

Geodesy, Cartography and Cadastre Authority of the Slovak Republic



ACCURACY AND CONTENT OF CADASTRAL MAPS

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Central Europe
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The Slovak Republic



- Area of Slovakia– **49 000** km²
- Number of actually existing plots (“C”-register)– **7,3** mil.
- “C”-register parcels with ownership documents– **5,7** mil., which represents approx. **78%**
- Remaining **1,6** mil. plots positionally correspond to approx. **8,2** mil. “E”-reg. parcels

Historical boundary accuracy of “E” – register parcels

- Generally, the accuracy is consistent in terms of global accuracy to imperial scale maps.
- In the case of boundary identity of “C” and “E” reg. parcels the accuracy is identical.
- Accuracy of detailed points after transformation into S-JTSK reference system represents values of 0-5 m.
- 1/7 of Slovak territory is formed of paced out sketches without any scale (almost impossible to speak of a particular accuracy).

Historical boundary accuracy of “C”– register parcels

- The importance of accurate boundary registration of real “C”– register parcels is based on constitutional provisions of real estate protection and fair tax collection.


Imperial scale cadastral maps – **33,9%**
particularly in the scale of 1: 2880

Cadastral maps in metric scales – **66,1%**
(Since 1927 - Act no. 177/1927 Coll. on Land
Cadastre and its further management)




Cadastral maps in metric scales

- Mapping according to the so-called “A”-manual (inter-war period) - 12.1%
- Technical-economic mapping without calculating of detailed point coordinates (THM to 1971) - 14.6%
- Technical-economic mapping with calculating of detailed point coordinates (THM between 1971 and 1986) – 16,4%
- After 1986, the remaining 23% of the territory was mapped (ZMVM)

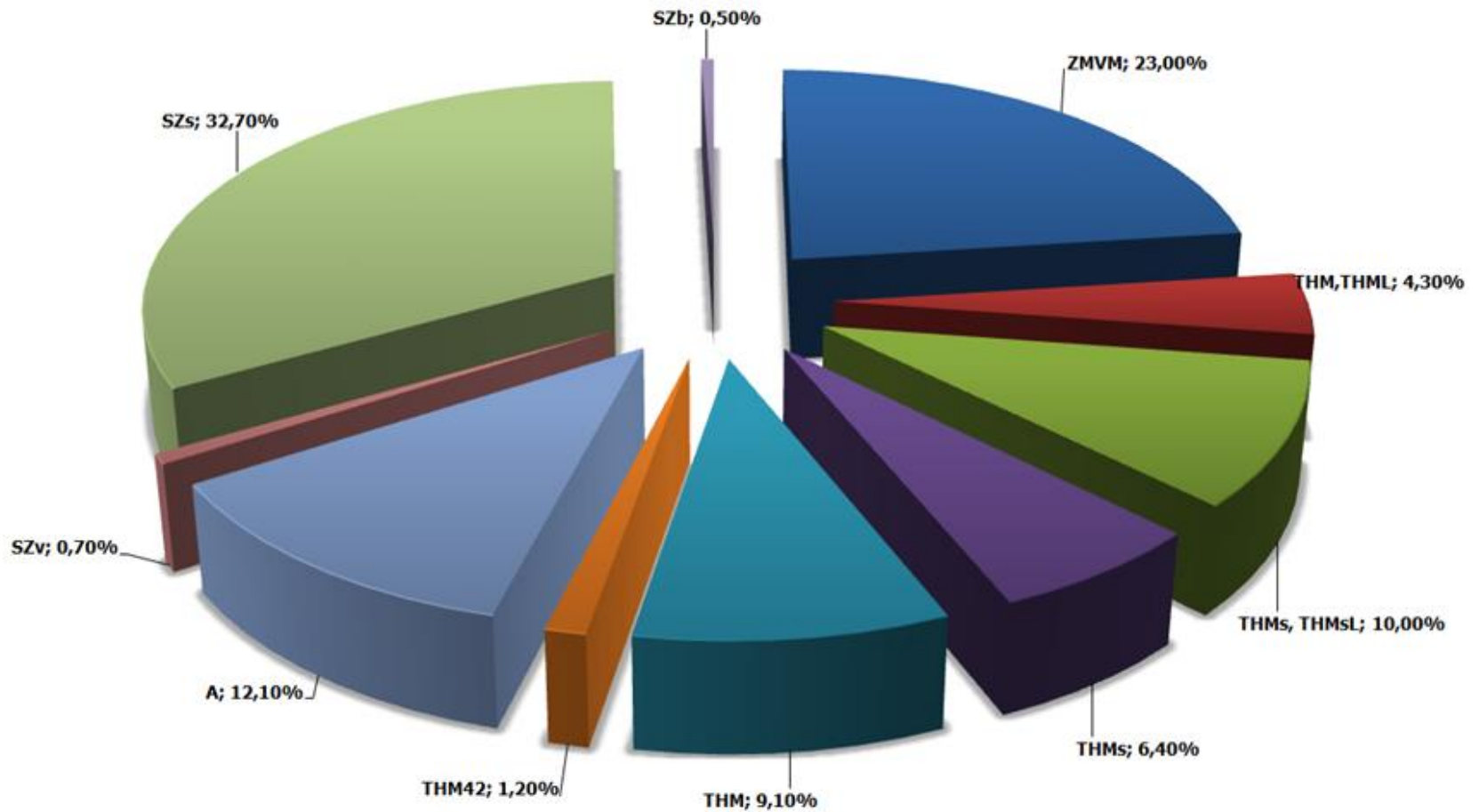


Documentation of coordinates in 3 respectively in 4 accuracy class (photogrammetric method for 4)
Basic mean coordinate error 0.14 m, resp. 0.26 m to the nearest points of geodetic control.



Present day:
Detailed points determined in coordinates, application of positional criteria in points determined terrestrially $1.7 U_{xy}$ in relation to point position determined by the GNSS.

Types of cadastral maps



Present day - application of Decree no. 87/2013 Coll.

Amendment to Decree no. 87/2013 Coll., of Geodesy, Cartography and Cadastre Authority of the Slovak Republic from 8 April 2013 amending and supplementing the Decree of Geodesy, Cartography and Cadastre Authority of the Slovak Republic no. 461/2009 Coll.

- New division of vector maps :

VKMč (numerical), VKMi (implemented) VKMt (transformed)

- New categorization of accuracy
- Registration of the quality of every detail point (before 1.5.2013 only registration of the quality of the whole VKM set)
- Work carried out in a single coordinate system (S-JTSK)
- Definition of a complex technology for measuring and updating of all kinds of VKM without local transformation
- Implementation of accurate measurements into maps of any quality
- Allowing the incorporation of precise measurements carried out in ETRS89 and their documenting in the S-JTSK reference system

Departmental Transformation Service

Measurement:



Set up by the decision of the president of ÚGKK SR:

- Departmental Transformation Service since 30.1.2013
- Conversion interpolation table

Transformation is provided

Directly in GNSS receiver



On the Authority's web site



Transformačná služba ETRS89 - S-JTSK

Úradu geodézie, kartografie a katastra Slovenskej republiky

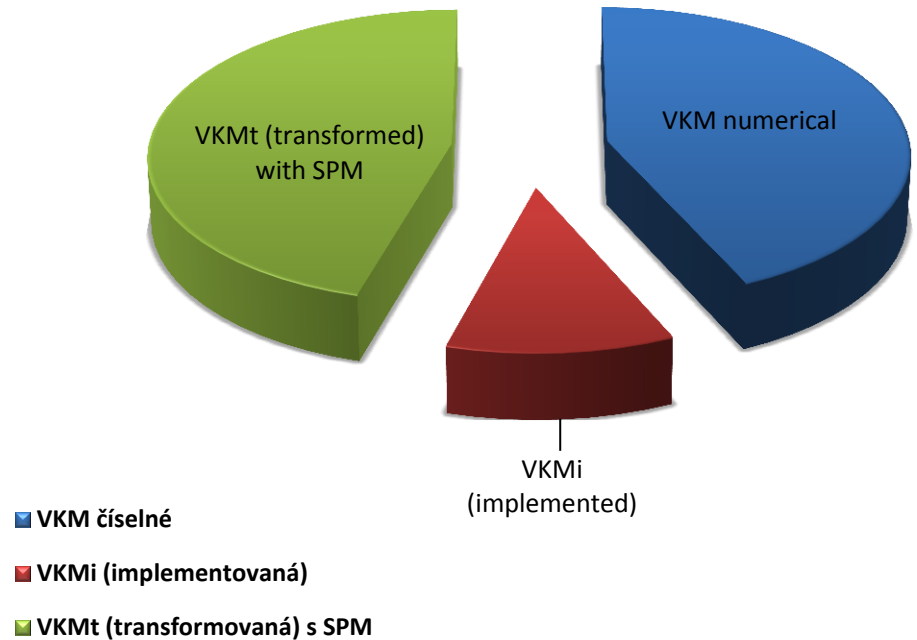
PC application



Categorization of vector cadastral maps

- All cadastral maps were prepared and taken over by the cadastre on 15.1.2015
- Slovak territory is completely covered by the VKM
- Total number of maps - 4156

| Vector maps | Total |
|-----------------------------|-------|
| Total number of vector maps | 4156 |
| VKM numerical | 1816 |
| VKMi (implemented) | 477 |
| VKMt (transformed) | 1863 |



Quality of a detailed point

(Annex no. 12 of Decree no. 461/2009 Coll.)

| Quality code | Detailed point quality |
|--------------|---|
| 1 | Numerically determined point in the S JTSK according to § 55 section 4 (mxy = 0.08m) |
| 2 | Numerically determined point in the S JTSK with no real denotation on the ground; this code cannot be used in the case in which the point denotation in the field is necessary or where the detailed point has been already denoted on the ground (mxy = 0,08m) |
| 3 | Numerically determined point in the S JTSK using terrestrial geodetic methods without being connected to active geodetic control (mxy = 0,14 m) |
| 4 | Numerically determined point in the S JTSK using terrestrial geodetic methods without being connected to active geodetic control (mxy = 0,26 m) |
| 5 | Non-numerically determined point; coordinates of the point were determined cartometrically (mxy without distinction of accuracy) |

Application of Decree no. 87/2013 Coll.

- Application of Decree no. 87/2013 Coll. has enabled incorporation of newer correct measurements without local mathematically unidentifiable transformation even to non-numerical vector maps.

Satisfactory accuracy - detailed points defined by basic mean coordinate error $m_{xy} = 0.14$ m and better. This corresponds to the maximum positional deviation 0.24 m (when comparing coordinates of the original terrestrial measurements and the coordinates determined by the GNSS).



From 1.5.2013 by applying the Decree the number of parcels with boundaries determined with satisfactory accuracy in the VKM increased from **3.5** million to **4.3** million. This represents an increase from **48%** to **60%** of the parcels registered with satisfactory accuracy.

- After completion of all previous measurements documented in coordinates with satisfactory accuracy it is expected to increase to about **70%**

Number of parcels according to vector maps

| State to 28.2.2015 | Total: |
|---|------------------|
| Number of parcels in VKMč | 3 505 164 |
| Number of numerically determined parcels in VKMi | 470 387 |
| Number of numerically determined parcels in SPM | 354 167 |
| Aggregated number of numerically determined parcels (satisfactory accuracy) | 4 329 718 |
| Aggregated number of non-numerically determined parcels | 2 975 232 |
| Aggregated number of C-register parcels | 7 304 950 |

Number of detailed points

| State to 28.2.2015 | Total: |
|--|-------------------|
| Number of points in VKMč | 24 118 327 |
| Number of numerically determined points in VKMi | 3 754 252 |
| Number of numerically determined points in SPM | 2 536 877 |
| Aggregated number of numerically determined points (satisfactory accuracy) | 30 409 456 |
| Aggregated number of non-numerically determined points | 22 135 058 |
| Aggregated number of points in SGI KN | 52 544 514 |

Survey sketch (GP)

- Survey sketch is a part of a cadastral geodetic data file (SGI)
- It forms a technical basis of legal acts, public documents and other documents
- It is drawn up on the basis of surveying results
- It is used to record changes into the cadastral map

- Number of officially verified GP per year: approx. **60,000**
- Most of GP registered into cadastre within **12** to **36** months
- Average number of parcels concerning one GP : **3,3**



- Annually the SGI base increases by about **200 000** parcels, which represents about **100** cadastral districts (average cadastral district contains about **2000** parcels)
- Accuracy of surveying works when creating a GP is the same as the one used for new mapping

New mapping in built-up areas - accuracy

- Accuracy of surveying works and final coordinates of detailed points is set by the accuracy characteristics and accuracy criteria
- Accuracy characteristic of the x, y coordinates of detailed point determination is the basic mean coordinate error m_{xy}

$$m_{xy} = \sqrt{[0,5(m_x^2 + m_y^2)]}$$

- Relative accuracy characteristic of determining a pair of point coordinates is the basic mean error m_d of the length d which is a direct connecting line of these points calculated from the coordinates. Coordinates of detailed points are determined in a way, so that
 - a) the characteristic m_{xy} does not exceed the criterion $u_d = 0,08 \text{ m}$,
 - b) the characteristic m_d does not exceed the criterion u_d calculated for each length d from the formula:

$$u_d = 0,12(d + 12)/(d + 20)12$$

New mapping in non-built-up areas

- Due to a fragmentation of ownership shares and plots new mapping in non-built-up areas without a simultaneous implementation of land consolidation makes no sense.
- Act no. **330/1991 Coll.** of 12 July 1991 on land consolidation, land ownership arrangement, land offices, land resources and land communities
- Content of land consolidation is a **rational spatial land ownership arrangement** in certain territory and other immovable agricultural and forestry property associated with it, performed in the public interest, in accordance with the terms and conditions of environmental protection and creation of territorial system of ecological stability, functions of agricultural land and operationally-economic aspects of modern agriculture and forest management and rural development support.
- Map content and mapping accuracy are the same as in new mapping in built-up areas.

Future of cadastral maps

- The objective is that detailed points of all boundaries and all buildings were determined with a fixed homogeneous accuracy
- Plot registration only in the “C”-register of the cadastre
- Entering of ownership rights to all plots and buildings
- “E”-register moved to the archive
- For assurance of the overall satisfactory accuracy is required:



- 1) **VKMt and SPM merge into VKMi**
- 2) **VKMi according to capacity possibilities will be gradually mapped to VKMč (in some cases the VKMč will be “mapped” directly from the SPM)**

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THANK YOU FOR ATTENTION
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