A user-centred re-design of indoor comfort

For the faculty of Civil Engineering and Geosciences with an energy-conscious approach

Appendices

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Studnr. 1303740

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Appendix A.1

Inhoudsopgave

Beginpagina

Questionnaire Indoor Climate
Main Building Faculty CEG in Delft

Completed questionnaires
will be treated confidentially

Click on "Next"

1. Inleidende vragen − Introductory questions

Welcome to this questionnaire on the indoor climate in the main building of the faculty of Civil Engineering and Geosciences.

This questionnaire is part of my graduation project in Building Engineering. I will use the results of this user survey as input for a re−design of the indoor climate.

The questionnaire reviews your experience and satisfaction with the current indoor climate at your workplace. The questionnaire reviews several aspects on indoor climate as well as possible physical complaints.

Thank you for your interest and participation!

Kind regards,

Bianca van Agtmaal

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This research focuses on the main building of CEG. Employees from Geosciences and Stevin Laboratoria are not part of the target group.
You are therefore asked to answer the question below.

In which part of the CEG building is your office located?

- Main building CEG → Ga verder met vraag *Inleiding*
- Geosciences → Ga verder met vraag *Afronding*
- Stevin Laboratoria → Ga verder met vraag *Afronding*
- Elsewhere → Ga verder met vraag *Afronding*

To begin, please fill in these introductory questions.

How old are you?

- Younger than 30 years old
- Between 30 and 45 years old
- Older than 45 years old

What is your gender?

- Male
- Female

For what period have you been working within the CEG faculty building?

- shorter than 6 months
- between 6 and 12 months
- longer than 12 months

What is the average amount of hours per week you work at the faculty building?

- less than 10 hours a week
- between 11 and 20 hours a week
- between 21 and 30 hours a week
- more than 30 hours a week

What is the average amount of hours a day your work behind a computer screen?

- less than 1 hour a day
- 1 to 3 hours a day
- 3 to 6 hours a day
- more than 6 hours a day

Want is the amount of freedom you experience in determining your own ***work pace***?

Very little freedom							A lot of freedom

How much freedom do you experience in determining the ***order*** of your work?

Very little freedom							A lot of freedom

How much freedom do you experience in determining the ***approach*** of your work?

Very little freedom							A lot of freedom

With how many ***other*** persons do you share your office?

Is there a copier or printer situated within your office?

- Yes → Ga verder met vraag
- No → Ga verder met vraag *sprong naar locatie*

What is the average number of prints you make per day?

- less than 50 a day → Ga verder met vraag *Binnenklimaat*
- between 50 and 250 a day → Ga verder met vraag *Binnenklimaat*
- between 250 and 2500 a day → Ga verder met vraag *Binnenklimaat*
- more than 2500 a day → Ga verder met vraag *Binnenklimaat*

→ *locatie*

2. Locatie in gebouw − Location within building

The following questions concern the location of your office within the building.

On which floor is your office located?

- ground floor
- 1st floor
- 2nd floor
- 3rd floor
- 4th floor
- 5th floor
- 6th floor

On which side of the building is your office located?
(see plan)

- Mekelpark side
- Stevin side

Binnenklimaat

3. Thermische behaaglijkheid − Thermal comfort

The proceeding questions concern the indoor climate of your workplace

Do you often consider your workplace *too hot in summer*? ○ Yes ○ No

Do you often consider your workplace *too cold in summer?* ○ Yes ○ No

Do you often consider your workplace *too hot in winter*? ○ Yes ○ No

Do you often consider your workplace *too cold in winter*? ○ Yes ○ No

Do you often consider your workplace *too hot in spring or fall*? ○ Yes ○ No

Do you often consider your workplace *too cold in spring or fall*? ○ Yes ○ No

Do you often experience discomfort by cold at your lower legs, ankles or feet? ○ Yes ○ No

Do you often experience discomfort by draught? ○ Yes ○ No

Do you often experience discomfort by varying temperatures? ○ Yes ○ No

Are you able to set the temperature within your room *during summer*? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Do you think that the temperature setting *in summer* works adequatly? ○ Yes ○ No

Are you able to set the temperature within your room *during winter*? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Do you think that the temperature setting *in winter* works adequatly? ○ Yes ○ No

Do you have any other comments on the indoor climate? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Please explain your other complaints about the indoor climate.

How satisfied are you with the temperature at your workplace?

Very dissatisfied	○	○	○	○	○	○	○ Very satisfied

Luchtkwaliteit

4. Luchtkwaliteit − Air quality

The next set of questions concerns the air quality at your workplace.

Do you often feel the air within your office is *too dry in summer*? ○ Yes ○ No

Do you often feel the air within your office is *too dry in winter*? ○ Yes ○ No

Do you often find the air within you office stale or stuffy? ○ Yes ○ No

Do you often experience discomfort by unpleasant odors ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Please describe these unpleasant odors.

Is your office equipped with an openable window? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Are you able to open the window(s) whenever you want? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If you are not able to open the window whenever you want to, how come? (If necessary you can select multiple answers)

- ☐ You are not able to reach the window easily
- ☐ The glare control screens are in the way
- ☐ It is not possible to position the window in an adequate position
- ☐ Hinderance by draught
- ☐ Hinderance by noise from outside
- ☐ Complaints from colleagues
- ☐ Other reason...

Describe other reasons why you are not able the window whenever you want to.

Do you have other remarks about the air quality? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

Please describe the other remarks you have about the air quality.

How satisfied are you with the air quality at your workplace?

○ ○ ○ ○ ○ ○ ○

Very
dissatisfied

Very
satisfied

---

hinderlijke geluiden

5. Geluidhinder − Noise hinderance

Do you often experience hinderance by the following sounds, while being at your workplace?

Traffic noise or other noises from outside.	○ Yes ○ No
Noise from the airconditioning or ventilation system.	○ Yes ○ No
Noise from adjacent (work)spaces.	○ Yes ○ No
Noise from the hallway.	○ Yes ○ No
Noise from printers, copiers and suchlike, located within your office.	○ Yes ○ No
Telephone conversations of colleagues present within your office?	○ Yes ○ No
Other noises	○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag
Please describe these other noises.	

How satsified are you with your workplace, concerning noise?

Very dissatisfied	○	○	○	○	○	○	○ Very satisfied

➡ *licht*

6. Licht − Lighting

Do you often experience the following complaints about the lighting at your workplace?

Too little artificial lighting	○ Yes ○ No
Too much artificial lighting	○ Yes ○ No
The artifical lighting is unevenly distributed	○ Yes ○ No
The artificial lighting is unpleasant to the eyes	○ Yes ○ No
The artificial lighting causes unpleasant reflections on the computer screen	○ Yes ○ No
Too little daylight	○ Yes ○ No
Light from the windows is unpleasant to the eyes	○ Yes ○ No
Light from the windows causes unpleasant reflections on the computer screen	○ Yes ○ No
Insufficient view towards the outside environment	○ Yes ○ No
Other complaints on lighting	○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag
Please describe the other complaints on lighting	

Does your workplace have sun shading on the outside of the building?

- ○ Yes ➡ Ga verder met vraag
- ○ No

If so, are you able to control the sun shading yourself?

- ○ Yes
- ○ No

Does your workplace have glare control on the inside?

- ○ Yes ➡ Ga verder met vraag
- ○ No ➡ Ga verder met vraag

If so, are you able to control this glare control device yourself?

- Yes
- No

How satisfied are you with the lighting at your workplace?

Very dissatisfied							Very satisfied

Meubilair

7. Inrichting − Furnishing

Do you often experience the following complaints about the funishing of your workplace?

The chair is uncomfortable	○ Yes	○ No
The chair is insufficiently adjustable	○ Yes	○ No
There is not enough legroom	○ Yes	○ No
The desktop is too low or too high	○ Yes	○ No
The desktop is not (easily) in height adjustable	○ Yes	○ No
The desktop is not big enough	○ Yes	○ No
There is not enough storage space	○ Yes	○ No
Other complaints on the furnishing	○ Yes ➪ Ga verder met vraag	○ No ➪ Ga verder met vraag

Please describe these other complaints

How satisfied are you with the furnishing of your workplace?

Very dissatisfied							Very satisfied
○	○	○	○	○	○	○	

➪ *Lichamelijke klachten*

8. Lichamelijke klachten − Physical complaints

The following questions concern physical complaints you might experience at your workplace

Do you often suffer from headaches at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, does the headaches usually become less when you leave the building? ○ Yes ○ No

Do you often feel fatigued at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, does the fatigue usually become less when you leave the building? ○ Yes ○ No

Do you often experience concentration problems at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, do the concentration problems usually become less when you leave the building? ○ Yes ○ No

Do you often suffer from problems with your eyes at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, do these problems usually become less when you leave the building? ○ Yes ○ No

Do you offer suffer from problems with your throat at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, do these problems usually become less when you leave the building? ○ Yes ○ No

Do you often suffer from problems with you nose at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag

If so, does this usually become less when you leave the building? ○ Yes ○ No

Do you often suffer from problems with your skin at your workplace? ○ Yes ➡ Ga verder met vraag ○ No ➡ Ga verder met vraag *Sprong naar afronding*

If so, does this usually become less when you leave the building? ○ Yes ○ No

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➡ *Afronding*

9. Afronding − Conclusion

You have almost reached the end of this questionnaire. I want to thank you for your interest and participation.

This questionnaire is part of my graduation project in Building Engineering. The end result of my research will be a proposal for a re−design of the indoor climate of the main building of CEG, based on the data collected from this survey.

If you would like to remain updated on my research, please leave your e−mailadres below.

Do not forget to click at the end of this page on 'next' to finalize the questionnaire!

Kind regards,

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If you have any other complaints or recommendations concerning this research, please describe them below

If you are interested in the results of this survey, please fill in your e−mailadress below

Beëindig vragenlijst

Afsluitende pagina

Thank you for your participation!

Variabelen

Variabele	Beschrijving	Waarden
hfdgebouw	In which part of the CEG building is your office located?	{1,Main building CEG} {2,Geosciences} {3,Stevin Laboratoria} {4,Elsewhere}
leeftijd	How old are you?	{1,Younger than 30 years old} {2,Between 30 and 45 years old} {3,Older than 45 years old}
geslacht	What is your gender?	{0,Male} {1,Female}
werkzaam	For what period have you been working within the CEG faculty building?	{1,shorter than 6 months} {2,between 6 and 12 months} {3,longer than 12 months}
tijd	What is the average amount of hours per week you work at the faculty building?	{1,less than 10 hours a week} {2,between 11 and 20 hours a week} {3,between 21 and 30 hours a week} {4,more than 30 hours a week}
bldschm	What is the average amount of hours a day your work behind a computer screen?	{1,less than 1 hour a day} {2,1 to 3 hours a day} {3,3 to 6 hours a day} {4,more than 6 hours a day}
tempoA	Want is the amount of freedom you experience in determining your own work pace? − Very little freedom	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
volgA	How much freedom do you experience in determining the order of your work? − Very little freedom	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
wijzeA	How much freedom do you experience in determining the approach of your work? − Very little freedom	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
aantalp	With how many other persons do you share your office?	
printjn	Is there a copier or printer situated within your office?	{1,Yes} {2,No}
prntaant	What is the average number of prints you make per day?	{1,less than 50 a day} {2,between 50 and 250 a day} {3,between 250 and 2500 a day} {4,more than 2500 a day}
verdieping	On which floor is your office located?	{1,ground floor} {2,1st floor} {4,2nd floor} {3,3rd floor} {5,4th floor} {6,5th floor} {7,6th floor}

locatie	On which side of the building is your office located? (see plan)	{1,Mekelpark side} {2,Stevin side}
zomwarm	Do you often consider your workplace too hot in summer?	{1,Yes} {2,No}
zomkoud	Do you often consider your workplace too cold in summer?	{1,Yes} {2,No}
winwarm	Do you often consider your workplace too hot in winter?	{1,Yes} {2,No}
winkoud	Do you often consider your workplace too cold in winter?	{1,Yes} {2,No}
lenwarm	Do you often consider your workplace too hot in spring or fall?	{1,Yes} {2,No}
lenkoud	Do you often consider your workplace too cold in spring or fall?	{1,Yes} {2,No}
voetkoud	Do you often experience discomfort by cold at your lower legs, ankles or feet?	{1,Yes} {2,No}
tocht	Do you often experience discomfort by draught?	{1,Yes} {2,No}
wissel	Do you often experience discomfort by varying temperatures?	{1,Yes} {2,No}
tempzominstel	Are you able to set the temperature within your room during summer?	{1,Yes} {2,No}
tempzomeff	Do you think that the temperature setting in summer works adequatly?	{1,Yes} {2,No}
tempwininstel	Are you able to set the temperature within your room during winter?	{1,Yes} {2,No}
tempwineff	Do you think that the temperature setting in winter works adequatly?	{1,Yes} {2,No}
opmbikli	Do you have any other comments on the indoor climate?	{1,Yes} {2,No}
wopmbikli	Please explain your other complaints about the indoor climate.	
temptevrA	How satisfied are you with the temperature at your workplace? − Very dissatisfied	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
zomdroog	Do you often feel the air within your office is too dry in summer?	{1,Yes} {2,No}
windroog	Do you often feel the air within your office is too dry in winter?	{1,Yes} {2,No}
bedomp	Do you often find the air within you office stale or stuffy?	{1,Yes} {2,No}
hingeur	Do you often experience discomfort by unpleasant odors	

		{1,Yes} {2,No}
geur	Please describe these unpleasant odors.	
openraam	Is your office equipped with an openable window?	{1,Yes} {2,No}
raambehoef	Are you able to open the window(s) whenever you want?	{1,Yes} {2,No}
raamrdnA	If you are not able to open the window whenever you want to, how come? (If neces − You are not able to reach the window	{1,Ja} {0,Nee}
raamrdnB	If you are not able to open the window whenever you want to, how come? (If neces − The glare control screens are in the	{2,Ja} {0,Nee}
raamrdnC	If you are not able to open the window whenever you want to, how come? (If neces − It is not possible to position t	{3,Ja} {0,Nee}
raamrdnD	If you are not able to open the window whenever you want to, how come? (If neces − Hinderance by draught	{4,Ja} {0,Nee}
raamrdnE	If you are not able to open the window whenever you want to, how come? (If neces − Hinderance by noise from outside	{1,Ja} {0,Nee}
raamrdnF	If you are not able to open the window whenever you want to, how come? (If neces − Complaints from colleagues	{1,Ja} {0,Nee}
raamrdnG	If you are not able to open the window whenever you want to, how come? (If neces − Other reason...	{1,Ja} {0,Nee}
raamrdn2	Describe other reasons why you are not able the window whenever you want to.	
opmluchtkwal	Do you have other remarks about the air quality?	{1,Yes} {2,No}
opmluchtkwal2	Please describe the other remarks you have about the air quality.	
tevrluchtkwalA	How satisfied are you with the air quality at your workplace? − Very dissatisfied	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
bulawaai	Traffic noise or other noises from outside.	{1,Yes} {2,No}
instlawaai	Noise from the airconditioning or ventilation system.	{1,Yes} {2,No}
buurlawaai	Noise from adjacent (work)spaces.	{1,Yes} {2,No}
ganglawaai	Noise from the hallway.	{1,Yes} {2,No}
printlawaai	Noise from printers, copiers and suchlike, located within your office.	{1,Yes} {2,No}
kletslawaai	Telephone conversations of colleagues present within your office?	{1,Yes} {2,No}
overiglawaai	Other noises	{1,Yes} {2,No}

v50	Please describe these other noises.	
GeluidA	How satsified are you with your workplace, concerning noise? − Very dissatisfied	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
weinigAL	Too little artificial lighting	{1,Yes} {2,No}
veelAL	Too much artificial lighting	{1,Yes} {2,No}
ongelijkAL	The artifical lighting is unevenly distributed	{1,Yes} {2,No}
hinderAL	The artificial lighting is unpleasant to the eyes	{1,Yes} {2,No}
schermAL	The artificial lighting causes unpleasant reflections on the computer screen	{1,Yes} {2,No}
weinigDL	Too little daylight	{1,Yes} {2,No}
HinderDL	Light from the windows is unpleasant to the eyes	{1,Yes} {2,No}
schermDL	Light from the windows causes unpleasant reflections on the computer screen	{1,Yes} {2,No}
onvuitzicht	Insufficient view towards the outside environment	{1,Yes} {2,No}
overigL	Other complaints on lighting	{1,Yes} {2,No}
v62	Please describe the other complaints on lighting	
zonwering	Does your workplace have sun shading on the outside of the building?	{1,Yes} {2,No}
zonwbed	If so, are you able to control the sun shading yourself?	{1,Yes} {2,No}
lichtwering	Does your workplace have glare control on the inside?	{1,Yes} {2,No}
lwbed	If so, are you able to control this glare control device yourself?	{1,Yes} {2,No}
LichtA	How satisfied are you with the lighting at your workplace? − Very dissatisfied	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
unChair	The chair is uncomfortable	{1,Yes} {2,No}
adjChair	The chair is insufficiently adjustable	{1,Yes} {2,No}

Legroom	There is not enough legroom	{1,Yes} {2,No}
heightDT	The desktop is too low or too high	{1,Yes} {2,No}
adjDT	The desktop is not (easily) in height adjustable	{1,Yes} {2,No}
sizeDT	The desktop is not big enough	{1,Yes} {2,No}
storage	There is not enough storage space	{1,Yes} {2,No}
overigMB	Other complaints on the furnishing	{1,Yes} {2,No}
v76	Please describe these other complaints	
meubilairA	How satisfied are you with the furnishing of your workplace? − Very dissatisfied	{1,1} {2,2} {3,3} {4,4} {5,5} {6,6} {7,7}
hoofdpijn	Do you often suffer from headaches at your workplace?	{1,Yes} {2,No}
hoofdpijn2	If so, does the headaches usually become less when you leave the building?	{1,Yes} {2,No}
vermoeid	Do you often feel fatigued at your workplace?	{1,Yes} {2,No}
vermoeid2	If so, does the fatigue usually become less when you leave the building?	{1,Yes} {2,No}
concentr	Do you often experience concentration problems at your workplace?	{1,Yes} {2,No}
concentr2	If so, do the concentration problems usually become less when you leave the building?	{1,Yes} {2,No}
oog	Do you often suffer from problems with your eyes at your workplace?	{1,Yes} {2,No}
oog2	If so, do these problems usually become less when you leave the building?	{1,Yes} {2,No}
keel	Do you offer suffer from problems with your throat at your workplace?	{1,Yes} {2,No}
keel2	If so, do these problems usually become less when you leave the building?	{1,Yes} {2,No}
neus	Do you often suffer from problems with you nose at your workplace?	{1,Yes} {2,No}
neus2	If so, does this usually become less when you leave the building?	{1,Yes} {2,No}
huid	Do you often suffer from problems with your skin at your workplace?	{1,Yes} {2,No}

huid2	If so, does this usually become less when you leave the building?	{1,Yes} {2,No}
opmerk	If you have any other complaints or recommendations concerning this research, please describe them below	
email	If you are interested in the results of this survey, please fill in your e−mailadress below	
nqid	Persoonsgegevens: Identificatienummer	
nqlastn	Persoonsgegevens: Achternaam	
nqfirstn	Persoonsgegevens: Voornaam	
nqinit	Persoonsgegevens: Voorletters	
nqinsert	Persoonsgegevens: Tussenvoegsel	
nqgender	Persoonsgegevens: Geslacht	{M,Man} {F,Vrouw} {X,Onbekend}
nqemail	Persoonsgegevens: E−mailadres	
nqusern	Persoonsgegevens: Gebruikersnaam	
nqpwd	Persoonsgegevens: Wachtwoord	
nqstart	Persoonsgegevens: Begonnen	{1,Ja} {0,Nee}
nqcompl	Persoonsgegevens: Afgerond	{1,Ja} {0,Nee}
nqsess	Persoonsgegevens: Aantal sessies	
nqdurat	Persoonsgegevens: Tijdsduur	
nqdatsta	Persoonsgegevens: Datum begonnen	
nqdatcom	Persoonsgegevens: Datum afgerond	
nqdatcre	Persoonsgegevens: Datum aangemaakt	
nqipaddr	Persoonsgegevens: IP adres	

Appendix A.2 Benchmark

The benchmark are the results of a research of the University of Wageningen from 1990[5]. This research investigate building related health complaints among 7043 office employees in 61 offices in the Netherlands.

Thermal Comfort	Average NL
Summer: often too hot	34%
Summer: often too cold	8%
Winter: often too hot	22%
Winter: often too cold	14%
Fall/Spring: often too hot	28%
Fall/Spring: often too cold	11%
Cold at legs or feet	10%
Draught	27%
Varying temperatures	35%
Air Quality	
Summer: air too dry	43%
Winter: air too dry	43%
Stuffy/stale air	27%
Unpleasant odours	17%
Visual Comfort	
Too little artifical light	12%
Hindrance by artificial light	4%
Reflections by artificial light	13%
Too little daylight	12%
Hindrance by daylight	10%
Reflections by daylight	13%
Insufficient outside view	10%
Acoustic Comfort	
Noise from outside	6%
Noise from ventilation system	13%
Noise from adjacent spaces	20%
Noise from hallway	20%
Noise from printers a.o.	16%
Noise from colleagues	33%
Physical Complaints	
Headache	13%
Concentration problems	6%
Fatigue	16%
Problems with the eyes	18%
Problems with the throat	17%
Problems with the nose	7%
Problems with the skin	6%

Table 2: Benchmark

[5] T. Zweers, L. Preller, B. Brunekreef, J.S.M. Boleij. *Gezondheidsklachten en klachten over het binnenklimaat in kantoorgebouwen*. Publicatie S 83, Directoraat-Generaal van de Arbeid van het Ministerie van SZW. Voorburg, 1992

Appendix A.3 Quick-scan

Do you experience any of the following complaints within this room?

Thermal comfort

The room is *too hot in summer*	☐ yes	☐ no
The room is *too cold in summer*	☐ yes	☐ no
The room is *too hot in winter*	☐ yes	☐ no
The room is *too cold in winter*	☐ yes	☐ no
Discomfort by cold at the legs or feet	☐ yes	☐ no
Discomfort by draught	☐ yes	☐ no
Discomfort by varying temperatures	☐ yes	☐ no

Air quality

The air is often too dry *in summer*	☐ yes	☐ no
The air is often too dry *in winter*	☐ yes	☐ no
The air is smelly, stale or stuffy	☐ yes	☐ no
Discomfort by unpleasant odors	☐ yes	☐ no

Lighting

Too little artificial light	☐ yes	☐ no
The artificial light is unpleasant to the eyes	☐ yes	☐ no
Too little daylight	☐ yes	☐ no
The day/sunlight is unpleasant to the eyes	☐ yes	☐ no
The presentation screen is not readable	☐ yes	☐ no

Acoustics

The teacher is inintelligible	☐ yes	☐ no
Noise from outside	☐ yes	☐ no
Noise from the ventilation system	☐ yes	☐ no
Noise from classmates	☐ yes	☐ no

Appendix B.1 – Results survey per category

Thermal Comfort				
Summer too hot	yes	50	no	22
		69%		31%
Summer too cold	yes	4	no	68
		6%		94%
Winter too hot	yes	18	no	54
		25%		75%
Winter too cold	yes	31	no	41
		43%		57%
Spring/Fall too hot	yes	21	no	51
		29%		71%
Spring/Fall too cold	yes	14	no	58
		19%		81%
Cold at legs or feet	yes	22	no	50
		31%		69%
Draught	yes	26	no	46
		36%		64%
Varying temperatures	yes	35	no	37
		49%		51%
Regulating T in summer	yes	9	no	63
		13%		88%
-> Effective?	yes	5	no	4
		56%		44%
Regulating T in winter	yes	41	no	31
		57%		43%
-> Effective?	yes	27	no	14
		66%		34%
Remarks	yes	25	no	47
		35%		65%

Table 4: Results survey - Thermal Comfort

Acoustics				
Traffic/outside	yes	13	no	59
		18%		82%
Airco/Ventilation	yes	2	no	70
		3%		97%
Adjacent spaces	yes	15	no	57
		21%		79%
Hallway	yes	40	no	32
		56%		44%
Printers	yes	2	no	70
		3%		97%
Conversations	yes	14	no	58
		19%		81%
Else	yes	6	no	66
		8%		92%

Table 5: Results survey - Acoustics

Air quality													
Summer too dry	yes	11	no	61									
		15%		85%									
Winter too dry	yes	25	no	47									
		35%		65%									
Stale/Stuffy	yes	30	no	42									
		42%		58%									
Odours	yes	7	no	65									
		10%		90%									
Openable window	yes	72	no	0									
		100%		0%									
Able to open window on demand	yes	62	no	10									
		86%		14%									
-> why not?	Reachable	4	Light screen	3	Positioning	3	Draught	4	Noises	1	Complaints	4	Else	2
		40%		30%		30%		40%		10%		40%		20%
Remarks	yes	6	no	66									
		8%		92%									

Table 3: Results survey – Air Quality

Lighting				
Too little artificial light	yes	2	no	70
		3%		97%
Too much artificial light	yes	6	no	66
		8%		92%
Unevenly distributed artificial light	yes	2	no	70
		3%		97%
Hinderance by artifical light	yes	4	no	68
		6%		94%
Reflections on screen by artificial light	yes	5	no	67
		7%		93%
Too little daylight	yes	6	no	66
		8%		92%
Hinderance by daylight	yes	17	no	55
		24%		76%
Reflections on screen by daylight	yes	27	no	45
		38%		63%
Insufficient view on to outside	yes	8	no	64
		11%		89%
Else	yes	8	no	64
		11%		89%

Table 7: Results survey - Lighting

Furnishing				
Uncomfortable chair	yes	11	no	61
		15%		85%
Unadjustable chair	yes	20	no	52
		28%		72%
Insufficient legroom	yes	7	no	65
		10%		90%
Height desk	yes	10	no	62
		14%		86%
Unadjustable desk	yes	29	no	43
		40%		60%
Desk too small	yes	6	no	66
		8%		92%
Insufficient storage	yes	19	no	53
		26%		74%
Else	yes	1	no	71
		1%		99%

Table 6: Results survey - Furnishing

Appendix B.2 – Cross-referenced data

NOTE: Numbers boxed in blue are highlighted in §3.2.1. Red discoloration is used in multiple tables to indicates strong relations (for percentages > 60%).

Physical complaints vs. working hours and computer use

Workweek	Physical complaints						
	H	F	C	E	T	N	S
10 tot 20	0%	0%	7%	10%	0%	0%	0%
21 tot 30	21%	25%	20%	25%	33%	30%	20%
> 30	57%	75%	73%	55%	67%	70%	80%
< 10	21%	0%	0%	10%	0%	0%	0%

Table 9: Cross-reference of working hours and physical complaints

Workweek	Computer use			
	1-3 u	3-6 u	>6 u	<1 u
10 tot 20 uur	1	2	3	0
21 tot 30 uur	0	4	6	0
> 30 uur	2	12	33	0
< 10 uur	0	3	5	1

Table 8: Cross-refence of working hours and computer use

Computer use	Physical complaints						
	H	F	C	E	T	N	S
1 tot 3 uur	0%	0%	0%	0%	0%	0%	0%
3 tot 6 uur	21%	10%	13%	30%	0%	30%	20%
> 6 uur	79%	90%	87%	70%	100%	70%	80%
< 1 uur	0%	0%	0%	0%	0%	0%	0%

Table 10: Cross-reference of computer use and physical complaints

Acoustics and air quality vs. number of colleagues

Nr. Colleagues	Acoustics				Air quality					
	Next	Hall	Coll	DisG	SD	WD	Stuffy	UO	NO	DisA
0	27%	25%	0%	13%	9%	12%	13%	14%	30%	17%
1	40%	48%	29%	44%	45%	52%	43%	43%	10%	42%
2	7%	10%	36%	25%	9%	16%	20%	14%	50%	25%
3	0%	3%	0%	0%	9%	4%	7%	14%	0%	0%
4	20%	13%	14%	13%	18%	12%	13%	0%	0%	8%
> 5	7%	3%	21%	6%	9%	4%	3%	14%	10%	8%

Table 11: Cross-reference number of colleagues, acoustics and air quality.

Thermal comfort, light and acoustics vs. location

Mekelpark

		Thermal Comfort												Light					Acoustics						
	# resp	SH	SC	WH	WC	SFH	SFC	CF	D	VT	RS	RW	DisT	<DL	hDL	rDL	View	DisL	Out	Inst	Next	Hall	Print	Coll	DisG
2nd floor	13	100%	0%	15%	77%	38%	31%	54%	62%	69%	92%	38%	54%	8%	31%	46%	0%	31%	0%	0%	15%	62%	0%	15%	23%
3rd floor	11	73%	0%	27%	36%	27%	9%	9%	45%	55%	82%	36%	27%	9%	27%	45%	9%	9%	18%	0%	27%	45%	18%	9%	18%
4th floor	12	17%	8%	8%	17%	8%	8%	25%	17%	17%	75%	33%	17%	8%	25%	25%	8%	0%	17%	0%	17%	67%	0%	17%	8%
6th floor	5	80%	20%	60%	60%	40%	40%	40%	40%	60%	100%	60%	40%	20%	40%	60%	0%	20%	40%	0%	80%	80%	0%	40%	40%
Total	**41**	**59%**	**50%**	**50%**	**66%**	**61%**	**62%**	**62%**	**68%**	**61%**	**59%**	**55%**	**54%**	**67%**	**80%**	**68%**	**25%**	**67%**	**46%**	**0%**	**73%**	**64%**	**100%**	**64%**	**53%**

Stevin

		Thermal Comfort												Light					Acoustics						
	# resp	SH	SC	WH	WC	SFH	SFC	CF	D	VT	RS	RW	DisT	<DL	hDL	rDL	View	DisL	Out	Inst	Next	Hall	Print	Coll	DisG
2nd floor	6	67%	0%	33%	33%	33%	0%	17%	17%	33%	83%	50%	17%	0%	0%	0%	50%	17%	17%	17%	17%	83%	0%	0%	33%
3rd floor	9	89%	11%	33%	44%	11%	33%	44%	44%	67%	89%	44%	67%	0%	0%	44%	22%	11%	11%	0%	0%	44%	0%	11%	11%
4th floor	9	56%	0%	22%	44%	33%	22%	33%	33%	44%	89%	33%	44%	22%	22%	33%	11%	11%	56%	0%	33%	56%	0%	22%	44%
6th floor	3	67%	33%	67%	0%	33%	0%	0%	0%	33%	100%	100%	33%	0%	33%	33%	0%	0%	0%	0%	0%	0%	0%	33%	0%
Total	**27**	**41%**	**50%**	**50%**	**34%**	**39%**	**38%**	**38%**	**32%**	**39%**	**41%**	**45%**	**46%**	**33%**	**20%**	**32%**	**75%**	**33%**	**54%**	**100%**	**27%**	**36%**	**0%**	**36%**	**47%**

Floor

		Thermal Comfort												Light					Acoustics						
	# resp	SH	SC	WH	WC	SFH	SFC	CF	D	VT	RS	RW	DisT	<DL	hDL	rDL	View	DisL	Out	Inst	Next	Hall	Print	Coll	DisG
Total 2nd	19	89%	0%	21%	63%	37%	21%	42%	47%	58%	89%	42%	42%	5%	21%	32%	16%	26%	5%	5%	16%	68%	0%	11%	26%
Total 3rd	20	80%	5%	30%	40%	20%	20%	25%	45%	60%	85%	40%	45%	5%	15%	45%	15%	10%	15%	0%	15%	45%	10%	10%	15%
Total 4th	21	33%	5%	14%	29%	19%	14%	29%	24%	29%	81%	33%	29%	14%	24%	29%	10%	5%	33%	0%	24%	62%	0%	19%	24%
Total 6th	8	75%	25%	63%	38%	38%	25%	25%	25%	50%	100%	75%	38%	13%	38%	50%	0%	13%	25%	0%	50%	50%	0%	38%	25%

Table 12: Cross-reference of location and % of respondents that complains per floor, subdivided for Mekelpark side, Stevin Side and Total.
The 'total' row in the sub tables for Mekelpark and Stevin side, is the % of the overall total for of a specific complaint.

			Thermal Comfort												Air quality						Physical Complaints						
		# dis	SH	SC	WH	WC	SFH	SFC	CF	D	VT	RS	RW	DisT	SD	WD	Stuffy	UO	NO	DisA	H	F	C	E	T	N	S
Thermal Comfort	Summer too Hot	50		4%	30%	48%	38%	24%	32%	48%	58%	92%	46%	48%	22%	38%	46%	10%	18%	22%	26%	36%	24%	34%	6%	20%	10%
	Summer too Cold	4	50%		50%	50%	50%	50%	75%	25%	50%	100%	50%	75%	0%	0%	25%	25%	50%	25%	25%	25%	25%	0%	0%	25%	0%
	Winter too Hot	18	83%	11%		22%	56%	22%	28%	44%	56%	89%	50%	50%	17%	50%	61%	17%	33%	28%	28%	28%	22%	28%	11%	28%	6%
	Winter too Cold	31	77%	6%	13%		35%	32%	52%	58%	71%	87%	45%	52%	23%	48%	52%	16%	10%	29%	32%	39%	26%	35%	6%	19%	13%
	Spring/Fall too Hot	21	90%	10%	48%	52%		33%	24%	48%	57%	90%	62%	67%	14%	33%	52%	14%	29%	33%	24%	38%	33%	19%	0%	19%	5%
	Spring/Fall too Cold	14	86%	14%	29%	71%	50%		57%	64%	79%	93%	50%	64%	14%	43%	43%	14%	29%	36%	29%	36%	36%	29%	0%	21%	7%
	Cold at legs/feet	22	73%	14%	23%	73%	23%	36%		50%	73%	82%	32%	41%	23%	45%	50%	9%	14%	23%	27%	32%	18%	36%	5%	18%	14%
	Draught	26	92%	4%	31%	69%	38%	35%	42%		81%	85%	38%	58%	23%	50%	65%	19%	19%	35%	31%	50%	35%	31%	8%	27%	15%
	Varying Temp	35	83%	6%	29%	63%	34%	31%	46%	60%		86%	40%	49%	17%	46%	60%	17%	17%	34%	31%	37%	20%	37%	6%	23%	11%
	Regulate T Summer	63	73%	6%	25%	43%	30%	21%	29%	35%	48%		49%	43%	17%	33%	38%	10%	16%	19%	19%	30%	22%	29%	5%	16%	8%
	Regulate T Winter	31	74%	6%	29%	45%	42%	23%	23%	32%	45%	100%		42%	23%	32%	35%	13%	13%	19%	23%	39%	29%	32%	3%	16%	3%
	Dissatisfied (<=3)	28	86%	11%	32%	57%	50%	32%	32%	54%	61%	96%	46%		11%	32%	43%	14%	18%	32%	7%	36%	18%	21%	4%	18%	11%
Air Quality	Summer too Dry	11	100%	0%	27%	64%	27%	18%	45%	55%	55%	100%	64%	27%		73%	64%	9%	9%	18%	36%	73%	55%	64%	18%	36%	18%
	Winter too Dry	25	76%	0%	36%	60%	28%	24%	40%	52%	64%	84%	40%	36%	32%		52%	12%	24%	28%	28%	44%	24%	40%	12%	32%	12%
	Stale/Stuffy	30	77%	3%	37%	53%	37%	20%	37%	57%	70%	80%	37%	40%	23%	43%		20%	17%	33%	27%	27%	20%	30%	7%	20%	13%
	Unpleasant Odors	7	71%	14%	43%	71%	43%	29%	29%	71%	86%	86%	57%	57%	14%	43%	86%		100%	57%	43%	43%	29%	29%	14%	29%	14%
	Not able to Open window	10	90%	20%	60%	30%	60%	40%	30%	50%	60%	100%	40%	50%	10%	60%	50%	70%		40%	10%	30%	40%	40%	10%	20%	0%
	Dissatisfied (<=3)	12	92%	8%	42%	75%	58%	42%	42%	75%	100%	100%	50%	75%	17%	58%	83%	33%	33%		50%	42%	17%	58%	8%	42%	8%
Physical	Headache	14	93%	7%	36%	71%	36%	29%	43%	57%	79%	86%	50%	14%	29%	50%	57%	21%	7%	43%		71%	43%	57%	14%	36%	7%
	Fatigue	20	90%	5%	25%	60%	40%	25%	35%	65%	65%	95%	60%	50%	40%	55%	40%	15%	15%	25%	50%		55%	45%	15%	35%	10%
	Concentration	15	80%	7%	27%	53%	47%	33%	27%	60%	47%	93%	60%	33%	40%	40%	40%	13%	27%	13%	40%	73%		47%	13%	20%	7%
	Eyes	20	85%	0%	25%	55%	20%	20%	40%	40%	65%	90%	50%	30%	35%	50%	45%	10%	20%	35%	40%	45%	35%		15%	25%	10%
	Throat	3	100%	0%	67%	67%	0%	0%	33%	67%	67%	100%	33%	33%	67%	100%	67%	33%	33%	33%	67%	100%	67%	100%		67%	33%
	Nose	10	100%	10%	50%	60%	40%	30%	40%	70%	80%	100%	50%	50%	40%	80%	60%	20%	20%	50%	50%	70%	30%	50%	20%		30%
	Skin	5	100%	0%	20%	80%	20%	20%	60%	80%	80%	100%	20%	60%	40%	60%	80%	20%	0%	20%	20%	40%	20%	40%	20%	60%	

Table 13: Cross-reference for Thermal Comfort, Air Quality and Physical Complaints.

			Light										Acoustics							Physical Complaints						
		# resp	<AL	>AL	≠AL	hAL	rAL	<DL	hDL	rDL	View	DisL	Out	Inst	Next	Hall	Print	Coll	DisG	H	F	C	E	T	N	S
Light	Too little Artificial Light	2		50%	50%	0%	0%	50%	0%	0%	50%	50%	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	50%	0%	50%	0%
	Too much Artifical Light	6	17%		17%	50%	0%	17%	67%	83%	0%	67%	0%	0%	17%	83%	0%	17%	50%	33%	33%	33%	67%	0%	33%	0%
	Uneven Artifical Light	2	50%	50%		0%	0%	50%	50%	50%	0%	100%	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	100%	0%
	Hindrance by Artificial Light	4	0%	75%	0%		0%	25%	50%	100%	0%	50%	0%	0%	0%	75%	0%	25%	50%	50%	75%	75%	50%	0%	25%	0%
	Reflections by Artifical Light	5	0%	0%	0%	0%		0%	20%	60%	20%	20%	20%	0%	40%	60%	0%	40%	40%	40%	60%	40%	60%	20%	20%	0%
	Too little Daylight	6	17%	17%	17%	17%	0%		33%	50%	33%	33%	17%	0%	50%	50%	0%	17%	50%	0%	33%	33%	17%	0%	17%	0%
	Hindrance by Daylight	17	0%	24%	6%	12%	6%	12%		71%	0%	24%	18%	0%	35%	59%	0%	29%	47%	29%	24%	29%	29%	6%	29%	12%
	Reflection by Daylight	27	0%	19%	4%	15%	11%	11%	44%		4%	30%	22%	0%	22%	59%	4%	26%	30%	33%	41%	26%	44%	4%	19%	4%
	Insufficient view	8	13%	0%	0%	0%	13%	25%	0%	13%		13%	25%	13%	38%	88%	13%	25%	50%	13%	38%	63%	38%	0%	13%	0%
	Dissatisfied (<=3)	11	9%	36%	18%	18%	9%	18%	36%	73%	9%		9%	9%	18%	64%	9%	18%	55%	18%	36%	27%	73%	0%	27%	0%
Acoustics	Noises from Outside	13	0%	0%	0%	0%	8%	8%	23%	46%	15%	8%		0%	54%	85%	0%	38%	46%	15%	54%	31%	23%	8%	23%	15%
	Noises from Installations	2	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	0%		0%	50%	0%	50%	50%	50%	50%	100%	50%	0%	0%	0%
	Noises from Adjacent Spaces	15	7%	7%	0%	0%	13%	20%	40%	40%	20%	13%	47%	0%		93%	7%	27%	47%	27%	40%	27%	20%	7%	20%	13%
	Noises from Hallway	40	3%	13%	0%	8%	8%	8%	25%	40%	18%	18%	28%	3%	35%		3%	23%	35%	28%	35%	28%	30%	5%	18%	10%
	Noises from printers	2	0%	0%	0%	0%	0%	0%	0%	50%	50%	50%	0%	0%	50%	50%		0%	50%	0%	100%	50%	50%	0%	0%	0%
	Noises from Colleagues	14	0%	7%	0%	7%	14%	7%	36%	50%	14%	14%	36%	7%	29%	64%	0%		36%	36%	50%	43%	43%	14%	29%	21%
	Dissatisfied (<=3)	16	0%	19%	6%	13%	13%	19%	50%	50%	25%	38%	38%	6%	44%	88%	6%	31%		25%	44%	50%	38%	13%	25%	13%
Physical	Headache	14	0%	14%	0%	14%	14%	0%	36%	64%	7%	14%	14%	7%	29%	79%	0%	36%	29%		71%	43%	57%	14%	36%	7%
	Fatigue	20	0%	10%	0%	15%	15%	10%	20%	55%	15%	20%	35%	5%	30%	70%	10%	35%	35%	50%		55%	45%	15%	35%	10%
	Concentration	15	0%	13%	0%	20%	13%	13%	33%	47%	33%	20%	27%	13%	27%	73%	7%	40%	53%	40%	73%		47%	13%	20%	7%
	Eyes	20	5%	20%	5%	10%	15%	5%	25%	60%	15%	40%	15%	5%	15%	60%	5%	30%	30%	40%	45%	35%		15%	25%	10%
	Throat	3	0%	0%	0%	0%	33%	0%	33%	33%	0%	0%	33%	0%	33%	67%	0%	67%	67%	67%	100%	67%	100%		67%	33%
	Nose	10	10%	20%	20%	10%	10%	10%	50%	50%	10%	30%	30%	0%	30%	70%	0%	40%	40%	50%	70%	30%	50%	20%		30%
	Skin	5	0%	0%	0%	0%	0%	0%	40%	20%	0%	0%	40%	0%	40%	80%	0%	60%	40%	20%	40%	20%	40%	20%	60%	

Table 14: Cross-reference Light, Acoustics and Physical Complaints.

Appendix B.3 – Results Quick-scan

	1	2	3	4	5	6	7	8	9	10	11	12	T	P
Thermal Comfort														
Summer often too hot	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**8%**
Summer often too cold	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too hot	0	0	0	0	0	0	0	0	1	1	0	0	**2**	**17%**
Winter often too cold	0	0	0	0	0	0	0	1	0	1	0	0	**2**	**17%**
Cold at legs or feet	0	0	0	0	1	1	0	1	0	1	0	0	**4**	**33%**
Draught	0	0	0	0	0	0	0	1	1	0	0	0	**2**	**17%**
Varying temperatures	0	0	0	0	0	0	0	0	1	1	0	0	**2**	**17%**
Air Quality														
Air too dry in summer	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**8%**
Air too dry in winter	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Stale/stuffy air	1	0	0	0	0	0	0	0	1	0	0	1	**3**	**25%**
Unpleasant odours	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**8%**
Visual Comfort														
Too little artificial light	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Hindrance by artificial light	0	0	0	0	0	1	0	1	0	0	0	0	**2**	**17%**
Too little daylight	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Hindrance by daylight	0	1	0	0	0	1	0	1	1	0	0	1	**5**	**42%**
Readibility presentation screen	1	1	0	0	0	0	0	1	1	1	0	0	**5**	**42%**
Acoustic Comfort														
Intelligibility teacher	0	1	0	0	0	0	0	0	1	1	0	0	**3**	**25%**
Noise from outside	0	0	0	0	0	0	0	0	1	1	0	1	**3**	**25%**
Noise from ventilation system	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from other students	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**8%**

Table 15: Results Quick-scan - Room 3.02
(23/11/2011 at 10:15 am and 11:45 am)

	1	2	3	4	5	6	7	8	9	10	T	P
Thermal Comfort												
Summer often too hot	0	1	0	0	0	0	0	0	0	0	**1**	**10%**
Summer often too cold	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too hot	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too cold	1	1	0	1	1	0	0	0	0	1	**5**	**50%**
Cold at legs or feet	0	1	0	1	0	0	0	0	1	0	**3**	**30%**
Draught	1	0	0	0	0	0	1	0	0	1	**3**	**30%**
Varying temperatures	1	0	0	0	0	0	0	0	0	0	**1**	**10%**
Air Quality												
Air too dry in summer	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Air too dry in winter	0	0	1	0	0	0	1	0	0	0	**2**	**20%**
Stale/stuffy air	0	0	0	0	0	1	1	1	1	0	**4**	**40%**
Unpleasant odours	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Visual Comfort												
Too little artificial light	0	0	0	0	1	0	0	0	0	0	**1**	**10%**
Hindrance by artificial light	0	1	0	0	0	0	0	0	0	0	**1**	**10%**
Too little daylight	0	0	0	0	0	1	1	0	0	0	**2**	**20%**
Hindrance by daylight	1	1	0	0	0	0	0	0	0	0	**2**	**20%**
Readibility presentation screen	1	1	1	1	1	0	0	0	0	1	**6**	**60%**
Acoustic Comfort												
Intelligibility teacher	0	1	0	0	0	0	0	0	0	0	**1**	**10%**
Noise from outside	0	0	1	0	0	0	0	0	0	0	**1**	**10%**
Noise from ventilation system	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from other students	0	0	0	0	0	0	0	0	1	0	**1**	**10%**

Table 16: Results Quick-scan - Room 3.98
(23/11/2011 at 11:30 am and 9/12/2011 at 9:45 am)

	1	2	3	4	5	6	7	8	9	10	11	T	P
Thermal Comfort													
Summer often too hot	1	1	1	0	1	0	0	1	0	0	1	**6**	**55%**
Summer often too cold	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too hot	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too cold	0	1	1	0	0	0	0	1	0	0	0	**3**	**27%**
Cold at legs or feet	0	1	1	0	0	0	1	0	0	0	0	**3**	**27%**
Draught	0	1	0	0	0	0	1	0	0	0	1	**3**	**27%**
Varying temperatures	1	0	0	0	0	0	0	0	0	0	0	**1**	**9%**
Air Quality													
Air too dry in summer	0	0	0	0	0	0	0	0	1	0	0	**1**	**9%**
Air too dry in w inter	0	0	0	0	0	1	0	0	1	0	0	**2**	**18%**
Stale/stuffy air	1	1	1	0	1	1	1	0	0	0	1	**7**	**64%**
Unpleasant odours	0	0	0	0	0	1	0	0	0	0	1	**2**	**18%**
Visual Comfort													
Too little artificial light	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Hindrance by artificial light	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Too little daylight	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Hindrance by daylight	1	0	0	0	0	0	0	0	1	1	1	**4**	**36%**
Readibility presentation screen	0	0	1	1	0	0	0	0	0	0	0	**2**	**18%**
Acoustic Comfort													
Intelligibility teacher	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from outside	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from ventilation system	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from other students	0	0	0	0	0	0	0	0	1	0	0	**1**	**9%**

Table 17: Results Quick-scan – Room 3.99
(28/11/2011 at 11:30 am and 2:45 pm)

	1	2	3	4	5	6	7	8	9	10	11	T	P
Thermal Comfort													
Summer often too hot	0	1	1	0	0	0	0	0	0	0	0	**2**	**18%**
Summer often too cold	0	0	0	0	0	0	0	1	1	1	0	**3**	**27%**
Winter often too hot	0	0	0	0	0	0	0	1	0	1	1	**3**	**27%**
Winter often too cold	1	1	1	1	0	0	0	1	0	0	0	**5**	**45%**
Cold at legs or feet	0	0	0	0	0	0	0	0	1	0	0	**1**	**9%**
Draught	0	0	0	0	0	0	0	0	0	1	0	**1**	**9%**
Varying temperatures	1	1	0	0	0	0	0	0	1	0	0	**3**	**27%**
Air Quality													
Air too dry in summer	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Air too dry in w inter	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Stale/stuffy air	1	1	0	1	1	1	0	0	0	0	1	**6**	**55%**
Unpleasant odours	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Visual Comfort													
Too little artificial light	0	0	0	0	0	1	0	0	0	0	1	**2**	**18%**
Hindrance by artificial light	0	1	1	0	1	0	0	1	0	0	0	**4**	**36%**
Too little daylight	1	0	0	1	1	1	1	1	1	1	1	**9**	**82%**
Hindrance by daylight	0	0	0	0	0	0	1	0	0	0	0	**1**	**9%**
Readibility presentation screen	1	1	1	0	1	1	1	1	0	0	0	**7**	**64%**
Acoustic Comfort													
Intelligibility teacher	0	0	0	0	0	0	1	0	1	1	0	**3**	**27%**
Noise from outside	0	0	0	0	0	1	0	0	0	0	0	**1**	**9%**
Noise from ventilation system	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from other students	1	0	0	0	1	1	0	0	1	1	1	**6**	**55%**

Table 18: Results Quick-scan - Room D
(24/11/2011 at 10:30 am and 6/12/2011 at 3:30 pm)

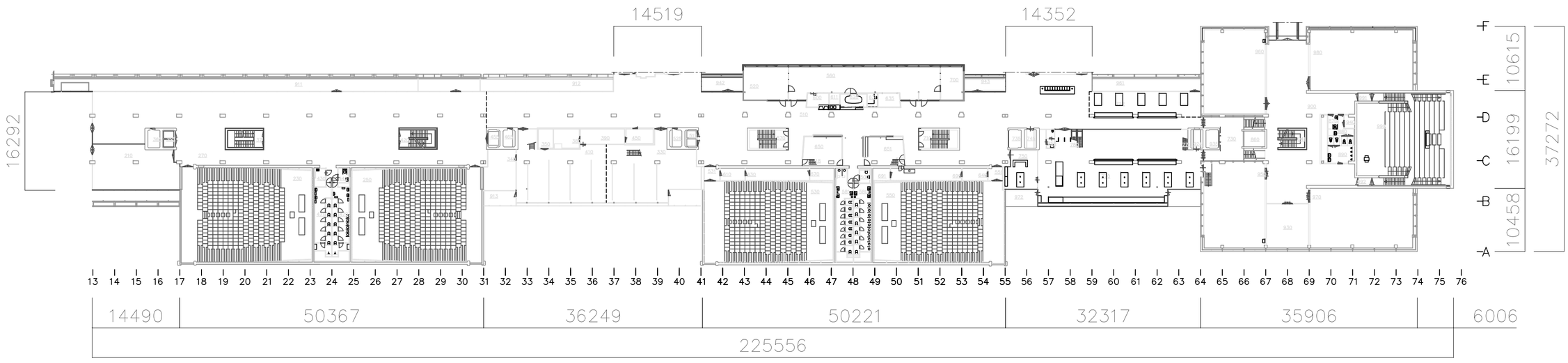
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T	P
Thermal Comfort																
Summer often too hot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Summer often too cold	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**7%**
Winter often too hot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too cold	0	1	0	1	0	0	0	1	1	0	0	0	0	1	**5**	**36%**
Cold at legs or feet	0	1	0	1	1	0	0	1	1	0	0	0	1	0	**6**	**43%**
Draught	0	0	0	1	0	1	0	0	0	1	1	0	0	1	**5**	**36%**
Varying temperatures	0	0	0	1	1	0	0	0	0	0	0	0	1	0	**3**	**21%**
Air Quality																
Air too dry in summer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Air too dry in winter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1**	**7%**
Stale/stuffy air	0	1	0	0	0	0	0	0	1	1	1	1	0	0	**5**	**36%**
Unpleasant odours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Visual Comfort																
Too little artificial light	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**7%**
Hindrance by artificial light	0	0	0	0	1	0	0	0	1	1	1	1	0	0	**5**	**36%**
Too little daylight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**14**	**100%**
Hindrance by daylight	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1**	**7%**
Readibility presentation screen	0	0	0	0	1	0	0	1	0	1	1	1	0	1	**6**	**43%**
Acoustic Comfort																
Intelligibility teacher	0	0	0	0	1	0	1	0	0	0	0	1	0	0	**3**	**21%**
Noise from outside	1	0	0	0	1	0	0	0	0	0	0	0	0	0	**2**	**14%**
Noise from ventilation system	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**7%**
Noise from other students	0	0	0	0	1	0	0	0	0	0	0	0	1	0	**2**	**14%**

Table 19: Results Quick-scan - Room E
(24/11/2011 11:30 am, 28/11/2011 10:30 am and 8/12/2011 11:30 am)

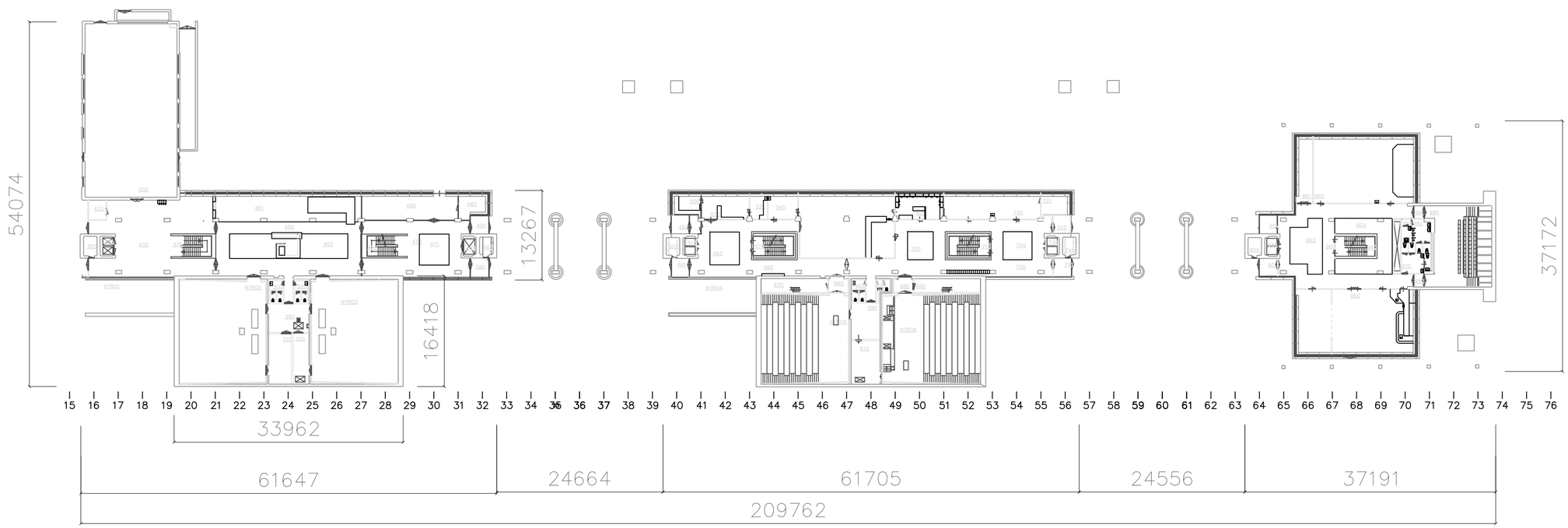
	1	2	3	4	5	6	7	8	9	10	T	P
Thermal Comfort												
Summer often too hot	0	0	0	1	0	1	1	1	1	0	**5**	**50%**
Summer often too cold	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Winter often too hot	0	0	0	0	0	1	0	1	0	1	**3**	**30%**
Winter often too cold	0	0	0	0	0	0	0	0	0	1	**1**	**10%**
Cold at legs or feet	0	0	0	0	0	0	1	0	0	0	**1**	**10%**
Draught	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Varying temperatures	0	0	0	0	0	0	1	1	0	0	**2**	**20%**
Air Quality												
Air too dry in summer	0	0	0	0	0	1	0	0	0	0	**1**	**10%**
Air too dry in winter	0	0	0	0	0	1	0	1	0	0	**2**	**20%**
Stale/stuffy air	0	0	0	1	1	1	1	0	1	0	**5**	**50%**
Unpleasant odours	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Visual Comfort												
Too little artificial light	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Hindrance by artificial light	1	0	0	0	0	0	0	0	0	0	**1**	**10%**
Too little daylight	1	0	0	1	1	1	0	1	1	0	**6**	**60%**
Hindrance by daylight	0	0	0	0	0	0	0	0	1	0	**1**	**10%**
Readibility presentation screen	0	0	0	0	0	0	1	0	0	0	**1**	**10%**
Acoustic Comfort												
Intelligibility teacher	0	0	0	0	0	0	1	0	0	0	**1**	**10%**
Noise from outside	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from ventilation system	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Noise from other students	1	0	0	0	0	1	0	0	0	0	**2**	**20%**

Table 20: Results Quick-scan - Room F
(24/11/2011 9:30 am and 11:30 am)

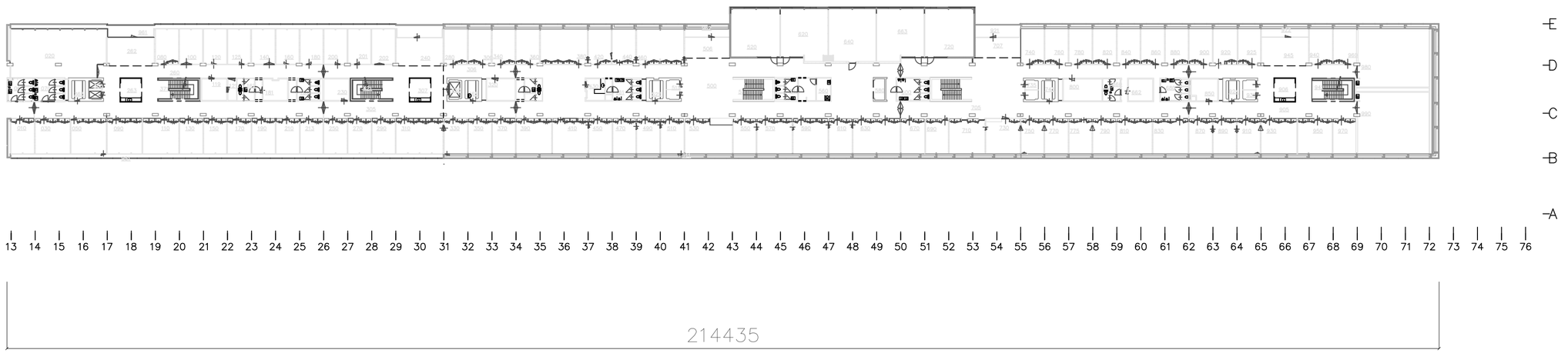
Appendix C



CEG – Main Building – First floor – Scale 1:500 mm



CEG – Main Building – Ground floor – Scale 1:500



CEG – Main Building – Second floor – Scale 1:500

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Appendix D – Datalogger measurements

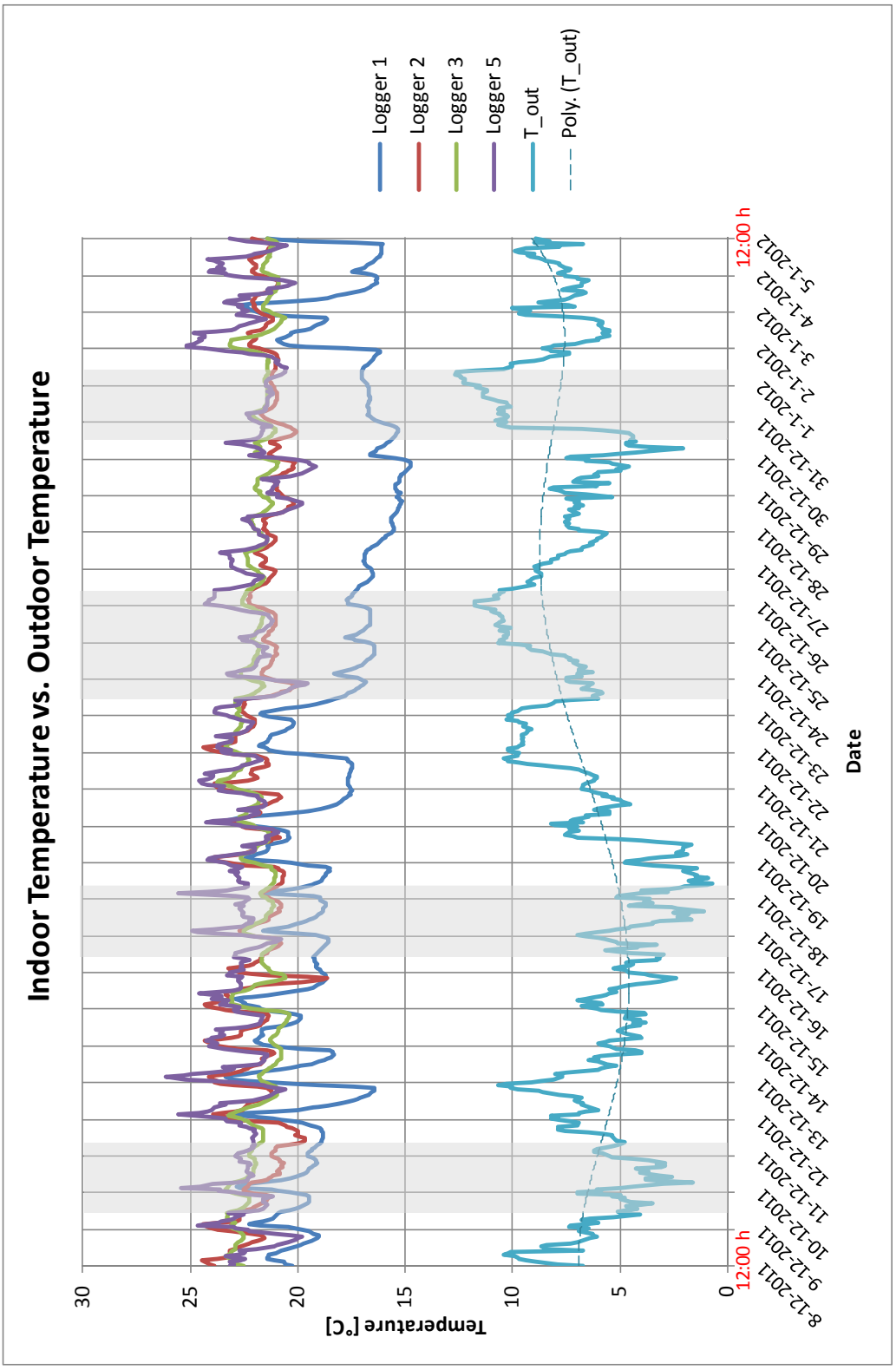

Figure D.1: Temperature measurements by dataloggers, from December 8, 2011 – January 5, 2012

Appendix E.1 – PMV-model of Fanger, 1970

Early in the seventies Fanger performed a series of experiments with nearly 1300 test persons. From these experiments he derived a parameter that predicts the average satisfaction of a group with the thermal indoor climate. Fanger's model is based on a steady-state heat balance of the human body, as is expressed in the figure below:

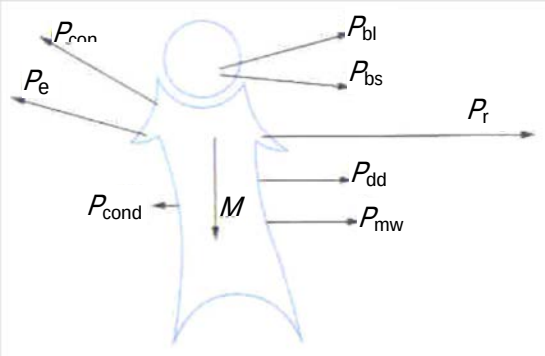

Figure E.1: Human heat balance according to Fanger

The picture above can also be described as a formula:

$M = P_{mw} + P_{dd} + P_{es} + P_{bs} + P_{bl} + P_{conv} + P_r + P_{cond}$

With:

M = energy from metabolic processes [J]
P_{mw} = mechanical work performed externally [J]
P_{dd} = energy emitted by damp diffusion (skin) [J]
P_{ev} = heat removal by evaporation of sweat [J]
P_{bs} = sensible heat removed by breathing [J]
P_{bl} = latent heat removed by breathing [J]
P_{conv} = heat emitted by convection [J]
P_r = heat emitted by radiation [J]
P_{cond} = heat emitted by conduction [J]

Thermal comfort is determined by the deviation from the equilibrium above. Thermal comfort is expressed in the PMV, 'Predicted Mean Vote'. The PMV is a function of:

$PMV=f(M, W, \Theta_a, \Theta_{mrt}, p_a, \Theta_{cl}, f_{cl}, h_c)$

with:

M = metabolism [W/m^2]
W = work performed externally [W/m^2]
Θ_a = air temperature [°C]
Θ_{mrt} = mean radiant temperature [°C]
p_a = partial atmospheric pressure [Pa]
Θ_{cl} = surface temperature for clothing [°C]
f_{cl} = ratio between human outer surface and unclothed surface [-]
h_c = convective heat transfer coefficient [W/(m^{2}K)]

The model of Fanger is not totally static. Metabolism and heat resistance of clothing can be influenced by the occupant. An occupant will react on any thermal discomfort he might experience. The occupant will try to restore the heat balance described above.

The parameters relevant for the PMV have been derived by Fanger from the experiments with test persons. The experiments took place in a climate chamber, a precisely controlled environment. Based on a free statistical spread, Fanger has developed a relation between the PMV and the percentage of people dissatisfied (PPD).

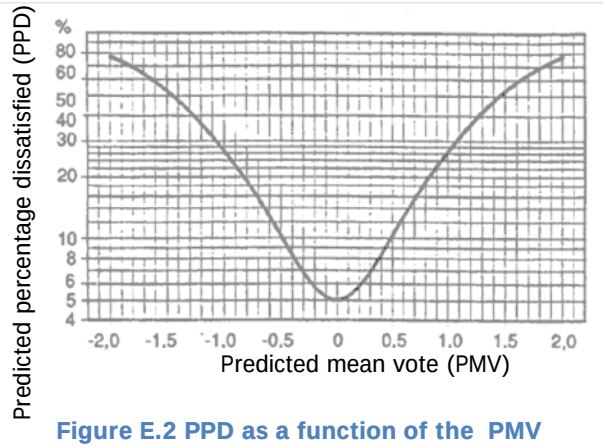

Figure E.2 PPD as a function of the PMV

Standards often demand that 80 – 90% should be satisfied. Based on the relation defined by Fanger, this means that the PMV will be between -0.5 and + 0.5.

E.2 Adaptive model of comfort

E.2.1 A standard for ASHRAE 55

Brager and de Dear have performed a large field research, from which it seems that a human is not just a passive observer in the thermal environment, as is the case in Fanger's model.

In case a person experiences thermal discomfort, a person will react to restore thermal comfort. De Dear has defined three main categories of adaptation:

1. Behavioural adaptation: Adaptations are made conscious or unconscious to restore the body's heat balance. These adaptations can be personal, technical or environmental and cultural. The behavioural adaptations have to be accommodated by the building and organisation.
2. Fysiological adaptation: changes in the fysiological reaction. Two subcategories exist; genetic adaptation and acclimatisation.
3. Psychological adaptation: changing experience of and reaction on sensory information. The thermal experience is influenced by the experience and expectations of the occupant.

Based on their field research, Brager and de Dear have developed a adaptive PMV-method for ASHRAE 55. This method distinguishes two types of building. Building with centralized HVAC and buildings with natural ventilation. The PMV model from Fanger corresponds well with the adaptive PMV model for buildings with centralized HVAC. For naturally ventilated building Brager and de Dear found large differences between the PMV-model and the field results. Naturally ventilated building allow for a higher degree of behavioural and psychological adaptation. Brager and de Dear have therefore developed two different models for these two types of buildings.

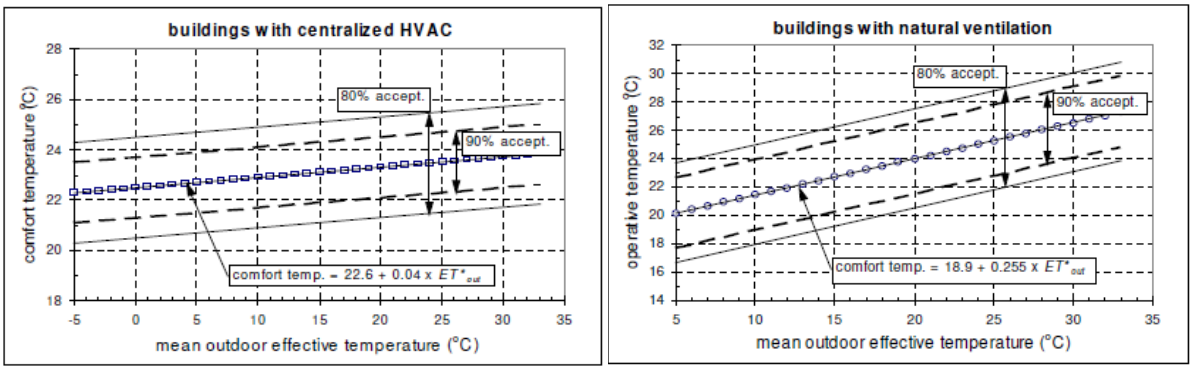

Figure E.3 Adaptive PMV-method for building with Centralized HVAC (left) and Natural Ventilation (right)

E.2.2 NEN-EN-15251

In the Netherlands (and European Union) NEN-EN-15251 defines the following relation for the indoor temperature, based on the outdoor running mean temperature:

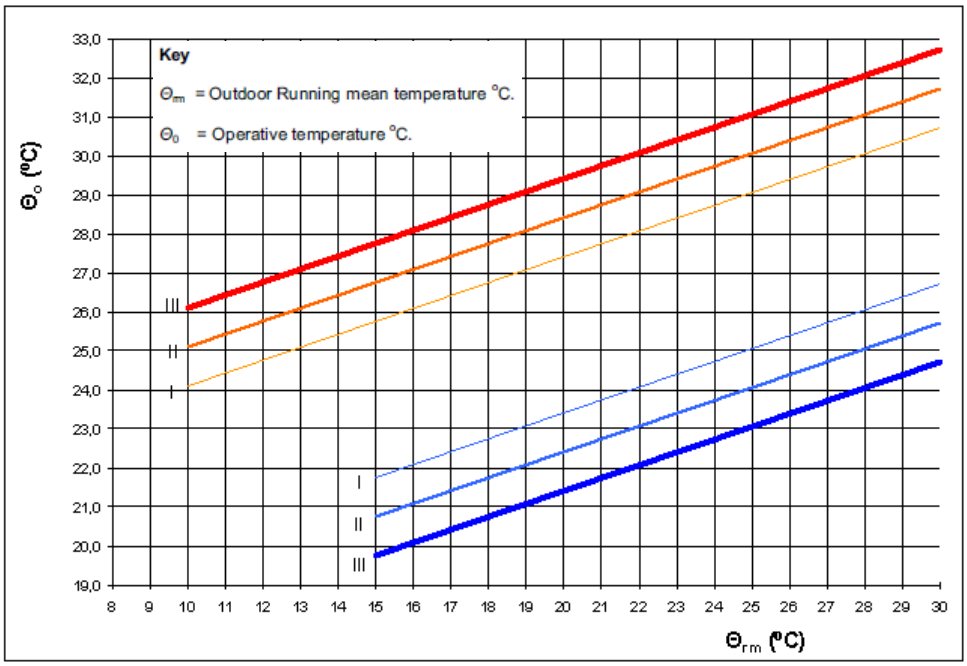

Figure E.4 Figure A1 from EN-15251 – Annex A, Design values for the indoor operative temperature for buildings without mechanical cooling systems, as a function of the exponentially-weighted running mean of the outdoor temperature.

The operative temperatures in figure E.4 are valid for office buildings and similar, where there is easy access to operable windows and occupants may freely adapt their clothing. Several field experiments have shown that occupants' thermal responses depends in part on the outdoor climate. NEN-EN-15251 clearly describes in which situations the above can be applied and why.

E.2.3 Adaptieve Temperatuur Grenswaarden methode (ATG-method)

From Roodvoets H., 2009

Nowadays, an Adaptive Temperature Boundary value (ATG-indicator) is used in the Netherlands as the standard, which is based on the previously mentioned De Dear and Brager criterion. Within the regulations that are used today, buildings have been divided into two groups. An Alpha building (natural ventilation) has other standards than a Beta building (mechanical ventilation). A higher maximum temperature in an Alpha building is allowed for example, because of the positive impact of controlling the climate by the user himself.

To judge the quality of the inside climate, buildings are divided into Classes A, B and C. In Figure E.5 and Figure E.6 the ATG-method is showed for these classes. The classification is based on the difference in acceptation of the inside climate by the users of the building. Class C is only used for temporary buildings and for measurements in an existing building. If at least 90% of the users accept the inner climate, the building is marked as Class A; 'very good inner climate'. From 80% to 90% acceptation, the building will be categorized as Class

B; ‘good inner climate’, which is used for standard buildings. Class B means that the PMV index does not exceed 0,5.

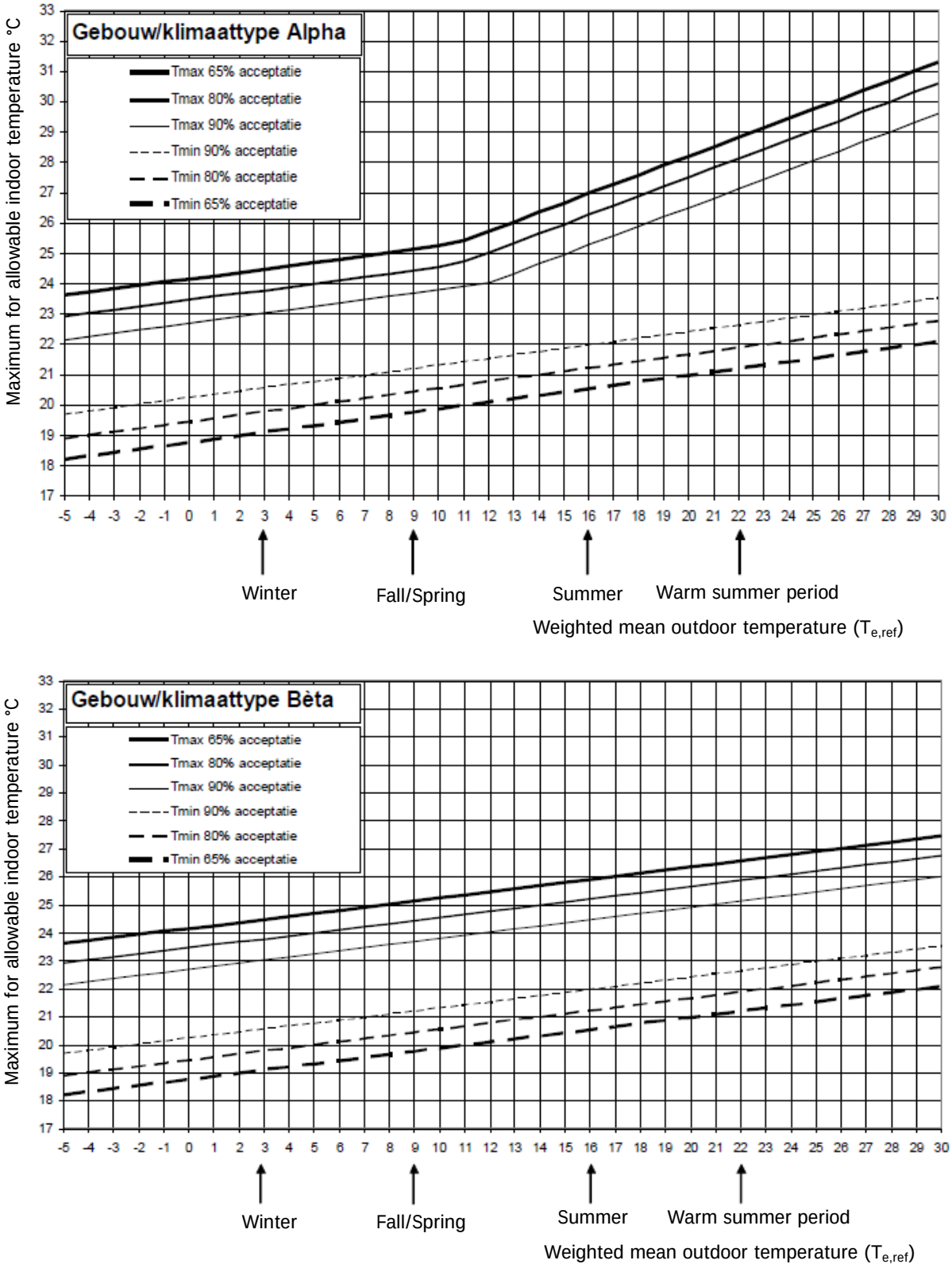

Figure E.5 Adaptive Temperature Boundaries method – Alpha and Beta building