

**PERFECTION – Performance Indicators for Health, Comfort
and Safety of the Indoor Environment**
FP7 Grant Number 212998

First Research Workshop (Finland)

Karl Wallasch¹, Oliver Kornadt¹, Pierre-Henri Lefèbvre²

Version	Description	Date
1.0	First Draft for Comments	18.3.2010
1.1	Commented PHL	
2.0	Second Draft for Comments	28.4.2010
3.0	Final Version	03.06.2010

Date of Issue: 03.06.2010

Document Version : 3.0.

Dissemination: Public

¹ Bauphysikbüro Kornadt und Partner - Ernst-Kohl-Strasse 4 – 99423 Weimar – Germany - bauphysik.kornadt@hotmail.com

² BBRI - Belgian Building Research Institute - rue du Lombard, 42 – 1000 Brussels – Belgium – Belgium – pierre-henri.lefebvre@bbri.be

CONTENTS

1.....	1
1. General	3
1.1. Scope of the Workshop	3
1.2. Attendances	3
1.3. Agenda	4
2. Presentations.....	4
2.1 Opening (Eva Häkkä-Rönholm, VTT).....	4
2.2 Welcome (Oliver Kornadt, Bauphysikbüro Kornadt and Partner)	4
2.3 Perfection Overview (Jan Desmyter, BBRI).....	5
2.4 Positive Stimulation and Productive Knowledge Work (Suvi Nenonen, Aalto University).....	5
2.5 Perfection Key Indoor Performance Indicator (KIPI) Framework (Pekka Huovila, VTT)	5
2.6 Indicator Case Study Villa Reale (Sergio Oliveira, SITI)	5
2.7 Perfection KIPI Tool (Nikos Sakkas, APINTECH)	5
2.8 Introduction to Perfection Case Studies (Stephen Garvin, BRE)	5
3. Workshop groups	5
3.1 Setup of Working Groups	6
3.2 Conclusions	7
3.2.1 Group A	7
3.2.2 Group B	7
3.2.3 Group C	8
3.2.4 Group D.....	8
4. Closing	9
5. Appendixes	9

1. GENERAL

The 1st Research Workshop was held at the 4th February 2010 in Finland. It was held at VTT Vuorimiehentie 5, Otaniemi.

1.1. Scope of the Workshop

Within the PERFECTION project there will be two policy oriented workshops and two research oriented workshops carried out. The aim is to engage major target groups of the project (research community and policy makers). It is also important to open current project findings to public group of experts and discuss in a wider group of stakeholders and experts. The 1st Research Workshop was attended by the Perfection Partners and the Committee of Experts and Stakeholders (CES). A full list of attendances is attached below. The 2nd Research Workshop will be held at the end of 2010 / beginning of 2011.

1.2. Attendances

1.2.1 Perfection Partners

Jan Desmyter	BBRI	Belgium
Jagoda Furman	ASM-Market Research and Analysis Centre	Poland
Stephen Garvin	BRE	UK
Eva Häkkä-Rönholm	VTT	Finland
Petr Hajek	Czech Technical University	Czech Republic
Aapo Huovila	VTT	Finland
Pekka Huovila	VTT	Finland
Helena Järnström	VTT	Finland
Jun Kojima	VTT	Finland
Oliver Kornadt	Bauphysikbüro Kornadt u. Partner	Germany
Pierre-Henri Lefebvre	BBRI	Belgium
Antonin Lupisek	Czech Technical University	Czech Republic
Sergio Olivero	SiTI	Italy
Janne Porkka	VTT	Finland
Nikos Sakkas	APINTECH	Greece
Paul Steskens	Eindhoven University of Technology	Netherlands
Stephane Thiers	ARMINES	France
Karl Wallasch	Bauphysikbüro Kornadt u. Partner	Germany

1.2.2 CES Networks Members and Others

Finn Aslaksen	Vista Utredning AS	Norway
Luigi Biocca	CNR ITC	Italy
Luis Braganca	University of Minho	Portugal
Robert Csott	EMI Nonprofit kft.	Hungary
John Currie	Scottish Energy Centre	Scotland
Markov Detelin	Technical University of Sofia	Bulgaria
Freek den Dulk	Piode Consultants	Netherlands
Maximilian Frank	TU Kaiserslautern	Germany
Gesmann-Nuissl	TU Kaiserslautern	Germany
Viktor Grinewitschus	Frauenhofer	Germany
Gudni Gudnason	Innovation Center Iceland	Iceland

Andrea Immendoerfer	Karlsruhe Institute of Technology	Germany
Ifa Kytösaho	City of Helsinki	Finland
Sami Kärnä	Aalto University	Finland
Patrizia Lombardi	Politecnico di Torino	Italy
Ljubomir Miscevic	University of Zagreb	Croatia
Suvi Nenonen	Aalto University	Finland
Anita Ory	Wienerberger NV	Belgium
Venetia Sandu	Transilvania University of Brasov	Romania
Jana Sabikova	Slovak University of Technology	Slovakia
Vaidotas Sarka	Vilnius Geiminas Technical University	Lithuania
Jens Schumacher	SFC	Germany
Allan Strus	Arhitektibüroo Strus OÜ	Estonia
Ricardo Tendero	Politechnic University of Madrid	Spain
Kyösti Tuutti	Skanska AB	Sweden
Maria C G de Viedma	Politechnic University of Madrid	Spain

1.3. Agenda

The following outlines the agenda for the 1st Research Workshop from 4th February 2010 in Finland at VTT, Vuorimiehentie 5, Otaniemi.

- 9.00 Opening, Eva Häkkä-Rönholm (Vice-President), VTT, Finland
- 9.05 Welcome, Oliver Kornadt, Bauphysikbüro Kornadt and Partner, Germany
- 9.15 Perfection Overview, Jan Desmyter, BBRI, Belgium
- 9.45 Keynote: Positive Stimulation and Productive Knowledge Work, Suvi Nenonen (Senior Researcher), Aalto University
- 10.15 Discussion
- 10.30 Coffee Break
- 10.50 Perfection Key Indoor Performance Indicator (KIPI) Framework, Pekka Huovila, VTT, Finland
- 11.05 Indicator Case Study Villa Reale, Sergio Olivero, SiTI, Italy
- 11.25 Perfection KIPI Tool, Nikos Sakkas, APINTECH, Greece
- 11.45 Discussion
- 12.00 Lunch and Networking
- 13.30 Introduction to Perfection Case Studies, Stephen Garvin, BRE, UK
- 13.50 Workshop Instructions, Pekka Huovila, VTT, Finland
- 14.00 Groups A, B: Selection of Key Indoor Performance Indicators
Groups C, D: Integration of Perfection Indicators with tools

2. PRESENTATIONS

2.1 Opening (Eva Häkkä-Rönholm, VTT)

Eva gave a welcome introduction to all attendances. She presented research facility VTT the Technical Centre of Finland, the structure and mission, VTT's status as a performer of R&D work and current project involvements.

2.2 Welcome (Oliver Kornadt, Bauphysikbüro Kornadt and Partner)

Oliver also welcomed all attendances and thanked for their involvement within PERFECTION as well as VTT for the perfect organization of the event. The proposed agenda /1.3) was adopted.

2.3 Perfection Overview (Jan Desmyter, BBRI)

Jan presented the PERFECTION project. This includes a short history, the objectives of the project and the role of the CES network. Jan discussed the five Workpackages within the PERFECTION project in specific Workpackage 1 (WP 1 “Indoor Indicators”) and Workpackage 2 (WP 2 “Use of Indicators”). The general time line of the project has been presented and future workshops mentioned.

2.4 Positive Stimulation and Productive Knowledge Work (Suvi Nenonen, Aalto University)

Suvi presented current results of a research project from the Aalto University regards to social factors and their development over a life-time of a building.

2.5 Perfection Key Indoor Performance Indicator (KIPI) Framework (Pekka Huovila, VTT)

Pekka’s presentation was to introduce the Perfection Key Indoor Performance Indicator (KIPI) Framework. The presentation included details about the scope and objectives, an outline of “Health and Comfort” performance indicators including:

- Acoustic Comfort,
- Visual Comfort,
- Indoor Air Quality,
- Thermal Comfort, and
- Quality of Drinking Water.

Pekka also gave an outlook of next required steps.

2.6 Indicator Case Study Villa Reale (Sergio Oliveira, SiTI)

The presentation from Sergio was a case study “Villa Reale di Monza” where performance indicators for a historical building have been applied. Sergio gave a general overview of historical buildings and their specific requirements. He presented the methodology, which has been used and the indicators. Furthermore, the indicators were presented from different point of views e.g. owner perspective, user perspective, artwork perspective and interactions.

2.7 Perfection KIPI Tool (Nikos Sakkas, APINTECH)

The presentation from Nikos was about a portal for the evaluation of key indoor performance indicators (KIPI) which has been developed within the PERFECTION project. Nikos presented the main principles of using the web-based portal, which will be used, by PERFECTION members as well as other users in the near future.

2.8 Introduction to Perfection Case Studies (Stephen Garvin, BRE)

Stephen from BRE presented the general approach of using case studies within the PERFECTION project. The main topics of his presentation were the overall aim of using case studies within PERFECTION, the tool which will be used, the number and type of case studies as well as timelines.

3. WORKSHOP GROUPS

The afternoon session mainly consists of the work within working groups A, B, C and D. Pekka (VTT) gave a short introduction to the workshops and split the group into four working groups as outlined below.

The following topics have been discussed:

Group A, B: Selection of Key Indoor Performance Indicators

Group C, D: Integration of Perfection Indicators with tools

3.1 Setup of Working Groups

3.1.1 Group A

Pierre-Henri Lefebvre	BBRI	Belgium
Paul Steskens	Eindhoven University of Technology	Netherlands
Luis Braganca	University of Minho	Portugal
Aapo Huovila	VTT	Finland
Andrea Immendoerfer	Karlsruhe Institute of Technology	Germany
Oliver Kornadt	Bauphysikbüro Kornadt u. Partner	Germany
Sami Kärnä	Aalto University	Finland
Allan Strus	Arhitektibüroo Strus OÜ	Estonia
Ricardo Tendero	Politecnico University of Madrid	Spain
Kyösti Tuutti	Skanska AB	Sweden

3.1.2 Group B

Stephen Garvin	BRE	UK
Helena Järnström	VTT	Finland
John Currie	Scottish Energy Centre	Scotland
Markov Detelin	Technical University of Sofia	Bulgaria
Freek den Dulk	Piode Consultants	Netherlands
Maximilian Frank	TU Kaiserslautern	Germany
Jagoda Furman	ASM-Market Research and Analysis Centre	Poland
Petr Hajek	Czech Technical University	Czech Republic
Suvi Nenonen	Aalto University	Finland
Venetia Sandu	Transilvania University of Brasov	Romania
Vaidotas Sarka	Vilnius Geiminas Technical University	Lithuania

3.1.3 Group C

Nikos Sakkas	APINTECH	Greece
Antonin Lupisek	Czech Technical University	Czech Republic
Luigi Biocca	CNR ITC	Italy
Gesmann-Nuissl	TU Kaiserslautern	Germany
Viktor Grinewitschus	Fraunhofer	Germany
Patrizia Lombardi	Politecnico di Torino	Italy
Ljubomir Miscevic	University of Zagreb	Croatia
Anita Ory	Wienerberger NV	Belgium
Jana Sabikova	Slovak University of Technology	Slovakia
Stephane Thiers	ARMINES	France
Maria C G de Viedma	Politecnico University of Madrid	Spain

3.1.4 Group D

Sergio Olivero	SiTI	Italy
Janne Porkka	VTT	Finland
Finn Aslaksen	Vista Utredning AS	Norway
Robert Csott	EMI Nonprofit kft.	Hungary
Gudni Gudnason	Innovation Center Iceland	Iceland
Jun Kojima	VTT	Finland
Ifa Kytösaho	City of Helsinki	Finland

Jens Schumacher
Karl Wallasch

SFC
Bauphysikbüro Kornadt u. Partner

Germany
Germany

3.2 Conclusions

After closing the working groups there was a plenary session, where the moderators of the groups concludes the results gained in the groups.

3.2.1 Group A

Group A was moderated by Paul Steskens (TUE) and Pierre-Henri Lefebvre (BBRI).

Conclusions

There was an agreement that a focussing on existing buildings and residential buildings would be useful. A ranking of the indicators was worked out within the group and produced the following results.

Ranking of Indicators

Health and comfort:	Acoustic and Comfort:	Background Noise
	Visual Comfort:	Daylight
	Indoor AirQuality:	Classical pollutants (NOx, O3, CO)
	Thermal Comfort:	Operative temperature Percentage of Dissatisfied (PPD)
	Quality of drinking water:	Water quality and treatment
Design for All:	Accessibility:	Approach to the building Movement inside the building
	Safety:	structural safety (stability) Mechanical safety (glazing, slips, etc.) Fire Safety
	Security:	Security of users
	Positive stimulation:	social enhancement
Other Indoor Performance:		
	Adaptability:	design flexibility Technical service life Adaptability to climate change
	Serviceability:	Maintainability
	Usability:	Spatial relations Furnishability Adjustability

3.2.2 Group B

Group B was moderated by Helena Järnström (VTT) and Stephen Garving (BRE).

Group B discussed the as well the ranking of indicators (similar to Group A), the results are listed below.

Ranking of Indicators

Health and comfort:	Acoustic and Comfort:	Background Noise
	Visual Comfort:	Illuminance
	Indoor AirQuality:	ventilation
	Thermal Comfort:	Operative temperature

	Quality of drinking water:	Water quality and treatment
Design for All:	Accessibility:	Entrance to the building Movement inside the building
	Safety:	Structural safety (stability)
	Security:	Food security
	Positive stimulation:	Visual positive stimulation
Other Indoor Performance:		
	Adaptability:	design flexibility Versatility
	Serviceability:	Maintainability
	Usability:	Adjustability

3.2.3 Group C

Group C was moderated by Nikos Sakkas (APINTECH) and Antonin Lupisek (Czech Technical University).

The Group (C) primarily discussed the use and the use cases of the PERFECTION tool. As use cases the following were identified as of a significant, potential, interest. The cases below relate to the building (not the product) and are as follows:

Phase: Initiation/ design phase
Use case: Assistance to define requirements
User: Client - Building owner/ manager
Notes: Requirements are linked to regulations; this difference can be captured in the indicator values
Phase: Initiation/ design phase
Use case(a) : Assistance achieve compliance with requirements and good practice
Use case(b) : Identification of critical points that need be monitored during the construction phase
User: Building designers
Phase: Construction
Use case : Checking and reviewing critical points as identified in Design
User: Building designers
Phase: Operation
Use case: Reporting and monitoring on building indoor performance; report highlights key IP issues and potentially adds value to the premise
User: Building owner/ manager

The Group discussed but did not really advance on the issue of product/ services. The key issue is “How can product manufacturers or service make use of the tool?”. The obvious use case is “promotion”. Further investigation is required.

This, important, issue remains open for discussion.

3.2.4 Group D

Group D was moderated by Janne Porka (VTT) and Jun Kojima (VTT).

It has been discussed that by integration of the Perfection indicators into tools a product level feature should support a building level tool. Furthermore the life cycle phase of a building should be considered.

It has to be taken into account that a benchmark depends on context, e.g. situation, country, building type, project. The tool should leverage building templates by providing general information as well as more specific indicators, e.g. energy consumption of the building.

It would be of advantage if the tool could give specific information for building owners as well as property sellers. The tool also should provide a product linkage to guide selections of products which are used in the building.

The presentation prepared by Group D is attached in Appendix A.

4. CLOSING

Oliver Kornadt thanked all CES members as well as the perfection partners for their engaged and fruitful contributions. He announced that the CES members will kept informed in the future about the Perfection project and further results. The CES members agreed to give additional strong support to assure further progress in the Perfection project. The perfection partners remained for another meeting the following day.

5. APPENDIXES

Appendix A – Presentation from Group A

Appendix B – Presentation from Group B

Appendix A – Presentation from Group A

Appendix A – Presentation from Group A

Appendix A – Presentation from Group A



Group A Conclusions



- Group A
 - Agreement on Existing building
 - Residential Building
- Poll for indicators
- Results: In the "Result group A.xls"

Appendix B – Presentation from Group B



Room A and B, Workshop 1: Selection of Key Indoor Performance Indicators

INSTRUCTIONS

- Choose 5 indicators/ sheet
- Assess their importance on a scale 1 (high-5 most important) + classify other : 2 (moderate), 3 (low)
- Time limit: 30 minutes/ sheet



RESULTS

(results presented as Excel- chart)

HEALTH AND COMFORT	Acoustic comfort	Background noise (Average noise level over 30 minutes (in a room)) Reverberation time Speech Intelligibility Structural vibrations at low frequencies (1-80Hz)
	Visual Comfort	Illuminance Discomfort glare Disability glare and reflections Uniformity and Contrast Flicker Colour Aspects Daylight
	Indoor Air Quality	Organic pollutants (VOCs) Inorganic pollutants Classical pollutants (NOx, O3, CO) Environmental tobacco smoke Man-made vitreous fibres Radon Bioaerosols Effective Ventilation CO2 Combustion Infiltration Odour intensity Particulate matter
	Thermal Comfort	Operative temperature Percentage of Dissatisfied (PPD) Draught Vertical air temperature differences Radiant asymmetry
	Quality of drinking water	Water safety plan (WSP) Water quality and treatment Distribution systems Construction materials Disinfection Biofilms Temperature of water



RESULTS



(results presented as Excel- chart)

DESIGN FOR ALL	Accessibility	Approach to the building (access routes, car parking) Entrance to the building (ramps, steps, handrails, entrance doors) Movement inside the building (corridors, lobbies, surfaces, doors, vertical) Facilities in buildings (sanitaries) Communication in buildings (lighting, colour contrast and signage, devices)
	Safety	Structural safety (stability) Mechanical safety (glazing, slips, trips and falls, entrapment, falling objects) Fire safety (fire resistance, fire reaction and spread, protection, signs) Flood safety (risk assessment, defences, resilience) Electro-magnetic safety (electricity, magnetic, non ionizing, radio-activity) Food safety Resistance to attack (access control, biometrics, surveillance, detectors)
	Security	Working / commercial environments (availability, confidentiality, integrity) Privacy (information and network security) Security of users (protection zoning, territoriality, lighting)
	Positive stimulation	Fragrances Visual (circadian lighting, colour temperature) Stress reduction (fractal art, round shapes) Social enhancement (architecture)





RESULTS



(results presented as Excel- chart)

OTHER INDOOR PERFORMANCE	Adaptability	Design flexibility (different lay outs possible)
		Adaptability in use (first user changes)
		Versatility (changes to future users, for different purposes)
		Technical service life
		Modernity (expected need for change because of old-fashionedness)
		Adaptability to climate change (flooding, winds, rains)
	Serviceability	Cultural heritage and protection
		Availability of services in the building
		Image
Usability	Branding (labels)	
	Wayfinding	
	Parking	
	Cleanliness	
	Maintainability	
	Spatial relations	
Orientation		
Furnishability		
Adjustability (easiness of use, controllability)		
Development potential (upside)		
Bicycle access		





Room A and B, Workshop 1: Selection of Key Indoor Performance Indicators

For discussion:

Indicator	Bldg type: offices/ housing/ schools/ hospitals/ historical	New/existing	Life cycle: Design/ construction/ operation



Discussion



Issues addressed during the workshop...



Appendix C – Presentation from Group C

GROUP (C)

The Group (C) primarily discussed the use and the use cases of the PERFECTION tool. As use cases the following were identified as of a significant, potential, interest. The cases below relate to the building (not the product) and are as follows:

Phase: Initiation/ design phase
Use case: Assistance to define requirements
User: Client - Building owner/ manager
Notes: Requirements are linked to regulations; this difference can be captured in the indicator values
Phase: Initiation/ design phase
Use case(a) : Assistance achieve compliance with requirements and good practice
Use case(b) : Identification of critical points that need be monitored during the construction phase
User: Building designers
Phase: Construction
Use case : Checking and reviewing critical points as identified in Design
User: Building designers
Phase: Operation
Use case: Reporting and monitoring on building indoor performance; report highlights key IP issues and potentially adds value to the premise
User: Building owner/ manager

The Group discussed but did not really advance on the issue of product/ services. The key issue is “How can product manufacturers or service make use of the tool”?. The obvious use case is “promotion”. Further investigation is required.

This, important, issue remains open for discussion.

Appendix D – Presentation from Group D



Group D

Integration of Perfection Indicators with tools

J. Porkka, S.Olivero
Feb 04, 2010

PERFECTION
COORDINATION ACTION FOR PERFORMANCE INDICATORS FOR HEALTH,
COMFORT AND SAFETY OF THE INDOOR ENVIRONMENT
Grant Agreement n°: 212998





Point of departure

- *T1.5 develops generic indoor performance indicator (IPI) framework*
- *T1.6 selects the key indoor performance indicators (KIPIs)*
- *T2.2 develops relationship model and product evaluation framework*
- *T2.3 Prototype tool for decision support*
- *T2.4 Case studies of different building types (1-2 case studies per partner)*



Boundaries

- ***Building types: offices / housing / hospitals / schools / historical buildings***
- ***Project types: new built / existing***
- ***Building level tool / product level features***



Results

- *Purpose / life cycle phase*
- *Product level features supporting building level tool*



WP2 Perfection tool focus areas

	Initiation	Design	Construction	Operation
Requirement setting				
Decision support tool (Assessment and selection)				
Reporting and monitoring tool				

Building assessment (Owner, FM...)

Product selection (Designer, contractor... maintenance)

PERFECTION
 COORDINATION ACTION FOR PERFORMANCE INDICATORS FOR HEALTH,
 COMFORT AND SAFETY OF THE INDOOR ENVIRONMENT
 Grant Agreement n°: 212998





Results

- *Benchmarking is context dependent*
 - *Different situations, different countries, different building types, different projects*
- *Tool should leverage “Building templates” (relevant pre-defined indicators for certain building/project type)*
 - *General information (m2 etc.), Selected KPIs*
 - *Different types of indicators, some filled once, others updated annually (e.g. energy consumption)*



Results

➤ *Business cases*

- *Building owner (Owner has a building portfolio, customer looks for premises and evaluates buildings by performance)*
 - *potential matchmaking?*
- *Property seller (showcase of building stock with indicators to find potential customers)*
- *Product linkage*
 - *To guide selections of products used in the building?*