Land Mapping Working Group - 3D/4D data

7.9.2018

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The Land Mapping working group - 3D/4D data

1. Introduction

This report includes description of the current production related to 3D/4D data activities and future plans within this group.

There is a lot of user requirements related to 3D models and time information. There is also already a lot of different solutions, but the role of the National mapping agencies in this development is not clear and well defined.

2. Current production

2.1.1. Aerial images / photogrammetry

	Resolution (meters)	Cycle (years)	Coverage	Additional information
Finland	0.40	5 and 10 (north Lapland)	Whole country	National Program
Sweden	0.24 and 0.48	2-10	Whole country	National Program
Norway	0.25-0.5 (omløp) Detailed 0.07-0.10-0.20 (Geovekst)	7-10 1-7	Sparsely populated areas Urban areas	National Program. Supplement to the Geovekst coverage. Carried out through the Geovekst-cooperation.
Denmark	**Spring** GeoDanmark 15 cm res. In urban areas also 10 cm We distribute ortophotos In resolution 12.5 cm. **Summer** 15 cm res. We distribute ortophotos In resolution 12.5 cm. **Spring** 5 – angle pictures	1 1 2	Whole country Whole country Whole country	https://sdfe.dk/hent-data/fotos-og-geodanmark-data/ https://sdfe.dk/hent-data/fotos-og-geodanmark-data/ No public information at this time
Island	No acquisition – private enterprise Satellite images are used. Digital Globe services are used.			No national coordination in data acquisition. Private enterprise is active (cycle about 3-7 years and whole Island is covered).

2.1.2. Lidar - point clouds

	Density (points/m2)	Cycle (years)	Coverage	Additional information
Finland	0.5-1.0	Not yet decided	Whole country will be covered 2019	National Program
Sweden	1. 0.5-1.0(old lidar) 2. 1.0-2.0 (new lidar) 3. 0.5-1.0 2,5D grid from point clouds from images.	1. 2009-2018 2. From 2018(new lidar) the goal for lidar is a 7-year cycle. 3. 2-10-year cycle for point cloud from images	1. Whole country 2009 – 2018.(old lidar) 2. New program started 2018 approx. 75% of the country. 3. Point cloud from images - whole country.	1. National lidar program 2009-2018 2. New lidar program from 2018 3. National program Point clouds from aerial images
Norway	2-5	2 point areas – not decided 5 point areas – 1-7 years	Whole country will be covered 2022	National Program Carried out through the Geovekst-cooperation.
Denmark	4 - 8 points each m²	5	1/5 each year (current program) The whole country is already covered twice.	https://sdfe.dk/saadan-arbejder-vi-med-data/flyfotos-og-laserscanning/
Island	0.5 p/m2	No plan	1/6 covered	Further Lidar acquisition is not yet planned but actively promoted. National program is in the planning stage (needs financing)

2.1.3. Elevation models

	Product(s)	Cycle (years)	Coverage	Additional information
Finland	Old 10 meter grid based on photogrammetry, 2 meter grid based on lidar	Based on lidar program	10 m grid - whole country 2 meter grid - country will be covered 2020	KM2 KM10
Sweden	1. Grid 2+, 2 meter grid. 2. WCS "Höjdmodell nedladdning", 1 meter grid. 3. 0.5-1.0 points/m2 DSM grid from images	1 and 2, based on old lidar program 2009-2018. 3. grid from point cloud from images		1. Grid 2+ 2. Höjdmodell nedladdning 3. DSM from images
Norway	10 m grid based on photogrammetry and lidar data. 50 m grid based on photogrammetry 0.25 ,0.50 and 1.0 m grid according to the density covering the area	Continuously updated based on new lidar data 50 m grid has not been updated since 2007. Continuously updated based on new lidar data	Whole country In urban areas and areas surrounding roads and railways.	The old 10 m grid based on photogrammetry has not been updated since 2013. The lidar-data is stored in hoydedata.no/
Denmark	0.4 m res. Different bases: Dtm, dsm, blue spot ++	5	1/5 each year	https://sdfe.dk/hent-data/danmarks-hoejdemodel/
Island	10 m grid based on photogrammetry and lidar data.	Updated with new data when available	Whole country	Plans to use ArcticDEM in the future, which is based on Digital Globe satellite images. Planned resolution is 2 m grid (already some test areas available)

2.1.4. Topographic database (2D/2.5D/3D/4D)

	Geometry, time information	Cycle (years)	Archiving	Additional information
Finland	2.5D data, z value is derived from the lidar based elevation model, no object based life cycle information	The road network and geographic names are updated continuously, the administrative borders and the buildings yearly and the other elements approximately every 5–10 years	Some database dumps	Open data Most of the data is collected from stereo images (Espa/Smallworld) Some field measurements and other data sources like municipalities (not common datamodel).
Sweden	2D vector products. Some data collected and stored in 2,5D.	E.g. properties, plans, geographic names/addresses and transport network updated continuously. Some layers/classes/objects twice a year some once a year and some 2-10 years via data collection from new aerial images.	Raster products 1:50 000 and smaller scales archived yearly. Some years archived as 1:10 000 raster products.	Fastighetskartan Most of the data is collected from stereo images (Espa/ArcGIS) and via greements with municipalities (“ABT-avtal”) – some stereo and some field measurements. Also plans and property information from municipalities. Some data from other governmental organisations (e.g. roads and ancient remains) and some via agreements with other organisations (e.g. power lines).
Norway	2.5D data	Photogrammetric mapping and construction are carried out every 1-5 years, themes for updating are considered in each project. The road network, buildings and land resource map are updated continuously (municipalities updating the central database).	Raster is the historic format, yearly versions	Photogrammetric mapping and construction is the base, in addition to update from the municipalities. We have some data capture from the public through our service “Correct-in-map”.
Denmark	2.5 D data Photogrammetric	1/5 total new (covering all the themes/objects) and 4/5 appointed (municipalities are doing the measurements/updates)	Oracle including several snapshots times in year.	https://sdfe.dk/hent-data/fotos-og-geodanmark-data/
Island	2D vector data.	Update cyclus not defined. Updates depend on what new data is available.	Database versions twice a year	Different sources for updates. Orthophoto for place names, Satellite images for hydro and land cover.

2.2. 3D modelling (also including 3D planning)

	BIM/IFC	GIS	Visualization	3D cadaster
Finland	No	No	No	Planes, not linked to the 3D buildings/objects
Sweden	No	No	No. 3D-properties /cadastre information possible to see via style/colour in the 2D Property map. General ideas of what is needed for implementation of 3D on a national level and test of 3D visualization have been done in the National geodata in 3D project.	3D properties documented in Real Property Register as “printed views” from e.g. 3D CAD drawings. Linked to property/parcel.
Norway	No. We have ongoing test projects (early face) to use BIM-models in updating the building themes New planning standard in progress, mainly related to the representation. of building limits (GML volume)	No	No Test projects ongoing according to visualize the building limits in 3D.	
Denmark	No	No	No	No
Island	No	No	No	Partially 3D properties are described in a legal document that defines how a 2d land object is split into 3D volumes. CAD drawing is part of the legal document. The owners of the subdivided space own the rights to the land object in proportion to total volume registered.

3. Development, future plans and ideas

This part of the report focus mostly on ongoing projects, but there is also some ideas what should or could be done.

3.1. 3D modelling

3.1.1. Finland

There is a large national Geospatial Platform program going on, which will renew the data modelling and related processes. The National Topographic database -program (NTDB) is part of this larger program and it will renew the current definitions and processes. Main goals are to get rid of the duplicated work between different organizations by using common data models and specifications, improve and enhance transparency of data-based decision making and e-services in public administration and make core spatial dataset available for all on a platform, which private sector can also use as a basis for its own services.

The new data model includes 3D objects and also detailed time information. All object will have permanent ID:s and time stamps, when it's created, changed and deleted. Also planning information will be included. This enables new services like linked data and change services.

Definitions for buildings are already quite complete and they are CityGML and INSPIRE compatible (3D buildings). There will be a national recommendation based on the work, which is done in NTDB program. The national recommendation should be ready in summer 2019.

One of the goals is to make more cooperation with construction industry and municipalities. In practice this means that we try to have common vocabulary and definitions in such way that geographical 3D models can be constructed automatically from planned BIM models and later these will be updated as as-build models. At this point, we are doing some cooperation with Building Smart Finland and some tools have been created and tested, but the time schedule is not yet fixed. There is also a draft for the regulatory roadmap, which is partially based on the work done by the Norwegian Building Authority.

Data quality checks are very important in distributed data management. For this reason, we are defining quality rules and tools, which can be used by all data producers. The first public test version will be launched in September 2018.

3.1.2. Sweden

The topographic database can handle 2.5D data and for buildings via the service, Byggnad Direkt, there is a possibility to get height information for the building geometry. The service provides buildings in 2,5D via REST interface in XML or JSON format. The z-value and what areas that are covered with a z-value are not so well documented, which means that at the moment the z-value is not so useful.

Plans for geodata in 3D are included in The Swedish National Geodata Strategy and the in the plan for "Handlingsplan för infrastruktur geodata". Actions includes work with specifications, how to implement 3D in national basic data and the interaction with BIM. BIM - 3D geodata work will e.g. be done in co-operation with the suggested Smart Built Environment project, Leveransspecifikationer för Geodata-BIM.

In the project Svensk geoprocess specifications and data models (2D/2,5D/3D) in GML e.g. buildings have been defined, and test data as well as validation tools are available. Now, as part of "Handlingsplan för infrastruktur geodata", actions are taken for how to best implement the models and specifications from Svensk geoprocess.

3.1.3. Norway

Action in national geodatastrategi - opportunity study on 3D:
3D geodata will be included in the geographic infrastructure.
The opportunity study on further development of the infrastructure and 3D geodata will describe actions and tasks within whole value chains.

- Look to experiences and good practices from other countries.
- Identify important use cases and describe user travels
- Within the public and private sectors.
- Further developing of standards and specifications.
- Harmonize and connect to other relevant disciplines.
- Implement requirements for a national management regime for 3D data.
- Customize production lines and products in the infrastructure.
- Arrange test projects for modern 3D data capture.
- Make profit analyzes for the actions.

3.1.4. Denmark

Several investigations, but no plans yet.

3.1.5. Island

The National Land Survey is not working on 3D implementation.

Registers Iceland is currently not working on furthering present 3D implementation defined in 2.2.

3.2. 4D / time

3.2.1. Finland

The new data model includes detailed time information. All object will have permanent ID:s and time stamps, when it's created, changed and deleted. Also planning information will be included. This enables new services like linked data and change services.

The time stamps will fulfill the INSPIRE requirements. They are based on the Finnish JHS-Public Administration recommendation JHS193.

3.2.2. Sweden

Today historic versions of the topographic vector database are handled within the ArcGIS system. All objects have unique permanent ID:s and time stamps, when the geometry is created and changed. Historic versions can be extracted from the system and are used to e.g. correct possible errors. Historic versions as e.g. yearly database dumps are not available. Actions are now taken for how to best archive versions of the topographic vector database, e.g. database dumps, and how/if historic versions can be provided to users.

In the database-model for buildings, objects have permanent ID:s(UUID) and time stamps, when it's created, changed and deleted and an attribute indicating if the building is planned, existing or demolished are available.

Via the e.g. the product GSD-Fastighetskartan, vektor and the service Byggnad Direkt some of the 4D/time information is available.

Information about plans are e.g. provided as part of additional information to the GSD-Fastighetskartan, vektor and via services, e.g. Planer, bestämmelser och rättigheter Visning. The planning information, as pdf-files, can be linked to polygons for the planned areas.

3.2.3. Norway

The topographic database (FKB-data) is under development to handle historical data. The plan is to develop the management system (QMS) to handle historical data 1-2 years back in time. For data older than this there will be made yearly versions made available in a separated system.

The Norwegian geoportal – Geonorge will be further developed. The map viewer shall be able to present WMS with time series. Satellite imageries from Sentinel 2 satellite will be provided from The Norwegian Meteorological Institute as WMS, with support for time parameter. We will test if the Geoportal can show data from NetCDF-files or Grib-files in an internal web based viewer. These files will contain weather forecast data some few days in advance.

3.2.4. Denmark

The data model includes detailed time information. All object have permanent ID:s and time stamps, when it's created, changed and deleted.

High focus on possible "more qualified" use and distribution of the timestamps. But no solutions in the pipeline, neither for linked data nor change services.

3.2.5. Island

Neither Register Iceland nor the National Land Survey are not working on 4D implementation.

4. Conclusion

For most of the participants this is hot topic at time being. There has been made some strategic decisions and also some implementations are already going on.

Overall this is a topic, which needs to be handled with other stakeholders as well. Geodata is coming more and more essential part of the different ecosystems. The understanding of the user needs are essential.

In practice this means need for common standards and tools, which are largely accepted and took as part of the different workflows. Co-operation is the key of success and national mapping agencies can't solve this alone.

Links:

- Study of the economic value of the 3D data: http://www.eurosdr.net/sites/default/files/uploaded_files/pub68_economicvalue-3d-geo-information_final_v1.pdf