Sustainable use and enlargement of the SDI for EU noise mapping in NRW – best practice for INSPIRE

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generated noise maps for EU reporting
Requirements

- EU Environmental Noise Directive 2002 (1st iteration 2007, every 5 years, statewide, great amount/multitude of 3D geodata)

- We were charged with feasibility study, implementation concept, project management in NRW by the State Ministry of Environment and the State Agency for nature in 2005 -2007

- Implementation in due time, due professional requirements, cost-efficiency and sustainability

- High financial savings in geodata acquisition and integration

- Noise mapping based on distributed data storage of the Spatial Data Infrastructure GDI NRW

- SDI solution for noise mapping is implementation example for EU Directive on INSPIRE

- Research: CityGML modelling, web service architecture
Provided 3D geodata

Web services provided via Spatial Data Infrastructure GDI NRW:

• 3D building models (3D block models LOD1 in CityGML format) with cadastral attributes (e.g. address, function, building id)

• Digital Terrain Model DTM5 (10x10m raster data in GeoTiff format)

• ATKIS road and railway data (output as AAA/NAS and converted on-the-fly to 3D in CityGML format)

• 3D state road data (in CityGML format) and thematic attributes

• 3D noise barriers and thematic attributes (e.g. reflection)

• refined geodata with noise attributes (e.g. building reflection, noise immission, traffic flow, speed limit, DTM breaklines)
Project partners

- Department of Geoinformation Uni Bonn: project management & scientific consulting
- LVermA NRW: generation and continuation of state geobasic data (3D block models, DTM5, ATKIS data)
- Straßen.NRW: generation and continuation of 3D state road data
- LDS NRW: provider of geodata and web services
- LUA NRW: noise calculation, generation of noise maps
- lat/lon GmbH: WFS-T 3D block models in CityGML, WCS DTM5 in GeoTiff
- Interactive Instruments GmbH: WFS ATKIS data in CityGML, Service 3D state road data in CityGML
- Stapelfeldt GmbH: geodata refining for noise calculation purpose
- Zerna GmbH: contract management
- Institute for Geodesy and Geoinformation Science, TU Berlin: CityGML consulting

Geodata refining based on distributed data bases
Project partners

Noise Mapping in NRW

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EU noise mapping in NRW
Employed standards

- CityGML-Version 0.3.0 OGC Discussion Paper Doc. No. 06-057
- OGC Web Feature Service Implementation Specification 1.1.0.
- OGC Web Coverage Service Implementation Specification 1.0.0
- OGC Geography Markup Language (GML) Implementation Specification 3.1.0
- GeoTIFF Format Specification 1.8.2
Noise immission calculation

3D block model in CityGML from WFS-T

DTM 10m grid in GeoTiff from WCS

noise immission simulation

noise immission maps for EU reporting (using WMS)

source: LVermA NRW, IGG TU Berlin, Stapelfeldt GmbH, LUA NRW
Noise mapping with CityGML

3D block models, ATKIS road data in CityGML from WFS
DTM 10m grid in GeoTiff from WCS

source: LVermA NRW, Stapelfeldt GmbH

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Noise mapping with CityGML

3D block models, ATKIS road data in CityGML from WFS
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source: LVermA NRW, Stapelfeldt GmbH
Exchange format CityGML

- Open data model for description of 3D building and landscape models
- Interoperable exchange via web services
- XML-based; application schema of GML3 of OGC/ISO → standardisation of CityGML is ongoing in the OGC
- Representation of geometry, topology, semantic → object groups, relations, aggregation
- Modelling of DTM, buildings, transportation, city furniture, vegetation, water bodies, sites, etc.
- 5 consecutive levels of detail (LOD) 0-4

Use for noise mapping

- Flexible integration of DTM, 3D building model and 3D roads of different sources and accuracy
- Modelling of e.g. noise barriers, road surfaces
- Continuation of different data sources (ids, inheritance of attributes/properties)
- CityGML as exchange format between data providers and noise mapping software
Noise mapping with CityGML

CityGML noise extension for transportation model

Modelling of roads and road segments; Management of gml:ids

Inheritance of properties/attributes

Modelling of noise attributes
Financial savings of SDI solution

• 77% financial savings for 3D geodata generation and provision
  – centralised 3D geodata generation (e.g. 3D block models in CityGML)
  – no manual data copies (use of web services for data access)
  – no conversion into different formats (syntactic interoperability via CityGML)
  – sustainable use of the architecture for all iterations (data continuation)

• again 15% financial savings for 3D geodata integration and refining
  – 3D geodata refinement based on web service access
  – 3D geodata integration via WFS-T
  – use of open source products
  – almost no licence fees
- Access to 3D geodata of the web services in CityGML format via the geobasis data portal NRW
- Authentified access for affected/responsible municipalities
- Visualisation of noise calculation results (noise maps) in a Web Map Service
- Download of noise calculation results for affected/responsible municipalities
Summary & outlook

- High requirements of the END (every 5 years, statewide, great amount/multitude of 3D geodata, geodata integration)

- Challenges:
  - 3D geodata provision: via Web Feature Services with CityGML-Output (ATKIS to CityGML Schema Mapping)
  - SDI architecture: based on CityGML, transactional service
  - CityGML modelling: semantic & syntactic interoperability, 3D modelling for noise mapping
  - 3D geodata integration and refining: based on distributed data storage

- Outlook:
  - geodata continuation: data bases and web services

- SDI solution important for international standardisation (OGC, INSPIRE)

- SDI solution cost-efficient and sustainable
Further questions

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