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European research on energy-efficient healthcare districts

D7.4

Real case in NL: Validation through participatory design session

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Real case in NL: Validation through participatory design session

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Colophon

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Publishable executive summary

As one of the live demonstration cases in the STREAMER project, Rijnstate hospital has organised a design workshop with the support of NL partners. Various stakeholders from the implementer's community, such as architects, advisors, other hospitals, were invited to be introduced to the proposed STREAMER's workflow and to share their professional views on this subject. NL partners used their network to define the participants carefully and tried to cover the representatives of the Dutch design and construction practice. Academics were invited too. The workshop was held on March 30th, 2016 within the premises of Rijnstate Hospital

The purpose was to organize a workshop to validate the new process and the tools that come along it (as we will refer to the input-output table later). The NL partners paid extra attention to make the design workshop interactive.
Therefore different groups were created. Within each group, various stakeholders were able to use and validate tools themselves. These groups were with 5 to 7 people. For each group, a facilitator (being one of the NL partners) was assigned. 10 laptops were prepared with the STREAMER software tools installed that were developed.

Regarding the content, the workshop was organized to validate several tools available at that moment as well as the process of using them. Figure 2 represents the new process supported by the STREAMER tools and the moments (called steps) in the overall process. The numbers refer to these design steps such as creating program of requirements (Step 1), selecting design rules (Step 2), creating various design alternatives (Step 3), visualization of the pre-selected design alternatives as they present the intended data (Step 4), performance calculations of selected alternatives based on selected KPIs (energy, quality and LCC), and visualization of the scores of each alternative based on KPIs and PIs (Steps 6,7,8,9), and choosing a final design alternative to continue the design process. In Figure 2 reader can notice several icons (eye and hand icon). Those icons defined the extent of the validation and readiness of the tools. When both icons are active, it meant that the participants were able to use the tool as the tool was mature enough for live use. When the hand icon was passive (crossed with red line), the participants were only informed the future use of the tools and they did not use it at the workshop. As example to this situation, selecting design rules (Step 2) and calculation of quality KPIs can be given.
The participants were informed about the capabilities of the tools at the time of the workshop. In this context, BriefBuilder (BB), the commercial software used as a support in the workshop, was used for creating program of requirements (Step 1). Early Design Configurator (EDC) was used to create design alternatives based on PoR initially created by BB. RE-Suite was used for visualization and representing the results of KPI Energy and KPI LCC calculations.

The validation was done by firstly through a demonstration on each tool. Next the different groups were invited to work with the tools themselves. Sometimes in a session, one step and one tool were validated, other times several steps by one tool within the same sessions were validated (See Figure 1). After each session feedback was gathered by using distributed forms. The feedback was studied and comments collected will be used for further optimalisation of the tools.
One point of improvement here was observed, the number of questions will be reduced next time for allocating more time to validation and also adding more clarity to the feedback moments.

Through these feedback forms we could draw important conclusions on the content presented, the extent of the tools, the process introduced with new tools as well as the organizational aspects. As a general view, all groups positively claimed that

the tool added value to steps in the design process. Even though there were challenges reported due to the number of steps and its sequence, the overall process was found to be logical.

Regarding the STREAMER library, labels and the tool (BriefBuilder in this case) to form a PoR (as Step 1), existence of the labels and the STREAMER Room library provided a common ground for decision making and the team members could set clear objectives. Thus, the library and the database approach for PoR led to fast and easy decision making. It also allowed the 'growth' of PoR in a manageable and traceable way. Yet the content of the STREAMER labels were not known (as not presented in the workshop). And we were advised to consider the STREAMER library based on (an) EU-level standard(s) in future. And these we took as a point of improvement for the next workshop.

Regarding Early Design Configurator and the design proposals created, the main criticism is that the current EDC did not seem to allow for iteration between PoR and design alternatives. In other words, the participants expect to change properties in the design alternatives and they expected to see these changes in the PoR. There occurred possible actions and follow-up considerations such as making exchange of data formats clear to understand, and the process iterative.

Regarding KPIs and Visualization, it was not very clear to see the reference values for energy calculation so that the results of the CEN tool can be interpreted as 'excellent/sufficient enough /bad'. There were operational problems such as bugs or dependencies to certain Windows operating systems. And this need to be solved in the next workshop to increase the extent of the use of the KPI Energy tool (referred as CEN Tool). For LCC KPI, the calculation should be differencieted per layer or per room.

When we look back to the objectives of the workshop, this leads to the following reflections and lessons learned:

1. The participants of the design workshop have different background which boosted the discussions during the workshop – all were able to participate by following the instructions and make use of the software tools and share their feed back
2. Some aspects (such as labels) should have been explained better to the public
3. Verification of the complete design process was not possible because not all tools were ready for demonstration.

More conclusions in detail have been drawn in the body of the report in Chapter 5 and 6. But over all the initiative of organising the design workshop was very much appreciated by the audience and an enthusiasm to participate in the 2nd workshop is also observed.

List of acronyms and abbreviations

AEC: Architecture, Engineering, Construction

BIM: Building Information Model

CSV: Comma Separated Value (This is the exchange format from PoR to EDC.)

DOW: Description Of Work

EDC: Early Design Configurator

EeB: Energy-efficient Building

FA: Functional Area

HVAC: Heating, Ventilation, Air Conditioning

IFC: Industry Foundation Classes (This is exchange format for BIM.)

KPI: Key Performance Indicator

PI: Performance Indicator (This is used within the RE-Suite tool)

LCC: Life Cycle Cost

MEP: Mechanical, Electrical, Plumbing technologies

PoR: Program of Requirements

Definitions

Building Information Model:

To be meant as the whole of the digital information relating to a given building. This wording especially applies to the digital information built and maintained at design time, but not only – it is relevant to the whole life cycle.

Brief Builder:

Online accessible tool supporting the development of a PoR. It is not developed within the STREAMER project but used as a mean for creating PoR database.

CEN Tool:

Energy Simulation tool according the NEN52016. It is capable of using label information (from STREAMER labels) as input for simulation. Requires an IFC file to calculate the energy KPI.

Early Design Configurator:

The Early Design Configurator, EDC for short, is an application developed by the Karlsruhe Institute of Technology that iteratively generates various amount of design layouts that conform to the program of requirements, building form and the design rules. The generated designs are then exported as IFC files for further evaluation in the STREAMER project.

KPI Thermal Comfort:

Thermal comfort is the thermal sensation of a space that is perceived by its occupants. We refer to EN 15251 for an overview of the criteria and existing calculation methods.

KPI Overall Quality:

This is a performance criteria used to assess the overall quality of design alternatives based on seven performance indicators. The assessment is done via the an existing tool called, ASPECT. There are seven sub-criteria (performance indicators) such as 1) Privacy, company and dignity, 2) Views, 3) Nature and outdoors, 4) Comfort and control, 5) Legibility of place, 6) Facilities, and 7) Staff.

KPI Patient Satisfaction:

This is an estimated self-reported factor of the patient room and outpatient clinic on room/clinic or total building level (average of all room/clinic scores). The factor is based on an algorithm and model developed by TNO.

KPI Operational Efficiency:

Operational efficiency is a level of performance indicator related to how efficient a building is in supporting the operational activities within it (building efficiency); and how efficient the processes in the building, given the building (process efficiency) are. The building efficiency is defined as the calculated ratio between net and gross floor area of the design and based on NEN 2850 or other national codes to determine this ratio.

Label:

Property attached to spatial components, also called “semantic label”.

Labels Approach:

This approach develops a labelling system with labels that add semantic information to functions and subsequently to rooms that accommodate that function. Information that can be added should be useful during the design process and operational phase and should have a relationship with the energy demand (temperature level, ventilation demand and air tightness, insulation between rooms, medical equipment, time of use, etc.).

Program of Requirements:

Is an ordered collection of data about an organisation’s housing needs and the performance required in respect of the site, building, rooms, parts of the building and facilities in the building and on the site” [Voordt2005].

RE-Suite:

Is a tool with several applications which ultimately shows results (KPI’s) of the simulations in a dashboard. It also includes an internal IFC viewer and modules for simulating the LCC and Quality KPI.

Abstract

This report presents the validation workshop conducted in the Netherlands by one of the live cases in the STREAMER project – Rijnstate Hospital. As agreed in the DoW (Description of Work), Rijnstate organised a first design workshop, involving multidisciplinary stakeholders, advisors and observers on March 30th, 2016. Prior to the workshop, the proposed design models (in BIM / GIS / Semantic Web format) addressing the case study are prepared. During the workshop, the preliminary design models are verified using preliminary performance simulation and assessment tools as developed in STREAMER.

The different stakeholders have been able to use the developed tools themselves and feedback was given, using feedback forms with predefined questions. This feedback gathered by the participants will be used in further developing the STREAMER tools.And these feedback will be used to communicate with STREAMER partners to reflect and if necessary re-direct the process of STREAMER developments.

A 2nd design workshop will be scheduled in 2017, when more tools will be available.

Over all the initiative of organising the design workshop was very much appreciated by the audience and an enthusiasm to participate in the 2nd workshop is also observed. This leads to a conclusion that the STREAMER design models, tools and the process are well-accepted and are seen as relevant for future practice.

Content

1 Background: Purpose of the interactive design workshop

As agreed in the Description of Work (DoW), the real live cases within STREAMER are responsible for organizing a validation workshop to confirm the research results. In this Deliverable, we report the results validated in the workshop conducted by Rijnstate Hospital in the Netherlands. Before the results are presented, it is important to share the way the workshop is planned, organized and conducted so that the most direct and valuable insights can be retrieved for the progress of the STREAMER project.

1.1 Objectives of the workshop:

1) To illustrate to the professional specialists and building operators of health premises the opportunities provided by BIM, boosted by the newly developed STREAMER software;
2) To encourage the exchange of knowledge between partners of the demonstration cases and other companies with expertise in BIM, showing new design processes, the new instruments and the relationships between them especially IFC – the standard format for exchanging data in the construction industry;
3) To verify the preliminary design models using preliminary performance simulation and asset tools as developed in STREAMER.
4) To validate the STREAMER storyline, using views of professional experts at the point of hospital design and build.

1.2 Programme and type of the workshops:

The design workshops will comprise of (a) meeting(s) in the respective national languages. The workshop is organized in such a way that participants will be able to use the developed tools themselves and are actively asked for feedback. The feedback then can be used to further develop the different tools.

1.3 Future events

Not all tools were developed or fully operational during the time the first workshop was held. Next to the ongoing development of the tools, typology models and methodology, it was noted that presenting and using all the different tools in this 1-day workshop proved far too ambitious. Therefore the suggestion was made to organise a second workshop before the end of the project to give an update of developments within the STREAMER project.

2 Preparation

In preparation of the interactive design workshop, the NL partners within the STREAMER Consortium have been discussing how to organise this workshop. This has led to setting up the so called ‘input/output table’, based on the developed STREAMER workflow schedule.

In the input/output table (figure 1) 10 steps were defined (see D 1.6 for explanation of the used terms):

1. PoR
2. Design rules
3. Early Design Configurator
4. Viewing the IFC file, produced by the EDC
5. PoR MEP
6. KPI: Performance calculation: Life Cycle Costs
7. KPI: Performance calculation: Quality
8. KPI: Performance calculation: Energy
9. KPI Dashboard
10. EeB Design

After setting up the input/output table (See Figure 1), a try out was scheduled with the NL partners. Trying out the STREAMER work process gave new insights and it was then decided to only demonstrate tools that were readily available. As not all tools were fully available at the time the design workshop was organized, it was expected to receive useful feedback only on tools that could be used ‘live’.

The following tools were demonstrated and could be used during the design workshop:

- Brief Builder for creating PoR
- Early Design Configurator for creating automatic design alternatives
- RE-Suite for Viewing the IFC file, produced by the EDC
- The CEN tool for calculation of KPI Energy and RE-Suite visualization of results per KPI as a Dashboard.

These tools were tested via a case prepared by the Rijnstate. This case is an extension of the test project ‘North East Department’, in which case many different roomtypes are present.

Numbers	1	2	3	4	5	6	7 (was also 6)	8 (was 7)	9 (was also 6)	10 (was 8)
	PoR	Design rules	Design configuration	Viewing	PoR MEP	LCC	Quality	Energy	KPI	Design
Input	Default library (rooms, labels)	Design rules in natural langague (.xlsx or .xls)	csv(PoR)	ifc	ifc	ifc	ifc	ifc	values and graph input from performance calculation	ifc
			designrules (xml)			LCC library	?			
			wp2 MEP systems list*/Compatibility matrix for the MEP and EeB							
Tool	Briefbruilder	Knowledge editor	EDC	FZK viewer	Manually enhanced ifc with MEP system ***	**RE Suite**	?	**VABI**	**RE Suite**	BIM modeling software
	Drofus	Excel		RE Suite				**ESS**	**Dashboard**	
	Excel							**CENtool (formerly known as the PIMtool)**		
								SBEM******		
actions			location	Inconsistancies filters**	Distribution	**LCC costs calculation**	**Quality calculation**	**Simulation**	LCC	
			orientation	Sublabel filters	Concept			Calculation	Quality	
			shape		Generation				Simulation	
			entrance*******		Emmision				Comparing (multiple)	
			selection designrules (xml)****							
output	csv	designrules in xml	ifc (multiple), including filtered MEP and EeB systems based on the design rules or compatibility matrix. For	insights, choice to redo EDC or to continue	decision, ifc (multiple) , enhanced with MEP system	values and graph in KPI Dashboard	values and graph in KPI Dashboard	ifc, with MEP system, with calculated values	Performance Graphs, Decision support.	EeB Design
workshop actions	Creating PoR		Using EDC, writing Design rule****	Creating/switching filters		Creating meter	Creating meter	Creating a fast energy simulation (only the energy demand. So only if other layouts are	Adding weighing factors, comparing	
Showing		Select or create designrules (included in the EDC?). There is not a			We can discuss the procedure but not let them do so	LCC dashboard. There will be a separate model to do some	Quality dashboard. There will be a separate model to do some		Showing the process	Viewing the design with a viewer (export to e.g. Revit and edit it) NOTE:
NL Actions Design workshop	Rijnstate will give a presentation about the POR and write a short	Martjan, presentation about the process and examples	Freek, will give a presentation about the EDC and write a short	Rijnstate, will give a presentation about the FKZviewer and write a	Jan Peter, presentation about the process and examples	Andre, presentation about the process and examples	Esra, presentation about the process and examples	Pim, will give a presentation about the CENtool and write a short	Andre, presentation about the process and examples	Martjan, presentation about the process and examples
validation	Labels, default roomlist	Is it feasable and practical to work with the design rules	Method of design rules, EDC functioning and outcome	Usability of insights.	Is it feasable and practical to use the lables to create design rules?	Would you use a LCC tool in practice if it is available?	Would you use a quality tool in practice if it is available? What other aspects are important?			General discussion about the design process.

Figure 1 Input- and Output table

3 Organisation of the design workshop

3.1 Sequence & Frequency

As stated before, two design workshops will be organised by the Dutch WP7 partners:
Preliminary models, tools, process and data flow [this report deals with this first workshop]
Advanced tools, processes and data flow in which the feedback from the 1st workshop will be embedded.

3.2 Selection of attendees

The experts were selected from different disciplines in order to create an inter-disciplinary and inter-organizational setting. The attendees are expected to cover the main disciplines in the value chain regarding healthcare design, such as architects, technical advisors, constructors, IT specialists, BIM specialists and Technical Universities.
By inviting experts from different disciplines and organisations, the whole AEC industry is represented at the workshop.

The experts were selected based on the following criteria:
1) they have a proven level of experiences in BIM and/or healthcare design/management;
2) they represent different disciplines (in the value chain) therefore taking different roles in healthcare design/management (appendix 1 for list of participants).

3.3 Selection of the Venue

The design workshop was held on 30 March 2016 at the premises of Rijnstate Hospital, Arnhem. Rijnstate Hospital was selected as the new North East Wing is subject of the design workshop and is one of the four pilot projects within STREAMER. The real case scenario helps participants to understand the models and typologies used in relation with a purely hypothetical case.

3.4 Operational structure of the Workshop

Instead of a one-direction (message-telling) event, we aimed to get direct and valuable responses. Therefore, we divided the participants into multi-disciplinary groups. These groups were predefined using numbers in the list of attendees (appendix 1). The input-output table is used to present the story line that clarified which tools are to be used in which step and how the exchange of data is. After having demonstrated the tool in a plenary session, the groups would try out/use the tools themselves. The different groups were each supported by a facilitator, being one of the NL partners from the STREAMER consortium. The agenda presented below reflects this way of organization. In the two workshop sessions, the participants were asked to work in a group and test the tools personally. They then were asked to provide feedback in the groups sessions (as a group feedback) and also individually (on the whole story line of STREAMER project and workflow).

9.30	**Welcome**
9.45	**Introduction STREAMER** Marc Koster manager real estate Rijnstate
10.00	**Purpose of the design workshop** Esra Bektas Researcher TNO
10.10	**Storyline STREAMER** Martjan den Hoed Operational director De Jong Gortemaker Algra
10:55	**Coffee break**
11.15	**Workshop session I** De Jong Gortemaker Algra, TNO, Demo consultants, DWA and Rijnstate
12.30	**Lunch**
13.15	**Workshop session II** De Jong Gortemaker Algra, TNO, Demo consultants, DWA en Rijnstate
15.00	**Coffee break**
15.30	**Conclusions** Marc Koster, manager real estate Rijnstate
16.15	**Networking reception**

Table 1. Time schedule of the workshop

3.5 Validation method: Feedback forms

There were two different types of feedback forms prepared:
1) individual feedback;
2) group feedback.

Besides the feedback forms, there was a Question-Card (so called Q-Cards) prepared for collecting questions about the STREAMER tools, -processes and -flows. These forms were collected by the facilitators. Appendix 2 presents the template prepared and used in the feedback gathering.

The individual feedback forms were distributed at the beginning of the Workshop just after presenting the Storyline. This was scheduled as such to check initial understanding and to foresee potential challenges before testing tools and starting the group sessions. After the plenary session, the group feedback forms were distributed. The facilitators (1 per group representing STREAMER project and leading the groups) were assigned to gather feedback from the group members and made sure that the forms were filled in.

The Q-cards were to be filled in at any moment of the workshop individually. The idea was to facilitate notes in order to respond to these remarks in the plenary session at the end of the workshop.

The group feedback forms were used to gather experiences and problems encountered collectively. The forms were also used to stimulate discussions. Last but not least, the feedback forms' distribution were used as a time management method. These forms were distributed 10 minutes before the group sessions would end, to remind the groups to wrap up so that we could move to the next step.

3.6 Tools/ Methods/ Lectures/ Manuals

10 laptops were installed with the available software including: PoR tool BriefBuilder, STREAMER tool Early-Design Configurator and RE-Suite.

Manuals were prepared particularly for the PoR tool BriefBuilder, and STREAMER Early Design Configurator. For the RE-Suite a general lecture to the audience was given.

4 Content of the interactive design workshop

The content of the workshop was determined based on the STREAMER process steps illustrated in Figure 2. The numbers in this figure refer to different steps that were to be demonstrated and validated in the workshop. The feedback forms were also prepared based on these steps (See Appendix 2). The symbols of the hand and the eye above the steps refer to demonstrating (eye) and practising (hand). Not every tool was fully available at the time of the workshop. Tools not available were not demonstrated but the purpose of the tool was explained. For each step a backup file was prepared that could be used if a step turns out to be unsuccessful. As the steps are using data from their predecessors, one could not continue if the previous step was unsuccessful. In this case a backup file was available.

Please see next page for the full scheme with the different Streamer process steps.

4.1 STREAMER Validation Scope

Figure 2 represents the new process supported by the STREAMER tools and the moments (called steps) in the overall process. The numbers refer to these design steps such as creating program of requirements:

Step 1: setting up the Programme of Requirements

Step 2: selecting design rules

Step 3: creating various design alternatives by using the Early Design Configurator

Step 4: visualization of the pre-selected design alternatives as they present the intended data

Step 5: performance calculations of selected alternatives based on selected KPIs (energy, quality and LCC), and visualization of the scores of each alternative based on KPIs and PIs

Steps 6-8: choosing a final design alternative to continue the design process.

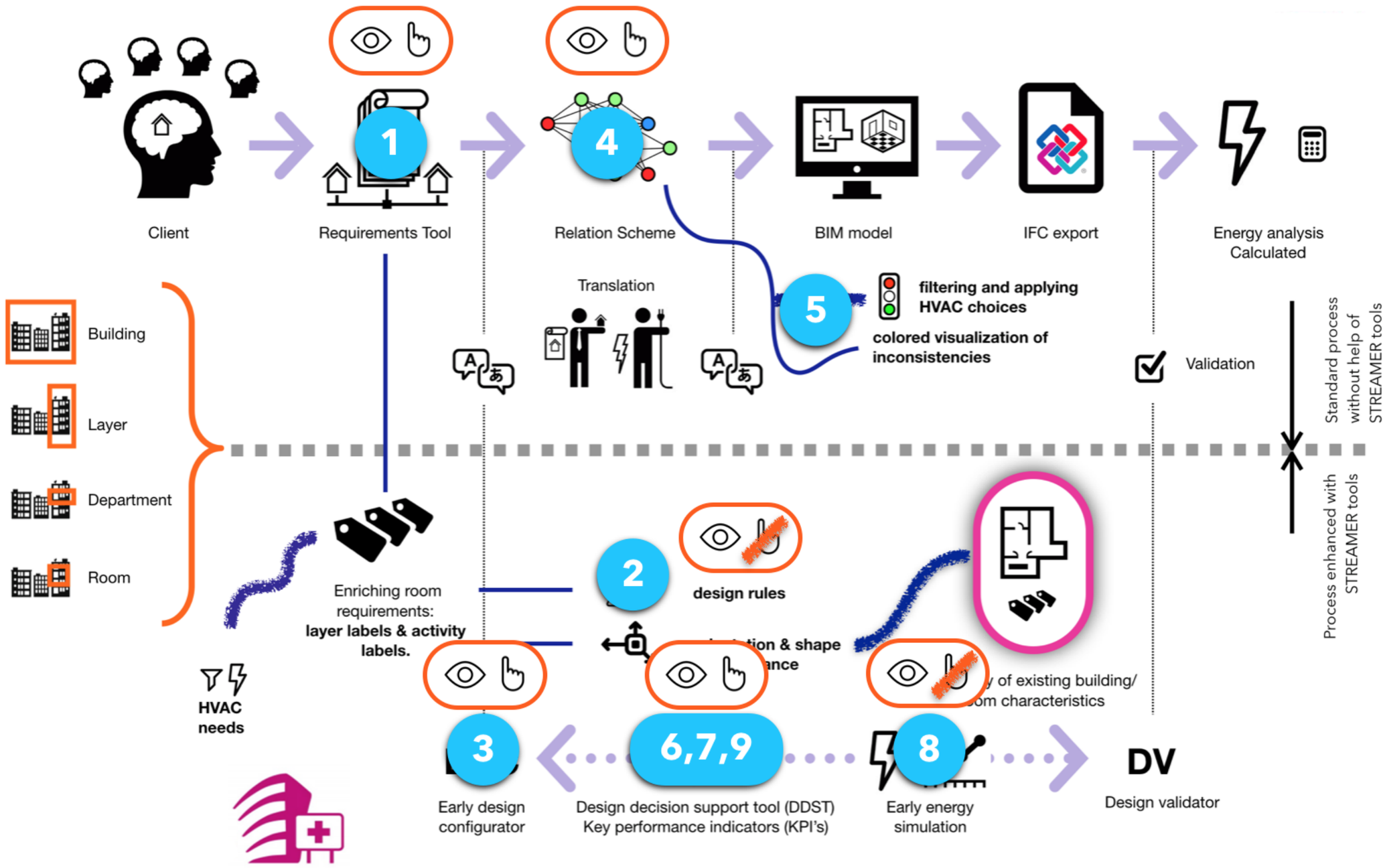

Figure 2 The STREAMER process steps

The scope of the validation is that the different STREAMER tools, both the individual design steps and the whole STREAMER storyline (meaning the intended outcome and the new design process covered in early design) are being validated, asking for feedback using the feedback forms. Steps 1, 2, 3, 6, 7, 8 and 9 (See Figure 2) were the scope of the validation. Some steps are for active participation and validation, and some steps are for information-sharing to provide input for further development of the workflow. As an example, Step 1, 3, 6, 7 and 9 involved participants actively testing the tools. Unfortunately step number 8 was unsuccessful as the operational systems of the separate laptops turned out to be incompatible with the tool.
It should be mentioned that Step 7 (quality KPI simulation) was presented but was still under development. Instead the presentation was used to validate this step but without the interaction of the participants.

4.2 STREAMER Story-line

4.2.1 STREAMER Room-library and Design Step 1

In the BriefBuilder tool, standard room templates were made available. Semantic data labels were attached to each standard room template. Rooms can be chosen from the library of room template to compose a Program of Requirements. After having composed the PoR, an export can be made from BriefBuilder into an excel file. This excel file can be exported with CSV extension. The CSV file can be imported in the Early Design Configurator. The participants were able to change some default labels and attach room names to the PoR to generate a unique PoR for each group.

4.2.2 STREAMER Design Configurator Step 3

The CSV-file with all room requirements can be imported in the Early Design Configurator software tool. This tool was developed in WP6. EDC will then run with these requirements and a model will be produced. The information in the model can be exported as IFC file, which can be used for the next steps. The following sub steps can be identified within EDC:

1. Create a project;
2. Create a building outline (first a building template was prepared in EDC);
3. Place building at the Rijnstate site by Open Maps integration;
4. Import the CSV PoR earlier made in BriefBuilder;
5. Start a design proposal in EDC;
6. Select basic sizes of walls and corridors;
7. choose a set of design rules EDC should apply
8. Run the proposal (EDC now produces various layouts);
9. Export one or more promising layouts as IFC.

4.2.3 STREAMER KPIs [CEN tool & KPIs & Visualization] Step 6, 7, 8 and step 9

The IFC file produced by EDC is used for the energy and other simulations such as quality and life cycle costs. The CEN tool can be used to perform energy calculations based on the IFC file. In the end, by using RE-Suite, a dashboard is produced to show the different KPI outcomes of various alternatives (Figure 3). The LCC and quality KPI simulation are integrated in the RE-Suite as separate modules. The LCC costs were based on TNO figures.
All the IFC modules produced by the different groups were simulated during lunch break by TNO.

As the last step RE-Suite has also an internal IFC viewer that is used to show the EDC outcomes in a 3D model.

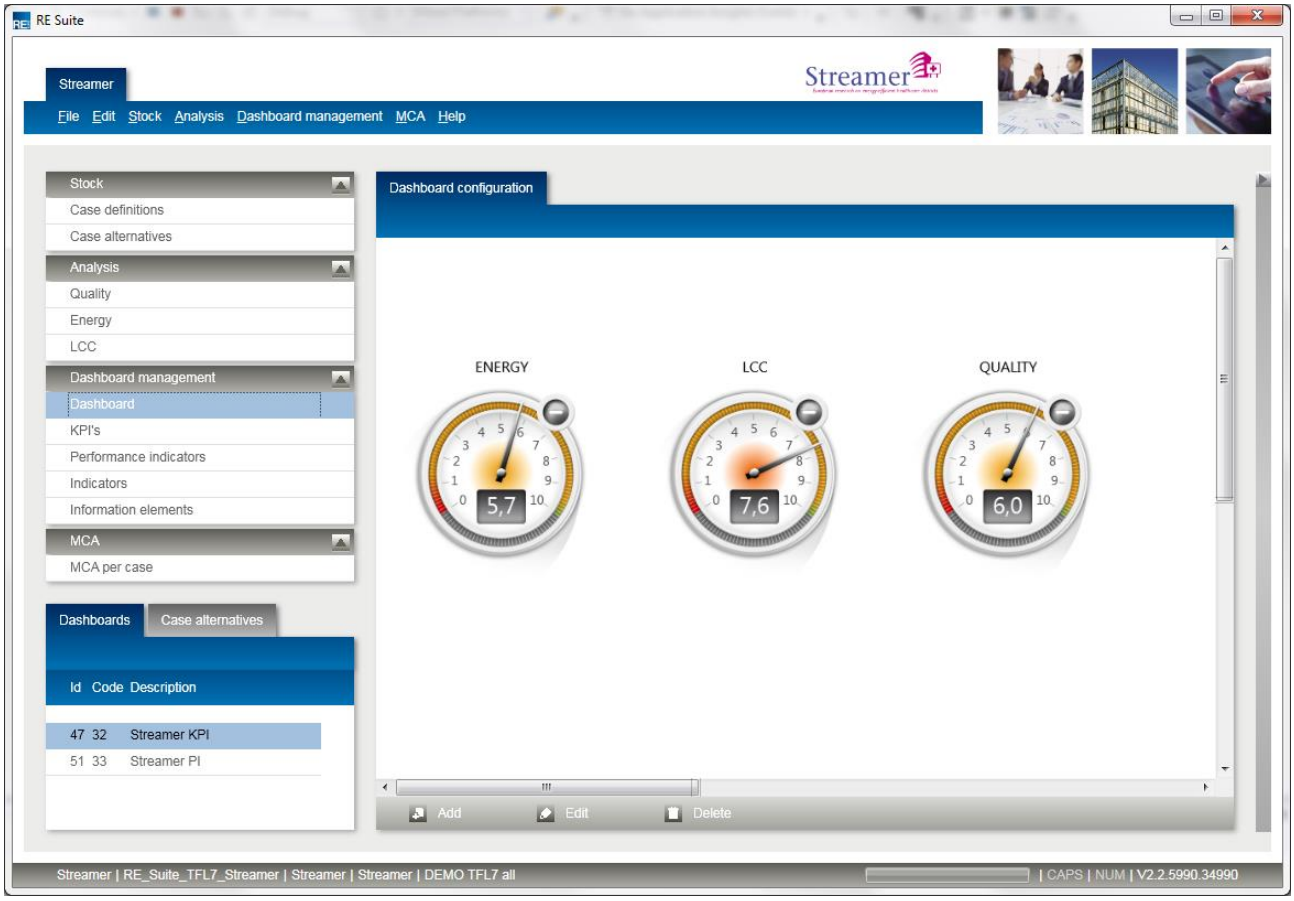

Figure 3 Dashboard showing KPI's calculated based on the IFC file

5 Feedback design workshop

In this chapter, we present the feedback received from the participants. The feedback was written in Dutch, since this was the regional validation of the STREAMER concepts and tools. The feedback forms were already pre-processed during the workshop, so that the highlights could be presented. After the workshop, all the forms were translated and structured per question (dealing with a particular concept/tool in the STREAMER process). The translated feedback can be found in Appendix 8. The questions were asked in a way that participants can give free answers.

5.1 Validation of the STREAMER Steps

Step 1: STREAMER library & database approach

At this step, there were four questions asked. The questions and feedback to each question are elaborated below.

1. *Whether the STREAMER-library added value to the definition of the PoR?*

The workshop validated that the STREAMER room library added value to the definition of the PoR process. All groups were positive regarding this statement. The type of values the STREAMER library added are identified below:

- The STREAMER library eased selecting and defining the room properties and gave a common structure to both the PoR document itself and the process around it.
- The STREAMER library prevents redefinition of the requirements each time (as 'reinventing the wheel'), can be reusable and result in an effective standard.

One point of attention was on the missing content and the background behind the STREAMER labels. Without knowing the background, the participants remained limited to give the meaning to the spaces. Thus, this needs to be overcome in the 2nd workshop. For the next workshop a scheme can be developed with the meaning of each of the labels and their semantic data. This is already developed for STREAMER itself, but not provided in the first workshop.

2. *Whether the STREAMER room-library was useful?*

The workshop validated that the library was useful and complete in general. However, several issues such as the meaning (content) of the labels, the standards or norms that the labels are based on i.e. regional building permits and regulations became important. The attention was drawn from the content of the STREAMER library. For example, the content Comfort class was unclear and it needed elaboration to see whether it involves acoustic, thermal, visual and other types of comfort. This draws a connection to Quality KPIs, particularly the Thermal comfort definition and inclusion in the design and decision process.

3. *Whether the tool added value to the design process?*

The workshop validated that the tool added value to the definition of PoR, as all groups answered this question positively. How it was supported was not detailed.

The tool was criticised on the three aspects:

- It's compatibility to other systems of other tools being compatible with the STREAMER tool landscape;
- It's content whether rooms can be coupled only with certain rules defined here;

- It's complication (or bug) that caused loss of data during the workshop. (in some cases the Room Name could not be adapted as it was restricted).

4. Whether the participants are willing to develop the STREAMER room library further?

The participants were willing for further development of the library.

The conclusion regarding this step can be drawn as:

- The STREAMER library provides the same starting points for a design team, as a common ground to the design process.
- Predefinition of labels for forming PoR makes the process faster and the decision making easier.
- The STREAMER library is well perceived and well-understood; it can be used as a benchmark.
- Once the PoR based on this library becomes a growing document, then it can be used throughout the process for validation and verification of decisions in the design process.

- The content of the labels needs to be available and in a self-communicating format This is still a human-led process; therefore it is still open to mistakes.
- At this stage, the future exchange of information among the tools that will be used was not clear.

Step 3: Early Design Configurator

At this step, there were three questions asked to the participants (as a group feedback) regarding the process sequence, the usability and practicality of the tool and the added value of the tool to the design process are validated. Below, we elaborate our findings.

5. Whether the step in the process is logical

The workshop validated that this step was logical in the overall design process. It was found innovative that there is a tool generating conceptual floor plans before the design starts. This step is considered as a validation of the different design alternatives.

6. Whether the participants were able to use the tool.

The workshop validated that the participants were able to use the tool with instructions given. The positive remarks were as follow:

- The different design alternatives created earlier in the process by using the STREAMER-room library in Brief Builder, matched with the floor plans created in the E.D.C. .
- The learning threshold, which is often an issue in new tools, was low. This affects the up-take of the tool by the market.

The criticisms were on the user-friendliness and automation of the design process.

The tool was found unintuitive.

- Combining the sketching and relating the spaces by using the output of the EDC should be possible.
- The workflow of placing corridors seemed somewhat lacking, the names of the templates were sometimes unclear or a specific template was missing.

- Suggestion was to add additional spaces like elevators, stairs and vertical ducts.

This can be seen as using the EDC outputs in a manual (conventional) way of design, as the outputs are used for design improvement. This is seen as a positive use, as another concern was the role of the architects in the whole process. Thus, EDC can still promote and support the architects from automated solutions (by EDC) to create more creative solutions triggered by the sketching over EDC alternatives.

7. Whether the tool added value to this step in design process.

All the groups positively claimed that the tool added value to this step in the design process. The positive impression was on the "creativity of the tool" in the alternatives that one "cannot come up with themselves".

- It is considered that the EDC provides reference layouts that supports and triggers the design process of architects and is good for design documentation (that is often a complex issue in the large scale projects as healthcare domain).
- The tool was found good for quick conceptualization, and efficient for variation study.

However, the criticisms were on the underdeveloped features of the tools as there are challenges between spaces to set relationships, and fire safety and window placement cannot be done. The rooms are very small and a feedback loop to BriefBuilder data is not provided.. If for instance a room in a design alternative becomes a different size it is not possible to have an automated adjustment in PoR.

If we summarize the feedback received by the groups as conclusions, the following issues arise:

- The tool is simple, helpful, but is still conceptual.
- The alternatives generated by the EDC seem like the ones that one can never come up oneself
- The alternatives are a good starting point for the design process for the architects by using existing conventional methods such as sketching etc..

- However, the tools received are very abstract and it is questioned whether it is a use for real-live cases.
- Editing the design alternatives was found difficult as it did not allow working with different shapes other than rectangular and changing circulation configurations etc. And this can be a point of improvement.
- There were challenges found in definition of the room relations. Therefore, the design rules become important to be play around with the design alternatives.

Step 4: Viewing IFC file generated through EDC

Validating this step was optional in the design workshop, as this involved only viewing the IFC file generated by the EDC. This is a natural yet implicit step that people need to go through. However we still tried to make familiarity with the RE-Suite (Demo's tool that will be used later in the performance calculation and viewing KPIs) and input on using it at this step. We asked two questions regarding this step. The first one, as a general process-related issue, if this is the logical order of this step in the overall process. And the second one is the content of the information (on IFC) file and whether the participants see the information that they expected to see. The latter is to identify whether there is gap of information that is provided earlier in Step 1 and 3. In other words, this step is to check whether the IFC file contains all the information used (and to be seen earlier) via the use of the RE-Suite. Below, we elaborate our findings on this step.

8. *Whether this step in the process is found to be logical?*

There were not many clear feedback forms received for this question. One reason can be interpreted as this was an optional feedback. The feedback is received from four groups and three of the groups claimed that the step was logical. However, one group noted that the EDC already provided this viewing option, as the EDC can already show which rooms are where and with what labels. The positive and different feature of this tool at this step was the provided visualization of the layers of the rooms was good. This is not yet clear whether it is a comparison or just an individual statement of the tool.

9. *Whether the IFC file/the tool is representing the information what is expected to see?*

Five out of nine groups contributed to provide feedback to this question. The comments were positive and claimed that the visualization was good, clear view of the 3D model (bundled with labels and requirements). However the majority of the comments stressed the need to execute the requirements back at this stage. Meaning that the users expected to change locations of several rooms or requirements of spaces related with the comfort classes (orientation and façade issues). However this was not possible. Even though this step was about 'viewing' the IFC file and the same concerns were raised in the EDC step, this coupling back with the requirements and design loop seem crucially important to the majority of the groups.

Based on the elaborated insights, the main conclusions can be drawn as:

- The tool provides a good visualization showing required properties in the 3D model.
- It is logical in the order of the design.

- However, Requirements from BriefBuilder should be more visualized and interlinked (any changes you make in this step, should be recorded). An important note here is that during the time the first workshop was held, the design Validator was not ready and its content was unknown for the Dutch partners. This tool will check the original requirements of a later design.
- Changing the room relations should be easier.
- The use of the tool was not intuitive (to find what is where).
- The visualization needed to be already earlier in the design process: in EDC

Step 6, 7 and 8: KPI calculation & dashboard

Validating the three steps was done by one feedback form for simplicity. At this moment, the validation was on the use of Key Performance Indicators (KPIs) and the tools developed for calculation of KPIs (Energy and LCC) and the attention on the further development of Quality KPIs (their prioritization and importance in the decision making process). Therefore the following questions were asked to the groups. This validation step involved workshop actions but also gathering input for STREAMER development processes regarding tools and processes.

10. *Are the steps/using KPIs in the process logical?*

The feedback from the participants made it clear that the KPI use and this step in the process was not well-understood. Half of the groups did not answer the question whether the step was logical in the overall process. When answered, the attention was on the incompleteness of the KPI tools (either the tool did not work, or the tool did not exist). There was also an emphasis on the definition of the KPIs as it was not clear to everyone, such as patient satisfaction and energy KPI (as to what it does calculate). At this moment, it is important to draw observations of the STREAMER representatives to a dilemma: to what detail an explanation and information should be presented in the workshop, simple and focused on the tools such as EDC and the

RE-Suite (in connection with the STREAMER library) or the whole STREAMER story. The main insight gained in this step was that there was little understanding on the definition of KPIs and their use and calculations. Below we elaborate.

11. KPI Energy/CEN Tool: Were you able to use the tool?

Except one group, the participants reported that they were not able to use the CEN tool (there were some problems with the compatibility of the operating systems with the tool) for energy KPI. Several concerns emerged such as the reliability of such early design calculations. It was also unclear on what assumptions the tool based its energy performance. The one push on the button tool with very quick results gave a kind of unreliable feeling to the audience, especially for the participant familiar with energy simulation tools like VABI. These traditional tools show far more options and need far more calculating time. Also, in the traditional process the energy simulating occurs at a far latter stage with more details known.

12. KPI Energy/CEN Tool: Has the tool added value to this step in the design process?

Similar to the previous answer, not all the groups could respond to this question. Only two groups reported that the tool added value to the design process but they noted that the tool needed to be operational (as it failed to work in several laptops). Besides, the definition of the values calculated by the CEN tool needed explanation. For many participants, the numbers did not make a sense. Regarding the LCC calculations in the RE-Suite tool, a criticism was on its lack of differentiation based on rooms or layers. In other words, the LCC calculation was not based on room/department/layer information, but simply on square meters. Therefore it did not present any differentiation. The suggestions were made on its differentiation on layer, department or room type level.

13. KPI Quality: Which KPI quality has a high priority? Which one to be further developed?

As mentioned, this question was to gather input on the development issue regarding Quality KPIs and the importance of the KPI to the Dutch practice. Only four groups can respond to this question. One of the questions was related with the variation limitations of the design alternatives created by the EDC. One specific answer (among 9 groups) was on the selection of the thermal comfort KPI but this was noted as due to the profession of the group members rather than being asked entirely by the Dutch practice.

If we summarize the feedback on KPIs, we arrive at the following conclusions:

- KPIs are not clear for most of the participants, either the meaning or the purpose of them in the decision process.
- Even though the energy issue is important as a decision criterion, the CEN tool was at the moment of the workshop is not operational. The purpose of calculation and the use (or the meaning) of the values as results of the tool need to be clarified.
- In the RE-Suite tool, the difference (or relations) between KPIs and PIs (performance indicators) are not clear.
- Further differentiation of LCC per layer or more importantly per room became necessary.

5.2 Validation of Tools: Their usability and practicality

Below, we discuss the usability and practicality of tools for BriefBuilder, Early Design Configurator and RE-Suite and give technical limitations or errors which occurred in the workshop, which are to be fixed or considered. In the validation of tools, we looked at the feedback received from individual forms as well as the observation and the session notes of the moderators.

5.2.1 BriefBuilder

The main feedback (both individuals and group forms) were on the concern that BriefBuilder would be the only system that works within STREAMER tool landscape. Therefore, the comments were that BriefBuilder should not be the only system that works with EDC. There needs to be alternative ways to consider. In other words, the STREAMER approach should not be based solely on BriefBuilder as there will be licensing issues in future. Other software or more open standards (systems) that can be used for creating PoR that EDC works with should be addressed. This feedback showed that there is a clarification (or clear communication) needed for the next workshop or any external dissemination. In the STREAMER tools and process, the specific CSV structure, with the right columns and vocabulary is needed, not specifically BriefBuilder. It was a software that can be used in the workshop to prepare the necessary CSV file. Alternatively, this can be made in Notepad, Excel, Google Sheets, dRofus, BriefBuilder and many more.

The second concern was the data flow between BriefBuilder and EDC. Even though this was discussed in the Step 1 and Step 2's validation, the majority of the participants wanted to be able to change the PoR in viewing and calculating IFC files within RE-Suite tool. Or they wanted to see the changes they make at the end. (The way-back loop from EDC to the BriefBuilder was needed) as an automatic flow or involving "design validator" (that checks several rules for validating the design alternatives to see whether the alternatives fulfil the rules). The latter can check the PoR requirements with the Layouts created by EDC and changed within EDC or other software and present the differences in two. The Design Validator is already being developed by CEA, STREAMER partner. But this needs to be clarified as well.

In addition to these, there were errors noted. Even though they are minor, it is still important to emphasize them. The first error was in the cross table view, column headings disappear when scrolling down. The second error was when making the room list by copying and pasting from library to project, the Object Name was not added automatically. Both need to be communicated with the partners dealing with the tool. This was due to some authorisation rights issues.

5.2.2 Early Design Configurator (EDC)

As particularly discussed in Chapter 4.2.2., EDC was received with an enthusiasm in the automation that it brought to the design creation process. However, there have been questions on the capability of the tool (i.e. design rules to include, or MEP systems to consider since energy efficiency is the focus of the STREAMER project). If we bring observations and notes from individual forms (addition to Chapter 4.4), we can say that there is a clear tendency that people want to interact with the tool more; like getting info on the rooms (labels), and influence the design. There was an emerging need for the participants to set different design rules (or with different priorities) in creating different proposals. The latter is under consideration and the 2nd workshop will show what types of design rules are considered and which the EDC can take into account in layout generation. On a detail level, several notes were on expectations of the participants on the information that the design proposals needed to contain. For example, when working with EDC, there was an uncertainty whether all required rooms were actually included in the program. So this was about finding out whether all the information and prerequisites established in PoR could be found back in the design proposals (particularly a room that the participants particularly looked for in the created proposals). Furthermore, there was a need to see the units of the wall thicknesses in the created proposals. Lastly, the corridors between different sub-buildings did not connect.

5.2.3 Validation of the STREAMER storyline

When we look at the individual feedback, we see that the storyline at the end of the workshop was mainly clear to the participants. The objective of STREAMER and the way that STREAMER adds value to the design process were positively noted. And communicating the storyline schematically was also very-well received, particularly on a complex subject as STREAMER. Besides, having handouts also help to process what the expectations are from the participants. Thus, good preparation made sharing the storyline easier. However, several participants had some difficulties with the "story" and mainly with the terminology that was used. This indicates a possible change or enhancement of communication in the second workshop. Particularly there needs to be better visualization and preparation for the steps where different KPIs are used.

5.3 Potential challenges

In the individual feedback forms, we deliberately asked what the potential challenges would be in the development and after-life of STREAMER. Below, we report these challenges and see the issues to consider in the coming months.
These challenges overlap with the feedback received in the groups within different titles. We see that it is important because this feedback is received again on the individual forms. The issues that recurred in the individual forms are as follows.

<u>Use of tools and dataflow</u>

- Two-directional dataflow between systems and licensing issues for wider use is an issue. This influences the acceptance too.
- Using existing and well-accepted tools for validation rather than creating new ones needs to be considered.
- Acceptance of the tools in practice did not feel intuitive to everyone. This may be an issue for practising more and having better feeling on how the tools work. New tools always take time to learn.
- Reuse of information and data through the lifecycle of project (circular BIM) needs to be explicit. Facility management needs to be considered here.
- A powerful tool for validation seems crucial.
- Extra intelligent additions are necessary to play around selection of design proposals.
- Reference (basis) details of the LCC and energy calculations need to be clearer. The calculations can be provided but what is the base line for decision making (i.e. acceptable, non-acceptable).
- Working with the rules like travel distance and the way to make certain (but necessary) rules & KPIs need to be clear. Those are crucial aspects in selection of design layouts.
- Flexibility in calculating design options (width of corridors per department for example) for EDC is crucial.
- Properties of the labels are missing. This is a structural and organizational issue. Structural in a sense of how the content of labels should be structured and practitioners can interpret meanings easily, it is organizational because the best and efficient way to present the overwhelming information (as it is in the labels) need to be found.
- Integration of the MEP content/design; it is important to talk about integral design and decisions.
- Certain aspects in design selection such as way finding, running costs etc. needs to be considered.

<u>Content of design proposals:</u>

- Making logical relations and configurations between the rooms need to be provided always.
- Possibility to work with more complex conditions such as lifts stairs, columns and stability etc. needs to be provided, otherwise it will remain conceptual.

- More influence in the creation of layouts such as daylight factors etc. needs to be considered.

5.4 Points of attention for the next workshop

The gaps in the participant lists will be identified for the second workshop. For example, which institutes/organizations/companies were missing and how to ensure their presence in the second workshop and make back up choices (for example, the participant from the technical university was missing. Therefore, either more universities need to be informed about the workshop or more participants from the same university need to be contacted.)

We need to identify whether there were any aspects not discussed during the workshop or could not be handled there. This needs to be done by cross-case insights gained through the workshops done in the other countries.

More organizationally, there needs to be more and clear manuals for each tool that are going to be tested.

From networking perspective, people wanted to change groups in the afternoon in order to meet more people (better networking) but also looking at different solutions from different perspectives.

However, (learning on the spot) we asked the audience to fill in the feedback form at the end, just after the plenary session, for several reasons. It turned out that the individual feedback forms became overwhelming when distributed together with the group forms. Therefore we stopped distributing these forms so as not to confuse the attendees. Secondly, it made more sense to gather feedback individually after the attendees had been through all the steps in the workshop and had experienced the tools and the process and data flows. Next time, we should do that at the end and it is also suggested that the number of questions should be limited.

5.5 Conclusions and actions to follow-up

Regarding the STREAMER library, labels and the tool (BriefBuilder in this case) to form a PoR

Existence of the labels and the STREAMER Room library provided a common ground for decision making and the team members (represented by the groups in the workshop) could set clear objectives. Thus, the library and the database approach for PoR leads to fast and easy decision making. It also allows 'growth' of PoR in a manageable and traceable way. As indicated several times, the content of the STREAMER labels were not known, and this becomes crucial. Furthermore, using different tools rather than BriefBuilder was also emphasized. Thus, the actions for STREAMER partners would:

- Make the STREAMER Label information available for the users.
- Make other tools, rather than BB, to create PoR based on the STREAMER labels or consider an alternative way.
- One point for the future was to consider the STREAMER library based on (an) EU-level standard(s).

Regarding STREAMER process (overall steps)

Even though there were challenges reported due to the number of steps and its sequence, the overall process was logical. The main criticism is that the current EDC did not seem to allow for iteration between PoR and design alternatives. In other words, the participants expect to change properties in the design alternatives and they expected to see these changes in the PoR. Below, we state the possible actions and follow-up considerations.

- Make exchange of data formats clear to understand.
- Reduce the number of steps (this does not mean to change the order but we can already consider which steps can be grouped under each other i.e. do we really need step 4, see the IFC file explicitly? May be yes.
- Make the process iterative

Regarding KPIs and Visualization

- Clarify definitions of Quality and indicate calculation (assessment) procedure or introduce calculation module (i.e. Operational efficiency was the least important one, as some said that they do this calculation anyhow not necessarily to be emphasized here. Counter argument would be, isn't it logical then to see it in the dashboard explicitly? We need to discuss it)
- Clarify reference values for energy calculation so that the results of the CEN tool can be interpreted as 'excellent/sufficient enough /bad'
- Make the CEN tool operational (avoid bugs or dependencies to certain Windows operating systems)
- Make LCC calculation differences per layer or per room

6 Final conclusions

Here we would like to summarize the main conclusions, based on the detailed analysis in chapter 5.

1. The STREAMER library provides the same starting points for a design team, as a common ground to the design process.
2. Predefinition of labels for forming PoR makes the process faster and the decision making easier.
3. The STREAMER library is well-perceived and well-understood; it can be used as a benchmark.
4. Once the PoR based on this library becomes a growing document, then it can be used throughout the process for validation and verification of decisions in the design process.
5. The (EDC) tool is simple, helpful, but is still conceptual.
6. The alternatives generated by the EDC seem like the ones that one can never come up oneself
7. The alternatives (provided by the EDC tool) are a good starting point for the design process for the architects by using existing conventional methods such as sketching etc.
8. The visualisation tool (can be any viewer that can import IFC files – here this is possible using RE-Suite) provides a good visualisation showing required properties in the 3D model.
9. (The use of the visualisation tool) (can be any viewer that can import IFC files – here this is possible using RE-Suite) is logical in the order of the design.
10. KPIs are not clear for most of the participants, either the meaning or the purpose of them in the decision process.
11. Even though the energy issue is important as a decision criterion, the CEN tool was at the moment of the workshop is not operational. The purpose of calculation and the use (or the meaning) of the values as results of the tool need to be clarified.
12. In the RE-Suite tool, the difference (or relations) between KPIs and PIs (performance indicators) are not clear.
13. Further differentiation of LCC per layer or more importantly per room became necessary.

When we look back to the objectives of the workshop, this leads to the following reflections and lessons learned:

1. The participants of the design workshop have different background which boosted the discussions during the workshop – all were able to participate by following the instructions and make use of the software tools and share their feed back
2. Some aspects (such as labels) should have been explained better to the public
3. Verification of the complete design process was not possible because not all tools were ready for demonstration.
4. The STREAMER story line and the input/output table (even though they were clear to everybody) still should be further elaborated on.

APPENDIX 1 - List of Participants and Group Distribution

Group	Title	Initials	Last Name	Organisation	Profession
1	Ms.	J.B.M. van	Meel	a/d Amstel Architecten	architect
2	Mr.	F.A.	Burger	a/d Amstel Architecten	architect
7	Mr.	R.	Gmelig	Arcadis	Advisor MEP
5	Mr.	R.P. van	Walsum	Arcadis	Advisor MEP
9	Mr.	R.	Brandts	Arcadis	Advisor MEP
1	Mr.	A.	Koutamanis	TU Delft	university
8	Mr.	L.	Labega	Avansplus	
3	Mr.	M.P.R. van	Wijk	Deerns	Technical advisor
-	Mr.	A. van	Delft	Demo bv	NL partner
4*	Mr.	R.	Sebastian	Demo bv	NL partner
5*	Mr.	S. van	Gennip	Demo bv	NL partner
6*	Mr.	D.	Werensteijn	dJGA	NL partner
7*	Mr.	M. den	Hoed	dJGA	NL partner
8	Mr.	S.	Wolse	Druchtman & Partners	
9	Mr.	R.M.	Homan	Dura Vermeer Hengelo	constructor
7	Mr.	J.P.	Pols	DWA	NL partner
1	Mr.	G.	Abdalla	DWA	NL partner
3	Mr.	V.S.M.	Ketting	EGM architecten	architect
4	Mr.	B. van	Kleef	EGM architecten	architect
2	Mr.	B.	Koudstaal	Erasmus MC	hospital
3	Mr.	A.	Windhorst	Erasmus MC	hospital
4	Mr.	I.	Immerzeel	Erasmus MC	hospital
5	Mr.	V.N.	Vladimir Necakov	Freelanger	
6	Mr.	A.C.	Wiggelinkhuizen	Grontmij Nederland B.V.	
7	Mr.	S. van den	Berg	ICOP	NL partner
2	Mr.	M. van den	Bos	ICOP	NL partner
9	Mr.	G.	Hornes	ICOP	NL partner
7	Mr.	R.	Kleine	Ing. Bur. Wolters & Dros b.v.	constructor
2	Mr.	E.	Steffens	K & R Consultants B.V.	advisor
3	Mr.	P.H.J.	Joosten	Kuijpers	constructor
4	Mr.	A.A.G.	Hoos	Kuijpers	constructor
5	Mr.	J.H.	Timmer	Plegt Vos Stoffels	constructor
6	Mr.	N.	Kerkhof Jonkman	Plegt-Vos	constructor
7	Ms.	D.	List	Plegt-Vos Oost B.V.	constructor
8	Mr.	N.G.	Janssen	Radboudumc	hospital

-	Mr.	A. van der	Beek	Rijnstate	NL partner
8*	Mr.	W.J.	Hanegraaf	Rijnstate	NL partner
-	Mr.	M.	Koster	Rijnstate	NL partner
6	Mr.	E.C.	Woudenberg	Royal HaskoningDHV	advisor
1	Mr.	E.	Smits	TBI	constructor
2	Mr.	H.P.	Meijs	TBI	constructor
-	Ms.	K.E.	Bektas	TNO	NL partner
3*	Mr.	A.	Koster	TNO	NL partner
1*	Mr.	F.M.	Bomhof	TNO	NL partner
2*	Mr.	R.	Traversari	TNO	NL partner
9*	Mr.	N.J.	Nauta	TNO	NL partner
5	Mr.	J.W.	Schut	Unica Installatie	constructor
4	Mr.	F.W. van	Enk	VE2BIM BV	BIM specialist
8	Mr.	F.M.	Pörtzgen	Wiegerinck architecten	architect
9	Mr.	J.	Graafland	Wiegerinck architecten	architect
6	Mr.	B.	Römgens	Ziekenhuis Oost Limburg	hospital

APPENDIX 2 - Template of the Feedback forms

Plenary Session: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name (optional):	……
Company (optional):	……

Was the STREAMER story-line clear and understandable?	
Yes/No	
Explanation:	
Was the STREAMER process-steps (sequence) logical?	
Yes/No	
Explanation:	
Is there any potential challenge you foresee, before testing tools and concepts?	
Yes/No	
Explanation:	
Are there any additional remarks?	

STEP 1: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name of Facilitator:	……
Group #:	……

Do you think the STREAMER-library has added value in the definition of a program of requirements? (If yes, in which sense? If no, why?)	
Yes/No	
Explanation:	

Would you be prepared to cooperate in further developing a standardized room-list (as common approach) together with Rijnstate?	
Yes/No	
Explanation:	
Were the STREAMER semantic labels useful in this step, did you miss any information?	
Yes/No	
Explanation:	
Was the tool(s) added value to this step in design process? (if) Where did the challenges occur?	
Yes/No	
Explanation:	
Are there any additional remarks?	

STEP 3: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name of Facilitator:	……
Group #:	……

Is this step in the process logical?	
Yes/No	
Explanation:	
Were you able to use the tool?	
Yes/No	
Explanation:	
Was the tool added value to this step in design process,? (if) Where did the challenges occur?	
Yes/No	
Explanation:	
Are there any additional remarks? i.e. Ideas for improvements.	
Yes/No	
Explanation:	

[Optional] STEP 4: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name of Facilitator:	……
Group #:	……

Is this step in the process logical?	
Yes/No	
Explanation:	
Is it representing the information what you expected to see?	
Yes/No	
Explanation:	
Are there any additional remarks?	
Yes/No	
Explanation:	

STEP 7/8: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name of Facilitator:	…… ……
Group #:	…… ……

Are these steps—and/or--using these KPIs in the process logical?	
Yes/No	
Explanation:	

KPI Energy & CEN tool: Were you able to use the tool?	
Yes/No	
Explanation:	

KPI Energy & CEN tool: Was the tool added value to this step in design process? (if) Where did the challenges occur?	
Yes/No	
Explanation:	

KPI Quality: Which KPI quality has a high priority in your decision & design process? Which one would you like us to develop/calculate further?	
Yes/No	
Explanation:	

Are there any additional remarks?	
Yes/No	

STEP 9: Feedback form for the Design Workshop of STREAMER, 30 March 2016

Name of Facilitator:	……
Group #:	……

Is this step in the process logical?	
Yes/No	
Explanation:	
Were you able to use the tool?	
Yes/No	
Explanation:	
Was the tool added value to this step in design process,? (if) Where did the challenges occur?	
Yes/No	
Explanation:	
Are there any additional remarks?	
Yes/No	
Explanation:	

Q-Cards: Any question to the STREAMER team on any issue

Naam (optional):	…… ……
Company (optional):	…… ……

APPENDIX 3 - Design Workshop Manual (Step 1 & 2)

Impession of the manual used at the Design Workshop of March 30th 2016 at Rijnstate Hospital. This manual will be digitally available at sharepoint WP7.

Design Workshop Manual

Rijnstate Arnhem, 30th March 2016

Streamer

European research on energy-efficient healthcare districts

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What does it calculate

- Building Energy demand for heating and cooling
  - Using the layout plan with glazing given by the STREMER(Early) design configurator
  - Using solar irradiance on surfaces
  - Using a replaceable climate data file (structure should stay the same)
  - Using ventilation heat loses (reduced by recirculation and heat recovery units)
- Building Energy consumption for heating and cooling
  - Using a efficiency per system (combination of emission, distribution and generation)

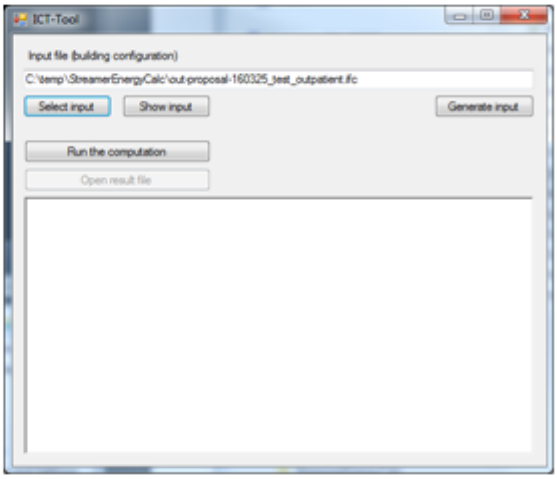
Individual spaces are not (yet) calculated

STREAMER – Arnhem Workflow 2

Doing a calculation

- "Select input" button
  To browse the file system for the ifc-file to be used as input.
- "Run the computation" button
  Starts the calculation and creates output files.

Ifc output is saved in the same location as the used input ifc-file
Other outputs are saved in the applications folder



STREAMER – Arnhem Workflow 3

Options to use in the calculation

- Climate => THC2012_3155003.RAY
  To be replaced to simulate another climate
- System configuration => SystemData.txt
  To be replaced to change the system configuration
  Ventilation recirculation factor, Ventilation heat recovery efficiency,
  total system efficiency (emission + distribution + generation) for heating, cooling
  (and domestic hot water not yet used)
- Occupancy schedule => occupancy_Space1.csv
  To be replaced to set a different user profile
  Like hours in use which influence the amount of heat generated by occupants and appliances, but also the set point temperature for heating and cooling.
  In the future this will mostly rely on the label values

STREAMER – Arnhem Workflow 4

Output of the calculation

- ThermalZone1.csv
  Detailed hourly report of the calculated demands and internal temperatures
- [original name]_energyCalc.ifc
  A new version of the IFC file used as input being extended with the results of the calculation (per zone and building)

APPENDIX 5 - Feedback forms (Individual)

Name: ....

Company: .....

Feedback form of the Design Workshop STREAMER

Plenary Session—30 March 2016

Was the STREAMER story-line clear and understandable?

Yes/~~No~~

Explanation: clear, but the labels couldn't be changed easily

Was the STREAMER process-steps (sequence) logical?

Yes/~~No~~

Explanation: yes, but - as mentioned - not all accessible

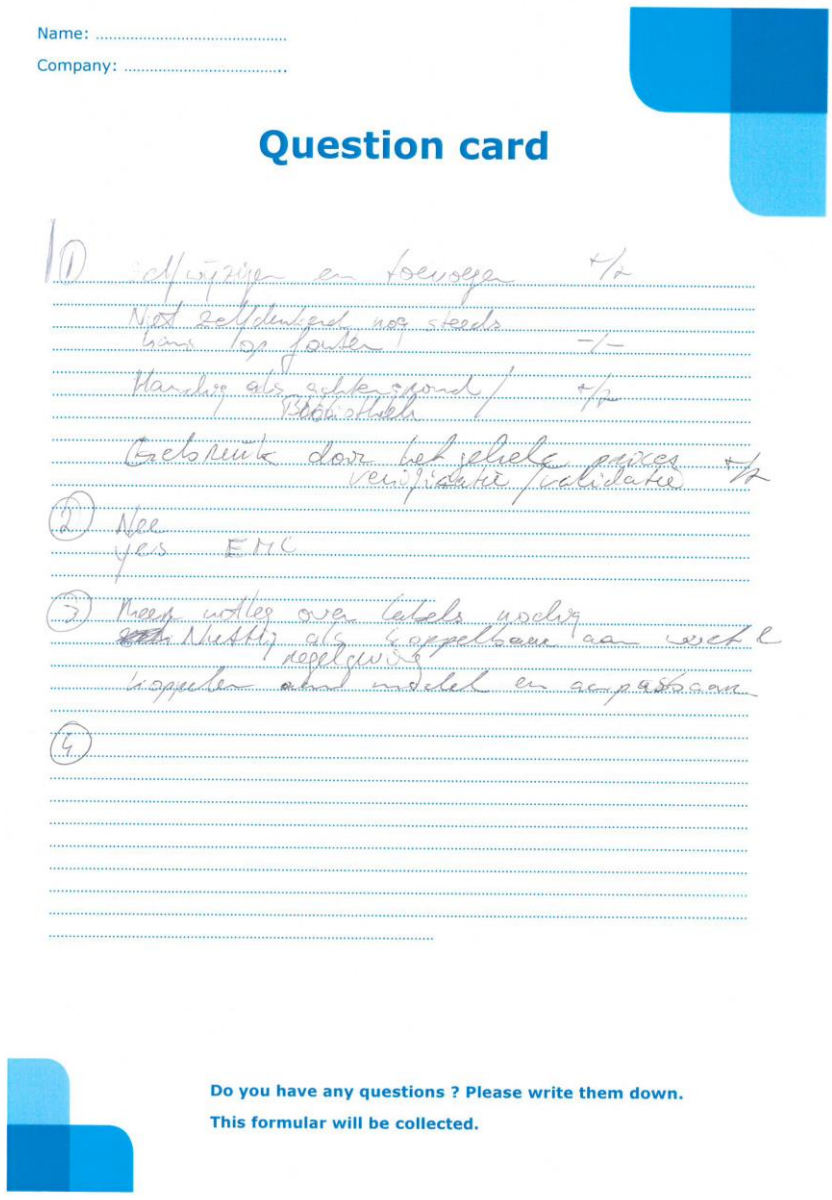
Is there any potential challenge you foresee, before testing tools and concepts?

Yes/~~No~~

Explanation: challenge is the relation between the rooms, if it ends up in a logical config.

Are there any additional remarks?

APPENDIX 6 - Question (Q)-Cards



Name: .....

Company: .....

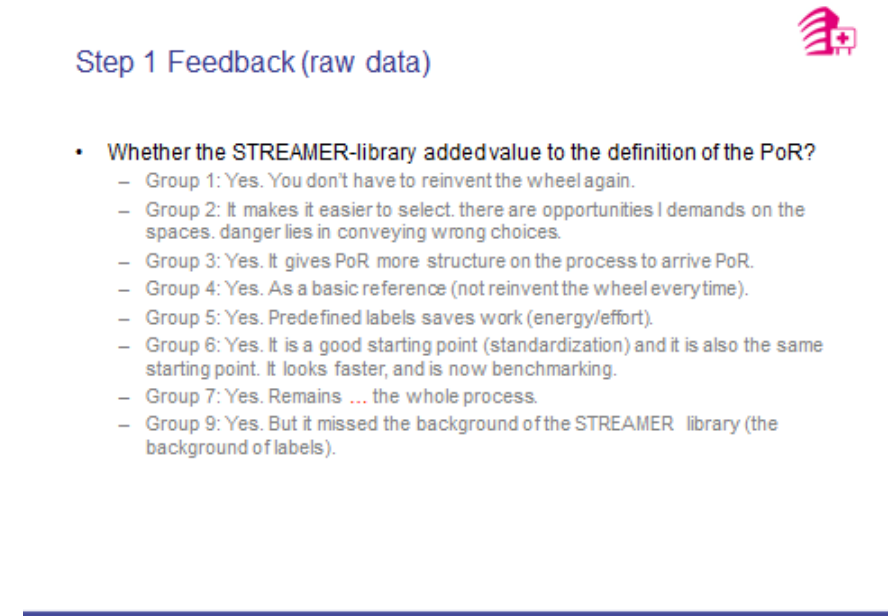
Question card

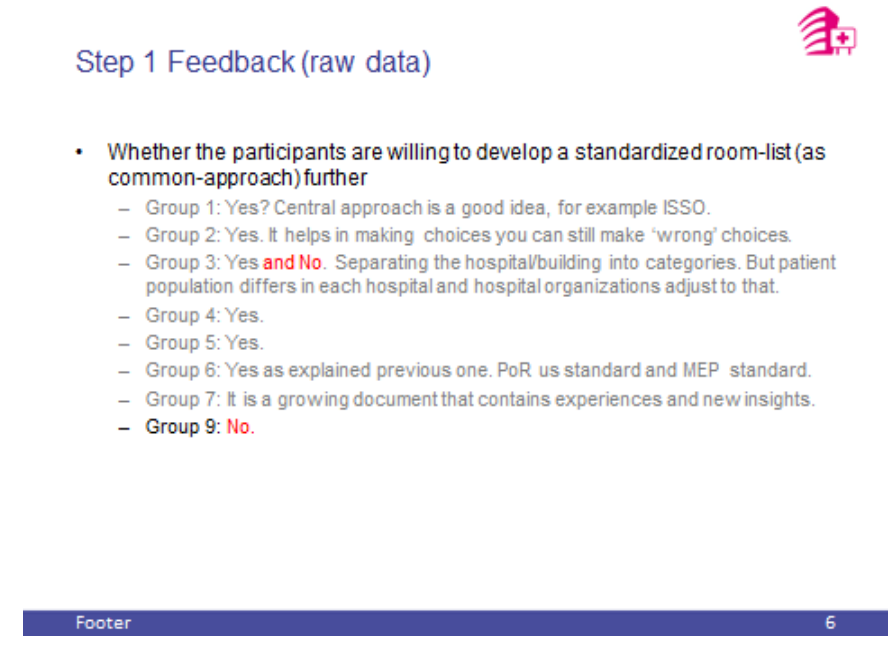
1. afwijzing en beweging +/-
   Niet zelfstandig nog steeds
   hulp bij lopen -/-
   Handig als achterwand / +/-
   Toolsattelen
   Gebruik door bekjelijke pijnen +/-
   verpleegkundige indicatie
2. Nee
   yes EHC
3. Meer uitleg over labels voorlig
   Nuttig als toepasbaar aan verzek
   vragen gw's?
   toepassen alsnog onderdeel en aanpassen
4.

Do you have any questions ? Please write them down.

This formular will be collected.

Appendix 7 – Group Feedback Translated in English (as Raw Data)





Step 1 Feedback (raw data)

- Whether the STREAMER room-library was useful.
  - Group 1: -
  - Group 2: Useful. But the meaning is for the outsiders unknown.
  - Group 3: Yes. It is useful. But the explanation for the content of the labels were missing.
  - Group 4: Yes. Technical norms/details of the labels needed as they influence energy performance. Question: Are the labels standardized on NL or EU level?
  - Group 5: Useful and seemingly complete.
  - Group 6: Yes and No. Relation with the land is important (the database). Building permits should be checked.
  - Group 7: They missed the content of the labels.
  - Group 9: The link with laws or regulations becomes important. The desired level is too. there should be linking the content to BIM model.

Step 1 Feedback (raw data)

- Whether the tool added value to the definition of the PoR
  - Group 1: -
  - Group 2: Yes, useful. But the meaning is for the outsiders unknown.
  - Group 3: Yes. But there is a challenge: how to couple the rooms with the design rules?
  - Group 4: Yes. BrieffBuilder. Only if it is compatible with other systems. If it is stand alone, not so much. Output to IFC is an important aspect.
  - Group 5: Yes.
  - Group 6: Yes. The overview is lost in the excel file.
  - Group 7: Yes, it is because everything is based on norms and regulations.
  - Group 9: Yes. Especially Both pre and during the design phase.

Step 3 Feedback (raw data)

- Whether the step in the process logical
  - Group 1: Yes.
  - Group 2: Yes.
  - Group 3: Yes. First design rules are entered (i.e. relations between spaces) then EDC is released on PoR.
  - Group 4: Yes. It is innovative to be able to generate 'conceptual floor plan' before the design stage.
  - Group 5: Yes.
  - Group 6: Yes. Validation of ideas and more alternatives.
  - Group 7: Yes. Normal, logical step in the process.
  - Group 8 and 9: Yes.

Step 3 Feedback (raw data)

- Whether the participants were able to use the tool.
  - Group 1: Yes. The use of the floorplans and its configurations needs to meet with requirements and EDC supports that.
  - Group 2: Yes.
  - Group 3: Yes.
  - Group 4: Yes. Quite simple but not intuitive.
  - Group 5: Yes and No. Yes: Low threshold and No: missing combination with technique (sketching, relation with spaces) and it does not connect to [PoR?]
  - Group 6: Yes. Yes. Small crash.
  - Group 7: Yes. No. Too less knowledge about the program and processor was too small (computation)
  - Group 8 and 9: Yes.

Step 3 Feedback (raw data)

- Whether the tool added value to this step in design process.
  - Group 1: Yes. The generation of design alternatives proposed here is the ones that you cannot come up with yourself.
  - Group 2: Yes. For variation study. It is still long and not ready. We have also 1) very small rooms, no relation between spaces (coupling).
  - Group 3: Yes. But challenge is relation between spaces (as the question before)
  - Group 4: Yes. The architect finds it is helpful to have a 'reference layout' before starting the design process.
  - Group 5: Yes and No as before. It is useful for quick conceptualization,
  - Group 6: Yes. A challenge is the top 10 best layouts.
  - Group 7: Yes. Design options are good for documentation.
  - Group 8 and 9: Yes. For 'vlakkenplan' (conceptual layouts) but how further an application can be developed?

  - Extra: fire safety and window placement should come too.
  - Spatial requirements are mandatory for this method.

Step 4 Feedback (raw data)

- Is this step in the process logical? ?
  - Group 1: Yes and No. The need to look at the design, what room is placed where; which labels are interested is already felt in the EDC.
  - Group 2: -
  - Group 3: Yes. Still logical but it has to work.
  - Group 4:-
  - Group 5: -
  - Group 6: -
  - Group 7: Yes. Good visual feedback of the layers of the building.
  - Group 8 and 9: … all stakeholders should involve in this step.
  - .

Step 4 Feedback (raw data)

- Is it representing the information what you expected to see?
  - Group 1: -
  - Group 2: Visual is good. The colors work nicely. I would like to execute back the requirements that in the briefbuilder are set befpre. Now it is a black box.
  - Group 3: -
  - Group 4: Yes from 3D to 3D. But not intuitive. (one should know exactly where to click the mouse & panel control is not intuitive).
  - Group 5: Yes.it gives headlines 3D model by bundling the labels/requirements. This is clear. It could be handy to change spaces in this model.
  - Group 6: -
  - Group 7: -
  - Group 8 and 9:Yes

  - Additional: energy simulation: Location of rooms in relation to comfort class (daylight → glazing), N, E, S, W façade are also very important.
  - Coupling back for making changes to the brief buildier is essential for fixating the he design choices.

Step 6/7/8 Feedback (raw data)

- Are the steps/using KPIs in the process logical?
  - Group 1:
  - Group 2:
  - Group 3: It is logical but tools have to work.
  - Group 4: the KPIs are not complete. Some MEP experts have doubt about the credibility of KPI related with energy.
  - Group 5: Yes. What is patient satisfaction, how do you define that?
  - Group 6: -
  - Group 7: Yes.
  - Group 8 and 9:

Step 6/7/8 Feedback (raw data)

- KPI Energy/CEN Tool: Were you able to use the tool?
  - Group 1:
  - Group 2:
  - Group 3: No
  - Group 4:
  - Group 5: Yes.
  - Group 6: -
  - Group 7:
  - Group 8 and 9:

Step 6/7/8 Feedback (raw data)

- KPI Energy/CEN Tool: Has the tool added value to this step in the design process?
  - Group 1:
  - Group 2:
  - Group 3: Yes but the tools have to work.
  - Group 4:
  - Group 5: Yes,
  - Group 6: CEN tool is not operational. KPI not really clear. Pis are totally different numbers.
  - Group 7:
  - Group 8 and 9:

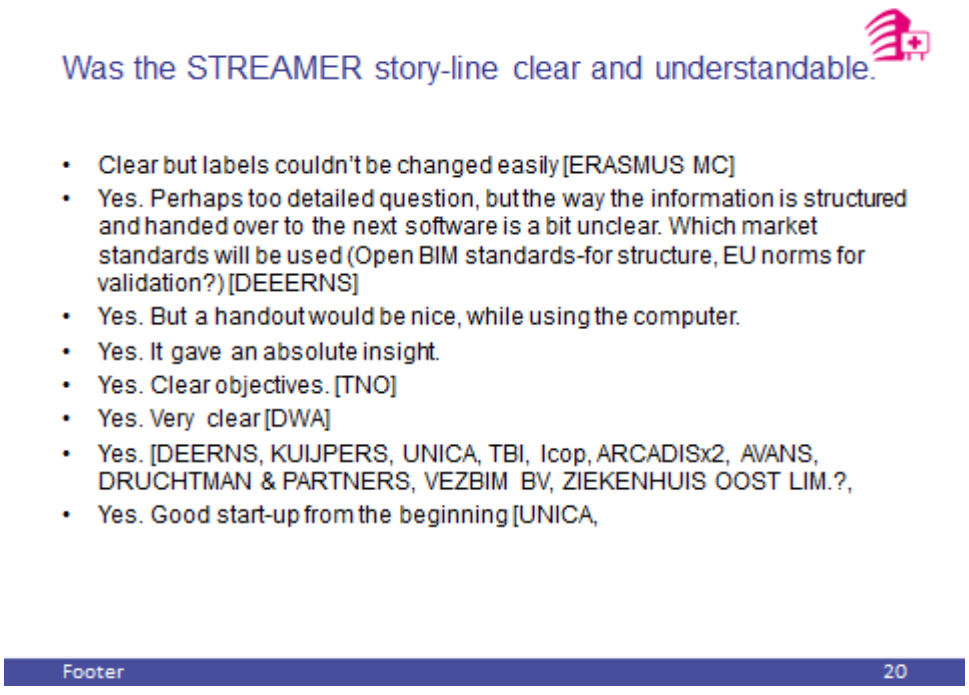
Step 6/7/8 Feedback (raw data)

- KPI Energy/CEN Tool: Were you able to use the tool?
  - Group 1:
  - Group 2:
  - Group 3: Yes but the tool have to work.
  - Group 4: not many people are familiar with the CEN calculation.
  - Group 5: Yes. Choice became simple.
  - Group 6: The difference between KPI and PIs are not clear. Where the numbers come from?
  - Group 7: Depending on the calculation model. Experiences showed thatr mant early design tools have little reliability.
  - Group 8 and 9:
  - LCC differentiation is needed.

Step 6/7/8 Feedback (raw data)

- KPI Quality: Which KPI quality has a high priority? Which one to be further developed?
  - Group 1:
  - Group 2:
  - Group 3: Assessment and comparison are not yet possible because the alternatives barely change.
  - Group 4: KPIs in Quality seem to be not objective.
  - Group 5: Yes. Energy, life cycle.
  - Group 6: -
  - Group 7: Thermal comfort [*from their profession*]
  - Group 8 and 9:
  - LCC differentiation is needed.

Appendix 8 – Individual Feedback Translated in English (as Raw Data)



Was the STREAMER story-line clear and understandable? (Cont')

- Yes. The layout is clear. I want [to be] more involved in the development of labels. [ERASMUS MC]
- Yes. Definition of labels are missing in BB [EGM Architecten]
- Yes. During the day became clear. In the beginning, a lot of new information that became clear after the use of tools [Plegt=Vos Stoffels??]
- Yes. Content of the labels are not clear. [?]
- Yes. In the main lines is really clear and understandable. [UNICA]
- Yes. Clear and schematic overview [Grontmij]
- Yes. Visualizations help to understand it. [RHDHV]
- Yes. Very clear but it is a known field for me. [tbi]

Footer 21

Were the STREAMER process-steps (the sequence) logical?

- Yes. But not all accessible [ERASMUS MC]
- Yes. [DEERNS, Kuijpers, Unica, TBI, Icop, Unica Arnhem, EGM Arch., Arcadis, Ing. Bureau …, Grontmij, Druchtman and Partners(?),
- Yes. But too many steps to select, It is not very intuitive.
- Yes, thinks so…
- Yes. Clear logical order. Not it looks like separate components, yet pieces steps clear. [TNO]
- Yes. But the use of various tools seem that the process is really shredded, many steps and often data exchange from one step to other is so [?]. Proposed idea: one integrated tool? [DWA]
- There is still a feedback loop desirable to get from brief builder to streamer [EDC]. [Deerns]
- It looks like one direction (one-way) design. I think the database of the brief builder has to stand centrally. Then the design steps can be documented and information can be centrally saved. [ARCADIS]
- Yes and No, Not always.

Footer 22

Were the STREAMER process-steps (the sequence) logical?

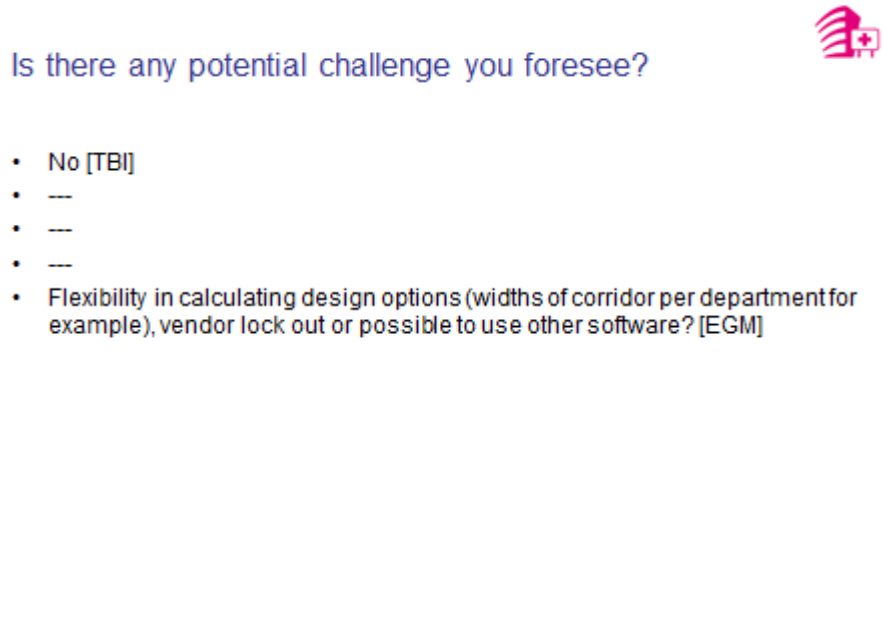
- Yes. Fast and minimum effort until coming to the design alternative analyses. [Plegt-Vos]
- Yes. The development kan be coupled with a training (Post_HBO).
- Yes. Logistic order of process [UNICA]
- Not everything.

Footer 23

Is there any potential challenge you foresee?

- Yes. Challenge is in the relation between the rooms, if it ends in a logical configuration ERASMUS MC
- Yes. The connectibility of the software to hand over information/Design from one phase to another one: The acceptability of people to work with a new "workflow/software/database: "depends on the complexity vs. acceptability [DERRNS]
- How does it work when the flow between more complex lifts, stairs, columns, elevators etc. [UNREADABLE]
- Commercial use will influence the process? Role of architects [TNO]
- Use of licences? [DWA]
- Complexity vs. flexibility, isn't it idea to create Solibri checks to visualize the data faster/more efficient in Solibri itself? [DEERNS].
- Reuse of information and dat athrough the lofe cycle of a building process (circular BIM) [KUIJPERS]
- Powerful tool for validation [UNICA]

Footer 24



Story-line

- Story-line clear
- Clear, but labels could not be changed easily.
- The way that information is structured and handed over to the next software is unclear
- But handout would be nice, while using the computer
- It gave absolute insight.
- Clear objectives and added value to what is needed
- Yes. Very clear,
- Yes.
- The layout is clear
- Definition of labels is missing
- Clear schematic overview
- Visualization helps to understand the storyline.

Process sequence

- Yes, but not all steps are accessible
- Yes
- Bit too many steps to select and it is not very intuitive.
- Yes.
- Yes. Clear logical order, it looks like separate components but the pieces come together at the end.
- The process of using different software looks very fragmented.
- There is still a feedback loop desirable target from brief builder.
- It looks like one way direction and design process. The database of BriefBuilder should be centrally located in the process.

- Logic follows the order of the design process
- The line from step to another step was not always clear.

Potential challenges

- Challenge is in the relation between the rooms, if it ends up in a logical configuration
- The connectability of the software to handover information/design from one phase to the other
    - The acceptability of people to work with a new “workflow/software/database””
    - Depends on the complexity vs. acceptability
- How does it work when the floors are more complex, lifts stairs, columns and stability etc.
- You should have more influence in the creation of layouts such as daylight factors etc.
- Commercial use will this influence the pieces? Role of architects,
- Use of licenses
- Isn’t it an idea of creating Solibri checks to visualize data faster more efficient than RE-Suite,
- Re-use of information and data through the lifecycle of project (circular BIM)
- Powerful tool for validation is needed
- How does it work with the spaces that are not good placed?
- Flexibility in calculating design options (width of corridors per department for example) for EDC
- Vendor lock (BriefBuilder) or possible to use other software
- Too much guideline or guidance needed rather than simple properties of the labels are missing
- Integration of the MEP content/design
- Extra intelligent additions are necessary.
- In using Facility Management
- Basis details of the details of LCC and energy calculations need to be clearer.
- Working with the rules like travel distance and the way to make certain (but necessary) rules & KPIs for things like way finding, running costs etc.