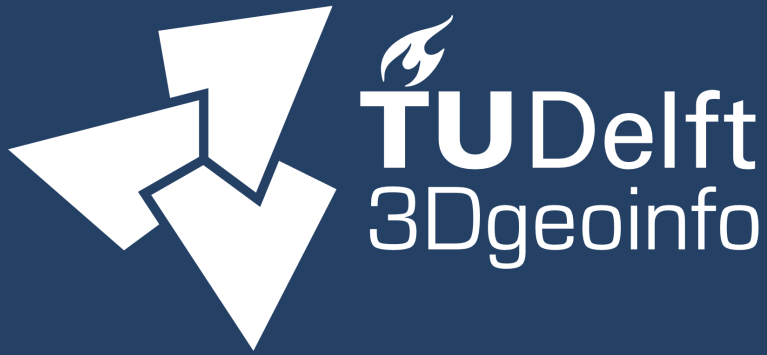
Basisbestand 3D geluid

Ravi Peters, Balázs Dukai, Tom Commandeur, Jantien Stoter

AHN congres, Utrecht, 16-04-2019

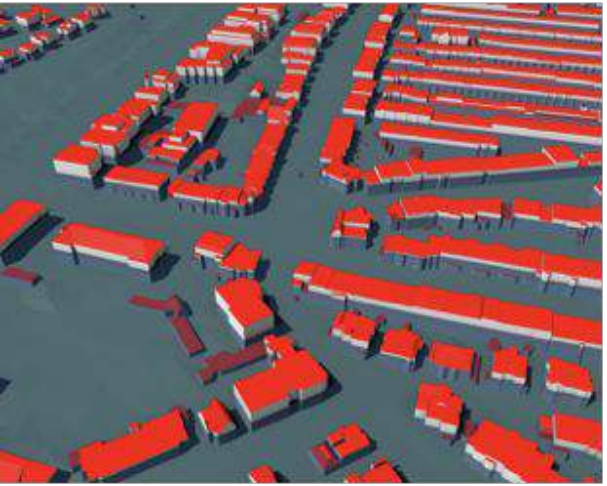


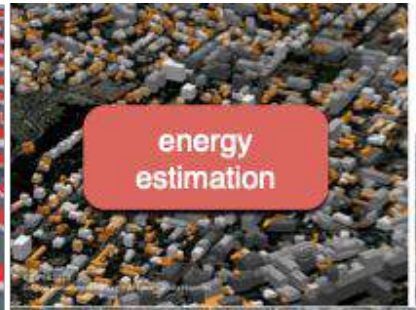
3D geoinformation group @ TU Delft

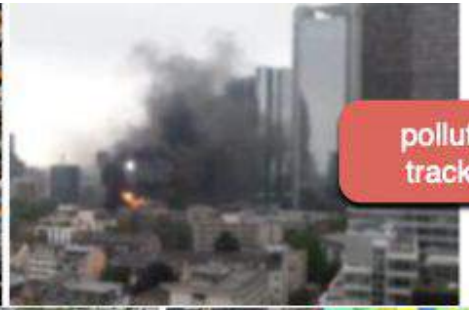
- Reconstruction, modelling and application of 3D geoinformation

3D geoinformation

Department of Urbanism
Faculty of Architecture and the Built Environment
Delft University of Technology




energy
estimation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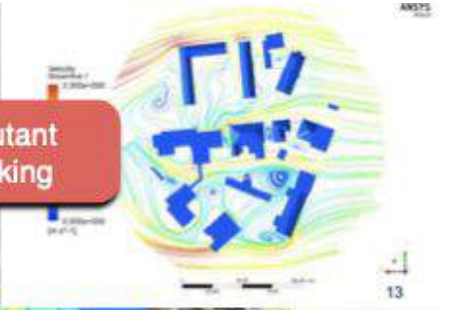
tracking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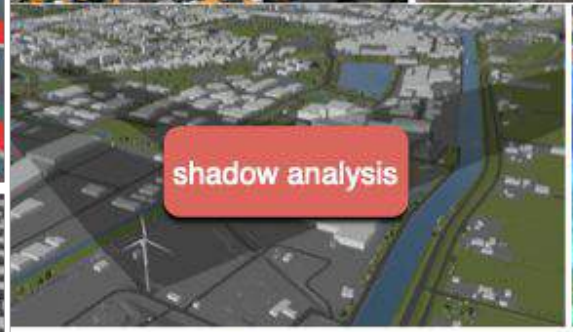
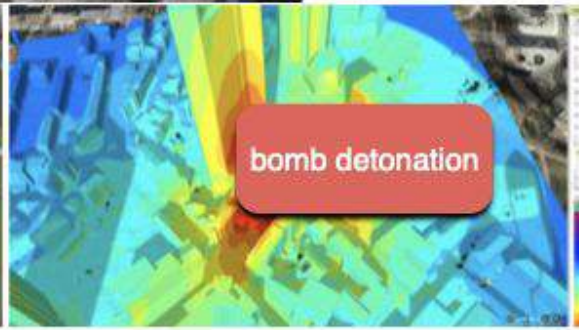
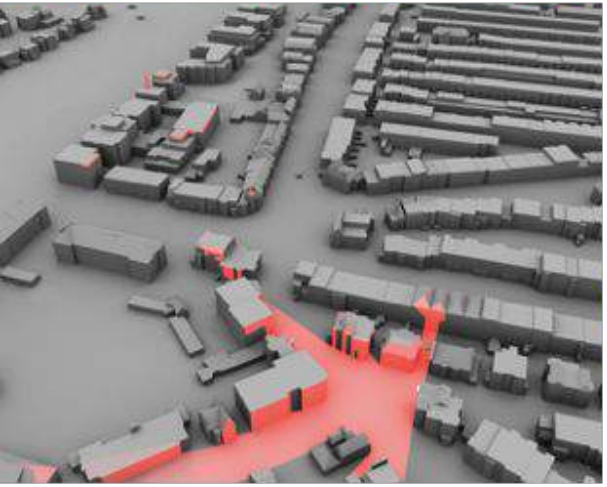
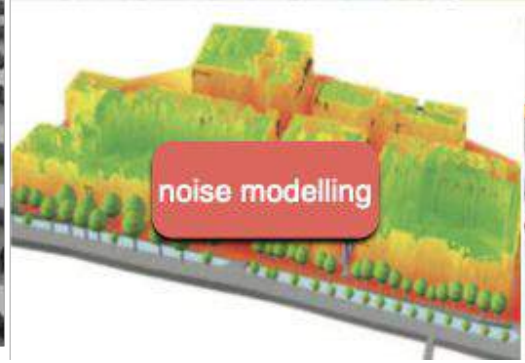
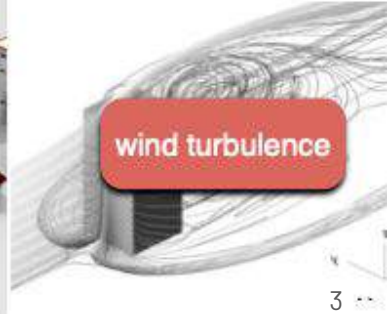

shadow analysis


bomb detonation



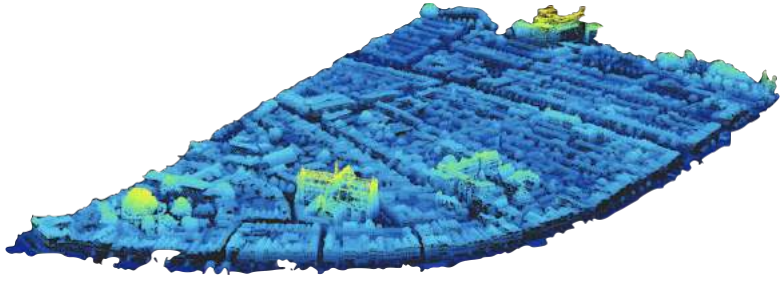

noise modelling


solar potential


wind turbulence

3dfier

Urban scene reconstruction from BGT + point cloud



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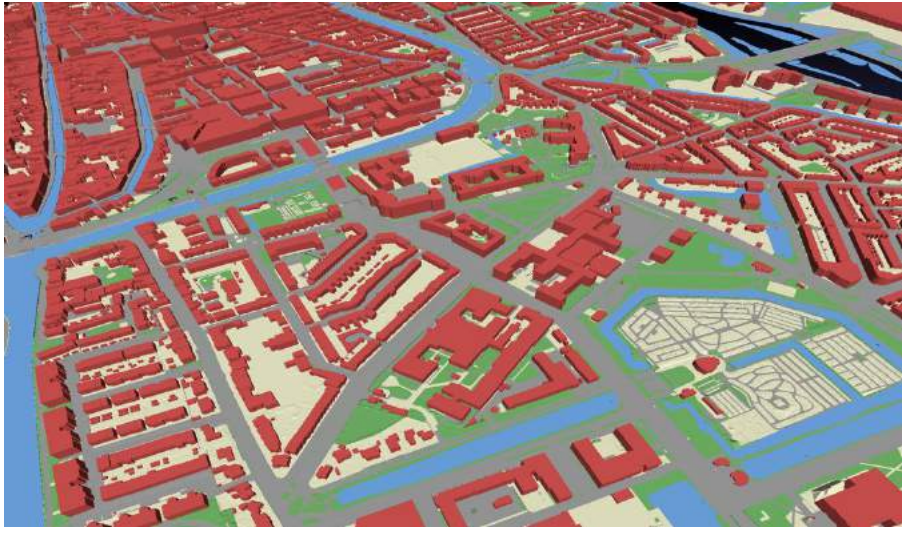
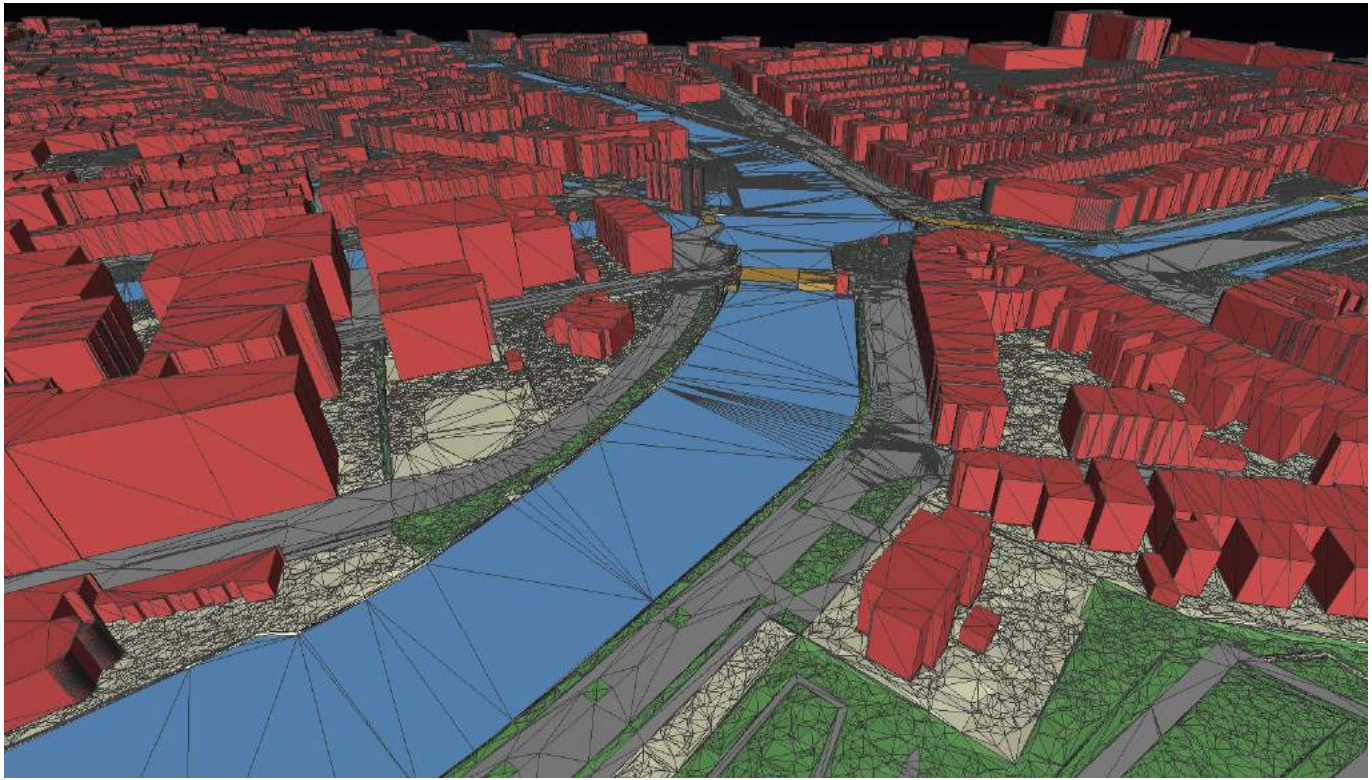


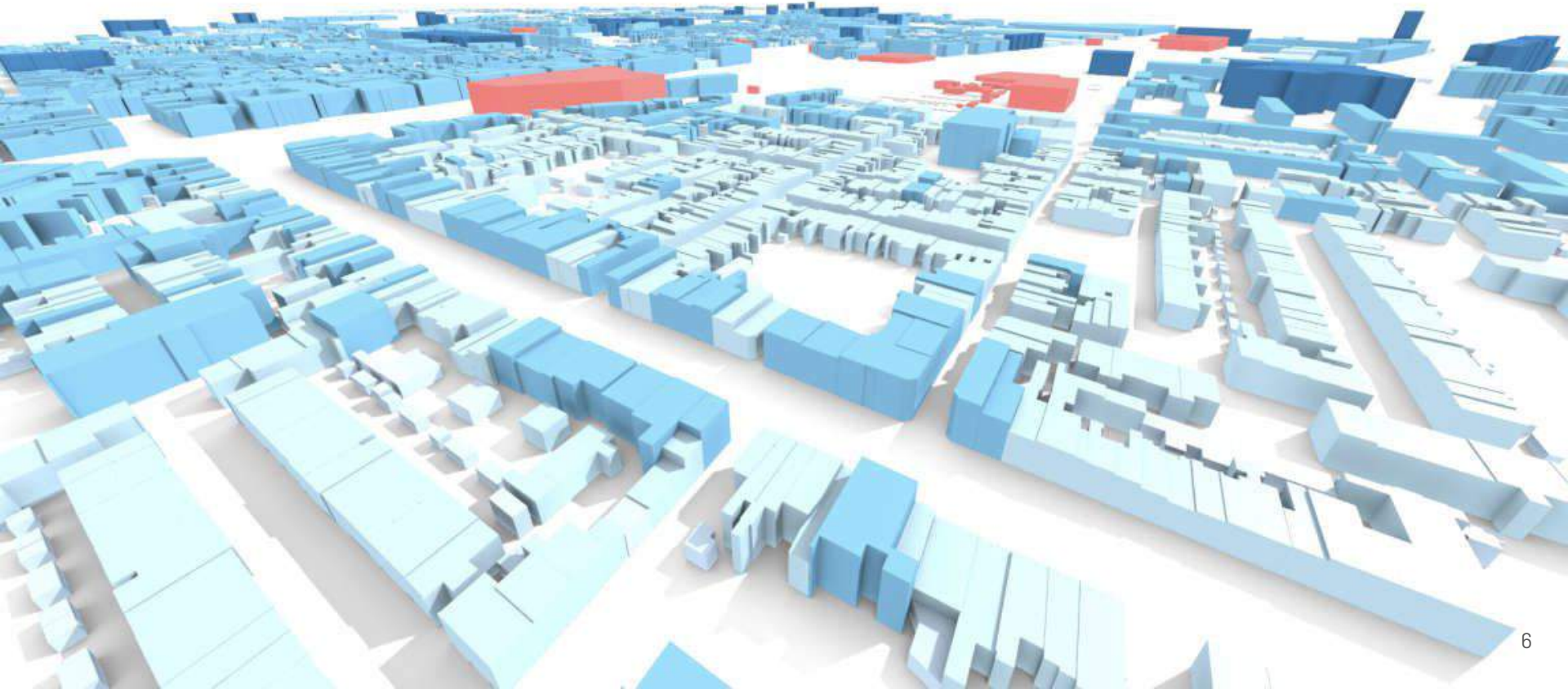
3dfier

Open source software: https://github.com/tudelft3d/3dfier/



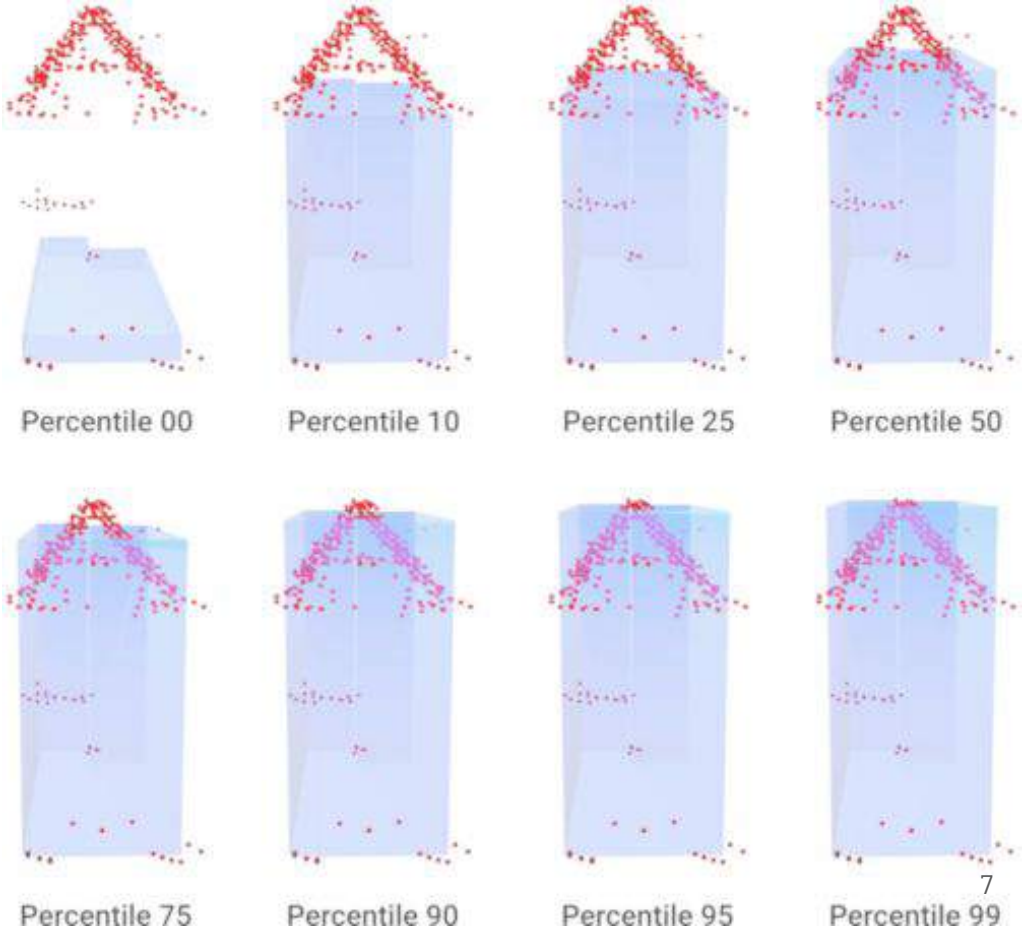
3D BAG

Reliable and up to date LoD1 building heights for BAG based on AHN3



3D BAG - Attributes

Attribute	Description
`ground-00, ground-10, ground-20, ground-30, ground-40, ground-50`	The height of the ground surface of the building at the given percentile.
`roof-25, roof-50, roof-75, roof-90, roof-95, roof-99`	The height of the roof surface of the building at the given percentile. For example roof-99 is the height of the building when the roof surface is set at the 99th percentile of the z-coordinates of the point cloud of the building.
`rmse-25, rmse-50, rmse-75, rmse-90, rmse-95, rmse-99`	The Root Mean Square Error or the geometric difference between the 3D building model and the point cloud that was used for generating the model. Or, the average discrepancy in meters between the 3D building model and the real-world building. This measure also accounts for the whole building, not only the roof.
`roof_flat`	Indicates that roof of the real-world building is flat or not. The value 1 means a flat roof, the value 0 means a not flat roof. **The classification is still under development, with a current accuracy of 80%.**
`nr_ground_pts`	The number of points in the point cloud that were used for determining the ground-height of the building model. If this value is 0, that means that the ground-points are missing from the point cloud at given model.
`nr_roof_pts`	The number of points in the point cloud that were used for determining the roof-height of the building model. If this value is 0, that means that the roof-points are missing from the point cloud at given model.
`ahn_version`	The version of the AHN that was used to obtain the height information.
`ahn_file_date`	The creation date of the AHN file that was used to obtain the height information. This is not the same as the timestamp of the LiDAR points of a particular building.
`height_valid`	0 – invalid height, because the building was build after the point cloud was acquired; 1 – valid height, because the building was built before the point cloud was acquired
`tile_id`	The ID of the tile where the building belongs to.

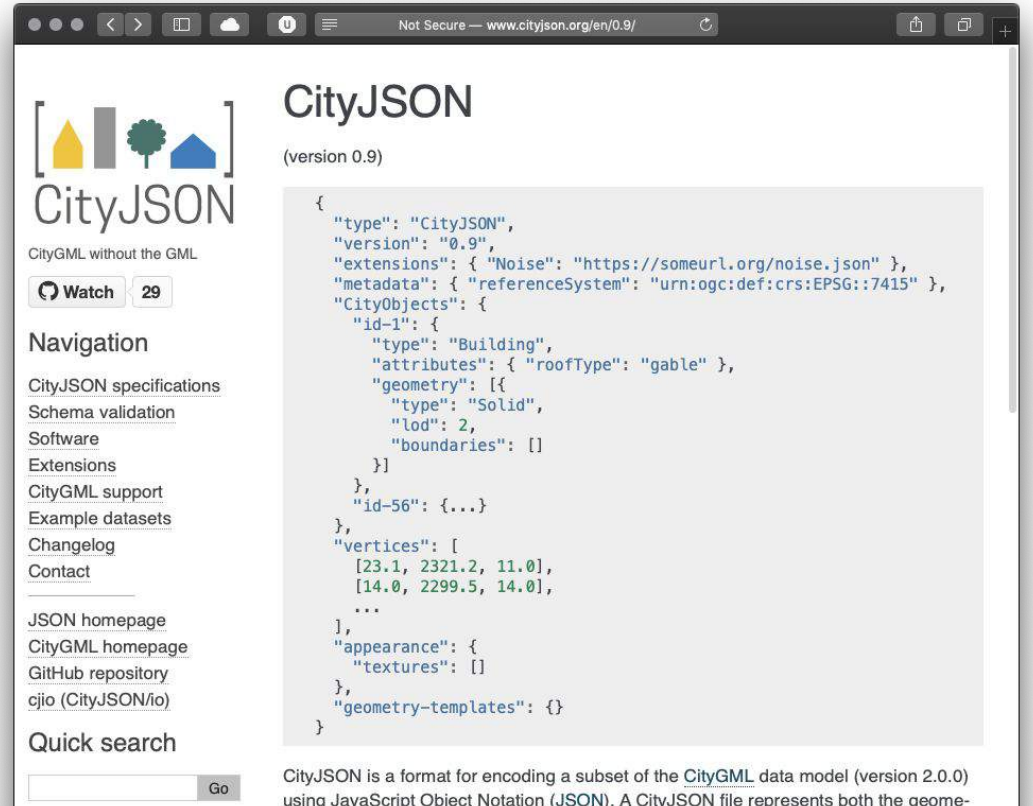


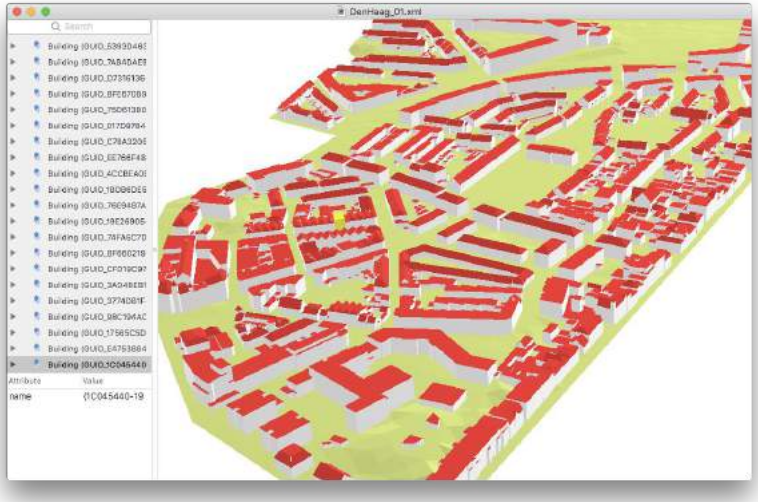
3D BAG

Web app, documentation, downloads and WMS/WFS available at 3dbag.bk.tudelft.nl

CityJSON - CityGML without the GML

A JSON encoding for CityGML - http://www.cityjson.org



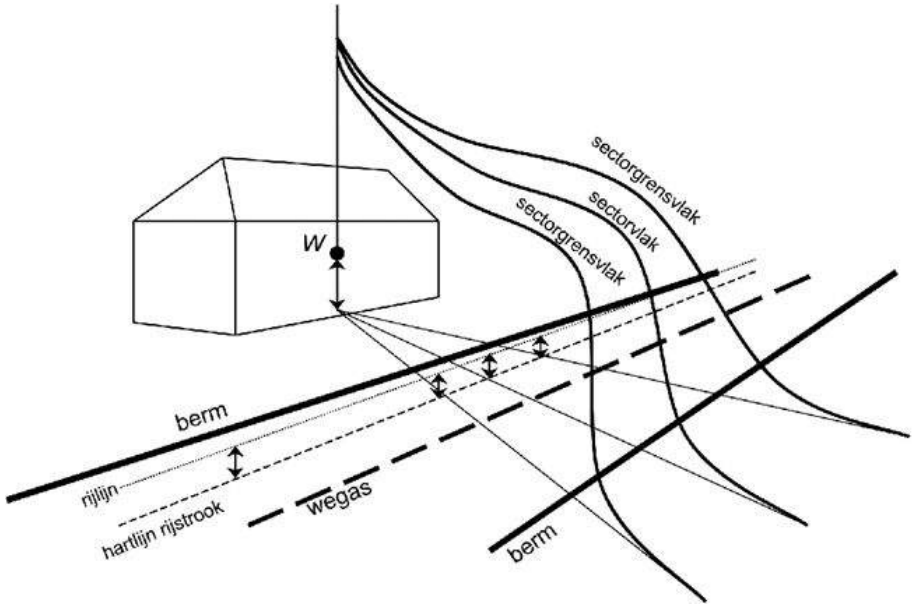


Azul - open source macOS viewer for city models
https://github.com/tudelft3d/azul

Basisbestand 3D geluid

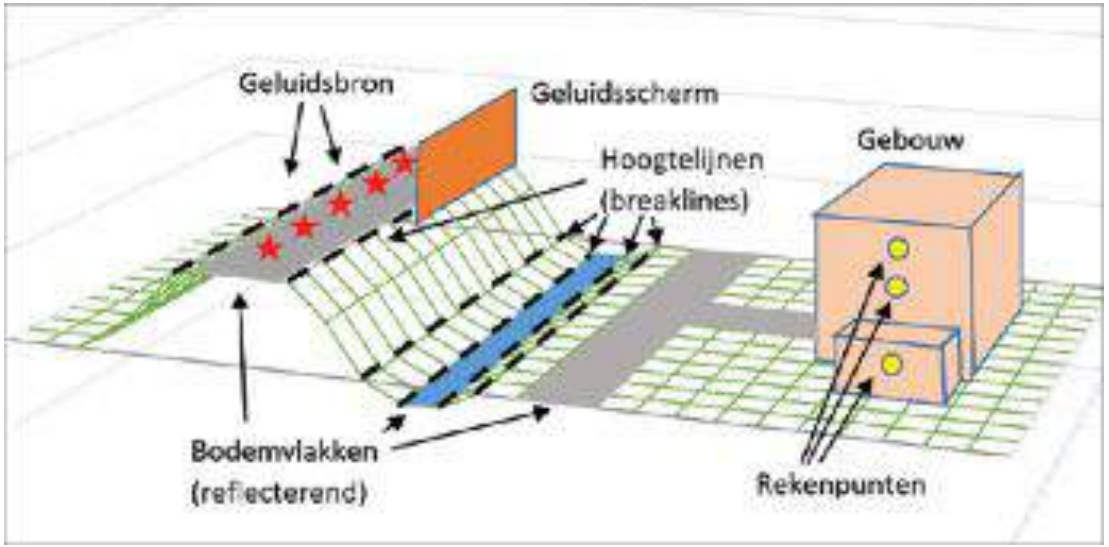
Geluidsimulatie

- Onderdeel van geluidstudies
- In Nederland vastgelegd in *Standaard Rekenmethode II (SRM2)*
- Geimplementeerd in software (GeoMilieu, Winhavik)



Input data nodig voor geluidsimulatie

1. Informatie over geluidemissie: geluidsbron (o.a verkeersintensiteit)
2. 3D representatie van omgeving voor berekenen geluidoverdracht
3. rekenpunten



De Kluijver & Van Tilburg, 2018

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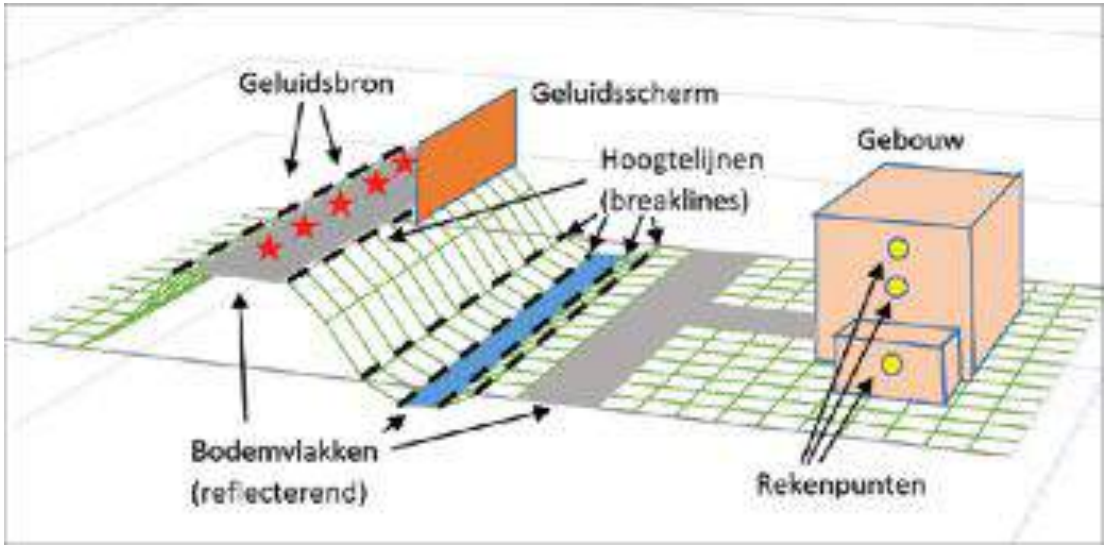


De Kluijver & Van Tilburg, 2018

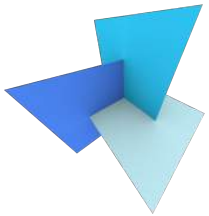
Huidige praktijk

Voor iedere studie wordt 3D afzonderlijk ingewonnen

- Niet efficient
- Niet consistent: verschillen in input data kunnen leiden tot verschillen in resultaten
- Niet automatisch: beperkt innovaties

Ons project

- Automatisch genereren van input data voor geluidstudies vanuit bestaande data sets:
  - BGT/BAG
  - AHN, hoogtepunten
- Consistent bestand met ruimte voor innovatie



3D geoinformation
Department of Urbanism
Faculty of Architecture and the Built Environment
Delft University of Technology

Rijksinstituut voor Volksgezondheid en Milieu
Ministerie van Volksgezondheid, Welzijn en Sport

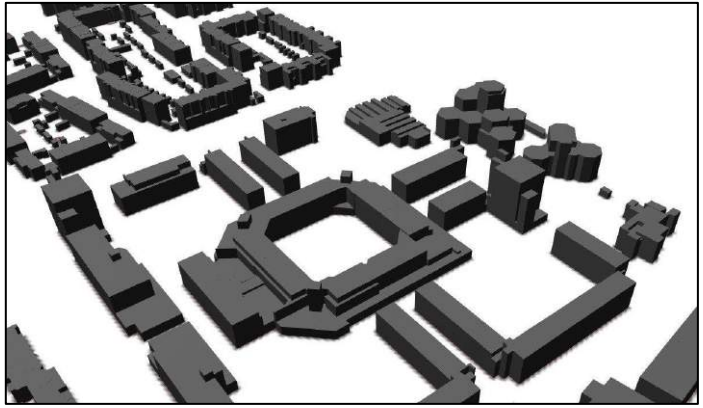
kadaster

Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

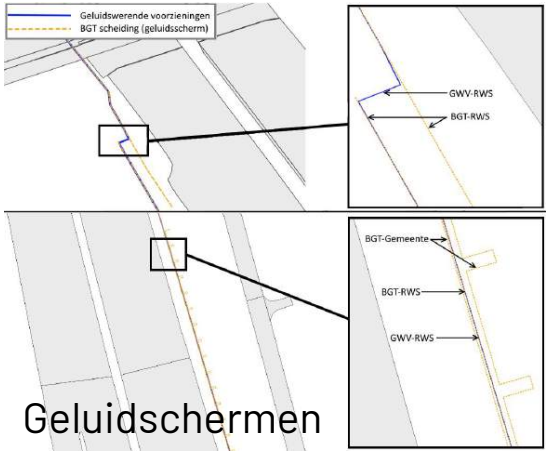
ip Interprovinciaal Overleg
van en voor provincies

Gegenereerde input data in ons project

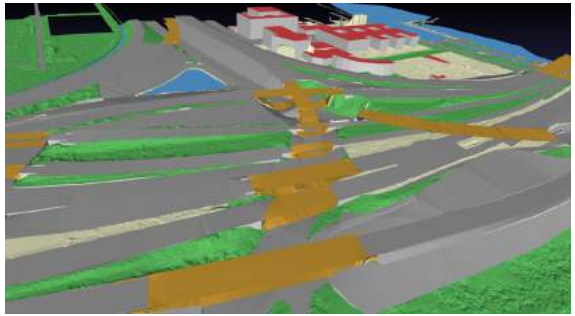
Hoogtelijnen



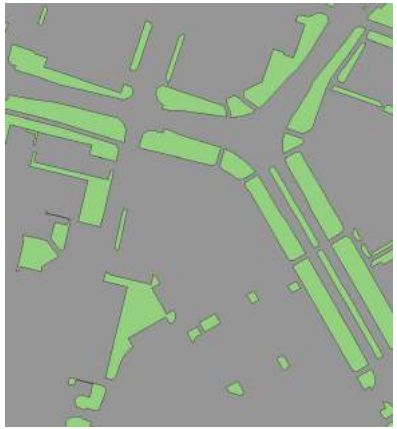
Gebouwen



Geluidschermen

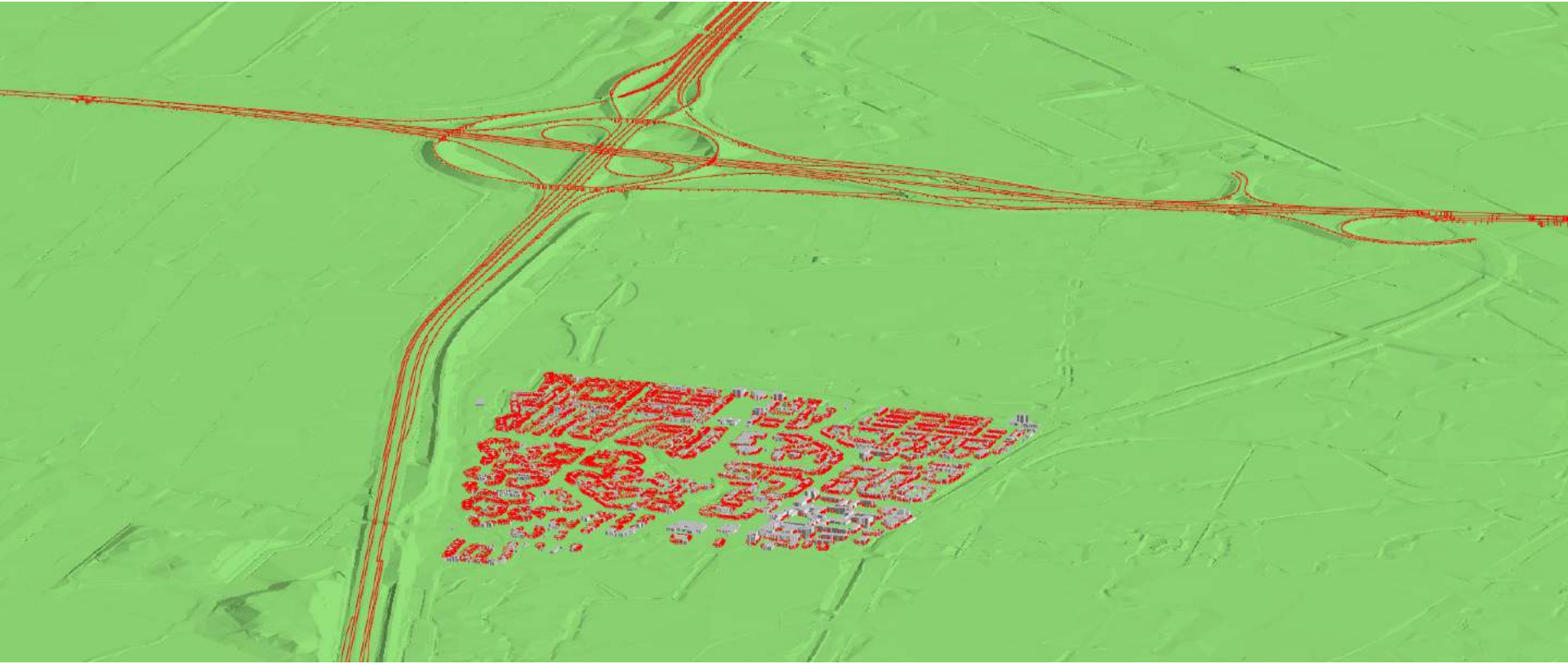


Bruggen

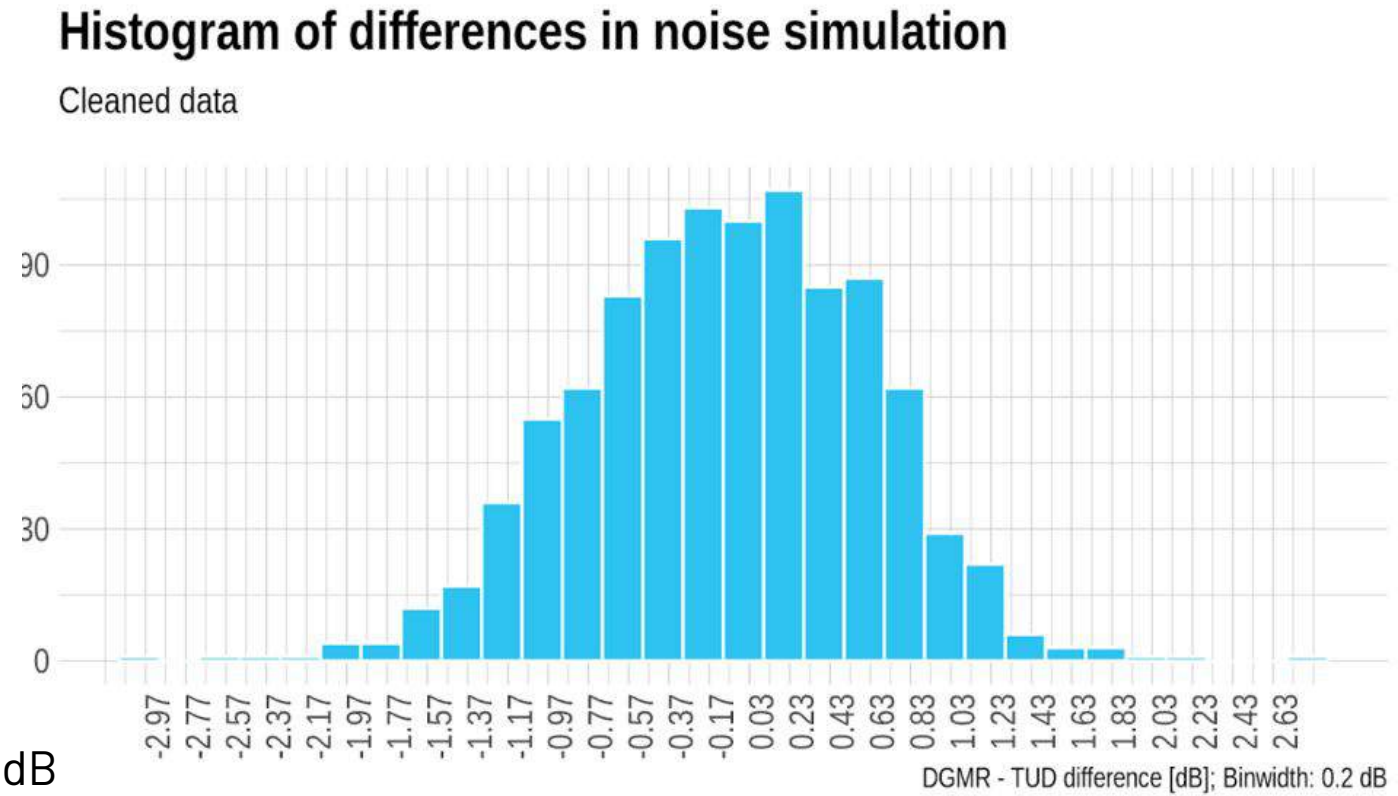


Bodemvlakken
(geluidabsorptie/reflectie)

Gegenereerde input data in ons project



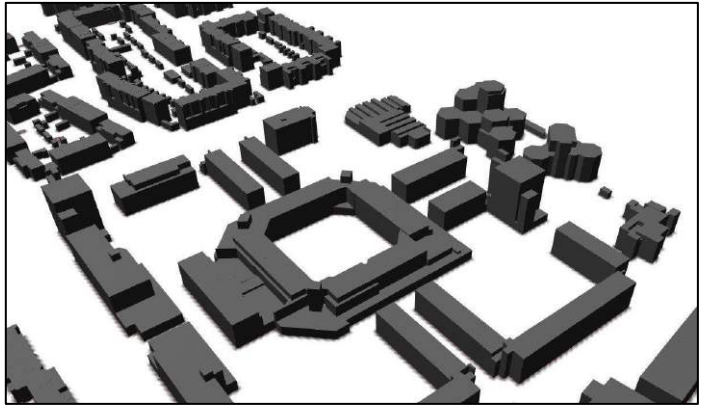
Test van onze resultaten



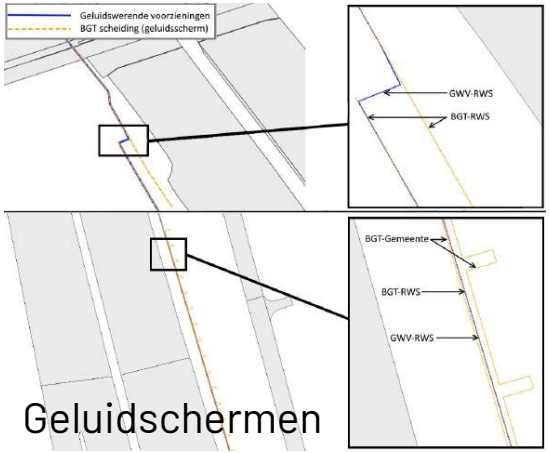
Mean difference 0.1 dB
Standard deviation 0.7 dB
95% confidential interval 0.1 dB

Waar zit het AHN?

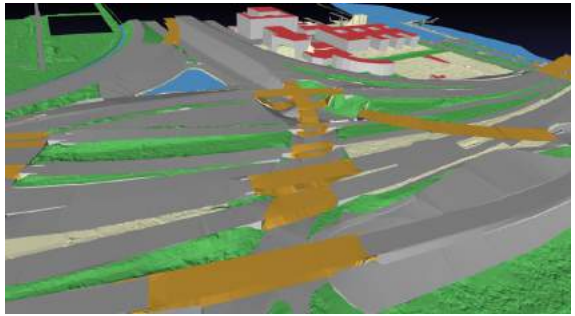
Hoogtelijnen



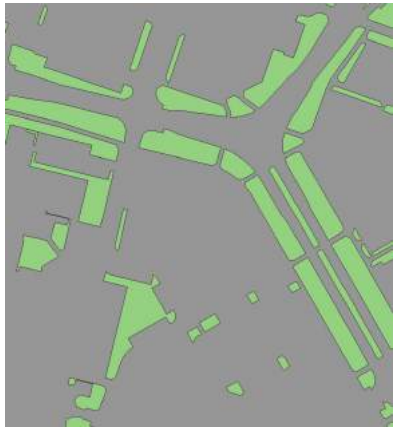
Gebouwen



Geluidschermen



Bruggen



Bodemvlakken
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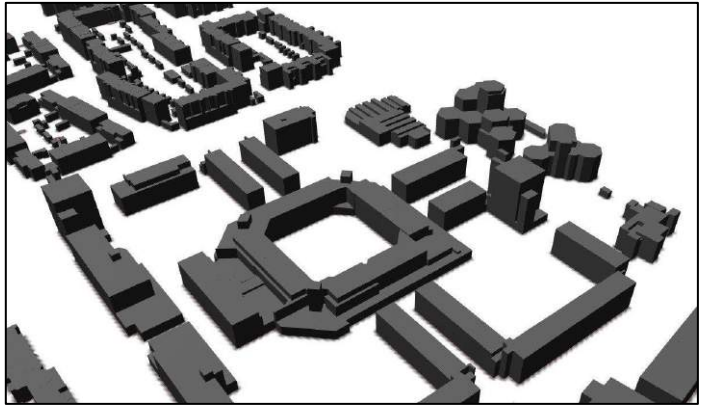
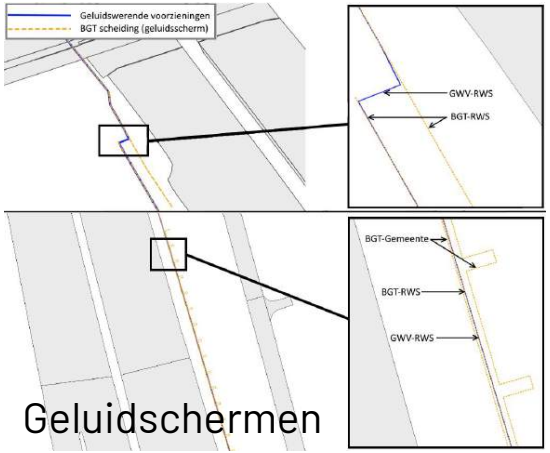
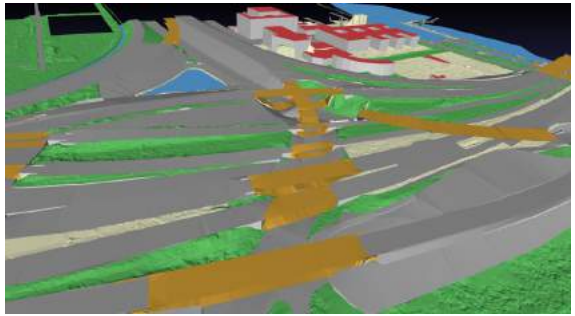


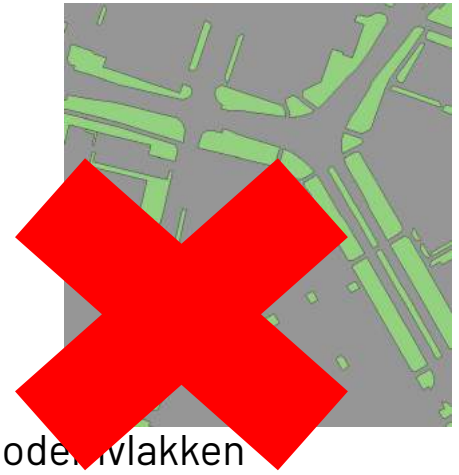
Gebouwen



Geluidschermen



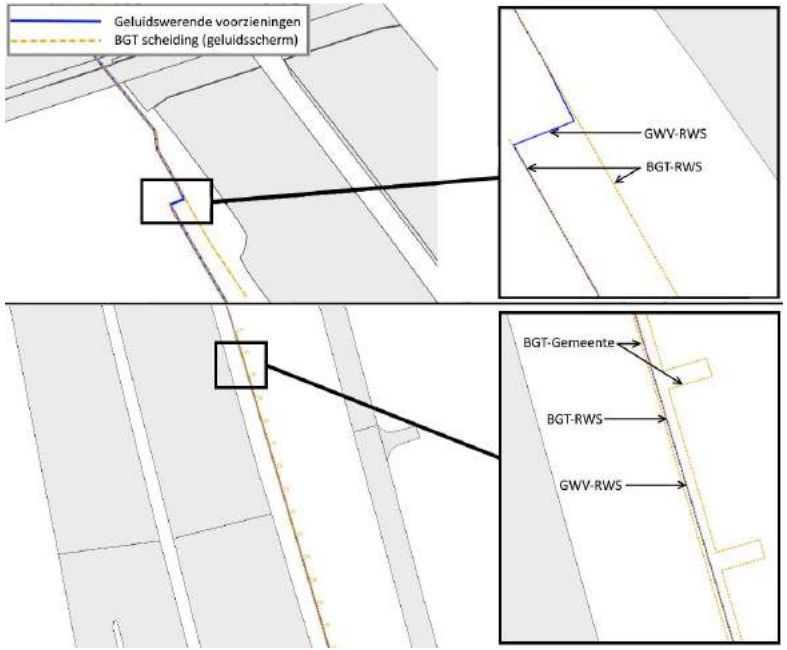
Bruggen



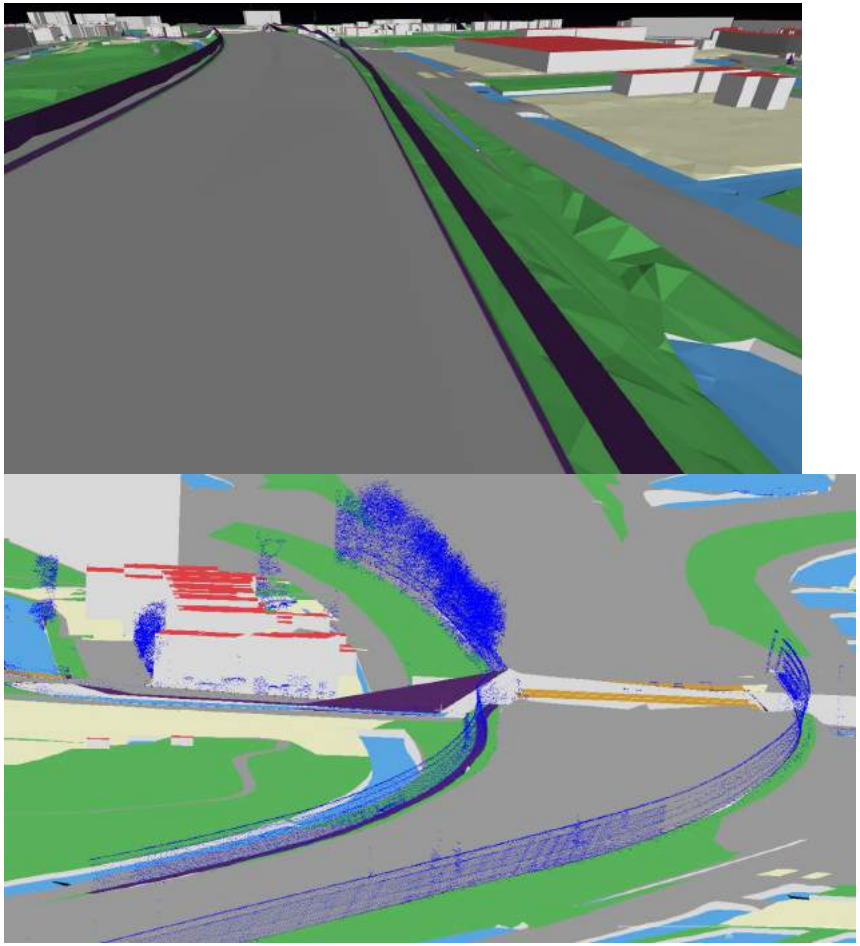
Bodemvlakken
(geluidabsorptie/reflectie)

Geluidschermen

In principe vastgelegd in GWV (Geluidswerende voorzieningen) en BGT



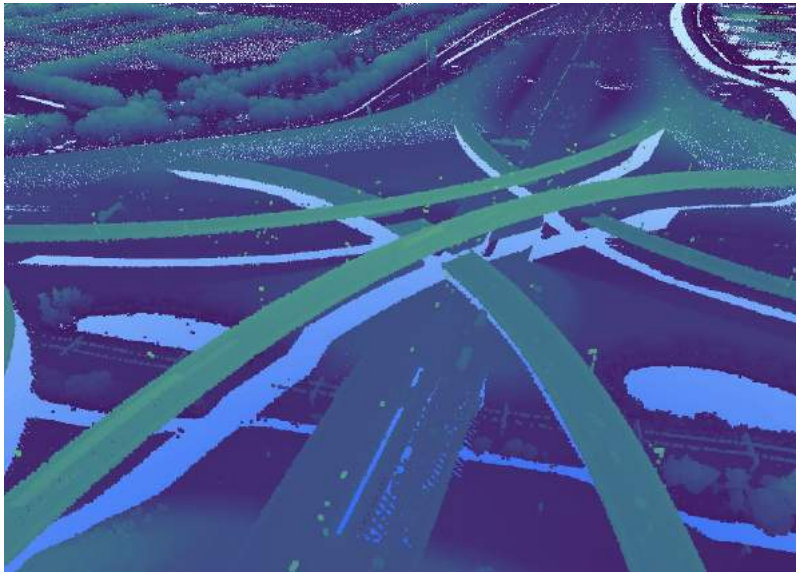
LAS klasse unassigned 1m buffer scheiding

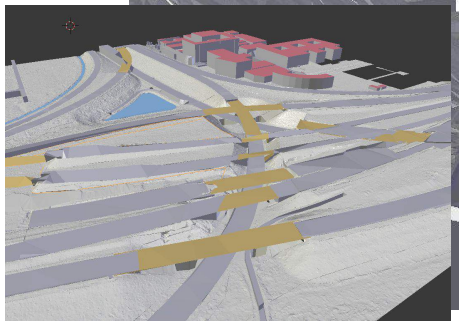


BGT uit 3dfier puntenwolk met klasse 'unassigned'

Bruggen uitdagingen

1. Occlusie puntenwolk
2. Geen volledige topologie/rijrichting in BGT
3. Classificatie grond/brugdeel

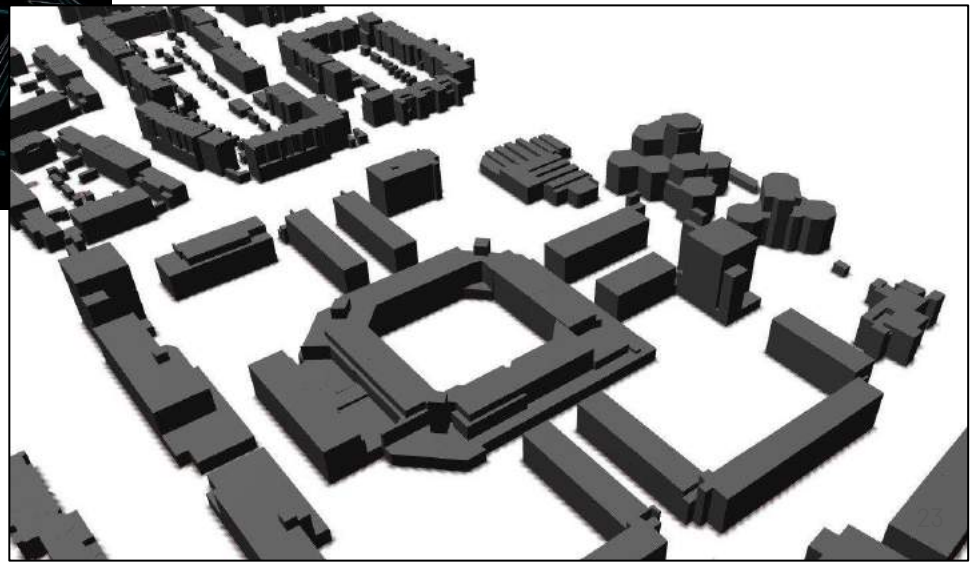




Waar zit het AHN?

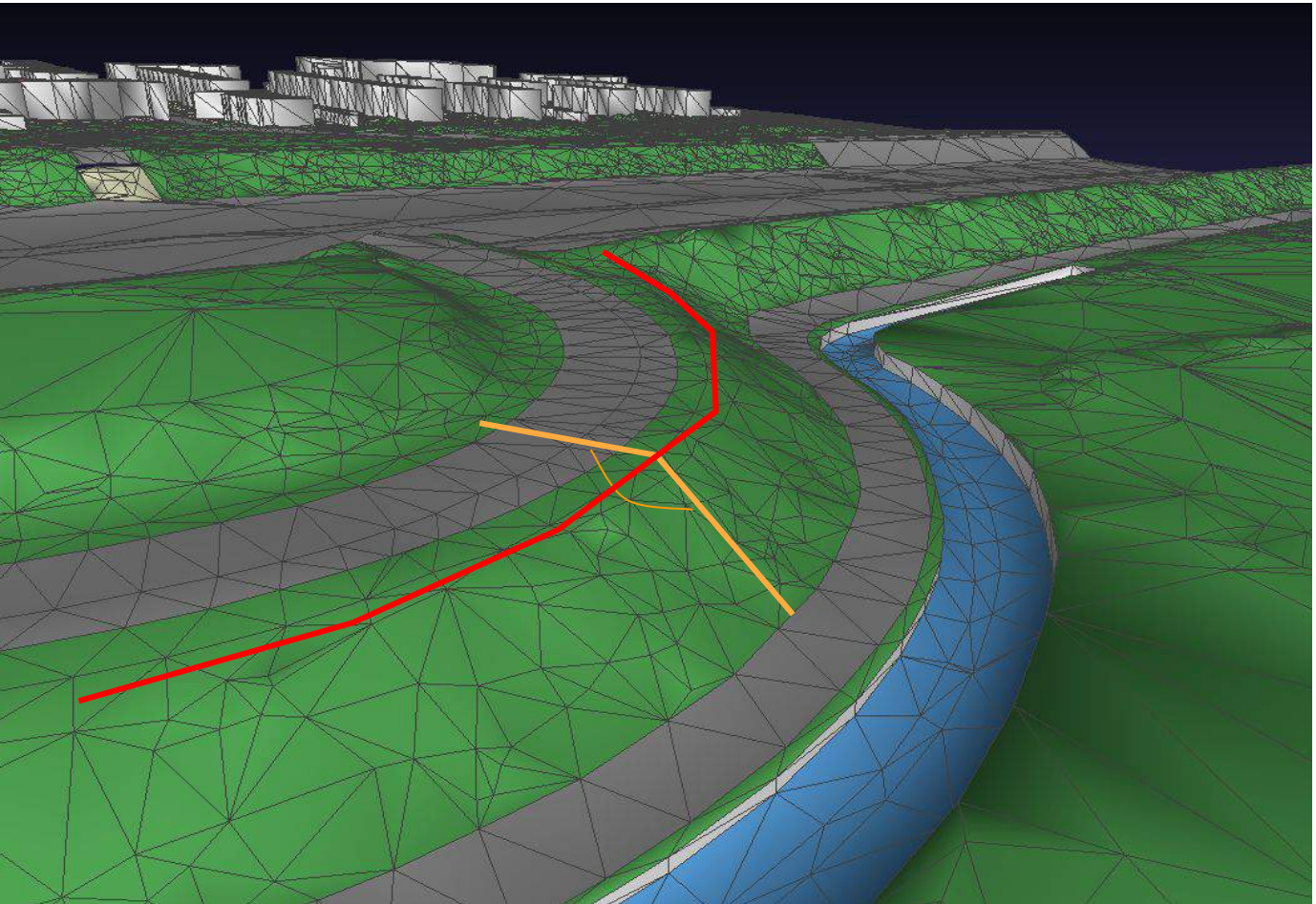
Hoogtelijnen

Gebouwen

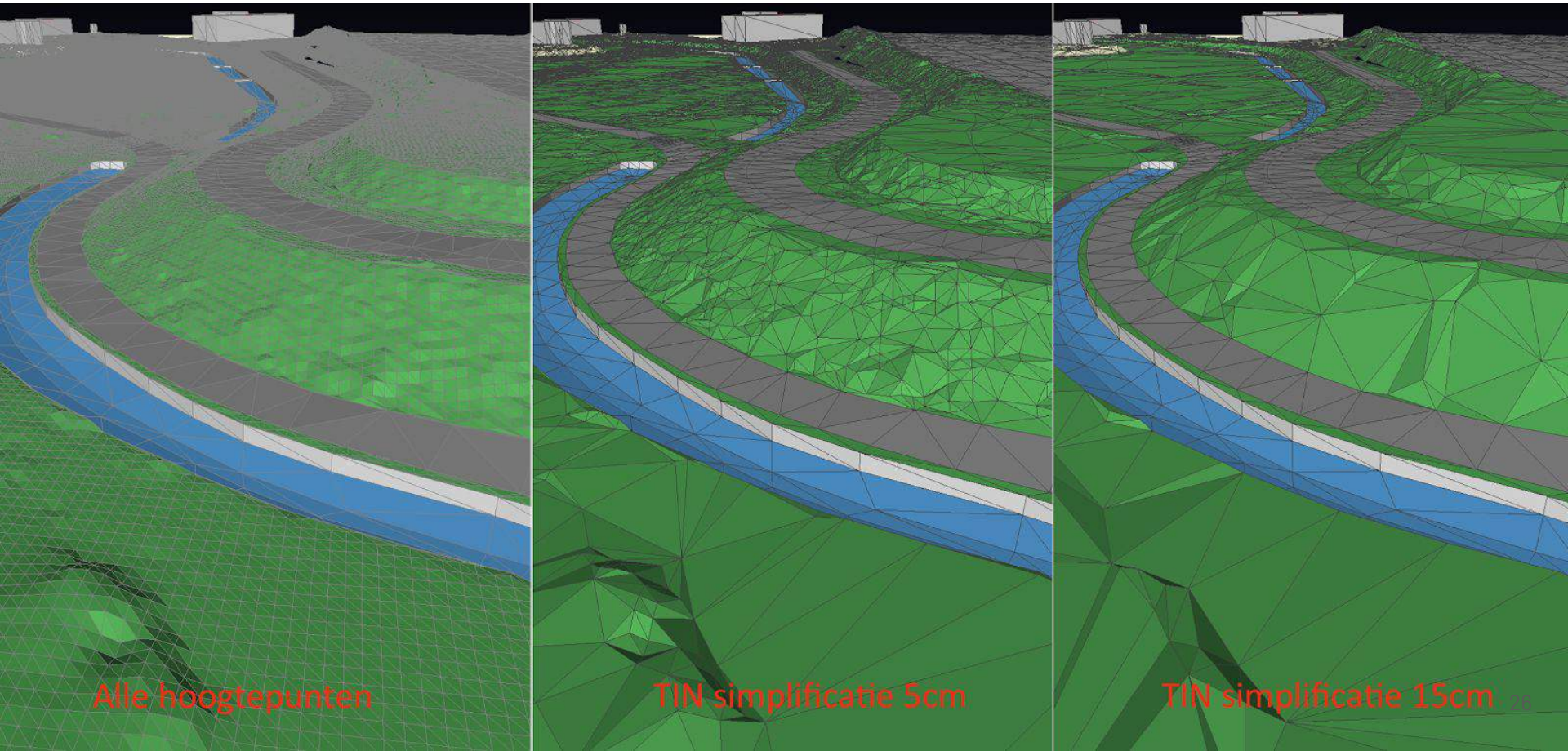


Hoogtelijnen

Hoogtelijnen



TIN simplificatie (3dfier)



Hoogtelijnen

1. **Voorselectie lijnen uit BGT**
2. Op hoogte leggen met AHN
3. Filter lijnen op 3D geometrie
4. Isolijnen hoogteverschil
5. 3D lijn simplificatie

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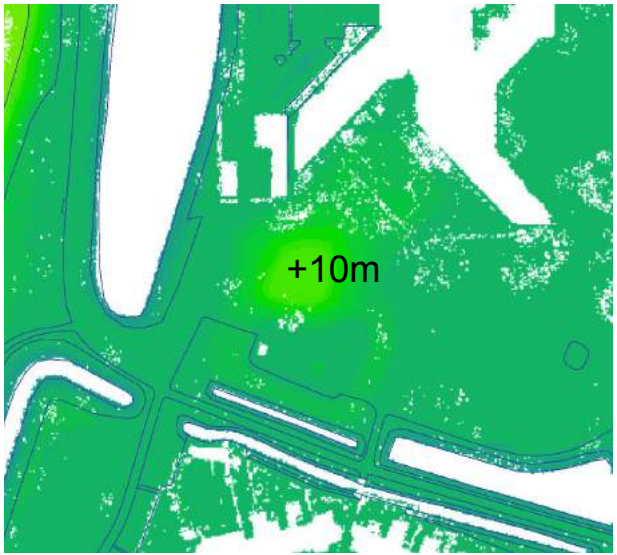
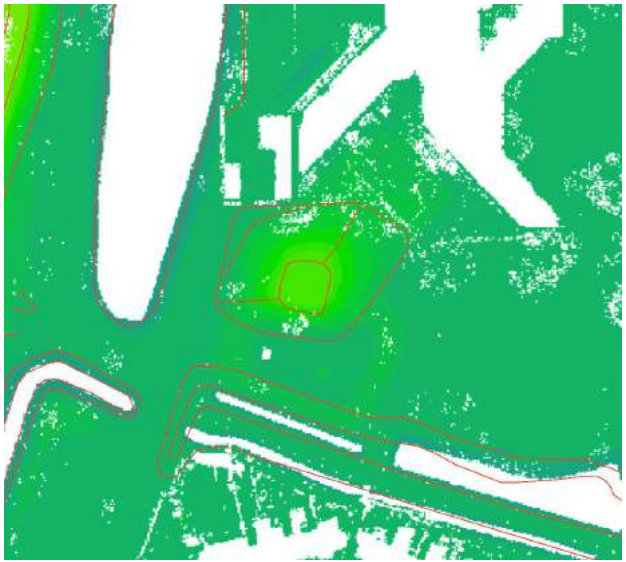
Isolijnen hoogteverschil

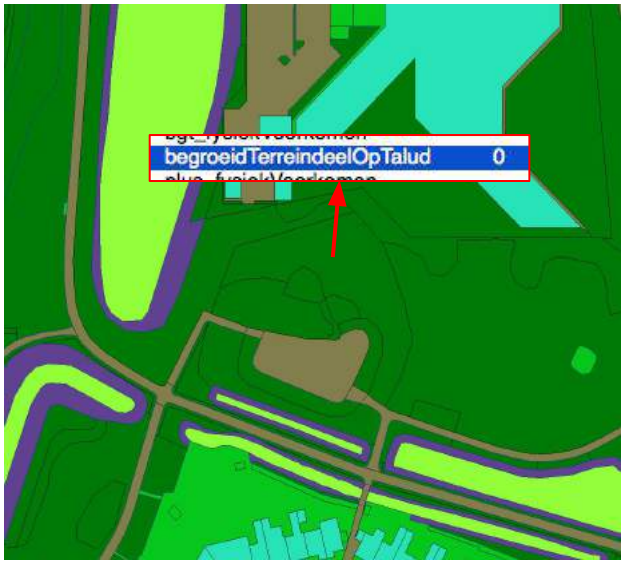
Can we rely on BGT geometry and attributes?



Basisbestand 3D v0.1



DGMR reference

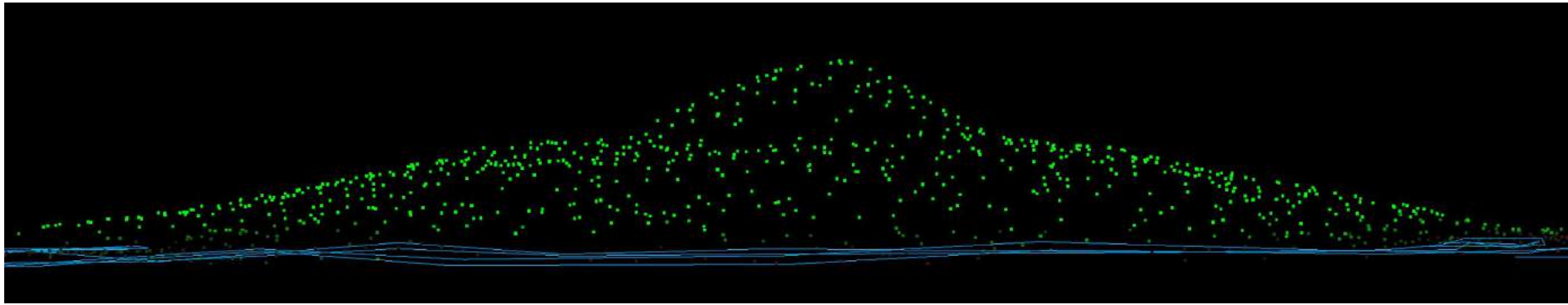


BGT

Isolijnen hoogteverschil

Can we rely on BGT geometry and attributes?

Basisbestand 3D v0.1



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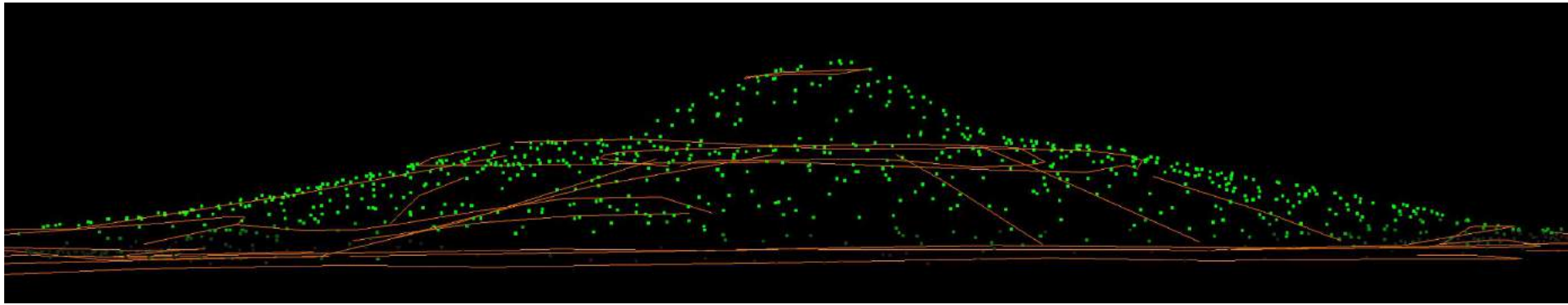
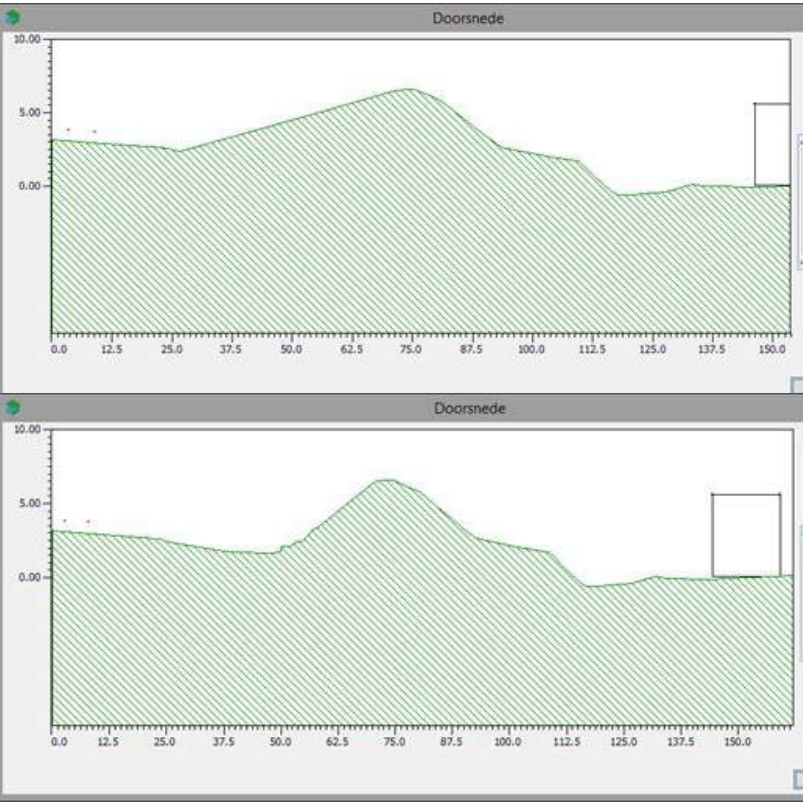


Isolijnen hoogteverschil

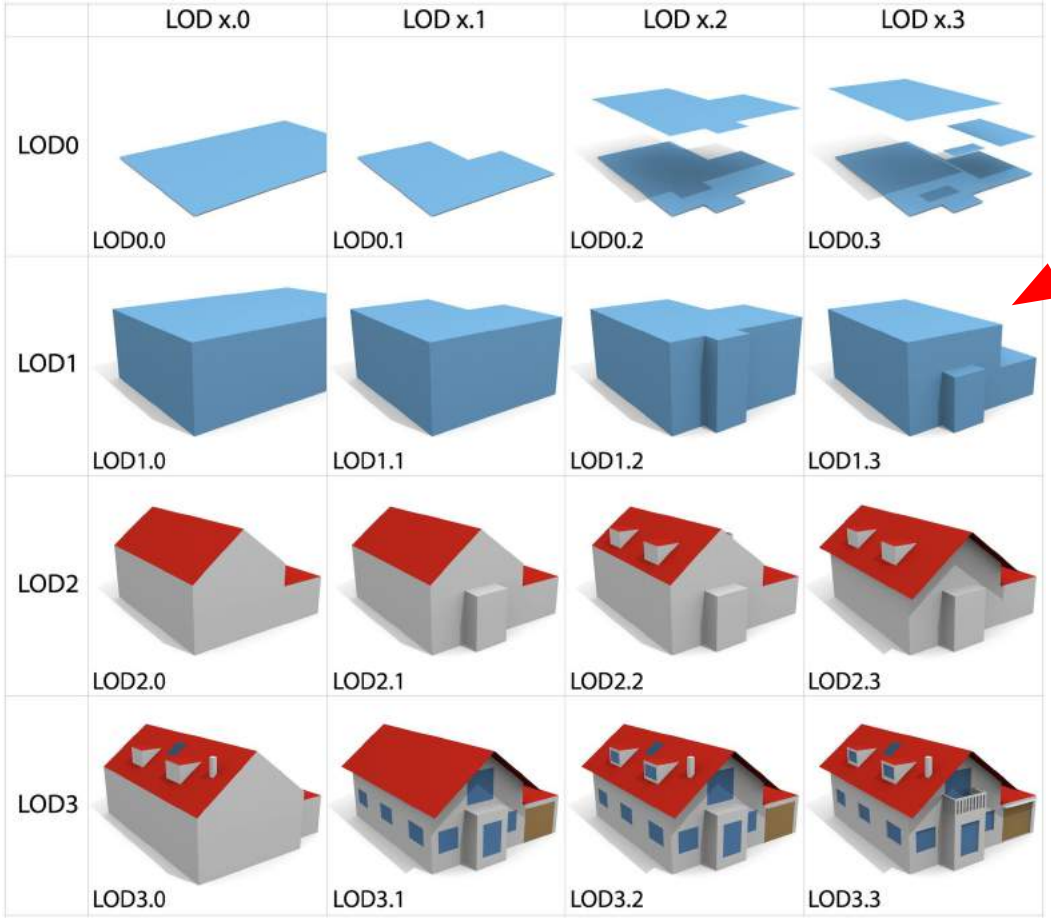
Ontbrekende waarde voor
OpTalud attribuut BGT

Isolijnen hoogteverschil



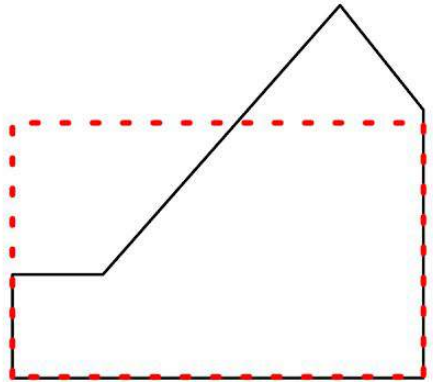
Gebouwen

Levels of Detail (LoD)

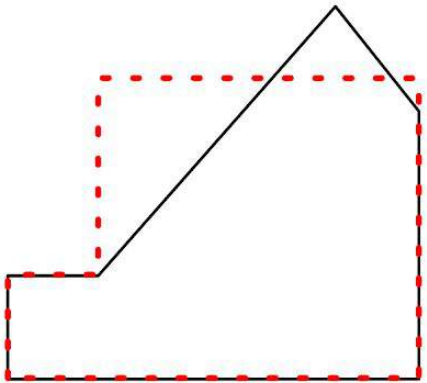


Wat is LoD 1.3?

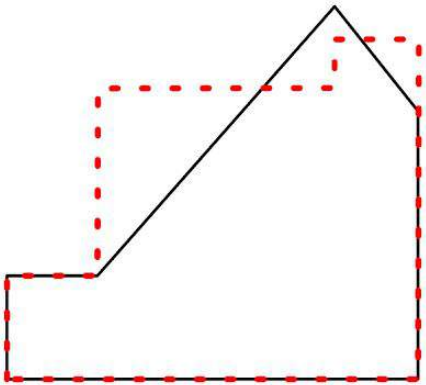
(a)



(b)

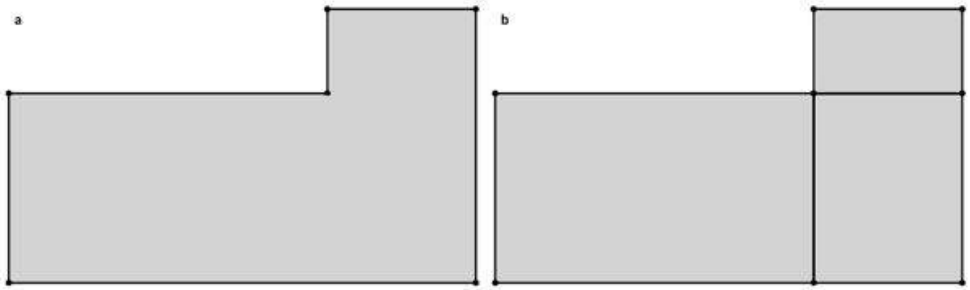


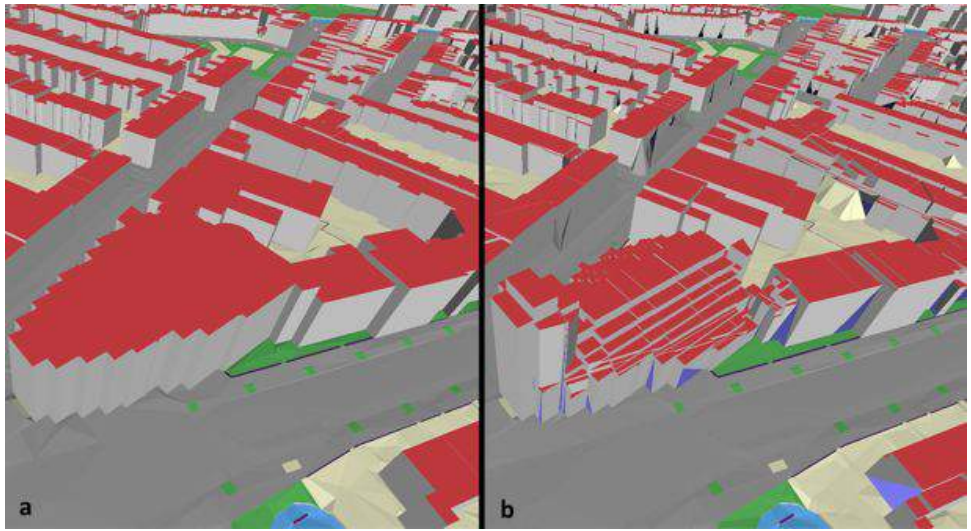
(c)

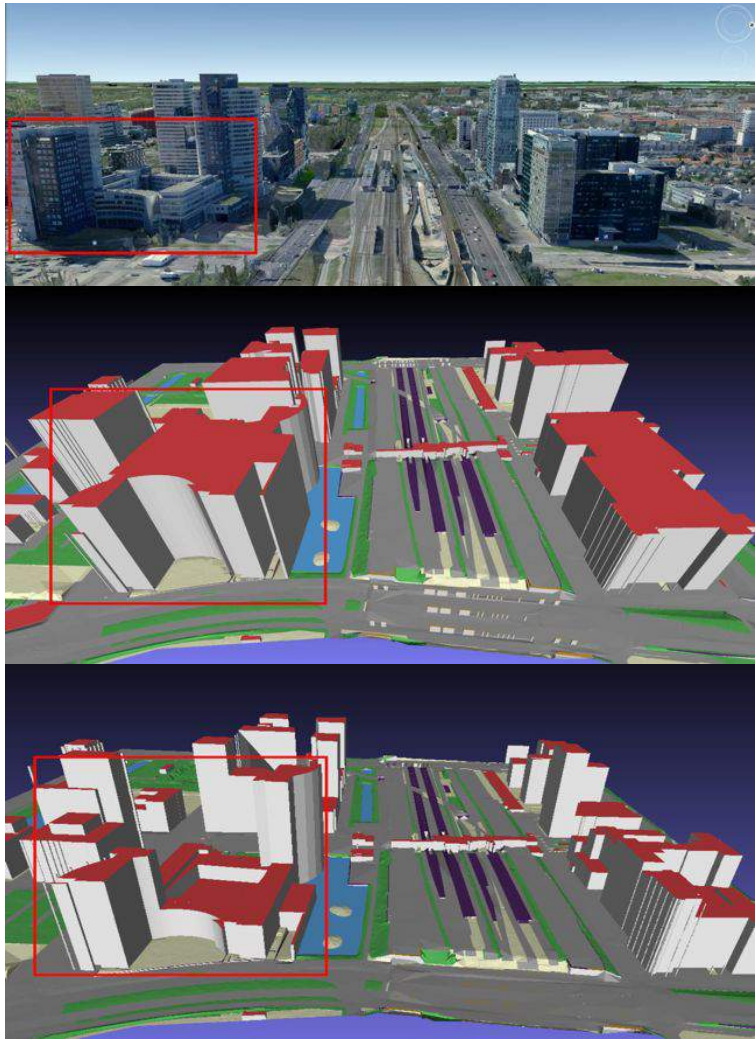


(d)

Footprint decompositie



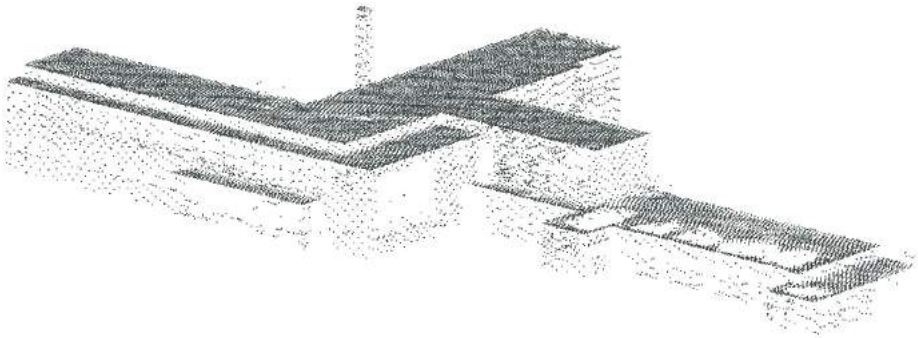




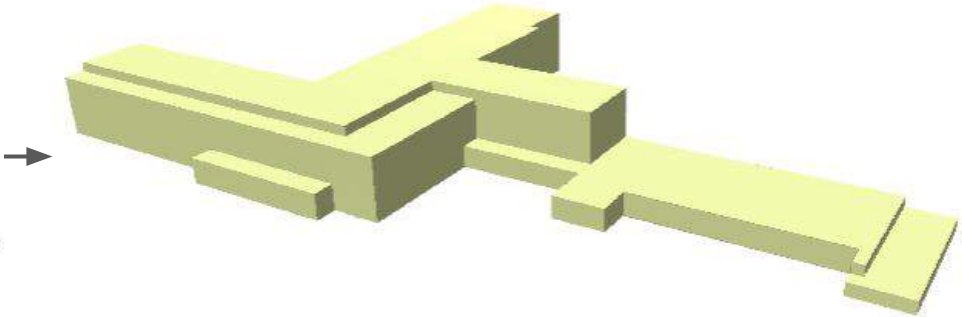
Objective

Obtain an **LoD 1.3** building model from the (AHN3) point cloud of a building

In LoD 1.3 a building's footprint is subdivided in separate roof parts. Each roof part is assigned its own height.



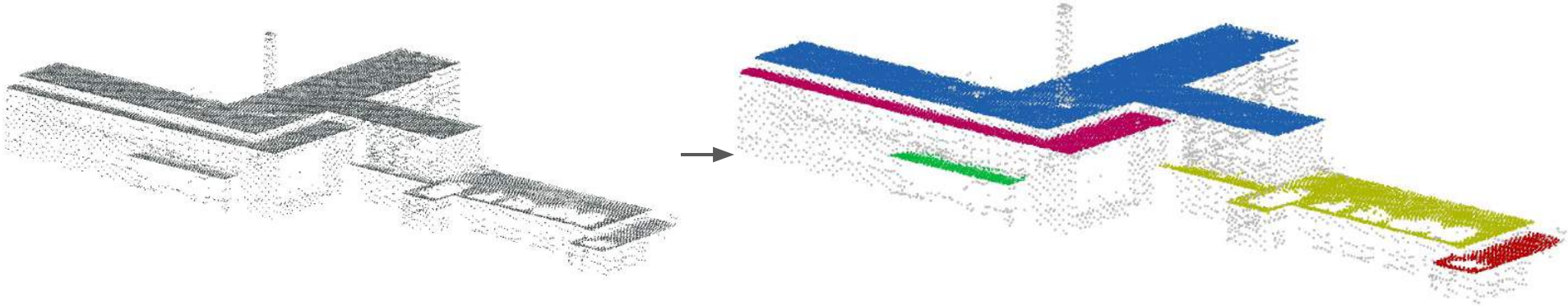
Point cloud



LoD 1.3 building model

Step 1: Detect roof planes

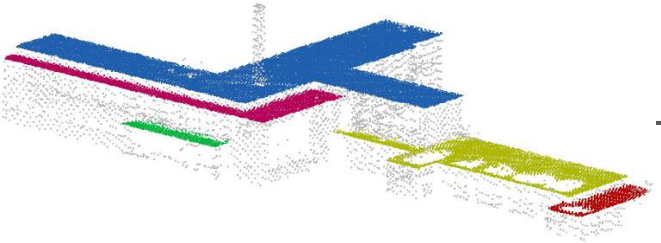
Perform plane detection in the point cloud and identify the roof planes

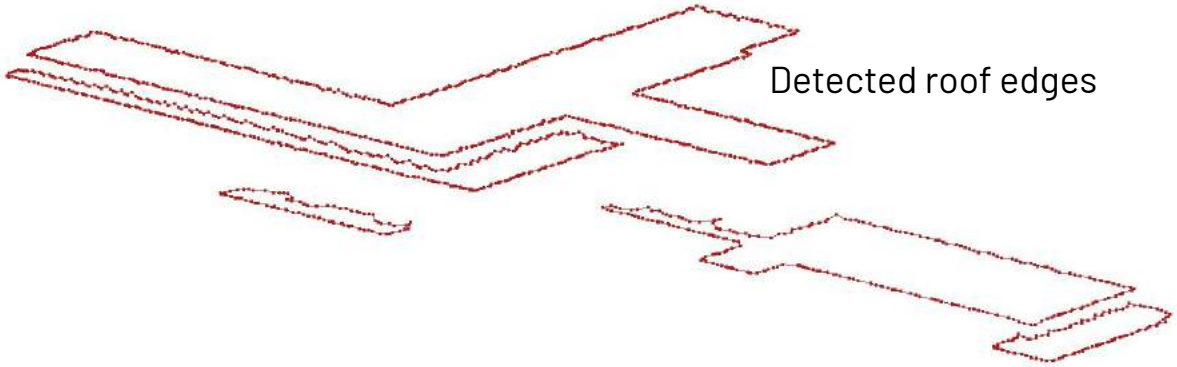


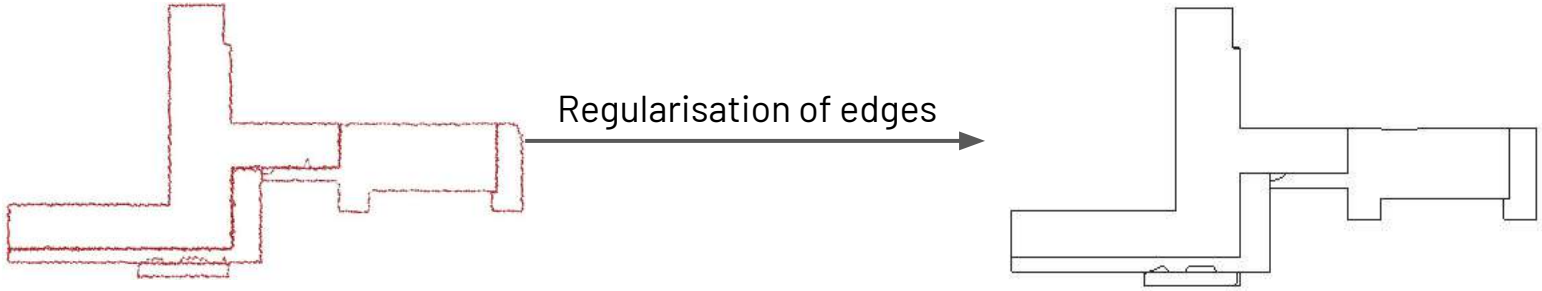
Roofplanes

Point cloud → **Roof planes** → Roof edges → 2D arrangement → LoD 1.3 model

Step 2: Detect roof edges + regularisation



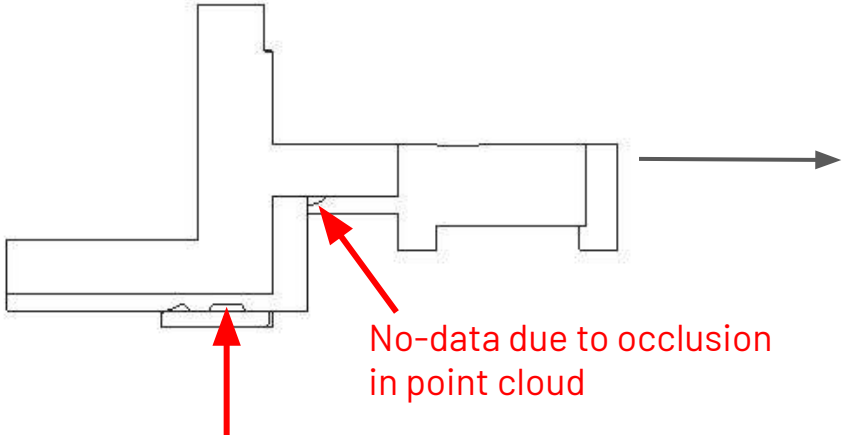


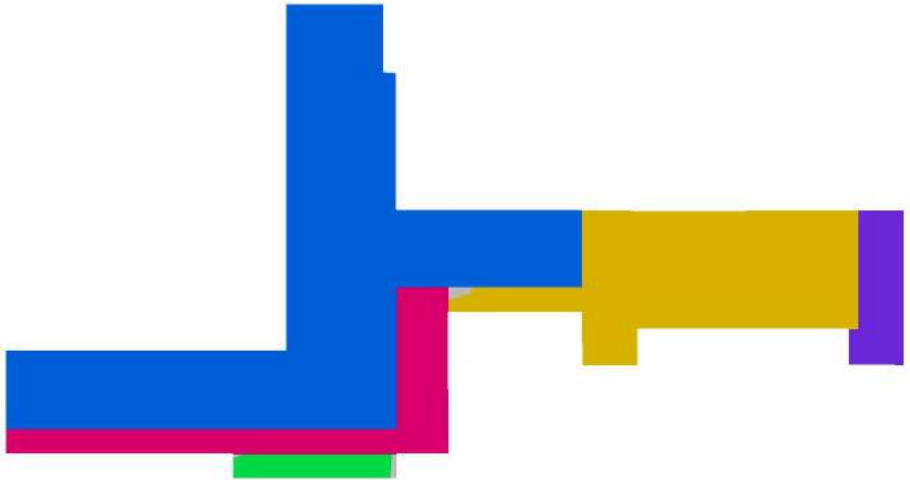


Point cloud → Roof planes → **Roof edges** → 2D arrangement → LoD 1.3 model

Step 3: Build 2D arrangement

The 2D Arrangement helps to solve conflicts (in)between roof parts and enforces topological validity



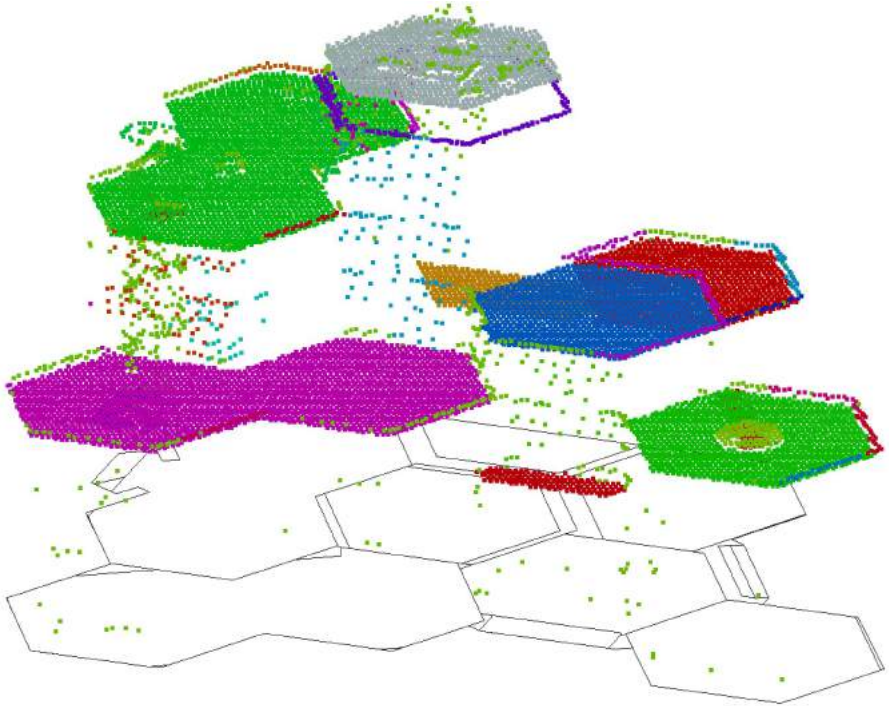


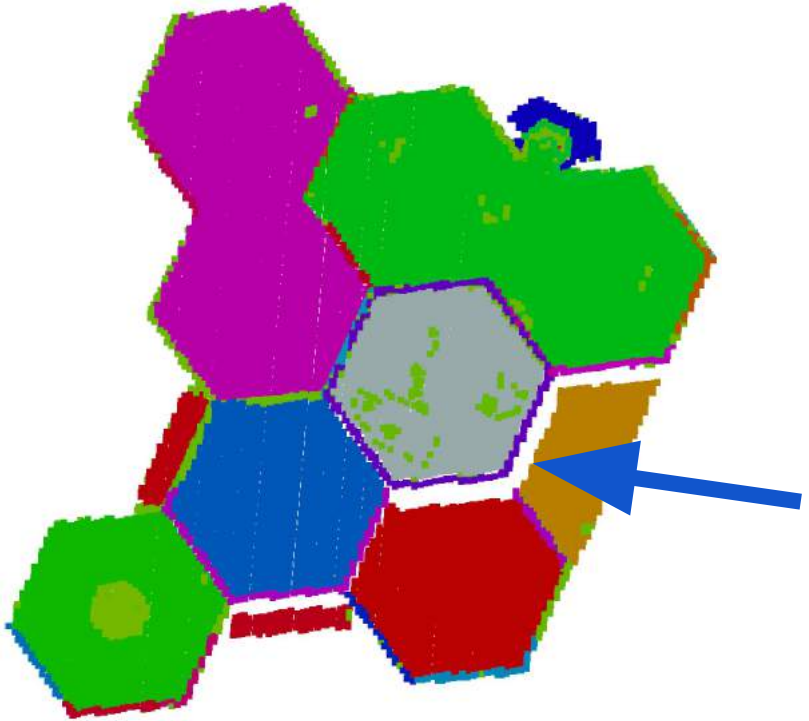
2D arrangement

Point cloud → Roof planes → Roof edges → **2D arrangement** → LoD 1.3 model

2D planar arrangements

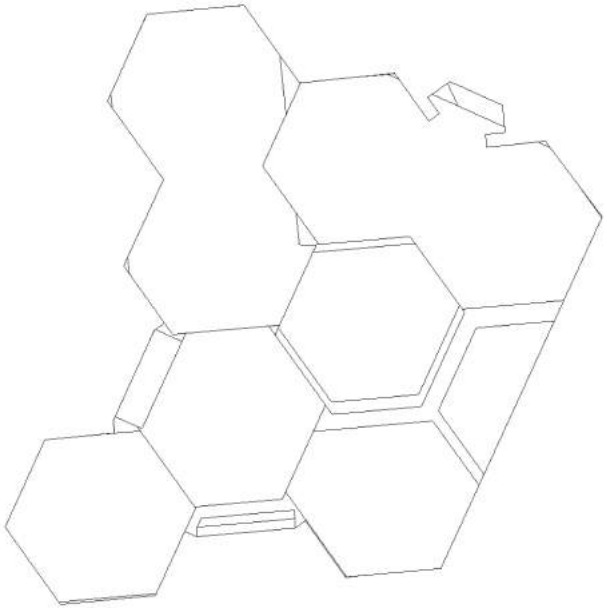
Used to recover from occlusion



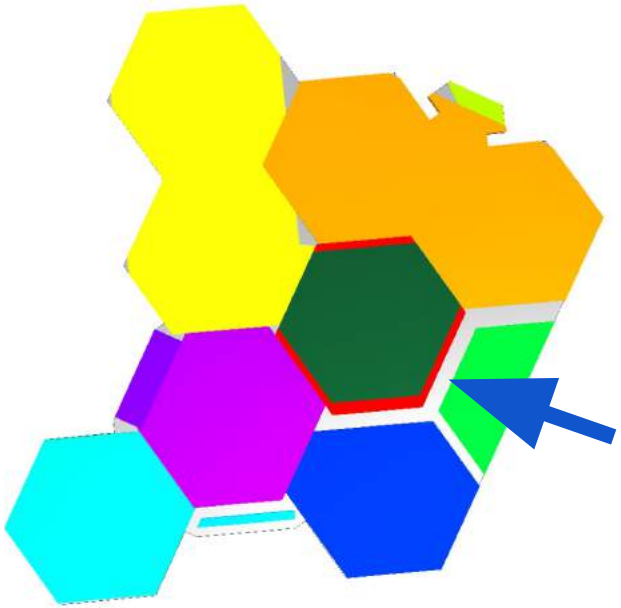


2D planar arrangements

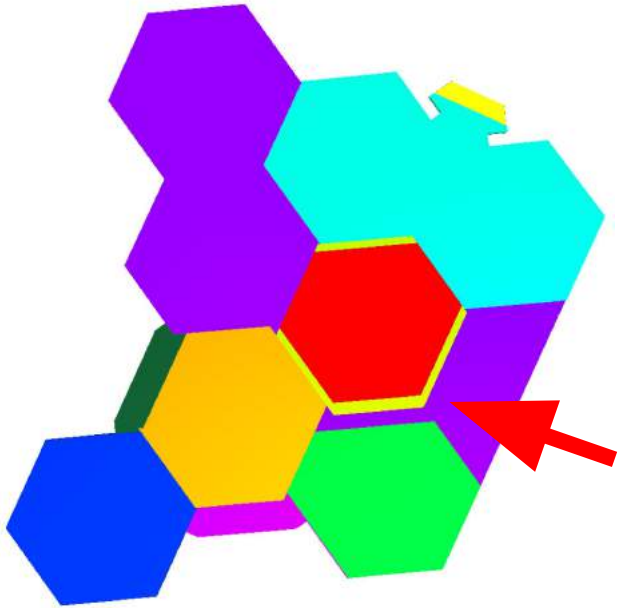
Can be used to recover from occlusion



Boundary lines

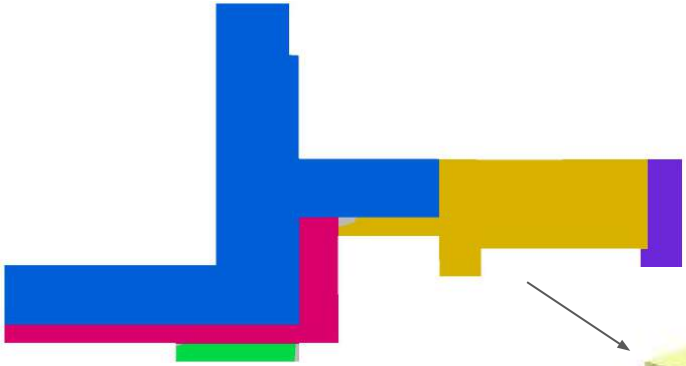


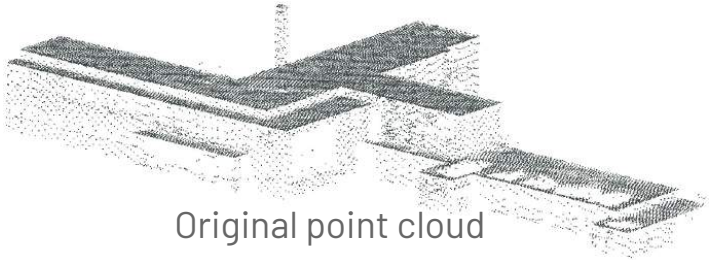
Roofpart labels



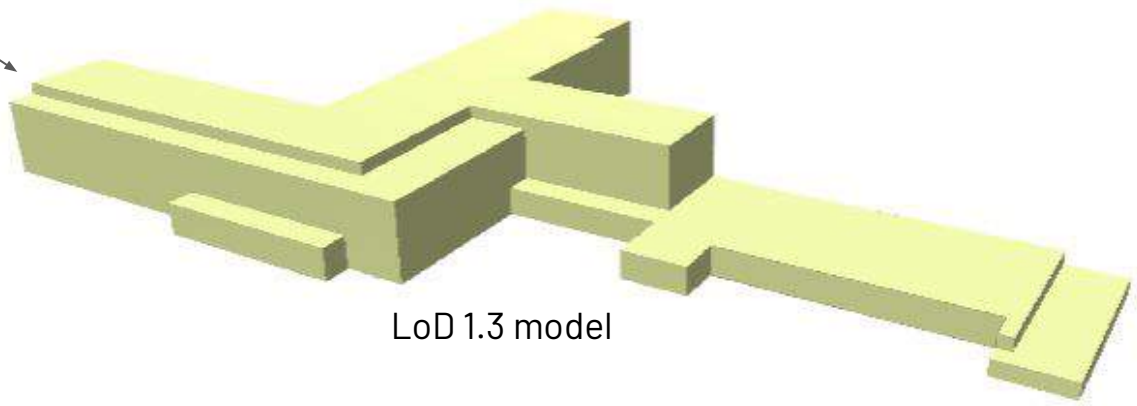
Floodfill from low to high parts

Step 4: Extrusion of roof parts





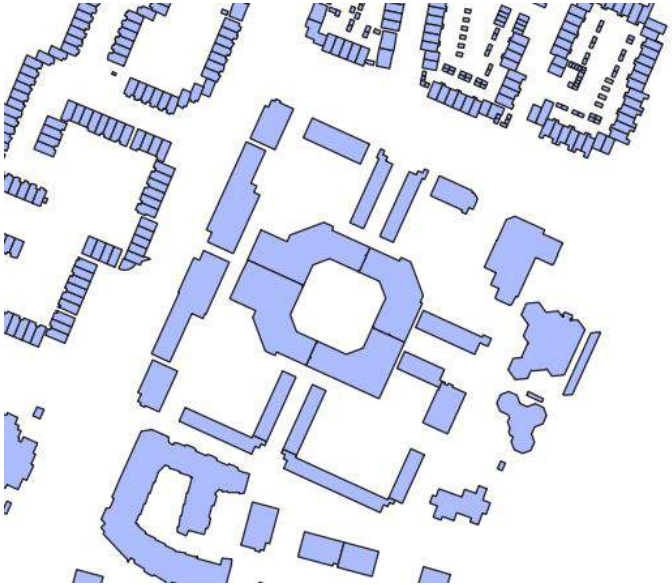
Original point cloud



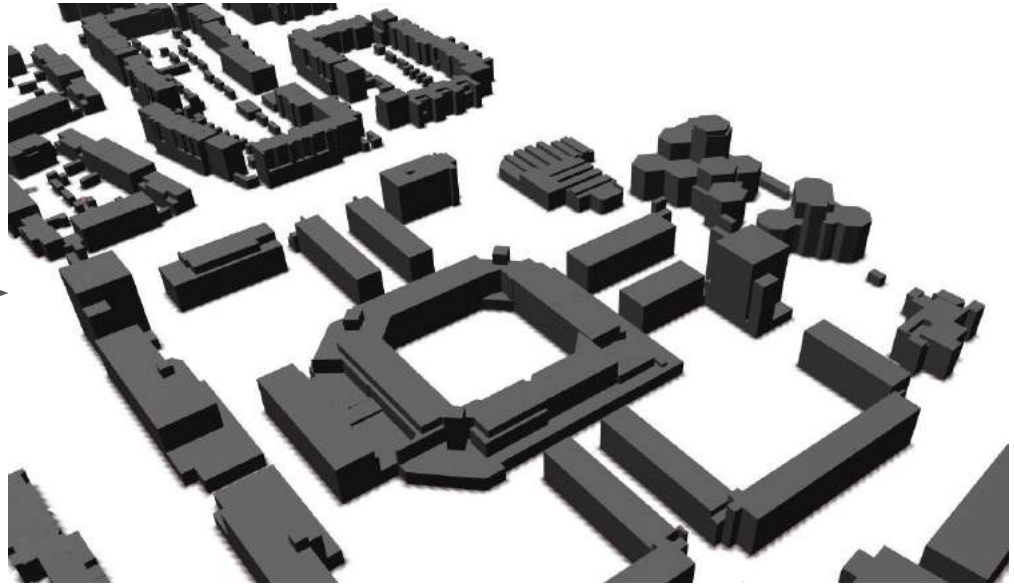
LoD 1.3 model

Point cloud → Roof planes → Roof edges → 2D arrangement → **LoD 1.3 model**

Result

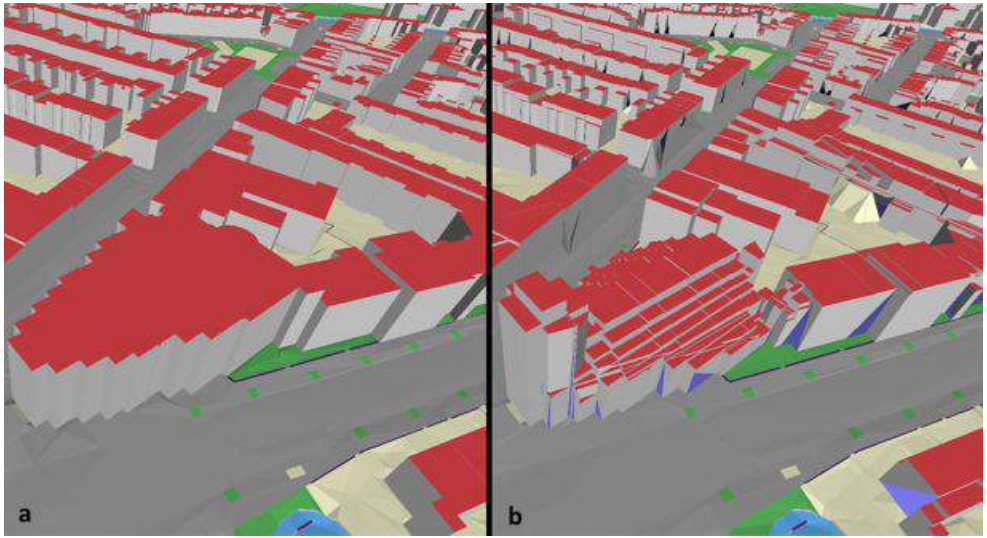


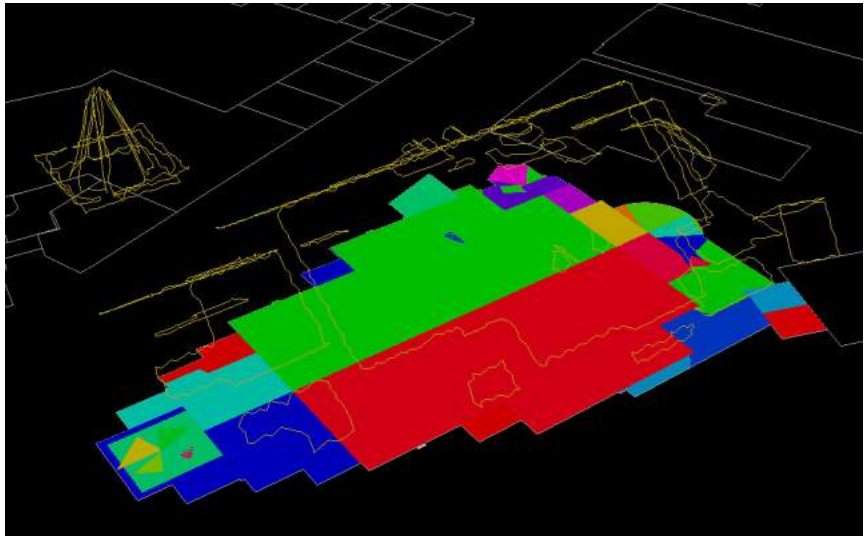
BAG footprints



Automatically generated LoD1.3 models

LoD 2





Notes

- If two adjacent roof parts have an elevation difference of less than 1 meter they are merged. The highest elevation is used for the merged roof part.
- Small planes with less than 20 points will not be detected in the point cloud.
- Non horizontal parts of the roof are extruded as one and not decomposed further.
- This method is still in an experimental phase, quality of results may vary.

Tot slot

Beperkingen AHN

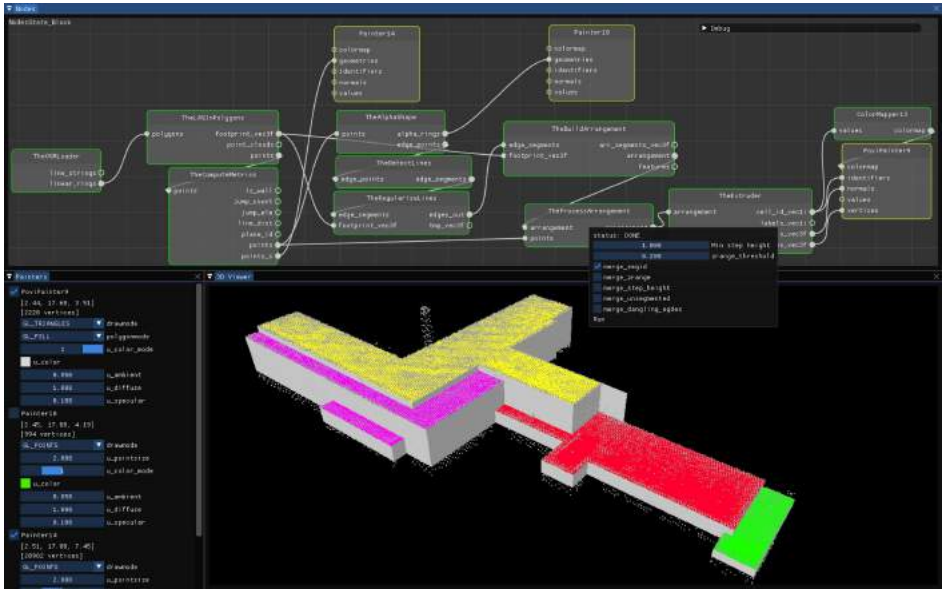
Proef dataset v0.2

3dgeluid.tudelft.nl

- Bodemvlakken
- Hoogtelijnen
- Gebouwen LoD1, LoD1.3

En nu?

- Luisteren naar feedback van gebruikers
- Verder ontwikkelen software tools
- Verder afstemmen parameters/impact op simulatie resultaat
- LoD2 gebouwen
- Standardisatie ZOAB, geluidschermen in BGT
- Opschalen naar heel NL (Kadaster)
- Update met puntenwolk uit luchtfotos



Thank you!

3d.bk.tudelft.nl

Hoogtelijnen v0.2 eerste resultaat

DGMR reference

Input

Basisbestand 3D v0.1

Hoogtelijnen v0.2 eerste resultaat

DGMR reference

Basisbestand 3D **(1 m)**

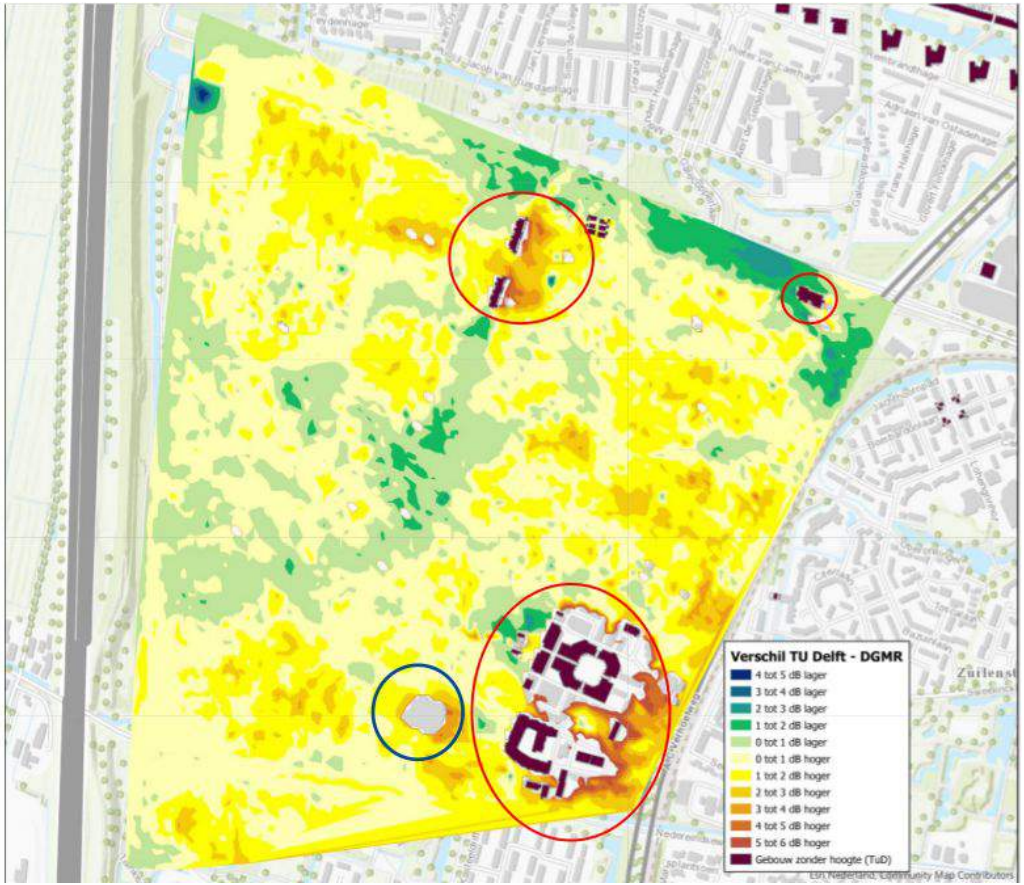
Hoogtelijnen v0.2 eerste resultaat

DGMR reference **(2 m)**

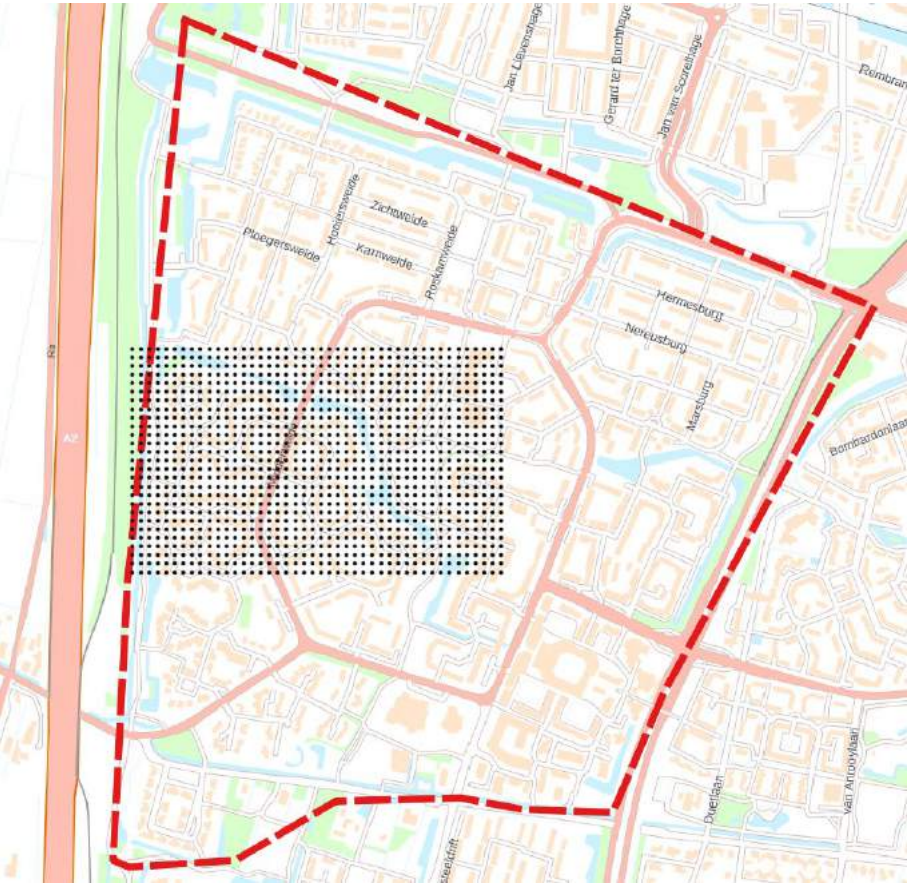
Selectie hoogte fout tot 2 m

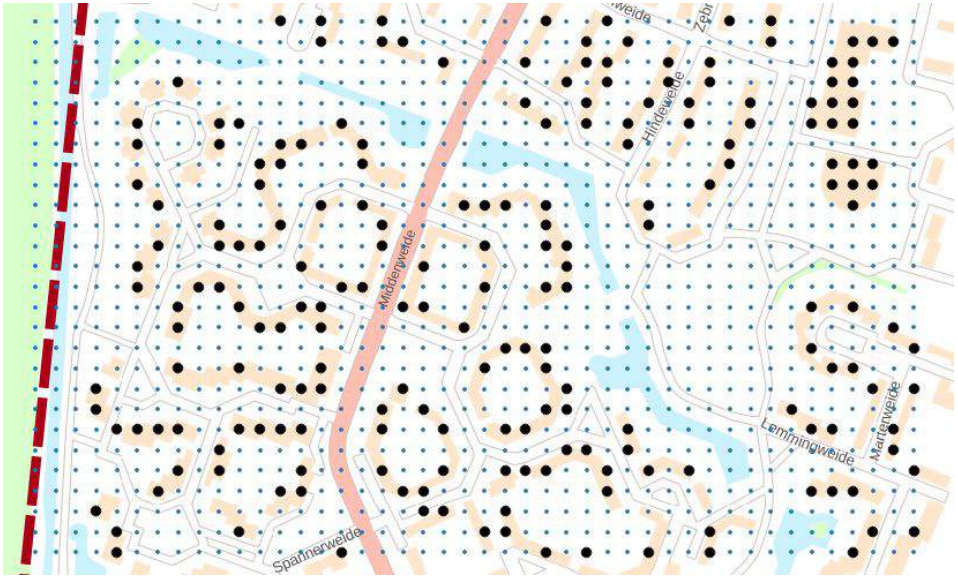
Basisbestand 3D **(2 m)**

DGMR's comparison of noise simulations



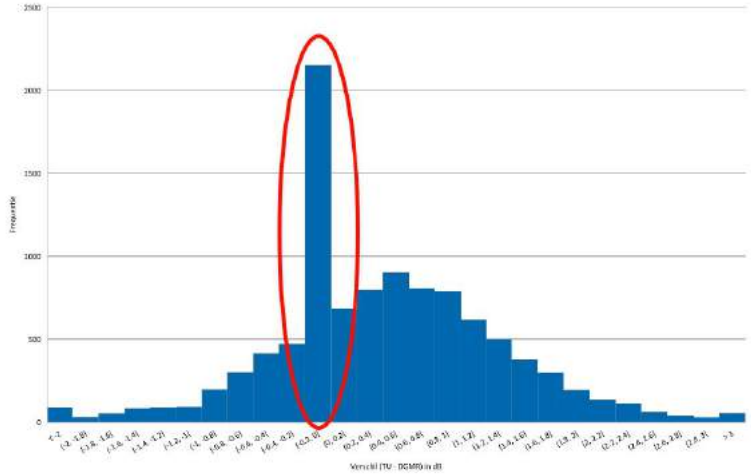
DGMR's comparison — Sampling points

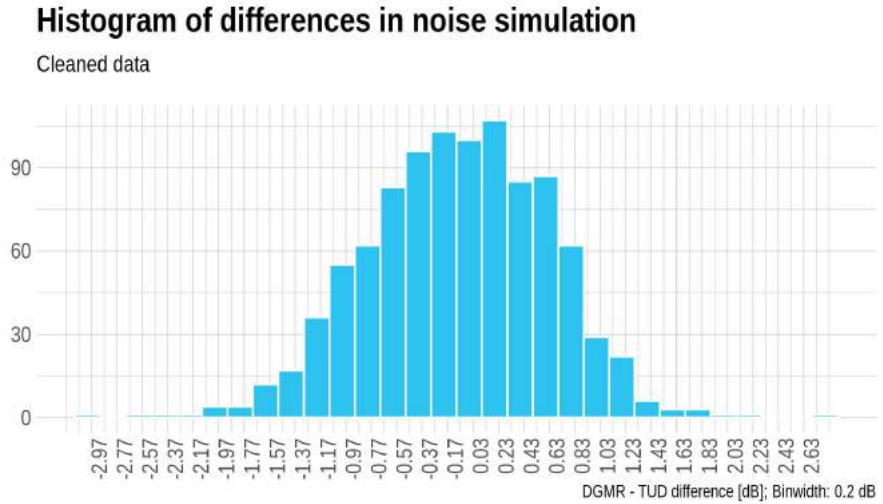




The sampling points marked with strong black indicate missing noise levels. The points with small blue indicate that noise was computed for the point.

DGMR's comparison — Sampling points





The peak due to missing noise levels is marked with red circle.

Average difference: **0.4 dB**

Standard deviation: **0.9 dB**

With removing the locations with the missing noise levels we computed the following statistics on the values of DGMR - 3D Geoinfo:

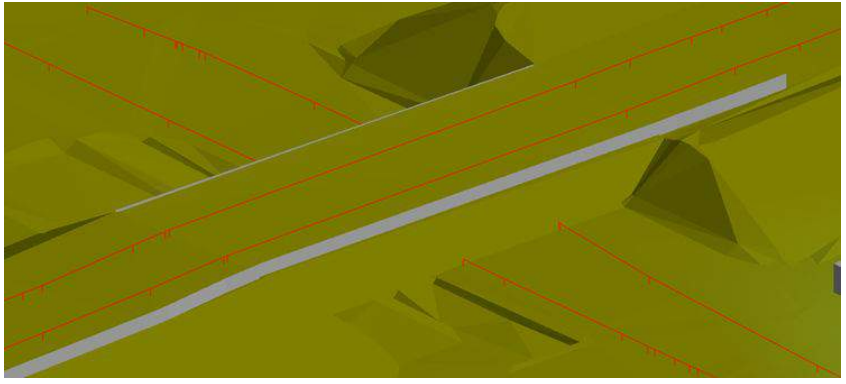
Mean difference: **-0.1 dB**

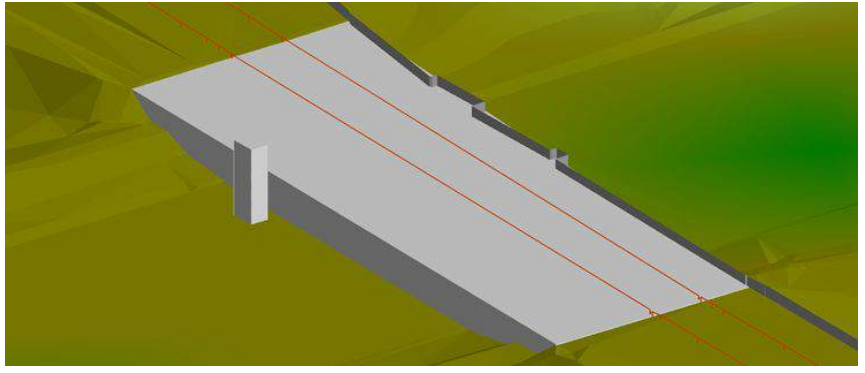
Standard deviation: **0.7 dB**

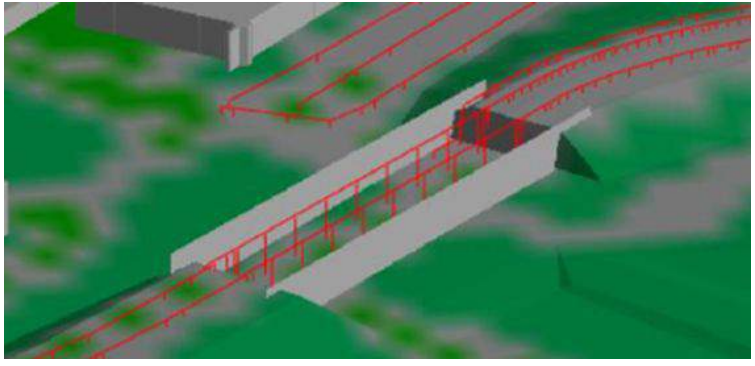
Median difference: -0.1 dB

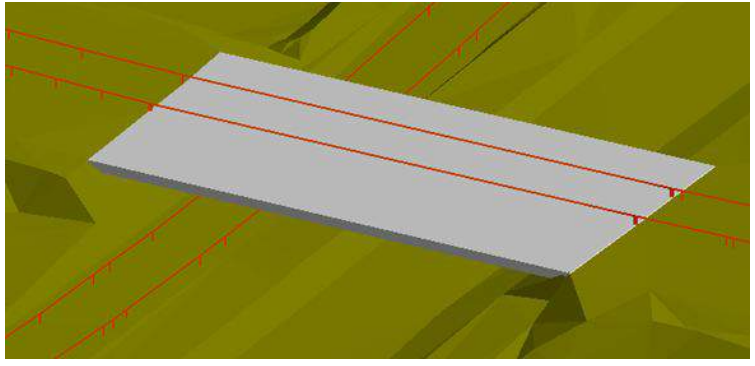
Bruggen

4 different ways to model bridges according to noise experts



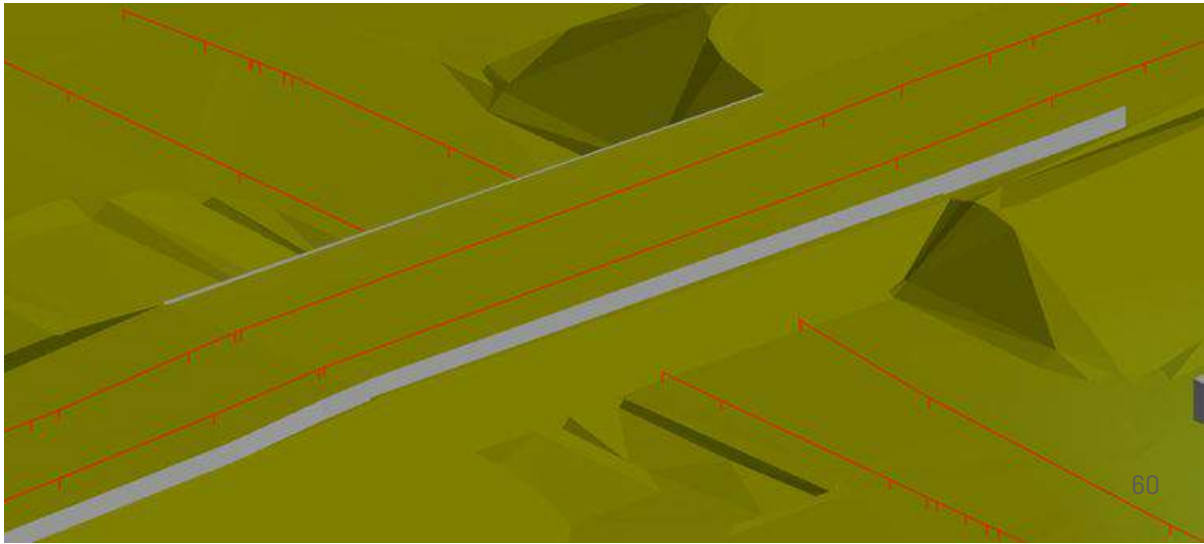




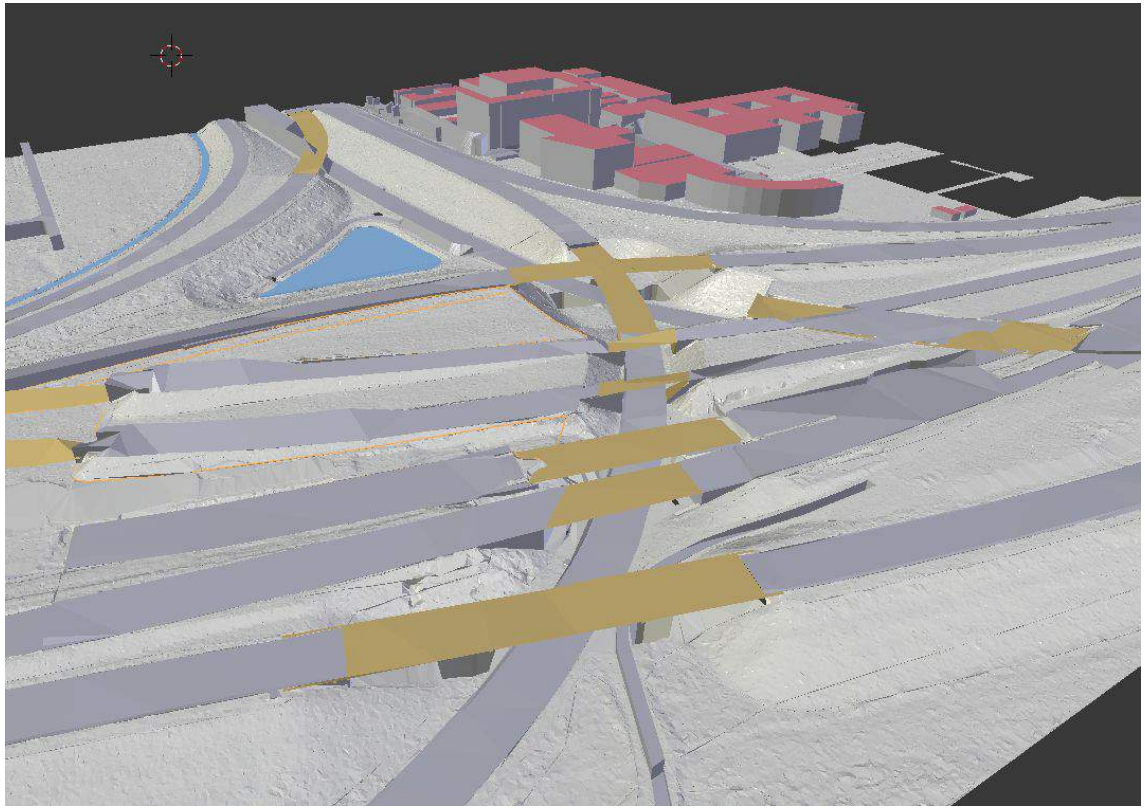


Contour lines

- Easy to assign the height of traffic lines relative to the terrain
- Traffic lines need to be cut
- Ground type under the bridge?
- Noise under the bridge?

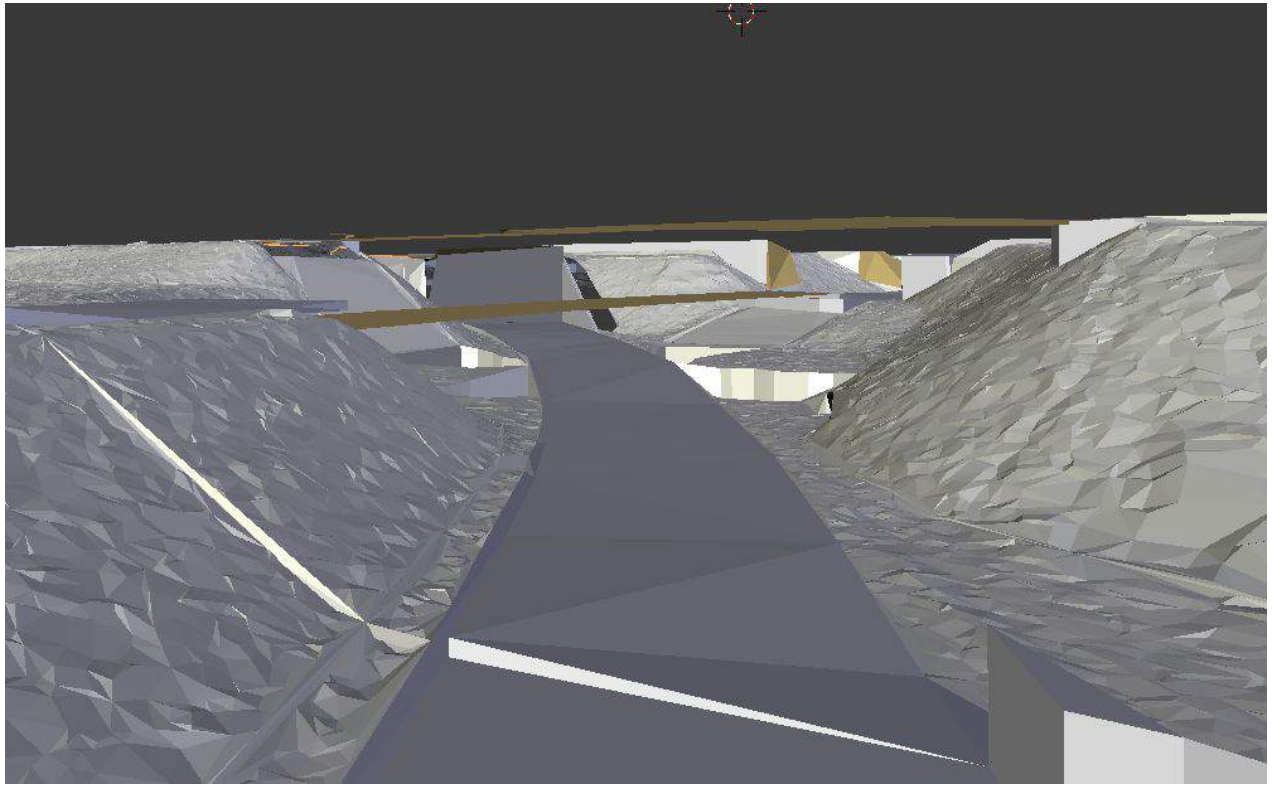


Our proposal

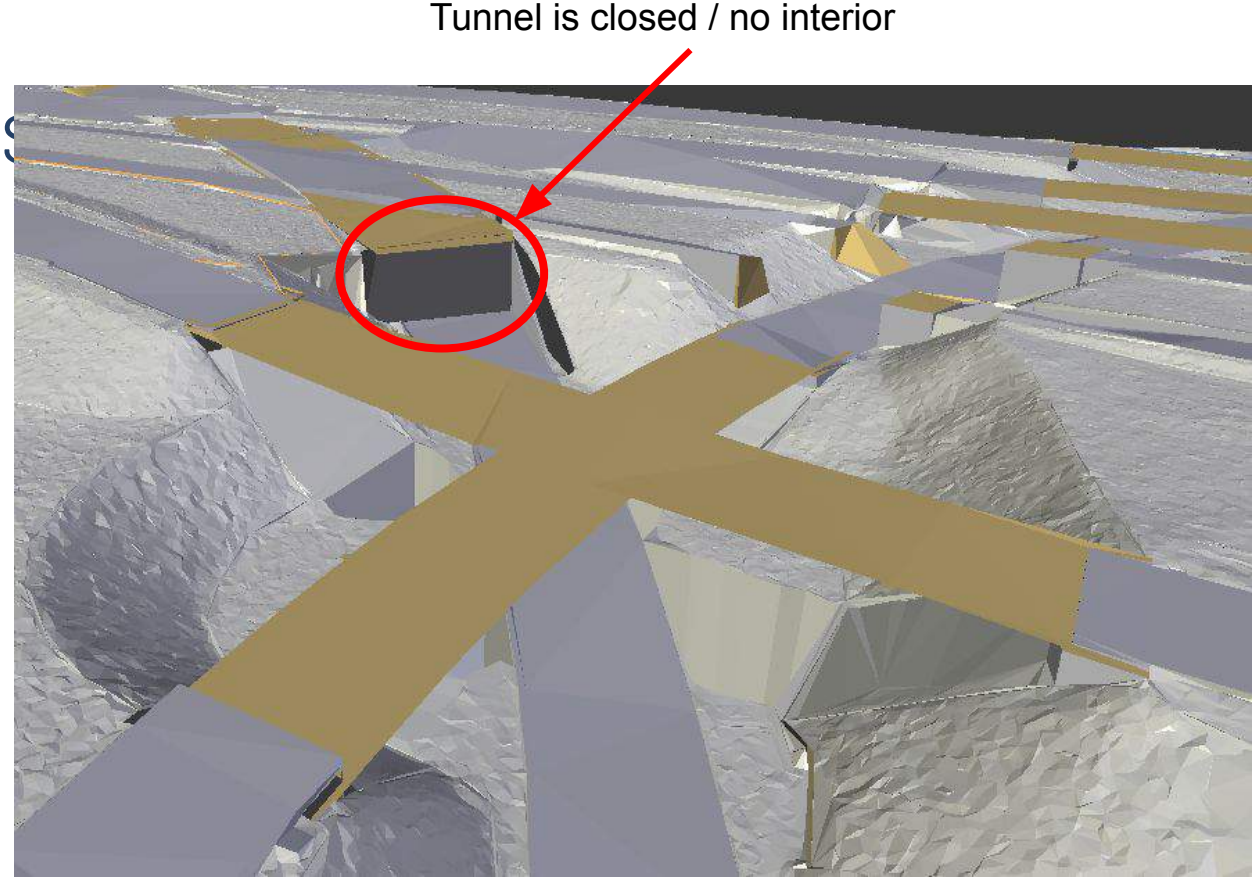


Nieuwe Meer A4/A10 West, Amsterdam

Our proposal



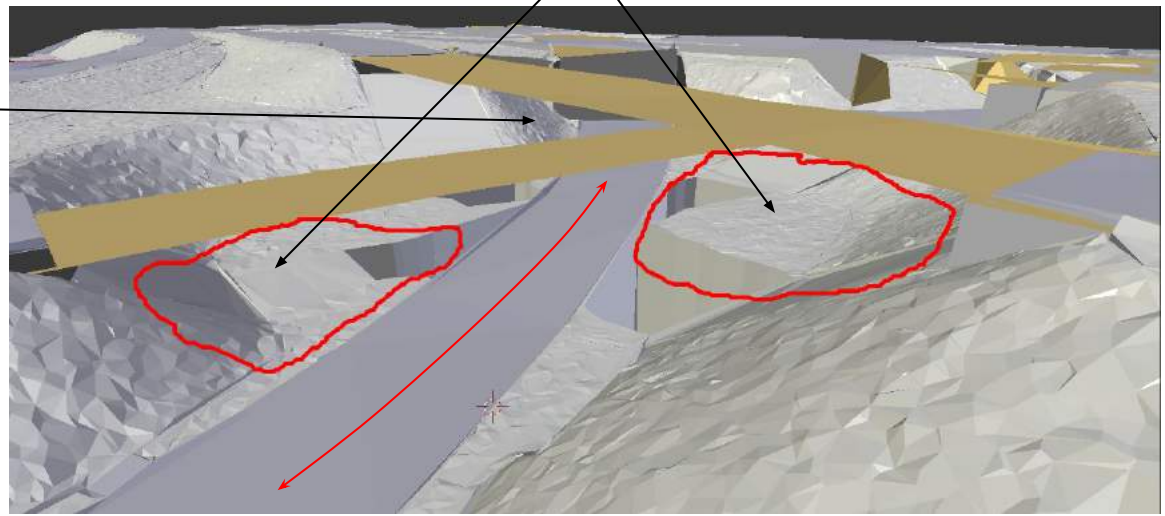
Our propos



Advantages

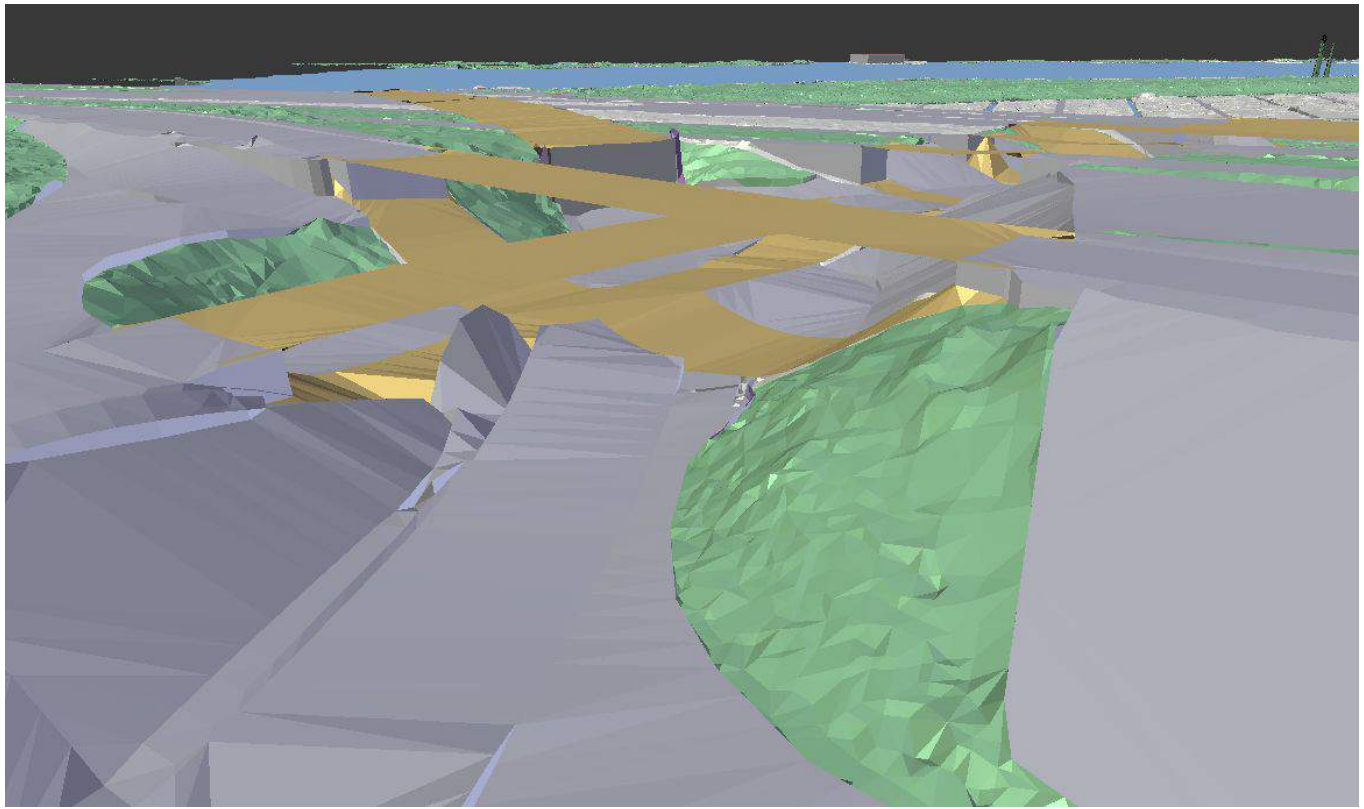
Different ground type under and on the bridge

Noise reflection in multi-level crossings



No need to cut the traffic line under the bridge

Current state:



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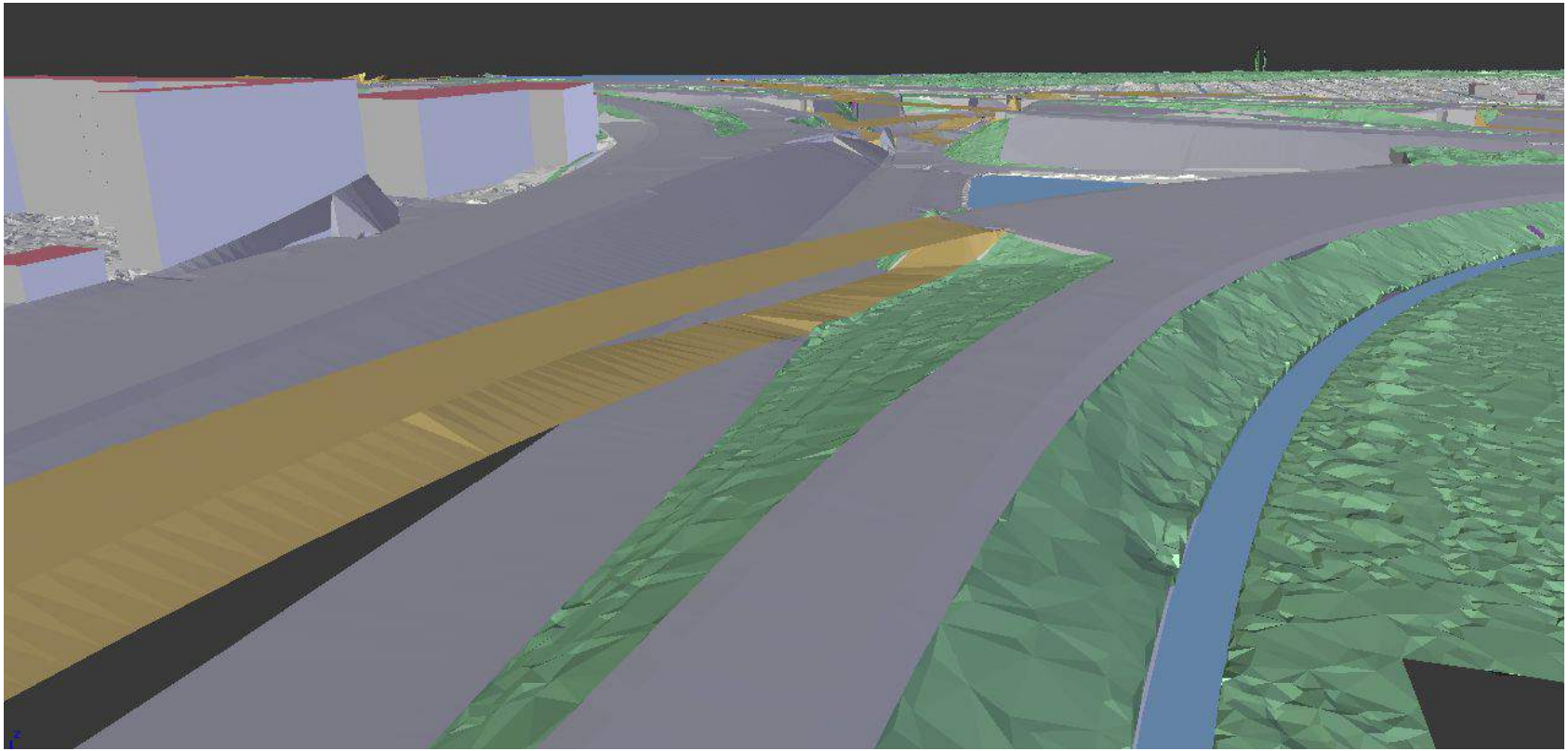
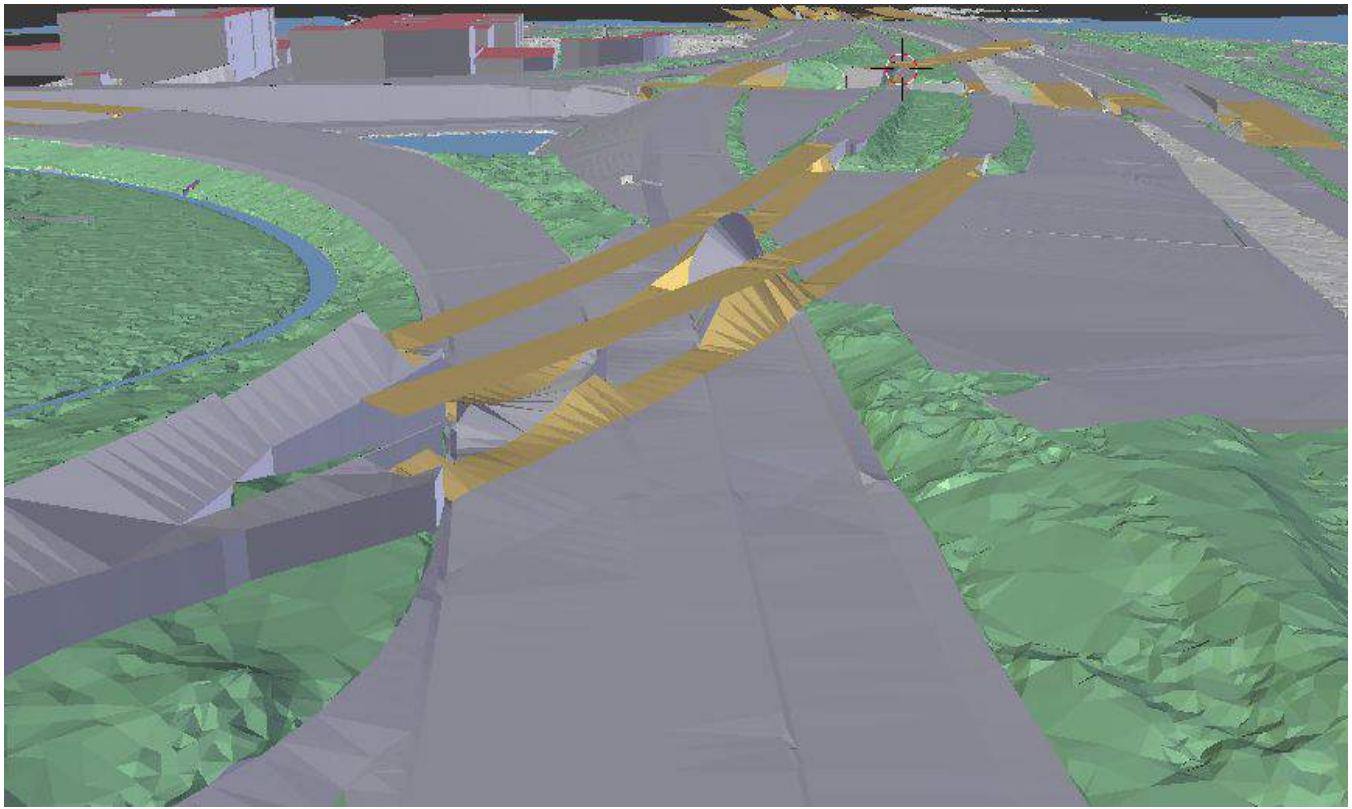
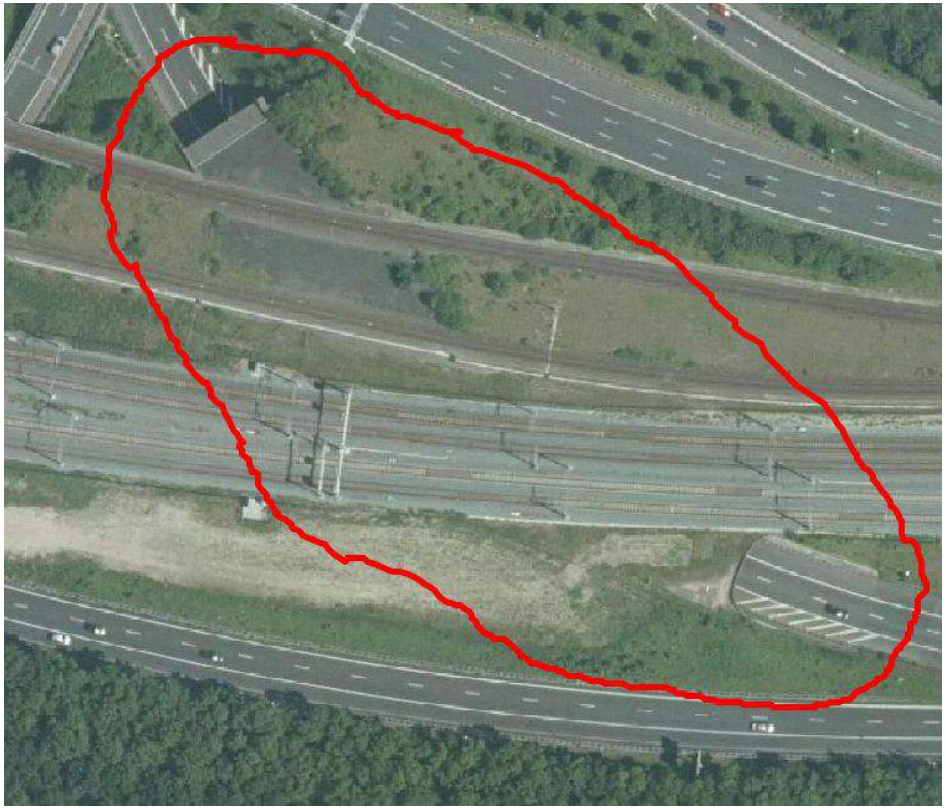


Current state:



Anatomy of a tunnel & crossing



Anatomy of a tunnel & crossing