# The divergence of various Building Information Models with dissimilar Levels of Development and Detail concerning the Life Cycle Assessment

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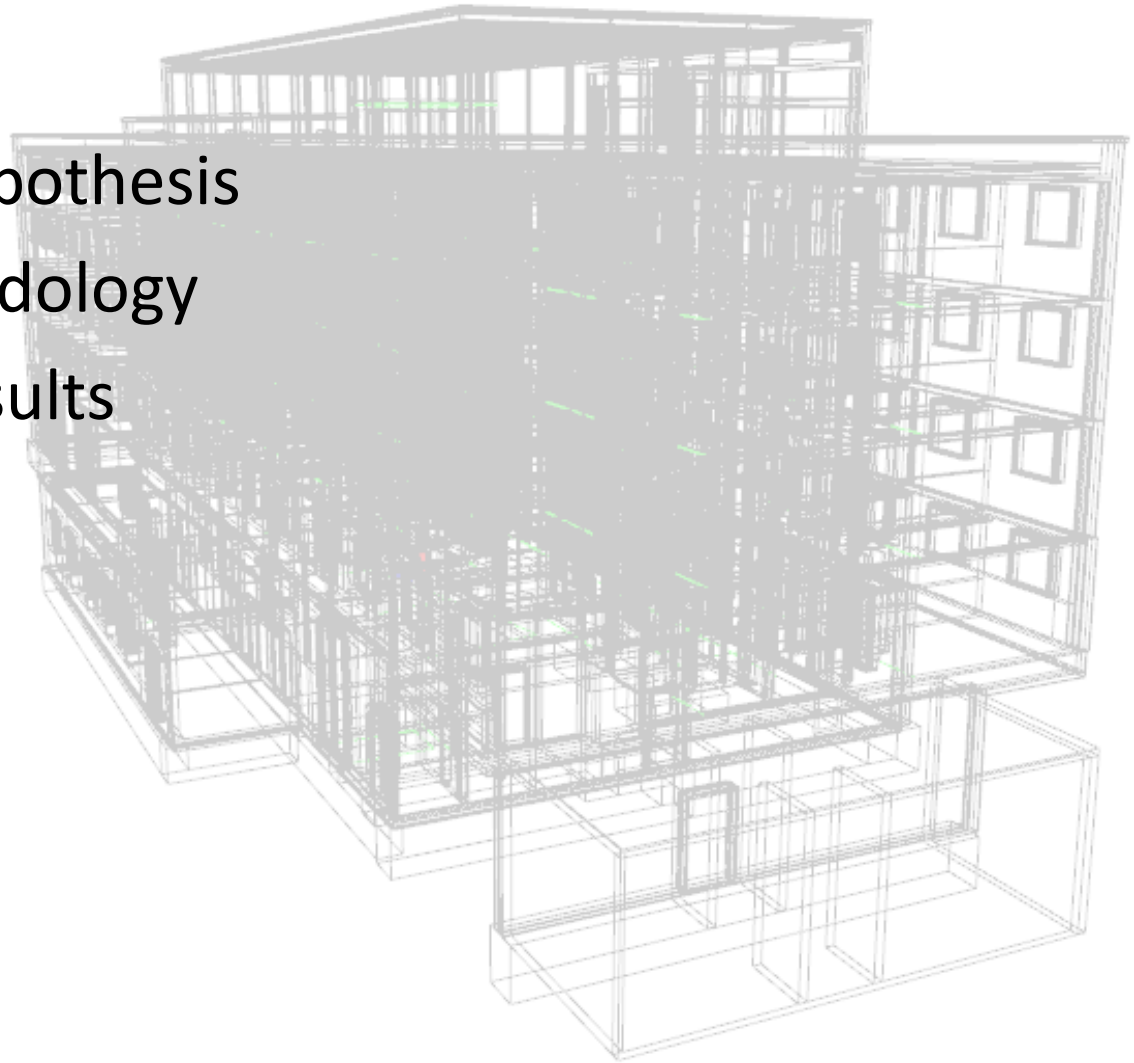
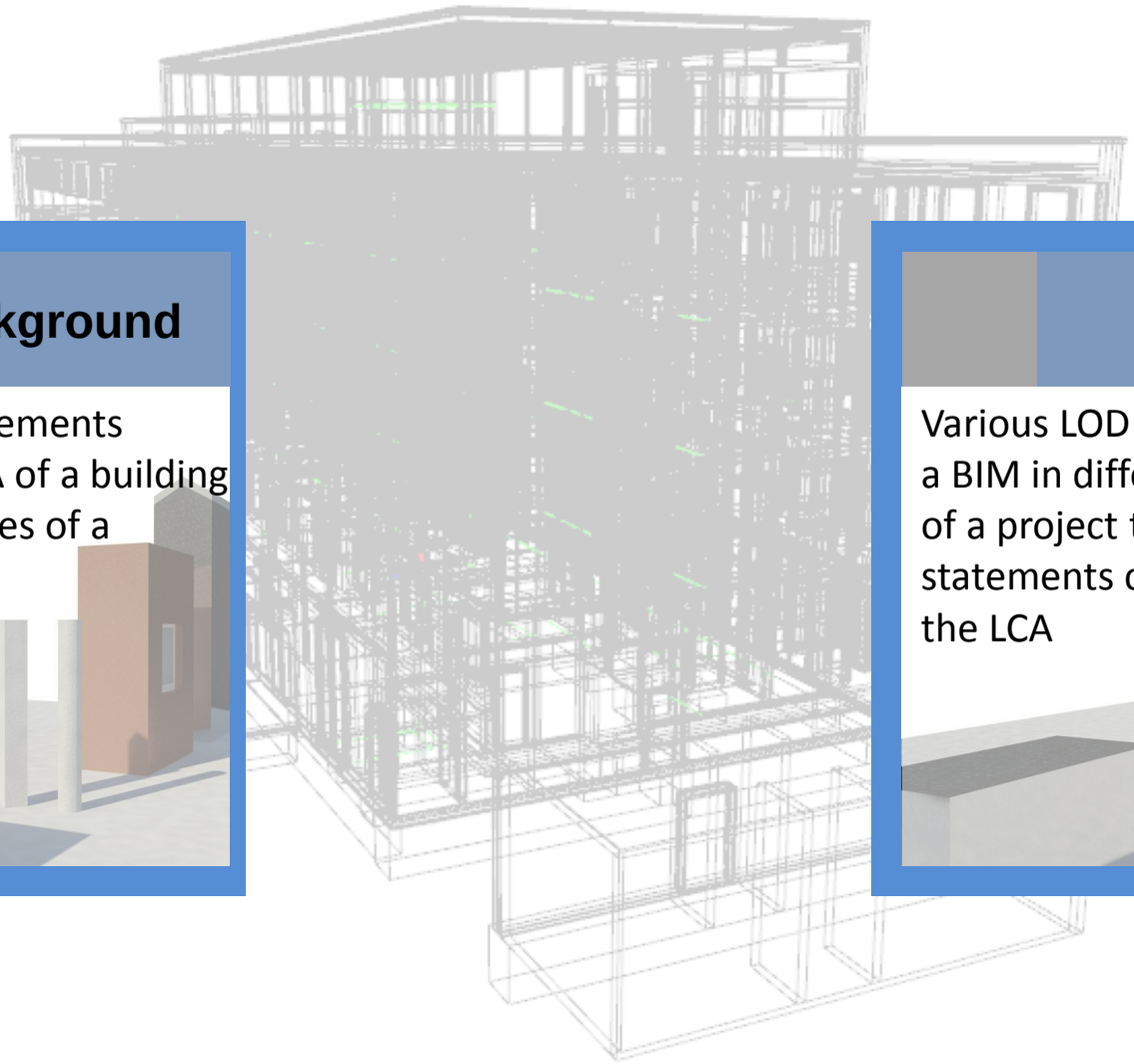
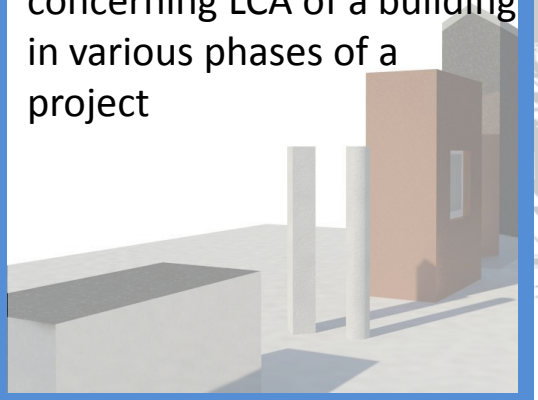


- Principal: Wolff+Müller
- Agent: HTWG Constance
- Duration: April 2012 – December 2012
- Extent: Focus on the building envelope



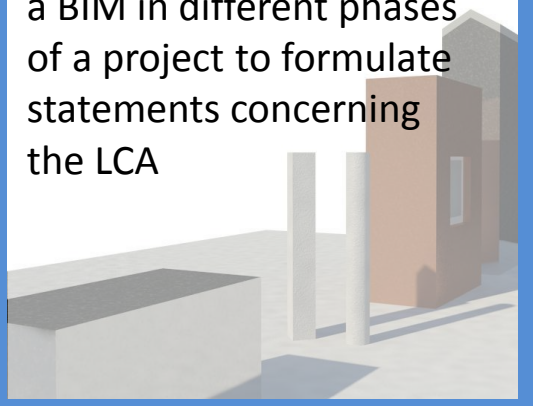
## Background

A need for statements concerning LCA of a building in various phases of a project

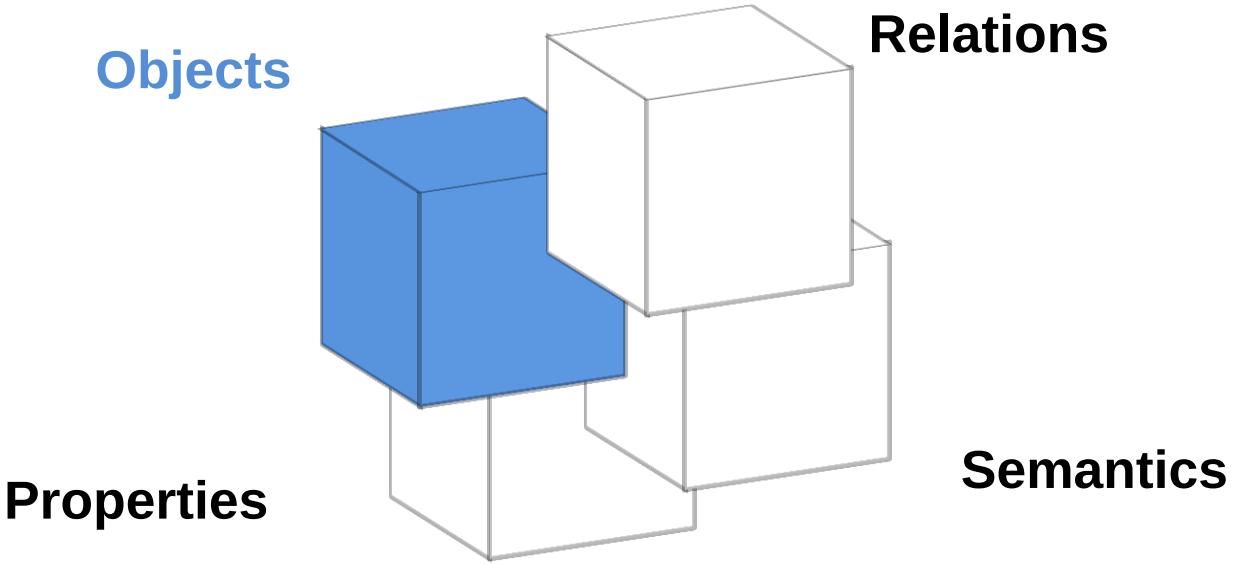


## Target

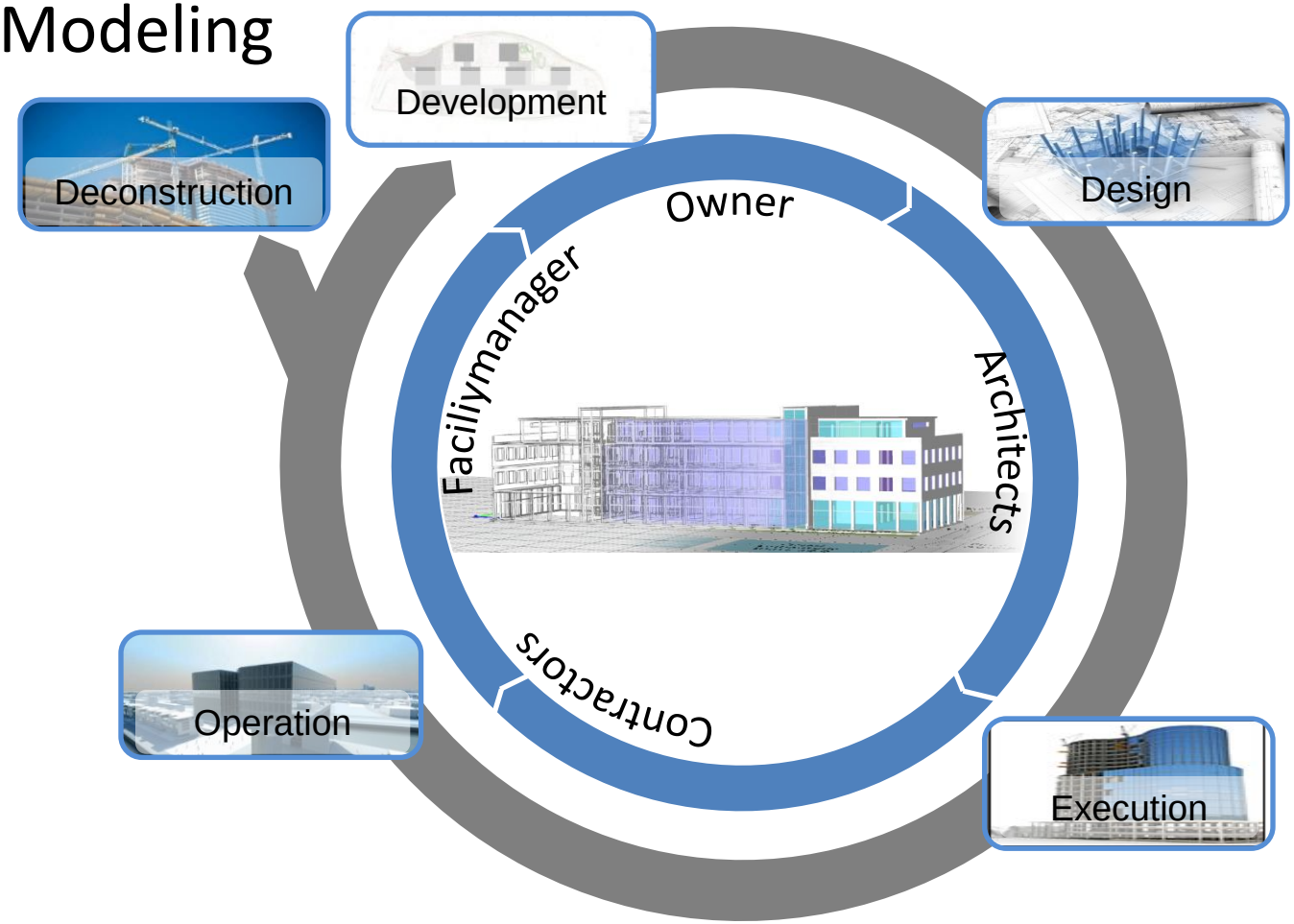
Various LOD and LoD of a BIM in different phases of a project to formulate statements concerning the LCA



# Characteristics of a Building Information Model…



… as well as the characteristics of Building Information Modeling

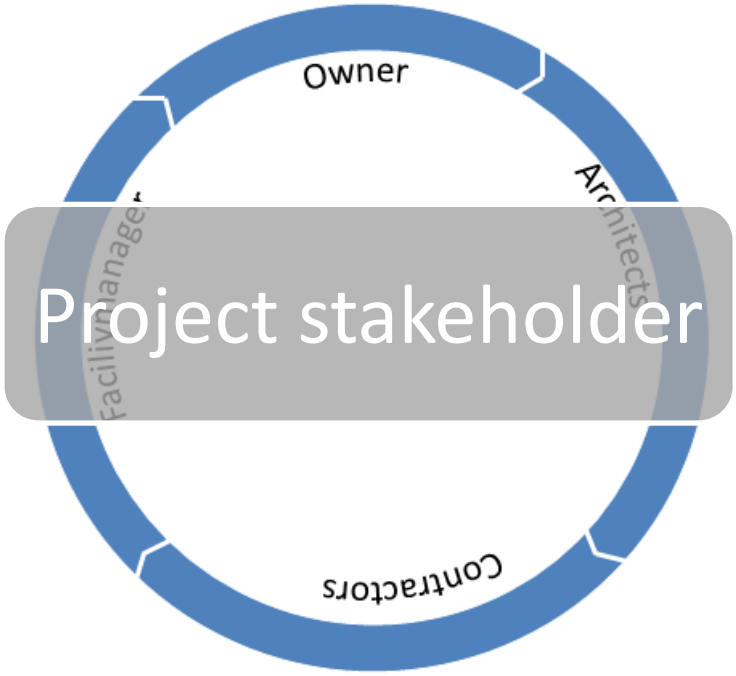


… are leading to the following hypothesis

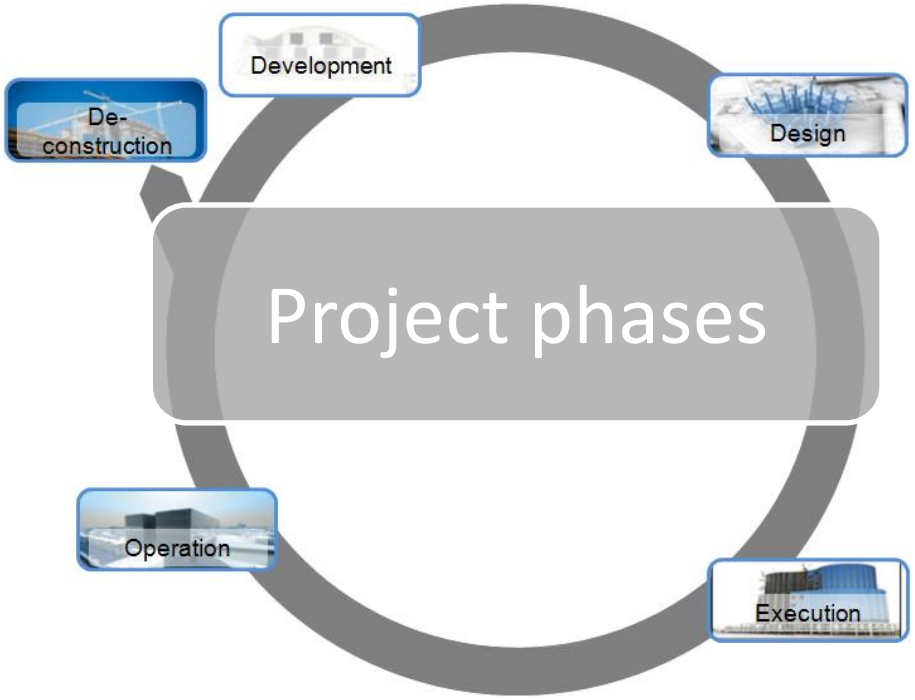
**Building Information Models are developing due to the different phases of a project.**

**Therefore Building Information Models have varying Levels of Development and Detail.**

# Building Information Modeling and its impact on a Building Information Model…




Level of Detail is dictated by the different views of the stakeholders as well as their varying intended purpose

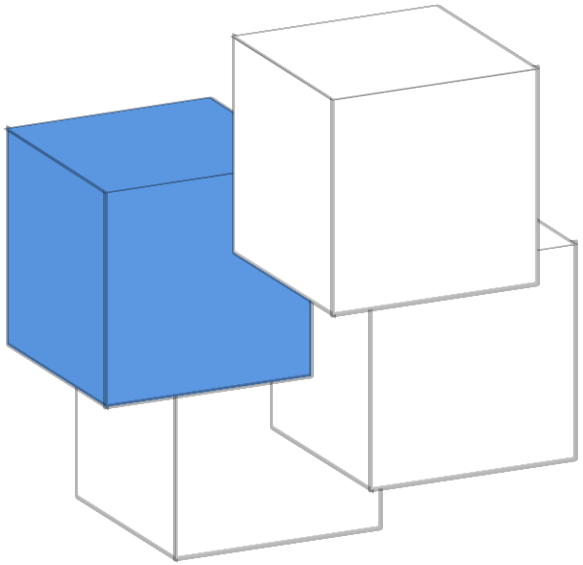



Levels of Development are increasing due to informational richness in later phases

# … are leading to varying representations of a BIM

## 1 Objects

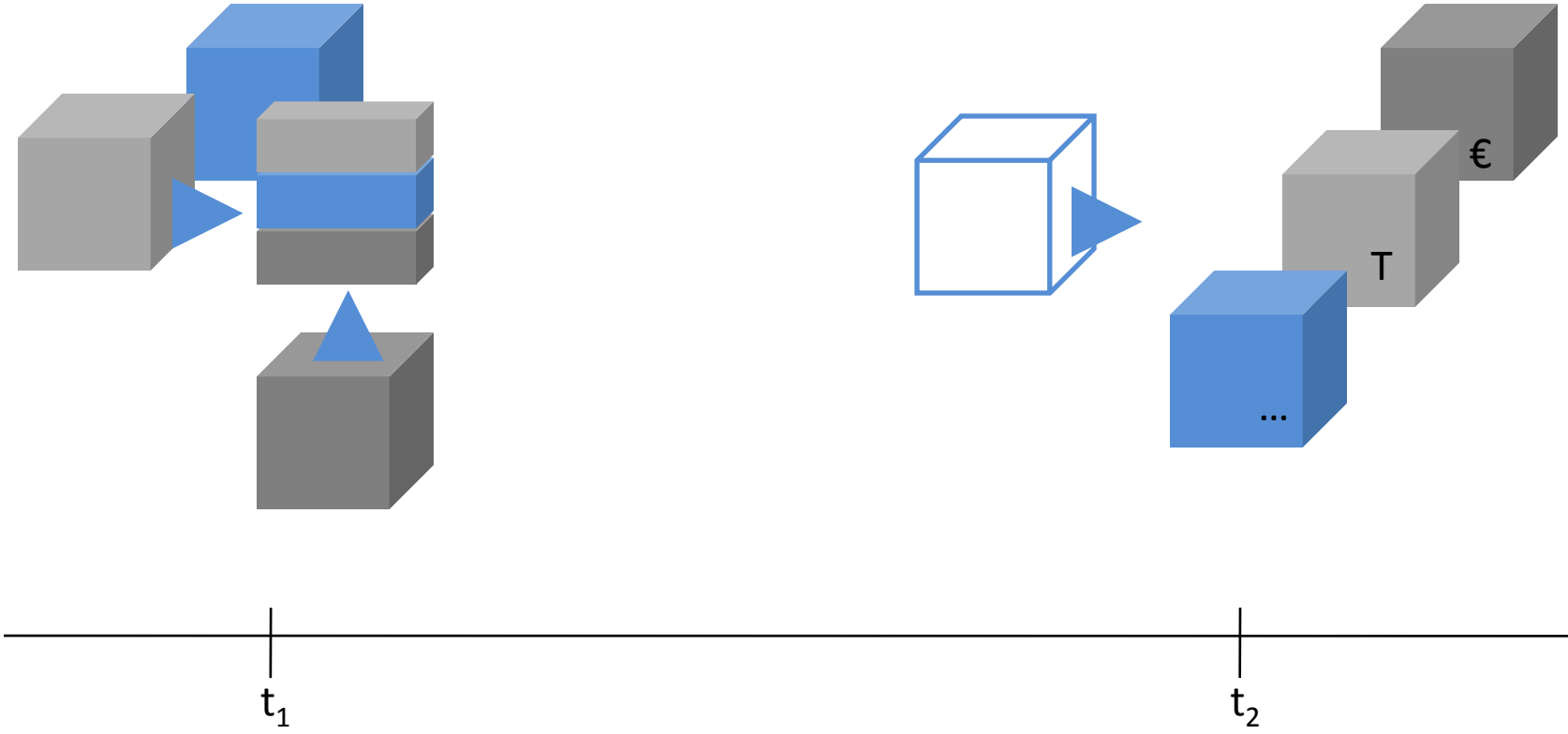
Different Objects: Development from mass to building specific objects



## 2 Properties

Properties and their Values are more precise in later phases of a project

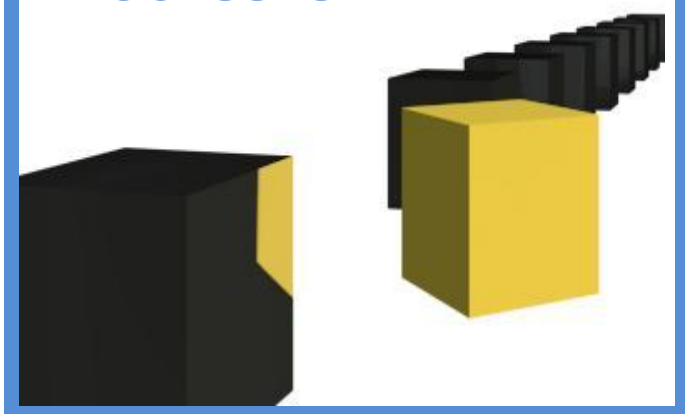
… a BIM can be separated in it´s construction and evaluation…



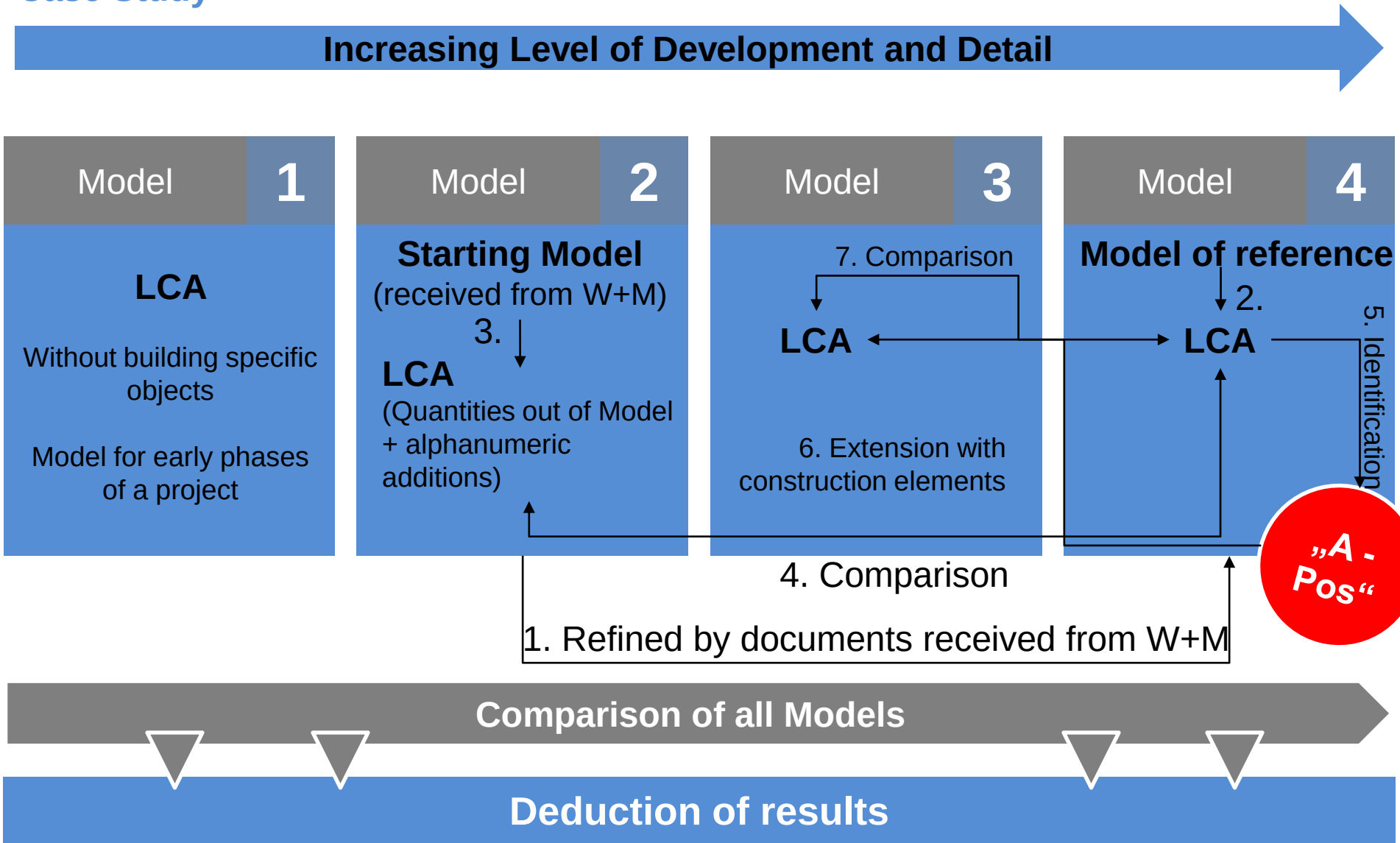
# … therefore properties have to be differentiated

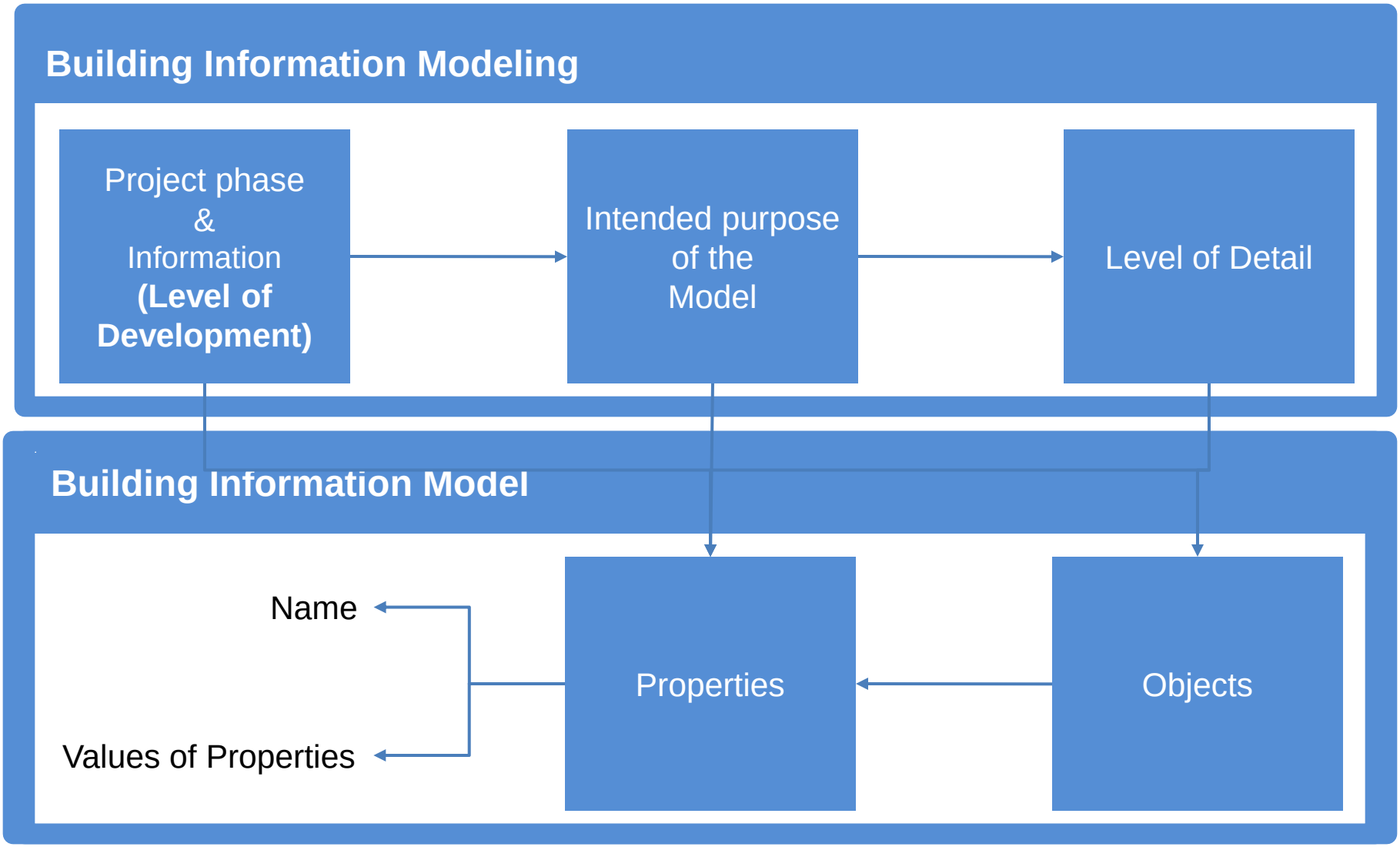
Properties for
IDENTIFICATION

Properties for
PROCESSES



## Case Study

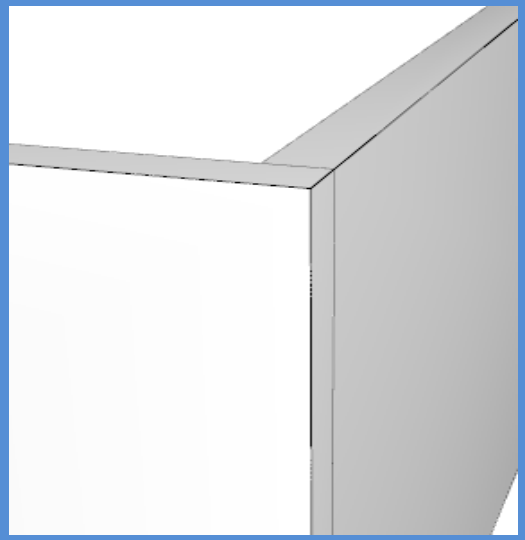

Increasing Level of Development and Detail
Model 1
LCA
Without building specific objects
Model for early phases of a project
Model 2
Starting Model
(received from W+M)
3.
LCA
(Quantities out of Model + alphanumeric additions)
Model 3
7. Comparison
LCA
6. Extension with construction elements
Model 4
Model of reference
2.
LCA
5. Identification
„A - Pos“
4. Comparison
1. Refined by documents received from W+M
Comparison of all Models
Deduction of results



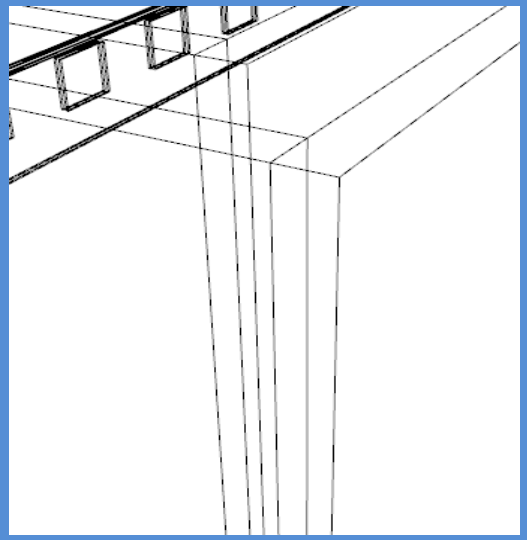

***Construction of Building Information Models with different LOD and LoD***

## Modeling exact geometric shape representation

## Not modeling exact geometric shape representation



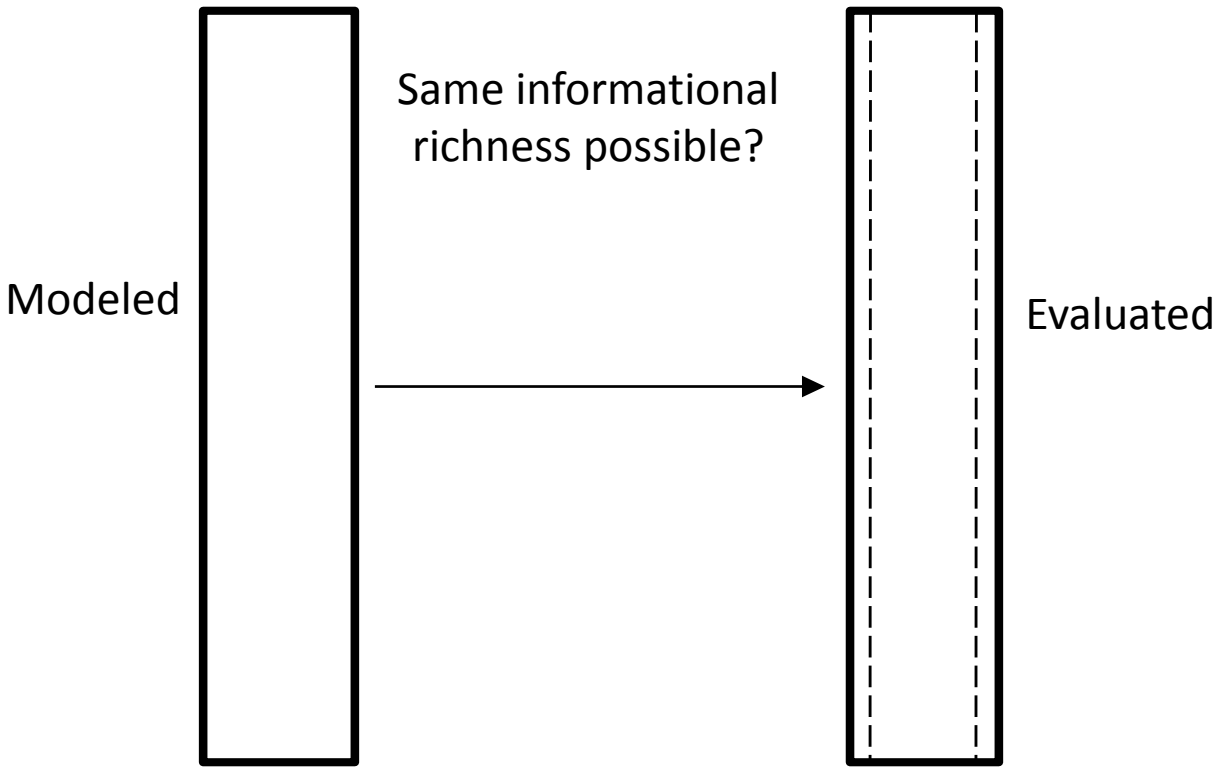
## Not modeling geometry



But all approaches should lead to the same informational content

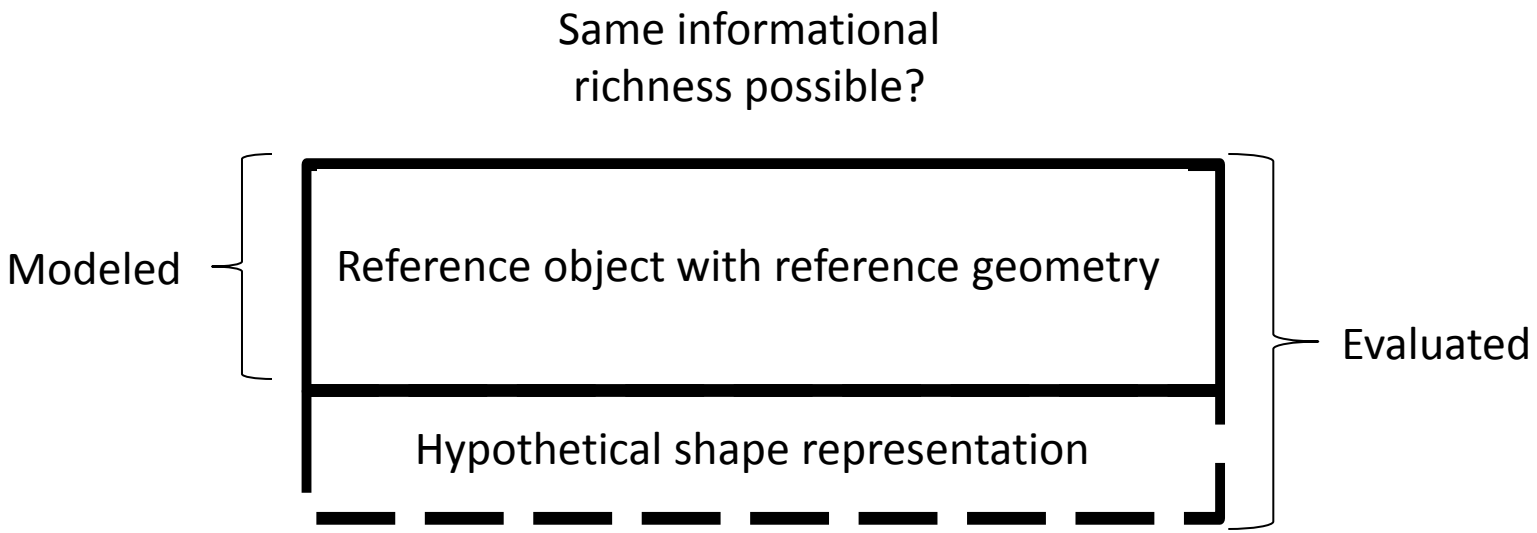
| Approach: | No exact shape representation | Target: | Derivation of different geometric shapes within an object |
|---|---|---|---|

## Requirements & challenges concerning Level of Detail

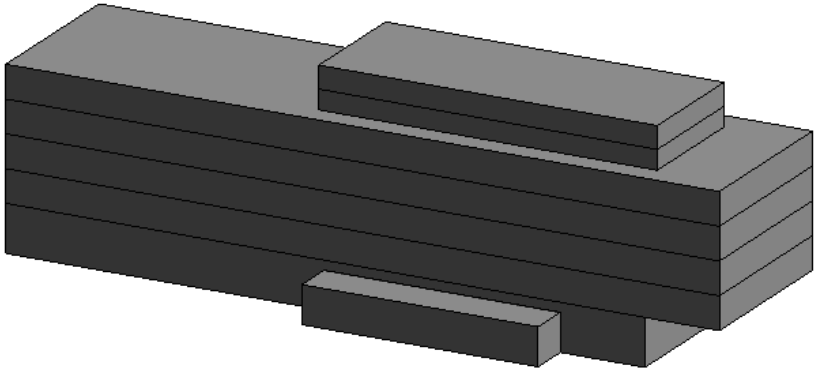


| Approach: | Not modeling geometry | Target: | Derivation of objects which are not modeled but have to be evaluated |
|---|---|---|---|

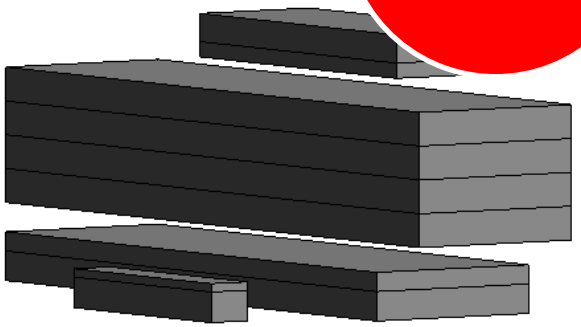
## Requirements & challenges concerning Level of Detail



Model 1



Principal of semantic containers



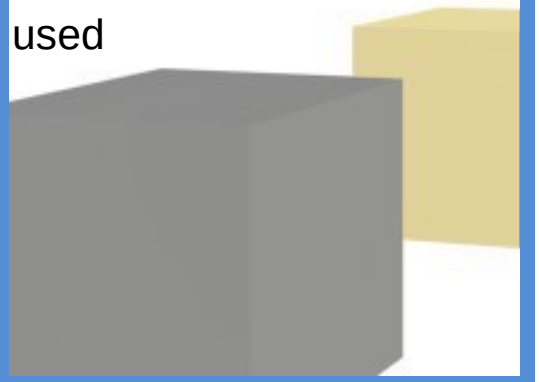
Building Information Model

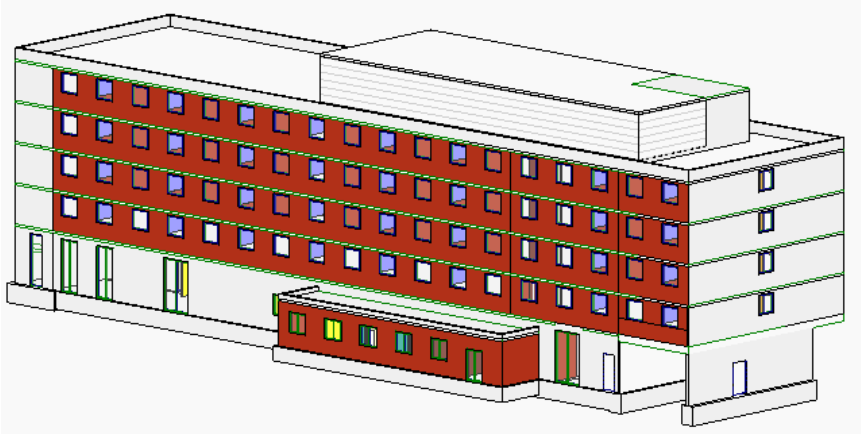
## 1 Objects

-Mass solids

## 2 Properties

-Only properties for identification have been used





Model 2a & 2b

## 1 Objects

- Building specific objects
- Foundations
- Walls
- Windows and doors
- Slabs

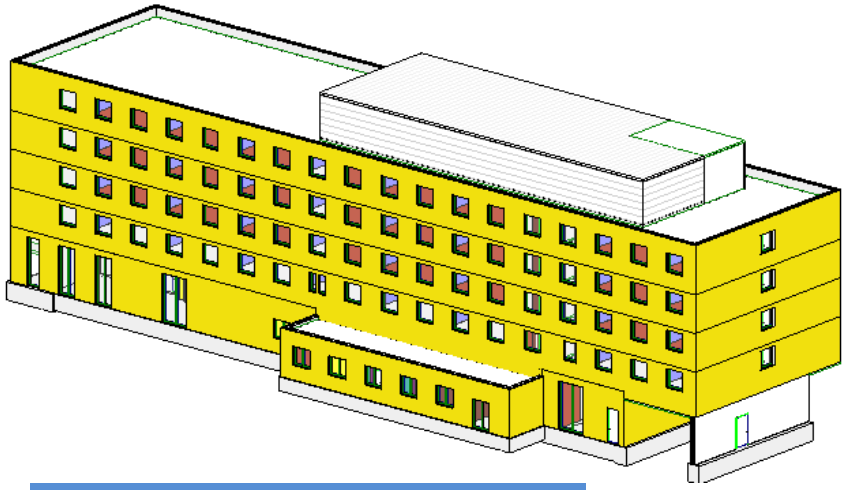
Building Information Model

Single shell objects

## 2 Properties

-Properties for identification
- -HTWG LCA material
- -HTWG LCA source
- -HTWG LCA craft
- -HTWG cost code no
- -HTWG cost code

-Properties for process
- -Needed values of the “Ökobau.dat”

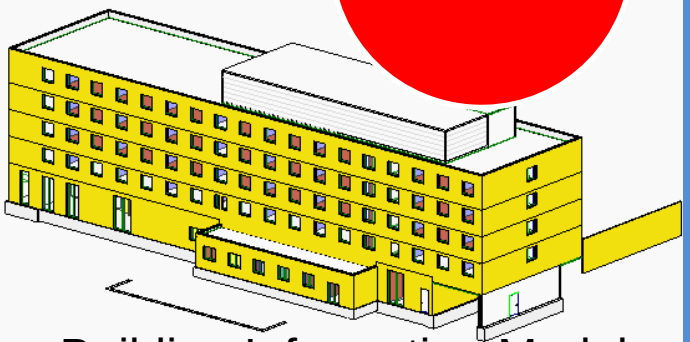


Model 3

## 1 Objects

- Building specific objects
- Foundations
- Walls
- Windows and doors
- Slabs
- Sweep elements

Extension with A-pos

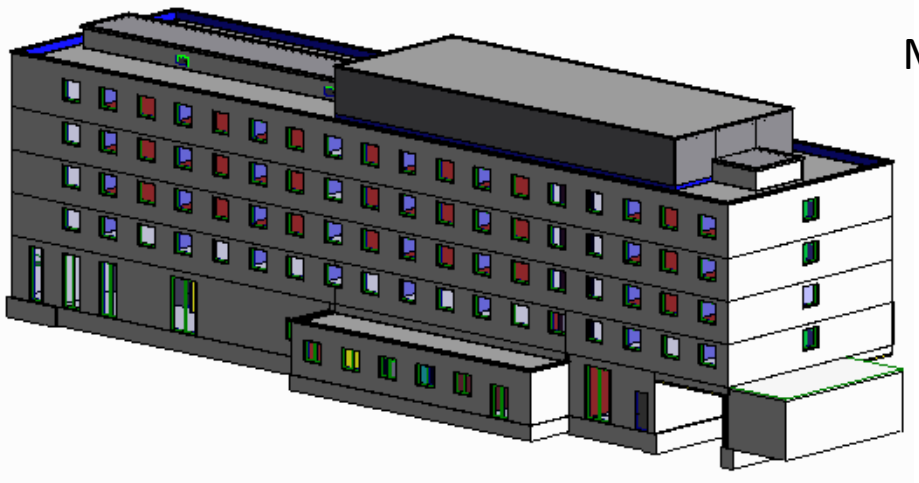


Building Information Model

## 2 Properties

-Properties for identification
- -HTWG LCA material
- -HTWG LCA source
- -HTWG LCA craft
- -HTWG cost code no
- -HTWG cost code

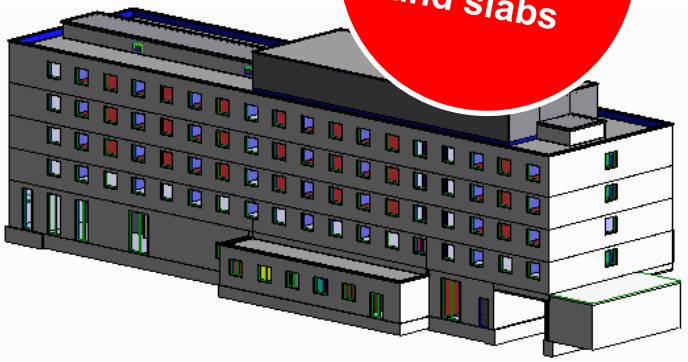
-Properties for process
- -Needed values of the “Ökobau.dat”



Model 4

## 1 Objects

- Building specific objects
- Foundations
- Walls
- Columns
- Windows and doors
- Slabs
- Facade
- Sweep elements

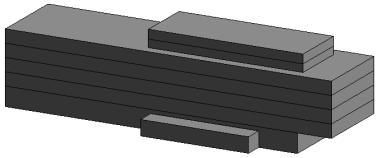
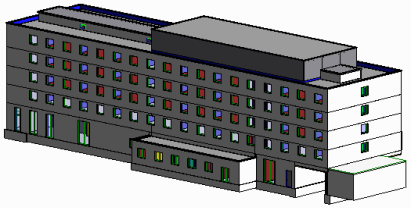
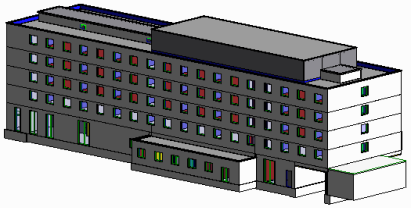
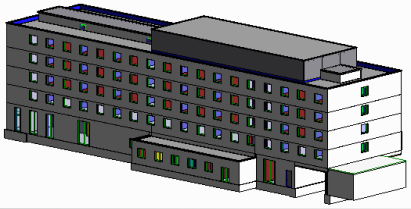
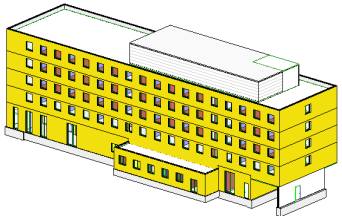
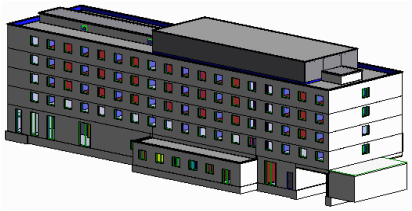



Building Information Model

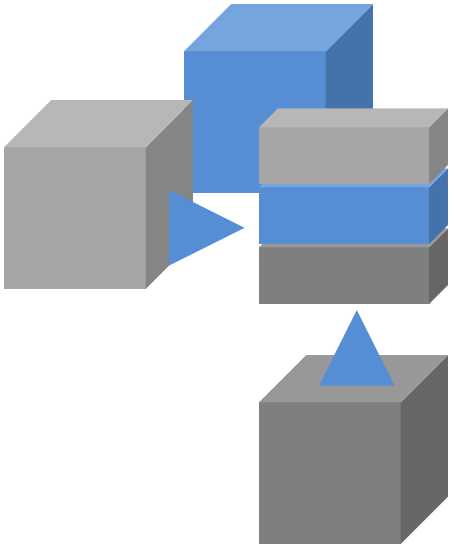
## 2 Properties

-Properties for identification
- -HTWG LCA material
- -HTWG LCA source
- -HTWG LCA craft
- -HTWG cost code no
- -HTWG cost code

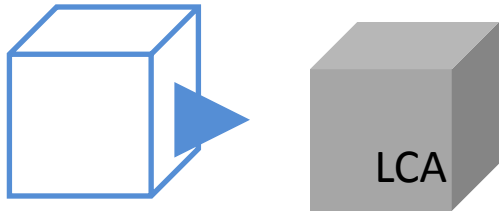
-Properties for process
- -Needed values of the “Ökobau.dat”

| Models which are related to the Model of reference | | Model of reference | Deviation of models concerning LCA |
|---|---|---|---|
| Principal of semantic containers |  |  | 56% |
| Building specific objects. Single shell. |  |  | 73% |
| Building specific objects. For the quantity take off alphanumeric is used. Single shell. |  |  | 55% |
| Building specific objects which have a high impact concerning LCA are added. Double shell. |  |  | 9% |

The rules for construction can help to reach a satisfying informational content with a lower LoD



Objects and Attributes are depending heavily on contained datasets of the Ökobau.dat




To receive better results in early phases of a project further datasets are required