Road-traffic Noise Assessment in Finland 2007

Analyzes of the Data used in 1st Round Noise Mapping and Applicability of the Data

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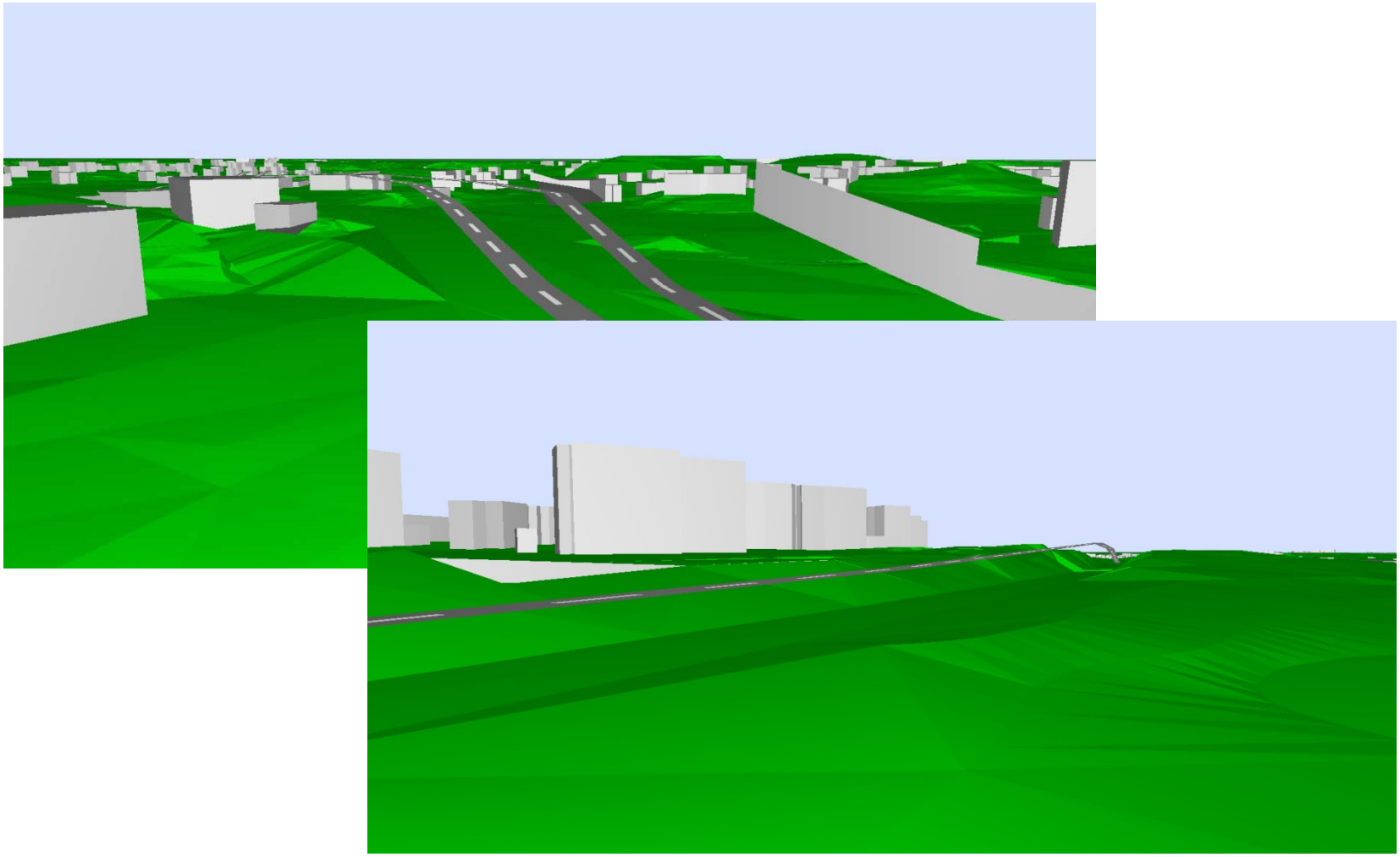
- All the needed data available for analyzes
- Accuracy and quality of the source material varies a lot
- Quality of the noise calculations and discovered inaccuracy
  - Documentation: good quality
  - Vertical geometry of roads: most remarkable local inaccuracy → the inaccuracy in the modeling work has partly more impact than the inaccuracy of the source data
- Temporal quality of the data
  - Source material partly out-of-date already during the noise mapping in 2007-2008

Analyzes of the Data used in 1st Round Noise Mapping and Applicability of the Data

- Right of use
  - Data of Helsinki has good quality, possibilities to use the data (also in other projects) can be discussed with the city of Helsinki. Due to the expenses of data production there is usually a fee of providing the data. In the border areas compensation trading may be possible.
  - Some cities take with a grain the usage of their data

- Applicability of the data
  - The data examined so far: only the data of Helsinki can be utilized mostly as such in the 2nd round
  - Other data will be used as support data in the 2nd round (e.g. sound barriers, horizontal geometry)

Example: Inaccuracy of Vertical Geometry of Roads



Testing of Terrain Model with Noise Calculation Program

- Laser scanning point cloud data of the elevation model is too detailed and cannot be used as such in noise calculation program.
- Point cloud data has to filtrated in order to obtain a usable digital terrain model (DTM) for noise calculations.
- DTM made for noise calculations includes contour lines, break lines, bridges, buildings. Accuracy needed is obtained with 1 m contour distance.
- The quality of DTM is more equal and therefore the amount of errors caused by the source data is less than in 1st round
- Calculation time with the more detailed DTM is 4-5 times higher compared to a less detailed DTM used in the 1st round. → detailed DTM has to be lightened
- Light version of DTM has less polygon points and almost same calculation result ($\Delta L<0,5dB$) but grid map calculation time is less than half of the original DTM

Applicability of Laser Scanning Data of National Land Survey of Finland (NLS)

- Data based on laser scanning
  - Point cloud, includes all point data unclassified (first to be finished)
  - Classified terrain model 2 x 2 m (classes: ground, vegetation, lake / sea, river / stream, bridges)
- Point cloud data is the best data for noise calculations

- Test calculation made in three test areas:

Tampere, highway 12

- Standard scanning: 0,5 points / m²
- Buildings: Automatic classification and manual modeling
- Digital terrain model coded by DTM standard of Finnish Road Administration

Turku, highway 1

- More detailed scanning: 1 point / m²
- Buildings: Automatic classification, no manual modeling
- Terrain model coded by terrain model standard of Finnish Road Administration

Applicability of laser scanning data of National Land Survey of Finland (NLS)

Espoo, ring road I

- 3 sound barriers chosen for accuracy assessment
- Sound barriers modeled using the laser scanning data (bottom and top edge)
- Results

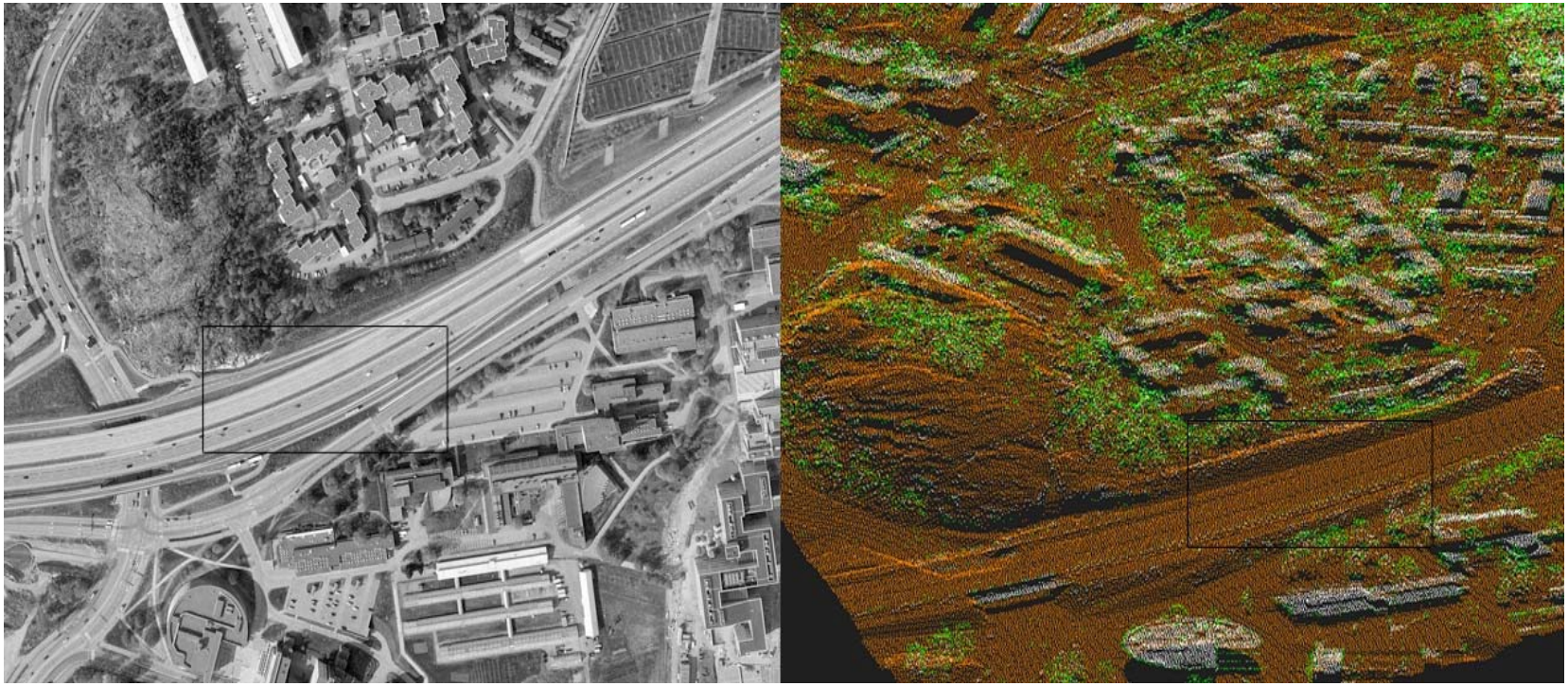
minimum deviation	-0.036 m
maximum deviation	0.116 m

Results

- Laser scanning data may well be used for terrain modeling
- The data filtrated heavily has adequate accuracy for DTM used in noise calculations
- Modeling the built environment needs support data (aerial photographs, vector data)
- Modeling narrow sound barriers is not possible without support data
- More detailed point data - > better interpretation accuracy
- Geometric accuracy of the data is very good

Example of Laser Scanning Data

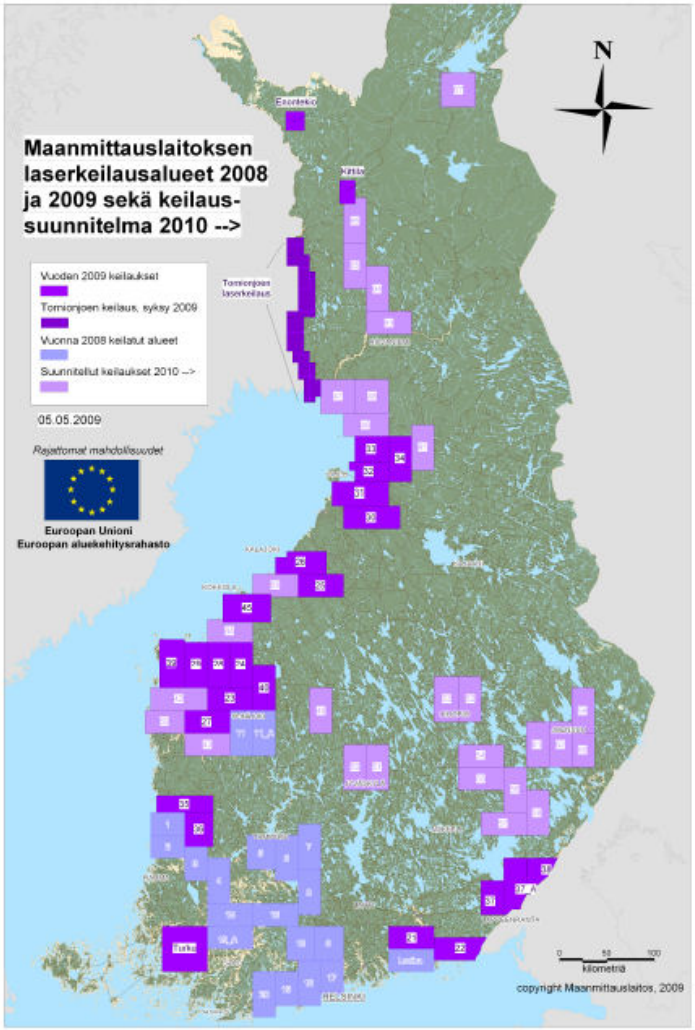
- On the left: aerial photograph; on the right: 3-D point cloud data, where ground points are brown.



Coverage of Laser Scanning Data Produced by NLS Compared to Survey Areas of Finnish Road Administration

- Areas of laser scanning
  - 2008-2009: Southern, South-Western and Western parts of Finland
  - Data available from all laser scannings made in 2008
  - Laser scannings of 2009 mostly done
- Planned areas 2010-2011
  - The rest of the Western coast, inland Finland, Northern Finland
- Quality of terrain data in other areas
  - Elevation model (resolution 25 x 25 m) available in other areas (partly 10 x 10 m)
  - Topographic database including vector data of contour lines, roads, buildings etc.
  - Quality of elevation model and temporal quality of topographic database varies spatially a lot (updating every 3-10 years for Topographic database, 1 year for roads)
  - Majority of the Topographic database has similar spatial resolution that aerial photographs
  - The data of Topographic database is heavily generalized
  - Stereo aerial photography is available (whole Finland), data updated approximately every 7 years

Coverage of Laser Scanning Data Produced by NLS



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Support Data

- Road photography, coverage 100 % in 2011 for 2nd round target areas of Finnish Road Administration
- Oblique photography, at the moment coverage 34 % for round target areas of Finnish Road Administration, 100 % for municipalities
- Topographic Database, coverage 100 %
- Urban areas: digital base maps

Examples of Road Photograph and Oblique photograph

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Mobile Laser Scanning of Road

- Mobile laser scanning is a new technique that produces huge amounts of data (laser scanning made from a car)
- Laser scanning data can be used for modeling road structures and structures in the neighbourhood (e.g. sound barriers)
- Handling huge amounts of data is challenging in larger projects

Example of Mobile Laser Scanning Data

- Point cloud data

Population Information

- The Finnish Population Information System (FPIS) is a computerised national register that contains basic information about Finnish citizens and foreign citizens residing permanently in Finland.
- Also recorded is information about buildings, construction projects, residences and real estate. The Population Information System is the most-used basic register in Finland.
- Finland’s registration of population data is viewed internationally as being of a high standard.
- FPIS is maintained by the Population Register Centre and local register offices
- Population information needed in END mapping is available in Building information of FPIS.

Building and Dwelling Register (BDR)

- Building information is commonly referred to as the Building and Dwelling Register (BDR).

- BDR is updated by
  - municipal building supervision authorities (constraction projects etc.)
  - local register offices (residence details related to persons and their respective residences, maintaining of addresses etc.)
  - Cooperating with municipal authorities, local register offices are also responsible for various changes and corrections to building information
  - Cadastre (land register) authorities – district survey offices and municipal authorities – are responsible for matching buildings to the correct property by maintaining the building codes of the FPIS

Building and Dwelling Register (BDR)

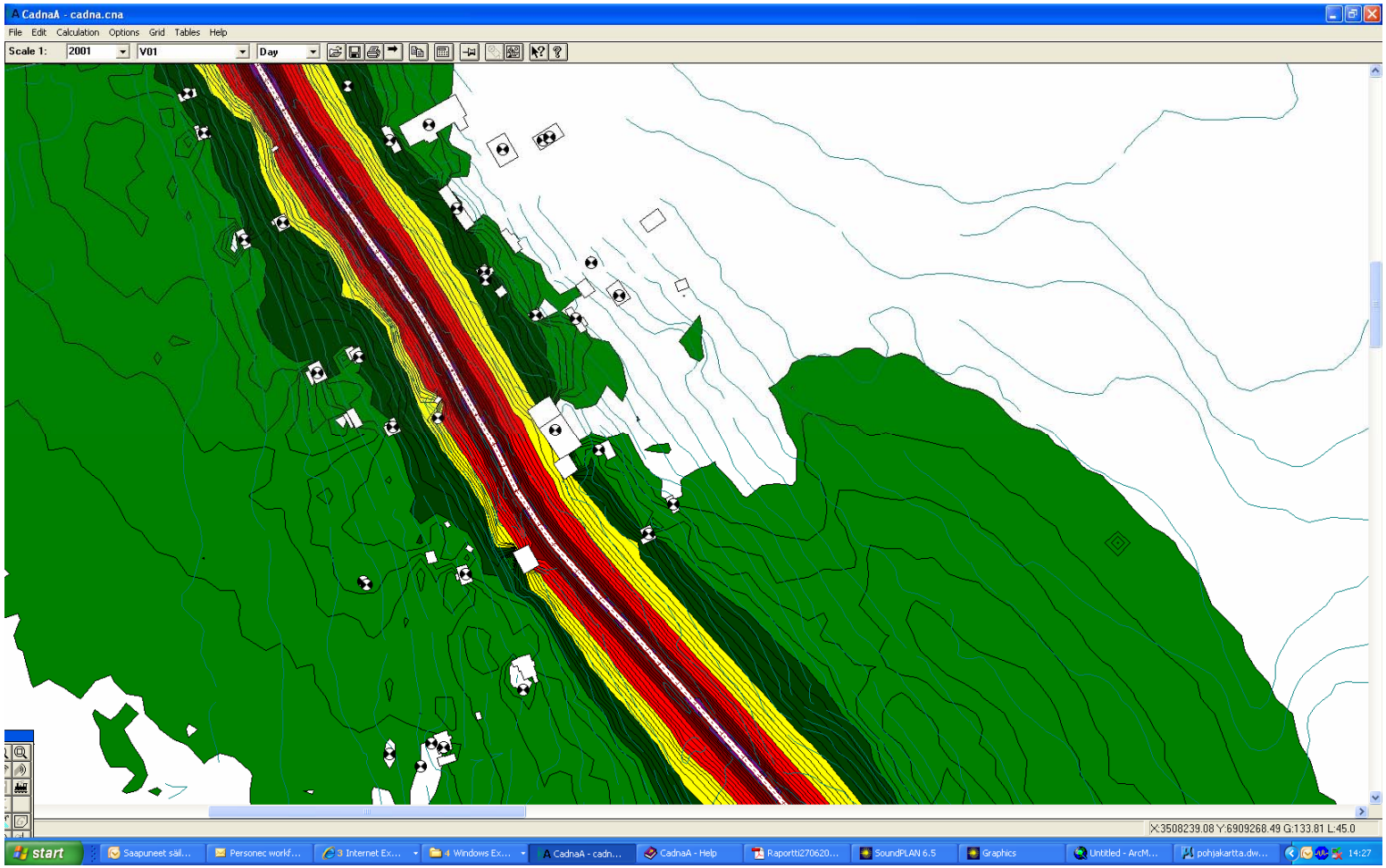
- Using building and apartment codes, persons registered in the FPIS can be linked with the centre coordinates of buildings
- Finnish Road Administration has a license to use BDR data
  - Updated for Finnish Road Administration once a year
- Data protection
  - Data protection of FPIS is strictly controlled, presenting identifiable information is forbidden.
  - In public presentations, the number of people may be presented by areas of equal sound level. If the number is equal to or less than 10, the number is presented as 0-10.

Building and Dwelling Register (BDR)

- Data in BDR is geographic vector (point) data that includes information on location (coordinates) and attribute data.

- The most relevant attribute data includes
  - Building and apartment codes
  - Coordinates
  - Accuracy of the coordinates
  - Completion date of the building
  - Usage situation
  - Address
  - Intended use
  - Number of people living in the building
    - Total number
    - 0-6 years old, 7-12 years old, 13-15 years old, 16-17 years old, 18-64 years old, 65- years old
    - 0-17 years old
    - 18 years old
    - 7-9 years old
    - 7-15 years old
    - 7-17 years old
    - 13-17 years old

Example of BDR data



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Spatial Accuracy of BDR Data

- The inaccuracy percentage caused by un-up-to-date data and / or inaccurate coordinates has to be determined in END noise mapping

- BDR data was compared with three building data sets: buildings from laser scanning data, buildings from digital base map, buildings from Topographic database (used in 1st round)

- Accuracy assessment of Tampere test area (BDR vs. buildings from laser scanning data)

	Number	%
Population points (BDR data)	455	76.0 % of all BDR points
Population points inside buildings (from laser scanning data)	447	98.2 % of population points
Population points inside or max 5 m outside the buildings	450	98.9 % of population points