

TC/TG/TRG MINUTES COVER SHEET

(Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG NO.: TC 4.1 DATE: March 5, 2011

TC/TG/TRG TITLE: LOAD CALCULATION DATA AND PROCEDURES

DATE OF MEETING: January 31, 2011, 2011 LOCATION: Las Vegas, NV

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Voting Chris Wilkins Rolando Legarreta Chip Barnaby Steve Bruning Bob Doeffinger Glenn Friedman Curt Pedersen Jim Pegues Jeff Spitler Larry Sun Non-Voting Doug Hittle Stephen Roth Som Shrestha Gary Wingfield	2009 2009 2010 2008 2007 2009 2007 2010 2007 2008	Voting [none] Non Voting Lucy Armankwah David Ariyo Lynn Bellenger Andrew Braum Jui-Chen Roger Chang Charlie Curcija Joe Ferdleman John Filler Dan Fisher Nick Gmitter Martin Gough Robert Hopper Stephen Kavanaugh Ken-Ichi Kimura Suzanne LeViseur Larry Lisenbee James Norman Brian Rock Thomas Romine, Jr. Arun Veda		Visitors Peter Elton Chad Taylor Roy Hubbard Chandan Sharma

DISTRIBUTION:

All Members of TC/TG/TRG

ADDITIONAL DISTRIBUTION:

TAC Chairman: Charles Wilkin, P.E.
 TAC Section Head: Walter T. Grondzik
 Chapter Tech Transfer: Andrew L. Cochrane
 Research Liaison: Dr. T. Agami Reddy
 ALI/PDC: Filza H. Walters
 Special Publications: Jack A. Clark, P.E.
 2013 HB Fundamentals: Peter Simmonds, PhD
 Standard Liaison: James R. Tauby, P.E.
 Manager of Standards: Stephanie C. Reinche
 Staff Liaison: Michael R. Vaughn

January 31, 2011
Committee Meeting Minutes
TC4.1 Load Calculations Data and Procedures
Las Vegas, NV

1. Meeting called to order by Chris Wilkins at 2:20pm
2. Roll Call
 - a. 9 of 10 voting members present. Quorum is present.
 - b. Curt Pedersen arrived after roll call to bring attendance to 10/10.
3. Introductions
4. Approval of June 2010 Albuquerque Meeting Minutes.
 - a. Approved 9-0-0 as amended to show Gary Wingfield was present.
5. Committee Officers
 - a. Joe Ferdelman (Secretary) resigned his position and withdrew from ASHRAE meetings.
 - b. Steve Bruning: Motion: TC 4.1 officer positions be extended by 1 year to allow return to 2 year cycles, per proposal by Chris Wilkins and Rolando Legarreta. Current officers will hold positions through June 2012.
 - c. Jeff Spitler: Second.
 - d. Motion approved 7-0-1, chair not voting.
 - e. Abstention: Rolando Legarreta, vice chair, because motion affects his position.
6. Research Chair Report (Bob Doeffinger)
 - a. RTAR 1616-RP - Revise Load Calculation Application Manual
 - Dr. Agami Reddy, research liaison agreed to approve changes to RTAR requested by RAC.
 - Bob Doeffinger: Motion: Approve RTAR as revised.
 - Roland Legarreta: Second
 - Motion approved 9-0-0.
 - b. ASHRAE has implemented a policy that 2 or more TCs can collaborate to pursue larger research projects.
7. Program Chair Report (Glenn Friedman)
 - a. Las Vegas Meeting - Jan/Feb 2011
 - Seminar 56 - Low Energy Load Calculations, Wednesday 11am
 - b. Montreal Meeting - June 2011
 - Glenn Friedman: Motion: TC4.1 offer a seminar in Montreal that is a follow-up to "BIM Load Calculations Pain or Pleasure?" from Albuquerque.
 - Rolando Legarreta: Second
 - Motion passes 10-0-0
 - Target for the seminar will either be Track 3 - "HVAC Fundamentals and Applications" or Track 6 - "Engineering Tools". Larry Sun identified chairs for tracks. Glenn will speak with each before submitting seminar proposal.

- c. Discussion of possible seminar topics for future meetings
 - The Art of Zoning
 - Ventilation and Infiltration
 - How load calculations interact with the topics covered by other ASHRAE TCs.
 - Liabilities of hidden defaults in a BIM load calculation.
 - Checks and balances in a load calculation. Calculations are black boxes. Care is needed to check and validate results. How do you do that?
 - Forum - What is the standard of care for computerized load calculations?
 - Rule thumb load calculations - What are the minimum inputs required for a load calculation on a mobile computing device. Mostly aimed at residential and light commercial.
 - What do people not know about load calculations.
 - Schedules for occupants. What are they? How do they shift the peak load? Defaults in many tools are way off.
 - How to model a design day.
 - Compare two different approaches to peak load calculation. Use of an energy modeling tool with TMY weather data versus the traditional design day approach outlined in the Handbook of Fundamentals. What are the pitfalls of one approach versus the other? Consider joint seminar on this topic with TC 4.7.
 - Load calculations - what is it and what is it not? Intended to spark discussion about whether this TC should tackle system load calculations.
 - Zoning, load calculations, system loads, equipment selection. Discuss how these concepts are integrated. Provide examples of two very different equipment types like chilled water AHU and VRF. Show how the space peak load is the same for each application, but the equipment loads and airflows are very different.
 - Bring BIM into the discussion above. Also consider how combining rooms into a single zone affects temperatures in individual rooms.
- 8. Standards Chair Report (Glenn Friedman)
 - a. SPC 203 - MOT / Determining Heat Gain of Office Equipment Used in Buildings
 - First meeting on February 2
 - Committee is lacking sufficient "producer" members. Working to recruit new members in this classification.
 - b. SPC 205 - Data Exchange Protocols for Energy Simulation of HVAC&R Equipment Performance
Chip Barnaby
 - First meeting on February 1, 8am
 - Committee is comprised of equipment manufacturers and software vendors. Trying to recruit additional equipment manufacturers representatives as members.

9. Handbook Chair Report

- a. Non-Residential Load Calculation Chapter (Steve Bruning)
 - See attachment for schedule of tasks and proposed changes.
 - Steve will send a master Word file to those contributing revisions.
 - Use "Track Changes" when making revisions.
 - Revisions to be submitted to Steve by June 1 so a compiled draft can be prepared for Montreal.
 - Steve to send a reminder to contributors in May
- b. Residential Load Calculation Chapter (Chip Barnaby)
 - A question was submitted via Mark Owens, ASHRAE Headquarters, regarding the use of one set of wall transmission factors instead of one set of factors for each wall orientation. This requires a formal response.
 - Chip to evaluate question and respond.

10. Liaison Reports

- a. Program (Larry Sun)
 - This TC may be approached by CEC regarding ideas for further seminars which are oriented to practice. CEC is looking for novel formats such as debates and panel discussions.
- b. Research (Dr. Agami Reddy)
 - Acknowledged receipt of revised RTAR-1616. Bob Doeffinger will submit result of committee's vote to approve RTAR to Dr. Reddy.
 - ASHRAE is increasing grant-in-aid scholarships from about 10 to about 20.
 - RAC is developing a new research track. Will make a general solicitation with no subject specified. Investigators can apply for grant. Result must be a published paper. This allows a concept to be fast tracked. This is not in place yet. Likely to be formalized within 1 year.
 - Multidisciplinary Task Groups (MTG) - Being created to allow pursuit of broader research topics which normally would not be sponsored by a single TC. Also intended to promote communication across TCs. Not in place yet. Likely by Montreal meeting.

11. Web Site (Jim Pegues)

- a. Site was updated in mid January with current roster, program and research projects.
- b. ASHRAE members have reported problems accessing the TC4.1 web site. Problems appear to occur when using Internet Explorer v8.0. Using earlier versions there is no problem. Will revise web site to use ASHRAE standard template to see if that resolves the issue.

12. Old Business

[None]

13. New Business

- a. Guideline 20 - Documenting HVAC&R Work Processes and Data Exchange Requirements
 - Chip Barnaby
 - Guideline 20 has been published.
 - Chip Barnaby and Stephen Roth would like to work with TC members to define a work flow for load calculations. The goal is to post the use case documentation resulting from this effort on a web site for general use.
 - Action: Chip Barnaby and Bob Doeffinger will explore ideas that could lead to an RTAR on this subject.
 - TC 1.5 (Computer Applications) is looking at this subject. The RTAR would be a collaboration between TC 1.5 and TC 4.1.

14. Adjournment

- a. Doug Hittle: Motion to adjourn.
- b. Rolando Legarreta: Second.
- c. Motion approved 10-0-0.

Attachments:

Meeting Agenda
Handbook Sub-Committee Report
Program Sub-Committee Report
1616-RTAR
Attendance Sign-in Sheet
TC 4.1 Current Roster



ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

Agenda for - TC4.1 Load Calculation Data & Procedures

**Las Vegas
January 31, 2011**

**TC4.1 Load Calculation Data and Procedures
Monday, 2:15 PM to 4:15 PM
LVCC N254**

- | | |
|---|---|
| 1. Call to Order | Chris Wilkins |
| 2. Roll Call | Jim Pegues |
| 3. Introduction of Visitors | Chris Wilkins |
| 4. Approval and/or Corrections to Albuquerque Meeting Minutes | Chris Wilkins |
| 5. Committee Officers Change | Chris Wilkins |
| 6. Liaison Comments
Section Head
Chapter Technology Transfer
Research
Handbook
ALI/PDC
Programs
Standards Liaison
Staff-Research/Tech Services
Staff-Standards | Walter Grondzik
Andrew Cochrane
Agami Reddy
Peter Simmonds
Filza Walters
?
James Tauby
Michael R. Vaughn
Stephanie Reiniche |
| 7. Research Subcommittee Report | Robert Doeffinger |
| 8. Programs Subcommittee Report | Glenn Friedman |
| 9. Standards Subcommittee Report | Glenn Friedman |
| 10. Handbook Subcommittee Report
Residential Chap 17
Non-Residential Chap 18 | Chip Barnaby
Steve Bruning |
| 11. ASHRAE Website for TC 4.1 | Jim Pegues |
| 12. Old Business | Chris Wilkins |
| 13. New Business | Chris Wilkins |
| 14. Adjournment | Chris Wilkins |



ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

Meetings

TC 4.1 Load Calculation Data and Procedures (20/10)

Monday 2:15-4:15p (LVCC) N254

Sponsoring: Seminar 56: Low Energy Load Calculations

TC 4.1 Handbook

Sunday 3:00-4:00p (H) Pavilion 10

TC 4.1 Research (10/5)

Sunday 4:00-5:00p (H) Pavilion 10

TC 4.1 Programs & Standards (10/5)

Sunday 5:00-6:00p (H) Pavilion 10

Introduction of officers and voting members for 2011:

Chris Wilkins	Chair	Voting
Rolando Legarreta	ViceChair	Voting
James Pegues	Secretary	Voting
Steven Bruning	Handbook Subc Chair	Voting
Robert Doeffinger, Jr	Research Subc Chair	Voting
Glenn Friedman	Stds/Prog Subc.Chair	Voting
Chip Barnaby		Voting
Curtis Pedersen		Voting
Jeff Spitler		Voting
Larry Sun		Voting



ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

TC4.1 Load Calculation Data & Procedures

Las Vegas, NV

January 29-February 2, 2010

Handbook Subcommittee Report

Sunday, January 30, 3:00 PM to 4:00 PM

Hilton, Pavilion 10

1. **Handbook Committee Liaison:** Peter Simmonds, Liaison to TC4.1.

2. **Schedule for 2013 HoF Chapters:**
 - 2011 January – Assign revisers, discuss revisions
 - 2011 June – Rough draft overall chapters
 - 2012 January – Full draft overall chapters reviewed by Handbook subcommittee
 - 2012 April – Deadline for new research results to be incorporated in chapters
 - 2012 June – Final chapters approved by full TC**
 - 2012 July 12 – Chapter 17 submitted to Simmonds/ASHRAE
 - 2012 July 19 – Chapter 18 submitted to Simmonds/ASHRAE
 - 2013 June – HoF Published

4. **Chapter 17 Residential Loads:**
 1. Discussed comments forwarded from Mark Owen regarding use of single RLF for opaque surfaces regardless of orientation. Agree this simplification was appropriate but that additional explanation should be added to the chapter.

 2. Discussed revision list. Bruning to review with Barnaby.

5. **Chapter 18 Non-Residential Loads:**
 1. Discussed revision list and confirmed each reviser.

 2. Discussed UFAD write up Gary Wingfield is working on. Agree discussion should address other non-fully mixed conditions such as displacement ventilation, chilled beams and radiant systems.

 3. Bruning provided update on master example using renovated ASHRAE HQ. Cleaned up Revit model has been produced and will be used for Seminar in Montreal, and then for updating the HoF example.

		TC4.1 Handbook Subcommittee 2009 HOF Chapter 18
		Nonresidential Cooling and Heating Load Calculations
Reviser:		<u>Possible Improvements List</u>
		January 31, 2011
Bruning, Doeffinger	G-1	Improve quality of existing Figures.
Bruning	G-2	Add more Figures – “picture is worth 1000 words”
Pegues	G-3	Provide an equation summary table in conjunction with flow chart, listing of data required and references for where to find it. Similar to what had in past chapters for older methods and in current Chapter 17. See Pegues comments.
Bruning	G-4	Provide better data on appropriate absorptivity and emissivity values for common construction materials, along with illustration of sensitivity of result to those inputs. Check with TC4.4 on data they plan to publish. Reference accordingly.
Bruning	G-5	Address impact inside convection coefficient assumptions has on load calculations. Use research results from 1416-RP.
Pedersen	G-6	Update/clean-out references where appropriate.
Legaretta	G-7	Add example of altitude adjustment in air calculations and illustrative table of impact on
Doeffinger	G-8	Improve ventilation and infiltration coordination with Chapter 16. Add realistic example of infiltration calculation, perhaps a tabular summary.
Bruning	G-9	Add clearer reference to Chapter 14 for derivation of Equations 13 and 14.
Roth	G-10	Add complete list of variables with definitions at end of chapter.
Doeffinger	I-1	Solicit internal heat gain information from other TCs. Review past, present and planned research projects for potential data. Decide where it is appropriate to include data versus just reference other chapters. Incorporate results from 1104-RP and 1395-RP as appropriate.
Doeffinger	I-2	Table on Medical Equipment – may be updated by RP-1343 (TC 9.6).
Wilkins	I-3	Table on Laboratory Equipment – TC 9.10 had research project on plan to obtain heat gain data. Need to determine if work statement written and offer to participate in PMS to obtain
Wilkins	I-4	Tables on Load Densities for Office – is updated data available? Research project needed to update measurements?
Pegues	I-5	Revise internal load tables for more consistent presentation of radiant/convection data. See Pegues comments.
Wingfield	S-1	Underfloor Air – add more available information to address impact of UFAD on load calculations.
Bruning	S-2	Add discussion of zoning and impact on load calculations.
Bruning	E-1	Update master example to use renovated ASHRAE HQ plans.
Bruning	E-2	Include both perimeter and interior spaces as single room examples.
Bruning	E-3	Example Table 36 - include slab edge loss or explanation why not needed.
Bruning	E-4	Example - add psychrometric diagram of block loads for air handlers. Address building air balance of OA, EA and infiltration.

TC 4.1 Meeting, Programs
Las Vegas, NV, January 31, 2011

Glenn Friedman, Program Chair

1. Current Programs

a. Las Vegas

Theme: Low Energy Load Calculations

1. SEMINAR

Speaker #1: Chip Barnaby

Speaker #2: Rolando Legarreta

Speaker #3: Chris Wilkins

2. Conference and Exposition Committee (CEC)

a. Larry Sun shared current updates on Programs. There is a strong feeling amongst CEC to integrate the types of things that happened in Albuquerque on HVAC fundamentals. Especially, lessons learned and practical load calculations stuff. Encourage conference papers. BIM/REVIT was well received and should be repeated with same title update.

b. Meeting themes are probably being dropped or at least not important for programs.

3. Future Programs

a. Montreal, Quebec, Canada, June 25 to 29, 2011

Theme: Net-Zero Buildings

Feb. 14 - Seminar and Forum proposals due

Track 1 Refrigeration

Track 2 HVAC Systems

Track 3 HVAC Fundamentals and Applications Wade Conlan

Track 4 Net Zero Energy Buildings

Track 5 Professional Skills

Track 6 Engineering Tools

Track 7 Commissioning

Track 8 Alternative Technologies

i. Update the BIM Load Calculations Seminar, Use Track 6 (alternate is Track 3, submit with the alternate listed or better yet, talk to the track chairs) Engineering Tools (confirm with Larry Sun), BIM Load Calc. Pain or Pleasure, the Remix

Speaker #1: Steve Bruning

Speaker #2: Chris Wilkins

Speaker #3: Stephen Roth

Session Chair: Glenn Friedman

TC 4.1 Meeting, Programs
Las Vegas, NV, January 31, 2011

Bruning has a new native BIM model of the ASHRAE Headquarters building, which can be used. Consider Bentley, IES and Revit. (Stephen Roth will talk to John Crosby, Bentley).

- b. Chicago 2012 Winter Conference, January 21 to 25, 2012, at the Palmer House Hotel. The website will go live on January 17, 2011.

Theme: *The Impact of HVAC&R on our daily lives*

The proposed tracks are:

Track 1 Energy Efficiency – New Technologies and Applications

Track 2 Integrated Design

Track 3 Specialized Applications – Healthcare, Laboratories, and Data Centers

Track 4 Energy Modeling Applications

Track 5 Installation, Operation & Maintenance of HVAC Systems

Track 6 High Performance Buildings

Track 7 HVAC&R Systems and Equipment

Track 8 Professional Skills

Track 9 HVAC&R Fundamentals and Applications

Track 10 Refrigeration

- i. Consider making an abstract of the two topics to be used for future seminars:

1. Zoning through selection

- a. Zoning
- b. Space loads
- c. Air side
- d. Refrigeration side

2. What is the difference between energy modeling and load calculations

- a. Design day
- b. TMY file versus handbook approach
- c. Peak load (combined with TC4.7 to explore the difference, this could be a good one hard session)

- ii. Brainstorming list of seminar topics:

- The Art of Zoning
 - Zoning criteria
 - Modeling results for poor zoning
- Ventilation and infiltration
- How Load Calculations Interact with Other ASHRAE Chapters

TC 4.1 Meeting, Programs
Las Vegas, NV, January 31, 2011

- Weather
- Infiltration
- Building skin color
- Ventilation
- Fenestration, dynamic windows
- Loads versus systems
 - Space loads definition
 - System effects on loads
 - Outside of the space load effects on systems
- TC1.7 Legal/Business Practices Risks of Loads Calc Codes Being so Hidden
- Forum on what is the Standard of Care for load calculations.
- Rule of Thumb Load Calculations: short cut load calculations for field load calcs in mobile devices.
- Design day schedules, diversity factors
- What is the difference between energy modeling and load calculations
 - Design day
 - TMY file versus handbook approach
 - Peak load (combined with TC4.7 to explore the difference, this could be a good one hard session)
- Load calculations, what we are not
- Zoning through system selection
 - Zoning
 - Space loads
 - Air side
 - Refrigeration side

**Program Themes for
Upcoming Meetings
Meeting**

Montreal Quebec
June 25-29, 2011
Chicago IL
Jan 21-25, 2012
San Antonio, TX
June 23-28, 2012

Program Theme

Net-Zero Buildings

**The Impact of HVAC&R
on our daily lives**

**Program themes have
been eliminated
starting with this**

TC 4.1 Meeting, Programs
Las Vegas, NV, January 31, 2011

conference

Jan. 14, 2011— Web Site Opens for Seminar and Forum Proposals

Feb. 14— Seminar and Forum proposals due

Feb. 21— Conference Paper Accept/Reject Notifications

Mar. 7— Final Technical Papers and Conference Papers Due

Mar. 18—Notifications of Seminar, Forum, TPS and CPS Accept/Reject Distributed

May 6— Upload of Seminar and Conference Paper PPTs Begin

June 6 — All Seminar and Conference Paper PPTs

Chicago 2012 Conference Update

Conference will be held January 21 to 25, 2012. The website will go live on January 17, 2011.

The proposed tracks are:

- Track 1 Energy Efficiency – New Technologies and Applications
 - Track 2 Integrated Design
 - Track 3 Specialized Applications – Healthcare, Laboratories, and Data Centers
 - Track 4 Energy Modeling Applications
 - Track 5 Installation, Operation & Maintenance of HVAC Systems
 - Track 6 High Performance Buildings
 - Track 7 HVAC&R Systems and Equipment
 - Track 8 Professional Skills
 - Track 9 HVAC&R Fundamentals and Applications
 - Track 10 Refrigeration
-

Conference and Exposition Committee

Bill Dietrich – Chair (410-799-6237)

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Dennis Wessel – Vice Chair (216-391-3700)

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Unique Tracking Number Assigned by MORTS 1616
RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM
Sponsoring TC/TG/SSPC: TC 4.1

Title:

"*Revise Load Calculation Applications Manual (2009)*"

Abstract

This project revises the ASHRAE *Load Calculation Applications Manual* (Spitler, 2009) to incorporate significant advances for peak cooling and heating load estimating data and procedures resulting from recently completed ASHRAE research.

Applicability to ASHRAE Research Strategic Plan:

This project supports goal #10 in the 2010-2015 ASHRAE Research Strategic Plan: "Significantly increase the understanding of energy efficiency, environmental quality and the design of buildings in engineering and architectural education. The proposed project will incorporate the results of four recent ASHRAE-funded research projects (RP-1363, RP-1453, RP-1311, RP-1362) into a new edition of the *Load Calculation Applications Manual*. Each of the four research projects makes significant advances in the art of load estimating which contribute to more accurate and effective building designs. By publishing this information in an application manual, a format likely to be more widely used in engineering and architectural education (and in engineering practice) than the *Handbook - Fundamentals* alone, the research results will reach a wider audience. That in turn will contribute to greater understanding of effective methods of building design through accurate peak load estimating.

Research Classification:

Technology Transfer

TC/TG/SSPC Vote:

10-0-0-0 (5/3/2010)

Reasons for Negative Votes and Abstentions:

(none)

Estimated Cost:

\$100,000

Estimated Duration:

18 months

RTAR Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Expected Work Statement Lead Author

James Pegues
Carrier Corporation
james.f.pegues@carrier.utc.com

Co-sponsoring TC/TG/SSPCs and votes:

none

Possible Co-funding Organizations:

none

Application of Results:

This research project will produce an ASHRAE Special Publication: the *Load Calculation Applications Manual, 2nd edition*. Separate versions of the manual using IP units and SI Metric units will be produced.

State-of-the-Art (Background):

ASHRAE research project RP-1326, *Load Calculation Applications Manual*, produced an application manual representing current state of the art for peak cooling and heating load procedures and data. By publishing this information in an application manual it was hoped the information would reach a wider audience than that reached by the *Handbook - Fundamentals* alone, thereby increasing the effective use of the information by our industry.

The 2009 edition of the *Load Calculation Applications Manual* utilized information from the *2005 Handbook - Fundamentals* and the decades of ASHRAE and industry research the *Handbook* is based upon. A few pertinent research projects, among many, contributing to this information were projects dealing with:

- The Heat Balance Method (Pedersen, Fischer and Liesen, 1997).

- The Radiant Time Series Method (Spitler, Fisher, and Pedersen, 1997).
- Design Weather Data (Thevenard and Humphries, 2005).
- Clear Sky Solar Radiation Profiles (Threlkeld, 1963).
- Calculation of solar heat gain for fenestration with shading devices (Klems and Warner, 1997)
- Heat gain from lighting fixtures (Fisher and Chantrasrisalai, 2006).
- Heat gain from commercial cooking equipment (Fisher, 1998).
- Heat gain from office equipment (Wilkins and Hosni, 2000).

Shortly after the first edition of the *Load Calculation Applications Manual* was finished, four ASHRAE research projects were completed which made significant advances in procedures and data for clear sky solar radiation profiles, design weather data, calculation of solar heat gain for fenestration shading devices and heat gain from commercial cooking equipment. This creates an information gap between the first edition of the Applications Manual and the new state of the art. The objective of this proposed project is to close the information gap by incorporating the new research into a second edition of the Applications Manual.

Advancement to the State-of-the-Art:

Four ASHRAE research projects completed in 2009 made important advances in the state of the art for estimating peak cooling loads:

- **RP-1453** - Updating ASHRAE Climatic Data for Design and Standards - Provides new procedures for accurately representing design day clear sky solar radiation profiles. These replace existing procedures originally formulated in the late 1950s and early 1960s. This project also provided new climatic design data based on the latest weather observations worldwide.
- **RP-1363** - Generation of Hourly Design Day Weather Data - Provides new procedures for accurately representing design day dry-bulb and wet-bulb temperature profiles.
- **RP-1311** - Improving Load Calculations for Fenestration with Shading Devices - Provides new procedures and data for calculating solar heat gain for fenestration and fenestration shading devices such as blinds, shades, drapes, and screens.
- **RP-1362** - Revised Heat Gain and Capture and Containment Exhaust Rates for Commercial Cooking Appliances - Provides new data for kitchen equipment heat gains, based on current equipment types and the latest measurement techniques.

Inclusion of results from RP-1453, RP-1363, RP-1311 and RP-1362 will bring the *Load Calculation Applications Manual* up to par with state of the art information in the *2009 Handbook - Fundamentals*.

Ongoing ASHRAE research is also likely to further advance the state of the art and will be worthy of inclusion in a revised Application Manual. Among the ongoing projects worthy of consideration:

- **RP-1482** - Update to Measurements of Office Equipment Heat Gain Data - Will provide new data for office equipment heat gains, based on current equipment types and the latest measurement techniques (project completed during 2010)
- **RP-1416** - Development of Internal Surface Convection Correlations for Energy and Load Calculation Methods - Will provide new data and procedures for determining internal surface convection coefficients (project due to be completed in summer 2011).

In addition to documenting state-of-the-art load calculation procedures, the manual also demonstrates the use of the procedures with examples. Because load calculation procedures have undergone significant changes, the example must be updated to incorporate these new calculations. This also provides an opportunity to update the example subject to use the post-renovation ASHRAE HQ building. In this way use of state-of-the-art procedures for a state-of-the-art building can be demonstrated.

Justification and Value to ASHRAE:

The Load Calculation Applications Manual special publication was created with the objective of gathering information related to load calculations from multiple chapters of the ASHRAE Handbook - Fundamentals into a single focused volume. Chapters contributing information to the Applications Manual include:

- Chapter 18 - Non-Residential Cooling and Heating Load Calculations
- Chapter 14 - Climatic Design Information

- Chapter 15 - Fenestration
- Chapter 16 - Ventilation and Infiltration
- Chapter 4 - Heat Transfer
- Chapter 26 - Heat, Air and Moisture Control in Building Assemblies - Material Properties

Publishing this information in an application manual allows it to reach a wider audience and increases the effectiveness of the material, particularly for education, but also for general industry uses.

This Manual has greatest value when it represents the current state-of-the-art in load calculation procedures and data. TC 4.1 believes an update to the Manual is justified each time significant changes to the state-of-the-art occur, but no more frequently than the 4-year Handbook-Fundamentals cycle. Since the publication of the 2009 edition of the Manual, the state-of-the-art has advanced with significant changes to both load calculation procedures and data. Updating the Manual to the new state-of-the-art will preserve its value both to industry and to ASHRAE.

Finally, ASHRAE has a long history of producing special publications focusing on load calculation procedures. The table below lists the previous special publications covering this subject and includes sales figures for the most recent editions.

Publication Title	Publication Date	Units Sold
Load Calculation Applications Manual	2009	1160 (IP), 36 (SI)
Cooling and Heating Load Calculation Principles	1998	3168
Cooling and Heating Load Calculation Manual, 2nd Edition	1992	no data
Cooling and Heating Load Calculation Manual, 1st Edition	1979	no data

Objectives:

The objective of the project is to revise the *Load Calculations Application Manual, 1st edition* to produce a second edition. The second edition will

- Incorporate results from recently completed ASHRAE research projects RP-1453, RP-1363, RP-1311 and RP-1362.
- Update the example problems to utilize floor plan and construction data for the renovated ASHRAE HQ building.
- Update the software spreadsheets included with the manual to incorporate the new load calculation procedures.
- Offer separate IP units and SI Units versions of the manual.

Specific portions of the manual that will be updated to achieve these objectives are shown in the following table:

Component	Description of Work
Chapter 3 - Thermal Property Data	Update thermal property tables to match data in the <i>2009 Handbook - Fundamentals</i> . Preliminary survey indicates this mainly involves 5-10 pages of indoor attenuation coefficient data for internal shading of windows.
Chapter 4 - Environmental Design Conditions	(1) Revise explanation of derivation of hourly design-day outdoor dry-bulb and wet-bulb profiles and associated examples, (2) Update all weather data tables to use data from the <i>2009 Handbook - Fundamentals</i> .
Chapter 6 - Internal heat Gain	(1) Update Table 6.2 to use lighting power density data from <i>ASHRAE Standard 90.1-2010</i> , (2) Update Tables 6.5, 6.6 and 6.7 to use new kitchen appliance data from the <i>2009 Handbook - Fundamentals</i> Chapter 15 tables 5A, 5B, 5C.
Chapter 7 - Fundamentals of RTSM	(1) Replace data in Tables 7.1 and 7.2 with data generated using the new ASHRAE solar radiation algorithms documented in the <i>2009 Handbook - Fundamentals</i> , (2) Revise section 7.5 item 4 to document the new procedures for calculating solar heat gain for fenestration with internal shades, (3) Revise examples 7.1 and 7.2 to use outputs from updated spreadsheets using revised algorithms for solar flux and heat gain.
Chapter 8 - Application of the RTSM - Detailed	The general format of this chapter can be preserved, but all specific data used in the example must be revised. This includes (1) updating all building diagrams and descriptions of input data to use data for the renovated ASHRAE HQ building, (2) replacing all data in tables and graphs to use new outputs

Example	from the updated spreadsheets using both the new input data and the revised calculation algorithms.
Appendix B - Spreadsheet Implementation of RTSM	Revisions in this Appendix flow from changes to the load calculation spreadsheets (see <i>CD-ROM Contents</i> below). Screen images of spreadsheet tables and VBA code require revision. Discussion of contents of input and results tables also require revision.
Appendix D	Basic format of the appendix can be reused, but the content must be completely revised and enlarged to document the <i>2009 Handbook - Fundamentals</i> procedures for calculating clear sky solar flux, solar heat gain and heat gain for fenestration with internal shades.
Appendix G	Graph results in Figures G.1 and G.2 require revision based on use of <i>2009 Handbook - Fundamentals</i> calculation results for solar heat gain.
CD-ROM Contents	<p>A CD-ROM is included with this manual. It contains ASHRAE design weather data and load calculation spreadsheets. This software is a very important component of the manual since methods discussed in the manual are only efficient when performed by computer calculation. Thus the spreadsheets are critical to the use and understanding of principles explained in the manual. Revisions needed to the CD-ROM include:</p> <p>(1) Replacing all data in the Stations folder with weather station data, IP index and SI index tables from the <i>2009 Handbook - Fundamentals</i>.</p> <p>(2) Updating the load calculation spreadsheets. There are 17 spreadsheets on the CD. These spreadsheets include Visual Basic for Applications (VBA) programming to implement the ASHRAE load calculation algorithms. Many of these algorithms are extensive and as a result the spreadsheets are complex. An initial survey indicates that 2 spreadsheets require significant revision to the VBA algorithms, 10 spreadsheets require moderate revision to update data tables, algorithms and results, and 5 spreadsheets require only minimal or no change to content. These revisions constitute software development and as a result formal software principles for design, development and testing must be used to ensure product quality. This task will therefore require significant effort.</p>
SI Metric Edition	Upon completion of the Inch-Pound (IP) edition, make a copy and produce a second edition with the same technical content which displays all numerical results using SI Metric Units. The time consuming challenge here is the large quantity of tabular data and graphs which will have to be reproduced in SI Metric Units.

Finally, it should be noted TC 4.1's longer term goal is to place the *Load Calculation Applications Manual* on continuous maintenance, synchronizing its revision with the publication of the *Handbook - Fundamentals* so that both publications continually represent state of the art for cooling and heating load estimating procedures and data. This proposed project is the first step in establishing a continuous maintenance regime.

Key References:

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