



Working Committee of the Surveying Authorities
of the Laender of the Federal Republic of Germany



National Report

2020/2021

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Table of Contents

Foreword.....	4
1. Organisation and Performance of Tasks.....	5
Organisation of the AdV.....	5
Objectives and Tasks of the AdV.....	6
Geobasis Steering Committee.....	7
Surveying and Cadastre Authorities of the Laender.....	7
Federal Ministry of Transport and Digital Infrastructure.....	9
AdV's Future Topics.....	14
2. Working Group Spatial Reference.....	17
PPP-RTK.....	19
3. Working Group Real Estate Cadastre.....	22
Central Distribution ALKIS®.....	25
4. Working Group Geotopography.....	27
Digital Landscape Models.....	27
Digital Elevation Models.....	28
3D Building Models.....	30
Digital Topographic Maps and Official Map Services.....	31
Digital Orthophotos.....	32
Remote Sensing and Copernicus.....	34
Toponymy.....	35
Smart Mapping.....	36
5. Working Group Information and Communication Technology.....	38
Implementation of the GeoPackage format.....	38
AdV-WMS-Profile, Version 5.0.0.....	39
AdV test suite.....	40
New Recruits Campaign.....	42
6. Working Group Public Relations and Marketing.....	44
15 years of PRM activity.....	44
The story behind the name Public Relations and Marketing	45
The long road to OpenData.....	46
INTERGEO®.....	48
PCC Chair.....	50
7. Involvement in National and International Organisations.....	53
EuroGeographics.....	53
Copernicus.....	57
Open Geospatial Consortium (OGC) and ISO/TC211.....	60
Permanent Committee on Cadastre in the European Union.....	62
Annex.....	63
Explanation of frequently used abbreviations.....	63



Dear Readers,

For society as a whole, as well as for the Working Committee of Surveying Authorities of the Laender of the Federal Republic of Germany (AdV), the years 2020 and 2021 will go down in history as the years of the pandemic. Due to the technical and digital affinity of the member authorities, and the fearless approach of its protagonists, AdV was one of the first committees to swiftly switch to virtual formats during the lockdown in spring 2020. AdV was thus able to hold their spring plenary meeting and the meetings of the Working Groups, task forces and project groups in an initially unfamiliar manner, and with more time-consuming organizational preparations, but nevertheless successfully.

Thus, AdV was able at all times to continue to manage their core projects. Due to their key strategic decisions on Smart Mapping, AdV opened the gates for modern web cartography even further and paved the way to the future of smart data models and for geospatial reference data. This web map will have the name [basiskarte.de](https://www.basiskarte.de). The course has been set to replace the raster data deliveries of the Laender for the WebAtlasDE in 2022 by means of the raster tile archives of [basiskarte.de](https://www.basiskarte.de). After the yet to be established operational state of the [basiskarte.de](https://www.basiskarte.de), WebAtlasDE will belong to the past.

Regarding further future topics, AdV is keeping on the ball and has institutionalised the tracking and analysis of future topics. Future-related topics will be continuously identified and evaluated regarding their significance and realization within the official surveying.

Addressing the growing demand for transnational data of the real estate cadastre, AdV decided to bundle the central distribution of cadastral parcel information at the Central Office for House Coordinates and Building Polygons. This can be regarded as a milestone in the field of official geospatial reference data distribution.

AdV was faced with the rare and therefore extraordinary challenge of hosting the PCC Congress in November 2020, where cadastre experts of almost all European countries joined for the virtual exchange of ideas. Considerable media attention was cast on the GNSS Campaign that took place between 7 June 2021 and 15 July 2021, in which the surveying basics for the entire Federal Republic of Germany were examined and renewed, coupled with the millimetre-accurate verification of 250 fundamental German surveying points. The results will not only be used in surveying but will in future also be implemented in interdisciplinary applications like the autonomous driving, climate change, flood control and geodynamic questions (changes of Alps and coast lines) and man-made surface deformations (road and water construction, mining).

AdV understands that a healthy age structure in staff of its member authorities is vital. That is why they contribute financially to and provide related content to the social media campaign [#weltvermesserer](https://www.weltvermesserer.de), which launched in 2020 and is supposed contribute towards raising the enthusiasm of young people for professions in the geodetic field.

I would like to particularly thank the colleagues who helped me with the AdV-related work in these two unusual but challenging years and who collaborated constructively and energetically in virtual meetings to reach sometimes complex decisions on complex and conflict prone topics.

I am wishing you an informative read.

Tobias Kunst
AdV Chairman

1. Organisation and Performance of Tasks

In the Federal Republic of Germany, the Laender are responsible for performing official surveying and mapping tasks. Since 1948, the responsible authorities of the Laender and the Federal Ministries of the Interior, Building and Community, of Defence as well as for Transport and Digital Infrastructure have been cooperating together in the Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV) to address technical matters of fundamental and national importance. The German Geodetic Commission (DGK), as a representative of geodetic teaching and research, and the German Federal Working Group Sustainable Rural Development, representing the field of land consolidation, have guest status in AdV.

Organisation of AdV

Figure 1 shows the organisation of AdV. Chair and plenum are its steering bodies. AdV is supported by the working groups and the management.

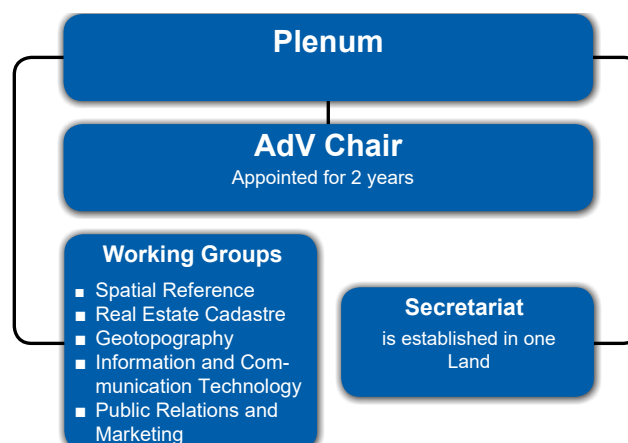


Figure 1: Organisation of AdV

Objectives and Tasks of AdV

The member authorities collaborate within AdV to:

- regulate field-related matters of fundamental and cross-regional importance for the official Surveying and Mapping in a standardised manner,
- create a pool of geospatial reference data that is essentially standardised and geared towards meeting the requirements of the information society,
- provide the infrastructure for geospatial reference data as an important component for modern e-Government architectures.

In order to achieve these objectives, AdV performs the following tasks:

- creation and coordination of future-oriented collaborative concepts for the nationwide standardisation of the real estate cadastre, surveying and mapping and the geographic reference information system in order to meet the needs of politics, industry and administration,
- promoting the joint execution of projects of cross-regional importance,
- steering and coordination of the norming and standardisation for the recording and management of geospatial reference data as well as the corresponding access and distribution methods,
- support in the establishment and development of the national and European geospatial data infrastructure and the corresponding electronic services,
- external representation of the official Surveying and Mapping,
- participation in international specialist organisations for the promotion of know-how transfer,
- collaboration with organisations and agencies from related fields and with institutions of geodetic research and teaching,
- coordination on issues of specialist training.

Geobasis Steering Committee

In 2010 the Geobasis Steering Committee (LA Geobasis), in which all Laender are represented, was established by the administrative agreement for cooperation in the official Surveying and Mapping in Germany. The administrative agreement aims to further improve the operational implementation of the strategies agreed on in AdV and to further optimise cooperation across Germany. Furthermore, it is the objective that the Geobasis Steering Committee ensures that the geospatial reference data is provided in standardised form to all users in the required level of quality.

The Geobasis Steering Committee, in order to implement the strategic resolutions adopted by AdV, has the following tasks and competences:

- monitoring and analysis of work and developmental progresses, including compliance with the defined quality standards and norms,
- analysis of cooperation possibilities and processing proposals towards their realisation,
- steering and collaboration between various Laender,
- quality control based on AdV standards regarding content and format consistency.

Mapping and Cadastre Authorities of the Laender

The development of the surveying and cadastre sector into a modern geoinformation system is a process that has been accompanied by comprehensive reforms throughout the last decade. The key to modernising the administrative procedures of the mapping and cadastre authorities in the Laender is the opening of the administrative bodies to adjacent areas in order to provide the groundwork for infrastructural and spatial planning policy in the network.

The mapping and cadastre authorities are divided into various departments in the individual Laender, the department of the interior being most frequently represented. Structural changes have been made in many authorities. In certain Laender, the real estate cadastral authorities and in some cases also the regional development / land consolidation authorities are now integrated into the higher-level geoinformation authorities. In other Laender, local areas of responsibility have been expanded by the amalgamation of real estate cadastral authorities.

The key aspects of the geoinformation system – management of the real estate cadastre and geotopography as well as first order control and the provision of official reference systems – are the responsibility of the Laender. The original services offered include:

- the nationwide provision of spatial reference data via reference networks in the Authoritative Control Point Information System (AFIS®), based firstly on terrestrial control points and their documentation, secondly, on the satellite-supported positioning service SAPOS®,
- maintaining a nationwide image of the surface of the earth through geotopographic products in the Authoritative Topographic-Cartographic Information System (ATKIS®) using landscape and terrain models, official topographic cartography and orthophotos,
- the nationwide digital documentation of buildings and approx. 64 million cadastral parcels for the property rights in the real estate cadastre, which will be managed throughout the Federal Republic using the Authoritative Real Estate Cadastre Information System (ALKIS®),
- the harmonisation of the real estate cadastre and surveying and mapping data.

The following table provides an overview over the statistical data in reference to the official Surveying and Mapping of the Laender.

Land	Inhabitants	Reference Area in km ²	Cadastral Parcels in thousand	Number of authorities		ÖbVI
				State Offices (State enterprises)	Regional offices	
Baden-Wuerttemberg	11.100.394	35.748	8.905	1	57	149
Bavaria	13.124.737	70.542	10.874	1	51	0
Berlin	3.669.491	891	403	1	12	47
Brandenburg	2.521.893	29.654	3.148	1	17	141
Bremen	681.202	419	207	1	—	7
Hamburg	1.847.253	755	257	1	—	8
Hesse	6.288.080	21.116	4.980	1	7	73
Mecklenburg-Western Pomerania	1.608.138	23.295	1.937	1	7	58
Lower Saxony	7.993.608	47.710	6.230	1	—	92
North Rhine-Westphalia	17.947.221	34.112	9.331	1	53	362
Rhineland-Palatinate	4.093.903	19.858	6.271	1	6	80
Saarland	986.887	2.571	1.292	1	—	10
Saxony	4.071.971	18.450	2.792	1	13	96
Saxony-Anhalt	2.194.782	20.457	2.683	1	—	47
Schleswig-Holstein	2.903.773	15.801	1.935	1	—	37
Thuringia	2.133.378	16.202	3.223	1	—	58
Total for Germany	83.166.711	357.581	64.468	16	223	1.265

Table 1: Number of Inhabitants – source: Federal Statistical Office, as of 31.12.2019. results based on the 2011 census. Land area – source: Federal Statistical Office, as of 31.12.2019, area in Rhineland-Palatinate: including the area “Joint German-Luxembourgian territory” of 6,20km². Differences in areas due to rounding of figures are possible. Cadastral parcels, number of authorities, ÖbVI: as of 31.12.2020.

Federal Ministry of Transport and Digital Infrastructure



The Federal Ministry of Transport and Digital Infrastructure (BMVI) has been a member of AdV since 1950. Division DG 26 coordinates the multi-layered use of geospatial reference information provided by the Länder within the Ministry and its executive agencies with more than 17 higher level authorities and the transfer of know-how from surveying units of the “wet” directorates-general (i.e. waterways and shipping) to AdV.

The Federal Waterways and Shipping Administration (WSV) is responsible for the maintenance (in terms of traffic and water-management) of the federal waterways (around 7,300 km of inland waterways and around 17,800 km² of waterways navigable by sea-going ships). In addition to its maintenance obligations, the WSV is also responsible for ensuring traffic safety of federal waterways. The surveying/geospatial information section provides, inter alia, geo-referenced data, processed to form user-focused products, for instance data on water depths and the topography of the riverbed. Official surveying functions are performed nationwide, and they require close coordination in AdV. The WSV provides its own basic network along the waterways (location and elevation benchmarks) and keeps a set of 1:2,000 scale digital charts whose contents inform the evolution of the ATKIS® basis digital landscape model.

For the maritime sector, the Federal Maritime and Hydrographic Agency (BSH) performs marine surveys in the Germany North Sea and Baltic Sea – the heavily navigated waters in the world. Maritime surveys and maritime cartography provide necessary basic information for environmental protection, the construction of offshore installations, coastal protection and hydraulic engineering. The area surveyed of the BSH covers around 57,000 km², which is equivalent to one sixth of the land area of Germany. This area is displayed on a set of nautical charts with around 150 datasets for electronic navigational chart systems plus 60 nautical charts in paper format. In addition, comprehensive datasets on the current and historical chemical, physical and biological condition of the water column in the German territorial sea plus operational information and forecasting services for the water levels, the tides, swell and drift are provided via web-based spatial data portal as a maritime component of the GDI-DE.

The “Geodesy” division of the Federal Institute of Hydrology (BfG) currently supports WSV in performing functions in the fields of geodetic reference systems, geokinetics, surveying of water bodies, geotopography and construction surveying. The expertise required for the provision of specialist scientific advice is present within the scope of applied research and project implementation. In this context, intensive cooperation with universities and other research establishments is obligatory.

All agencies and higher-level authorities cooperate closely with the surveying authorities of the federal states and in the AdV working parties. Their activities focus on the exchange of information regarding topography, information technology and spatial reference, as well as the use of SAPOS® services, especially in the oversea reception range.

In conjunction with the Federal Highway Administration reform, the Federal Government took over the planning, construction, operation, structural maintenance and funding of federal motorways from the Länder on 1 January 2021. The Autobahn GmbH, a 100 percent federal company, and the Federal Highway Authority are fully operational since then. This entails 13,200 km of federal motorways which are administered from a central location from now on, yearly investments of approximately 5.5 billion euros and currently 4500 construction projects. With the reorganisation, construction projects at and on the motorways are supposed to be planned, approved and executed in a faster, more efficient and economic manner from a single source. The construction of a geoinformation know how with the corresponding organisational structures is accompanying the reform.

In addition, BMVI has lead responsibility in coordinating the European Union's Copernicus earth observation programme within the Federal Government. The Federal Government's Copernicus strategy, which was adopted by the Federal Cabinet in September 2017, defines Germany's objectives and fields of action for Copernicus so that government, public authorities, industry, academia but also all citizens can benefit substantially from the programme. The measures resulting from these fields of action fall under the responsibility of different government departments. To support coordination, concrete national activities are formulated and adopted in regular work programmes of the Federal government.

More detailed information on geospatial information of the Ministry and its executive agencies can be found on our website www.bmvi.de in the section: "Themen"/"Digitales"/"Digitale Gesellschaft"/"Geoinformationen" (in German only).

Publishing hydrographic geoinformation

The North and the Baltic Sea belong to those regions of the earth with the highest ship traffic volume. Because of the high density of traffic it is important to survey these areas often and to publish up to date nautical charts on a regular basis. The Federal Maritime and Hydrographic Agency (BSH) is according to the Federal Maritime Responsibilities Act (SeeAufgG) responsible for the continuous production and publication of official charts and official nautical publications.

For the creation of charts, a multitude of data is analysed and added to a central database. The presentation of the data is also defined by international standards (S-52 and S-4).

The results from the hydrographic surveying and wreck search from BSH and the waterways and shipping office are the most important general basics, but other information necessary for shipping are analysed, pre-processed and stored as well. This includes, for example, data from cable and pipeline routes, digital charts of federal waterways, topographic harbour maps, orthophotos and other aerial images as well as legal regulations and announcements of the waterways and shipping office regarding changes in navigation marks, restricted areas or construction activities. Deriving from that, BSH publishes paper charts and electronic navigational charts (ENC). They cover the German territorial waters and the German exclusive economic zone (AWZ).

It has turned out that data derived from hydrographic products also forms an important basis for other tasks like for example coastal protection, environmental protection, oceanography hydraulic engineering and archaeology. In order to meet the increasing demand, the International Hydrographic Organisation (IHO) developed the new data standard “S-100”: “The Universal Hydrographic Data Model”. This standard supports a large variety of digital hydrographic data products, not only the ENCs of the new generation. Other products include bathymetry, currents, tides, ice formations, weather data and much more. S-100 is not a digital data format but a framework which defines how specifications for spatial data products can be developed and it provides the necessary components for it. Currently BSH is working on the development of diverse new products like for example the S-102 Bathymetry Surface, S-122 Marine Protected Areas, S-411 JCOMM Ice Information, etc.

The new S-100 products are supposed to be published via the geospatial data infrastructure BSH (GDI-BSH), as far as possible. Within GDI-BSH the datasets of different departments are being merged. This allows a quick standardised and interdisciplinary access to BSH’s geospatial data. The GeoSeaPortal (www.geoseaportal.de) is the central access point to GDI-BSH for internal and external users. The geospatial data and geospatial data services published in the GeoSeaPortal are freely accessible. They may be used without constraints together with a source reference according to the ordinance to determine the conditions for use for the provisional spatial data of the Federal Government (GeoNutzV).

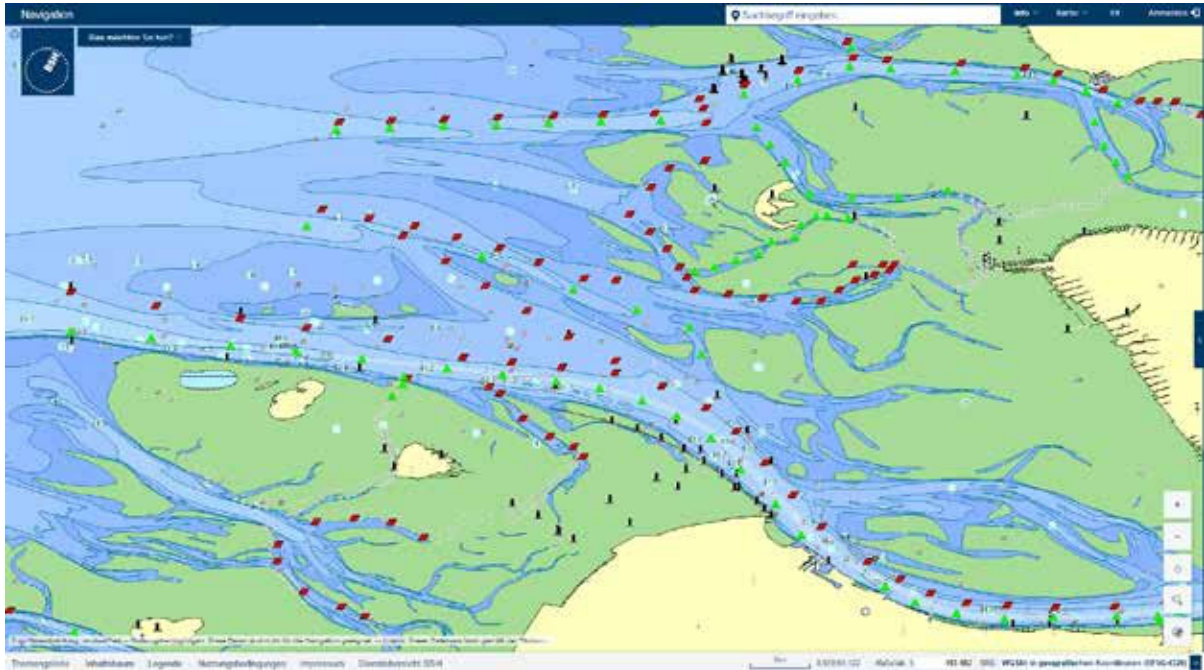


Figure 2: GeoSeaPortal, theme map navigation.

Provision of statistic and dynamic street or street status data and traffic data.

BMVI is also responsible for the provision of statistic and dynamic street or street status data as well as traffic data and makes them available via the National Access Point for Traffic Data. The legal framework for that is the Intelligent Traffic System Act (IVSG) which implements the Directive 2010/40/EU of the European Parliament and the Council of 7 July 2010 in order to introduce more intelligent transportation systems in the field of road transport and their interfaces with other modes of transport in Germany. The delegated regulations of the EU introduced on the basis of the IVS directive have immediate effect on the EU Member States and regulate the access to the mobility-relevant data of both public as well as private sector players¹. Thematically the delegated regulations published so far cover data from the following areas:

- multimodal travel information,
- real-time traffic information,
- traffic safety relevant traffic information,
- Information regarding safe parking spaces for heavy goods vehicles.

¹ Further information: <https://nationalestelleverkehr.de>

In these regulations the EU Member States are bound to implement and operate so-called National Access Points for Traffic and Mobility Data (Nation Access Point – NAP). These NAPs make the finding of, and access to, the relevant data via uniform interfaces possible. In Germany the Mobility Data Marketplace (MDM) is in charge of the NAPs. The MDM is a virtual marketplace for mobility data¹ that is operated by BMVI on behalf of the Federal Highway Research Institute (BAST). The data available there contain statistic and dynamic information about various modes of transport. The motivation behind the creation of such an internet portal is, in addition to the tasks of the NAP, to interlink as many providers and users as possible and to create a platform on which data can be exchanged. The MDM is therefore a main supporter of the implementation of intelligent traffic systems (IVS) and travel information services.

An important category of information relevant for the mobility sector is data about the available transport network (geospatial data). Examples that can be named are:

- road network data (street geometry, road width, number of lanes, gradient/slope, crossroads, road class),
- network data (cycle paths, footpath network),
- network topology and routes/tracks of public transport choices.

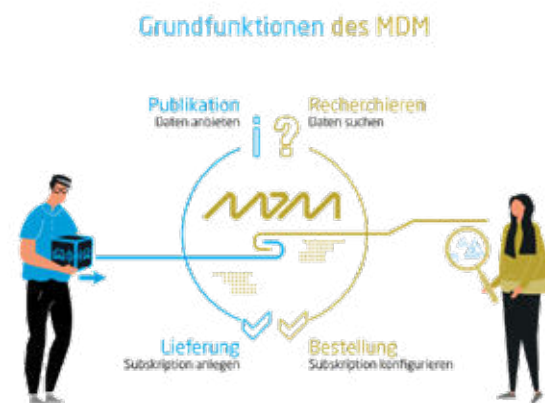


Figure 3: basic function of the Mobility Data Marketplace (MDM).

This data should be provided according to the delegated resolution in the manner of implemented data forms via the NAPs. For geospatial data as well as statistic data of the public transport formats are used according to directive 2007/2/EG (INSPIRE) and CEN/TS 16614 (NeTEx).

¹ Further information: www.mdm-portal.de

Future-related Topics of AdVV

The products and services of the official German surveying system do not only look back on a long tradition. Their consistency, reliability, area coverage and uniformity, but also their constant further development in accordance with the requirements of the administration, the economy and, last but not least, the citizens, are a great asset that is appreciated by the users. At the same time, in our age characterised by digital change and the spirit of innovation, new technologies and applications are constantly entering the market. Even if not every innovation can be reconciled with the requirements of geospatial data, it is essential to keep up with new web technologies, collection methods, sensor technology and other innovations in order to be able to continue to reliably provide geospatial data according to current standards, interfaces or services in the required quality and scope..

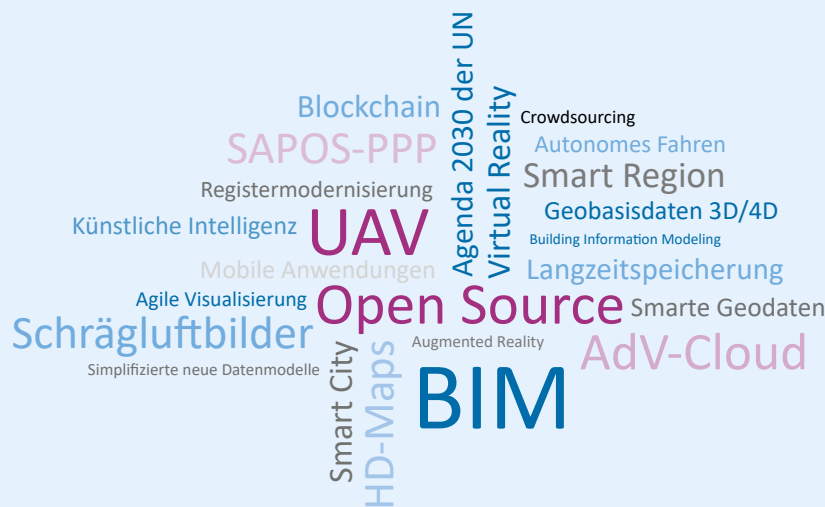


Figure 4: Word Cloud "Future-related Topics".

Source: AdV/LGB

With Decision P 2019/14 the AdV plenum dealt with results of the special working group "Future-related Topics", and four future-related topics were classified as top priority and their implementation was initiated. Three topics have been forwarded to the Working Group "Information and Communication Technology" for further treatment. The Working Group "Spatial Reference" was charged with the future topic "autonomous driving" (see page 19 ff. PPP-RTK). But it is not limited to that, the remaining topics from the report of the special working group as well as other topics will be appraised and included into the work plans of the Working Groups. The focus of AdV towards future-related topics has therefore become an ongoing mission. This means to not look at tasks and requirements already legally standardised. These are, just like the implementation of the law for the improvement of online access (Onlinezugangsgesetz – OZG) or of the real estate tax reform, an "obligation". Rather, the consideration of future topics focuses on looking with a keen instinct at technological

developments, their benefits and feasibility, as well as future user needs – to have the necessary “freestyle”, so to speak. This requires foresightedness and decision-making-competency – since the implementation within a federal surveying system needs a certain preliminary timeframe.

Open Source as strategic recommendation for action

The use and development of software under an open source licence is gaining importance in institutions and public authorities in order to guarantee a digital national sovereignty. In addition to the strategy¹ of the European Commission for the promotion of the use and the development of open source software, the Federal Office for Information Security (BSI) as well as several Laender see strategic advantages in the use and development of open source software².

Compared to proprietary software (standard software, closed source software) these are, amongst other things, transparency and acceptance due to controllability of functionality and algorithms, trust and security as well as innovation through distributed development, lower dependency on individual partners and higher information security. Especially for digital national infrastructures new prospects are opening up. This is why the current and future developments of AdV as well as of individual member authorities are supposed to be based on the open source approaches of reusability, collaboration and interoperability.

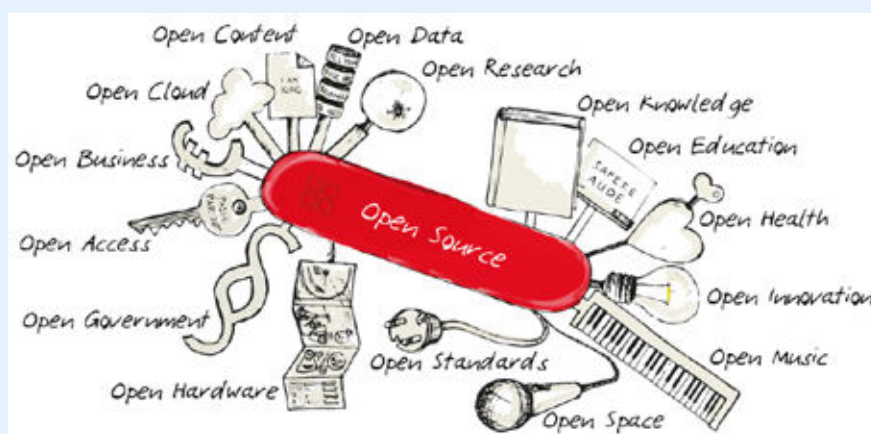


Figure: 5: Open Source – OpenSwissKnife. Source: Johannes Spielhagen, Bamberg, Germany (https://commons.wikimedia.org/wiki/File:121212_2_OpenSwissKnife.png), licence: <https://creativecommons.org/licenses/by-sa/3.0/legalcode>.

¹https://ec.europa.eu/info/departments/informatics/open-source-software-strategy_en

²https://www.bsi.bund.de/DE/Themen/Unternehmen-und-Organisationen/Informationen-und-Empfehlungen/Freie-Software/freie-software_node.html

Currently the collaboration of the AdV working group Smart Mapping (development of a contemporary web application with geospatial data visualisation, see page 36), to which various Laender and the BKG belong, is of particular importance. The software as well as the associated documentation which is developed in the project Smart Mapping is supposed to be published as fully as possible under one or several open source licences and will be continuously developed further. The AdV plenum confirmed with Decision P 2021/6 a strategic recommendation for action of the Information and Communication Working Group to categorically establish new and further developments of software procedures.

Further future topics: AdV cloud and simplified data models

Cloud computing is also seen by public authorities as an efficient way to cheaply store large datasets, jointly develop application software, use information location and device-independent and to use IT resources on a need-based and flexible level without generating great personal acquisition and operation costs. It is the goal to draft an AdV strategy in order to pilot test the use of initial projects before the year 2021 ends.

Modern architecture today is almost always aligned with Micro-Service-Architectures. These are based on comparatively simple/specific data models. This is how more complex concepts like the AAA® data model could be depicted accordingly. AdV plans to address also this subject area with primal developments and aims to analyse appropriate architectures and specific data models in the near future.

Furthermore, AdV will also take on topics like e.g. artificial intelligence, augmented/virtual reality and crowd sourcing.

2. Working Group Spatial Reference

The integrated geodetic spatial reference adds value

With the implementation of the integrated geodetic spatial reference in 2016, the holistic approach of the components position, height, and gravity was established. The realisation of this high precision reference frame, which fulfils today's requirements, simultaneously creates an important base for the appraisal and answering of social questions, for example climate change or other anthropogenic alternations to the Earth's surface.

The technical development of the last 20 years have caused a paradigm shift in the area of spatial reference provision, which today is not based on classic geodetic control stations anymore but instead provides, service-based via the satellite positioning service of the German land surveying (SAPOS®), the required accuracy of 1 – 2 centimetres for the real estate surveying. The “cm-Quasigeoid” GCG2016 enables a reliable conversion of ellipsoidal height, determined by the GNSS technology, into physically defined levelled height. Via SAPOS® elevation centimetre-accurate elevation measurements in real-time can be achieved, which open up the possibility for new applications within the everyday surveying practice like, for example, the coarse marking-out or topographic surveying.



Figure 6: Precision Farming in the official special reference.

Outside of the core area of the “surveying”, the endorsement of the geodetic spatial reference also takes place: The GNSS technology already enables the vehicle navigation on a centimetre accurate level as building block for “precision farming” in the agricultural sector today. Further interdisciplinary geo-applications are emerging. High precision georeferencing is not only a sole geodetic discipline for experts anymore.

For the foreseeable future, further development trends will emerge, which lie in the linking of different survey methods on one hand and in a new orientation of quality assurance on the other. For the surveillance of changes in elevation, various observational methods like levelling, GNSS networks, laser scanning and radar interferometry can be used. In order to achieve the optimum result in regard to accuracy as well as spatial and temporal resolution, the data collection methods are combined in so-called “method mix”, where the strength of each individual procedure can be made use of. This is why, for example, the radar interferometry is integrated in the collection process, which is used for extensive and continuous information acquisition, since the economic advantages that arise due to the reduction of costly terrestrial surveillance methods are also exploited.

The GNSS Campaign 2021 is, as a repeat of the campaign from 2008, elementary for the quality assurance of the infrastructure, since it is supposed to detect changes on identic marks compared to 2008. The feature of the GNSS Campaign 2021 is that both SAPOS® and GREF ground stations are included. Together with the reference station network monitoring this campaign heralds a paradigm shift to the “Near Real Time Monitoring” of the geodetic infrastructure. A future reduction of the GNSS remeasurements is apparent. The integrated spatial reference 2016 represents the zero measurement of a time series. Due to the control points acting as geosensors, the time series analysis enables a reliable, precise and continuous detection of local and (trans) regional movements of the surface of the Earth and opens up to the potential for scientific long-term studies for the purpose of environmental monitoring.

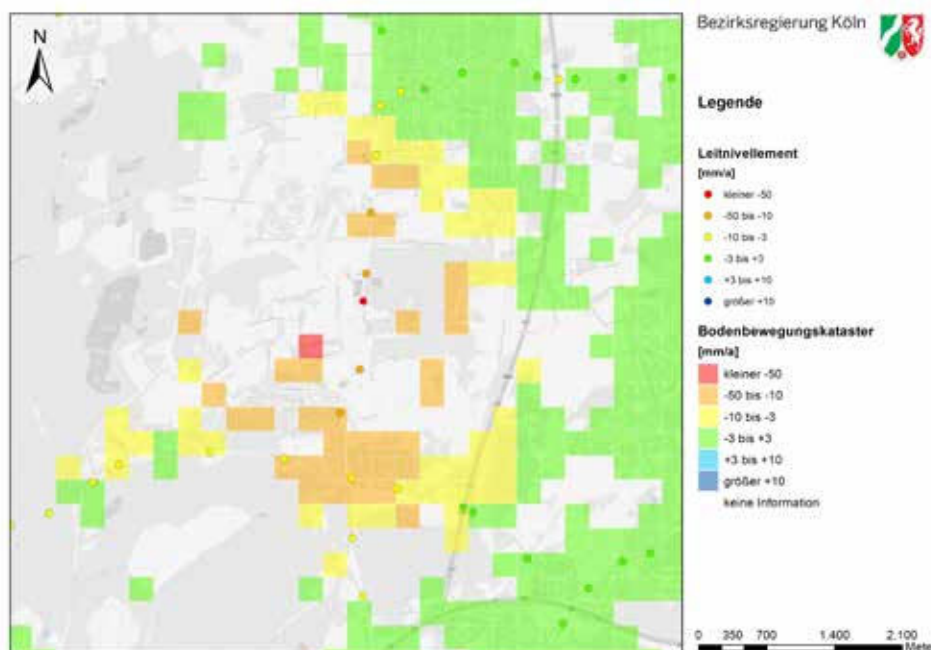


Figure 7: Haltern (North Rhine-Westphalia), Ground subsidence in the area of the Prosper-Haniel mine: results of the radar interferometry (tiles) show a great conformity in comparison to the terrestrial levelling (circles) within an apparent density of information. Picture: Geobasis NRW

The digital society is built on data that mostly has a direct or indirect reference to a location and therefore answer the question “what happens where?”

Global satellite positioning systems (GNSS) like the American GPS and the European Galileo enable high precision positioning. This is why these systems have developed further, in addition to their role in geodetic applications, to an important instrument for logistics, transport, aviation and location-based services.



Figure 8: Core competences of the geodesy and networking of the digital society.
Picture: © DVW e.V 2019

The usage possibilities of a precise satellite navigation stands in contrast to the considerable amount of effort that the operators of such systems face. The determination of the position of the user is generally derived from the position of the satellites that move on their trajectories. Therefore it is necessary to continuously determine the exact satellite trajectory, which is only possible by means of globally distributed geodetic observatories, permanent GNSS stations and analysis centres.

Towards this purpose, the Federal Agency for Cartography and Geodesy operates three geodetic observatories together with partner institutions in Wettzell (Bavarian Forest), La Plata (Argentina) and O'Higgins (Antarctica). Here, the BKG uses various techniques to observe, among other things, the movements of the satellites. This global component is supplemented by the Integrated Geodetic Reference Network of Germany (GREF). As a result, the BKG provides a uniform spatial coordinate system for all of Germany as a link between national and international GNSS reference stations. This is the basis for the official spatial reference in Germany.



Prof. Dr. Paul Becker, President des BKG

The actual centimetre-accurate positioning is guaranteed with the satellite positioning service SAPOS®. This is a part of the basic infrastructural service as well as the legal mandate of the German land surveying.

At this time, all services are based on differential GNSS positioning procedures and the provision of correction data by means of bidirectional communication. Until a few years ago, the use was primarily limited to real estate measurements only. This changed in 2017 when at the Conference of the Ministers of Agriculture it was decided that in order to strengthen innovation and digitalisation in the agricultural sector, just like geo, weather and satellite data, the official satellite positioning service SAPOS® needed “to be made available to economic operators free of charge in order to implement the potential of Smart Farming like for example the improvement of resource efficiency and security in a short amount of time, in the sense of the Open Data directive.”



The surveying and geoinformation authorities have recognised this demand and are providing SAPOS® today for the agricultural sector free of charge or at special terms. Due to the high usage of SAPOS® in the agricultural sector, it can be seen as critical infrastructure. AdV is prepared to support further mass market applications in the field of autonomous driving in the future.

Tobias Kunst, Chair of AdV, Bavarian State Ministry of Finance and Regional Identity

Here, the broadcast provision of correction data via for instance mobile internet or digital radio (DAB+) is needed. The technical basis is that signal data is modelled along the signalling path and that the entire error budget is transmitted to the user. This principle is called PPP-RTK and is as accurate as previous services.



AdV is planning a PPP-RTK service as a joint development of federal government and the Länder. Redundant deployment is provided for resilience. The service will merge the high-precision potential and short convergence times with the broadcast capability during the transfer of correction data. The number of users is not limited. The Official German Surveying is opening to a future technology. In order to answer the initial question as to “What happens where?”, AdV will provide a high-precision official coordinate.

Dr.-Ing. Jens Riecken, Head of the Working Group Spatial Reference of AdV

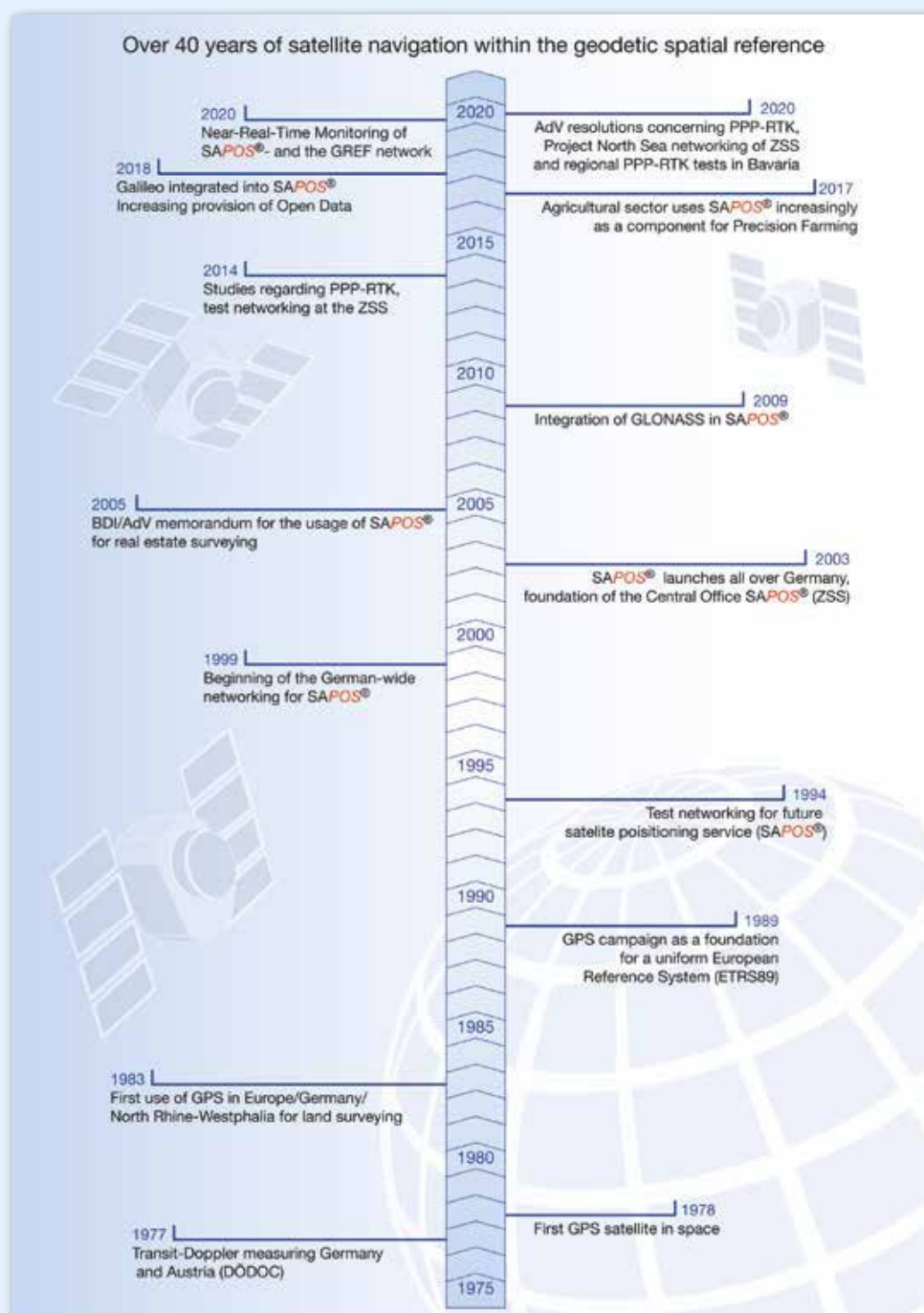


Figure 9: Timeline 40 years of satellite navigation.

3. Working Group Real Estate Cadastre

Official Estate Appraisalment

Increasing real estate prices and increasing rents have become a social issue. What may be beneficiary to real estate owners, presents prospective buyers and renters with problems. Attractive locations are being gentrified and those that cannot keep up financially get pushed to the side. An end to this situation is not on the horizon.

Therefore, it is even more important that with the Official Estate Appraisalment a non-profit institution exists that creates transparency on the real estate market. This is possible, since all property valuation committees analyse all sales contracts of an entire year and derive from that the ground values and the real estate market reports.

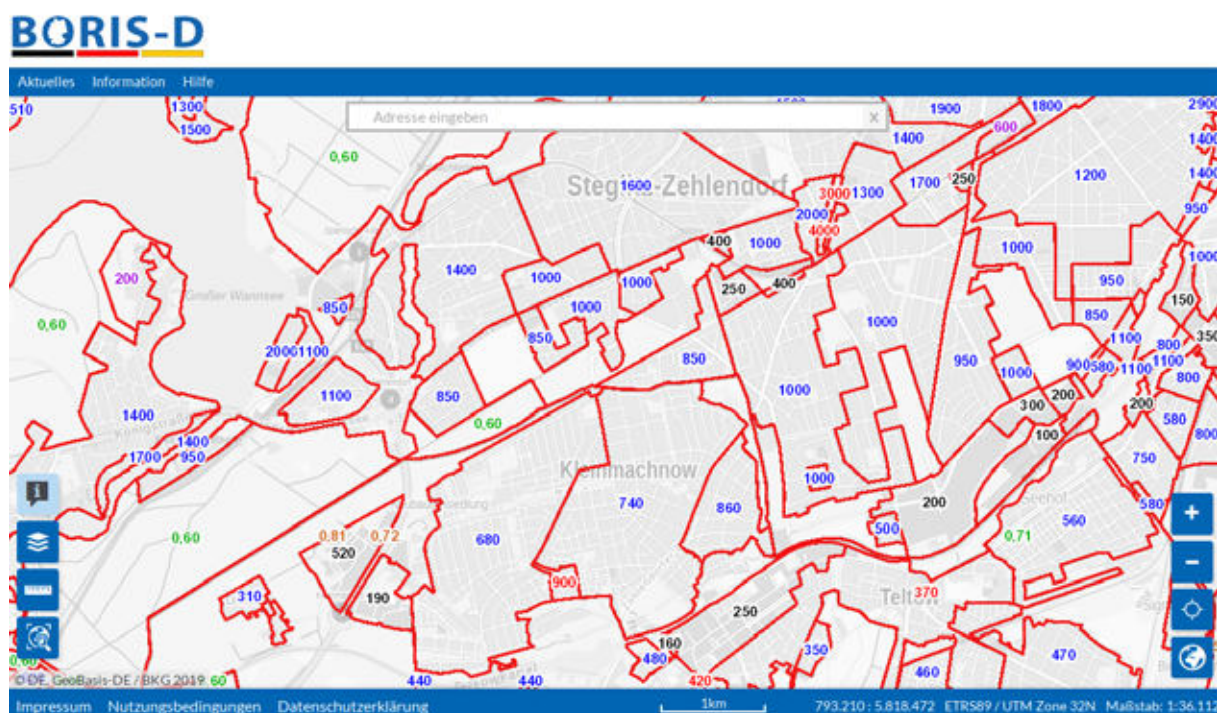


Figure 10: Screenshot of the ground value information system BORIS-D, www.bodenrichtwerte-boris.de. Shown here are Steglitz-Zehlendorf (part of Berlin) and Kleinmachnow (part of Brandenburg).

The valuation committees are formed in the Laender. Like in so many other areas of administration, transnational coordination is essential when the customer of the official real estate appraisal is supposed to be presented with uniform results. Since the real estate appraisal is set up closely to the real estate cadastre within most Laender, the Working Group Real Estate Cadastre has been active in exactly this field for a long time already.

Since 2019, the real estate appraisal is institutionalised as an equal footing with the topics of the classic real estate cadastre. With this, the necessary coordination between the Laender has been given an official framework. AdV is a point of contact since then and, as such, will participate in discussions.

The implementation of the law for the improvement of online access for the official real estate cadastre

I want to build a house. For this purpose, I need to present my bank with extracts of the real estate cadastre. Furthermore, I need to apply for a subdivision survey and later on in some areas, even a building survey. Surely, I can apply for all of this online?

No, unfortunately not.

The surveying and cadastre authority claims to be one of the most modern authorities in Germany. This is not entirely unjustified, since already in the 70's the digitization of the real estate cadastre started. When the processes ALB (automated real estate book) and later ALK (automated real estate map) had gone into production, e-Government had been practiced at a time when the word hadn't even been invented yet.

To rest on old laurels is a rather dangerous business, indeed. It can easily happen that one is overtaken by the developments from elsewhere. Although paper has been replaced by bits and bytes within the real estate authorities, consulting the local office is still necessary often enough if a person wants to use the services of the cadastre.

This is when the law for the improvement of online access (OZG) comes into play. It requires the Federal Government and the Laender to also offer their administrative services online on the internet, by the end of 2022. The implementation is based on the "One-for-all" principle. The Free State of Bavaria is programming internet applications for the real estate cadastre that can then be used by other Laender. Within the federal cadastre field this won't be possible to do one-to-one, but the groundwork has been done for everybody.

Up to today, the question posed initially must usually be answered with no. Despite the decades of experiences gathered regarding digitization, an application is still a piece of paper with a signature. The implementation of the law for the improvement of online access will change this.

In the year 2023 the answer will be: Yes, of course.

The screenshot shows a web application interface for the Bavarian Land Surveying Office (Landesamt für Digitalisierung, Breitband und Vermessung). The main heading is "Vermessungsantrag (Grenzermittlung oder Grenzwiederherstellung)". Below this, there is a section titled "Informationen" which contains text explaining the purpose of the application and a list of conditions under which it can be used. To the right of the main content, there is a sidebar with a list of links: "Informationen", "Angaben zum Grundstück", "Antragstellende Person", and "Vordringliche Bearbeitung / Kostenübernahme / Datenverarbeitung und Datenschutz". At the bottom of the page, there are three buttons: "Abbrechen", "Zurück", and "Weiter".

Landesamt für Digitalisierung, Breitband und Vermessung

Vermessungsantrag (Grenzermittlung oder Grenzwiederherstellung)

Informationen

Sie können einen Antrag auf Grenzfeststellung oder Grenzwiederherstellung stellen, wenn Sie

- den Verlauf einer Grundstücksgrenze wissen wollen;
- ein Grenzzeichen nicht finden können, oder ein Grenzzeichen beschädigt wurde.

Solfern Sie nicht Grundstückseigentümerin oder -eigentümer sind und/oder eine andere Person die Kosten für die Vermessung trägt, ist es erforderlich im Zuge der Antragstellung entsprechende Nachweise/Unterlagen hochzuladen.

Weitere Informationen zum Ablauf einer Grenzvermessung finden Sie auf unserer [Webseite](#) und im [Faltblatt](#) (pdf).

Abbrechen Zurück Weiter

- Informationen
- Angaben zum Grundstück
- Antragstellende Person
- Vordringliche Bearbeitung / Kostenübernahme / Datenverarbeitung und Datenschutz

Figure 11: screenshot of the prototype of the Bavarian internet application for the application of the determination of boundaries.

Central distribution of products derived from ALKIS®

The provision of nationally standardised, centrally available and quality assured data is an infrastructure mandate for the official surveying. This assignment has been fulfilled beyond national boarder lines, by the three current, so-called, “Central Offices” (ZS) of AdV.



Figure 12: The current product range of ZSHH.

The task of the Central Office for House Coordinates and Building Polygons (ZSHH) includes the fusion and provision of selected derived products on the basis of the real estate cadastre and therefore ALKIS®. The core task is for one the merger and harmonization of data including quality assurance and secondly the provision of data which includes the licensing and user support.

The advantages for the users are therefore clear. For a German wide procurement of products

- a central point of contact and contractual partner is available – ZHSS acts in the name of the Laender,
- uniform fees and licensing models on the base of the AdV Fee Directive exist,
- uniform contractual regulations based on AdV's model-licensing exist,
- uniform, quality assured data content and formats exist.

Furthermore, the surveying authorities of the Laender do also benefit from the work of the ZSHH and the two other Central Offices (Central Office SAPOS®, Central Office Geotopographie). The geospatial reference data of the Laender are used to a broader extent. Especially internationally operating enterprises get targeted. Here, the ZS are an important interface between the users, which form a crucial foundation for the extension and optimizing of the product range of the surveying authorities. In addition to this, the data of the Laender is, due to the continuous quality assurance and steadily optimization, perpetually improved.

The product portfolio of the ZSHH contains currently the official house coordinates (HK-DE), the official building polygons (HU-DE) as well as the building models in the levels of detail 1 and 2 (LoD1-DE and LoD2-DE).

The HK-DE are used for, amongst other things, the navigation in vehicles or in apps or web services, in the telecommunication sector for the 5G network development or in the real estate sector for the exact localisation and interlinkage of further address-based technical data.

The HU-DE is used in applications in the field of geo-marketing, like for example for the derivation of features/attributes like centroid coordinates, building complexes or sealed areas.

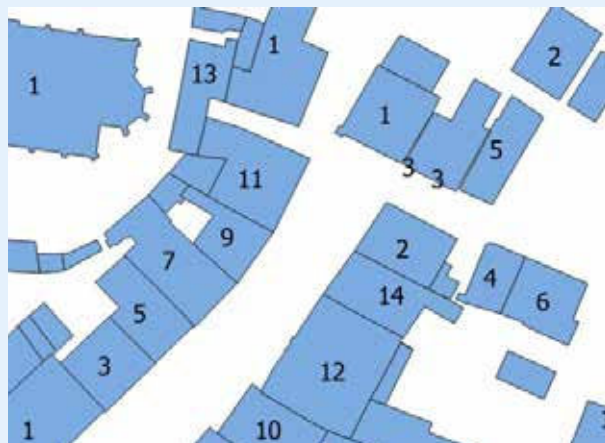


Figure 13: HU-DE and HK-DE.

The usage of official building models (LoD1/2-DE) especially takes place in the real estate and insurance sector, where for example features/attributes for the appraisalment such as building type, remodelled space/volume or number of storeys are derived.

This product range is currently being extended by the product “ALKIS® – parcel information”. This satisfies the long-standing wish of the users for a national central reference for parcels.



Figure 14: 3D-Building Model LoD2.

Currently, for the first time a national data pool is merged and all components necessary for the quality assurance and for the distribution are either developed or expanded. An initial launch of this product is planned in the course of the year 2022. With this extension to the product range, the ZSHH has made another step towards a “Central Office ALKIS®”.

4. Working Group Geotopography

Using the Authoritative Topographic-Cartographic Information System (ATKIS®), the surveying and mapping authorities of the Länder manage geospatial reference data that describes landscape in the product groups Digital Landscape Models, Digital Terrain Models, Digital Topographic Maps and Digital Orthophotos. The individual products of these product groups are kept current with regular updates. For key topographic features in the Digital Landscape Models, the updates take no more than a few months. The data of the ATKIS® product range is provided in a customer-oriented way, with contents that are sufficiently up to date; of the desired quality, and within the scope of the staffing and financial capacities of the AdV member authorities. During the reporting period, numerous documents accounted for by the Working Group Geotopography were revised and standardised in order to make standardised product and quality standards available for producing member authorities as well as the product-benefiting users.

Digital Landscape Models

One of the key tasks of the surveying agencies in the field of geotopography is to manage and update the Digital Basic Landscape Model (Basis-DLM) as the basis for the establishment of various specialised information systems in administration and business. The ATKIS® Basis-DLM data pool also serves as the basis for the derivation of the small-scale Digital Landscape Model ATKIS®-DLM50, -DLM250, -DLM1000, the production of official Digital Topographic Maps, and the joint web-based map service of the Federal Government and the Länder (WebAtlasDE), and is also an essential data source of the Smart Mapping project of AdV (see page 36).

The regular updating of the Basis-DLM database takes place in different time frames. These cover the period from the emergence of change in the landscape up to the release of the updated database. A distinction is made between a key update of three, six or twelve months for feature types or attributes of greatest importance for the customers and the basic update of the entire database within a maximum of a five-year period during which the ATKIS®-Basis-DLM is checked and, in the case of changes, updated. The basic update period is

three years. The DLM50 is derived fully automatically from the ATKIS®-Basis-DLM using model generalization. DLM250 and DLM1000 will be operated and maintained by BKG, they will be updated yearly.

The model accuracy of ATKIS®-Basis-DLM is at least ± 3 m and refers to the geometry of significant linear objects like for example streets, rail-bound infrastructure and water bodies on the surface of the Earth.

For quality assurance purposes during registration, modelling examples for the ATKIS®-Basis-DLM are managed and maintained, that are supposed to help with a uniform implementation within the Laender. Furthermore, a specifically developed testing platform – the AdV-Testsuite – is set up in order to verify the requirements from AdV specifications. For that purpose, approx. 200 testing criteria for ATKIS®-Basis-DLM and more than 70 for ATKIS®-DLM50 are defined.

Digital Elevation Models

In addition to the Digital Landscape Models that describe position, the surveying and mapping authorities manage Digital Terrain Models (DGM) with varying levels of resolution to represent height as a third dimension. These models are available to authorities and businesses as part of the geotopographic core data for setting up Geographic Information Systems (GIS). Digital Terrain Models are digital, numerical models of the terrain heights and shapes of the earth's surface reduced to a regular grid. They do not contain any information about structures (e. g. bridges) and vegetation.

The products of the product group Digital Terrain Models (ATKIS®-DGM) are structured according to their grid size. DGMs with a larger grid size are then usually automatically derived from DGMs with the lowest available grid size. For the ATKIS® technical concept, the DGM feature type catalogue is available in the GeoInfoDok. The data quality is documented in the ATKIS® product standard for Digital Terrain Models. For the DGM1, for example, this stipulates a terrain-type-related height accuracy of the grid points of ± 0.15 m to ± 0.30 m with a confidence level of 95 % (2σ). The foundation for this high precision is usually the high precision Airborne Laser Scanning, which generates data for the DGM mostly automatically by now.

Currently, DGM data sets with a grid size of 1 m (DGM1), 5 m (DGM5), 10 m (DGM10), 25 m (DGM25), 50 m (DGM50), 200 m (DGM200) and 1,000 m (DGM1000) are available nationwide for the whole of Germany. Since 2004, the Central Office Geotopography offers standardised Digital Terrain Models for the entire territory of the Federal Republic of Germany. Here, BKG is taking on the task of harmonising the height data collected by the Laender in the overlap areas between the Laender. The current Digital Terrain Model of Germany, available

with a grid size of one meter, and all the other above-mentioned lower resolutions are constantly updated and continuously improved on the basis of the data updates of the Laender.

In the surveying and mapping agencies, Digital Surface Models (DOMs) are created in addition to DGMs. DOMs are digital, numerical models of the heights and shapes of the earth's surface, including structures and vegetation, reduced to a regular grid. As with the DGMs, DOMs are structured according to their grid size and DOMs with a larger grid size are automatically derived from the DOM with the lowest available grid size using new interpolation. DOMs are based on the method of Airborne Laser Scanning or the digital image correlation (image matching). An increasing demand for these products can be observed amongst the users. The DOM and their data quality are defined by the standards for Digital Surface Models.

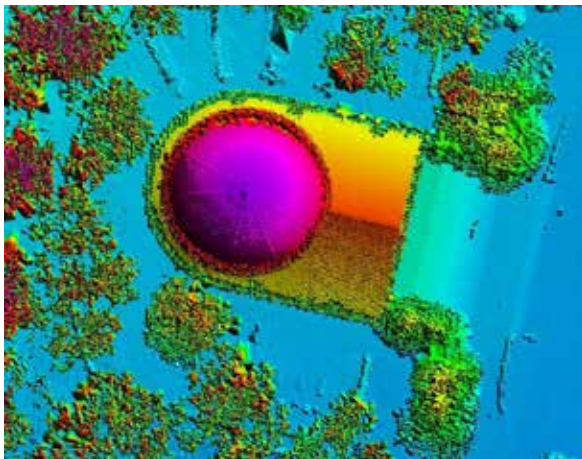


Figure 15: Mausoleum Bückeburg, visualised as DOM. The mausoleum located in the palace garden Bückeburg near Hanover is a gravesite of the dynasty Schaumburg-Lippe. © GeoBasisDE/LGLN Niedersachsen, 2021.

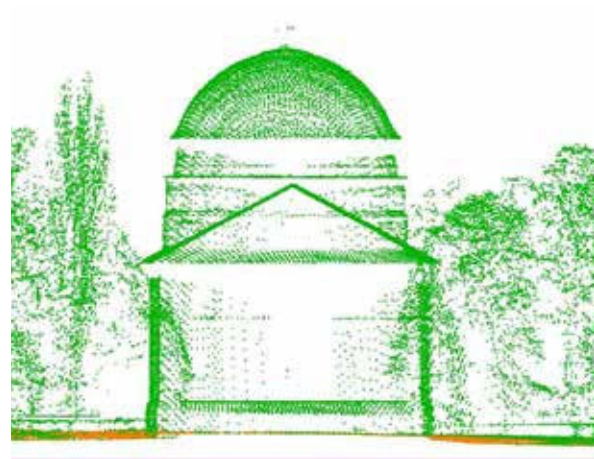


Figure 16: Mausoleum Bückeburg. This view is the result of a laser scanning measuring and classification, © GeoBasisDE/LGLN Niedersachsen, 2021.

The focus of efforts during the reporting period was the further development of standards for surface models. In addition to the already existing standard for a DOM, standards for 3D models and image-based surface models were re-defined. While Digital Terrain Models and Digital Surface Models have so far been defined as models of the heights and shapes of the earth's surface reduced to a regular grid, this modelling is no longer compatible with results from image-based methods (e.g. Dense Image Matching – DIM, bDOM), since these are modelled as raster data. When balancing the benefits and the drawbacks of the grid and raster-based modelling, the elevation model standards are supposed to be converted gradually into raster-based modelling. During the reporting period the standard for DOM was also developed further, in order to use it as the foundation for the AdV standard product DOM.

3D Building Models

The surveying and mapping authorities within AdV have been offering the product 3D Building Models since 2013. The data is collected on the basis of the product and quality standards for 3D Building Models and the data format description in the AdV CityGML profile. The AFIS®-ALKIS®-ATKIS® model has been expanded to include 3D buildings and 3D structures as part of the AAA® modelling application scheme 7.1.

Nationwide, 3D Building Models have been available in the first degree of detail with the Level of Detail 1 (LoD1), for several years now. Here all buildings and structures are given a flat roof (“block model”). Since 2020 a nationwide uniform database for the Level of Detail 2 (LoD2) is available, which is provided by the Central Office for House Coordinates and Building Polygons (ZSHH) at the Bavarian Agency for Digitisation, High-Speed Internet and Surveying. In total, this database comprises more than 54 million buildings that have been modelled using standard roof shapes. The LoD1 is now derived fully automated from the LoD2.

Owing to user requirements, AdV has further decided to incorporate significant structures into the database in addition to the buildings. Modelling examples for the identified feature types such as towers, bridges and masts are available. These supplementary objects are available nationwide 2021. The Figures 17 and 18 show such visualisation based on digital orthophotos.



Figure 17: ICE bridge construction in the Elster-Saale wetlands in a 3D modelling. This part of the ICE route Munich-Berlin is with more than 6 kilometers km in length the longest mainline bridge. It bridges the especially protected meadow landscape of the rivers Saale and Weiße Elster. Also shown in the picture is a parallelly running high-voltage powerline. ©GeoBasis/DE/LVermGeo LSA, 2021.



Figure 18: Dam wall of the Rappbode Dam in the Harz region. ©GeoBasis/DE/LVermGeo LSA, 2021.

Digital Topographic Maps and Official Map Services

Based on the Digital Landscape and Terrain Models, the surveying and mapping authorities create the Digital Topographic Maps based on the ATKIS® portrayal catalogue as part of the GeoInfoDok of the AFIS®-ALKIS®-ATKIS® project. The current portrayal catalogues are available in a formalised form aligned with all the above-mentioned information systems. For the Digital Topographic Maps (ATKIS®-DTK) section, portrayal catalogues have been integrated into the product and quality standard which combines all existing internal AdV regulations regarding DTK.

Digital Topographic Maps are basically available extensively in all Laender on the scales of 1:25,000 (DTK25), 1:50,000 (DTK50) and 1:100,000 (DTK100). For DTK50 and DTK100, the surveying and mapping authorities have made an agreement with the German Federal Ministry of Defence that they should be maintained and published as joint civilian and military maps. Due to the regular evaluation of the map contents and as requested by the Federal Armed Forces, the publications of DTK50 contain again the detached house display generated via automated generalization processes, which will be available in all map sheets starting 2022.

At BKG the small-scale topographic maps 1:250,000 (DTK250), 1:500,000 (DTK500) as well as 1:1,000,000 (DTK1000) are derived from the digital landscape models DLM250 as well as DLM1000 and get updated regularly.

For several years, the analogue provision of the Digital Topographic Maps is subject to a strong dynamic.

“WebAtlasDE”, the web-based map service established by the Federal Government and the Laender since 2012, has been updated regularly during the reporting period and is integrated in the portals of the Federal Government and the Laender. Here, raster tiles of various scales are derived from the Digital Landscape Models, then performed via the Web Map Tile Service (WMTS) and provided with a high fail-safe stability.

With the TopPlusOpen product BKG is offering a continuous, freely usable worldwide web map on the base of official reference data of the Laender, official data of the federal government and Europe as well as of independent geodata sources. Here, diverse data sources were joined, prepared and combined in order to achieve the optimum map display. The web map is available as an internet service via the standardised Open Geospatial Consortium (OGC) conform interfaces Web Map Service (WMS) and Web Map Tile Service (WMTS).

With the Smart Mapping project (see page 36) AdV has set themselves the ambitious target to service the production and provisioning processes for Digital Topographic Maps, the WebAtlasDE and TopPlusOpen from a single procedure. For the area of the Working Group Geotopography an intensive cooperation takes place in this project.

The surveying authorities of the German Laender commission aerial imagery flights at regular intervals in order to provide up-to-date aerial photographs to external customers and for internal use in updating the Digital Landscape Models and Digital Topographic Maps. These aerial photos are oriented and orthophotos are calculated from them. Digital Orthophotos (ATKIS®-DOP) with a ground resolution of 20 cm (DOP20) are available in colour for all of Germany. Individual Laender have been producing DOP10 or even DOP5, which means Orthophotos with a ground resolution of 10 cm or 5 cm. Because the results of aerial photography are crucial to the prompt continuation of the geotopographical reference data of ATKIS®, the high-resolution DOP20 is subject to an update cycle of no more than three years.

The stipulations in the product and quality standard for the Digital Orthophotos provide the necessary conditions e.g. for the pooling of the Laender data at the Central Office for Geotopography (ZSGT) located at BKG. Along with the Laender, the ZSGT provides the DOPs and visualises them, as a nationwide data pool, in a DOP viewer available online. The DOP20 is firmly established as a standard product for virtually all technical applications with a spatial reference within and outside of the surveying authorities. The member authorities of AdV decided in 2017 to develop the standard product DOP to the extend, that a so-called TrueDOP can be created. TrueDOP no longer contain any tilting effects, meaning all the objects displayed are shown in the correct position. No occluded areas remain. Meanwhile, numerous Laender have adapted their product pro-

cesses to TrueDOP, starting with the switch of the image acquisition to a longitudinal coverage of 80% and a transverse coverage of at least 50%.

The switch to digital aerial survey camera systems has been completed for some time now. The high efficiency of multi-channel imagery permits the simultaneous use of black-and-white (PAN), colour (RGB) and infrared (CIR) aerial image data. Since the near infrared wavelength channel has been made available, urgent requirements of surveying, forestry, agriculture and environmental authorities can be met.

Besides questions regarding the quality requirements for digital photography flights and questions of data transmission and analysis, the surveying authorities are focusing on the challenges of long-term data security and history management, as time series of aerial images are an indispensable tool for the work of the ever-growing number of users. The protection of aerial image data files should therefore also meet uniform minimum standards in the future. Through this long-term preservation of historical aerial images in digital databases, the AdV member authorities offer a data pool that often dates back decades and meets customers' requirements in this segment, for time series to a special degree. A section of such a time series can be seen in Figure 19. The image shows the urban development of Halle-Neustadt based on pictures from the years 1937, 1975 and 2020.

In addition to the ATKIS® DOPs, oriented aerial images or preliminary DOPs are increasingly being made available to professional users by the surveying authorities. These preliminary and intermediate products in the production process of the standard DOP are available much faster after the aerial survey and satisfy the needs of professional users with time-critical applications, such as in the IACS procedure, the Integrated Administration and Control System for a uniform EU agricultural policy.



Figure 19: Aerial image time series Halle-Neustadt, 1937, 1975, 2020 (from left to right), ©GeoBasis/DE/LVermGeo LSA, 2021.

Remote Sensing and Copernicus

During the reporting period, a new project group was established for this topic area. This group will bundle the activities of the member authorities in the field of remote sensing and Copernicus and ensure an increased exchange of information. In addition to this, the project group leader is the central contact person between AdV and BMVI for Copernicus issues. The project group thus consolidates the work on this topic that has been carried out in various places for several years.

Toponymy

In collaboration with the Permanent Committee on Geographical Names (StAGN), BKG offers a standardised (gazetteer) service that provides the toponymy (GN-DE) from the vector data pool of the products DLM250, VG250 (Administrative Areas 1:250,000) and GN250 (Geographical Names 1:250,000). GN250 is generally available in a classification of names corresponding to the feature types of ATKIS® in the AFIS®-ALKIS®-ATKIS® data model. The raw data pool comprises around 183,000 entries of geographical names, including names of municipalities, parts of municipalities, landscapes, mountain ranges, mountains, islands, rivers, canals, lakes and seas.

The GN-DE database is available as a standardised Web Feature Service (WFS) at the BKG Service Centre in accordance with the specifications of the Open Geospatial Consortium (OGC). This data set has been provided in INSPIRE-compliant form as a service for the European Open Data Portal.

In accordance with the relevant resolutions of the United Nations Group of Experts on Geographical Names (United Nations Group of Experts on Geographical Names – UNGEGN), in 2018 the StAGN has compiled “Toponymic Guidelines for Transportation Areas within Germany”. These guidelines are available on the StAGN website: <http://www.stagn.de/empfehlung-verkehrsflaechen>. The focus of the UNGEGN's regular meeting in 2021 will be the discussion and adoption of UNGEGN's new strategic plan and work programme for the next five to ten years¹.

¹ On 17 July 2018 the United Nations Social and Economic Council (ECOSOC) accepted the new rules of procedure of UNGEGN as well as the provisional agenda for the next (first) meeting of the – on the basis of the ECOSOC resolutions 2017 – newly aligned UNGEGN: https://unstats.un.org/unsd/geoinfo/UNGEgn/docs/11th-uncsgn-docs/E_Conf.105_165_11th_UNCSGN_report_e.pdf

Smart Mapping – AdV's new agile process

With the innovation project “Smart Mapping”, AdV develops and operates a central and modular development platform for a fast, flexible and economic generation of modern cartographic products of the surveying authorities. The functionality of this platform has been extensively tested before new or further developed cartographic AdV standard products are now gradually generated with it. Therefore, in the first realization step, the production of a new vector-based web map was prototyped and published as a beta version (www.adv-smart.de).

Smart Mapping is thus not another AdV product, but a joint procedure that is functionally managed and continuously developed by a development community supported by the Federal Government, the Laender and local governments. Implementing such an elaborate Smart Mapping platform requires new, unconventional ways of working for AdV. Due to the high level of technical complexity and the resulting difficulty in assessing the potential impact of the possible measures, an agile development was introduced in the development of concrete implementation recommendations. The goal of agile development is to make the implementation process more flexible, faster and leaner than is the case with classic process models. The decision-making paths are short and the work packages to be implemented gradually are manageable. The working group is distributed throughout Germany, but still highly networked.

The advantage of the vector-based web map is that the cartographic presentation (rendering) is calculated locally, which allows flexibly selectable display types (styles). The web map can be displayed in the beta version via a specially developed editor (Web Editor). In addition to several control elements and output options, you can currently choose from the following styles:



Figure 20: Currently available styles for Smart Mapping.

Image: AdV/LDBV

Users may also load up their own styles and use them. Via a location search function, it is possible to navigate to places and display them.



Figure 21: Relief display in the web map.

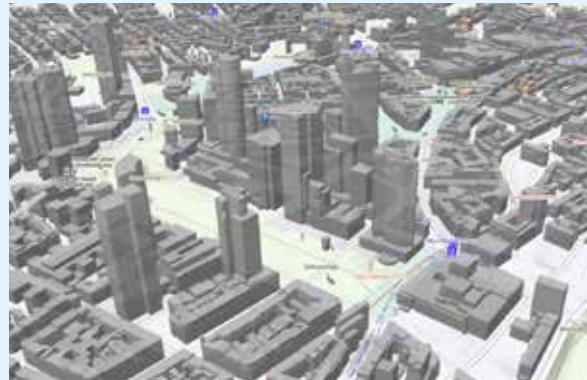


Figure 22: Colour display with 3D building.

High-resolution, scale-related print outputs are now also possible after the development of a corresponding print component (print editor). The modular structure of the development platform allows flexible further development as well as the integration of additional data sets. In addition to generalised print outputs in the standard scales, work is currently being done, for example, on the provision of LoD2 data, as well.

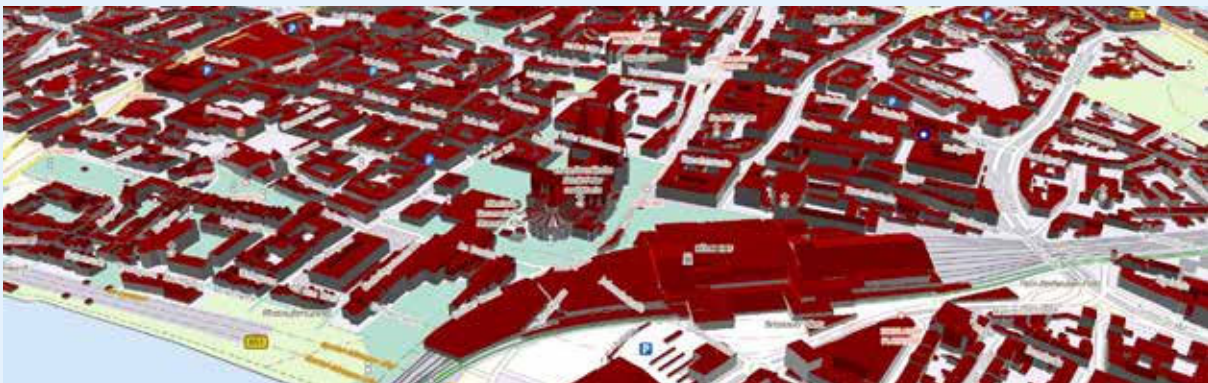


Figure 23: LoD2 building implanted exemplarily in Cologne.

The hallmark of AdV standard products from Smart Mapping is a uniform appearance, consistent terms of use, complete coverage of the Federal Republic and a high degree of timeliness. Due to the agile approach, the procedure can flexibly tap new data sources and new tools and constantly evolve in a user-oriented manner. This also includes the flexible integration of any specialised data, as shown in Figure 24.



Figure 24: Web map combined with 3D-data for trees in Hamburg.

5. Working Group Information and Communication Technology

Introduction of the GeoPackage format

The GeoPackage (GPKG) of the Open Geospatial Consortium (OGC) is used for the independent and user-oriented provision of geospatial reference data. As an open source format, geodata can be stored, managed and exchanged in a contemporary technological standard. The GeoPackage is based on an SQLite database.

In an agile development approach, suitable test data sets were created parallelly to the drafting of an AdV profile for the GeoPackage, in order to obtain practical feedback in a timely manner. For this purpose, various sample data sets of AdV products were created, including vector and raster data for parcels, boundary points, buildings, digital orthophotos (DOP) as well as the complete ATKIS® Basis-DLM and tile pyramids of WebAtlasDE.

The profile draft was subjected to a broad review. Both the surveying authorities of the Laender and external parties were involved in this process. The feedback was formulated as tickets and the profile was updated. Unfortunately, a further qualified feedback during the fair FOSSGIS had to be cancelled. The exchange with this community in particular is, however, a future objective. The GeoPackage profile of AdV has been adopted and will be gradually established in the product delivery.



Figure 25: AdV profile for GeoPackage version 1.0.0.

AdV WMS profile, version 5.0.0

The current WMS profile is available in version 5.0.0. In connection with this it should be noted that AdV is also already working on the implementation of profiles for a new service architecture under the term “OGC API”. This does not concern the definition of new versions of existing OGC Web services as much as it concerns the definition of modular building blocks for the use in modern Web APIs; the previous separation of services is largely eliminated. This is intentional and reflects a paradigm shift in how future geospatial data is likely to be delivered via open standards. The OGC-API family of norms is supposed to be structured according to resource types. Currently, the following parts emerge:

- Common (comprehensive structures like datasets, API definitions, etc.)
- Features (→ WFS)
- Tiles (→ WMTS, prepared server as well as client interface)
- Styles (→ SLD/SE in a portrayal registry)
- Scenes (→ 3DPS)
- Maps (→ WMS)
- Processes (→ WPS)
- Coverages (→ WCS)
- Records (→ CSW)

AdV Testsuite

To ensure nationwide interoperability, it is necessary to check the geospatial reference data for compliance with the applicable specifications. A test environment (AdV Testsuite) must be created for this purpose. The AdV Testsuite is a prerequisite for the establishment of transnational quality management. This promotes the uniformity of official geospatial reference data and their provision via geodata services, also in the interest of cross-Länder users.

Test definition of the GeoInfoDok

Various AdV project groups have each developed the test definition for NAS data in accordance with GeoInfoDok for their area of activity.

The test definition is based on a hierarchically structured data model with the object types test class, conformance class, test case and test criterion. At the test criteria level, the consistency conditions are described and modelled with machine-readable test expressions. In sum of its components, the test definition embodies the technical part of the data quality measure for the logical consistency of NAS data.

This test definition was implemented and further developed in an agile manner as part of the AdV project “Establishment and operation of an AdV test suite”, sub-component “Test standard conformity to GeoInfoDok”. This method has proven successful, as it was possible to establish a close link between the conceptual definition and the practical testing. In addition to the software solution “AdV-Testsuite”, the test definition will be available in a high degree of maturity and cover the AAA® application schema of version 6.0.1 and 7.1.0.

The development of the AdV test suite is based exclusively on Open Source. All developments made in the software creation are also subject to the Open Source approach. The Open Source license European Union Public Licence (EUPL) 1.2¹ is applied. This is a copyleft license for licensing free software developed by the European Union taking the copyright laws of the EU Member States into account. Licensees are required to also publish their further developments under the same Open Source license. In this way, there is theoretically a greater chance of benefiting from further developments by external developers, since redistribution as closed source software is prohibited. The target group for this license is, in particular, public administrations in the EU that intend to publish an Open Source license.

¹ https://joinup.ec.europa.eu/sites/default/files/custom-page/attachment/eupl_v1.2_de.pdf

In order to make the test definition (including all descriptive and technical information) accessible to the widest possible circle of interested parties without breaking the license, it will be published in an XML-based format (exchange format of the AdV Testsuite registry) under the aforementioned Open Source license on a suitable platform. This would also create the prerequisite for establishing sustainable quality assurance of the AdV Testsuite software solution using Continuous Integration.

Subcomponent Geodata Services

After the successful implementation of the data tests for AFIS®, ALKIS® and ATKIS®, the implementation of the test criteria for the AdV service profiles is to be realised. The process of service tests is more complex than the relatively static testing of data because of the constant interaction between client and server. The interactions must be configured and standardised accordingly. The returned content must be checked, also with regard to the data. The service tests thus include the testing of the basic service parameters from the AdV service profiles (including AdV-OWS-Basis profile and AdV-WFS profile) as well as the validation of the determinations of the product specifications related to the respective requested data (e.g. product specification ALKIS®-WFS and ALKIS®-WMS). The further development of the geodata services subcomponent is also to be continued consistently under EUPL 1.2 in line with AdV's strategy on Open Source licenses, which is currently being drawn up.

@weltvermesserer (world surveyors/world improvers) – Young Talent Social Media Campaign

Surveying and cadastral authorities (VKV) all over Germany are facing a high number of age-related staff departures in the coming years. It is already becoming apparent that there will not be a sufficient number of qualified young recruits available in the coming years, not only for apprenticeship capable professions but also for the relevant bachelor's and master's degree programmes. It is not only the VKV that are affected by this shortage of skilled staff. Whether public authority, industry, university, engineering or public surveying offices: All of them lack interested and well-trained young applicants. In consideration of this, Adv has addressed the issue of how the VKV could be made better known and which measures could be taken to survive in the increasing competition for skilled experts compared to other professions.

Image promotion for occupational fields – not only geodetic professions – cannot begin early enough; interest in these occupational fields must be raised as early as adolescence and school age. The entire exciting occupational field of a "geodesist" in all its facets is too little known among the general population and should be better advertised in the future.



Figure 26: Banner of the Young Talent Campaign "Weltvermesserer" (world surveyors/improvers).

Previous offers of information via homepages such as www.adv-online.de or www.arbeitsplatz-erde.de have been very helpful. There is, however, a lack of strategies to actively point out the potential of the geodetic occupational field to young people between the ages of 14 and 18 who are in the phase of future professional orientation and to make them curious. In addition to increasing the level of awareness of the geodetic occupational field itself, attention should also be drawn to the extensive range of information offered by technical colleges, universities, as well as administrations and authorities. Against this backdrop, the associations and employers have agreed to jointly implement the cross-employer and cross-association social media campaign [@weltvermesserer](https://www.instagram.com/weltvermesserer/)¹. In addition to the initiators DVW, VDV and BDVI, who have joined forces to form the InteressenGemeinschaft Geodäsie (IGG – Community of Interest Geodesy), not only Adv and the Working Group Land Development (Arge Landentwicklung) but also universities such as the Technical University of Munich, the Technical University of Berlin or the University of Stuttgart are involved in this campaign. In addition, the Deutsche GeoForschungsZentrum (German Research Centre for Geosciences) and other companies from the surveying sector are cooperation partners, also.

¹ <https://www.instagram.com/weltvermesserer/>

The launch of **@weltvermesserer** took place in August 2020. By concentrating the campaign primarily on Instagram, the focus is on a visual medium with meaningful images and videos. The chosen visual language conveys a positive atmosphere and shows authentic emotions from the everyday life of the geodetic profession. The appearance of the campaign is adapted to the target group, young people aged 14 to 18 or young people looking for a future career field. In a uniform design, images (“eye-catchers”) in different categories, e.g. fun, facts, education and technical terms related to the geodetic profession are presented and posted in a varied way. To date, over 100 such posts have been published on Instagram; the channel has over 2000 subscribers (as of August 2021). In order to further increase the awareness and the number of subscribers of this campaign – and thus also the general visibility of our professional image – the campaign may be referred to and linked to. In this way, everyone can contribute to increasing the awareness of the geodetic profession and thus to recruiting new talents without much effort.

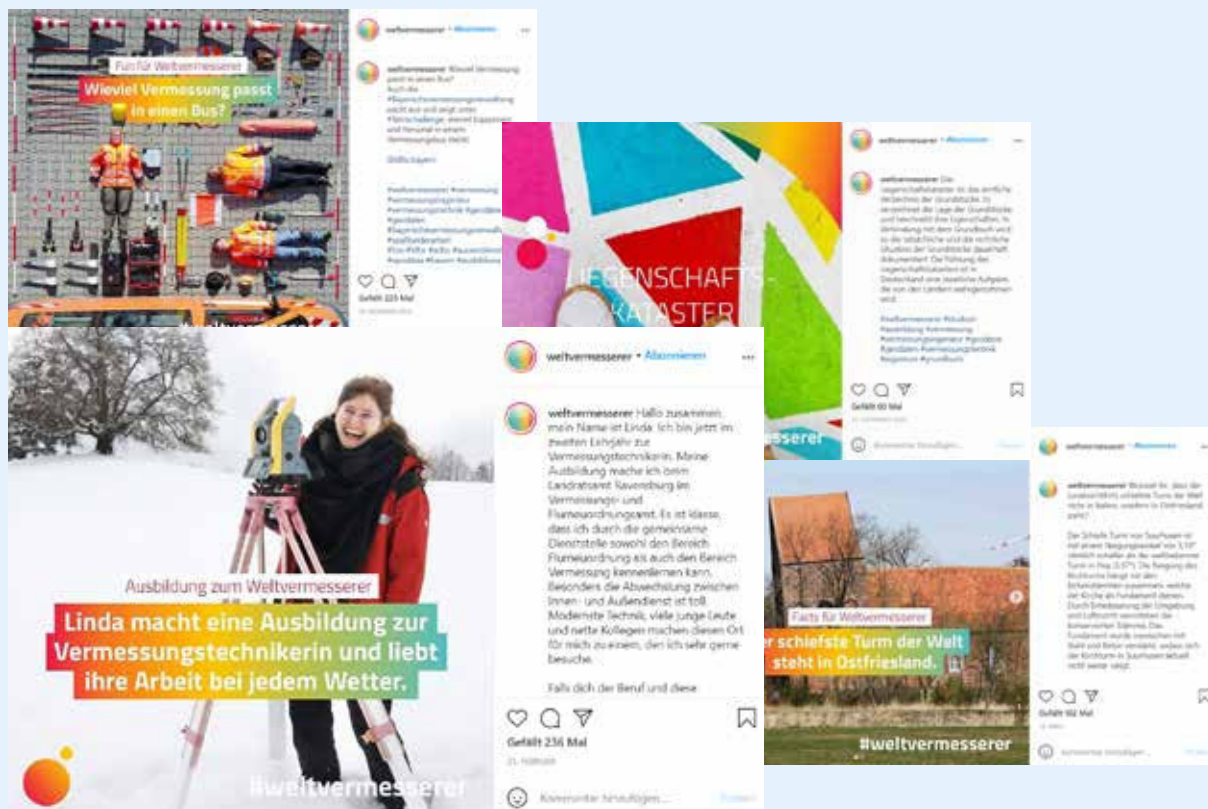


Figure 27: Examples from the Campaign “Weltvermesserer”.

6. Working Group Public Relations and Marketing

The Working Group Public Relations and Marketing can look back on 15 years of successful activity: Among other things, with the AdV Fee Directive it set a milestone for the nationwide standardization of fees and licensing models, especially for major customers. This anniversary is an occasion to, not only highlight the current tasks of Working Group PRM in this chapter, but to also provide a brief review of its origins.

15 Years of PRM activity

As early as 2002, a working group on public relations and marketing (PRM) was set up within AdV with the task of developing guidelines for PRM. The working group was directly assigned to the plenum and was disbanded in spring 2006 after its work was completed. The strategic responsibility for PRM was to remain with the AdV chair, and the plenum was to set up a separate group for this work.

As a result, the plenum established the Task Force PRM (TF PRM) in spring 2006, which met for the first time on 24 and 25 April. The then AdV Chairman Prof. Dr. Klaus Kummer was instrumental in setting up the Task Force. The web presence of the AdV as well as the standardization of the fee and license issues at the founding meeting were already predominant topics.

In nine meetings up to 2014, the Task Force dealt with a wide range of matters that were very fundamental for the external appearance of the AdV; consequently, the TF PRM was "promoted" to a working group in April 2015. Since then, the Working Group Public Relations and Marketing and its five project groups have met regularly or as needed:

- Needs assessment and analysis,
- Licensing/fee model,
- Product information, corporate design and internet portal(s),
- Public relations,
- Sales manager meeting.

What is behind the name Public Relations and Marketing (PRM)?

Public relations refers to the management of public communication of organizations towards their internal and external customers.



Figure 28: Customer meeting at a surveying office
(image: BVV).

Public relations refers to all groups, especially the heterogeneous public. The term organization also includes the Working Committee of the Surveying Authorities of the Länder of the Federal Republic of Germany (AdV).

Marketing is the alignment and design of an organization's activities with the needs of the market in order to satisfy these needs with appropriate products and services. The better this succeeds, the greater the (entrepreneurial) success. To this end, the processes and action areas relevant to the market are optimised.

Thus, the Working Group PRM has not only the task of describing fee and license models for the internal and external customers relevant to the market, but also to present AdV to the multi-layered public.

In particular, the Working Group PRM has the task of informing the interested public about the range of official geospatial reference data available throughout Germany and to support the transnational harmonious provision of official geospatial reference data and official geospatial reference data services of the Official German Surveying. The following topics are to be dealt with:

Determination and analysis of needs

- ascertainment and documentation of the requirements of the state and the public for the geospatial reference products,
- analysis of the requirements of the users for the geospatial reference services and comparison with the supply thereof.

Conditions policies

- development of licencing and fee models,
- recommendations for further developments of AdV's Fee Directive,
- adaptation of the model license agreements for the use of official geospatial reference data and official geospatial reference data services to technical and legal developments.

Product information

- maintenance of the Corporate Design of the Official German Surveyings,
- provision of information material (i.e. product brochures and flyers, product-related internet presentations),
- implementation of measures to provide information on the availability and usability of the geospatial reference data supply.

Distribution politics

- coordination and harmonization of the transnational provision of geospatial reference data products.

Public Relations

- implementation of promotional measures for the purpose of image branding and maintenance,
- maintenance of the AdV website,
- exhibition appearances.

The long path to Open Data

Directive (EU) 2019/1024 of 20 June 2019 on open data and the re-use of public sector information (hereinafter the Open Data Directive) builds on Directive 2003/98/EC of 17 November 2003 on the re-use of public sector information. This directive set a uniform legal minimum level of EU Member State regulations and procedures for the re-use of public sector information. According to its English title "Directive on the re-use of public sector information", the directive became commonly known as the PSI Directive. The Directive underwent significant revision with the amendment 2013 via the Directive 2013/37/EU of 26 June 2013 to changes to Directive 2003/98/EC on the re-use of public sector information. The two directives were transposed into German law by the Act on the Re-Use of Public Sector Information, the Information Re-Use Act (IWG).

The intention is to implement the directive in the 2019 recast, through the Data Use Act (DNG), which replaces the IWG.

Open Data has a high political relevance on a national and international level. Since the publication of the Open Data Directive in 2019 at the latest, the topic has been discussed in a targeted manner in all Laender. What began in 2012 and 2013 with the Open Data initiatives in Hamburg and Berlin was continued by the larger Laender of North Rhine-Westphalia and Thuringia from 2017. From this point on, geospatial reference data was made available as Open Data for a significant proportion of Germany's surface area, for the first time. Since the Central Offices of AdV responsible for the supraregional users are bound by the AdV Fee Directive, it had to be adapted accordingly. While users are certainly willing to pay for the services of the Central Offices, they also expect to benefit from the Open Data initiative when it comes to charging. Therefore, in 2019, the AdV Fee Directive was adjusted so that data from the Open Data Laender is included in Annex E and only charged with a percental base rate of the initial fee. Since then, Annex E reflects the Open Data situation in the official surveying quite well. For example, Rhineland-Palatinate and Saxony-Anhalt rely on Open Data only for a selection of geospatial reference data. Most recently, in 2020, the Laender Saxony and Brandenburg jumped on the Open Data bandwagon.

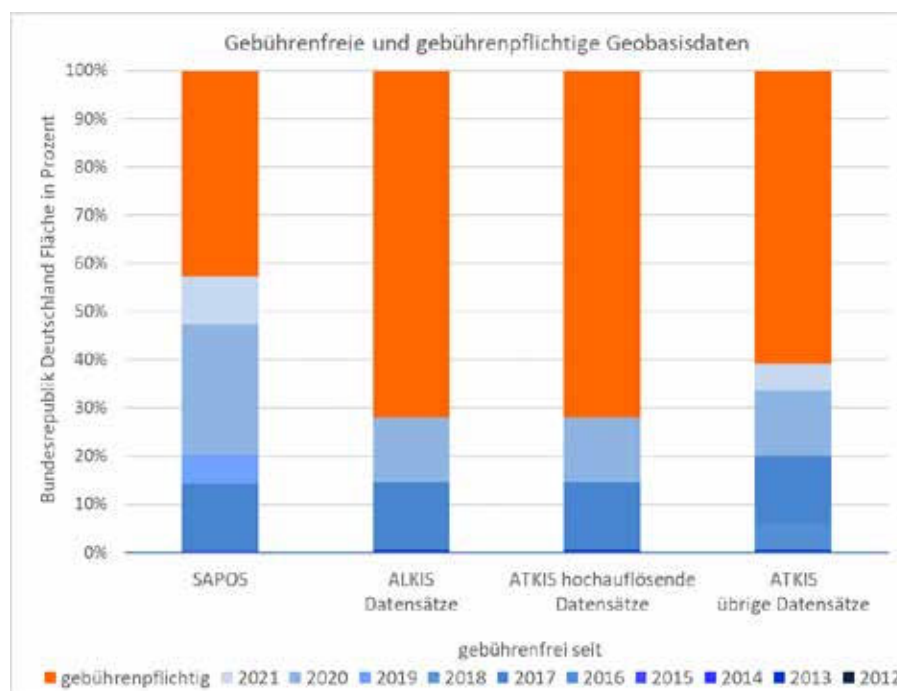


Figure 29: Geospatial reference data free of charge and subject to charge.

Currently, about 30–40% of the geospatial reference data from ALKIS® and ATKIS® are made available to the user as Open Data. In the case of SAPOS®, this figure is already just under 60% of the area, which can partly be traced back to an initiative from the agricultural sector. With the implementation of the Open Data Directive as well as the associated Implementation Act, this trend will continue in the Laender.

INTERGEO®



INTERGEO®, as the leading trade fair for geodesy, geoinformation and land management, was, like so much else in the Corona year 2020, an exceptional fair. Instead of being held, as originally planned, as “on-site” event in Berlin, INTERGEO® 2020 had to take place purely virtual from 13 to 15 October due to the pandemic situation. Some may have asked themselves “holding a trade fair virtually – is that even possible?”

Sure, the trade fair visitor could not stroll past stands as usual and be impressed visually, acoustically and above all haptically by the technology on display, but, nevertheless, 228 registered trade fair exhibitors presented themselves to an international audience. Overall, there were fewer visitors than at previous INTERGEO®s, yet numerous presentations were shown in virtual rooms and personal discussions were held.



Figure 30: Banner of the virtual trade fair appearance of AdV 2020.

AdV also provided first-hand information on official German surveying at its virtual “stand”. In addition to the AdV chairman and his deputy, other AdV experts were available to the visitors for discussions. While concrete projects on the workstations of individual Laender are shown in personal discussions and in live presentations at the AdV joint stand during presence events, this time some Laender participated virtually. For example, under the motto “Brandenburg – digital without borders”, Brandenburg provided information about its provision portal with which the official geospatial reference data of the Land is made available to users as Open Data and which allows submitting applications for surveying and relevant documents – all via a uniform digital plat-

form <https://geobroker.geobasis-bb.de/>. Transparent administrative action and open data create trust in the work of the state.

As in previous years, the three AdV Central Offices for SAPOS®, Geotopographic Data and House coordinates, Building Polygons, and 3D Building Models were also important points of contact. Representatives of the three Central Offices were available to answer questions from the virtual visitors. The flagship of the AdV projects was also represented by experts in the AdV virtual trade fair appearance: Smart Mapping, core project of the Official Cartography for deriving innovative cartographic products by means of modern web applications by integrating cloud technologies. The first product shown was the beta version of “basiskarte.de”, which can be used to display monthly updated maps for web applications in a wide variety of forms.

In September 2021, a hybrid INTERGEO® is planned, i.e., in addition to a presence fair in Hanover, there will be an extensive digital offer. The future of INTERGEO® will be LIVE and DIGITAL.

European Cadastre Experts Visiting AdV: PCC Congress “Smart Cadastre – shaping the future” held successfully



The cadastral authorities of the EU member states have joined forces in the “Permanent Committee on Cadastre in the EU (PCC)” with the aim of an informal experience exchange. In accordance with the PCC statutes, the PCC is chaired by the country holding the presidency of the EU Council. The cadastral authority of this country hosts a cadastral congress and the General Assembly of the PCC during this period. As the EU Council Presidency in the second half of 2020 was held by the Federal Republic of Germany, the presidency of the PCC in Germany fell to AdV, which represents the Länder responsible for the cadastral system throughout Germany. Due to the Corona pandemic, the congress held on 3 and 4 November 2020 (including the General Assembly) had to be held virtually, instead of in the rooms of the Munich Residence as originally planned, and was organised in cooperation with the Cadastre and Land Registry Knowledge Exchange Network (CLRKEN) of EuroGeographics.

“Together for Europe’s recovery” was the motto of the German EU Council Presidency and addressed in a global approach the goal of overcoming the current Corona pandemic and thereby comprehensively promoting a sustainable development, while not losing sight of other crises such as climate change.

Sustainable development is at the top of the political agenda of most countries, including Germany. The authorities responsible for real estate cadastres are convinced that they can make a fundamental contribution to this. For this reason, the PCC Congress was held under the topic “Smart Cadastre – shaping the future”, highlighting various aspects of the role of cadastral, but also land registry, with a view to the sustainability goals of the United Nations Agenda 2030.

Greg Scott, Inter-Regional Advisor on Global Geospatial Information Management (GGIM) in the United Nations Statistics Division (UNSD) and one of the founding fathers of the Expert Committee on Global Geospatial Information Management, presented the United Nations Sustainable Development Goals (SDGs) in his keynote address. These 17 global goals are the guiding principles for creating a better and more sustainable future for all the people of the Earth. They were adopted by the 2015 United Nations General Assembly and are to be implemented by 2030 (UN Resolution A/Res/70/1, so-called “Agenda 2030”, <https://sdgs.un.org/goals>).

Scott highlighted that practically all of the fundamental data themes defined in the Sustainable Development Goals are affected in some way by cadastral and land registration systems. Legally sound and efficient cadastral and land registration systems are therefore a fundamental pillar and prerequisite for achieving the sustainability goals. At the same time, he expressed regret that experts do not promote themselves sufficiently well and therefore the importance of their work and contribution to society is not adequately recognised. In the voluntary national reports in which individual states report on progress toward achieving the sustainability goals, hardly any reference is made to the importance of real estate cadastre and land registration.

The questionnaire sent out to the member administrations of the PCC and EuroGeographics in preparation for the conference and evaluated by Daniel Steudler, head of CLRKEN, was answered by 24 experts from 19 states, four German Laender and one association. The following five sustainability goals were identified as particularly relevant for cadastral and land registers, in the order of priority:

- **Goal 15:** Land-based life: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss are prerequisites for protecting land-based life;
- **Goal 11:** Sustainable cities and communities: affordable housing and sustainable and integrated urban development policies are prerequisites for safe and resilient settlements and urban life;
- **Goal 9:** Industry, Innovation and Infrastructure: Building resilient infrastructure, promoting inclusive industrialization, and supporting smart innovations are prerequisites for sustainable and healthy living;
- **Goal 16:** Peace, Justice and strong institutions: Good governance without corruption is essential for peace, justice and the rule of law; strong and transparent institutions must be promoted;
- **Goal 1:** No Poverty: End poverty in all forms and everywhere.

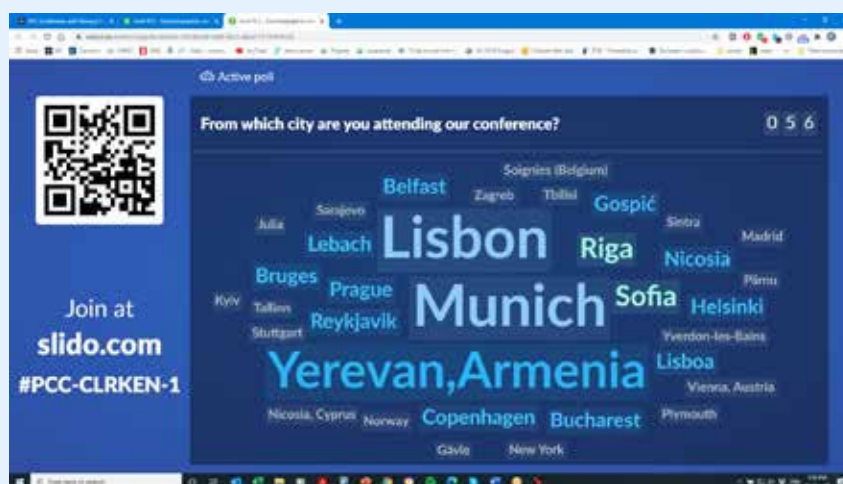


Figure 31: Locations from which the participants of the German PCC Congress were logged in.
Screenshot: AdV.

A number of interesting speeches and presentations examined the relationship between the cadastre/land registry and the Sustainable Development Goals from a variety of perspectives.

At the end of the event, Tobias Kunst, AdV Chair and Chair of the PCC in the second half of 2020, handed over the PCC flag to the Chair of the PCC in the first half of 2021, Dr. Fernanda do Carmo from the Cadastral Administration of Portugal. This flag handover, like the entire congress, also had to take place virtually (see Figure 32).

A total of 133 participants from 35 countries attended the congress. The interaction of the speakers with the participants was made possible by asking questions to the speakers via an app. The speeches as well as the evaluations of the questionnaire are available here:

www.adv-online.de/Veroeffentlichungen/Vortraege-Praesentationen/PCC-Kongress-2020-Deutschland/



Figure 32: Virtual handover of the PCC flag from Tobias Kunst to Dr. Fernanda do Carmo in autumn 2020. (Photomontage, Screenshot)

7. Involvement in National and International Organisations

EuroGeographics



EuroGeographics (www.eurogeographics.org) is the non-profit association of the national institutions in Europe that are responsible for performing geodesy, cartography and real estate cadastre-related tasks. The collaboration within EuroGeographics includes the development of cross-national, harmonised products, as well as joint working groups and projects. The members of EuroGeographics particularly aim to support the European Commission in establishing the European geospatial data infrastructure in connection with the INSPIRE framework directive and the Copernicus earth observation programme.

AdV is an associated member and the Federal Agency for Cartography and Geodesy (BKG) a regular member of EuroGeographics. Both are actively involved in the work on products, in expert groups and in projects. Furthermore, the president of the BKG is a permanent member of the Management Board. Currently this role is being filled by the head of staff of the office for international affairs of BKG.

EBM, ERM, EGM, EuroDEM and Open Regional Gazetteer

EuroGeographics offers the following official European data sets in standardised form, harmonised across national borders and with an actuality of data in line with demand:

- EuroBoundaryMap (EBM) – all the administrative units of all national administrative levels in Europe, with names, unique code numbers and a reference to the statistical classifications NUTS/LAU of Eurostat, the Statistical Office of the European Union. The data set in the scale 1:100,000 is currently being compiled by 40 data producers (see Figure 33),

- EuroRegionalMap (ERM) – the topographic reference data set in the scale 1:250,000 ERM is currently being compiled by 37 data producers (see Figure 34),
- EuroGlobalMap (EGM) – the topographic reference data set in the scale 1:1,000,000 is automatically being derived and has been available on the Internet as Open Data on EuroGeographics' website since 2013,
- European Digital Elevation Model (EuroDEM60) – a digital terrain model computed by the BKG in 2008 from the national data sets with a position resolution of two arcseconds (approx. 60 m) and a height accuracy of 8 – 10 m,
- Open Regional Gazetteer – a European naming service containing geographical names of the EBM and ERM products. The name database is enriched with exonyms (geographical names in other languages) by a name expert.

On the basis of the specifications for EBM and ERM, the BKG and its partner authorities in Europe produce official national data corresponding to the annual production plan. This data is checked for EBM by the BKG and for ERM by the regional coordinators and BKG. They are then respectively merged into one data set. The "Institut National de l'Information Géographique et Forestière (IGN)", France, generalises the ERM data for EGM. EBM and ERM are published once a year.

BKG is the product manager for EMB and ERM. The area of responsibility includes the organization of the entire manufacturing process as well as its strategic planning and technical implementation. Another key task for the product managers is the communication with the data producers and regional coordinators. In cooperation with them, the manufacturing process is continuously reviewed and optimised if needed. The Federal Service Centre for Geoinformation and Geodesy of BKG acts as a distribution centre for EuroGeographics and delivers the European datasets to German and international customers.

Knowledge Exchange Networks

The Knowledge Exchange Networks (KENs) provide platforms for an exchange of experiences on various topics between experts from the EuroGeographics members. One example is the INSPIRE KEN, in which members can present their experiences with INSPIRE implementation and discuss solutions for its execution.

BKG is represented in most of the KENs and actively contributes to the work. AdV – represented by the Secretary General – and BKG are members of PolicyKEN, in which European strategies, directives and regulations are evaluated and position papers are prepared.

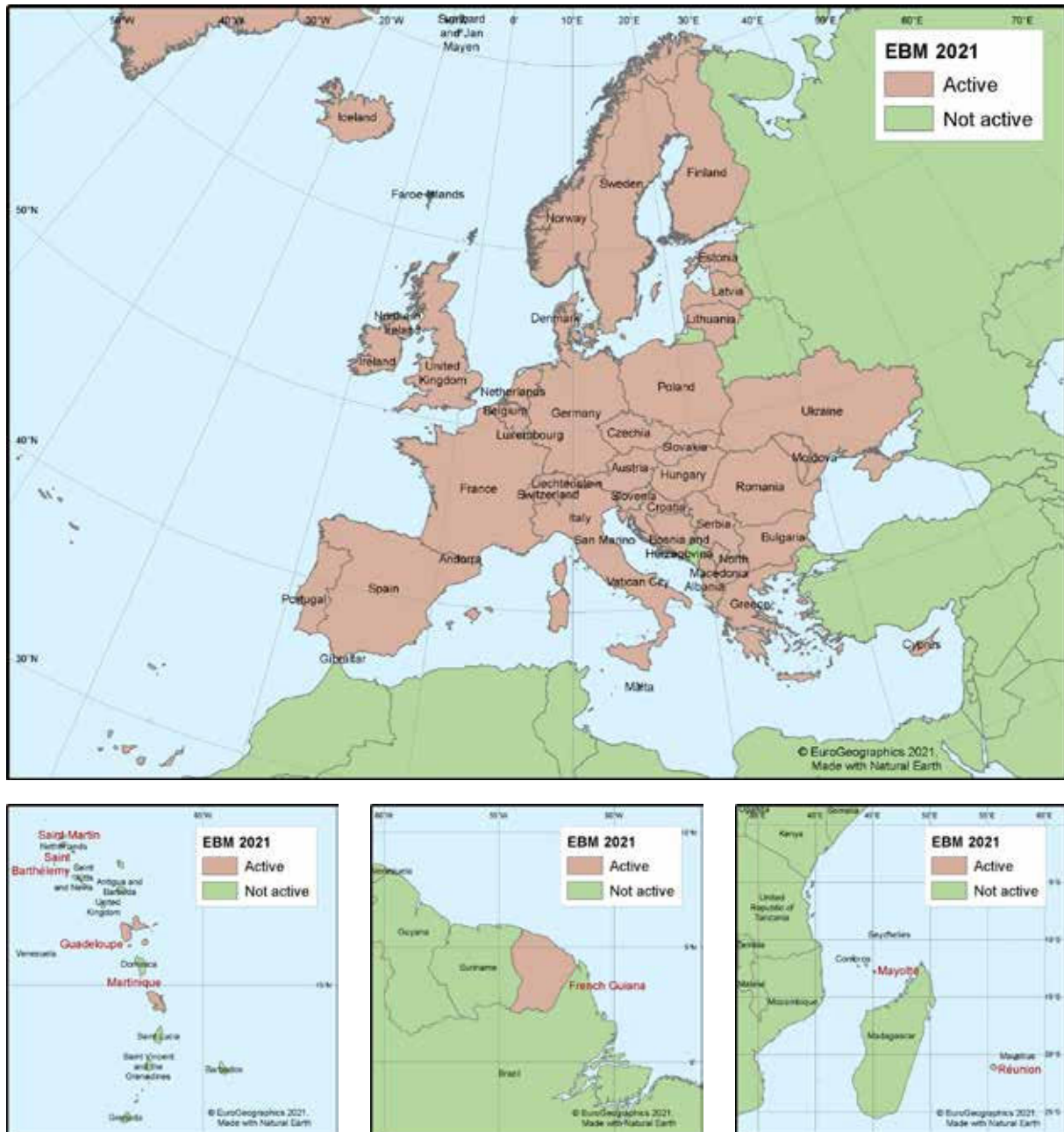


Figure 33: Members EBM (EuroBoundaryMap).

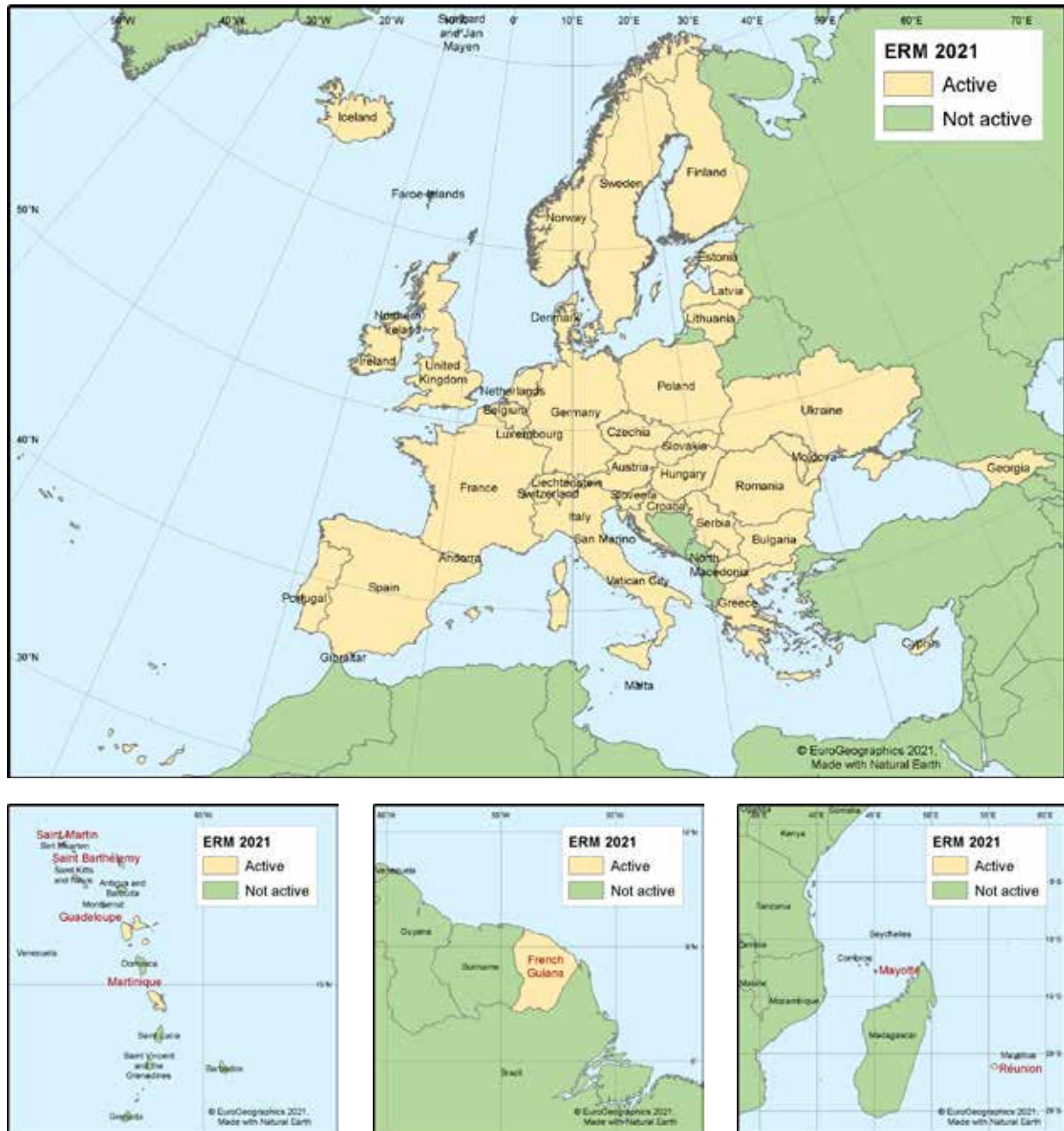


Figure 34: Members ERM (EuroRegionalMap).

Copernicus



The European Earth observation programme Copernicus has developed rapidly since the launch of the first Sentinel satellite in 2014. At the end of 2020, the eighth Sentinel satellite was launched (21 November 2020, satellite Sentinel-6).

The volume of satellite data products generated each day now reaches 25 terabytes, and about 420,000 users are registered for data access with ESA, around 23,000 of them in Germany – more than in any other country in Europe. The six Copernicus services are now well established and recognised as a reliable source of information. For example, the products of the Copernicus Climate Service are regularly picked up by the press and television and sometimes complement the weather report. The same applies to products of the atmospheric monitoring service, which are used for statements on air quality. Regular reports such as the Copernicus Climate Service's "European State of the Climate" report (March 2020) or the Ocean State Report of the Marine Environment Monitoring Service (2020) not only achieve wide dissemination, but also find their way into the conception of climate change adaptation measures, for example. Geoinformation based on satellite earth observation is increasingly establishing itself as a regular source of information for planning decisions.

In September 2017, the German government adopted a national Copernicus strategy. Through structured, targeted action, the benefits of the major European investment are to be maximised in Germany as well. National policy can and should also benefit from Copernicus in its implementation. To this end, the German government, under the leadership of the Federal Ministry of Transport and Digital Infrastructure (BMVI), has stepped up its efforts to effectively incorporate the needs of institutions in Germany into the development of European services. At the same time, capacities have been and are being created in selected institutions in Germany with targeted funding measures so that the potential of the EU Copernicus programme can be optimally exploited. To further strengthen the performance of Copernicus and increase its ability to contribute to key policy areas, six additional satellite missions will complement the six existing Sentinel missions starting in 2025.

In order to be able to make optimal use of the new satellites and the resulting thematic fields and, above all, to further support authorities in the implementation of Copernicus data, BMVI has extended the National Copernicus Integration Measure, which was already initiated in 2012, beyond the year 2020. Germany is responsible for many potential applications of the federal states. The space agency therefore also supports pilot applications at the state level with funding from BMVI. One example for this is the development of an automated process chain for remote sensing detection, recording and monitoring of hazards to the traffic infrastructure in Schleswig-Holstein (SAR4Infra). The State Office for Surveying and Geoinformation in Schleswig-Holstein is in charge here, working closely with the State Office for Road Construction and Transport.

The SAR4Infra project aims to enable early detection of such deformations that pose a threat to transport infrastructure (roads, rails, bridges, earth walls, etc.) by setting up an automated system. The detection of deformations is based on the interferometric evaluation of radar remote sensing data from the Copernicus Sentinel-1 mission (S1), which maps any uplift and subsidence by means of point information. The highest possible compression of the point information is to be achieved by integrating a wide variety of radar time series evaluation methods. For efficient processing, the operational process chain will be based on an open source software solution and integrated into an appropriate cloud environment that already holds the required Sentinel1 data (e.g. CODE-DE). Possibilities for later upscaling should already be taken into account during implementation. The finished product represents an innovative risk assessment map for vulnerable infrastructure in Schleswig-Holstein derived from the point information, which could also be generated for other states if required. Through the areal and cost-efficient use of Sentinel-1 Copernicus data, SAR4Infra offers real added value compared to the classic, point-based terrestrial surveying methods that have been used to date to monitor transport infrastructure. The project started in December 2020.



Figure 35: Examples for defective and destroyed transportation infrastructure in Germany. Line by line from left to right: A3 at the Wiesbaden interchange 2010 (dpa, Fredrik von Erichsen), Rhine valley railway near Rastatt 2017 (Badische Neueste Nachrichten, Deck), B180 near Eisleben 2001 (dpa), A20 near Tribsees 2017 (ndr.de).

Efforts at the Laender level are increasingly bearing fruit. State environmental agencies are now recognizing the added value that Copernicus can generate for the performance of their tasks. Currently, applications have been submitted to the DLR Space Agency to launch an integrated “lighthouse” project involving most of the state environmental agencies. The goal of the lighthouse is to develop services and applications on the two main topics of grassland monitoring and inland water monitoring in order to establish Copernicus in a sustainable way in the state environmental agencies. The project on grassland monitoring (CopGruen) started in May 2021 and the topic inland water monitoring could start on 1 July 2021..

Copernicus is also gaining a foothold at the municipal level. Here, a notice on climate adaptation strategies for municipal applications has been initiated in December 2020. In March 2021, eleven outlines were received, from which two consortia could be invited to submit a full proposal. Both consortia are composed of municipal actors (cities), scientific institutions and companies and both deal with the topic of climate adaptation strategies for urban areas. The CoKLIMAx project will start on 1 November, the second project UrbanGreenEye in January 2022.

Since 2017, the DLR Space Agency has been providing access to Copernicus data, products and services optimised for the needs of government users in Germany on behalf of the Federal Ministry of Transport, Building and Urban Affairs through the CODE-DE platform (<https://code-de.org>). In 2020, performance and user-friendliness were improved, and the web presence (Figure 36) was revised. By providing a hybrid cloud infrastructure, the transfer of large amounts of data can be avoided, as work can be done directly in the cloud – where the data is available. Beyond pure data access, the first federal agencies are testing the development and implementation of applications via virtual machine (VM) access. In the development of such offerings, authorities are receiving targeted support from the German Space Agency at DLR. In addition to a complete archive of Sentinel data over Germany, the platform's data offering also includes digital terrain models and access to selected other satellite data and derived products and the Copernicus services. The products on CODE-DE are freely usable. Parts of the offer are only accessible to certain user groups, such as government users, according to the individual data license conditions.

Via a CODE-DE contingent for the use of virtual machines, the following surveying offices are already active users of CODE-DE:

- State Office for Surveying and Geoinformation Schleswig-Holstein,
- State Office for Geoinformation and Surveying of Lower Saxony,
- Saxony-Anhalt State Office for Surveying and Geoinformation,
- State Office Geoinformation and Surveying Hamburg.



Figure 36: homepage of the website of CODE-DE.

Open Geospatial Consortium (OGC) and ISO/TC211



Both standardisation panels are currently revising their strategy for data provision. The ISO and OGC standards, which have been developed and used for about 20 years, are somewhat outdated and are to be adapted to the current, widespread Internet technology. The goal is to create so-called data spaces, which aim to provide cross-national data without media discontinuity via open interfaces (API).

Presumably, geospatial data infrastructures will not disappear as a result, but presumably the standards used so far will be replaced. The spatial data infrastructures will (have to) change significantly. The basic principles of a National Spatial Data Infrastructure (NSDI) (standardised search, access and harmonization of data) are still key factors for widespread use of official geodata, especially in times of Big Data, cloud computing, data streaming, OSM, etc. This also includes clear regulation for the use of data (licensing). Therefore, standardisation panels are currently developing concrete standards for this seamless digital space, which should significantly simplify the development of new products and services based on data-regardless of whether the data is collected and provided by public administration, companies or citizens. Just being online is definitely not enough anymore.

The existing geospatial data infrastructures should become a part of this data space. To achieve this goal, however, they have to get out of their silo existence. To do so, they must overcome the hitherto predominant data provider view when defining specifications and products.

Two aspects must be taken into account in such a change:

- All stakeholders involved in a NSDI must be jointly involved in the definition of standards and the design of technical solutions, but also in the further development of the infrastructure. Such an integrated approach would include the data providers, the users, but also the data preparers and web developers.
- The architects of a NSDI must recognise that geospatial data does not have a special role on the internet but must become a part of it (“spatial is not special anymore”) and not vice versa. This means that there must be an increased orientation towards mainstream IT so that the reach of the NSDI is extended in the direction of general Internet technology.

In order to achieve these two goals mentioned above, it is necessary to set new technical framework conditions in addition to organizational measures (e.g., participation concepts for all stakeholders, simple licenses, evaluation of user behavior). One aspect of this is a rethinking of the modeling of geospatial data towards a simple but flexibly expandable data structure that has only one spatial object as its core (with simple geometry) and not, as in INSPIRE 34, special data models that can hardly cover all use cases anyway. Such a simplified data model is already used e.g. in OSM, but also in Smart Mapping. Besides the simple extensibility, such an approach also has the advantage that many Open Source tools (libraries) can be used immediately.

The central technical core are the various programme interfaces (API). For this purpose, the standardization panels (especially OGC) are developing a series of user-tested specifications that are intended to further develop or even replace the existing web services. The new APIs are structured according to resource types and published step by step.

From the point of view of AdV, these developments must be monitored, influenced if needed and adapted to the current framework conditions. In addition, it would have to be decided when this technology would be used. The PG GDI Standards of the AK IK is currently working on a corresponding API profile as a precaution. However, the concrete goals that AdV wants to pursue with this as part of the deployment strategy are still unclear. In any case, new standards should only be deployed if the user group described above demands it and support is available on the part of the software manufacturers. In the case of the OGC APIs, however, this is definitely already the case.

Permanent Committee on Cadastre in the European Union



On 1 July 2020 Croatia assumed the EU Council Presidency and thus also the Presidency of the Permanent Committee on Cadastre in the European Union (PCC) for the first half of 2020. At the conclusion of the presidency, the PCC General Assembly was held virtually as a web-based conference on 16 and 17 June 2020, and not as originally planned in the city of Zagreb. The main focus of the conference was on the topic “The importance of land administration data in strengthening competitiveness and economic development”.

As of 1 July 2020, Croatia handed over the PCC presidency to Germany. The motto of the German PCC Presidency was “Smart Cadastre – shaping the future”; at the conference and General Assembly held virtually on 3 and 4 November 2020, the significance of the cadastre was considered against the backdrop of the United Nations' policy goals for sustainable development. For more information on the German PCC Presidency: see page 50.

On 1 January 2021, Portugal succeeded to the EU Council Presidency and thus to the PCC Presidency for the first half of 2021. Due to the ongoing Corona pandemic, the Portuguese Conference and General Assembly also had to be held virtually at the end of May. Here, the topic of sustainability goals, which had been taken up for the first time in Germany, was continued and fleshed out with a particular focus on the potential contribution of the cadastre to climate protection, especially the reduction of greenhouse gas emissions.

In the second half of 2021, Slovenia chaired the PCC. The topic of their presidency had not yet been determined at the time this National Report went to press.

Further information can be found at www.eurocadastre.org.

Explanation of frequently used abbreviations

AdV	Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany
AAA®	AFIS® – ALKIS® – ATKIS®
AFIS®	Authoritative Control Point Information System
ALKIS®	Authoritative Real Estate Cadastre Information System
ATKIS®	Authoritative Topographic-Cartographic Information System
BKG	Federal Agency for Cartography and Geodesy
BMI	Federal Ministry of the Interior, Building and Community
BMVg	Federal Ministry of Defence
BMVI	Federal Ministry of Transport and Digital Infrastructure
DGK	German Geodetic Commission
DGM	Digital Terrain Model
DLM	Digital Landscape Model
DOP	Digital Orthophoto
ELF	European Location Framework
GDI-DE	Spatial Data Infrastructure Germany
GeoInfoDok	Documentation on the Modelling of Geoinformation of Official Surveying and Mapping
INSPIRE	Infrastructure for Spatial Information in Europe
NAS	Norm-based Exchange Interface
ÖbVI	Publicly Appointed Surveyors
OGC	Open Geospatial Consortium
SAPOS®	Satellite Positioning Service of the Official German Surveying and Mapping
TN	Actual Use
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service
ZSGT	Central Office for Geotopography
ZSHH	Central Office for House Coordinates and Building Polygons
ZSS	Central Office SAPOS®



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of the Laender of the Federal Republic of Germany