

# **Cadastral Survey – an important link in establishing sustainable land management**

**Jelena UNGER and Dominik DUJNIĆ, Croatia**

**Key words:** cadastral survey, real estate cadastre, land register

## **SUMMARY**

The development of the modern Croatian state cannot be imagined without large investments in land administration. Using modern technologies, it should provide transparent, reliable and accurate data on cadastral plots and their owners. Even a foreign observer with the best of intentions would be surprised at the state of cadastral and land registry data in Croatia today, even after decades of investment in improving these data. In Croatia, we have dual land management – the cadastre that records technical data about land plots (area, shape, position, lot coverage and use) and the land registry that keeps data on owners and other holders of rights. This paper focuses on the development of the cadastre and consequently on land registers in Croatia through the implementation of cadastral surveys in the area of the Koprivnica–Križevci County. After the independence of the Republic of Croatia in 1991, we were faced with the great challenge of renovating and improving the cadastre and land registry. The cadastral offices had cadastral plans that were sometimes to such an extent physically damaged due to their daily use in working with the public that they became almost unusable. In such situations, the only solution was to perform a new cadastral survey, but it was initially quite difficult to arrange with other (besides the cadastre) important stakeholders at the local level, namely contractors, local government, courts and citizens. Depending on the changes in the society, the adoption of special regulations and technological development, we can recognise several phases of cadastral surveys in the past more than two decades. In all of these phases, the purpose of the cadastral survey remains the same – collection and processing of all data necessary for establishment of new cadastral records for the real estate cadaster. The difference lies in defining activities and tasks, areas of implementation, deadlines, holders and participants, as well as ways and sources of funding. This paper describes the specifics of each of the mentioned phases on the examples of cadastral surveys carried out in the area of Koprivnica–Križevci County.

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## **1. INTRODUCTION**

Cadastral data represent a critical foundational pillar for the modern economy, real estate sector, and land administration system within the Republic of Croatia, directly serving as the primary basis for the land register. For the system to function efficiently, these data must be complete, accurate, reliable, and easily accessible. Achieving this would directly contribute to legal certainty, transparency, and, consequently, sustainable land management.

Croatia's historical legacy, unlike that of some more developed countries, has resulted in significant challenges, primarily because the majority of cadastral plans date back to the 19<sup>th</sup> century. For instance, even today in Koprivnica–Križevci County, 68% of the plans in use are approximately 200 years old. Until 2009, these records were maintained in analogue form and used daily for client services. Such intensive, long-term use led to the exceptionally poor physical condition of the cadastral plans. Furthermore, the data on cadastral parcels shown on the plans often differed from the data recorded in the textual part of the cadastral records and the land register, nor did the data accurately reflect the actual state on the ground. The need to resolve this inherited status quickly led to the realization that the only optimal and permanent solution was the systematic and accelerated implementation of cadastral surveys (a comprehensive process of collecting, processing, and harmonizing all technical and legal data on real estate) for the purpose of establishing a new cadastre and renewing the land register.

Over the past two and the half decades, several phases of cadastral survey implementation can be recognized, spanning from the adoption of the first State Survey and Real Estate Cadastre Act in 1999 (following Croatia's independence) to the adoption of the Multi-year Program of Cadastral Surveys in Construction Areas for the period 2021–2030. This paper analyzes the specifics and results of these phases using a case study focused on Koprivnica–Križevci County.

## **2. ADOPTION OF THE STATE SURVEY AND REAL ESTATE CADASTRE ACT IN 1999**

Following the adoption of the Constitution of the Republic of Croatia in 1990 (Official Gazette 56/90), the country entered a period of political changes and territorial reorganization of local self-government, which inevitably led to the restructuring of land administration. Due to the war, internal migration, and economic trends, real estate transactions increased significantly, resulting in a surge of reported changes to both the cadastre and the land register. The Government of the Republic of Croatia recognized these records as having great potential for state development and expected them to be complete, accurate, and reliable. Until then,

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cadastral surveys for the purpose of recording changes were exclusively carried out by state bodies. However, due to the numerous changes in cadastral and land register data that required official recording, the Act on Independent Performance of Economic Activities by Personal Work (Official Gazette 19/90) was adopted, subsequently expanding this activity to the private sector.

As a measure to improve cadastral and land register records, the Republican Geodetic Administration adopted the Program of Geodetic Works under the Authority of the Republic of Croatia for the period 1991–1995. This Program envisioned implementing cadastral surveys in areas that had not yet undergone a numerical cadastral survey, ensuring that all measured data would be precisely defined by coordinates. Cadastral Offices, then within the municipalities (and later within the counties), were requested to submit proposals for areas under their jurisdiction to be included in the Program.

Certain areas of Koprivnica–Križevci County desperately needed new cadastral surveys, primarily because their historical cadastral plans, some dating to the Austro–Hungarian Monarchy, were severely damaged. Nevertheless, even after diligent attempts to engage the local community, not a single survey was contracted under this Program.

The main cause of this failure lay in the inherited legal and organizational framework. From Croatia's independence in 1991 until 1999, the prevailing legislation was the Geodetic Survey and Land Cadastre Act (NN 16/1974), which had been enacted in the Socialist Federal Republic of Yugoslavia. This outdated framework failed to provide adequate mechanisms for financing and implementing such complex and expensive cadastral projects. Furthermore, cadastral offices operated under the counties and were consequently limited by severely restricted capacities. Consequently, fundamental changes in the organization and valuation of the Croatian Cadastre and its data only occurred with the adoption of the new State Survey and Real Estate Cadastre Act (Official Gazette 128/99) in 1999. Based on this Act, the Cadastres transferred from the jurisdiction of counties to the State Geodetic Administration and were reorganized as Regional Cadastral Offices. The implementation of projects that contribute to the development and improvement of cadastral data continued under programs adopted by the State Geodetic Administration, with cadastral surveys remaining one of the most important initiatives.

This time, immediately following the program's adoption, all relevant stakeholders in the local community were successfully mobilized, leading to the launch of the first cadastral survey in Koprivnica–Križevci County after Croatia's independence in 2000. This project covered the area of Cadastral Municipality (C.M.) Legrad. C.M. Legrad is located at the confluence of the Mura and Drava rivers, bordering Hungary. Due to historical circumstances involving intense Magyarization (cultural and linguistic assimilation policies) during the Austro–Hungarian Monarchy, the vast majority of documents in the cadastre and land register for this area were in the Hungarian language (Figure 1).

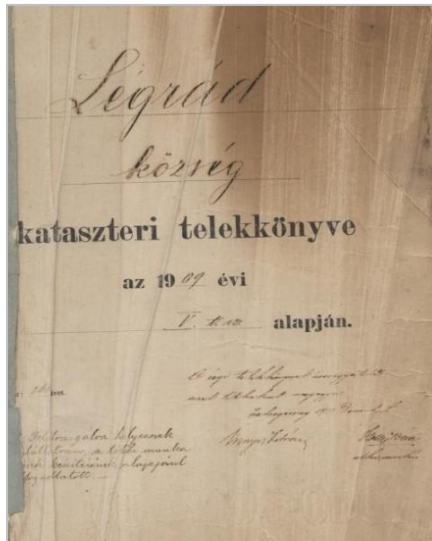


Figure 1 – Old cadastral records of the C.M. Legrad



Figure 2 – Damaged cadastral plans of the C.M. Legrad

Furthermore, there were three types of cadastral parcel numbers in existence in C.M. Legrad, which differed across the cadastral plan, the textual part of the Cadastral Records, and the Land Register. A separate list linked the numbers on the cadastral plan to those in the Cadastral Records, while special sketches were required to find the connection to the third set of numbers recorded in the Land Register. The fact that cadastral plans were, in some places, completely destroyed (see Figure 2) unequivocally indicated that this chaotic situation could only be reconciled through the implementation of a new cadastral survey.

The State Survey and Real Estate Cadastre Act (Official Gazette 128/99) of 1999 clearly defined what a cadastral survey is, how it is performed, and who is responsible for its execution. For instance, Article 21 of the Act stipulated that the cadastral survey collects and processes data concerning:

1. The position, shape, area, use, and rights holders of land parcels;
2. The position, shape, use, and rights holders of buildings and other structures;
3. The position within a building, area, and rights holders of parts of buildings (apartments, business, and other premises) and other structures; and
4. Areas subject to special legal relationships on the land.

The same Act established that the cadastral survey is carried out by the State Geodetic Administration in agreement with the Ministry of Justice (then Ministry of Law), while certain tasks within the survey are performed by legal and natural persons authorized for geodetic

activities, selected via public tenders. This definition of cadastral survey implementation has been retained, with certain amendments, in the regulations currently in force.

Since the co-financing ratios for the cadastral survey were not yet formally defined, intensive negotiations were necessary with major users of cadastral and land register data to ensure their participation in the project. The primary goal of these negotiations was to inform them about the extremely poor state of the existing records and emphasize that the survey would provide a rectified status reflecting the actual situation on the ground. The benefits extended to all data segments – the area, shape, structures, and use of cadastral parcels, as well as ownership data – thereby enabling stakeholders to recognize their self-interest in co-financing the survey.

In the area of C.M. Legrad, the following entities provided financial support alongside the State Geodetic Administration (37.5%): the Municipality of Legrad (20.5%), Koprivnica–Križevci County (21%), Croatian national water management authority (17%), and Croatian electric power company (4%).

Although this phase was characterized by a lack of regulations specifically governing the implementation of cadastral surveys, it was successfully completed. An authorized geodetic company, selected via public tender, performed the field measurements and prepared the Cadastral Survey Case (the final set of technical reports and documentation of the survey). Subsequently, commissions composed of representatives from the cadastre and the land register conducted the public display of the collected survey data. This procedure resulted in the entry into force of the new cadastral records and the renewed land register for the surveyed municipality.

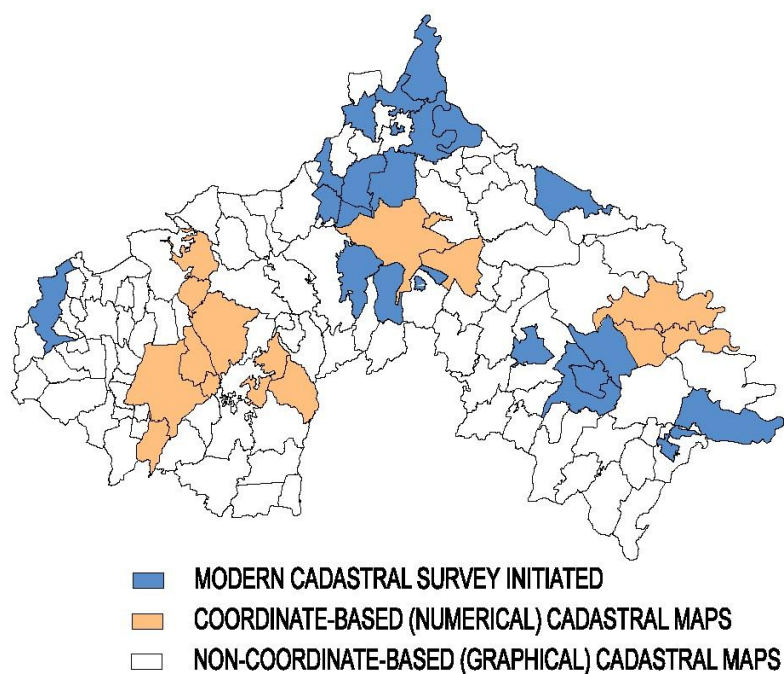
Despite being a pioneering, arduous, time-consuming, and expensive procedure, the achieved results confirmed that the work was entirely necessary and cost-effective. The success of C.M. Legrad and other early surveys served as a powerful argument for the institutionalization of a systematic approach, leading to the launch of the Cadastre and Land Register Management Project in 2003.

### **3. LAUNCH OF CADASTRE AND LAND REGISTER MANAGEMENT PROJECT IN 2003**

The Cadastre and Land Register Management Project, launched by the Government of the Republic of Croatia in 2003, injected a new momentum into the implementation of cadastral surveys. The Project formally defined participants, established clear financing ratios (with local communities securing the larger portion of funds, approximately 60%), and instituted a transparent division of responsibilities. Nevertheless, awareness regarding the necessity of conducting these surveys matured slowly within local communities, despite the constant daily issues arising from the use of severely inadequate cadastral and land register data. Consequently, efforts to inform and engage the local community had to remain proactive and rigorous. Despite this resistance, the number of cadastral surveys implemented during this period significantly increased.

Surveys covering the Cadastral Municipalities (C.M.) of Podravske Sesvete, Reka, Gola, Kunovec Breg, Koprivnički Ivanec, Đurđevac I, II, and III, Kunovec, Đelekovec, Kutnjak, Gorica Nova, Subotica Podravska Nova, and Gornja Rijeka were financed according to the standard Project model (with the local community providing around 60% of the funds). Conversely, C.M. Jagnjedovec–grad and C.M. Bakovčica were financed through a World Bank loan. Within the framework of the Project, the Republic of Croatia funded 18 cadastral surveys nationwide using this World Bank loan, including these two in Koprivnica–Križevci County.

An overview map of Koprivnica–Križevci County (Figure 3) shows the Cadastral Municipalities where cadastral surveys have been implemented from 2000 to the present. These surveys are exceptionally valuable as they were conducted in areas where the existing cadastral and land register data were nearly unusable.



*Figure 3*

The cadastral surveys followed the same workflow as in the earliest phase:

1. Obtaining prior consent from the Ministry of Justice to initiate the survey.
2. Publication of a public tender and selection of the contractor.
3. Publication of the Decision on Cadastral Survey implementation in the Official Gazette.
4. Opening of works, marked by informational signs in the surveyed area.
5. Holding informational forums with the population to introduce the procedure.
6. Holding meetings with representatives of public enterprises, the State Attorney's Office, and other institutions to introduce the procedure.

7. Marking cadastral parcels on the ground, measuring, collecting data on presumptive owners, and preparing the Cadastral survey case.
8. Publication of the start of the public display in public media.
9. Conducting the public display of cadastral data with the simultaneous renewal of the Land Register (recording new owners).
10. Processing objections to the displayed data.
11. Control and final works—completion of the procedure.
12. Entry into force of the new Land Register and Cadastral Records.

During this period, the greatest problem in project implementation was cooperation with the Land Registry Departments, which are under the jurisdiction of municipal courts. In some surveys across Croatia, the procedure for the public display of data collected by the cadastral survey was significantly delayed, sometimes by more than five years after the submission of the completed cadastral survey case. As of today, field surveys for 536 Cadastral Municipalities have been completed and their survey case confirmed in the Republic of Croatia, yet public display procedures have not even been initiated for 101 of them.

This delay in the public display process is primarily caused by inertia or a lack of personnel within the judiciary, which prevented the formation of judicial commissions by Land Registry Departments. These commissions are tasked with determining actual ownership during the public display for entry into the new land register. The cadastral commissions, responsible for presenting technical data on parcels (position, area, shape, structures, and use), cannot begin their work without the courts because regulations mandate that both inspections must be conducted simultaneously. Regulations also require that the new cadastral records and the renewed land register enter into force at the same time.

The failure to promptly implement the new land registers and cadastral records in areas where field surveys are complete is a key problem, as it effectively devalues all efforts and invested funds. Koprivnica–Križevci County, however, proved to be an exception to this national challenge; cadastral and judicial commissions were promptly established after the completion of each cadastral survey, and public display procedures commenced without delay.

#### **4. ADOPTION OF THE NEW STATE SURVEY AND REAL ESTATE CADASTRE ACT IN 2018**

The fundamental definition of cadastral surveys remained largely consistent in the new State Survey and Real Estate Cadastre Act of 2018 (Official Gazette 112/2018) compared to the 1999 Act (which was the initial legislation that launched systematic surveying after the independence of the Republic of Croatia). Despite this definitional consistency, the 2018 Act's adoption nevertheless ushered in a new phase in the implementation of these surveys. The key innovation introduced by this Law was the presentation procedure for collected survey data, conducted by the contractor prior to the formal public display procedure performed by the cadastral and land register commission.

During the presentation, the contractor shows the parties the data recorded in the parcel record sheet and the cadastral plan. The parcel record sheet is the central record, documenting all technical details for the parcels measured in the field, including coordinates, and identifying the presumed owners (derived from existing records and/or statements taken on the ground). The presumed owner must confirm that the data has been presented to them and sign a statement confirming their consent to the details provided. Should the owner disagree with the presented data, the contractor is obliged to carry out an on-site inspection and, if necessary, re-present the updated cadastral survey case. If the presumed owner still disagrees with the updated data and refuses to sign the statement, they will then be summoned to the public display.

The implementation of this procedure significantly reduced the scope of public display performed by the cadastral commission, and to some extent, the workload of the land register commission in determining the actual owner. This reduction stems from the fact that in cases where the owner agrees with the technical data, such as the position, shape, area, lot coverage and use of the cadastral parcel, contained in the cadastral survey case (which is the majority of cases), the cadastral commission is relieved of the display requirement for those parcels; instead, only a notice is sent to the owners stating that this status will be adopted into the new cadastral records.

Similarly, the contractor compares the data on presumed owners collected during the cadastral survey with the ownership data recorded in the land register being renewed. If this data is identical (i.e., there is uncontested ownership), the display by the land register commission is not performed; instead, a notice is sent to the owner that the Land Register will be renewed based on that data.

This process did streamline the land register commission's work, but not substantially. This is because in most new cadastral survey cases, the data on the presumed owner collected by the contractor differs significantly from the ownership data recorded in the land register being renewed. For this reason, the land register commission still had to conduct numerous procedures to determine the actual owner during the land register renewal. To further reduce the land register commission's workload, the Amendments to the State Survey and Real Estate Cadastre Act adopted in 2024 (Official Gazette 152/2024) redefined the parcel record sheet and the presentation procedure. With the 2024 amendments, the presentation procedure was expanded to include ownership data. In this regard, parties are now presented with the technical status of the parcels alongside a comparison of the owner status from the old land register and the presumed owner data collected during the new survey.

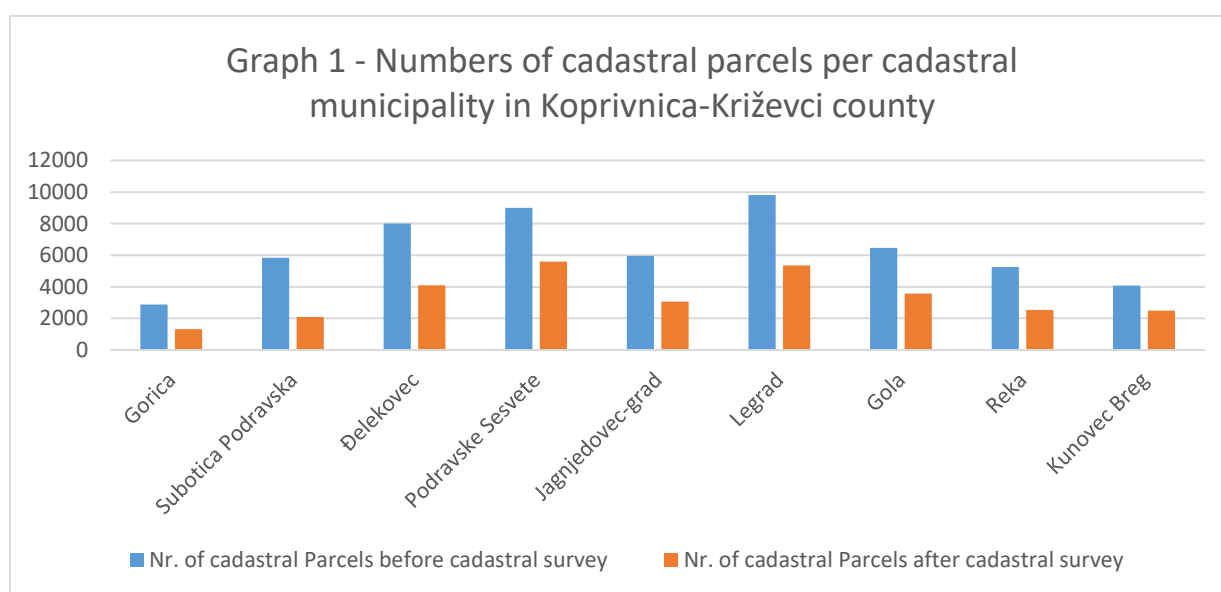
The presentation now involves a party hearing where data on the proposed owners for the renewed land register is recorded in the parcel record sheet, supported by various pieces of evidence and party statements. Since these hearings focus on determining actual ownership, contractors are now required to engage lawyers/attorneys to participate in the procedure. These legal professionals prepare proposals for registration of the new owner in the land register based on their analysis of the statements and available documentation. The land register commission subsequently verifies these proposals, accepting them or conducting an additional hearing only when necessary. Past experience shows that this legal involvement has significantly accelerated the land register commission's work, as an additional hearing is rarely required.



The overall efficiency of the new model is unequivocally demonstrated by the drastic acceleration of the public display procedure and the consequent reduction in the time required to bring the cadastral records into official use. Nationally, the average productivity of the old survey model was 2.18 parcels per day (based on the ratio of parcels in cadastral municipality to days from display commencement to official use). In contrast, the average for the two municipalities operating under the new model shows a significantly improved productivity of 11.37 cadastral parcels per day.

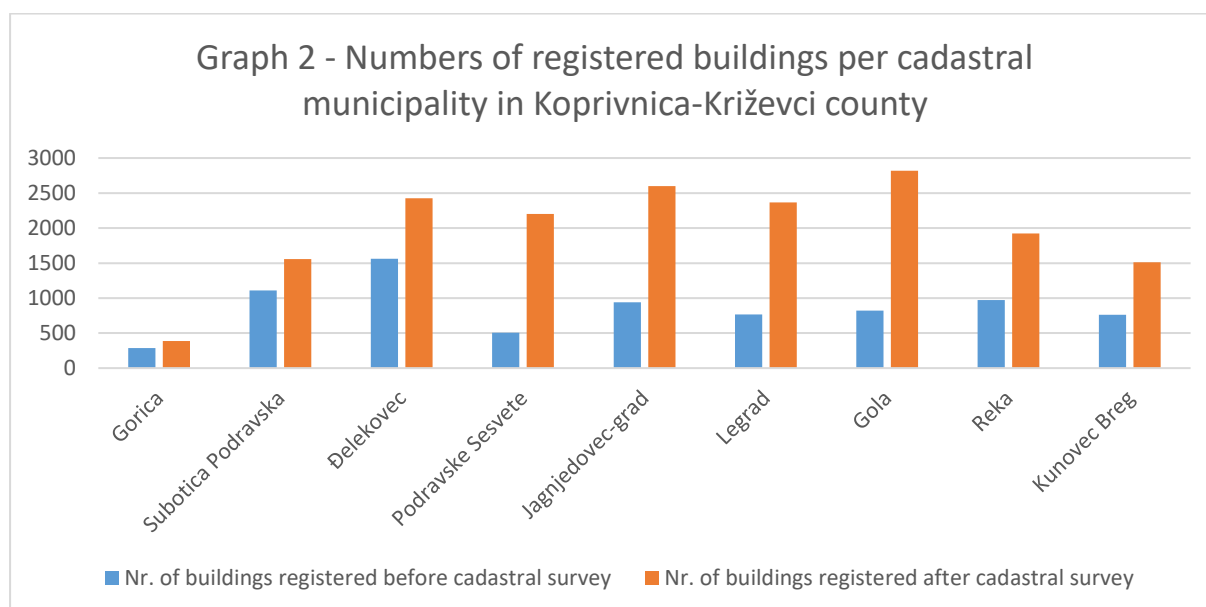
In Koprivnica–Križevci County, the cadastral survey of C.M. Veliki Otok was the first to be implemented using this new methodology.

It is undeniable that this, and all other cadastral surveys carried out in Koprivnica–Križevci County, were both necessary and cost-effective, as clearly demonstrated by the statistical data presented in Graphs 1 and 2.



Graph 1 illustrates the change in the number of cadastral parcels per cadastral municipality where the cadastral survey had been conducted. The comparison of cadastral municipalities before and after the survey clearly demonstrates a significant reduction in parcel fragmentation and subsequent parcel consolidation. This land consolidation, coupled with the harmonization

of records, reduces transaction costs and opens new opportunities for investment and agricultural production, thereby directly supporting economic development.



Graph 2 shows the growth in the number of registered buildings per cadastral municipality. Recording the up-to-date status of built-up areas has led to a significant increase in the number of registered buildings. This directly affects the increase in local self-government revenue from communal contributions and similar fees, thus returning a portion of the funds invested in the survey and ensuring the sustainability of spatial management.

## 5. ADOPTION OF THE MULTI-YEAR PROGRAMME OF CADASTRAL SURVEYS IN CONSTRUCTION AREAS FOR THE PERIOD 2021–2030

Decades of experience demonstrated that the need for implementing cadastral surveys substantially exceeded the capacity of those required to fund them and the available pool of contractors to perform them. Consequently, the Government of the Republic of Croatia made a strategic decision to prioritize construction areas, recognizing their pivotal importance for the nation's economic development.

The Multi-year Program of Cadastral Surveys in Construction Areas for the period 2021–2030 was therefore adopted. It was enacted by the Croatian Parliament on October 1, 2021. The Program, spanning ten years (2021 to 2030), is considered the largest project for the harmonization of cadastres and land registers in Croatian history. Its main objective is the renewal of the Cadastre and Land Register for 600,000 hectares of land and real estate. This ambitious scope includes construction areas, surrounding regions, and other areas in the Republic of Croatia deemed vital for the development of cities, municipalities, counties, and the country as a whole.

The operational execution of this Multi-year Program is carried out through annual programs that the Government of the Republic of Croatia must adopt yearly. Each annual program defines activities and tasks, implementation areas, deadlines, project bearers and participants, as well as financing methods and sources. It also includes a list of cadastral municipalities targeted for surveying during the program year to update cadastral and land register data.

Previous experience in implementing cadastral surveys highlights the paramount importance of timely and high-quality public information regarding the work being performed, its rationale, and its benefits. Therefore, a comprehensive information campaign represents an essential component of this Multi-year Program. The campaign is designed to foster public understanding of the Program's significance and secures the public support crucial for its successful execution. Active participation of owners and stakeholders is also essential for the successful execution of the program. Messages such as "Be an active participant in the cadastral survey" (Figure 4) and "Do you have clear records?" (Figure 5) urge all individuals in the surveyed areas to respond to the invitation from the State Geodetic Administration (sent to their home address) to ensure uncontested ownership (or "clear records") for their properties included in the Program.



*Figure 4 – Leaflet with the message urging stakeholders to “Be an active participant in the cadastral survey”*



*Figure 5 – A sign at the entrance to the settlement being surveyed*

Effective cooperation and joint action of all stakeholders in the Program's implementation, from contractors, owners, and local self-governments to state institutions, is the key to achieving its main goal: the updating and harmonization of cadastral and land register data for the benefit of citizens, the economy, and efficient spatial management. Owners actively participate in all procedures within the survey, including:

- Marking of land boundaries with permanent boundary markers
- Measuring of land boundaries and collection of data on cadastral parcels
- Presentation of the Cadastral Survey Case
- Public display of the data from the Cadastral Survey Case.

In these procedures, they can and should protect their rights and interests.

While crucial, this cooperation faces certain challenges, particularly concerning properties owned by the Republic of Croatia and regional/local self-government units. The biggest problems relate to the inactivity of the managers of these properties (such as the Ministry of Agriculture and the local self-government) in boundary marking and the presentation of cadastral data. Furthermore, short deadlines between the delivery of the invitation and the Presentation date, along with the problematic delivery of necessary documentation to the State Attorney's Offices, contribute to the complexity. In response, the State Geodetic Administration committed during coordination meetings to introduce a joint presentation term for the involved owners, while the relevant ministries pledged to ensure more active involvement from the property managers.

The State Survey and Real Estate Cadastre Act (Official Gazette 112/18, 39/22, 152/24) stipulates that the Decision on the Cadastral Survey is adopted by the Director General of the State Geodetic Administration and must be published in the Official Gazette. Information regarding the cadastral survey implementation is also published in local media.

Furthermore, public gatherings are held in all units of local self-government in the area under survey. There, the new cadastral survey procedure is explained to interested persons, and instructions are provided for marking land boundaries with visible permanent boundary markers. Boards marking the worksite are placed at the main road entrances to the area under survey. Owners of the cadastral parcels are formally invited in writing to mark the land boundaries and are obliged to perform this task within the deadline set by the Decision on the Cadastral Survey. The contractor provides the necessary professional assistance and ensures the permanent boundary markers used for the marking. If the marking procedure is performed correctly, the remaining procedures (survey, presentation, and display) proceed efficiently, and the ultimate goal—the implementation of the new cadastral records and the opening of a renewed Land Register—is reached faster. Throughout this process, the contractors on the ground play a key role in implementing communication activities and establishing two-way cooperation with citizens and local authorities.

In Koprivnica–Križevci County, surveys of construction areas in the settlements of Virje, Kloštar Podravski, Štaglinec, and Imbriovec have been successfully completed within this Program. For the mentioned cadastral municipalities, the new cadastral records and the renewed Land Register are put into use simultaneously. This synchronized action significantly contributes to security in legal transactions and the protection of confidence in the Cadastre and Land Registers.

The Program confirms the trend that the new implementation model accelerates the Display procedure. This efficiency is vividly demonstrated by a comparison within Koprivnica–Križevci County itself. In this county, the display under the old model for C.M. Kunovec Breg (which covered the built-up area of the settlement and contained 2,511 cadastral parcels), lasted 1,668 days, resulting in a productivity of 1.51 parcels per day. In contrast, the cadastral survey of the construction area of the settlement Štaglinec was implemented under the new model, achieving a significantly improved productivity of 2.69 parcels per day (490 cadastral parcels in 182 days).

## 6. CONCLUSION

The implementation of cadastral surveys since the independence of the Republic of Croatia unfolded in several phases. The earliest phase was notably characterized by a lack of a legal framework and the significant challenge of securing funding. While regulations were much better defined in later phases, the problem of insufficiently available resources remained a persistent challenge, given the inherited poor state of the records.

The adoption of the Law in 2018, its amendments in 2024, and the Multi-year Program 2021–2030 represent key procedural and strategic shifts. Procedural innovations (such as changes in the presentation procedure and the introduction of lawyers/attorneys) have significantly reduced the burden on the cadastral and land register commissions and accelerated the overall process. This has successfully created a positive environment and reinforced the understanding that the continuity of surveys is the only viable solution.

Despite continuous implementation, the system still exhibits a certain inertia. This is evident in the fact that for as many as 101 cadastral municipalities across of the Republic of Croatia, the Cadastral Survey Case stands confirmed, yet the display procedure has not been initiated. Nevertheless, the efficiency of the new strategic and procedural solutions is undeniable, as the average waiting time for the cadastral survey to be put into official use has been drastically reduced.

To achieve the full effect of the Multi-year Program (2021–2030), remaining systemic issues need to be resolved. Although a positive atmosphere has been created, the challenge of the lack of available qualified personnel (surveying experts) remains a priority. To sustain this progress, future efforts must concentrate on two core needs: securing financing models that allow surveys to expand beyond priority construction areas, and investing heavily in the education and development of new surveying experts. The consistent and permanent execution of this work is paramount, as it will guarantee the long-term stability of the cadastral and land records, which serves as the indispensable foundation for the Republic of Croatia's future economic growth.

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## BIOGRAPHICAL NOTES

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