STATEGEOCADASTRE

Good practices for Digital transformation in Ukraine

ANDRII CHERIN
SE Scientific and Research Institute for Geodesy and Cartography, Ukraine, gki.com.ua

18-20 SEPTEMBER 2019 VRDNIK, SERBIA

Digital transformation in Ukraine

Move from the cartographic to geoinformation paradigm

Basic principles

1. The core of the system is the geodata base
2. Coordinated, topological, structurally Data consistency
3. Geodata monitoring system
4. Conformity to ISO and INSPIRE standards
5. Geoservices and rules-based access to geodata
6. Work on all devices
7. Geodata created once and is available at all levels

Development NSDI in Ukraine

"In the age of the information society, an effective country / community will be one in which the cost of production and use of information is optimized and the public is widely available"

Digital transformation in Ukraine

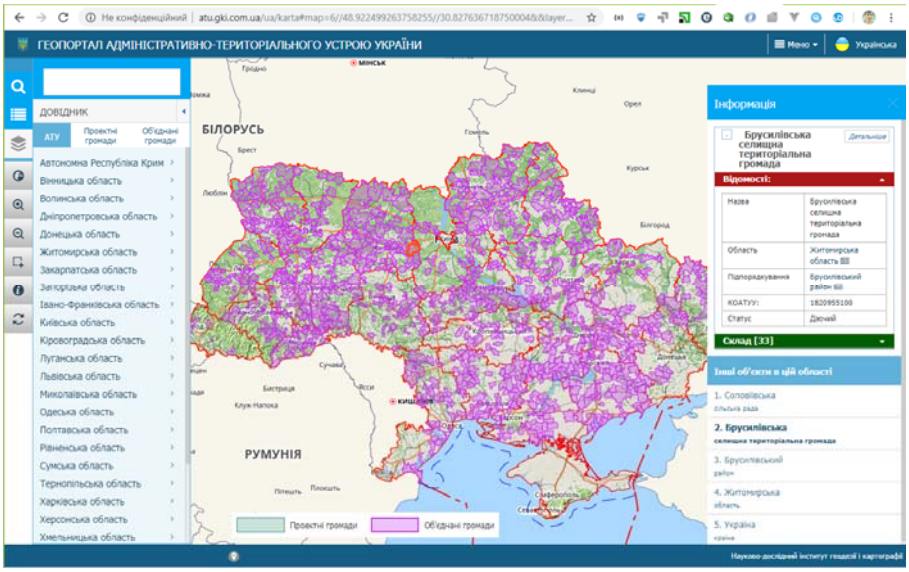
What is the NSDI problems in Ukraine we should solve?

- **Absence of relative data including basic (fundamental)**
- **Absence of effective monitoring system**
- **Interagency competition. Difficulties with data transfer from one agency to another**
- **Duplication of topographic, geodetic and cartographic activities on the same area**
- **Absence of data interoperability. Coordinative and attributive inconsistency and incompatibility of different sources that greatly complicates data integration**
- **Lagging of GI resources level in comparison with the level of development and utilization of informational and communicational technologies in Ukraine.**
- **Geo-informational data inconsistency with international standards in the sphere of geographical information / geomatics of ISO 19100 series**
- **Absence of an effective system of geospatial data quality control**
- **Absence of catalogues and metadata databases for GI resources**

Digital transformation in Ukraine

The drivers of digital transformation in Ukraine

http://atu.minregion.gov.ua

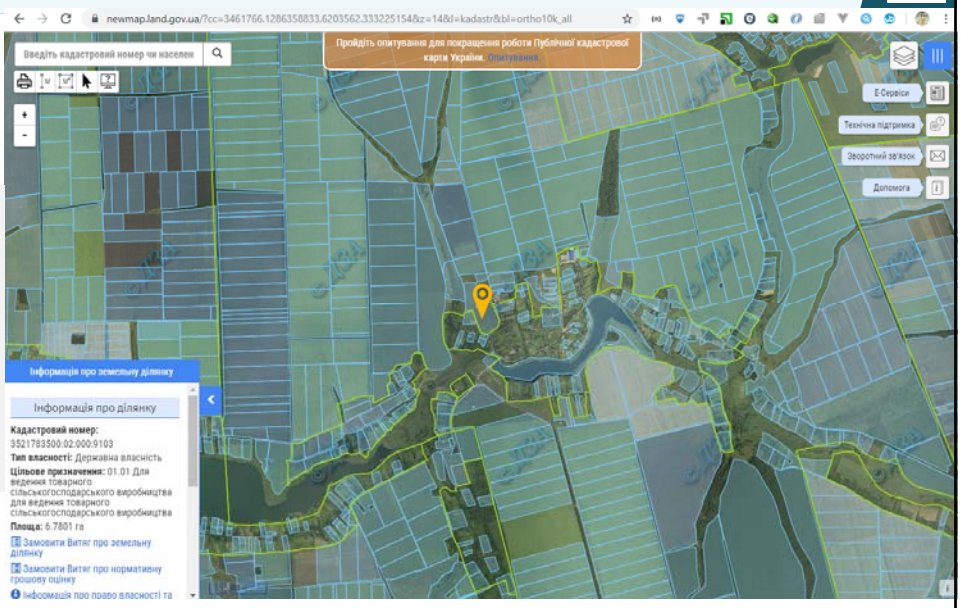


World drivers
- globalization
- mobile technologies
- online services
- open data

Ukraine drivers
-Decentralization
-Land cadastre development
-Urban cadastre development
-NSDI development

Digital transformation in Ukraine

Land Cadastre - https://map.land.gov.ua/



Services

1.Information about the Cadastral Parcel

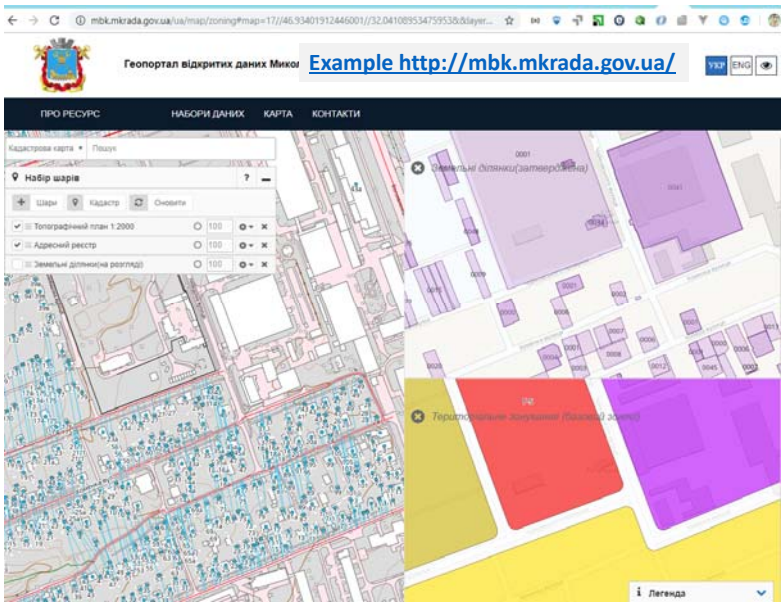
2. Official extract from land cadastre

3. Evaluation land parcel

4. Information about property rights

Digital transformation in Ukraine

City-planning cadastre / Urban GIS



According to law of Ukraine – “On the regulation of urban development”, feb.2011

all cities, regions, communities have to create geodatabase of self territory and provide topographical and city-planning monitoring

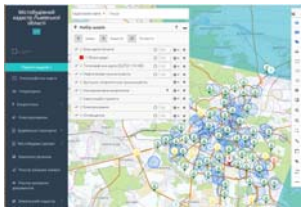
273 classes of object in 19 groups:

- Objects of the country and its administrative and territorial structure
- Objects of the territory
- Objects of transport infrastructure
- Objects of engineering infrastructure
- Objects of engineering preparation and protection of the territory
- Objects of the territories of the nature reserve fund
- Objects of planning restrictions
- Cultural Heritage Sites
- Tourism and recreation facilities
- Objects of functional planning structure and zoning
- Objects of buildings and structures
- Objects of deposits and manifestations of minerals
- Natural Agricultural Zoning and Soils
- Objects of territories of engineering researches
- Address registry objects
- Objects of the state land cadastre
- Objects of land valuation
- Objects of temporary structures and small architectural forms
- Objects of advertising

Digital transformation in Ukraine

Typical architecture of system of urban cadastre

Private part - DMZ



Unified geospatial database of the
GeoDB data holder 1
GeoDB data holder N

Automated publishing of open data

Public Geoportal

Public geospatial database of the territory

- Control of registry keeping
- Access settings
- Publication of data
- GIS analysis, data preparation and processing

Administrator

Regulations

- Service Regulations
- About acceptance of geodetic works
- Etc.

Keeping registers in compliance with the rules using the automated workstations

Data holders

- Districts
- OTG
- Departments and others
- Cities
- Sectoral inventories
- Utilities

Open official data

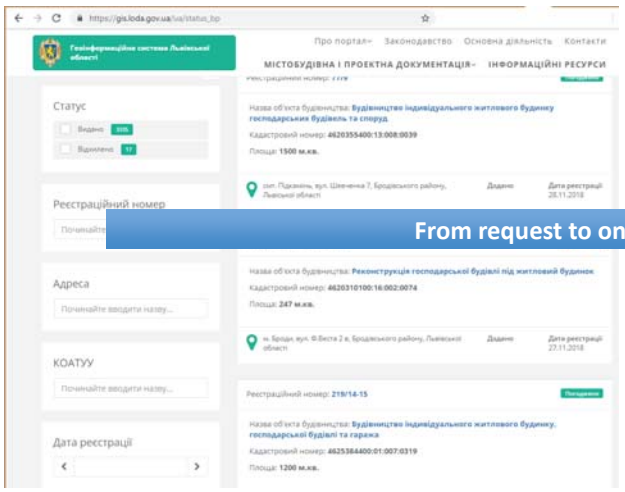
Accounts - providing admin services, appeals, etc.

Integration: API, WCS, WFS, WMS, WMTS

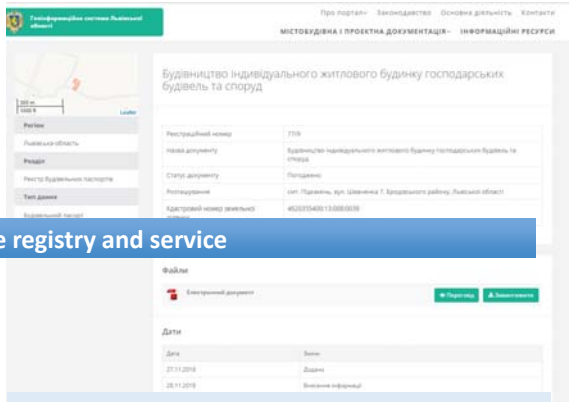
Digital transformation in Ukraine

From request to online registry and service

Registers and map with filters and search



Map with full information about the object



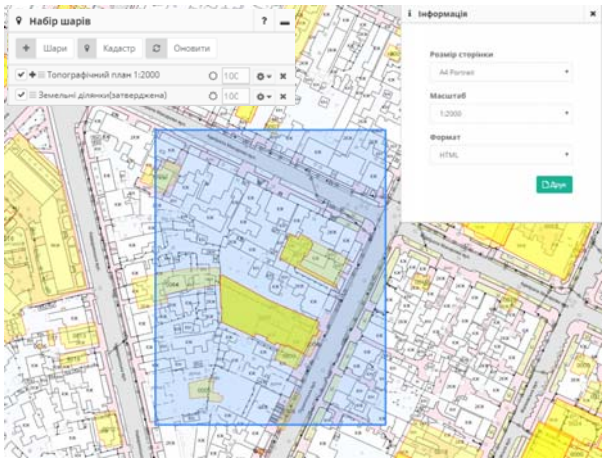
From request to online registry and service

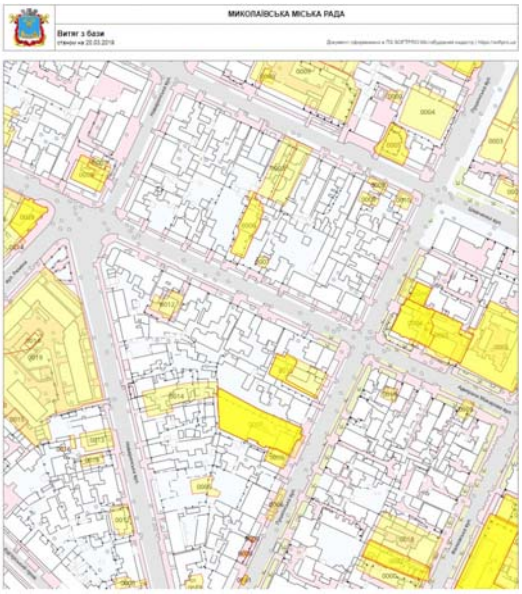
1. Most requests for information are made through Geoportal
2. Other services are actively using reliable data: the Ministry of Emergencies, law enforcement agencies and others.
3. Monitoring of use of state and communal property
4. User feedback and office with online services

Digital transformation in Ukraine

Direct excerpt from an urban cadastre

1. List of layers and bound
2. Output format (GeoTIFF/PDF/Vector) and scale
3. Instantly get an extract from the official GeoDB

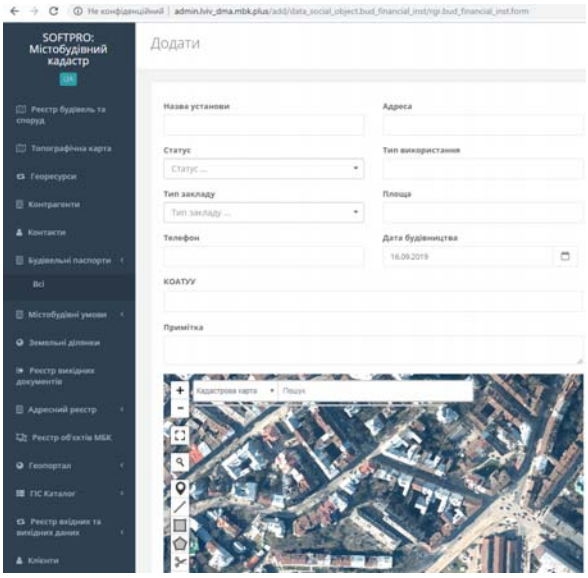




Digital transformation in Ukraine

Automatization of administrative services

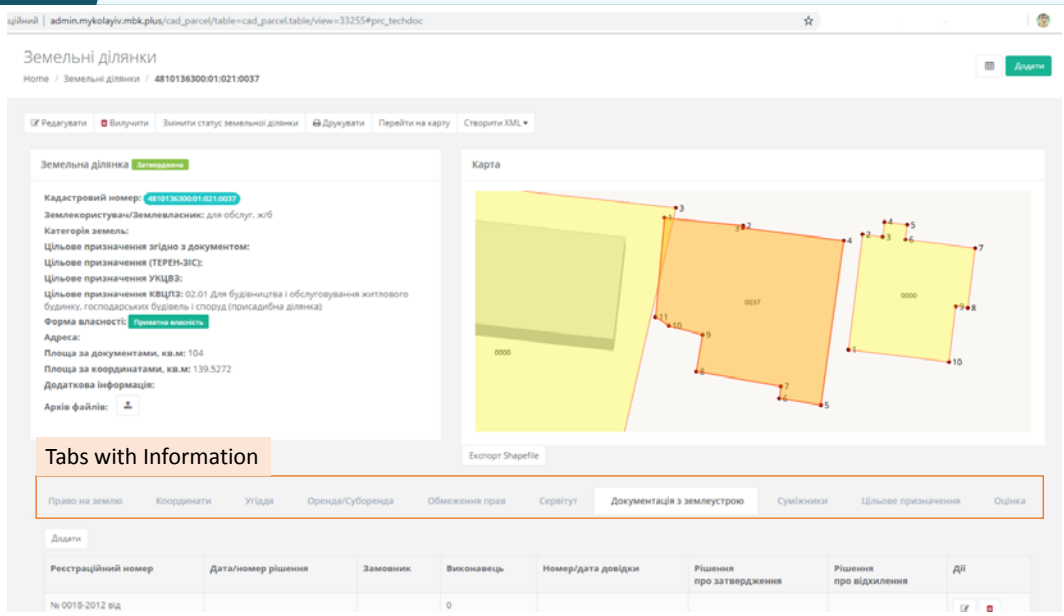
Simple Web Form



Forming one document earlier took days of work -> now automatically

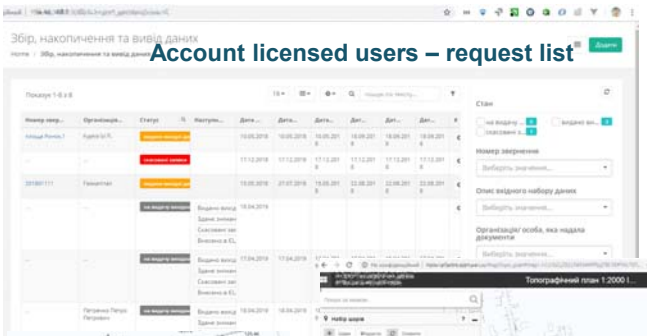
Digital transformation in Ukraine

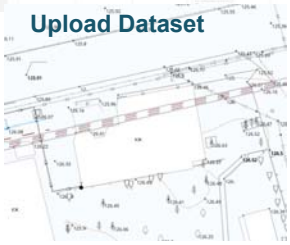
Integrated data – Full information about object



Digital transformation in Ukraine

Service and accounts for licensed GIS engineers





Business process of topographic monitoring by online account

1. Registration licensed user
2. Request on territory of work
3. Download of source core data of the territory
4. Freeze of the territory of work
5. Import and automatic validation of results
6. Acceptance of works
7. Integration and updating single GeoDB

Digital transformation in Ukraine

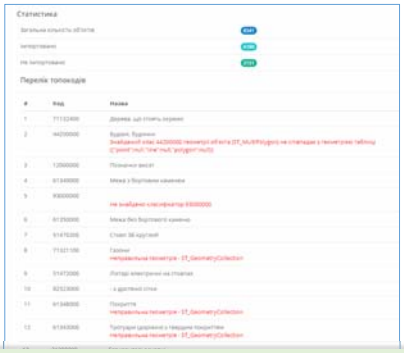
Topographic monitoring. Automatization of data manipulation

1. Upload standardized Data and Metadata

Preparation and upload of geospatial data archive in SHP format of defined structure

2. Validation

Validation, quality check and report of uploaded data according to data specification



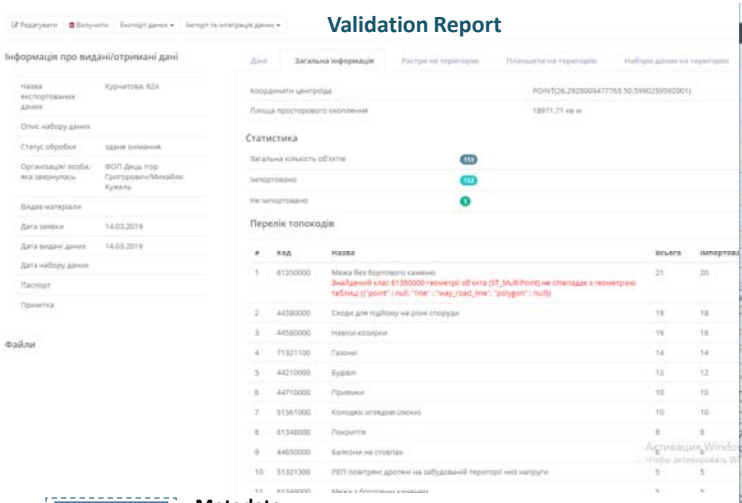
1. uniform source data
2. state coordinate system is USC2000
3. uniform data specifications and standards
4. unified system of geo-identifiers

3. Integration

Data integration into a set of basic topographic bases. Previous data is archived and can be recovered

Digital transformation in Ukraine

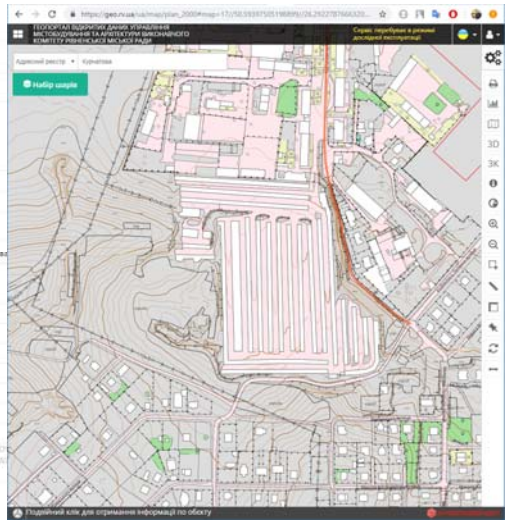
Topographic monitoring. Example



- Name of work
- Date
- Producer
- Bound

Metadata:

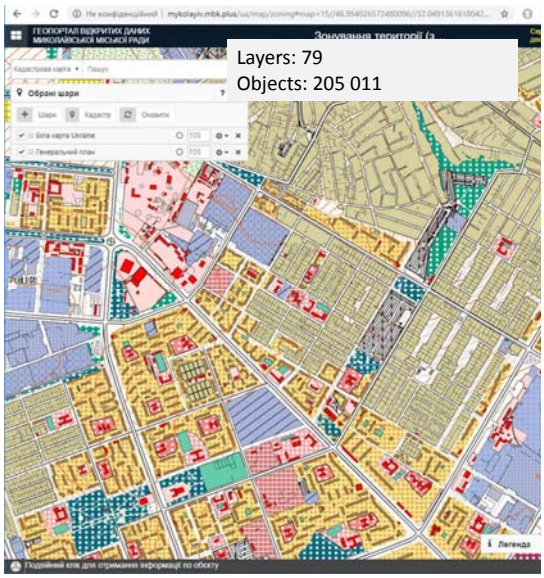
Rivne str. Kurchatov, 62
Area of spatial coverage 18971 sq. M
Date of issue of data 14.03.2019



The result of integration

СУЧАСНІ ВИМОГИ ДО ГЕО ДАНИХ

Validation and import city plan Mykolaiv



Problems by category

Problems

Actions to Solve problems

Статистика

Загальна кількість об'єктів 205 011

Без помилок 158 181

26 193

Помилки доменної узгодженості 21 927

Помилки внутрішньої топологічної узгодженості 0

Помилки не відповідності просторової локалізації об'єктів 4 256

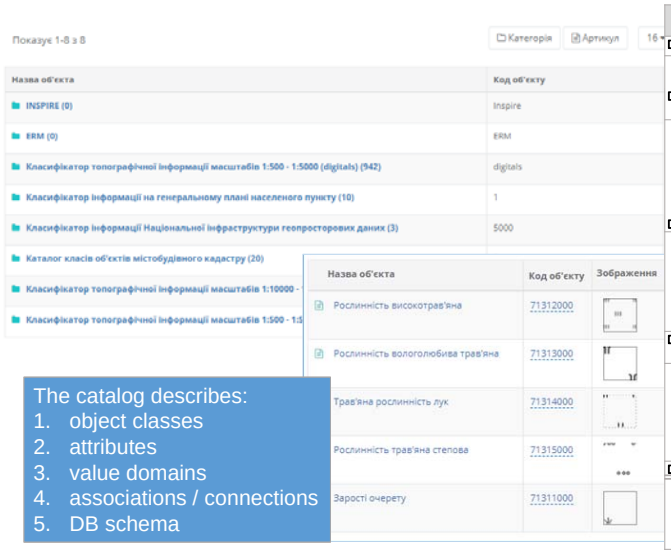
Перелік топокодів

#	Код	Назва	Всього	Без помилок	Кількість помилок	Присутні атрибути	Обов'язкові атрибути	
1	20706	Водосховища	2	2	0	code Explanator LAYER_ID ZAYER_ID		Змінити код
2	3334445	Класифікатор відсутній	40	0	40	code NAME		Змінити код
3	34562	Класифікатор відсутній	12	0	12	code FID		Змінити код
4	54823	Класифікатор відсутній	250	0	250	code LAYER_ID		Змінити код
5	341454	Класифікатор відсутній	6	0	6	code FID		Змінити код
6	176353	Класифікатор відсутній	12	0	12	BUFFERDIS code		Змінити код
7	30705	Вулиці і дороги місцевого значення в населених пунктах	160	160	0	code LENGHT Name OBJECT_ID		Змінити код

СУЧАСНІ ВИМОГИ ДО ГЕО ДАНИХ

Data specification and validation rules

Data specification is part of the system and base for validation rules



The catalog describes:
1. object classes
2. attributes
3. value domains
4. associations / connections
5. DB schema

Validation rules are based on ISO 19157: 2013 Geographic information - Data quality

Groups and types of quality checking	Description
DQ_Completeness	The presence or absence of objects, their attributes and relations
DQ_Commission	Excess data available in the dataset
DQ_Omission	Mandatory data not included in the data set
DQ_LogicalConsistency	The degree of compliance with the logical rules of data structure, attributes, and relationships
DQ_ConceptualConsistency	Compliance with the rules of the conceptual scheme
DQ_DomainConsistency	Matching Domain Values
DQ_FormatConsistenc	The degree of correspondence between the storage of data and t physical structure of the data set
DQ_TopologicalConsistenc	The correctness of explicitly encoded topological characteristics o data set
DQ_PositionalAccuracy	Accuracy of the location of objects
DQ_AbsoluteExternalAccuracy	The proximity of the values of the coordinates to the values specifi the report are taken as correct
DQ_RelativeInternalAccuracy	The proximity of the relative locations of the objects specified in t dataset to the appropriate location accepted as correct
DQ_ GriddedDataPositionAccuracy	The proximity of the location values specified for cell data, the val accepted as correct
DQ_ThematicAccuracy	Accuracy of numerical attributes, correctness of non-numerical attributes, classification of objects and their relations
DQ_ClassificationCorrectness	Comparison of classes of objects and their attributes with a certain subject area (ie, compliance with the basic concepts of the subject or concepts of the reference set of data)
DQ_NonQuantitativeAttributeCorrectne ss	The correctness of non-numeric attributes
DQ_QuantitativeAttributeAccuracy	Accuracy of numerical attributes
DQ_TemporalQuality	Accuracy of time attributes and time relations of objects
DQ_AccuracyOfATimeMeasurement	Correctness of element time links (error reporting in time measurement)
DQ_TemporalConsistency	Correctness of ordered events or sequences if they are reported
DQ_TemporalValidity	Correctness of data over time

Digital transformation in Ukraine

City-planning monitoring

Using of drones by city authorities

1. Detection of illegal construction
2. Identification of inconsistency with urban planning conditions
3. Monitoring construction process

Example of Orthophoto and applications for urban city control

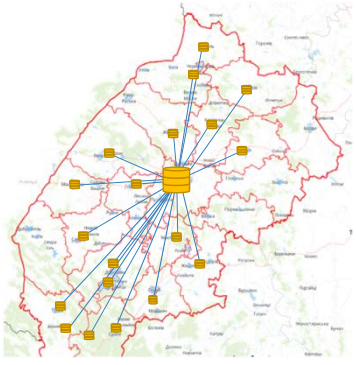
Digital transformation in Ukraine

Interoperability data available at all levels

Interoperability data is created for objects once and is available at all levels: OGC, ISO 190xx, INSPIRE

Local level

Regional level



Global Services

- Google
- OSM

National level

Europe Level

- EuroRegionalMap 1:200 000
- Core Refrence DataSet 1:10 000
- *Geoportal Inspire*
- *European **Land** Information Service*
- *European **Location** Framework*

Integration: API, WCS, WFS, WMS, WMTS

Digital transformation in Ukraine

Project «Creation of NSDI in Ukraine» 2016-2018

NSDI PROTOTYPE STRUCTURE

Fundamental geospatial data

- Coordinate-spatial base of geospatial data
- State border of Ukraine, boundaries of administrative-territorial unit
- Hydrographic objects and hydro-technical utilities
- Settlements and their street-road network
- Industrial, agricultural and socio-cultural object
- Buildings and structures
- Automobile roads
- Railways
- Engineering communications
- Airports, sea and river ports
- Vegetation and soils
- Boundaries of land parcels
- Boundaries of planning elements of settlements and objects of zoning plans
- Registers of streets and addresses of objects on territory of settlements and beyond
- Geographical names
- Digital relief model

Ortophoto plans, orthophoto maps, aerial and satellite images and results of remote sensing of Earth

Profile data sets

- demography
- taxation zones
- condition of street network
- public hearings objects
- election districts

Geoportal & Services

- Search service
- Data sets viewer
- Access service
- Transformation service
- Metadata editor

Reference Information

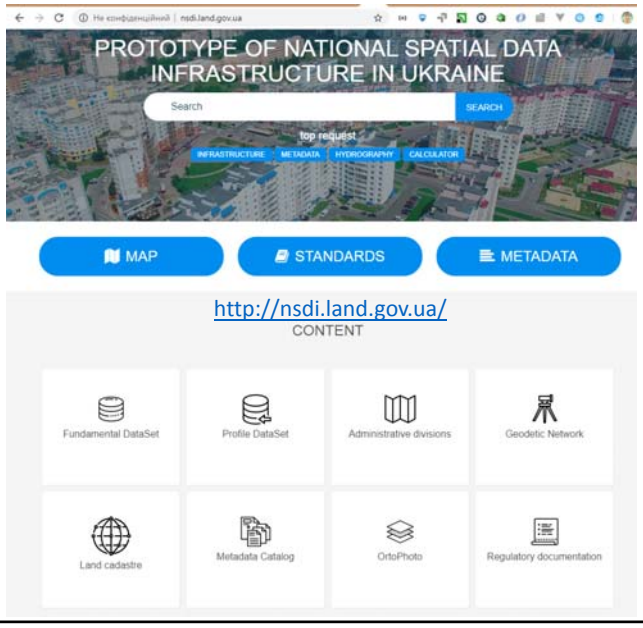
- standards
- normative documents
- INSPIRE Directive
- Projects of EuroGeographics
- User manual

Pilot area

Area of 11 km² was determined for the prototype (3.2 km from North to South X 3.5 km from East to West), that partly covers the territory of Vinnytsia city and

Digital transformation in Ukraine

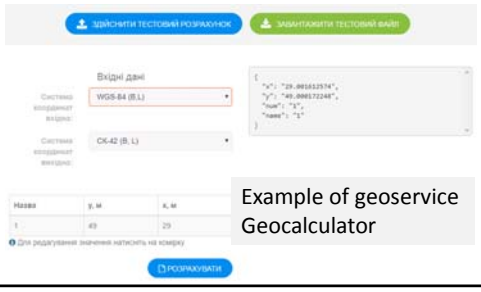
Project results is open - http://nsdi.land.gov.ua/



http://nsdi.land.gov.ua/
CONTENT

Project results

1. Standards and Data Specification
2. Example fundamental and profile data
3. Web maps style and symbol
4. Developed Geoservices
   - Metadata editor
   - Metadata validator
   - Metadata catalog
   - Geo calculator



Example of geoservice Geocalculator

Digital transformation in Ukraine

Integration of basic and profile datasets by geographical identifiers – JOIN operation

1. Integration by coordinates. ISO19111 Spatial referencing by coordinates
2. **Integration by geographic identifiers. ISO19112 Spatial referencing by geographic identifiers**

A	D	G
B	E	H
C	F	I

⇔

G	J	M	P	S	V	1	4	7	10	13	16	19	21	24
H	K	N	Q	T	W	2	5	8	11	14	17	20	22	25
I	L	O	R	U	X	3	6	9	12	15	18	21	23	26

A	D	G	P	S	V	1	4	7	10	13	16	19	21	24
B	E	H	Q	T	W	2	5	8	11	14	17	20	22	25
C	F	I	R	U	X	3	6	9	12	15	18	21	23	26

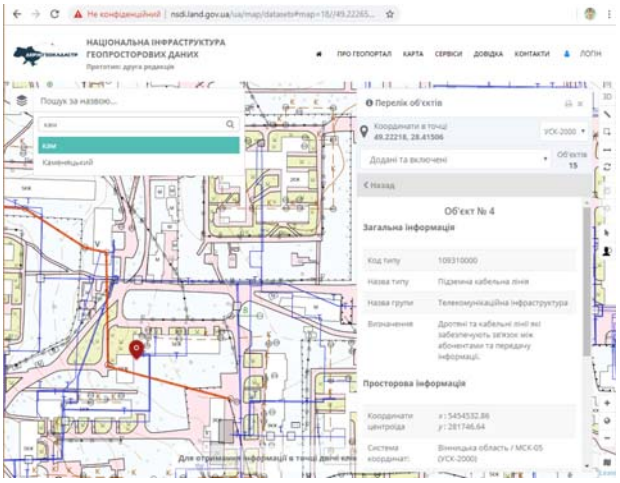
The minimum attribute set for mandatory persistent storage for each object includes: class code, unique class identifier and object name, and mandatory object identifiers (codes) for official nationwide classification (codification) systems. entities in the relevant sectoral registers:

1. **The address is the basic geo-identifier of the urban cadastre**
2. **COATUU for the objects of the administrative and territorial structure of Ukraine;**
3. **Cadastral numbers of land parcel - according to the register of the State Land Cadastre;**
4. codes of high-voltage power grids - according to the registers of the Ministry of Energy and Coal Industry of Ukraine
5. codes of rivers, reservoirs and drains - according to the Water Cadastre Classifier;
6. forests and vegetation - according to the Register of Forest Cadastre;
7. buildings and structures - according to real estate registers, BTI registers and urban cadastre;
8. highways, bridges, crossings, railroads at the registers of the Ministry of Infrastructure and Ukrzaliznytsia and more

Digital transformation in Ukraine

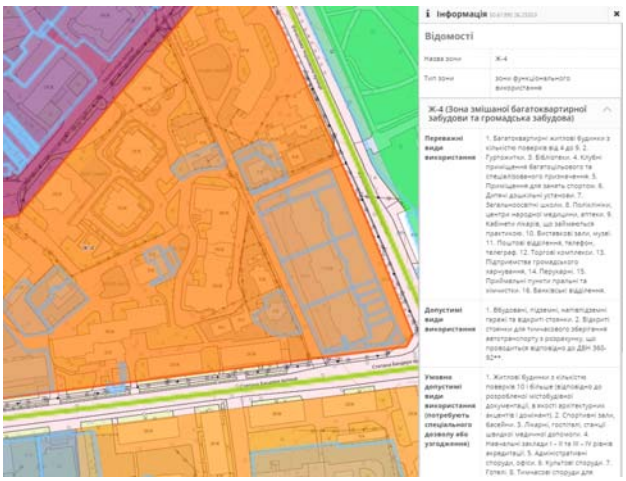
NSDI Prototype. Example of usage of integrated data

ISO19111 Spatial referencing by coordinates



Clicking on the map displays information about communications at this point, building passport, demographics, etc.

ISO19112 Spatial referencing by geographic identifiers

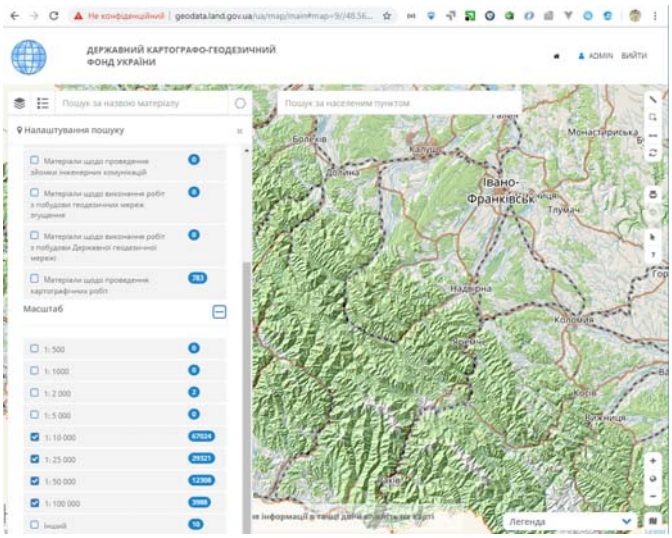


Clicking on the map displays information about the land parcel, preferred / valid / invalid kind of uses of land

Digital transformation in Ukraine

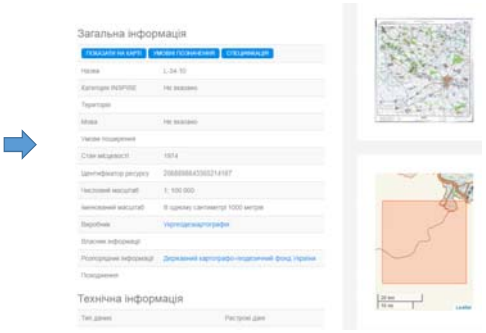
State mapping-geodesic fund of Ukraine

http://geodata.land.gov.ua/login



Users

1. **Data Producer -** validation, upload, access data
2. **Local Authorities –** access to self territory data
3. **All Users –** catalog, search, preview and request to access data



STATEGEOCADASTRE

Thank you!

cherin.andrey@gmail.com
+380977863656

Basic principles

1. The core of the system is the geodata base
2. Coordinated, topological, structurally Data consistency
3. Geodata monitoring system
4. Conformity to ISO and INSPIRE standards
5. Geoservices and rules-based access to geodata
6. Work on all devices
7. Geodata created once and is available at all levels

ANDRII CHERIN
SE Scientific and Research Institute for Geodesy and Cartography, Ukraine

LAND.GOV.UA