour la métrologie dans les domaines de la lumière et de l'éclairage.
3. De donner des directives pour l'application des principes et des méthodes d'élaboration de normes internationales et nationales dans les domaines de la lumière et de l'éclairage.
4. De préparer et publier des normes, rapports et autres textes, concernant toutes matières relatives à la science, la technologie et l'art dans les domaines de la lumière et de l'éclairage.
5. De maintenir une liaison et une collaboration technique avec les autres organisations internationales concernées par des sujets relatifs à la science, la technologie, la normalisation et l'art dans les domaines de la lumière et de l'éclairage.

Les travaux de la CIE sont effectués par 7 Divisions, ayant chacune environ 20 Comités Techniques. Les sujets d'études s'étendent des questions fondamentales, à tous les types d'applications de l'éclairage. Les normes et les rapports techniques élaborés par ces Divisions Internationales de la CIE sont reconnus dans le monde entier.

Tous les quatre ans, une Session plénière passe en revue le travail des Divisions et des Comités Techniques, en fait rapport et établit les projets de travaux pour l'avenir. La CIE est reconnue comme la plus haute autorité en ce qui concerne tous les aspects de la lumière et de l'éclairage. Elle occupe comme telle une position importante parmi les organisations internationales.

DIE INTERNATIONALE BELEUCHTUNGSKOMMISSION

Die Internationale Beleuchtungskommission (CIE) ist eine Organisation, die sich der internationalen Zusammenarbeit und dem Austausch von Informationen zwischen ihren Mitgliedsländern bezüglich der Kunst und Wissenschaft der Lichttechnik widmet. Die Mitgliedschaft besteht aus den Nationalen Komitees in rund 40 Ländern.

Die Ziele der CIE sind:

1. Ein internationaler Mittelpunkt für Diskussionen aller Fragen auf dem Gebiet der Wissenschaft, Technik und Kunst der Lichttechnik und für den Informationsaustausch auf diesen Gebieten zwischen den einzelnen Ländern zu sein.
2. Grundnormen und Verfahren der Meßtechnik auf dem Gebiet der Lichttechnik zu entwickeln.
3. Richtlinien für die Anwendung von Prinzipien und Vorgängen in der Entwicklung internationaler und nationaler Normen auf dem Gebiet der Lichttechnik zu erstellen.
4. Normen, Berichte und andere Publikationen zu erstellen und zu veröffentlichen, die alle Fragen auf dem Gebiet der Wissenschaft, Technik und Kunst der Lichttechnik betreffen.
5. Liaison und technische Zusammenarbeit mit anderen internationalen Organisationen zu unterhalten, die mit Fragen der Wissenschaft, Technik, Normung und Kunst auf dem Gebiet der Lichttechnik zu tun haben.

Die Arbeit der CIE wird in 7 Divisionen, jede mit etwa 20 Technischen Komitees, geleistet. Diese Arbeit betrifft Gebiete mit grundlegendem Inhalt bis zu allen Arten der Lichtanwendung. Die Normen und Technischen Berichte, die von diesen international zusammengesetzten Divisionen ausgearbeitet werden, sind von der ganzen Welt anerkannt.

Alle vier Jahre findet eine Session statt, in der die Arbeiten der Divisionen überprüft, berichtet und neue Pläne für die Zukunft ausgearbeitet werden. Die CIE wird als höchste Autorität für alle Aspekte des Lichtes und der Beleuchtung angesehen. Auf diese Weise unterhält sie eine bedeutende Stellung unter den internationalen Organisationen.

Published by the

COMMISSION INTERNATIONALE DE L'ECLAIRAGE
CIE Central Bureau
Kegelgasse 27, A-1030 Vienna, AUSTRIA
Tel: +43171431870, Fax: +431714318718
ciecb@cie.co.at
<http://www.cie.co.at/>



ISBN 978-3-902842-44-2

COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

PROCEEDINGS of CIE Centenary Conference „Towards a New Century of Light“

April 15/16, 2013

Paris, France

CIE x038:2013

(including Addendum 1)

UDC: 628.9

Descriptor: Lighting. Illuminating engineering

International Scientific Committee:

(in alphabetical order):

Jean Bastie (DIV2, FR)	PhD, (retired from INM/CNAM as Head of the Optical Radiation Measurement Department)
Peter Blattner (DIV2, CH)	PhD, Head of Optics, Federal Institute of Metrology (METAS), CH, Director CIE Division 2
Cyril Chain (DIV4, FR)	PhD, International Expert in Light and Lighting for the French Government (Ministry of Territory Equality, Transport, Housing METL + Ministry of Ecology, Sustainable Development and Energy MEDDE)
Jean-Michel Deleuil (DIV4,FR)	PhD, Prof. at the Environment and Urban Planning Department, INSA engineer school, FR
Dominique Dumortier (DIV3, FR)	PhD, Vice-Director of LASH laboratory, ENTPE engineering school, FR
Christine Fernandez-Maloigne (DIV8, FR)	PhD, Prof, Director of SIC laboratory, University of Poitiers, FR
Marc Fontoynt (DIV3, FR)	PhD, Prof at Aalborg University in Copenhagen, DK
Ron Gibbons (DIV4, US)	PhD, FIES, Director, Center Infrastructure Based Safety Systems, Virginia Tech Transportation Institute, US, Associate Director CIE Division 4
Teresa Goodman (VPP, GB)	Principal Research Scientist in the Optical Radiation Measurement Group at the National Physical Laboratory (NPL), GB, CIE Vice President Publications
Jacques Lecocq (DIV5, FR)	Application Support Manager, Thorn Lighting, FR
Ronnier Luo (DIV1, GB)	PhD, Professor of Zhejiang University (CN), Leeds University (GB), Colour and Imaging Science, National Taiwan University of Science and Technology (Chair), Director CIE Division 1
Jan Morovic (DIV8, GB)	PhD, Senior Color Scientist, Hewlett-Packard Company, GB, Director CIE Division 8
John O'Hagan (DIV6, GB) Loughborough University, GB, Director CIE	PhD, UK Health Protection Agency;Visiting Fellow, Division 6
Yoshi Ohno (Chair, US)	PhD, NIST Fellow and the Group Leader for Lighting and Color Group at Sensor Science Division, National Institute of Standards and Technology, US, CIE Vice President Technical
Peter Schwarcz (DIV5, HU)	Director CIE Division 5
Jennifer Veitch (DIV3, CA)	PhD, Senior Research Officer in the National Research Council of Canada, Institute for Research in Construction, CA
Françoise Viénot (DIV1, FR)	PhD, Prof. Emeritus at the National Museum of Natural History (MNHN), FR
Peter Zwick (CB)	PhD, Technical Manager CIE Central Bureau

International Organising Committee:

Conference Presidency:

Ann Webb

Cyril Chain

Members (in alphabetical order):

Marie-Pierre Alexandre

Marc Fontoynont

Teresa Goodman

Yoshi Ohno

Martina Paul

Lorne Whitehead

Local Organising Committee:

(in alphabetical order):

Marie-Pierre Alexandre

Jean Bastie

Cyril Chain (Chair)

Éric Dumont

Dominique Dumortier

Alain Azaïs

Jean-Jacques Ezrati

Christine Fernandez-Maloigne

Alain Floris †

Marc Fontoynont

Jacques Lecocq

Eric Loisy (Insight Outside, Event Organizer)

Gaël Obein

Leo Trausnith (CB Office Manager)

Françoise Viénot

Any mention of organisations or products does not imply endorsement by the CIE. Whilst every care has been taken in the compilation of any list, up to the time of going to press, these may not be comprehensive.

© CIE 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without the permission in writing from the CIE Central Bureau at the address below.

Commission Internationale de l'Eclairage
CIE Central Bureau Kegelgasse 27
A-1030 Vienna, AUSTRIA
Tel.: +43 1 714 31 87 0 / Fax: +43 1 714 31 87 18
ciecb@cie.co.at
<http://www.cie.co.at>

**PROCEEDINGS of CIE Centenary Conference
„Towards a New Century of Light“
April 15/16, 2013, Paris, France (CIE x038:2013)**

ADDENDUM 1 (2013-06)

PP065: Piccablotto, G., Aghemo, C., Pellegrino, A.
SUBJECTIVE AND OBJECTIVE ASSESSMENT ON LED LIGHTING QUALITY FOR
MUSEUM SHOWCASES

Paper has been added (pp. 1240 – 1249).

PP084: Pellegrino, A., Lo Verso, V.R.M., Cammarano, S., Aghemo C.
A GRAPHICAL TOOL TO PREDICT THE DAYLIGHT AVAILABILITY WITHIN A ROOM
AT THE EARLIEST DESIGN STAGES

Paper has been added (pp. 1250 – 1260).

PP114: Markey, Y., Deswert, J.-M.
IN DEPTH INVENTORY FOR A HIGHER QUALITY OF STREET LIGHTING

Paper has been added (pp. 1261 – 1265).



Towards a new century of Light

Paris, 12-19th of April 2013



The following table provides an overview of the Papers and Posters presented at the Conference. The papers are published in the Proceedings in consecutive order of presentation. The authors are responsible for the contents of their papers.

Oral Presentations	Page
Keynote & Plenary Session 1: History of Lighting and Art	
Chair: Ann Webb, United Kingdom	
KS01 Bastie, J. ONE HUNDRED YEARS OF CIE AND EVOLUTION OF LIGHTING	1
OP01 Olsson, G. ONE AND A HALF MILLENNIUM OF COLOURED LIGHT	10
OP02 Ezrati, J.-J. BACK ON A HUNDRED YEARS OF TECHNOLOGICAL DEVELOPMENT IN THE SERVICE OF THE MUSEUM LIGHTING	16
Plenary Session 2: Hot Topics in Outdoor Lighting	
Chair: Ron Gibbons, USA	
OP03 Fotios, S.A., Unwin, J. RELATIVE WEIGHTING OF LIGHTING ALONGSIDE OTHER ENVIRONMENTAL FEATURES IN AFFECTING PEDESTRIAN REASSURANCE	23
OP04 Romnée, A. et al. A NEW REAL TIME INTELLIGENT MANAGEMENT MODEL FOR STREET LIGHTING	32
OP05 Heynderickx, I. et al. ESTIMATING EYE ADAPTATION FOR TYPICAL LUMINANCE VALUES IN THE FIELD OF VIEW WHILE DRIVING IN URBAN STREETS	41

Oral Presentations	Page
Colour Quality Assessment Chair: Ronnier Luo, United Kingdom	
OP06 Bodrogi, P. et al. SEMANTIC INTERPRETATION OF COLOUR RENDERING INDICES: A COMPARISON OF CRI AND CRI2012	48
OP07 Jost, S. , Fontoynt, M. COLOUR RENDERING OF FACE COMPLEXION AND HAIR UNDER LED SOURCES	53
OP08 Imai, Y. et al. A STUDY OF COLOR RENDERING PROPERTIES BASED ON COLOR PREFERENCE OF OBJECTS IN ADAPTATION TO LED LIGHTING	62
OP09 Tsukitani, A. OPTIMIZATION OF COLOUR QUALITY FOR LANDSCAPE LIGHTING BASED ON FEELING OF CONTRAST INDEX	68
OP10 Nagy, B.V. et al. THE EFFECT OF AMBIENT ILLUMINATION SPECTRUM ON VISUAL PERFORMANCE	72
OP11 Decuypere J. et al. SIMULATION OF THE RETINA RESPONSE TO MESOPIC VISUAL SCENES	76
Health and Wellbeing Chair: John O'Hagan, United Kingdom	
OP12 Biro, A. , Bianchi, C. LIGHT AS A MOTOR FOR INNOVATION AND WELLBEING	82
OP14 Wojtysiak, A. , Lang, D. APPLICATION STUDIES ON NON-VISUAL EFFECTS OF LIGHT WITH TRADITIONAL AND SOLID STATE LIGHT SOURCES	91
OP15 Govén, T. , Laike, T. VISUAL AND NON-VISUAL EFFECTS OF DIFFERENT SPECTRAL POWER DISTRIBUTIONS FROM LIGHT SOURCES - LIGHT EMITTING DIODES (LED) VS. 3-PHOSPHORUS FLUORESCENT TUBES	95
OP16 Ámundadóttir, M.L. et al. MODELLING NON-VISUAL RESPONSES TO LIGHT: UNIFYING SPECTRAL AND TEMPORAL CHARACTERISTICS IN A SINGLE MODEL STRUCTURE	101
OP17 Boulenguez, P. et al. BLUE LIGHT HAZARD OF LEDS – COMPARISON OF THE PHOTOBIOLOGICAL RISK GROUPS OF FIFTEEN LAMPS ASSESSED USING THE UNIFORM SPECTRUM ASSUMPTION AND A NEW HYPERSPECTRAL IMAGING METHOD	111

Oral Presentations	Page
Workplace Lighting Concepts Chair: Yasuko Koga, Japan	
OP18 Ayama, M. et al. DISCOMFORT GLARE OF WHITE LED SOURCES OF DIFFERENT SPATIAL ARRANGEMENTS	119
OP19 Villa, C. , Labazrade, R. SUITABLE LUMINOUS ENVIRONMENT FOR VARIOUS ACTIVITIES IN SHARED OFFICE	123
OP20 Inoue, Y. , Maruyama, H. STUDY ON ILLUMINANCE BALANCE BETWEEN WORKING AREA AND AMBIENT - EFFECTS OF THE DISTRIBUTION OF LUMINOUS INTENSITY OF AMBIENT LIGHTING AND THE ORDER AND SPEED OF ADJUSTMENT	133
OP21 Suzuki, N. et al. A STUDY ON THE PERMISSIBLE RANGE OF NON-UNIFORMITY BY AMBIENT LIGHTING IN A WORKPLACE	142
OP22 Kronqvist, A. REVIEW OF OFFICE LIGHTING RESEARCH	148
OP23 Logadóttir, A. et al. COMPARISON OF USER SATISFACTION WITH FOUR DIFFERENT LIGHTING CONCEPTS	159
Plenary Session 3: Hot topics in Interior Lighting Chair: Marc Fontoynt, France	
OP24 Veitch, J.A. et al. WHAT WE KNOW ABOUT WINDOWS AND WELL-BEING, AND WHAT WE NEED TO KNOW	169
OP25 Mardaljevic, J. , Christoffersen, J. A ROADMAP FOR UPGRADING NATIONAL/EU STANDARDS FOR DAYLIGHT IN BUILDINGS	178
OP26 Poplawski, M.E., Miller, N.M. FLICKER IN SOLID-STATE LIGHTING: MEASUREMENT TECHNIQUES, AND PROPOSED REPORTING AND APPLICATION CRITERIA	188
OP27 Porritt, J. et al. THE REBOUND EFFECT - AN OVERVIEW OF THE IMPLICATIONS FOR LIGHTING ENERGY	203

Oral Presentations	Page
Advanced Correction Methods for Spectroradiometry and Goniophotometry Chair: Peter Blattner, Switzerland	
OP29 Heidel, G. , Marchl, W. PRACTICAL EXPERIENCES WITH STRAY LIGHT CORRECTION ON ARRAY SPECTROMETERS FOR LED-PRODUCTION	211
OP30 Wang, J. , Qiao, B., Luo, Y. STRAY LIGHT CORRECTION IN GONIOPHOTOMETRY MEASUREMENT	223
OP31 Chen, C. et al. DETERMINATION OF SCANNING RESOLUTION BASED ON NYQUIST SAMPLING THEOREM IN GONIOSPECTRORADIOMETRY	227
Lighting the City - Applications and economics Chair: Yandan Lin, China	
OP32 Putteman, K. et al. INTELLIGENT STREET LIGHTING AND LEDS: BUSINESS CASE AND RETURN ON EXPERIENCE	231
OP33 Fotios S. et al. CRITICAL PEDESTRIAN TASKS: USING EYE-TRACKING WITHIN A DUAL TASK PARADIGM	234
OP35 Saraiji, R. , Oommen, M.S. PEDESTRIAN CONTRAST PROFILE	241
Integrating Daylight and Electric Lighting Chair: Dominique Dumortier, France	
OP36 Sarey Khanie, M. et al. INVESTIGATION OF GAZE PATTERNS IN DAYLIT WORKPLACES: USING EYE-TRACKING METHODS TO OBJECTIFY VIEW DIRECTION AS A FUNCTION OF LIGHTING CONDITIONS	250
OP37 Kelly, R. et al. CAPTURING THE USER EXPERIENCE OF ELECTROCHROMIC GLAZING IN AN OPEN PLAN OFFICE	260
OP38 Fernandes, J.T. et al. LIGHTING AND DAYLIGHTING QUALITY: CRITICAL REVIEW OF CRITERIA AND RECOMMENDATIONS AND ITS INSERTION IN BRAZILIAN CONTEXT	267
OP39 Nakamura, Y. , Fujita, N. JUST SUFFICIENT LIGHTING CONDITION UNDER HYBRID-LIGHTING OF REAL DAYLIGHT AND ARTIFICIAL LIGHT	276

Oral Presentations	Page
LED Photometry and Performance of Photometers Chair: Armin Sperling, Germany	
OP40 Dubnicka R. et al. ANALYSIS OF PERFORMANCE PARAMETERS OF ILLUMINANCE METERS PER CIE DS 023 QUALITY INDICES FOR SPECIFIC FIELD MEASUREMENTS	282
OP41 Martinsons, C. et al. INFLUENCE OF CURRENT AND VOLTAGE HARMONIC DISTORTION ON THE POWER MEASUREMENT OF LED LAMPS AND LUMINAIRES	290
OP42 Krüger, U. , Blattner, P. SPECTRAL MISMATCH CORRECTION FACTOR ESTIMATION FOR WHITE LED SPECTRA BASED ON THE PHOTOMETER'S f1' VALUE	300
OP43 Vaskuri, A. et al. RADIOMETRIC DETERMINATION OF THE JUNCTION TEMPERATURE OF LIGHT-EMITTING DIODES	308
Lighting the City - Luminaires and Design Chair: Peter Schwarcz, Hungary	
OP44 Gasparovsky D. , Raditschova, J. LIGHTING PROPERTIES AND EFFICIENCY OF LUMINAIRES EXCEEDING THEIR LIFETIME	317
OP45 Akashi, Y. et al. VISUAL MECHANISMS OF DISCOMFORT GLARE SENSATION CAUSED BY LEDS	327
OP46 Zhu, X. et al. THE LUMINAIRE BEAM-SHAPE INFLUENCE ON DISCOMFORT GLARE FOR LED ROAD LIGHTING	331
OP47 Niedling, M. et al. INFLUENCE OF A GLARE SOURCES SPECTRUM ON DISCOMFORT AND DISABILITY GLARE UNDER MESOPIC CONDITIONS	340
Concepts in Lighting Quality Chair: Anna Pellegrino, Italy	
OP48 Labayrade, R. , Avouac, P. VISUAL QUALITY ASSESSMENT OF LED SPOTS IN COMPARISON TO LOW-VOLT AGE HALOGEN SPOTS	348
OP49 Chen, J.R. et al. ASSESSING COLOR HARMONY IN A ROOM USING LED LIGHTINGS	356
OP50 Pagot, C. et al. EVALUATION OF INDOOR LIGHTING SITUATIONS IN PUBLIC ACCESS BUILDINGS AND OUTDOOR SITUATIONS AT NIGHT BY VISUALLY IMPAIRED PEOPLE	365

Oral Presentations	Page
OP51 Yoshizawa, N. et al. A STUDY ON THE APPEARANCE OF PAINTINGS IN THE MUSEUM UNDER VIOLET AND BLUE LED	374
Brightness and Colour, Individual or Shared Percepts Chair: Miyoshi Ayama, Japan	
OP52 Sarkar, A., Blondé, L. COLOURIMETRIC OBSERVER CATEGORIES AND THEIR APPLICATIONS IN COLOUR AND VISION SCIENCES	382
OP53 Vidovszky-Nemeth, A., Schanda, J. INDIVIDUAL CHANGES OF BRIGHTNESS PERCEPTION	393
OP54 Kozaki, M. et al. A PROPOSAL OF PREDICTIVE EQUATION FOR “SPATIAL BRIGHTNESS” CONSIDERING THE EFFECT OF LOOKING AROUND AND ITS APPLICATION TO REAL PROJECT	402
Lighting the City - Spaces Chair: Dionyz Gasparovsky, Slovakia	
OP55 Bülow, K.H. LIGHT RHYTHMS IN ARCHITECTURE INTEGRATION OF RHYTHMIC URBAN LIGHTING INTO ARCHITECTURAL CONCEPTS	410
OP56 Bezerra, R., Simões Z. REINVENTING URBAN SPACES THROUGH LIGHT AND COLOUR: CACILHAS PROJECT	418
OP57 Conniasselle, T. et al. IMPRESSION OF LIGHT AND FEELING OF SECURITY IN THE CITY - EXPERIMENTING MESOPIC VISION	425
Well-being, Glare and Comfort Chair: Alessandro Rizzi, Italy	
OP58 Hsu, S.-W. et al. RELATIONS BETWEEN FLICKER, GLARE, AND PERCEPTUAL RATINGS OF LED BILLBOARDS UNDER VARIOUS CONDITIONS	428
OP59 Hsieh, P.H. et al. FLICKER AND VISUAL COMFORT EVALUATIONS OF LED PANEL DISPLAY	435
OP60 Lai, P.-Y. et al. INVESTIGATION OF DISCOMFORT GLARE OF RGB LED BILLBOARD AT NIGHT	442

Poster Presentations	Page
D1 - Vision and Colour / Colorimetry	
PP001 Price, L.L.A. INFORMATION ENTROPY AND THE COLORIMETRY OF SPECTRA	452
PP002 Polster, S., Schierz, C. TOWARDS A FIELD SIZE INDEPENDENT METAMERISM	456
PP003 Melgosa, M. et al. TESTING A COLOUR-DIFFERENCE FORMULA FOR THE AUTOMOTIVE INDUSTRY USING THE EXPERIMENTAL VISUAL DATASETS EMPLOYED IN CIEDE2000 DEVELOPMENT	465
PP004 Kobayashi, S. et al. COLOUR RENDERING EVALUATION OF THE LED LIGHT SOURCE BY THE RELATIVE EVALUATION	470
PP005 Nakajima, Y., Fuchida, T. AFFECTIVE EVALUATION ON COLOR SAMPLES ILLUMINATED BY LED ILLUMINATION~INFLUENCE OF ILLUMINANCE LEVEL	479
PP006 da Pos, O. et al. SUBJECTIVE ASSESSMENT OF UNIQUE COLOURS AS A TOOL TO EVALUATE COLOUR DIFFERENCES IN DIFFERENT ADAPTATION CONDITIONS	488
PP008 Markvart, J. et al. USER EVALUATION OF EIGHT LED LIGHT SOURCES WITH DIFFERENT SPECIAL COLOUR RENDERING INDICES R9	496
PP009 Itoh, N., Sagawa, K. SPANS OF FUNDAMENTAL COLOURS OF PEOPLE WITH COLOR VISION DEFECTS	506
PP010 Hertog, W. et al. THE CHROMATICITY OF WHITE LIGHT	510
PP011 Huang, T.-W. et al. AN INTELLIGENT COLOUR TEMPERATURE CONVERSION FUNCTION WITH MULTI-PRIMARY COLOURS FOR INDOOR SOLID-STATE LIGHTING	516
PP012 Perales, E. et al. INFLUENCE OF SPECTRAL POWER DISTRIBUTION OF LIGHT SOURCES ON THE COLOUR APPEARANCE OF GONIOCHROMATIC COLOURS	523
D1 - Vision and Colour / Mesopic Vision	
PP013 Uchida, T., Ohno, Y. EFFECT OF HIGH LUMINANCE SOURCES TO PERIPHERAL ADAPTATION STATE IN MESOPIC RANGE	529

Poster Presentations	Page
D1 - Vision and Colour / Miscellaneous	
PP014 Yao, H. , Li, X., Chen, J. PUTTING MULTI-SHADOW INTO NUMBERS	537
PP016 Liedtke, C. et al. THE LIGHT DIRECTION AND DIRECTIONAL LIGHT—TOWARDS A NEW QUANTIFICATION OF AN ESSENTIAL LIGHTING QUALITY CRITERION	542
D2 - Measurement / Measurement of Material	
PP018 Matusiak, B. LIGHT DIFFUSING POWER OF TRANSLUCENT GLAZING	552
PP020 Deneyer A. et al. BI-DIRECTIONAL SCATTERING DISTRIBUTION DATA OF SOLAR SHADING: CHARACTERIZATION AND PERFORMANCES	560
PP021 Li, W. et al. Measurement of typical road surface reflectance in china	568
D2 - Measurement / Measurement of LEDs	
PP026 Tarbeyevskaya, A. et al. OPTIMAL THERMAL MANAGEMENT OF LED LIGHTING SYSTEMS REGARDING EFFICIENCY AND COSTS	575
PP028 Bensel, S. , Völker, S. SPATIAL COLOUR DISTRIBUTION OF WHITE LED LUMINAIRES	585
PP029 Govorov, F. P. et al. EVALUATION OF LED SOURCE DEGRADATION	591
PP030 Bartsev, A.A. et al. THE FEATURES OF THE TESTING PROGRAM FOR LED-LUMINAIRES AT VNISI TESTING CENTRE	595
D2 - Measurement / Measurement Systems	
PP032 CHARACTERIZED PHOTOPIC-SCOTOPIC LUMINANCE METER FOR MEASUREMENTS IN THE MESOPIC RANGE Shpak, M. et al.	601
PP033 Porrovecchio, G. et al. LOW NOISE DETECTION SYSTEM FOR MESOPIC AND SCOTOPIC PHOTOMETRY	605
PP035 EFFECT OF ROTATION AXIS ON THE VALUE OF PHOTOMETER DIRECTIONAL RESPONSE INDEX F2 Poikonen, T. et al.	607

Poster Presentations	Page
PP036 Dubnicka R. et al. USING OF CCD BASED FIBRE OPTIC SPECTRORADIOMETERS IN PHOTOMETRIC MEASUREMENTS UNDER DIFFERENT CONDITIONS	611
PP037 Li, S. et al. AN IMPROVED CCT-TLF CALIBRATION METHOD FOR SPHERE-SPECTRORADIOMETERS	617
PP038 Calore, E. et al. TEST OF AN OPEN HARDWARE COLORIMETER	620
PP039 Yamada, T., Kohko, S. GLARE EVALUATION SYSTEM USING IMAGING PHOTOMETRY	627
PP040 Zhao, W. et al. COMPARISON ON TOTAL LUMINOUS FLUX MEASUREMENT OF SPECTROGONIOPHOTOMETER AND GONIOPHOTOMETER	634
D2 - Measurement / Miscellaneous	
PP042 Costa, C.L.M. et al. LIGHTING QUALITY AND CHARACTERIZATION OF LAMPS AND LUMINAIRES: BRAZIL GETS READY FOR THE ADVANCEMENT OF SOLID STATE ILLUMINATION	637
PP043 Coelho, C.T., Alves, L.C. REALIZATION OF THE CANDELA AT INMETRO	643
D3 - Interior Lighting / Glare	
PP044 Higashi, H. et al. THE DEVELOPMENT OF EVALUATION FOR DISCOMFORT GLARE IN LED LIGHTING OF INDOOR WORK PLACE: THE EFFECT OF THE LUMINANCE DISTRIBUTION OF LUMINOUS PARTS ON SUBJECTIVE EVALUATION	648
PP045 Koga, S. et al. THE DEVELOPMENT OF EVALUATION FOR DISCOMFORT GLARE IN LED LIGHTING OF INDOOR WORK PLACE: THE MODIFICATION OF G-CLASSIFICATION USING LUMINANCE DISTRIBUTION OF LUMINOUS PARTS	657
PP046 Chao, W.C. et al. A STUDY ON DEVELOPING VEILING GLARE RATING ACCORDING TO CHARACTERISTICS OF REFLECTED IMAGES ON SCREENS AND HUMAN RESPONSES	663
PP048 Peng, S. et al. VISUAL COMFORT LIGHTING FOR COMPUTER USE AT HOME	668
PP049 Barbato, G. et al. SUBJECTIVE RESPONSES TO DIFFERENT LIGHT SOURCES. A STUDY ON LIGHT PREFERENCES AND COMPARISON OF STANDARD LIGHT MEASURES WITH HUMAN INDIVIDUAL ESTIMATES	673

Poster Presentations	Page
D3 - Interior Lighting / Homes	
PP050 Haj Hussein, M. , Semidor, C. AN INVESTIGATION INTO LUMINOUS COMFORT IN THE SUMMER SEASON OF PALESTINIAN DWELLINGS: INHABITANTS' POINT OF VIEW	679
PP051 Khan, A.A. , Semidor, C. VIRTUAL STUDY OF THE DAY-LIGHTING PERFORMANCE OF RAWSHAN IN RESIDENTIAL BUILDINGS OF JEDDAH	689
PP053 Gok-Sook, L. , Ji-Eun, S. A STUDY ON THE PERCEPTION CHANGE OF FINISHING MATERIAL BY LIGHTING IN RESIDENTIAL SPACE	697
PP054 Csuti, P. et al. PREFERRED HOME LIGHTING DESIGN	705
PP055 Kim, H.-J. et al. AN EXPERIMENTAL STUDY ON THE LIGHTING ENVIRONMENT FOR RESIDENT ACTIVITIES IN LIVINGROOMS	711
D3 - Interior Lighting / LEDs	
PP056 Pawlak, A. , Zaremba, K. INFLUENCE OF TECHNICAL PARAMETERS OF LED INDIRECT LIGHTING INSTALLATIONS ON ILLUMINATION PARAMETERS	720
PP058 Chen, Y. et al. COMPARISON BETWEEN FLUORESCENT AND LED LIGHTING ON VISIBILITY AND VISUAL COMFORT IN SCHOOL CLASSROOMS	727
PP059 Dangol, R. et al. SUBJECTIVE PREFERENCES FOR LED LIGHTING IN OFFICES	733
PP060 Elhaddad A.I.M. et al. USER PREFERENCES IN INDOOR LED LIGHTING	742
PP061 Le Rohellec, J. et al. A STUDY OF THE SUSTAINED PUPIL RESPONSE UNDER A VARIETY OF LED ILLUMINATIONS	752
D3 - Interior Lighting / Museums	
PP062 Mou, X. , Berns R. DESIGN OF LED FOR MUSEUM LIGHTING APPLICATION	758
PP063 Szabó, F. et al. LIGHT EMITTING DIODES IN MUSEUM LIGHTING – COLOUR QUALITY REQUIREMENTS FOR VISITORS' ACCEPTANCE	767

Poster Presentations	Page
PP066 Lanyi, C.S. et al. MUSEUM OBJECTS ON THE INTERNET, IN PRINT AND IN REALITY	772
PP067 Thorseth, A. et al. DYNAMIC MINIATURE LIGHTING SYSTEM WITH LOW CORRELATED COLOUR TEMPERATURE AND HIGH COLOUR RENDERING INDEX FOR MUSEUM LIGHTING OF FRAGILE ARTEFACTS	777
D3 - Interior Lighting / Daylight	
PP069 Tralau, B. et al. THE EFFECT OF COLOUR TEMPERATURE TO HUMANS DEPENDING ON TIME OF DAY, DAYLIGHT AND WEATHER	783
PP070 Ho, J.C.K. et al. SIMULATION OF ANNUAL DAYLIGHT PERFORMANCE UNDER HONG KONG REPRESENTATIVE SKIES FOR USINE LIGHTING ENERGY INTELLIGENTLY	787
PP071 Koga, Y., Miki, Y. A REVIEW OF HISTORICAL CHANGES IN JAPANESE REGULATIONS AND STANDARDS FOR SUNLIGHT AND DAYLIGHTING	793
PP072 Deroisy B., Deneyer A. DAYLIGHT AND SOLAR ACCESS AT URBAN SCALE: A METHODOLOGY AND ITS APPLICATION TO A HIGH DENSITY DEVELOPMENT IN BRUSSELS	801
PP073 Filetóth, L.I. DAYLIGHTING DESIGN TOOL FOR ARCHITECTS	809
PP074 Souza, D.F. et al. SKY CLASSIFICATION METRICS FOR HIGH DYNAMIC RANGE IMAGES	817
PP075 Kato, M. et al. RESEARCH ON PREFERABLE LUMINANCE CONTRAST OF WINDOW AND WALL AT DAYTIME	826
PP076 Fontoynont, M. et al. PROPOSAL OF SIMPLE DAYLIGHTING PERFORMANCE INDICES FOR REGULATIONS: VALIDATION WITH ON-SITE MEASUREMENT CAMPAIGN	831
PP077 Aizenberg, J.B. HOLLOW LIGHT GUIDES: 50 YEARS OF RESEARCH, DEVELOPMENT, MANUFACTURE AND APPLICATION - A RETROSPECTIVE AND LOOKING TO THE FUTURE	838
PP079 Tsikaloudaki, K. et al. ASSESSMENT OF DAYLIGHT CONDITIONS IN OFFICE BUILDINGS WITH THE INTEGRATION OF EXTERNAL BLINDS	844

Poster Presentations	Page
PP083 Liu, Y., Mou, T. EVALUATION OF WINDOW LIGHTING CONSIDERING THE CIRCADIAN EFFECT	851
D3 - Interior Lighting / Controls	
PP085 Kojima, Y. et al. DEVELOPMENT OF AUTOMATIC LIGHTING CONTROL SYSTEM USING BRIGHT-NESS IMAGE	857
PP086 Higuera, J.E. et al Energy harvesting sources for intelligent LED lighting systems	866
PP087 Mochizuki, E. et al. EFFECTS ON ENERGY SAVINGS OF PERSONAL LIGHTING CONTROL SYSTEM IN AN OFFICE BUILDING IN JAPAN - PART 1 OUTLINE OF THE MEASUREMENT AND EFFECTS ON LOWERING ELECTRICAL POWER CONSUMPTION FOR LIGHTING	872
PP088 Oikawa, D. et al. EFFECTS ON ENERGY SAVINGS OF PERSONAL LIGHTING CONTROL SYSTEM IN AN OFFICE BUILDING IN JAPAN - PART 2 EVALUATION OF LIGHTING ENVIRONMENT AND OCCUPANTS' RESPONSE TO PERSONAL LIGHTING CONTROL SYSTEM	880
PP090 Chun, S.Y. et al. SMART LIGHTING CONTROL USING HUMAN MOTION TRACKING FROM DEPTH CAMERAS	889
D3 - Interior Lighting / Energy Efficiency	
PP091 Kirsch, R., Völker, S. LIGHTING QUALITY VERSUS ENERGY EFFICIENCY	895
PP093 Cho, S.-H., Kim, H. DEVELOPMENT OF THE METHOD TO BE ECONOMIC EVALUATION OF A LIGHTING SYSTEM	903
PP094 Miki, Y. THE REQUIREMENTS FOR THE LIGHTING ENERGY PERFORMANCE ASSESSMENT OF NON-RESIDENTIAL AND RESIDENTIAL BUILDINGS CONSIDERING ASSUMPTION OF BUILDING USAGE CONDITIONS	912
PP095 Mucklejohn, S.A. et al. UNRAVELLING EFFICACY, MAINTENANCE AND LIGHTING ENERGY FOR THE END USER	918
PP097 Novák, T. et al. SOFTWARE CALCULATION TOOL FOR LIGHT SAVINGS IN THE BUILDINGS	928

Poster Presentations	Page
D3 - Interior Lighting / Lighting Design	
PP098 Säter, M. LIGHTING DESIGN BASED ON HUMAN PRINCIPLES	934
PP102 Dubnicka R., RELATION BETWEEN THE GRID FOR CALCULATION/MEASUREMENT AND RESULTING LUMINOUS PARAMETERS FOR ILLUMINATION OF INDOOR WORK-PLACES	941
PP103 Garcia-Hansen, V. et al. TESTING THE ACCURACY OF LUMINANCE MAPS ACQUIRED BY SMART PHONE CAMERAS	951
PP104 Filetóth, L.I. GLOBAL ILLUMINATION ALGORITHM USED IN COMPUTER AIDED ARCHITECTURAL DESIGN PRESENTATION	956
PP105 Németh, Z., et al. HOW TO CHOOSE SIMULATION PARAMETERS TO IMPROVE ACCURACY?	962
D4 - Lighting and Signalling for Transport / LEDs	
PP106 Saito, T., Akashi Y. FIELD EXPERIMENTS OF STREET LIGHTING USING HIGH S/P RATIO LEDS	966
PP107 Hirakawa, S. et al. STUDIES ON TUNNEL LIGHTING VISIBILITY AND ENERGY-SAVING EFFECT IN HIGH-OVERALL-UNIFORMITY (APPLICATION OF LED IN TUNNEL LIGHTING)	971
PP108 Lee, M.W., Kim, H. A SET OF QUALITY CRITERIA FOR SELECTION AND INSTALLATION OF LED ROAD LIGHTING	976
PP109 Fontoynt, M. et al. PERCEPTION OF HUMAN SKIN IN STREET LIGHTING UNDER FIVE TYPES OF LED SPECTRA	983
D4 - Lighting and Signalling for Transport / Road Lighting	
PP110 Fotios, S., Yang, B. MEASURING THE IMPACT OF LIGHTING ON INTERPERSONAL JUDGEMENTS OF PEDESTRIANS AT NIGHT-TIME	990
PP113 Gasparovsky, D. CALCULATION OF THE OPERATION TIME OF ROAD LIGHTING	999
PP115 Jägerbrand, A.K., Robertson, K. RENEWAL OF STREET AND ROAD LIGHTING IN SWEDISH MUNICIPALITIES	1009

Poster Presentations	Page
PP117 Wang, L. , Zhang, M. RESEARCH ON TESTING METHODS OF RELATIVE PARAMETERS OF OVER-PASS LIGHTING SAFETY BY HDR IMAGE	1017
PP118 Lee, M.W. et al. A STUDY ON THE LIMIT OF LIGHTING POWER DENSITY FOR ROAD LIGHTING	1021
PP119 Schade, S. , Völker, S. OPTIMISING VISIBILITY IN STREET LIGHTING BY OPTIMISING AND COMPARING LUMINOUS INTENSITY DISTRIBUTIONS	1028
PP120 Pracki, P. , Jägerbrand, A.K. APPLICATION OF ROAD LIGHTING ENERGY EFFICIENCY EVALUATION SYSTEM IN PRACTICE	1038
PP123 Saraiji, R. et al THE EFFECT OF ONCOMING CAR HEADLIGHTS ON PEDESTRIAN VISIBILITY	1044
D4 - Lighting and Signalling for Transport / Road Surface / Objects	
PP126 Akizuki, Y. , Okuda, S. RELATIONSHIP BETWEEN LUMINANCE DISTRIBUTIONS OF ROAD SURFACE AND VISIBILITY IN STREET LIGHTING DESIGN	1051
PP127 Lecocq, J. et al. LUMIROUTE: OPTIMISATION OF ROAD SURFACES REFLECTION PROPERTIES AND LIGHTING	1062
PP128 Hagio, T. et al. THE STUDY OF REFLECTANCE FACTOR'S DISTRIBUTION OF FALLEN OBJECTS AND THE INFLUENCE ON VISIBILITY	1070
PP129 Korobko, A.A. APPROXIMATION OF ROAD SURFACE LUMINANCE COEFFICIENT	1076
D4 - Lighting and Signalling for Transport / Tunnel Lighting	
PP131 Ito, H. et al. VISIBILITY OF THE CRITICAL OBJECT AND ENERGY EFFICIENCY OF PRO-BEAM LIGHTING FOR TUNNEL INTERIOR LIGHTING	1083
PP133 Miyazaki, B. et al. DETERIORATION PREDICTION IN CONSIDERATION OF THE DIFFERENCE IN LIGHTING TIME OF A TUNNEL LIGHTING EQUIPMENT	1092
D5 - Exterior Lighting	
PP136 Wänström Lindh, U. RHYTHM IN ILLUMINATION CREATED BY STATIC LIGHT PATTERNS	1101

Poster Presentations	Page
PP137 Djokic, L. et al. SUBJECTIVE IMPRESSIONS AS QUALITY INDICATORS OF AMBIENT LIGHTING	1107
PP139 Zou, N. et al. INVESTIGATION ON RESIDENTIAL LIGHTING STATUS IN PART AREA OF CHINA	1112
PP141 Song, G. , Yan, C. J. THE QUALITATIVE EVALUATION OF LIGHTING QUALITY IN URBAN SQUARE LIGHTING	1116
PP143 Corten, I. LIGHT AND PARTICIPATION NIGHT EXPLORATORY WALKING	1124
D6 - Photobiology	
PP145 Noguchi, H. et al. ECO-FRIENDLY COLOR TUNABLE LED OFFICE LIGHTING INCORPORATING CIRCADIAN PHYSIOLOGY	1127
PP146 Takahashi, Y. RESEARCH TREND ON QUANTIFICATION SYSTEM FOR BIOLOGICAL CLOCK	1131
PP149 Vincent, R.L. et al. COMPUTER AIDED DESIGN (CAD) FOR APPLYING UPPER ROOM UVGI FIX- TURES TO CONTROL AIRBORNE DISEASE TRANSMISSION	1135
PP152 Ishii, C. , Mochizuki, E. COMBINED EFFECTS ON SLEEPING QUALITY OF LIGHTING ENVIRONMENT IN THE DAYTIME AND THAT IN THE NIGHT TIME	1144
PP153 Lim, J.-M. et al. A STUDY ON DEVELOPMENT AND PERFORMANCE OF LIGHT SOURCE'S UV-IR WAVELENGTH BLOCKING FILTER	1153
PP154 Diethelm, B. LIGHT IN THE BODY - BODY IN THE LIGHT REVISIONING THE BALANCE OF LIGHT AND DARK	1162
PP155 Sliney, D.H. , Lyon, T.L. BALANCING BENEFITS WITH EXPOSURE RISKS OF ULTRAVIOLET EMISSIONS FROM LAMPS	1168
PP156 Lang, D. , Wojtysiak, A. MELANOPIE ASSESSMENT OF LIGHT – STANDARDIZATION ACTIVITIES	1176
PP157 Umemiya, N. et al. MOOD STATES AND LIGHT ENVIRONMENT EVALUATION	1180

PP159 Coetzee, E. et al. SPECTRAL REFLECTANCE MEASUREMENTS ON VERVET MONKEY PELTS	1186
PP160 Zou, N. et al. LED LIGHT SUPPLEMENT TECHNIQUE FOR INDOOR PLANTS	1195
PP161 Škoda, J. et al. OPTIMAL ILLUMINATION OF PLANTS IN GROWTH CHAMBERS WITH LOW ENERGY DEMAND	1199
D8 - Image Technology	
PP162 Sumec, S. et al. EVALUATION OF ILLUMINATION USING DIGITAL PHOTOGRAPHY	1208
PP163 Richard, N. et al. TOWARD A VALID IMAGE PROCESSING SYSTEM THROUGH COLOUR STANDARDS	1216
PP164 Iatsun I. et al. EYE-TRACKING FOR 3D-APPLICATION: GAZE-POINT DETECTION TAKING INTO CONSIDERATION DISPARITY	1226
PP165 Yamaguchi, H. et al. DEVELOPMENT OF GENERIC COLORIMETRY SYSTEM FOR LIGHTING ENVIRONMENT BY USING CCD CAMERA	1235

ADDENDUM 1 (2013-06)

PP065 Piccablotto, G. et al. SUBJECTIVE AND OBJECTIVE ASSESSMENT ON LED LIGHTING QUALITY FOR MUSEUM SHOWCASES	1240
PP084 Pellegrino, A. et al. A GRAPHICAL TOOL TO PREDICT THE DAYLIGHT AVAILABILITY WITHIN A ROOM AT THE EARLIEST DESIGN STAGES	1250
PP114 Markey, Y., Deswert, J.-M. IN DEPTH INVENTORY FOR A HIGHER QUALITY OF STREET LIGHTING	1261