MINUTES

CIE Division 3 Meeting

9:00 am to 15:40 pm, Tuesday, October 7, 2008

M Hotel, Ljubljana, Slovenia.

1. Opening of meeting

The new DD, Jan Ejhed, opened his first Division 3 meeting by expressing thanks to the Slovenian Lighting Society for inviting us to Ljubljana. He introduced himself to those not familiar with him: He is a professor at KTH (The Royal Institute of Technology) in Stockholm and a practicing lighting designer, and he has been active in CIE since the Venice session in 1987. He will try to do his very best as DD.

2. Approval of agenda

The DD said that he would like to finish up to item 11 before lunch, so that after lunch we will have time for thorough discussion about future activities of D3.

There were no comments or additions to the agenda; it was considered to be accepted without need for a formal vote.

3. Attendance

The DS circulated a sign-up sheet; and asked whether anyone held a proxy for an NC members who was not present. The following is the list of people who signed the sheet, with their roles within the division.

Name	Country	Role
Jennifer Veitch	Canada	DS3
Hans J. Jacobsen	Denmark	NC Rep
Liisa Halonen	Finland	NC Rep
Ilkka Pekanheimo	Finland	observer
Christoph Schierz	Germany	NC Rep
János Schanda	Hungary	CIE-VPT; Hu NC Rep proxy
Eliyahu Ne'eman	Israel	NC Rep
Fabio Bisegna	Italy	TCM-Cor 3-46
Valerio LoVerso	Italy	observer
Anna Pellegrino	Italy	NC Rep; TCM 3-34, 3-39
Yukio Akashi	Japan	TCS 3-44

Yasuko Koga	Japan	NC Rep; R 3-13; TCM 3-46
Yoshiki Nakamura	Japan	AD/EL, TCC 3-45
Ken Sagawa	Japan	TCM 3-44 (CIE VP)
Martine Knoop	Netherlands	NC rep; TCM 3-45, 3-46, TCM-Cor 3-44; R 3-28
Werner Osterhaus	New Zealand	TCC 3-39
Jan Petter Skar	Norway	NC Rep
Dorin Beu	Romania	Observer
Julian Aizenberg	Russia	NC Rep
Grega Bizjak	Slovenia	NC Rep
Gazvoda Motija	Slovakia	NC Rep
Robert Henderson	South Africa	NC Rep; TCM-Cor 3-45; task group R 3-23
Jan Ejhed	Sweden	DD3
Tommy Govén	Sweden	NC Rep; TCM 3-44, 3-45. 3-46
Lou Bedocs	UK	TCC 3-43; R 3-27; CEN & ISO liaison
Geoff Cook	UK	NC Rep; TCC 3-44
Peter Thorns	UK	DE3
Mojtaba Navvab	US	TCC 6-41
Rados Topalova	US	TCM 3-39

4. Apologies for absence

The DS read a list of members who had sent their regrets prior to the meeting:

Peter Dehoff (R 3-23; Austrian representative)

Arnaud Deneyer (Belgian representative)

José R. de Andrés Díaz (Spanish representative)

Dominique Dumortier (French representative)

Marc Fontoynont (CIE VP)

Hyman Kaplan (IALD liaison, TCC 3-42)

Richard Kittler (TC member)

Yandan Lin (TC 3-46 member)

Prof. Dr. András Majoros (Hungarian representative)

John Mardaljevic (R 3-26)

Barbara Matusiak (TC 3-45)

Terry McGowan (US representative)

Piotr Pracki (Polish representative)

Simon Simos (Swiss representative)

Yoshiaki Uetani (Liaison to ISO 163/SC2)

5. Approval of minutes of the Division 3 meeting, July 10, 2007, Beijing

The DD reviewed the minutes of the previous meeting. There were no changes suggested; therefore the minutes were considered approved without formal vote.

6. Division membership changes - welcome new members

The DS read a list of new national committee representatives since the 2007 meeting, and welcomed them to their new roles. She particularly noted Dr. Schierz, who was present.

Mr. Arnaud Deneyer, Belgium

Prof. Dr. András Majoros, Hungary

Prof. Dr. Christoph Schierz, Germany

Mr. Jose de Andres Díaz, Spain

It was noted that long-serving New Zealand member, Hayden Willey, has retired. A new member is to be appointed. There is currently no member on record for Slovakia.

7. Division Director and Associate Directors reports

DD report: Prof. Ejhed is pleased to work with CIE because there are so many competent people to work with, people who are his friends and fellow "freaks" who can talk about lighting as no other place. He announced the line-up of the executive. The web site has been moved and is now hosted by CIE. Over the next little while it will be reformatted into a standard CIE format. DS worked with CB to clear out discrepancies in records of TCs and Rs. New guidelines for TCs and publications are being developed by Teresa Goodman (VP Publications). We don't have any old, inactive TCs; he is pleased by our progress in this. D3 produced one report this year, from TC 3-43, with successful balloting by both Division and BA. Reporterships also are being productive. He is interested in making liaisons with professional lighting designers (PLDA and IALD), particularly PLDA where he has been active – particularly with consultants (independent lighting designers), because what D3 does affects their work. There seems to be two worlds: the PLDA world seems to be very separate from CIE, PLDA people know little to nothing about CIE. CIE and PLDA have signed a cooperation agreement this year and DD3 is very happy. There's one liaison officer for PLDA to CIE – a professional from Wiemar in Germany. This afternoon he wants to talk about a strategy for more efficient work in D3: questions about lighting are almost always interdisciplinary – people ask

questions that are wide; how do we work better to answer these questions? Announced next meeting in Budapest (BA/GA before; 27-29 May for LED conference, then Monday-Wed for TC and D meetings, 1-3 June; TC meetings could be accommodated earlier depending on desire of committee members; http://www.cie-hungary.hu).

Prof. János Schanda noted that he has looked at PLDA web site, and would like particularly to make some connections with D3 because the content of the web site is most directly related to lighting applications. He would like D3 to provide them with some feedback on some of their web content, which in his view is not entirely accurate.

Dr. Geoff Cook mentioned his pleasure that CIE has taken over the web site, something he had wanted to see for some years. He suggested that we should formally thank Dominique Dumortier for his years of hard work in creating the web site.

"That Division 3 expresses its thanks to Dominique Dumortier for his work in creating and maintaining the Division 3 web site."

Moved: J. Veitch; Seconded: G. Cook. In favour: Unanimous, voted with applause.

Action item: DS to write to Dr. Dumortier to express D3's thanks.

AD/Daylight: Dr. Dominique Dumortier - no report received.

AD/Electric: Dr. Yoshiki Nakamura gave an oral report. After the Beijing meeting, he has reflected on our needs: We need to address the health and lighting relationship, as we are doing in TC 3-46. We also need to address energy issues in lighting urgently, but we have not enough activity in this area. There are three possible activities:

1. How to reduce illuminance levels and therefore save energy. It might be possible to reduce illuminance for task lighting by taking adaptation level into account.

2. Integration between daylighting & electric lighting is another technique, but we need design methods to do so (although his luminance-based method might be one way to do this).

3. Control of electric lighting: We need to move from a reportership to a TC. He would like to see someone take on such an activity.

DD3 said that he agreed with this analysis of the situation.

Prof. Aizenberg commented that world situation is that energy savings in lighting is a critical issue, and a TC on this topic would be important. IEA Annex 45 (led by Halonen, FI) finishes this month, and perhaps Prof. Halonen would lead such a TC. This discussion was postponed to the afternoon discussion of future activities.

8. Technical Committees:

Chairmen's Reports

TC 3-25 Co-ordination of the IDMP and its data (D. Dumortier)

The round-robin calibration effort has been going on. The stations in Bratislava, Athens, Nantes, Vaulx-en-Velin and Osaka have taken part in it. The calibration has shown that compared to the reference sensor, Bratislava is 3% lower, Vaulx and Nantes are in line with the reference sensor, Athens and Osaka are 5% higher. The reference sensor is

now available from Vaulx-en-Velin to any IDMP station which would like to take part in the calibration; Freiburg is a potential candidate. For the MESOR project, we are preparing an updated list of the IDMP stations still running.

There was discussion of the need to change the status of TC 3-25 to an ongoing activity, something like a "working group". It was suggested that the DS and DD correspond with TCC about this. Prof. Navvab noted that new countries are joining, and he would like our web site to provide a link for new members to join. Prof. Schanda noted that members of the IDMP network, if it is a CIE activity, should be from countries that are CIE members or associates.

Action item: DS and DD to write to Dr. Dumortier to discuss.

TC 3-34 Protocols for describing lighting (J. Veitch)

TCC is working to revise the draft document based on comments received in summer 2007. She will submit it to the committee for ballot by end of calendar 2008, with the goal of submitting it for Division and BA ballot in spring 2009.

TC 3-36 Use of satellite images to derive daylight data (D. Dumortier)

The use of satellite imagery, in conjunction with quality ground data sets and other meteorological information, has become an increasingly important and effective way of developing site-time-specific solar resource assessments over large areas. The advantage of the satellite approaches is that large areas of the earth's surface can be assessed at high spatial and temporal resolutions using uniform and consistent methodologies at relatively low costs, when compared to developing the same information using a ground-based network. The work of this TC is linked to the currently running IEA Task 36: "Solar Resource Knowledge Management".

The objective of this task is to provide further standardization, better data reliability and availability, and improved spatial and temporal coverage, with customized solar resource products, including daylight. The task has three subtasks:

A. Standardization of solar resource products to insure worldwide intercomparability and acceptance;

B. Development of a common structure for archiving, processing and accessing solar resource information, such as through a single portal;

C. Improved techniques for solar resource characterization and forecasting

From the work of subtask A, TC 3.36 is defining a standard procedure to derive illuminances from satellite images. From the work of subtask B, TC 3.36 will provide technological guidelines to implement the procedure to produce daylight information from solar radiation portals focusing only on irradiance/irradiation. From the work of subtask C, TC 3.36 is investigating whether the spectral information available through the new generation of satellites could improve the computation of illuminances. The TC work is due to end in 2010, one year after the end of the IEA Task 36.

TC 3-37 Guide for the application of the CIE general sky (D. Dumortier)

The TC was lucky to get two editors: Ian Ashdown and Phillip Greenup. They have proposed a new structure for the final document which would make it much easier to read. So the document has been reorganized.

Prof. Kittler had expressed concern that the work done under Derrick Kendrick's chairmanship was in danger of being lost. He should not be afraid that the work will be completely lost, because the modified document exists. Unfortunately, the editors which are working for or even running private companies have been so busy this last year that the final version is not ready yet. Dr. Dumortier accepted the chairmanship only because there were two editors who could finalize the document. At least for the next six months, he cannot promise to take the documents back from the editors and finalize it myself. So for now, he will let the editors see if they can manage it.

Following this report, which was read by the DS from an e-mail message sent by the TCC, there was discussion concerning the need for a timetable to complete the committee. Mr. Thorns said it seems that the TCC has a plan to complete the work. Prof. Navvab has surveyed software that is being used and does not see any of the software companies using any of Kittler's 22 models, which appear (we think) in this report – they all use the Perez model. Prof. Navvab wants to see where the Kittler models are being used, if there is to be such a report. Mr. Bedocs doesn’t think this is a feasible question until the report is actually made public; he wants the DE to get involved to extract the document from the TC Editors and see if the work can be moved along. LB is concerned that if it doesn't get done soon it will be superseded by other work, it could be obsolete. DD3 asked if anyone disagreed with this course of action; no one did.

> *Action item: DE to contact Dumortier et al. to see if his support can help to advance the work. (DS to provide DE with contact information.)*

TC 3-39 Discomfort glare from daylight in buildings (W. Osterhaus)

The TCC reviewed the terms of reference of the committee, which was formed in 2002 in Ottawa. At Beijing it had been suggested that the committee terminate its work with a technical report based on a literature review, and that the development of a guidance document be moved to a new TC. Yesterday's TC meeting in Ljubljana came to agreement on this: The committee will write a technical report that summarizes the research and identifies directions for new research, outlining influences on discomfort glare from windows. The TC has set a new goal to have a draft report in time for the Budapest meeting in May 2009.

TC 3-42 Indoor Work Space Application Guide (H. Kaplan)

The DS had received a report by e-mail, which she read: "I will no longer be able to attend the Division 3 meetings and, regretfully, must resign the Chair of TC 3-42. I will work with the new Chair and provide them with all of the information I produced as part of the Reportership."

Mr. Bedocs remarked that this activity this started from taking out the technology schedule from CIE 29.2 to form S008, so the advice to designers was being lost. Non-quantifiable parameters were being cut out. Since 2001 we have been looking for someone to come forward to take this on in a general sense as opposed to a series of application-specific guides. Mr. Bedocs thinks that whoever takes on the task has a good starting point in the material Mr. Kaplan collated earlier. If no one else takes it on, he will be glad to do it – but he couldn't organize a TC.

The DD remarked that he finds this committee problematic. He is not confident that he understands the terms of reference sufficiently to close it down, but it doesn't sound like we clearly have someone to take on its leadership.

Mr. Bedocs said that he is willing to coordinate the work temporarily but is open to a new Chair being the one to complete the work, so that at the next D3 meeting we can make a decision. It may be possible to yield a document by examining the various country-specific bits.

Mr. Jan Petter Skar expressed interest in the work, although not in leading the TC.

Dr. Yasuko Koga reported that the Japanese have created their own guideline based on S008 and would be happy to contribute their material, although they would not be willing to chair. Sweden, similarly, has such a guide; Mr. Govén is interested in involvement.

Action: Bedocs to take over as Acting Chairman.

Dr. Cook proposed that D3 send a letter of thanks to Hyman Kaplan for his work on R 3-22. This was agreed.

Action: DS to send letter of thanks to Mr. Kaplan on behalf of Division 3.

TC 3-43 Determination of discomfort glare (L. Bedocs)

This TC was to create a standard CIE table for UGR to support S008. The TC completed its work, having set out to supplement CIE 117 and using its terminology and structure. The draft was positively voted by the Division and BA. Some negative votes were registered because the document wasn't exactly in line with CIE 117, and some editorial issues were criticized for being inconsistent with ISO practice. Over the past few month the document has been revised with the held of the CIE VPT and on Monday it will go to CB for publication. When published it will be a standard (CIE S021).

The VPT, Prof. Schanda, thanked Mr. Bedocs for his excellent work. He commented that CIE usually suggests to IEC and ISO that they adopt CIE standards for joint publication on the "fast track", where it gets voted at the highest level (not at the technical committee level within IEC and ISO). Sometimes when ISO and IEC national members are unaware of the issue, things die. He asked NC members to please contact your ISO and IEC NC members to alert them to this, so that they can vote favourably. (Mr. Bedocs said that it is his understanding that ISO and IEC select 5 countries at random – so CB needs to learn from ISO and IEC which countries will have the vote on a particular document. Sometimes the countries chosen don't know anything about lighting, so they abstain and then the document dies.)

TC 3-44 Lighting for Older People and People with Visual Impairment in Buildings (G. Cook)

TC3-44 met on 7th October 2008 in Ljubljana. Task 1 of the TC to provide summary recommendations for the lighting provision for older people and people with visual impairment in buildings for the draft 'CIE Guidelines on accessibility', as commissioned by the Board of CIE and led by Ken Sagawa (JP), had continued over the last year. It was agreed that, following comments from the Board of CIE on Chapters 5 & 6 of the latest draft, further revisions were required. It was agreed that the Chair would draft the new revisions and the Secretary would circulate these to the TC members in order to provide an agreed draft by the end of November 2008.

Task 2, to produce a Technical Report on the lighting requirements for older people and people with visual impairments in buildings, was discussed. It was agreed that Section 8, 'Lighting design recommendations for partially sighted as a group', of CIE 123:1997 would be used as the basis for the report, although expanded to include the older person. A contents list of the report was agreed. A preliminary draft of the Technical Report is to be circulated for comment to TC members prior to the CIE Mid-term meeting in Budapest in June 2009.

TC 3-45 Luminance based design approach (Y. Nakamura)

The committee met yesterday with 4 members and 2 observers. The committee has gathered 17 related papers in its literature search, and 5 more were identified yesterday. The TCC has an outline for the report and the committee agreed to this. Luminance-based lighting design could be used for promoting energy savings because it can permit more attention to predicting adaptation levels; and it can also focus attention on room appearance. The committee will expand its literature search, particularly in relation to perceptual matters, and will look for data sets combining subjective assessments and luminous images. TCC will have a draft report for the next meeting (2009), but would like to have the committee life extended for 1 year, to 2010. The TCC will discuss with K. Sagawa to coordinate with his work in Division 1.

Mr. Jan Petter Skar, a TC member, had missed the meeting. He feels that visual performance should not be overlooked in the work of this TC.

TC 3-46 Research Roadmap for Healthful Interior Lighting Applications (J. Veitch)

The TCC reported that, having met the previous day for the first time, the committee now has a structure for the report, based on the principles of healthy lighting articulated in CIE 158:2004, with an additional section dealing with issues of research quality (e.g., common measures; metrology) that will ensure that results can be applied. A draft report is planned for early 2009 and discussion will continue in Budapest. The TCC would like the report to be published in calendar 2009.

TCs for closure

The DS reported that there had been confusion between D3 records and CB records concerning the status of two TCs that D3 had decided previously to close. She asked, as a matter of housekeeping, for formal votes to close these two TCs.

TC 3-20 Lighting and Architecture Concerning Artificial and Daylighting (H. Kramer).
Moved: Prof. Schanda (Hungary – proxy). Seconded. Mr. Henderson (South Africa). In favour: Unanimous. [Only NC representatives voted.]

TC 3-41 The Visual Quality of Displays in Museums (E. Ne'eman)

Moved: Dr. Cook (UK). Seconded : Prof. Schanda. In favour: Unanimous.

> *Action: DS to communicate these results to CB, and ask that the records be updated.*

9. Reporters

Reports

R 3-13 International Lighting Vocabulary (Y. Koga)

The equations in the ULV needed some further editing, this has now been done. VPP is checking the "final" draft, and it will be sent to NCs for voting, hopefully this year.

CB is negotiating with IEC whether the material should be put onto the Electropedia web site, or CIE will have its own web place for the dictionary. It should become freely available on the Internet.

Mr. Bedocs asked if the ILV will it also still be IEC 845? Prof. Schanda said "yes", and Dr. Koga said that IEC has no committee to revise it.

R 3-23 Lighting Control and Energy-Efficiency (P. Dehoff)

The DS read a short report received by e-mail from Mr. Dehoff: "The topic is developing very fast. It is hard to produce a final report. Anyway, I am still willing to do this task. During the last period several standards have been issued addressing controls as the necessary tool to reduce energy consumption. This relates to:

- daylight use

- presence detection

- constant illuminance control

"Furthermore, lighting for user´s need is also a matter of controls, particularly dynamic and personal rhythm-supportive lighting.

"There are several strategies for the control issues.

"If Div 3 wants me to continue and come up with a summary statement I am still willing to do so."

Discussion ensued, although the reporter was not present. D3 wants a report, but he has not completed his report. DD said it's obviously an important issue but there are questions as to Mr. Dehoff's availability to serve on this topic – he had promised in Beijing to complete it by the end of 2007. D3 could send the request back to him to ask him to complete a report; or could take other action. Mr. Bedocs suggested that we ask the reporter to propose the specific kind of document that CIE could produce on this topic. Mr. Govén says this is important; there are standards for energy-saving calculations, but not agreement on user acceptance of automated controls. He and others expressed dissatisfaction with the situation of not having the report. Dr. Knoop offered to contact Mr. Dehoff, make outline of report, push it forward to complete an outline of the report by end of calendar 2008 with input from Peter's task group and a complete report with recommendations for the 2009 meeting.

> *Action item: Dr. Knoop to contact Mr. Dehoff to advance the work prior to 2009 meeting.*

R 3-24 Overhead Glare (T. McGowan)

DS read the report that had been received by e-mail: "I had expected to supply the final report from my reportership on Glare (R3-24) particularly since the work of TC3-43 has proceeded. However, I have just found some new glare research which has been published in Japan and I believe it should be included in my report. Unfortunately, the work is published only in Japanese at this moment and I was not able to get it translated in time for the Ljubljana meeting. I expect, however, to submit it for the Minutes which will then conclude the reportership as the Division has intended."

R 3-25 Lighting and Health (M. Fontoynont)

Dr. Fontoynont was not present and had sent no report. There was discussion as to the need for this reportership. Mr. Bedocs thinks that this reportership was to develop a CIE statement on lighting for health that would be issued by CIE as a press release. Now that there is TC 3-46 and the need for lighting recommendations to address health as well as energy has been recognized in the CIE statement on energy. The work seems to have been accomplished.

R 3-26 Climate-based Lighting Analysis (J. Mardaljevic)

The report is attached as Appendix A. It concluded with a proposal for a new TC. There was general agreement that the report is complete. The proposal for a new TC was dealt with during the discussion of new committees.

Prof. Schanda commented that there is a mechanism for publication of this report in the compendium of CIE work. DS will consult with the author on this.

Action item: DS to consult with the author and with CB about this, and shepherd it through if the author wishes.

R 3-27 CIE Method for Calculation of UF (L. Bedocs)

The reporter delivered his report:

> The need for developing a practical procedure and method for calculating UF tables for indoor luminaires, used for general lighting of spaces, was presented at the Beijing session of Division 3 and it led to the creation of this reportership.
>
> A brief study was made of current calculation options that make use of elements of CIE developed parameters. These included the CIE luminous flux zones, accumulated luminous fluxes, geometric multipliers and transfer factors.
>
> CEN already makes use of these parameters and have developed a practical, albeit limited solutions, calculation system. The system “Calculation of UF tables” is published in the Annex A of EN 13032-2. This system is available to CIE and the ideal solution would be to adopt and extend the method to provide a comprehensive solution. The development of the CIE system based on this method will require a team of experts that is best organised via a Division 3 TC.
>
> It is recommended that Division 3 sets up a TC charged with the production of the “CIE standard method of UF table calculation for indoor luminaires”. The proposed TC chairman is Mr Peter Thorns and expression of membership interests to date were indicated from Australia, Germany, Sweden, Japan and UK. This could be completed within two years.

Mr. Govén commented on the importance of having a harmonized method to permit international comparisons. Mr. Bedocs added that such a document would partly replace older CIE documents that are largely unworkable. The proposal for a new TC was dealt with later in the day.

R 3-28 Lighting requirements for night-shift workers (M. Knoop)

Dr. Knoop reported that the report will review and describe the influence of lighting and strategies for night-shift workers, drawn from current research findings. To ensure a state of the art knowledge, the review mainly includes information from recent reviews and a carefully selected number of publications. It does not provide a complete review of the literature. There has been little cooperation with TC 6-62 yet, mainly because this TC is still in its starting phase. The document is ready in a draft version and will be reviewed by a number of people, amongst them one TC 6-62 member, in the period October – November 2008. It is her intention to finalize the document before the end of 2008.

Reporterships for closure

R 3-25 has been superseded now by TC 3-46. It was moved by Mr. Skar (Norway) and seconded by Dr. Knoop (Netherlands) that it be closed. In favour: Unanimously approved.

R 3-27 has completed its work and the report has been received. It was moved by Dr. Cook (UK) and seconded by Dr. Schierz (Germany) that it be closed. In favour: Unanimously approved.

> *Action item: DS to communicate these results to CB and request that they update their records.*

10. Liaison Officers reports

CEN TC169 – Light and Lighting – L. Bedocs

The next plenary of this TC will be in Oct 08.

The tasks are devolved and are progressing in the 10 WGs.

WG1 – Terms and Definitions – New convenor appointed to update the EN 12665

WG2 – Lighting of work places – The WG has updated standard EN 1837 Lighting in Machines in line with the new Machinery Directive and is revising EN 12464-1.

WG3 – Emergency lighting – The EN 13032-3 on photometric data has been published. The next task is to revise 1838 with particular attention to signage.

WG4 – Sports lighting – The revised EN 12193 has been published. There is some dissatisfaction with FIFA requirements that have dramatically increased illuminance requirements, which is seen as unacceptable at CEN because of the energy implications. Discussions are ongoing.

WG5 – Road lighting – New convenor for joint WG by TC169 and TC226 is to be appointed to revise EN 13201 and add energy limiting criteria.

WG6 – Tunnel lighting – No activity.

WG7 – Photometry – Work commenced on a, characterisation of illuminance and luminance meters, b, photometry of T5/T16 lamps, c, angular spacing in goniophotometry.

WG8 – Exposure to incoherent radiations – All parts of this multi part standard have been published.

WG9 – Energy requirements for lighting in buildings – The standard EN 15193 has been published.

WG10 – Characterisation of optical materials – New working group formed with task to draft as part 1 standard on “Characterisation of ductile mirror optical materials".

ISO TC159/SC4 – Ergonomics of human-system interactions – L. Bedocs

The main focus is on the updating of the multi part of ISO 9241 standard covering both hardware and software components of interactive systems. Work is progressing on ISO 6385 standard to define ergonomics terms and concepts and establishes basic guidelines for the design, operation and maintenance of work systems.

Dr. Schierz asked whether there is a schedule for the work of SC4. Mr. Bedocs said there is a published work schedule and as far as he knows the document is currently out for review by NC members. He will pass web links on to Dr. Schierz.

> *Action item: Mr. Bedocs to pass web links for ISO TC 159/SC4 documents to Dr. Schierz.*

ISO TC159/SC5 – Ergonomics of the physical environment – L. Bedocs

> *WG2 – Lighting*, the group is at standstill to await clarification on CIE/ISO voting procedure agreements.
>
> *WG4 – Integrated environments*, environmental information gathering in progress.
>
> *WG5 – Environment for people with special requirements*, the development of the draft requirements are progressing.

Dr. Sagawa reported that there is a new advisory group for accessible design under TC 159. This new group is to coordinate other ISO TC activities related to accessibility, not only TC 159. He would like CIE to be in contact with that AG.

> *Action item: DS to communicate ask CB to follow up with ISO.*

ISO TC 163/SC2 – Thermal performance and energy use in the built environment / Calculation Methods (Daylight) -- Y. Uetani

> Dr. Uetani's report is attached as Appendix B.

This is a new liaison. The DS asked that we formally accept it. It was moved by Dr. Schierz, seconded by Dr. Cook, that we should accept Dr. Uetani as our liaison to this organization. In favour: unanimous.

World Meteorological Organisation (WMO) – None.

Following the 2007 meeting, Dr. F. Hentzberger was to have contacted WMO to establish a new liaison. We have had no word from him on this. DS will follow up and report back in 2009.

> *Action item: DS to communicate with CB and Dr. Hentzberger to see whether this liaison can be made.*

International Association of Lighting Designers -- H. Kaplan

Hyman Kaplan reported by e-mail to the DS: "The Board of IALD is in the process of changing the liaisons to Divisions 3 & 5, as I have been very active on the Energy Code front, both the ASHRAE/IES 901 & IECC codes. Kevin Theobold is being presented to the IALD Board as the proposed liaison to Division 3."

IESNA – None

The DS was to have contacted the IESNA concerning establishing a formal liaison. She failed to do so, but will follow up and report back for 2009.

> *Action item: DS to communicate with CB and IESNA and request that a liaison be appointed.*

International Dark Sky Association: Terry McGowan

Mr. McGowan's report is attached as Appendix C.

Society of Light and Lighting - G. Cook

The SLL has had a long association with other UK professional bodies in the field of lighting. Over recent years this has seen the emergence of joint technical meetings and a shared publication, 'The Lighting Journal' with the Institution of Lighting Engineers (ILE), as well as other shared activities. There is an active CIE-UK committee as are the PLDA and ILDA. There is also an active Lighting Industry Federation (LIF). The overall level of lighting related activity in the UK, although substantial, has meant that the individual professional institutions are relatively small and therefore do not offer a co-ordinated approach to Government strategy, and a range of other issues, in the field of lighting. The SLL and ILE are currently working towards the establishment of an over-arching body to provide that co-ordinated approach. This new body will retain the existing organizational structures and membership whilst continuing to develop in areas of mutual benefit.

The SLL are working on the production of the 'Lighting Handbook' a complementary document to 'The Code for Lighting' which is due for publication in 2009. A recent publication which is endorsed by the SLL is the 'Thomas Pocklington Trust Design Guide – Housing for people with sight loss', which offers a wide range of lighting design guidance.

Illuminating Engineering Institute of Japanese (IEIJ): Y Nakamura

The liaison officer gave an oral report: Their committees on "Lighting Design based on Room Brightness" and "Energy-Saving Residential Lighting" will issue reports in November 2008.

Professional Lighting Designers' Association – J. Ejhed

The informal liaison officer reported that PLDA and CIE have signed a cooperation activity to support each other. Michael Rohde is proposed as liaison officer for all CIE. CIE has invited a lecture on indoor lighting for the LED symposium at Budapest in 2009 and expects a reciprocal invitation for the PLD conference for October 2009 (although the invitation has not been received yet). PLDC in London in October 2007 had over 1000 participants.

11. Review of Division 3 publications

It was decided to undertake this task in 2009 in Budapest. The Division Editor is to undertake this.

> *Action item: DE to review the status of Division 3 publications and report back at the 2009 meeting as to the need for any to be withdrawn or updated.*

12. Future work

Discussion

DD initiated the discussion by observing that D3 has a wide scope of activity, from interior lighting provided through lighting design and incorporating both electric lighting and daylighting. What is our strategy to address the important issues?

Dr. Cook latched on to the word "strategy": We have plans for the 3-4 year time frame addressing controls; lighting design; health. What about the 5-7 years that could be left in our DD's time in office? We need highly motivated people who will put in a lot of time as volunteers on topics that are important, and that fit into their work so that they can get support for the CIE activities.

Dr. Veitch added that we have no activity addressing energy issues, or in particular the need to maintain lighting quality while being very energy efficient – not let energy-savings regimes be enacted without comment on potential losses of quality.

Mr. Govén mentioned need to evaluate new lighting systems to ensure that quality is maintained. We need some way to ensure that new technologies are evaluated.

Prof. Ejhed says it's hard to set a single level of any target; we can set ranges with the various quantities.

Prof. Halonen commented on her IEA task work – They are producing guidebook on energy and quality issues balance, due out in 2009. She summarized the contents of the guidebook, which includes interviews with lighting designers and case studies of successful energy-saving installations. They will propose to upgrade recommendations and codes to incorporate their findings.

Prof. Ejhed noted that technology is changing fast and so is our attitude towards environmental issues. Recommendations can be left out of date very fast as a result – although the fundamentals don't change, our expectations about good lighting do.

Prof. Aizenberg says no one except specialists thinks much about energy savings in buildings, but we could save ~ 50% if we tried. We need systematic monitoring of energy consumption in different installations, good data together with detailed looks at

new equipment, to give a prognosis for how (through various scenarios) energy conservations might be achieved. He would like to see a TC on energy conservation.

Prof. Halonen: energy performance and human well-being must go hand in hand. She noted that developing and developed countries have different concerns and should be taken into account.

Mr. Bedocs noted a simplicity in the situation brought to the issues by law and regulations enacted by official bodies. In Europe 2 directives directly affect lighting: Energy Performance of Buildings (for which standards already exist); Energy Use of Products, to be implemented in 2009. CIE could defend how we got to where we are today, to justify the maintenance of good conditions as we understand them. We cannot move forward fast enough on these energy issues, we have difficulty in defining solutions; we don't control lamp companies, circuit makers or luminaire designers. We can define what light we need and for what reason. Energy savings will come along in any case. We need to maintain an emphasis on preserving task visibility and the maintenance of a livable environment, while also acknowledging that unknowns also have an effect that we need to study (e.g., health effects). He reminded us that 20+ years ago we tried to set up TCs related to energy use but were unsuccessful.

Mr. Bedocs continued: The next big trade-off is between electric and daylight. Our tools are independent of light source. That is not made clear enough. There need not be fights between electric lighters and daylighters, but we need to better integrate the two so that people understand more clearly that our documents are independent of the light source. Our title is "Interior Environment and Lighting Design" which could actually be far larger than just lighting – but actually involves room surface finishes over which lighting people have no control.

Mr. Govén: We know more than we used to, and we can communicate the health and well-being issues with politicians in understandable ways to preserve good lighting while also saving energy.

Prof. Ejhed: Designers want to know what to do about health issues in their work, but we don't have all the answers there yet. The information comes from outside the lighting field.

Prof. Navvab: He encounters many different local ordinances that he needs to be compliant with, and needs to cope with that even if they are different from what CIE or IESNA recommend.

Dr. Veitch: We can't control all authorities but we could influence public opinion by promoting good lighting to the general public.

Mr. Bedocs: Good lighting can be produced with low energy but takes more attention from the decision-maker and operator:

- defend what we have (maybe including new parameters to address health)
- generate, quickly, a solution-focused approach for application areas that provides guidance on how to produce low-energy, good solutions.
- then we could engage in mass education to bring this information to awareness

Mr. Govén: Perhaps we could save energy by improving quality, putting the right light in the right place.

Mr. Bedocs: People don't always understand that our recommendations are task-oriented not room-oriented.

DD asked people to reflect over these issues for our next meeting, to develop a strategy for Division 3 over the next 3-4 and then 4-8 years. He also asked individuals to e-mail him with ideas and thoughts as time goes on.

Mr. Skar commented that as a designer he is always mindful of "The right amount, the right place, the right time" – and if you do that you also save energy. You can't achieve all criteria all the time, and don't need to.

New TCs

The division voted on two proposals for new technical committees.

Proposal 1: Climate-Based Daylight Modelling

The issues to be addressed by the TC over an anticipated four year duration (to end in 2012) would include the following:

- To describe the state-of-the-art in CBDM and determine levels of research activity.
- To identify themes in ongoing areas of CBDM research and forecasting of future developments.
- To identify key areas of core or supporting research which are either lacking or with insufficient activity.
- To determine key application areas for CBDM and the required data pre-requisites.
- To codify an authoritative workflow for CBDM that is compliant with agreed quality assurance criteria.
- To provide guidance on the application of CBDM to predict emerging daylight metrics.

Interim and final reports would be prepared as required to document the activities, findings, conclusions and recommendations of the TC. The Technical Committee, if approved, will include the majority of key researchers in the field, and have a wide representation across member countries.

TCC: John Mardaljevic (UK). Potential members (to be confirmed) include: Christoph Reinhart (Harvard, US), Marilyne Andersen (MIT, US), Dominique Dumortier (ENTPE, France), Matej Kobav (University of Ljubljana, Slovenia), Peter Raynham (UCL, UK).

Moved: Cook. Seconded: Schierz. In favour: Unanimously approved.

Proposal 2: CIE standard method of UF table calculation for indoor luminaires

The TC would produce a CIE standard for the calculation of utilization factor (UF) tables for indoor luminaires.

The proposed TC chairman is Mr Peter Thorns (UK) and expression of membership interests to date were indicated from Warren Julian (Australia), Axel Stockmar (Germany), Tommy Govén (Sweden), Sueko Kanaya (Japan) and Peter Raynham (UK).

Moved: Schierz. Seconded: Knoop. In favour: Unanimously approved.

> *Action item: DS to communicate these results to CB and ask that the proposals be presented to the BA for approval.*

New Reporters

No proposals were received.

13. Any other business

In 2007 it had been noted that under ISO rules, it was time to review the status of S008 (which had been published in 2001; ISO rules required a 5-year review). Prof. Schanda explained situation:

- Review can occur within Division meeting, and then inform CB
- If big update is needed then a new TC can be formed
- Small amendments can be accommodated.

In 2007, D3 members had been asked to review the document and to report any necessary changes to Mr. Bedocs. No one indicated to him that S008 needs revision. He himself doesn't think that S008 is in need of amendment; that it is a good document and ahead of others including CEN. (DE should examine this over the next year as part of his review.)

> *Action item: DS to report this review to CB and ask that ISO be informed, if appropriate.*

14. Next meeting

2009, May: Budapest, Hungary (mid-term) The schedule for these meetings is available on the web at http://www.cie-hungary.hu. There was a request made to hold the Division meeting on either June 2 or 3 to allow TCs to meet in advance of the Division . Prof. Schanda asked for proposals on preferred schedule well in advance; some TC meetings could be accommodated during the conference days if committees wish to do so.

Mr. Bedocs commented that TCs could hold their meetings at Lux Europa in September if they want. TCCs can contact the conference president.

2010 No proposals have as yet been made.

2011, July: Sun City, South Africa (27th CIE Session)

15. Vote of thanks to hosts

The meeting unanimously thanked the Slovenian hosts with a round of applause.

16. Adjournment.

The meeting adjourned at 3:40. The BalkanLight organizers invited attendees to take a tour of Ljubljana old town.

J. A. Veitch

Secretary Division 3

Appendices:

Appendix A – Report of R 3-26

Appendix B – Report of Liaison to ISO TC 163/SC2

Appendix C – Report of Liaison to the International Dark-Sky Association

Conclusion to Reportership R3-26

Climate-Based Daylight Analysis

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1 Introduction

The recent history of daylight evaluation has been one of diminishing areas of application, and, in the eyes of design team colleagues, diminished relevance. A daylight factor evaluation was often undertaken as an afterthought, and rarely did the findings have a substantive impact on the design. Similarly, from certain perspectives it seemed that fundamental areas of daylighting research were in the doldrums - continued reliance on the half-century old the daylight factor had, inevitably, led to a sense of stagnation in sectors of the research community.

Two seemingly concurrent, but out-of-step and totally independent developments are changing both the perceived importance and the nature of daylight evaluations. The first is the increasing demand to demonstrate compliance at the design stage with recommended measures of building performance, e.g. the LEED rating system. The need for this appears to be widely accepted throughout the developed world, and the rate of uptake by practitioners is ever increasing in response to pressure and encouragement from governments, regulatory bodies, etc. For those striving to effect good daylighting design however, the race for compliance is by no means entirely good news because the recommendations are founded on schema that ignore fundamental parameters such as building orientation and prevailing climate. The second development is a major advancement in the way that daylight evaluations are carried out. This advancement, called climate-based daylight modelling, can address the very real concerns that practitioners and researchers are now voicing regarding the high potential for 'compliance chasing' resulting in poor design choices for buildings.

This report contains: a brief overview of the history and practice of daylight evaluation as it is commonly carried out; a description of the new climate-based schema for daylight modelling; a list of activities related to the Reportership; and, a discussion of issues arising. It concludes with a recommendation to continue these developments under the aegis of a full CIE Technical Committee on climate-based daylight modelling.

1.1 Background

Design guidelines worldwide recommend daylight provision in terms of the long-established daylight factor (DF). Formulated in the UK over fifty years ago, the daylight factor is simply the ratio of internal illuminance to unobstructed horizontal illuminance under standard CIE overcast sky conditions [1]. It is usually expressed as a percentage, so there is no consideration of absolute values. The luminance of the CIE standard overcast sky is rotationally symmetrical about the vertical axis, i.e. about the zenith. And, of course, there is no sun. Thus for a given building design, the predicted DF is insensitive to either the building orientation (due to the symmetry of the sky) or the intended locale (since it is simply a ratio). In other words, the predicted DF value would be the same if the building had North-facing glazing in Stornoway or South-facing glazing in Brighton. The same would

be true if the locations were Moscow and Miami - or indeed for any city in any country.

The daylight factor was, until recently, the sole quantitative 'measure' of daylight in buildings. The word measure needs to be treated with some caution since the daylight factor is not a direct indicator of actually occurring daylight provision - although it is often taken to be so. The daylight factor is precisely what it was defined to be: a ratio of illuminances under a specific sky condition. The daylight factor is therefore a proxy for actual daylighting. It is not at all clear however just how effective a proxy the daylight factor actually is. In fact, the question has rarely been posed. Aside from a small number of exceptions [2, 3], the effectiveness of the daylight factor as a 'measure' of daylight has been largely accepted by practitioners and researchers alike. The daylight factor continues to be employed routinely and, for most part, uncritically.

Daylight designers commonly make use of the daylight factor, which nowadays can be determined with relative ease by non-experts. The real value of the designer's expertise however is in envisioning those many aspects of daylight provision that are *not* accounted for by the daylight factor. These aspects are many and varied. Key amongst them, however, are the contribution of the sun to the overall illumination of the building and the potential for glare resulting from direct sun and/or skylight. The first of these - the illumination contribution of the sun - can only be very approximately estimated. In truth, it is a qualitative judgement founded on experience and intuition rather than numerous computations of light transfer. The second depends in part on a consideration of geometrical relations between the progression of the sun and the configuration of the building, i.e. the windows of the building, their orientation and any nearby obstructions. This involves envisioning the progression of the sun illuminated surfaces inside the building, and estimating the potential for views of bright sky that might be a cause for glare. In other words, for either case there is an envisioning of sorts by the designer of the spatio-temporal dynamics of daylight illumination. These evaluations can be informed to a limited degree by shadow pattern studies of solar penetration. In addition, of course, an experienced designer will offer advice on a great many other, secondary aspects of daylighting design for the building. However valuable the advice offered by the daylight designer, it is unlikely that it could be distilled into a codified scheme and, ultimately, some numerical measure of predicted performance.

The drive towards sustainable, low-energy buildings places increasing emphasis on detailed performance evaluation at the early design stage. The role that daylight evaluation plays in the design process has acquired a new impetus as the need to demonstrate compliance with various 'performance indicators' becomes ever more pressing. Practitioners have become increasingly vociferous in their criticism of the standard method for daylight evaluation [4]. Of particular concern is the lack of "realism" of the daylight factor approach and its fundamental inability to be part of an "holistic" solution that offered reliable, quantitative measures of actual daylight and which also informed on the effectiveness or otherwise of solar shading strategies, since the

two are inextricably related.

The situation with regard to the confusion and uncertainty that practitioners experience when attempting to effect "good daylighting design" cannot be overstated. Practitioners encounter guidelines and recommendations for target daylight factors values that, from their experience, they know are likely to result in over-glazed buildings with excessive solar gain. Furthermore, the hoped for daylight benefit (i.e. the displacement of electric lighting usage) is often not achieved because, in over-glazed buildings, the blinds/shades are likely to remain drawn much of the time and the electric lights switched on. Note that 'practitioner' has been used rather than 'daylight designer'. The skills of the experienced daylight designer are not in question, and the majority of building projects would doubtless benefit from their expertise. As noted however, the daylight designer's input is unlikely to lend itself to ready quantification for the purpose of demonstrating compliance at the design stage.

1.2 Climate-based daylight modelling

Climate-based daylight modelling (CBDM) is the prediction of various radiant or luminous quantities (e.g. irradiance, illuminance, radiance and luminance) using sun and sky conditions that are derived from standard meteorological datasets. Climate-based modelling delivers predictions of absolute quantities (e.g. illuminance) that are dependent both on the locale (i.e. geographically-specific climate data is used) and the building orientation (i.e. the illumination effect of the sun and non-overcast sky conditions are included), in addition to the building's composition and configuration.

The term climate-based daylight modelling does not yet have a formally accepted definition - it was first coined by Mardaljevic in the title of a paper given at the 2006 CIBSE National Conference [5]. However it is generally taken to mean any evaluation that is founded on the totality (i.e. sun and sky components) of contiguous daylight data appropriate to the locale for a period of a full year. In practice, this means sun and sky parameters found in, or derived from, the standard meteorological data files which contain hourly values for a full year. Given the self-evident nature of the seasonal pattern in daylight availability, an evaluation period of a full year is needed to fully capture all of the naturally occurring variation in conditions that is represented in the climate dataset. The exact pattern of hourly values in a standard climate dataset is unique and, because of the random nature of weather, it will never be repeated in precisely that way. Climate datasets are however representative of the prevailing conditions measured at the site, and they do exhibit much of the full range in variation that typically occurs. There are a number of possible ways to use climate-based daylight modelling [4, 6, 7, 8, 9]. The two principal analysis methods are cumulative and time-series.

A cumulative analysis is the prediction of some aggregate measure of daylight (e.g. total annual illuminance) founded on the cumulative luminance (or radiance) effect of (hourly) sky and the sun conditions derived from the

climate datset. It is usually determined over a period of a full year, or on a seasonal or monthly basis, i.e. predicting a cumulative measure for each season or month in turn. Evaluating cumulative measures for periods shorter than one month is not recommended since the output will tend to be more revealing of the unique pattern in the climate dataset than of "typical" conditions for that period. The cumulative method can be used for predicting the micro-climate and solar access in urban environments, the long-term exposure of art works to daylight, and the determination of seasonal dynamics of daylight and/or shading at the early design stage.

Time-series analysis involves predicting instantaneous measures (e.g. illuminance) based on all the hourly (or sub-hourly) values in the annual climate dataset. These predictions are used to evaluate, for example, the overall daylighting potential of the building, the occurrence of excessive illuminances or luminances, as inputs to behavioural models for light switching and/or blinds usage, and in assessing the performance of daylight responsive lighting controls.

Evaluations founded on the cumulative approach have the potential to influence the design of the building form at the very earliest stages of conception. For example, massing studies could be evaluated in terms of their interaction with the local solar micro-climate. Fundamental decisions about the building shape would be informed by an appreciation of how the form and existing context determine the magnitude and quality (i.e. direct and diffuse proportions) of the incident daylight radiation. As the design evolves, cumulative monthly analyses could be used to disclose the prevailing levels and seasonal dynamics of daylight exposure, for both the external envelope and roughly-modelled internal spaces. The cumulative approach therefore has the potential to become a valuable tool to help guide the design of the building from the initial conception onwards. It is unlikely however to serve as the basis for a daylight metric since this would need to be founded on the likely range and degree of occurrence of instantaneous illuminances, which cannot be reliably inferred from a cumulative measure of illumination. Thus a daylight metric would needed to be based on a time-series of instantaneously occurring daylight illuminances. As noted, evaluations should be for an entire year, however only data for the occupied periods (e.g. the working day) needs to be considered.

2 Activities related to the Reportership

The activities related to this Reportership have been both academic and professional in nature. For either case, the activities pertain the theoretical basis, refinement, application and wider-promotion of climate-based daylight modelling amongst researchers and practitioners alike. The academic-related activities have included the following:

- Publication of articles in peer-reviewed journals.
- Presentation of papers at conferences.

- Teaching of the science and application of climate-based daylighting modelling at the Masters level.
- Participation in relevant working groups.
- Open and free exchange of information etc. with other researchers.

Whereas the professional-related activities have been:

- Application of CBDM to consultancy projects.
- Revision of British Standard 8206-2 (Daylight in Buildings).
- Planning and urban deisgn.

The categories are not strictly separate because, at this early stage of development for climate-based modelling, the application examples often contain sufficient original research to warrant publication. Brief details related to the activity in each of the categories are outlined below.

2.1 Publications and presentations

These include papers on supporting techniques and core methodology [10, 11], daylight metrics [8, 9], conferences such as the Teaching in Architecture 2007 at Krems [12] and the VELUX Daylight Symposium in Bilbao [13]. Additionally, there have been papers and presentations on case-study applications of climate-based daylight modelling to 'live' building projects [5, 14, 15].

2.2 Teaching

The background and methodology for CBDM forms a core part of the 'Climate and Daylight' module of the 'Energy and Sustainable Building Design' (ESBD) masters course run by the IESD.[1] The ESBD masters teaches the basics of daylight, thermal and air-flow simulation within the general context of low-energy building design. Necessarily, the "hands-on" daylight simulation teaches application of the standard method (i.e. daylight factors) as is commonly used in practice. However this is supplemented with lecture notes derived from research publications on CBDM, which also serve as a critique of the standard method. Students have remarked that, knowing something of climate-based modelling, they actually feel better prepared to make use of the standard daylight factor method since they now have a good understanding of its fundamental limitations. The course is perhaps unique in offering the very latest research findings as a core part of the syllabus material.

More generally, an understanding of daylight informed from climate-based approaches is radically different from that offered by the traditional modes of evaluation where the 'mind-set' is that of static/snapshot illumination scenarios. Architectural students have noted that it is *easier* to understand

[1] http://www.iesd.dmu.ac.uk/msc/esbd_details.htm

daylighting through climate-based principles than it is from trying to unpick the significance of a combined daylight factor and shadow pattern study. Thus, CBDM has the potential to lead to fundamental changes in the teaching of daylighting principles in schools of architecture etc.

2.3 Working groups and information exchange

Climate-based daylight modelling has been the focus of a number of CIBSE Daylight Group (DG) events from 2006 onwards. The potential role of CBDM in urban planning engendered quite a heated debate in a 2006 meeting on 'rights to light' - a century-old arcane methodology that is still used to determine measures of 'daylight injury'. Other DG meetings have included sessions dedicated to predicting the performance of the light-redirecting material Serraglaze (2007), and open forum meetings on daylight metrics.

Mardaljevic has participated in exchanges with the US Daylighting Forum, e.g. by telephone conference and e-mail, and in face-to-face meetings at conferences. In particular, there have been regular exchanges with Lisa Heschong regarding the Heschong-Mahone Group project on daylight metrics.

2.4 Application to consultancy projects

Climate-based daylight modelling has been applied to a number of consultancy projects. Perhaps more than any other activity, these evaluations have generated practitioner interest in CBDM. It is known that Arup Engineering have sufficient in-house capabilities to carry out CBDM themselves, and have done so on a number of projects.[2] The details of these however are not in the public domain.

For the projects carried out by Mardaljevic, he has generally managed to obtain permission from the clients to publish the findings. What is striking about these projects is the range of application, e.g. daylight injury for the New York Art Students League building, combined daylight provision and visual comfort for the New York Times Headquarters Building, performance evaluation of light redirecting glazing, a parametric study of daylight provision for buildings with skylights. What these projects have revealed is that the domain of application is far larger than, say, the case of a typical side-lit office space. This in turn presents issues for consideration in the design of an end-user system since these invariably must offer restricted functionality if they are to be 'easy' to use.

2.5 Revision of British Standard 8206-2

British Standard 8206-2 'Lighting for Buildings Part 2: Code of Practice for Daylighting' has just undergone revision (Summer 2008). The last revision prior to the this was in 1992. The current revision was carried out between

[2]Private communication: Bob Venning, Arup, UK.

December 2006 and May 2008, with the final version ready for review in August 2008. The review panel comprised: Chair Mr Peter Raynham (UCL), Dr Paul Littlefair (BRE), Dr Arfon Davies (Arup), Dr Kevin Mansfield (UCL) and Dr John Mardaljevic (DMU).

Mardaljevic was invited to join the panel specifically to address the issue of including metrics founded on climate-based measures of daylight in the revision. It was established in the first few meetings that, to date, there had been insufficient groundwork on climate-based metrics, and that significant research remains to be done before authoritative metrics could be recommended in a British Standard. Despite this, the panel voted to include a technical annex on climate-based daylight modelling to serve as notice that a more substantive future revision of the standard is expected to recommend measures founded on climate-based metrics. This is perhaps the most significant endorsement to date of climate-based daylight modelling by a government or regulatory body.

2.6 Planning and urban deisgn

Solar access and the solar micro-climate have long been a consideration in urban planning, even if their precise definitions are somewhat vague. CBDM offers the means to provide definitive measures of the urban solar micro-climate. For example, one measure of the solar micro-climate could be rigorously specified as the total annual irradiation (or illumination), i.e. the total energy (or the visible part) from the sun and the sky incident on building facades, arriving directly and from reflections [16, 17, 18, 19]. This quantity has a direct bearing on the delivered power from, say, a building integrated photovoltaic (BPIV) array. Thus it could be used to determine measures of injury when a proposed building overshadows a BIPV array. Issues such as these will come to the fore as solar-dependant technologies become more common in urban settings. Investors in these technologies will need assurance that there are reliable procedures in place to determine a just measure of financial compensation should the performance of a BIPV array be degraded by later building developments.

It should be noted that the current guidelines used in so-called 'Rights to Light' disputes are based on a century-old paradigm that is woefully inadequate for the purpose of assessing impact to energy generating system. The New York Art Students Leaguex (ASL) study (carried out by Mardaljevic in 2005) appears to be the first - and possibly only - solar access dispute where the legally-binding settlement was decided on climate-based metrics. Surveyors - a notoriously conservative industry sector - have been made aware of the ASL study at special CIBSE Daylight Group events dedicated to 'Rights to Light' issues. To say that it provoked interest and consternation (rather more of the latter) is putting it mildly. Progress here will require a technical-legal approach, i.e. collaboration with experts in construction and planning law.

3 Issues arising

3.1 Basic research

As noted in earlier sections, there are a number of areas where further research in climate-based daylight modelling is needed. The computational mechanics of climate-based daylight modelling are reasonably well advanced. Though it should be noted that the existing implementations are mostly based on the *Radiance* system [20]. These software range from purely in-house research tools (e.g. XDAPS [21]) to end-user versions such as DAYSIM from the NRC, Canada[3]. It is fair to note that all implementations, including the 'end-user' DAYSIM system, require operation by a user that is at least competent if not expert with the *Radiance* system. Additionally, the user should be reasonably familiar with the science of climate measurement (at least the radiant energy part), and also the handling/manipulation of climate data. Thus climate-based daylight prediction is still very much the preserve of a small handful of experts, though the numbers are steadily growing.

Following on from the mechanics of computation are the issues relating to data input requirements, and in particular the use of sky models to generate the sky luminance distributions from the basic quantities in the climate files. There is as yet no consensus on the selection of sky model types or the use of sky model blends for climate-based simulation. This was the case when the number of commonly used sky model types was just a handful, i.e. far fewer than the fifteen types offered by the CIE General Sky [22]. The large number of types offered by the CIE General Sky certainly does not simplify the matter of selection. However, a recent study by Tregenza suggests that a subset of the fifteen types will most likely suffice for most climates [23]. That study examined the probability of occurrence of the various sky types using data collected at the BRE. Tregenza found that:

> *five sky types account for nearly 80% of the scanned data sets; some types are rarely applicable or not used at all. This suggests that the daylight climate could be characterized by a small subset of standard types without significant loss of accuracy.*

What is not yet clear however is how to select the most suitable sky type and/or blend on a time-step basis from the data contained in climate files. A recent paper by Dumortier and Kobav gives the first results for a possible solution in which the the Perez All-Weather model is used as means to select suitable types from the CIE General Sky [24]. It is however early days and further work along these lines is needed.

Climate-based daylight evaluations can generate huge amounts of time-varying illuminance data that needs to be processed, reduced and interpreted[4]. Whilst a summary metric might be the end goal, the spatio-temporal dynamics of daylight illumination contains much that can inform the designer

[3] http://irc.nrc-cnrc.gc.ca/ie/lighting/daylight/daysim_e.html

[4] For example, a recent parametric study on daylight provision for the VELUX corporation by Mardaljevic generated over 140Gb of illuminance data [15]

about the prevailing character of daylight illumination in the space. Processing these data into forms that can readily convey the significance of the patterns and rhythms of the daylight in the space is a challenging task in itself [25, 26]. The Lightsolve project at MIT has as one of its goals the formulation of suitable graphics for end-users to easily interpret the output from climate-based simulations [27, 28].

It is the formulation of daylight metrics however which probably requires the greatest sustained research effort. The Heschong-Mahone Group (CA, USA) are currently engaged in a project to determine daylight metrics.[5] The results of that study are eagerly awaited by those in the daylight community with an interest in climate-based daylight modelling. Regardless of the success of the Heschong-Mahone Group (H-MG) project, it is almost certainly the case that one project is unlikely to answer all the questions and issues related centrally and peripherally to the formulation of definitive climate-based daylight metrics. Recall that dynamic thermal modelling today is the accumulation of numerous research projects across the developed world over the last three decades. The H-MG project should therefore be seen as a 'pioneer' effort, hopefully the first of several. One of the candidate metrics under consideration in the H-MG project is the Useful Daylight Illuminance scheme [5, 8, 15].

3.2 Industry sector

The demand for climate-based modelling by practitioners is certainly growing, though it is impossible to estimate the number of projects carried out since the majority are not generally reported. Various high-profile projects that have received publication have been instrumental in engendering interest in the new approaches, and anecdotal evidence from software developers indicates a steady increase in the number of enquiries regarding climate-based modelling.[6]

As note earlier, the key factor limiting wider uptake of climate-based modelling is the lack of authoritative climate-based metrics. Another significant factor is the lack of best-practice guide(s) to carrying out climate-based daylight modelling, i.e. something comparable to what has appeared in various manuals and technical memoranda for thermal and airflow modelling (e.g. CIBSE guides or their equivalents in other countries). Whilst the work required to compile the necessary guides will probably not have the cachet of that needed to formulate the daylight metrics, it is nonetheless a vital part of demonstrating quality assurance in the process and should not be overlooked.

In addition to designers and architects, the manufacturers and vendors of daylighting and daylight responsive systems have much to gain from the formulation of climate-based daylight metrics. These systems include: innovative glazing materials (e.g. Serraglaze); light-pipes; daylight responsive

[5] http://www.h-m-g.com/DaylightPlus/Daylight_Metrics.htm

[6] Private communication: Craig Wheatley, Technical Manager, Integrated Environmental Solutions, Glasgow, UK.

lighting controls; brise soleil and shading devices etc. Marketing of innovative daylighting systems has always proven to be difficult because the currently-accepted "measure" of daylighting performance (i.e. the daylight factor) gives no indication of how much natural light and how often. Data on the magnitude and occurrence of absolute measures of natural illumination - precisely how much and how often - are vital to reliably assess both the performance-effectiveness and the cost-effectiveness of daylighting systems. Thus the hoped-for emergence of climate-based daylight metrics will greatly assist in the general promotion and marketing of daylighting and daylight responsive systems. The climate-based study on skylights in residential buildings was immediately made public by VELUX on their Daylight website.[7] Whilst it hardly bears remarking that the addition of skylights will increase the daylight provision in a space, the degree to which this occurs can only be reliably quantified using climate-based modelling. VELUX plan to use these findings as a basis for improved marketing of their skylight products.

3.3 Daylighting guidelines

As noted in the Introduction, there is an increasing emphasis on demonstrating compliance with guidelines and recommendations at the design stage. Thus building designers are resorting more and more to simulation as means of demonstrating compliance with schemes such as LEED:

> *The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council (USGBC), provides a suite of standards for environmentally sustainable construction. Since its inception in 1998, LEED has grown to encompass more than 14,000 projects in 50 US States and 30 countries covering 1.062 billion square feet (99 km^2) of development area.*[8]

Daylight is one of the considerations in the determination of a LEED credit rating. In version 2.1 the requirement for the LEED daylight credit (8.1) was phrased as follows: "Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks.[9] The note in parentheses that all direct sunlight penetration should be excluded is somewhat vague since LEED recommends a standard daylight factor calculation which, of course, makes no account of sunlight, direct or otherwise. In version 2.2 the metric was changed to "glazing factor", where the goal is to "achieve a minimum glazing factor of 2% in a minimum of 75% of all regularly occupied areas".[10] In either version, the metric is climate and orientation *insensitive*. Thus, the outcome of the evaluation would be the same if the building had North-facing glazing and was intended for Seattle, or South-facing and intended for Texas. To the onlooker uninitiated in the

[7] http://www.thedaylightsite.com/showarticle.asp?id=166&tp=6
[8] From the Wiki page on LEED.
[9] http://www.usgbc.org/Docs/LEEDdocs/LEED_RS_v2-1.pdf
[10] http://www.usgbc.org/ShowFile.aspx?DocumentID=1095

habits and beliefs of the traditional daylight practitioner, the notion that a climate-insensitive parameter could play any role in determining either the form of a building or the construction of its facade must seem very strange indeed. Particularly so when this parameter is applied uniformly across a continent that experiences such extremes in prevailing climatic conditions.

Seemingly in an attempt to address the idealised nature of the basis of daylight evaluation in LEED version 2.2 has a second option where, to achieve credit 8.1, the requirement can be:

> *Demonstrate, through computer simulation, that a minimum daylight illumination level of 25 footcandles has been achieved in a minimum of 75% of all regularly occupied areas. Modeling must demonstrate 25 horizontal footcandles under clear sky conditions, at noon, on the equinox, at 30 inches above the floor.*

Whilst this may appear, at first, reasonable, the LEED documentation gives no supplementary data for the evaluation. This omission all but renders the 'evaluation' meaningless since there is no statement regarding the diffuse horizontal illuminance that the sky should be normalised against. The user, it seems, is to trust the default value that is provided by the sky generator program. The default value is an extremely coarse approximation with some latitude dependance, but no basis whatsoever in local, prevailing climatic conditions. Many users are unaware that the key input parameter for their simulation is of dubious provenance and has been automatically selected on their behalf. It gets worse. Nor indeed is there any mention of what the sun luminance (usually derived from direct normal illuminance) should be. Surprising, since the sun contribution will greatly add to the illuminances resulting from the diffuse sky (which will depend on the unspecified diffuse horizontal illuminance anyway). Given the relatively modest target illuminance (around 250 lux) it seems likely that the evaluation is meant to be carried out using a clear sky distribution *without* a sun. Which, of course, is a physical impossibility in reality. Anecdotal evidence has confirmed that users of LEED have indeed 'demonstrated compliance' with the recommendations and obtained Daylight Credit 8.1 by using a physically impossible luminous environment (i.e. clear sky without sun) that is normalised to an unknown value (i.e. diffuse horizontal). Whatever the shortcomings of the daylight factor and glazing factor methods - they are many and manifest - at least those methodologies are self-consistent rather than arbitrary. With the Clear Sky option, major decisions about the building envelope could be made on the basis of meaningless data.

The purpose of the above is not just to bring to attention an unsound methodology, which somehow appeared in a key guidance document. Instead, a deeper concern is with state of grassroots knowledge about daylighting in the practitioner, and indeed 'daylight specialist' community. It should be noted that, at the time of writing this report, there appears to be no material anywhere on-line that is querying or challenging the formulation of the LEED Clear Sky option. This is evidently an unsatisfactory state of affairs, and one hopes that it will be remedied in Version 3.

4 Conclusion and recommendations

Both the basis for daylight evaluation and the role that it plays in the building design process are at a crossroads. The increasing importance that daylight has in the performance evaluation of buildings for compliance purposes should lead to a renaissance in the field of applied daylighting. However, the standard evaluation techniques, on which nearly all compliance indicators are founded, are increasingly recognised as not fit-for-purpose and in need of upgrading. Furthermore, there has been no convincing demonstration that the standard methods are capable of advancement by incremental means - the LEED Clear Sky option is testament to the failure of attempting to repackage the daylight factor method for non-overcast skies.

Climate-based daylight modelling is now gaining acceptance as the most promising, perhaps even the only, line of research that will deliver truly effective tools for the realistic evaluation of daylight in buildings. The number of active researchers is small but steadily growing, and the potential to deliver major changes in the practice of daylight evaluation is great. Thus, at this crucial juncture, it is important that the efforts of the research community are well co-ordinated, and that decisions which could have far-reaching consequences are made under conditions of the greatest transparency and fullest-possible peer review. To this end, the creation of CIE Technical Committee (Division 3) on Climate-Based Daylight Modelling is proposed. The issues to be addressed by the TC over an anticipated four year duration would include - but are not restricted to - the following:

- To describe the state-of-the-art in CBDM and determine levels of research activity.
- To identify themes in ongoing areas of CBDM research and forecasting of future developments.
- To identify key areas of core or supporting research which are either lacking or with insufficient activity.
- To determine key application areas for CBDM and the required data pre-requisites.
- To codify an authoritative workflow for CBDM that is compliant with agreed quality assurance criteria.
- To provide guidance on the application of CBDM to predict emerging daylight metrics.

Interim and final reports would be prepared as required to document the activities, findings, conclusions and recommendations of the TC. The Technical Committee, if approved, should include the majority of key researchers in the field, and have a wide representation across member countries.[11]

[11] Potential members (to be confirmed) include: Christoph Reinhart (Harvard, US), Marilyne Andersen (MIT, US), Dominique Dumortier (ENTPE, France), Matej Kobav (University of Ljubljana, Slovenia), Peter Raynham (UCL, UK).

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CIE Division 3 meeting October 7, 2008
Liaison Officer's Report: ISO/TC 163/SC2

First, I would like to apologize for my absence to the meeting.

The title of the ISO/TC 163 is "Thermal performance and energy use in the built environment". The scope is as follows:

Standardization in the field of building and civil engineering works

- of thermal and hygrothermal performance of materials, products, components, elements and systems, including complete buildings;
- of thermal insulation materials, products and systems for building and industrial application, including insulation of installed equipment in buildings;

covering and including:

- test and calculation methods for heat and moisture transfer, temperature and moisture conditions;
- test and calculation methods for energy use in buildings;
- test and calculation methods for heating and cooling loads in buildings;
- in-situ test methods for thermal, hygrothermal and energy performance of buildings and building components;
- input data for calculations, including climatic data;
- specifications for thermal insulation materials, products and systems with related test methods and conformity criteria;
- terminology;
- general review and coordination of work on thermal and hygrothermal performance within ISO.

There are three Subcommittees:

TC 163/SC 1	Test and measurement methods
TC 163/SC 2	Calculation methods
TC 163/SC 3	Thermal insulation products

AHG 'Daylight in buildings' under SC 2 is the most important to the CIE Division 3. The following pages are the status report of the AHG 'Daylight in buildings' prepared by the group leader Dr. Jan de Boer.

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Status Report
ISO/TC 163/SC 2. AHG 'Daylight in buildings'

Dr. Jan de Boer, Fraunhofer-Institute of Building Physics
Stuttgart Germany
30.9.2008

1. Designation and title of AHG

ISO/TC 163/SC 2. AHG 'Daylight in buildings'

2. Scope

To prepare an outline for a standard that provides a procedure for the calculation of the availability of daylight in buildings by 2008-12-31.

3. Name and contact details of the Convenor

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5. Work programme with the target dates

- Draft Proposal for a procedure for the calculation of the availability of daylight in buildings: 12 /2007, status: *closed*
- Comments on draft 4 / 2008, status: *closed*
- Adaption to other climatic conditions 9 / 2008, status: *ongoing*
- Final Draft 12 / 2008, status: *open*

6. LIAISON: ISO - CEN

A liaison between the ISO AHG and CIE has been established. Responsible: Dr. Yoshiaki UETANI

7. Activities in the WG

- Submission of a draft proposal for a procedure for the calculation of the availability of daylight in buildings. It is based on the German standard DIN V 18599 – 4 “Energy efficiency of buildings — Calculation of the energy needs, delivered energy and primary energy for heating, cooling, ventilation, domestic hot water and lighting — Part 4: Energy need and delivered energy for lighting”. The method is in practice since 3 years. The daylight model serves in main parts also as basis of the European Standard on lighting and energy EN 15193 “Energy performance of buildings-Energy requirements for lighting – Part 1: Lighting energy estimation”,
- *Comment:* Proposal to refer to the sky luminance distribution according ISO15469/CIE 011 'Spatial distribution of daylight - CIE standard general sky' as a standard of ISO. *Response to Comment:* The method fully complies with the CIE sky models. The proposed method is based on regression analysis using state of the art daylighting software (IEA daylighting simulation engines ADELINE and Radiance with dynamic sky models based on the referred CIE sky luminance distributions).
- Approval of activity and status report at last meeting of ISO/TC 163/SC 2 (April 2008, Nanjing).
- Currently an adaption of the procedure allowing for incorporation of other climates and geographic locations is performed.

8. Meetings planned

End of November in Stuttgart, Germany. Still to be confirmed. As alternative a telephone conference might be scheduled

9. Problems/comments/questions/recommendations for ISO/TC 163/SC 2 to consider or take a decision on

None.

Report to Division 3 of the CIE
From
The International Dark-Sky Association

Terry McGowan*, CIE Division 3 Liaison Member
October 1, 2008

Division 3 members may recall that this liaison was established at the 2006 Ottawa Division meeting for the purpose of exchanging information about the subject of light and human health and to work together to minimize the energy waste and light pollution effects from building interior lighting.

The International Dark-Sky Association (IDA) continues to focus on efforts to reduce light pollution from outdoor lighting including sky glow, light trespass, glare and wasted light which, of course, represents wasted energy. Those who wish to learn more about these efforts are directed to the undersigned or to the IDA web site at: http://www.darksky.org

Recently, the IDA has expanded its role to include the environmental effects of outdoor lighting on plants and animals and has developed liaisons with other environmental organizations with similar interests, such as the Audubon Society http://www.audubon.org/ and the Urban Wildlands Group http://www.urbanwildlands.org/

An excellent reference to this work being done on this subject is the book, "Ecological Consequences of Artificial Night Lighting" by Catherine Rich and Travis Loncore (Eds.). Island Press, 2006. ISBN: 1-55963-129-5.

New models have recently been developed for the analysis of light pollution. Two in particular are capable of predicting the amount of light being emitted from buildings or outdoor site lighting and translating that information into sky glow, light trespass and wasted light. Technical papers and reports describing these models are now available including, "Outdoor Site-lighting Performance: A Comprehensive and Quantitative Framework for Assessing Light Pollution" by J.A. Brons, J.D. Bullough and M.S. Rea. *Lighting Research & Technology. 2008; 40: 201-204.* and the report, "Towards Understanding Skyglow" by C.J. Baddiley, The British Astronomical Association Campaign for Dark Skies and T. Webster, Institution of Lighting Engineers, U.K.

The IDA looks forward to maintaining this liaison with CIE Division 3 on subjects of mutual interest.

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