The potential impact of BIM uptake regarding EPC calculations

Bart Ingelaere, Belgian Building Research Institute

3rd QUALICHeCK conference
Better compliance and quality of the works, in practice
Brussels, May 10 2016
INTRODUCTION

INTRODUCTION

BIM and its POSSIBILITIES

the POTENTIAL IMPACT on EPC CALCULATIONS

OUTLINE

OUTLINE

OUTLINE
The present situation

- At present: for many aspects the necessity to use simplified approaches, default values, ...
  - HVAC systems, summer comfort, ...
  - Less and less evident when moving to NZEB

- Detailed calculations (thermal bridges, ...) require a lot of input data and extra calculation tools

- Growing interest for hourly calculation methods – this will require more data

- Organisation of effective compliance and enforcement is in most countries not evident
1. BIM and (part of) its possibilities
6 % up to 10 % of the total cost of buildings are due to construction errors. Using BIM allows to build it a first time (digitally), to eliminate errors, optimise everything and then build it for real ...

It can be a more efficient way of building in a lot of ways, but it requires BIM-management, rules, etc. ..
BIM and its POSSIBILITIES

ARCHITECTURAL DESIGN (LEVELS)

DESIGN WORK

BUILDING PROJECT and AS BUILT MODEL

AUTHORIZED

OTHER SUBCONTRACTING
- Subcontractors
- Material suppliers
- System and prefabrication suppliers

PRINCIPAL CONTRACTOR
- Adapted construction plans and model
- Handling material suppliers
- Quantity surveillance
- Planning
- Construction site management (access, lifts, cranes, building equipment,...)
- Technical documentation
- Meeting reports
- Site safety
- Insurance

TECHNICAL CONSULTING EXECUTION (LEVELS)
- Structural
- Fire
- Thermal
- Safety
- Acoustics
- AC
- Electricity
- Lighting
- Interior design
- ...
BIM

Building information **MODEL** (3D/4D)

Building information **MODELLING**
(simulations, intertwined databases...)

Building information **MANAGEMENT**

“Ceci n’est pas une BIM” (~ R. Magritte)
3D or 4D visual representation

Complex project designs are possible

Fondation LVMH Paris - arch. GEHRY - STUDIOS - image Fondation Louis Vuitton
INTRODUCTION

BIM and its POTENTIAL IMPACT on EPC CALCULATIONS

3D or 4D visual representation

DATABASES

Submodel security
Submodel energy performance...
Submodel structural integrity
Submodel structural fire aspects
Submodel structural acoustics
Submodel architectural design
Submodel interior design
Submodel electricity
Submodel water appliances
Submodel air conditioning
Submodel light
Submodel ...
COMBINING EVERYTHING = IS THIS CRAZY?
INTRODUCTION

BIM and its possibilities

The potential impact on EPC calculation

3D or 4D visual representation

Assembled BIM

Submodel energy performance, ...

Submodel water appliances

Submodel air conditioning

Submodel light

Submodel electricity

Submodel architectural design

Submodel interior design

Submodel structural integrity

Submodel structural fire aspects

Submodel structural acoustics

Submodel security

DATABASES

Data analysis tools

“Clash” detection

Quantities & Price estimation

Primary Energy consumption

Overheating aspects

Daylight calculations

Acoustics

………
2. BIM and the potential for EPC
The potential of BIM in relation to compliance and enforcement of the EPC lies in the following areas:

• Specific **data analysis tools** (e.g. EPC simulations, acoustics, fire, manufacturing control software…) allow to optimise and control technically the design phase of a building (~ “speller check”)

• Less specific efforts for the modeller needed for collecting EPC (and other) input data, they are attached via **databases** to the different objects, components in the model

• The creation of **databases with locally available products** is important and should contain the necessary EPC data in **formats** that can be read by data analysis tools. The work of **CEN TC 442 in liaison with other CEN TC’s** (for EPC, this will be CEN TC 88 and CEN TC 89) is important.
INTRODUCTION

BIM and its POSSIBILITIES

the POTENTIAL IMPACT on EPC CALCULATIONS

BRICK – DATA (dim, description, structural, weight, thermal, fire, acoustics,...)

GLASS WOOL – DATA (dim, description, structural, weight, thermal, fire, acoustics,...)

RESILIENT CLIP – DATA (dim, description, structural, weight, thermal, fire, acoustics,...)

CEILING STUD – DATA (dim, description, structural, weight, thermal, fire, acoustics,...)

PROJECT STRUCTURES GROUPS FAMILIES OBJECTS (data)

DATABASES are the KEY / LIAISONS CEN TC 442 – CEN TC 88
e.g. all necessary data needs to be provided, e.g. sustainable summer comfort issues (liaison with CEN TC 442 – BIM)

- **Solar shading**
  - All product data in BIM model, including possibility of surroundings (shading, …)?

- **Thermal mass**
  - All data in BIM model?

- **Multi-zoning**
  - All data in BIM model?

- **Ventilative cooling**
  - All component data in BIM Modelling?

- **Cool roof products**
  - All component data in BIM modelling?

- **Control strategies**
  - Control systems can be included in BIM model, parameters to be fixed?

 e.g. all necessary data needs to be provided for EPC-calculations (liaison with CEN TC 442 – BIM)
DATA ANALYSIS TOOLS are available (DIRECT PRIMARY ENERGY CONSUMPTION, SUMMER COMFORT, DAYLIGHT, ACOUSTICS,...), extracting and using the geometric and objects DATA in the model...

HARMONISED SIMULATION TOOLS?
AGREEMENTS / PROTOCOLS needed for a certain LEVEL OF DETAILS (from the start of the modelling): WHAT is NEEDED up to what level of detail. To be specified by technological field...

SEMANTICS, STRUCTURES, DEFINITIONS, NAMES... OPEN STANDARDS are needed to find back the information!
Detailed calculations of junctions…
The potential of BIM in relation to compliance and enforcement of the EPC lies in the following areas:

• BIM offers the possibility to have a larger set of relevant “extra input data”: the BIM model can be very detailed, including organisation of spaces, composition of building components, building nodes. In practice, it means that there might be access to a wide range of input data without the need for a lot of extra “input data work” in the EPC context. This data needs to be found back and requires definitions, unambiguous names and addresses (“semantics”). This requires an organisation from the start of the modelling. Guidance of necessary “semantics” in the model are necessary to be able to have and to find back all the necessary data for a certain type of data analysis, e.g. EPC calculations.

• Possibility to simplify certain calculation aspects: as indicated in the previous point, there is the potential for a larger set of relevant input data. This might e.g. allow to assess the 2- and 3-dimensional heat flows by a direct calculation, without the need for extra work by the EPC rapporteurs.

• Possibility to have more refined assessment procedures. An interesting example is the assessment of the risk of overheating and/or the need for active cooling. Such assessment should ideally be done at room level and by using dynamic simulations. One of the major concerns without BIM is the need for a detailed model of the building and/or its installations. With BIM, this might become very straightforward.
The potential of BIM in relation to compliance and enforcement of the EPC lies in the following areas:

• Possibility to have an **effective enforcement without the need to involve governmental actions.** Simulation proofs on “AS BUILT” models (LOD 500)

• **Challenges: how can these simulations tools be certified?** Can calculation codes be more harmonised with extensions for different countries / regions?

• BIM connected to EIM (ENVIRONMENTAL INFORMATION MODELS) can be a support for Urban Building Physics…

**Vertex modelling**
BIM and OFF SITE MANUFACTURING
In search of perfect detailing, manufacturing and construction