

Erfahrungen mit 3D (CityGML) Stadtmodellen

2010-06-25

Karl-Heinz Häfele

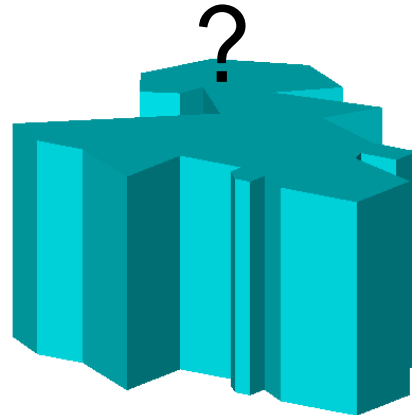
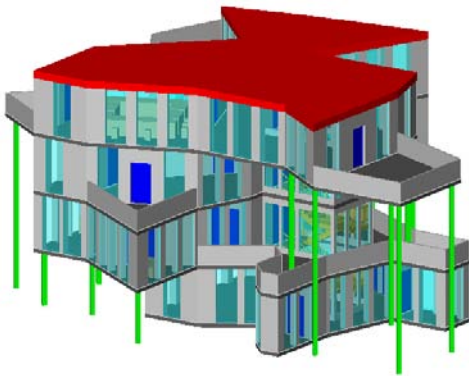
Institut für Angewandte Informatik (IAI)

Allgemein

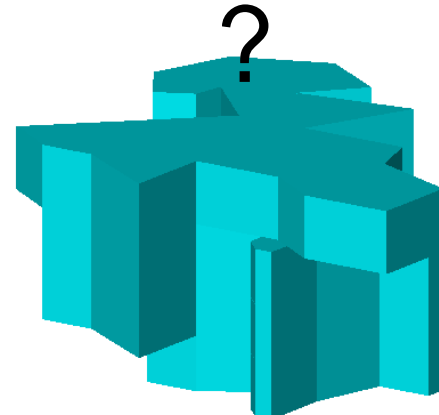
- Betrachtung der Modelle nicht nur unter Visualisierungsaspekten
- Betrachtung von Modellen mit entsprechender Semantik (Dächer, Wände usw.)
- Flächen mit nicht korrekter Orientierung (Flächennormalen)
- Nicht ebene Flächen
- Fehlende Referenz Koordinatensysteme

LoD 1 Klötzchenmodelle

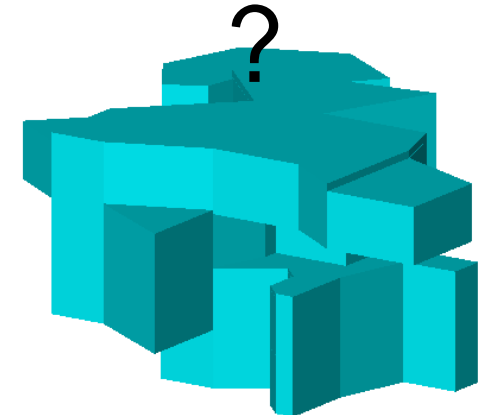
■ Definition



Volumen 3403 m³

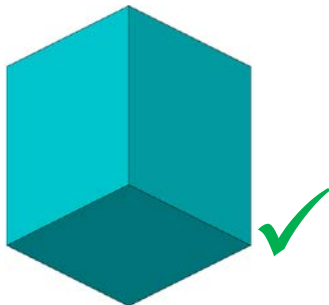


Volumen 2249 m³

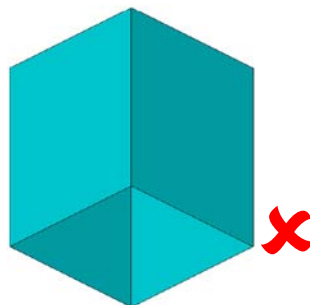


Volumen 2055 m³

■ Vollständigkeit



Solid unter geschlossen



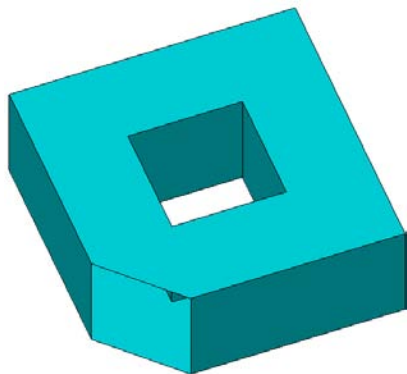
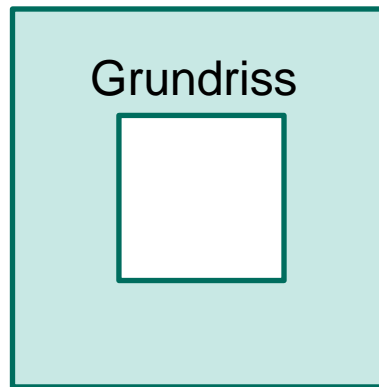
Solid unter offen

| | Solid geschlossen | Solid offen |
|-------------|--------------------|----------------------|
| Rhino | 150 m ³ | 125m ³ * |
| IfcExplorer | 150 m ³ | 150 m ³ * |

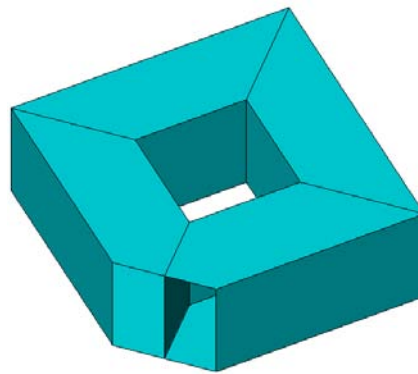
* Mit Fehlermeldung

LoD 1 Klötzchenmodelle

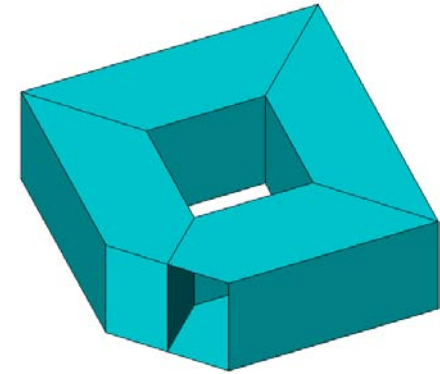
■ Modellstruktur (BuildingParts)



1 Building
1 Solid



1 Building
1 CompositeSolid
4 Solids

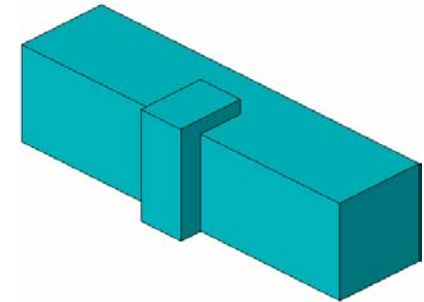
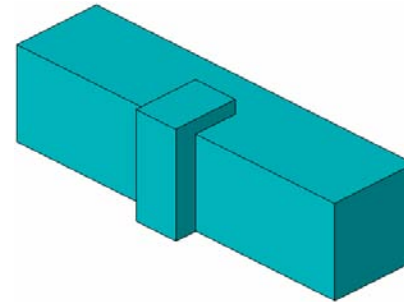
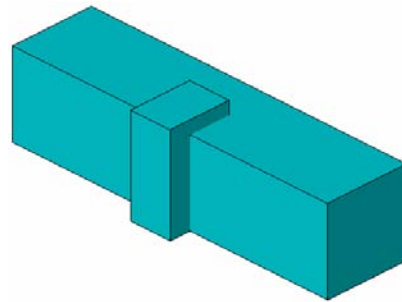
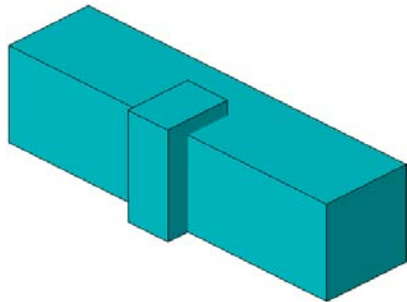
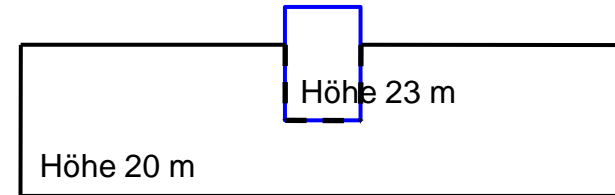
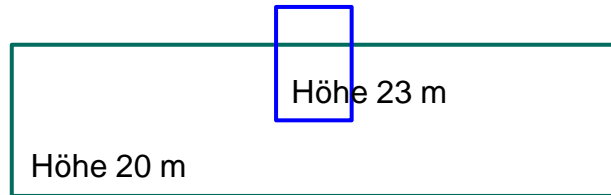


1 Building
4 BuildingParts
4 Solids



LoD 1 Klötzchenmodelle

■ Durchdringungen



1 Building
1 BuildingParts
2 Solids
Volumen: 35450 m³ !

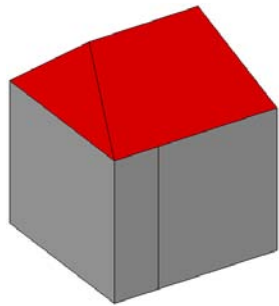
1 Building
1 CompositeSolid
2 Solids
Volumen: 35450 m³ ✗

1 Building
1 BuildingParts
2 Solids
Volumen: 33450 m³ ✓

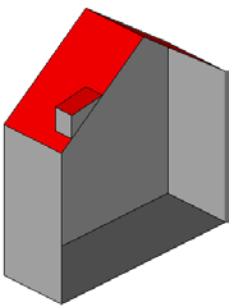
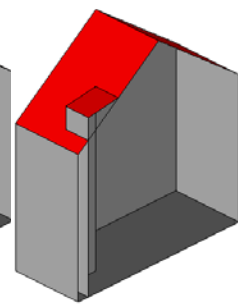
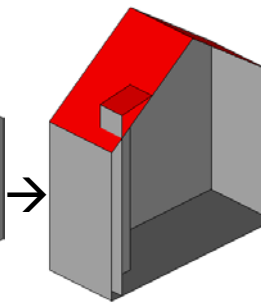
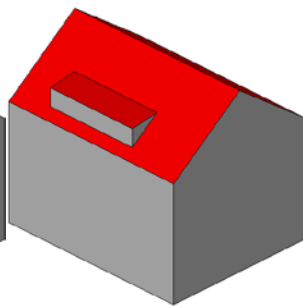
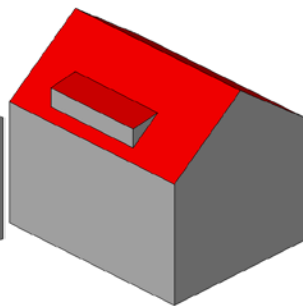
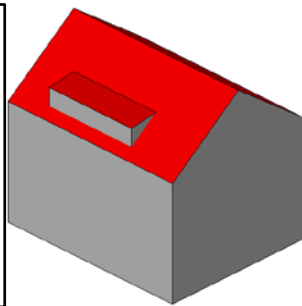
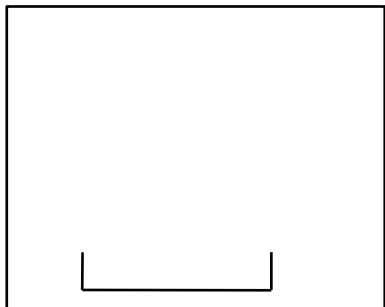
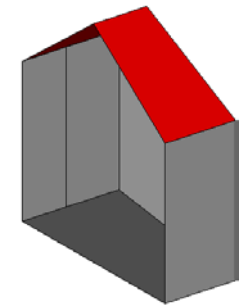
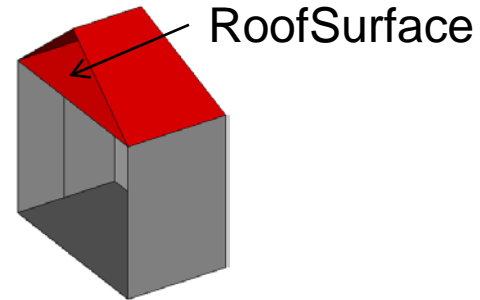
1 Building
1 CompositeSolid
2 Solids
Volumen: 33450 m³ ✓

LoD 2 mit Semantik

Außenhülle I

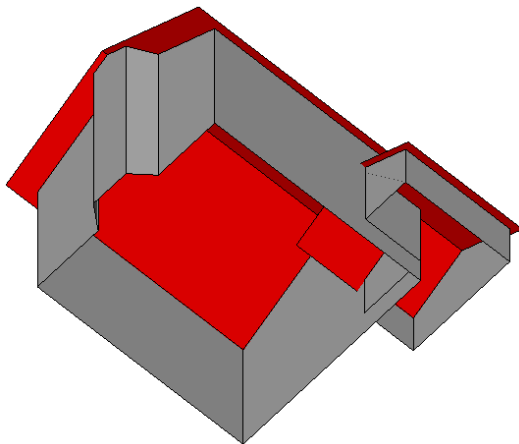
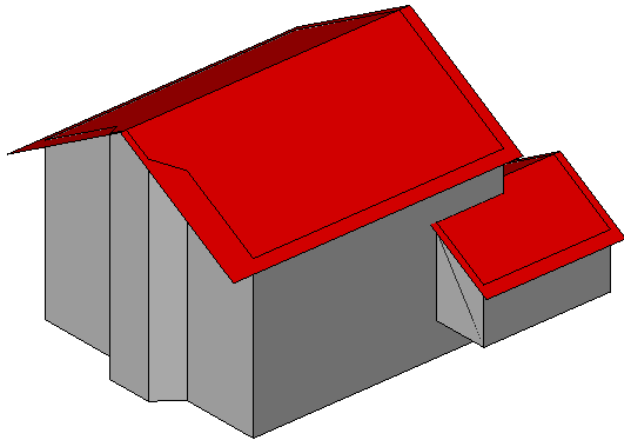


| | |
|-----------------------|---|
| CityGML Modell | 1 |
| CityGML Building | 1 |
| CityGML RoofSurface | 5 |
| CityGML WallSurface | 7 |
| CityGML GroundSurface | 1 |

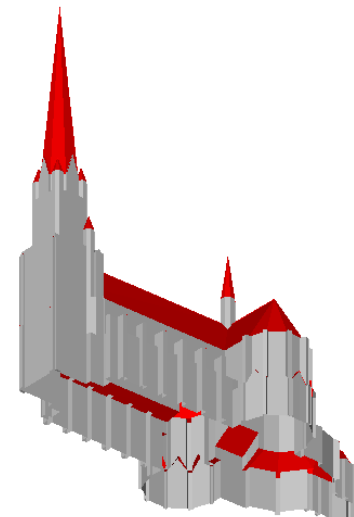
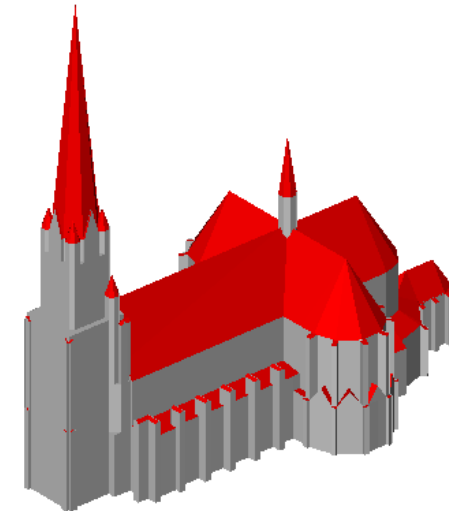


LoD 2 mit Semantik

■ Außenhülle II



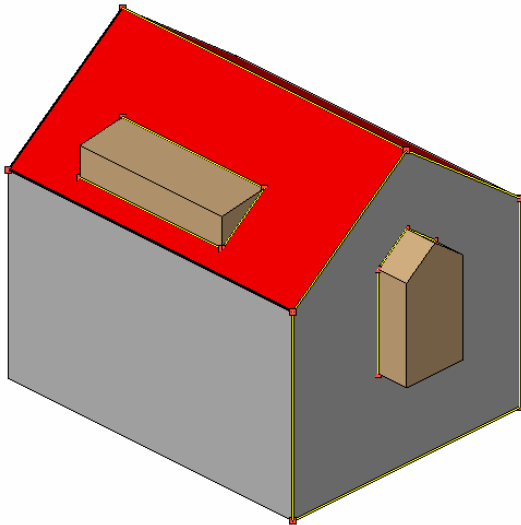
Courtesy of Prof. Henning Karlsruhe



Courtesy of Stadt Karlsruhe

LoD 2 mit Semantik

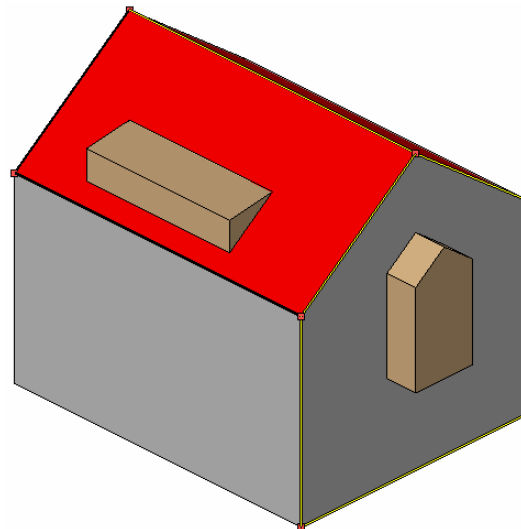
■ Building Installations ⇔ Boundary Surfaces



Erker und Dachgaube als Building Installation mit Ausschnitte der Gebäudebegrenzungsflächen

Vorteil:

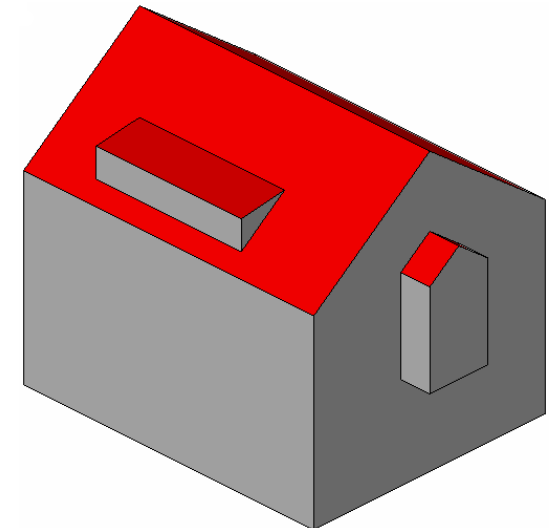
Flächeninhalt der Begrenzungsflächen ist „korrekt“



Erker und Dachgaube als Building Installation ohne Ausschnitte der Gebäudebegrenzungsflächen

Vorteil:

Building Installations können ausgeblendet werden



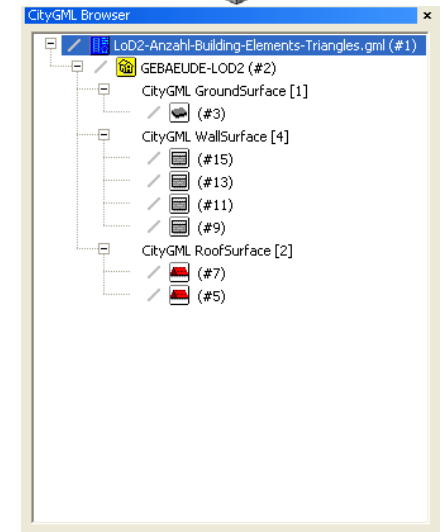
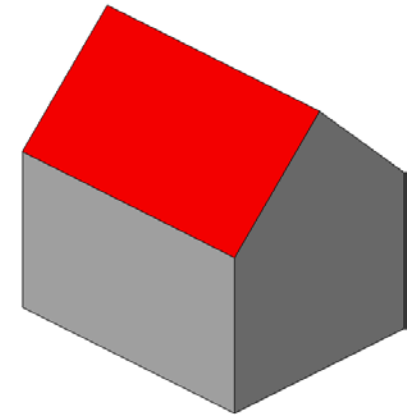
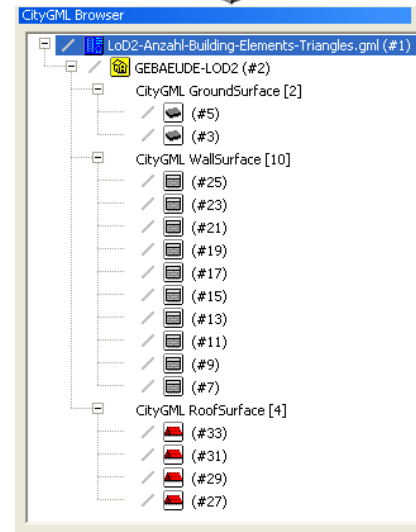
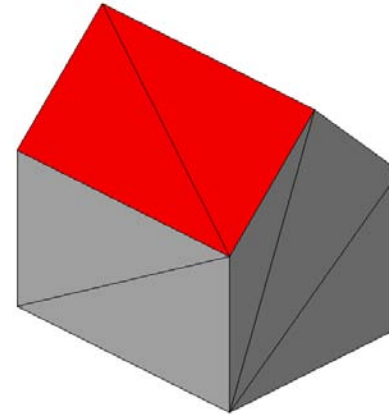
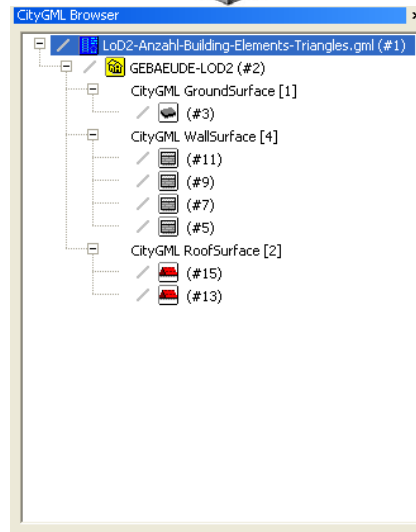
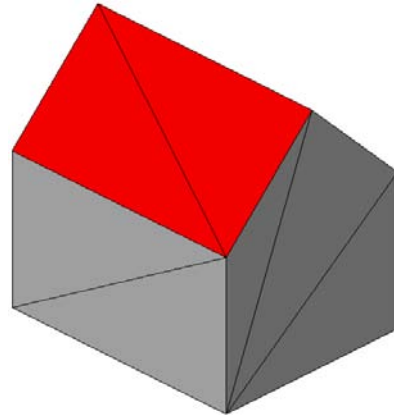
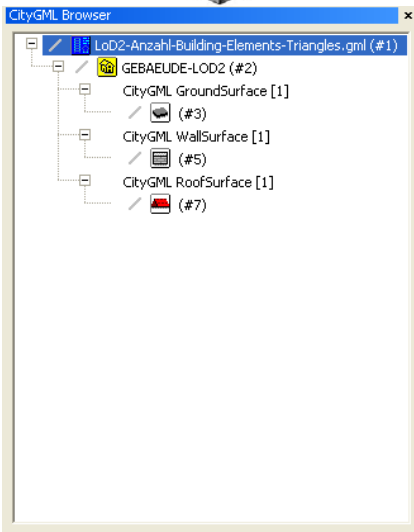
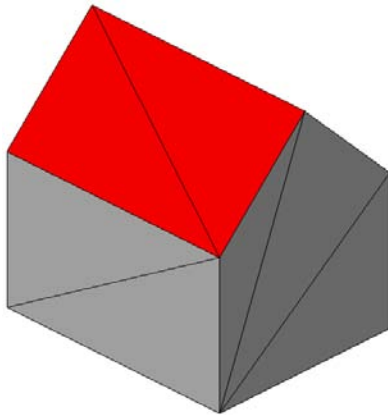
Erker und Dachgaube als Gebäudebegrenzungsflächen

Vorteil:

Flächeninhalt der Begrenzungsflächen ist korrekt

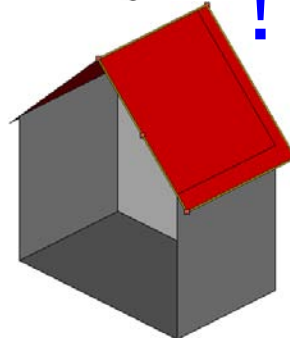
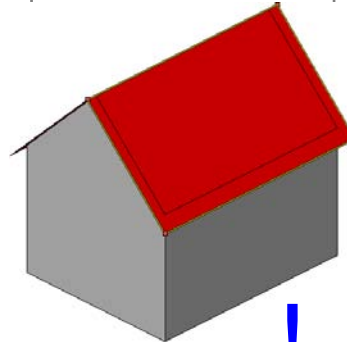
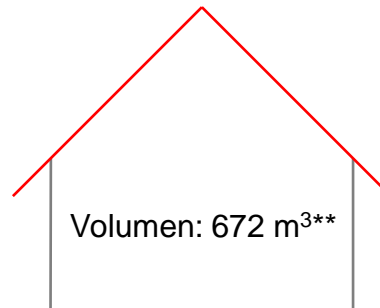
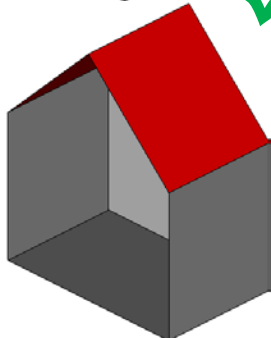
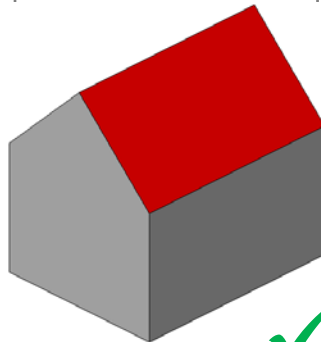
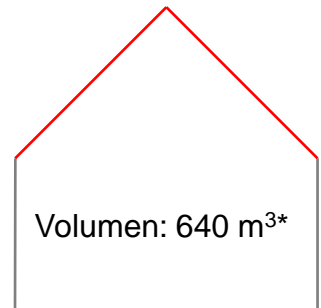
LoD 2 mit Semantik

■ Anzahl der Begrenzungsflächen

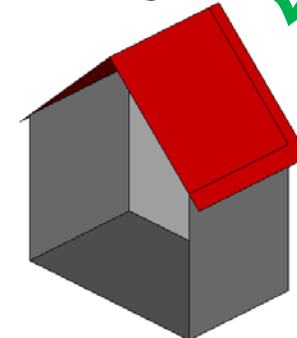
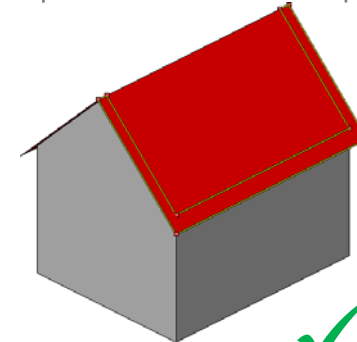
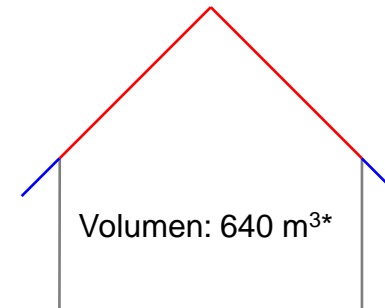


LoD 2 mit Semantik

■ Dachvorsprünge I



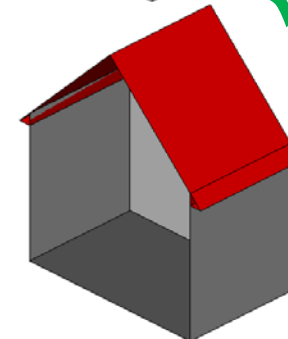
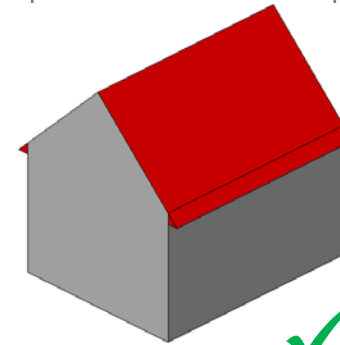
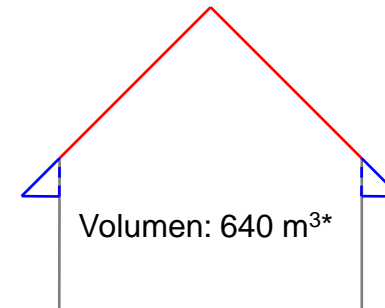
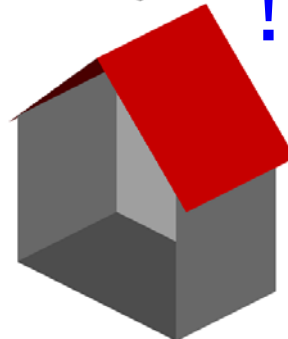
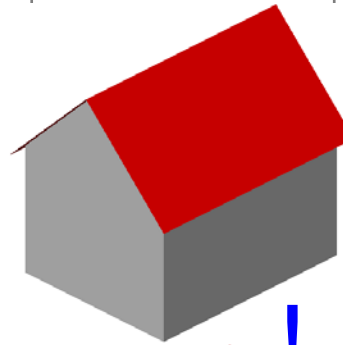
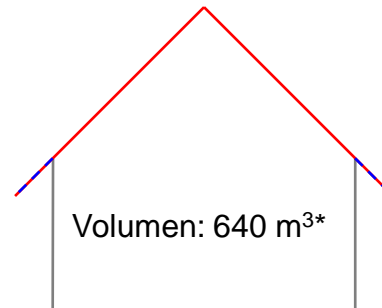
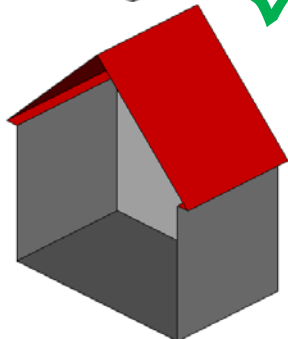
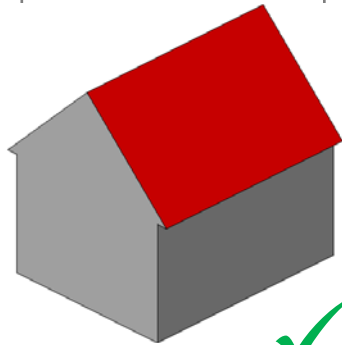
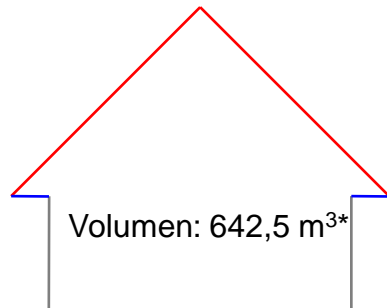
** Warnung



* Berechnet in Rhino

LoD 2 mit Semantik

■ Dachvorsprünge II

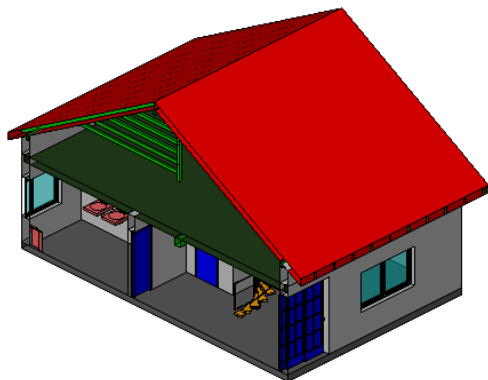
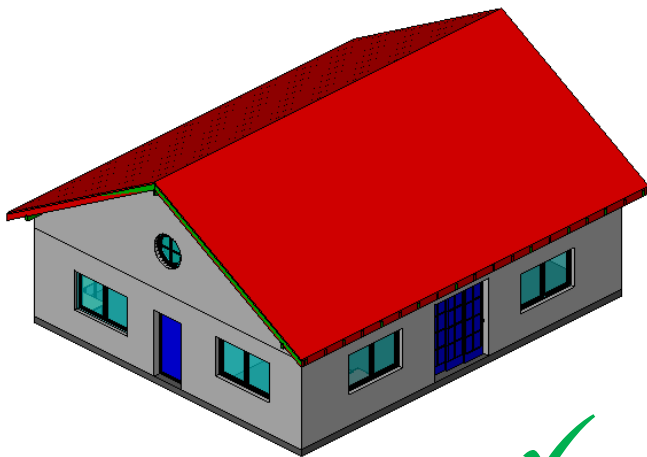


* Berechnet in Rhino

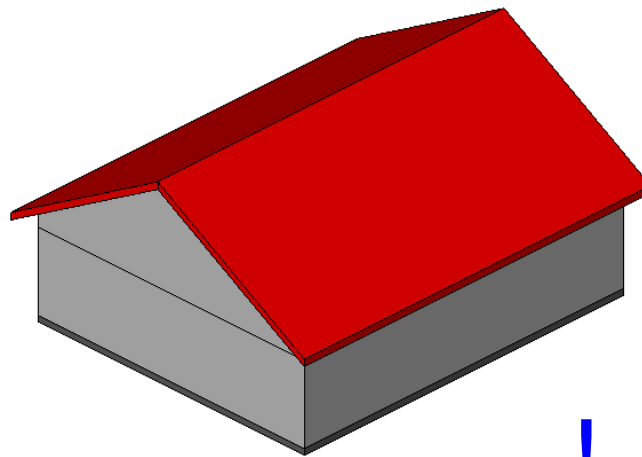
LoD 2 mit Semantik

■ Volumetrische Bauteile

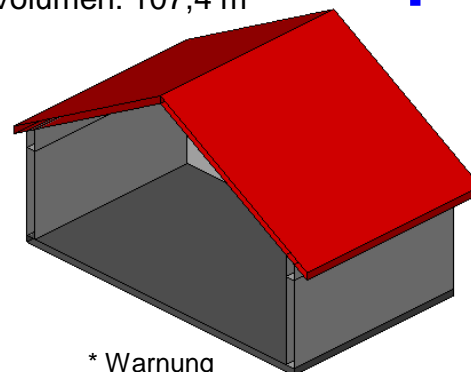
IFC



CityGML

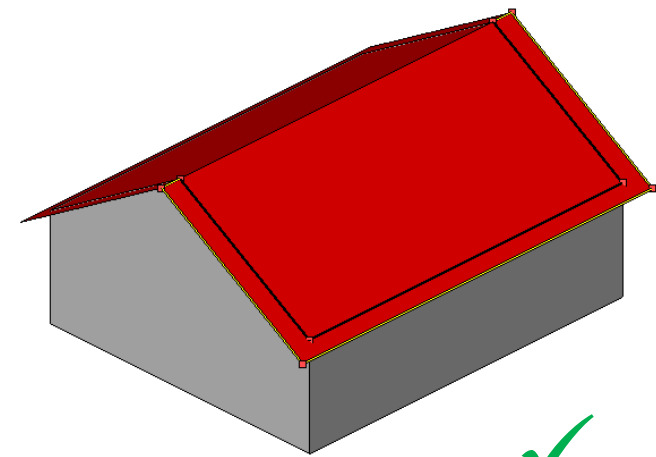


Volumen: 107,4 m³*

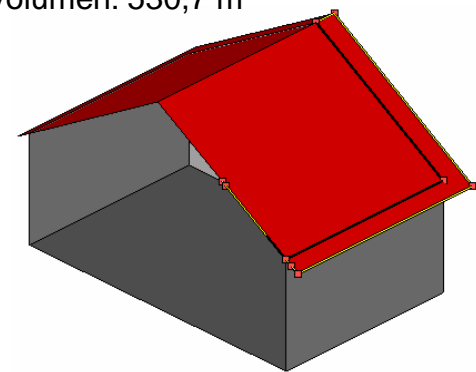


* Warnung

CityGML

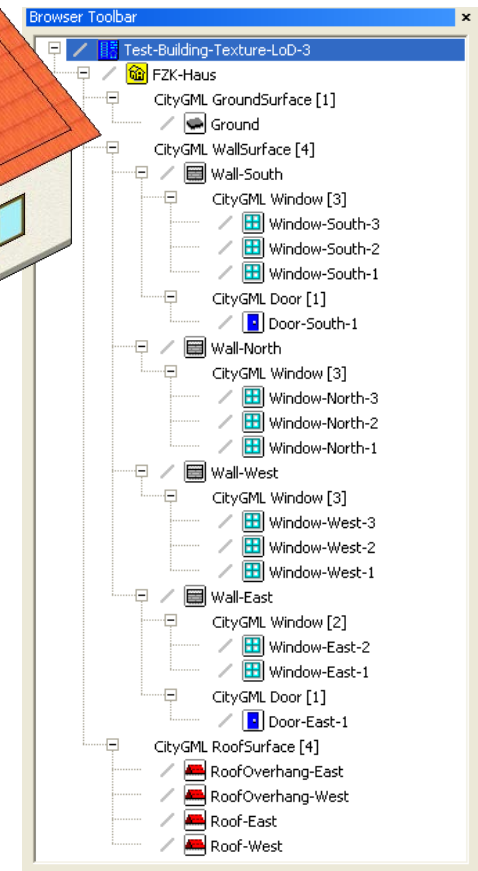
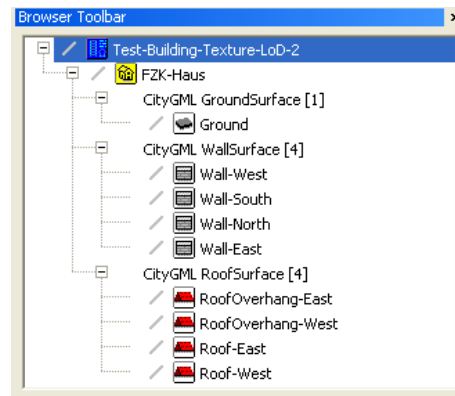
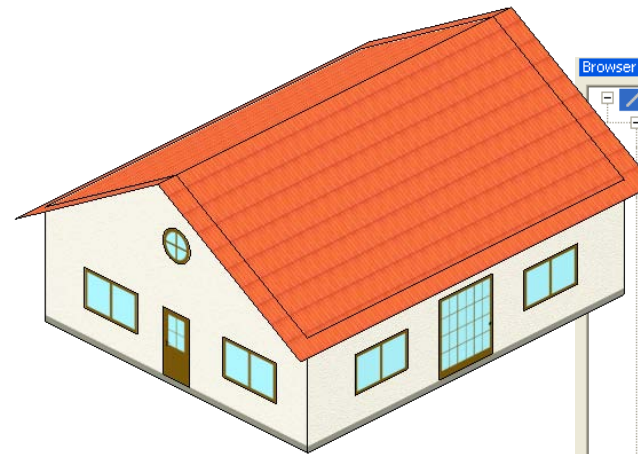


Volumen: 530,7 m³



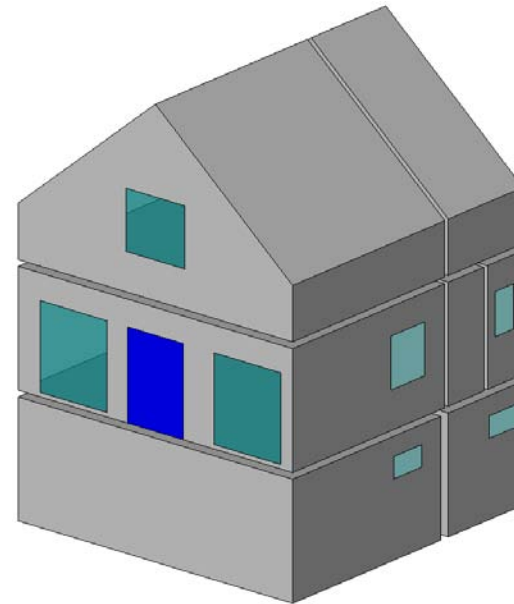
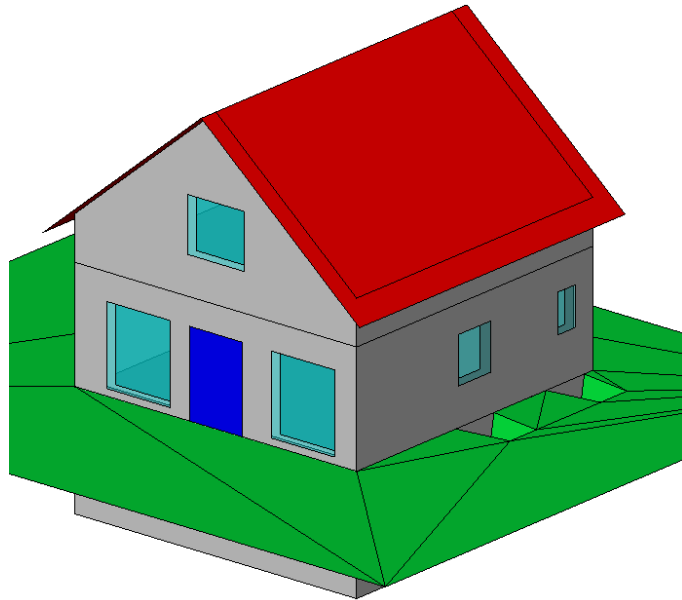
LoD 3 mit Semantik

■ Semantik durch Texturen?



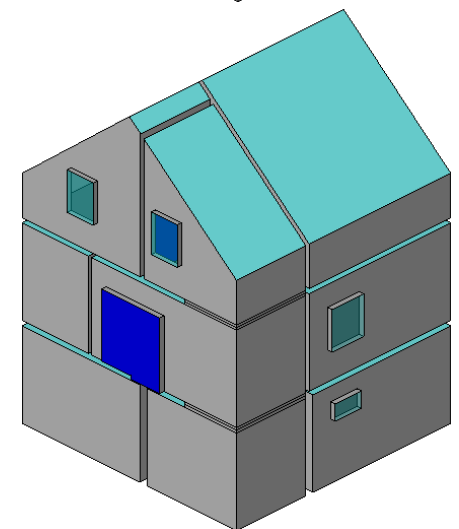
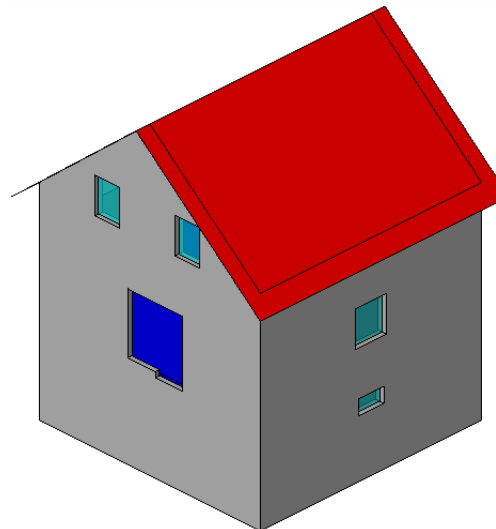
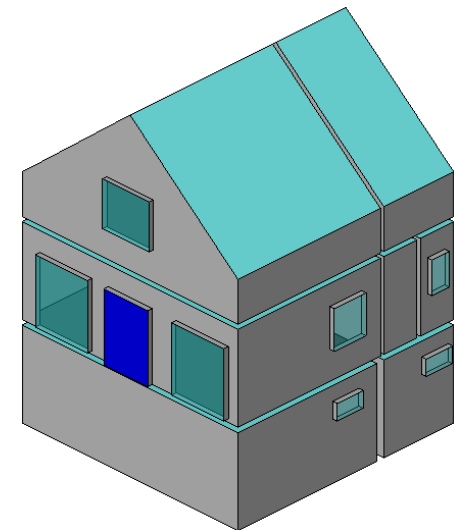
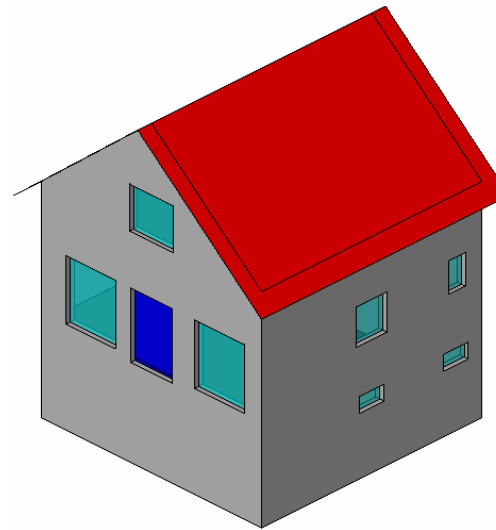
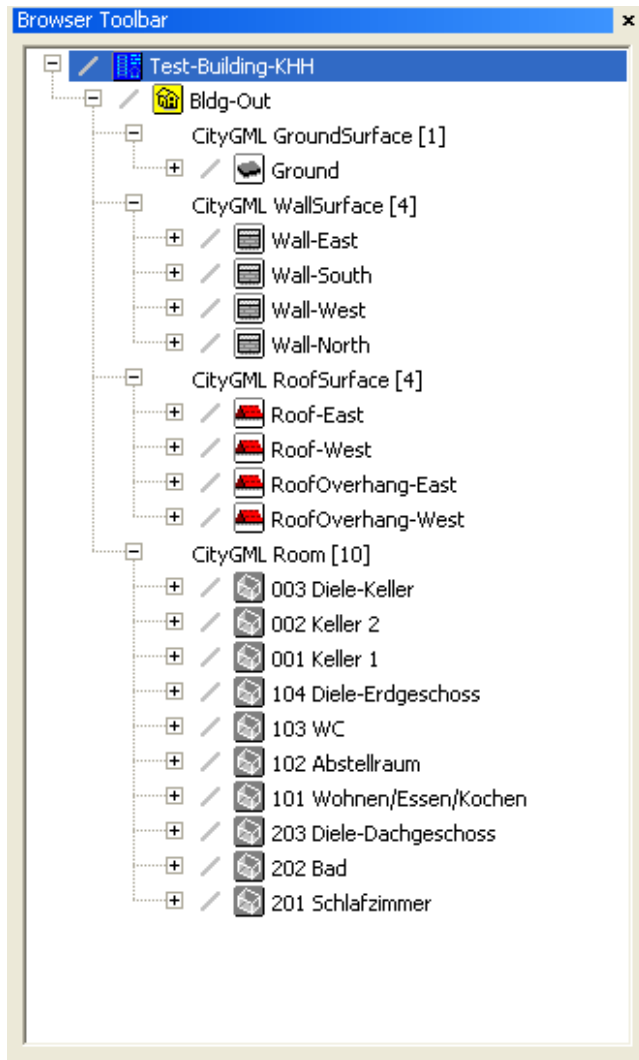
LoD 4 Semantik

■ Fenster und Türen



- Ohne Verwendung von Xlinks doppelte Anzahl von Fenster und Türen
- Bei der Verwendung von Xlinks nur eine Geometrie möglich

LoD 4 Semantik



Zusammenfassung

- Definition der einzelnen Level of Detail
- Strukturierung von Gebäuden mit Building Parts
- LoD 1 nur noch Solid Geometrie zulassen
- Definition Außenhülle
- Verwendung von Dachüberständen
- Definition von Innenräumen
- Erweiterung der Semantik (neue Boundary Surfaces, Building Installations)
- Modelle im Lebenszyklus

