

ISSN 2518-7325 (Online), ISSN 2306-1677 (Print)
Land Management, Cadastre and Land Monitoring
Received: 28.04.2026; Accepted: 06.05.2026; Published: 30.09.2026;
<http://dx.doi.org/10.31548/zemleustriy2026.03.07>

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UDC 349.41:528.44:004.65

PROSPECTS FOR INTRODUCING A UNIFIED REAL ESTATE IDENTIFIER IN UKRAINE

A. Martyn, *Doctor of Economics, Professor, Corresponding Member of the National Academy of Agrarian Sciences of Ukraine*

Email: martyn@nubip.edu.ua

ORCID: 0000-0002-6905-2445

N. Medynska, *Doctor of Economics, Professor*

E-mail: medynska.n@nubip.edu.ua

ORCID: 0000-0003-2573-0205

O. Tykhenko, *PhD in Agricultural Sciences, Associate Professor*

E-mail: tykhenko_o@nubip.edu.ua

ORCID: 0000-0001-9271-434X

O. Tsvyakh, *PhD in Economics, Associate Professor*

E-mail: tsviakholeg@nubip.edu.ua

ORCID: 0000-0001-9284-2966

O. Kovalenko, *Postgraduate student*¹

E-mail: region_kyiv@ukr.net

ORCID: 0009-0004-5197-9682

National University of Life and Environmental Sciences of Ukraine

¹ Scientific supervisor - Doctor of Economics, Professor N. Medynska

Abstract. *The article addresses the problem of fragmented real estate identification in Ukraine and substantiates the need to move from a set of registry-specific keys to a unified identifier for real estate objects. The relevance of the topic follows from the fact that different public information systems currently describe the same legal and economic phenomenon through different primary keys: the State Land Cadastre uses the cadastral number of a land parcel, the State Register of Proprietary Rights uses the registration number of the object together with related attributes, the Unified State Electronic System in the Field of Construction uses its own construction object identifier, while the national address register is still being created and populated. The purpose of the study is to develop a legal and technical model of a unified identifier capable of ensuring an unambiguous link “land parcel – building or structure – building unit – address – rights and restrictions”. The methodological framework combines formal legal analysis, system-structural analysis, comparative legal method, logical-semantic analysis, and information modelling. The paper reconstructs the historical evolution of real estate identification in Ukraine and provides a detailed analysis of the structure of the cadastral number, the construction object identifier, address-related identifiers, and the registration number used in the rights register. It is demonstrated that the current interoperability model mostly transports data between registries but does not create a shared ontology of the object itself. A multi-level unified real estate identifier is proposed, rooted in the cadastral number of the land parcel and supplemented by special regimes for objects without a formed parcel and for complex multi-component objects. The scientific novelty lies in combining the spatial logic of cadastral zoning with life-cycle principles of digital identifiers. The practical significance of the proposed model lies in enabling end-to-end traceability of rights, restrictions, encumbrances, taxation, and management decisions in land administration, urban development, and state registration.*

Keywords: *unified identifier; real estate; cadastral number; State Land Cadastre; State Register of Proprietary Rights; Unified State Electronic System in the Field of Construction; address register; data interoperability*

estate; cadastral number; State Land Cadastre; State Register of Proprietary Rights; Unified State Electronic System in the Field of Construction; address register; data interoperability.

Relevance

In a digital state, the issue of real estate identification ceases to be purely technical. It shifts to the realm of legal certainty, the enforceability of rights, the manageability of restrictions, the accuracy of taxation, and the state system's ability to identify the same property consistently across all its registries. The State Land Cadastre (SLC) initially identifies a land plot by its cadastral number; The State Register of Real Property Rights (SRRPR) tracks an object by its registration number and a set of attributes; The Unified State Electronic System in the Construction Sector (E-Construction) assigns its own identifier to a construction object; the address identification system is undergoing reform but has not yet become a mature backbone for all registries [3-16]. As a result, the same piece of real estate lacks a single, stable, end-to-end “name” that would function uniformly in the cadastre, the legal registry, the construction electronic system, the urban planning cadastre, and the address registry.

The problem goes beyond the inconvenience of searching for information. Without a standardized primary key, the government cannot establish an automated chain linking “land parcel – building – part of a building – address – right – restriction – encumbrance.” That is precisely why even relatively simple queries—such as determining the full set of rights and public-law restrictions regarding a specific land plot—still often require manual aggregation of data from multiple systems, comparison of textual attributes, and additional human verification. The existence of electronic interaction between registries does not in itself eliminate this flaw: without a common identity model, it merely accelerates the exchange of heterogeneous entities [8; 14; 15].

The problem becomes particularly acute in the context of post-war reconstruction, the growing role of electronic administrative procedures, the need for

rapid documentation of destroyed, reconstructed, or newly created objects, as well as in the context of property taxation, mass land valuation, engineering infrastructure management, and enforcement of planning restrictions. Under these conditions, a unified identifier should be viewed not as an auxiliary detail, but as an element of the national infrastructure of legal certainty.

Analysis of Recent Studies and Publications

In international scientific and applied literature, the identification of real estate objects is regarded as a fundamental prerequisite for the functioning of modern land administration systems. The UNECE guidelines on real property units and identifiers emphasize that unified identifiers must ensure not only uniqueness but also interoperability between land registries, cadastres, and other government information databases [19]. In their paper on linking land registries and other official registries based on LADM, M. Mađer, H. Matijević, and M. Roić demonstrate that without formal modeling of the relationships between an object, its parts, rights, and spatial framework, it is impossible to achieve true, rather than merely declarative, interoperability [20]. C. Okembo and co-authors, analyzing land administration data in Kenya, also demonstrate that data exchange without agreed-upon identifiers does not eliminate duplication, ambiguities, and conflicts between systems [21].

Practical government solutions from various countries demonstrate several models for addressing this issue. The United Kingdom has established a robust ecosystem based on UPRN and USRN—permanent identifiers for properties and streets—which are mandatory for government systems working with address and street datasets [22]. The RESO Universal Parcel Identifier builds on the concept of a universal cadastral parcel identifier capable of resolving conflicts between identical numbering series from different agencies by linking the parcel number to the geography of the agency that assigned it [23]. The Estonian Address Data System demonstrates a model in which the address, its code representation, and versioned address identifier are used as fully-fledged machine-readable links between the address, the object, and other government datasets [24]. The Dutch BAG, in turn,

shows how a government-maintained basic registry of addresses and buildings can function as a mandatory reference system for other public authorities [25].

In Ukrainian literature, the topic is usually addressed in a fragmented manner: separately through cadastral numbering, separately through state registration of rights, and separately through the digitization of urban planning. However, a comprehensive view of real estate as a multi-level object that must have a single, end-to-end identifier for spatial, address, and legal description has not yet been sufficiently developed. It is precisely this gap that determines the relevance of this study.

Purpose and goals of the study

The purpose of this article is to develop a theoretically coherent and legally viable model for a unified identifier of real estate objects in Ukraine, capable of ensuring full interoperability between the State Land Cadastre, the State Register of Real Estate, the Unified State Electronic System in the field of construction, the Register of Buildings and Structures, the Unified State Register of Addresses, and the State Urban Planning Cadastre.

To achieve this objective, the following tasks have been set: 1) to clarify the essence of the real estate identifier as a legal and informational category; 2) to reconstruct the historical development of real estate identification models in Ukraine; 3) to analyze in detail the structure of existing identifiers used in land, legal, construction, and address contexts; 4) to classify foreign approaches to real estate identification; 5) to propose a model of a unified identifier and rules for its lifecycle; 6) assess the significance of cadastral zoning as the spatial framework of such a system.

Research Materials and Methods

The material basis of the study consists of constitutional, legal, and sector-specific provisions of Ukraine's civil, land, registration, and urban planning legislation, as well as subordinate acts of the Cabinet of Ministers of Ukraine and departmental acts regulating the formation of cadastral numbers, registration numbers, and identifiers in the fields of construction and the address registry [1–18].

Additionally, international standards, government materials, and scientific publications on land administration, LADM, and digital interoperability were utilized [19–25].

Methodologically, the article combines several approaches. The formal-legal method was used to analyze normative definitions and procedures for assigning identifiers. The systemic-structural method was applied to decompose existing identification models into elements and to identify gaps between them. The comparative-legal method allowed for a comparison of Ukrainian solutions with models from the United Kingdom, Estonia, the Netherlands, and the UPI concept. The logical-semantic method was used to investigate the scope of meaning that a good identifier should and should not convey. Finally, the information-model method was applied to construct the structure of a unified real estate identifier proposed by the author.

Results and Discussion

An identifier is not merely a numerical record, but a legally and technically recognized means of establishing an object's identity over time. Its purpose is not to “describe everything” about the object, but to enable an unchanging reference to the same object across various registries, procedures, decisions, and information flows. An identifier, in turn, allows for changes to an object's properties—such as area, address, functional purpose, rights configuration, and restrictions. In doing so, the connection to the object itself is not lost; rather, the moment of the old object's cessation and the moment of the new object's creation are correctly recorded.

This leads to a fundamental requirement: the identifier must not be excessively “semantically overloaded.” Historically, cadastral systems have often attempted to encode location, object type, administrative affiliation, and even other parameters within the number. Early Ukrainian acts on cadastral numbering already emphasized that the generated cadastral number is used primarily for coding and should not become a tool for semantic analysis of derived data [17]. This is a very important methodological guideline that remains relevant today.

In this sense, a real estate identifier serves as a form of state-backed guarantee of identity. It provides the answer to the question, “What exactly are we talking about?”—even before questions arise regarding the owner, encumbrances, address, taxes, zoning regulations, or the property’s actual condition. If, however, the state system cannot provide the same answer to this question across all its key registries, the result is not merely a technical flaw in the databases, but a lack of legal certainty.

The historical development of the Ukrainian model of real estate identification began with a parcel-centric logic. Directive No. 12 of the State Committee for Land Resources dated March 20, 2002, not only established the cadastral number as a unique code for a land parcel but also directly linked its introduction to the creation of an automated system for maintaining the state land cadastre, a system for registering land parcels, real estate objects, and rights thereto, as well as with maintaining information links with other cadastres and information systems. Thus, at the outset of land reform, the cadastral number was intended to serve not only as a land attribute but also as a potential root node of a broader real estate identification system.

In 2002, the structure of the land plot’s cadastral number was explicitly defined hierarchically: KOATUU:NCZ:NCQ:NLP, i.e., 10 digits of the administrative-territorial unit code, 2 digits of the cadastral zone number, 3 digits of the cadastral quarter number, and 4 digits of the land plot number within the quarter [17]. For buildings, structures, and their parts, a derived structure was proposed that extended the land parcel number with a building/structure code and a code for its part. This historical episode is of fundamental importance: the Ukrainian legal tradition was already familiar with the concept of land-derived identification of buildings and their parts, meaning that the modern idea of a single identifier is not foreign to it.

The Procedure for Assigning Cadastral Numbers to Land Plots, approved by Order of the State Committee for Land Resources No. 168 dated February 15, 2010, established the basic hierarchy of the cadastral number and detailed the spatial basis of cadastral zoning [18]. It is in this resolution that a detailed definition of the concept of a cadastral zone is provided, as a set of blocks within a single settlement

or a district outside settlements, and a cadastral block as a compact grouping of land parcels bounded by natural or artificial boundaries: rivers, streams, canals, forest belts, streets, roads, engineering structures, fences, building facades, and other linear features [18]. This means that the Ukrainian cadastral numbering system was based not on an abstract cartographic grid, but on real spatial boundaries that are understandable to the local population.

This model offers a number of advantages. First, it intuitively aligns the cadastral block with a space as it is actually perceived: an urban block, a development area, a field boundary, a forest area, or another morphologically distinct landscape feature. Second, it creates a foundation for local spatial analytics, particularly for mass land valuation, where the cadastral block often corresponds to a potential valuation district. Third, it enhances the field verifiability of cadastral information. At the same time, this model also has weaknesses: cadastral zoning is a planning activity that requires time, professional resources, approval procedures, and ongoing maintenance; furthermore, actual spatial boundaries do not always perfectly align with the boundaries of administrative-territorial units or the logic of other state registries [17; 18].

The current Procedure for Maintaining the State Land Cadastre, approved by Resolution of the Cabinet of Ministers of Ukraine No. 1051 dated October 17, 2012, establishes the cadastral number of a land plot in the format NCZ:NCQ:NLP, where the cadastral zone number and cadastral quarter number are determined according to the rules of this Procedure, while NLP is the land plot number within the quarter [8]. Despite the change in the technical and legal form of the description, the essence of the model remains hierarchical: the cadastral number continues to express the spatial embedding of the plot within a larger zoning system. For a land plot as a cadastral object, this solution is entirely logical: the plot itself constitutes the basic unit of spatial jurisdiction, taxation, land management, and public restrictions.

Particular attention should be paid to the provision of Article 17 of the Law of Ukraine “On the State Land Cadastre” [3], according to which information on the cadastral zoning of land within the territory of Ukraine includes the numbers of

cadastral zones and blocks, a description of the boundaries of such zones and blocks in the state coordinate system, their area, as well as the grounds for establishing the boundaries. At the same time, the current State Land Cadastre already contains an important intermediate tool for describing the relationship between a land plot and the buildings and structures located on it. Paragraph 30-2 of Order No. 1051 provides for the following structure of the registration number for the contour of a construction project and a completed construction project located on a land plot: NCZ:NCQ:NLP:KBS:NBS, where KBS is a three-digit plot code according to DK 018-2000 at the group level, and NBS is a three-digit sequential code for a specific plot [8]. This is an extremely revealing tool: in fact, the cadastre itself already incorporates an element of construction inventory into its data, but this element has not yet become a universal key for the entire state system. The breakdown of the structure of the construction object identifier (for a completed construction object) in version “01” is presented in Table 1.

The construction industry uses a separate, independent identification system. According to the Regulations on the Operation of the Unified State Electronic System in the Construction Industry, the identifier of a construction project (or a completed construction project) is a unique sequence of data automatically assigned by the software of the Construction Activity Registry. Its structure in version “01” consists of seven groups: 0 – version of the formation rules; 1 and 2 – coordinates of the object’s location; 3 – date of identifier creation; 4 – two randomly generated digits; 5 – code of the object’s independent component; 6 – checksum. For a building or structure, group 5 has the value “0000,” while for an apartment, garage, parking space, or other independent object within a building, it is a unique code within the respective object [10]. This model is technically robust: it is suitable for the early stages of an object’s life cycle, particularly when the address has not yet been finalized or the land plot has not yet been established.

Table 1 - Structural elements of the construction project identifier (for a completed construction project) in version “01”

Group	Number of digits	Content	Function
0	2	Rule generation version; “00” –	Support for versioning and

		temporary identifier	special mode
1	7	L coordinate of the object's location	Spatial location at the time of assignment
2	7	B coordinate of the object's location	Spatial location at the time of assignment
3	8	Date of identifier creation in YYYYMMDD format	Recording of registration event
4	2	Randomly generated code	Ensuring additional uniqueness
5	4	Code for an independent component of an object; for a building/structure – “0000”	Hierarchical distinction between the main object and its independent components
6	2	Checksum	Record integrity check

It is perfectly suited for managing documents in the construction cycle, but is not the optimal candidate for the role of a nationwide primary key for all real estate. For legal and cadastral integration, an identifier that, from the outset, has no legally established root in a land plot will remain external to the land cadastre.

Moreover, Ukrainian legislation explicitly permits the separate registration of buildings, structures, and their parts regardless of the registration of rights to the land plot on which they are located [4]. This reflects a fundamental feature of the Ukrainian model: unlike the classical Roman principle of *superficies solo cedit*, according to which a building is an improvement to the land plot [1; 2; 7]. A land plot, building, structure, apartment, and non-residential premises retain separate object status in the registration process. This is precisely why the need for a formal identifier in Ukraine is even greater than in legal systems with a stricter unity of land and superstructure.

The State Register of Property Rights uses a different identification logic. The law defines the registration number of a real estate object as an individual number assigned during the state registration of ownership rights to the object; it is unique throughout Ukraine, remains unchanged for the entire duration of the object's existence, and is not reused after cancellation [4]. This is a very high-quality registration number from a lifecycle-management perspective. However, its public regulatory structure is “opaque”: unlike a cadastral number or a building identifier, the registration number is not broken down into spatial or typological components.

Nor is it supposed to do so. Its function lies not in describing the location, but in the stable existence of a legal record about the object in the rights registry.

From a data theory perspective, this means that the State Register of Property Rights registration number is a strong local key within a single registry, but a weak candidate for the role of an inter-system root. It arises not at the moment of land parcel formation or building construction, but at the moment of state registration of the right; it is functionally tied to the legal registry; it carries no spatial logic and does not allow for automatic tracing to cadastral, urban planning, and address subsystems without external attributes. Therefore, using the State Register of Property Rights as the “center of gravity” for the entire real estate identification model would be methodologically flawed.

The address system is currently in the process of being established. Urban planning legislation defines an address as a unique, structured set of details used to identify an object and determine its location [5; 11]. Resolution No. 254 of the Cabinet of Ministers of Ukraine dated March 5, 2024, launched a pilot project to create the Unified State Register of Administrative-Territorial Units and Community Territories, the Unified State Register of Addresses, and the Register of Buildings and Structures as part of the Unified State Electronic System in the field of construction [12]. The Address Register explicitly provides for the accumulation of identifiers for named objects, streets, and addresses [12]. Thus, the state already recognizes that the address environment must be formalized through its own machine-readable identifiers. Today, the address identifier should be viewed as a critically important, yet still transitional, link in the national system of unified real estate identification.

The development of the address registry and the Registry of Buildings and Structures is occurring in parallel with the introduction of the State Urban Planning Cadastre at the national level as a pilot project [13]. The very names and regulatory frameworks of these acts indicate that this is a phase of implementation, not a completed, mature integration. This is a fundamental conclusion. While the intermediate registry and urban planning components are still in the deployment

phase, the state model for real estate identification cannot rely on them as the established core of the system; instead, it must rely on the most stable and spatially fundamental unit—the land parcel.

Attempts to ensure the integrity of the system through electronic interaction, particularly via the “Trembita” infrastructure, should be evaluated with due caution. “Trembita” is a technological environment for automated exchange between state electronic resources [14]. It significantly increases the speed and standards of data transmission, but does not in itself resolve the issue of entity identity if registries construct the object differently. A transport protocol can connect systems, but it cannot independently replace an object’s ontology. This is precisely why, even with interaction between the State Land Cadastre, the State Register of Real Property Rights, and other systems, gaps between legal registries and cadastres persist [14; 15].

The amendments to the Procedure for Maintaining the State Land Cadastre, introduced by Resolution No. 1131 of the Cabinet of Ministers of Ukraine dated September 10, 2025, are of undoubted administrative significance: they improve the acceptance of applications, the handling of incomplete sets of documents, the recording of deficiencies, and the procedure for approving entries [16]. However, by their nature, these are procedural rather than ontological changes. They improve the mechanism for entering information into the cadastre but do not create a new universal primary key that would simultaneously function in the cadastre, the registry of rights, the building system, the address registry, and the urban planning cadastre. Thus, the fundamental problem of fragmented object identity after 2025 remains unresolved.

A general comparison of the current identification “keys” in the main state systems is presented in Table 2.

A comparative analysis allows us to classify current real estate identification models worldwide into at least five types. The first type consists of parcel-centric hierarchical identifiers, where the primary element is a land parcel and its spatial placement within cadastral zoning. The second type consists of address-centric

permanent identifiers, where the key is the addressed location or addressable object. The third type comprises universal parcel identifiers based on the geographic jurisdiction of the assigning authority, designed to resolve conflicts between local systems. The fourth is registry-local “opaque” record identifiers. The fifth is federated ecosystems of linked identifiers, where a land parcel, address, street, building, and other objects have different identifiers but are linked within a single data model [19–25]. The British UPRN/USRN model is notable in that the state does not attempt to cram the entire complexity of real estate into a single code. Instead, it provides stable, mandatory, universally recognized references to an addressed location and street, which are then used by other datasets [22].

Table 2 - Current primary property identification “keys” in Ukraine's key government systems

System	Primary Key	Structural Logic	What It Actually Identifies	Key Constraint
SLC	Cadastral number of the land parcel	Hierarchical spatial model of the National Cadastral System: NCZ:NCQ:NLP	A land parcel as a cadastral object	Does not, in and of itself, encompass a building, its parts, or the legal chain
SLC	Object boundary ID on a land parcel	NCZ:NCQ:NLP: KBS : NBS	Boundary of a building/structure within a specific parcel	Not a universal cross-register key
Unified State E-System for the Construction Sector	Construction Project ID	Version + coordinates + date + random code + part code + checksum	Construction project/completed project and independent parts	Based on location and events, rather than on a land parcel
State Register of Property Rights	Registration number of the real estate object	Non-transparent unique registration number	Object in the legal register	Has no spatial structure and is created at the stage of registration of the right
Address Registry	Identifiers for named objects, streets, and addresses	Registered model; the open positional structure of the code is not specified by regulation	Address entities	The system is in the implementation phase and does not serve as a national root key

Note: Author's summary based on current regulations.

The Estonian ADS model goes even further in terms of address machine readability: an address has both a code representation and a separate address version identifier, and the system includes links to objects and other registries [24]. The Dutch BAG demonstrates the advantages of a basic, mandatory registration of addresses and buildings, which is becoming the norm for all public entities [25]. RESO UPI, in turn, is useful as a concept for resolving conflicts between local parcel numbers across different jurisdictions [23].

A classification of basic international real estate identification models is presented in

Table 3 - Classification of international real estate identification models

Model Type	Example	Root Element	Advantage	Limitations
Parcel-centric hierarchical	Traditional cadastral systems; Ukraine	Land parcel	Spatial primacy and strong linkage to public restrictions	Weak linkage to addresses and buildings without additional tables
Address-centric constant	UPRN/USRN, United Kingdom	Addressed location / street	High interagency service interoperability	An address does not always correspond to a legal spatial unit
Universal parcel-based	RESO UPI	Plot number + geography of the assigning authority	Resolution of conflicts between local numbering systems	Requires disciplined cross-organizational implementation
Address- and object-based basic registration	ADS, Estonia; BAG, Netherlands	Address / building / object of the base registry	Strong machine readability and reusability within the country	Requires a high level of maturity in the base registries
Federated linked ecosystem	Combination of cadastral, address, street, and building IDs	A network of interconnected identifiers	Flexibility and scalability	Without a shared master key, fragmentation may persist

Note: Author's summary.

For Ukraine, an important conclusion follows from this comparison: a unified identifier should not be merely “just another number,” but the core of the registry architecture. It must combine three properties. First, spatial primacy, which in the Ukrainian context is best ensured by the cadastral number of a land parcel. Second,

longevity, that is, immutability as long as the corresponding object exists. Third, the hierarchical ability to generate derived but formally related identifiers for buildings, structures, and their independent parts. It is precisely this logic that forms the basis of the proposed model.

It is proposed to introduce a Unified Real Estate Identifier (UREI) as a single mandatory cross-registry entity for the State Land Cadastre, the State Register of Real Estate Rights, the Unified State Electronic System for Construction, the Register of Buildings and Structures, the Unified State Register of Addresses, and the State Urban Planning Cadastre. Conceptually, the UREI is not intended to replace the internal service identifiers of these systems; it is intended to serve as their common external root key. In other words, the cadastral number, State Register of Real Estate Rights registration number, construction identifier, and address identifier may continue to exist as specialized service attributes, but they must all refer to a single shared UREI.

The basic form of the UREI is as follows:

$$\text{UINM} = \text{ROOT} : \text{LVL} : \text{OBJ} : \text{PART} : \text{MOD} : \text{CHK}.$$

Here, ROOT is the root spatial element; LVL is the object level code; OBJ is the serial number of a building, structure, or other independent object within the root; PART is the serial number of an independent part of a building; MOD is the service mode for generating the identifier; CHK is the checksum. For the convenience of visual display, elements may be separated by a colon or a period, but in a machine environment they must be stored in canonical format.

In general, ROOT corresponds to the normalized cadastral number of the land plot recorded in the State Land Cadastre. This is a key point. A land plot is the only object that simultaneously has spatially defined boundaries, a formalized procedure for its establishment as an object of civil rights, a cadastral number, and a connection to public restrictions [2; 3; 8]. That is why it must serve as the primary spatial root for all real estate located on it. Accordingly, LVL can take on, for example, the following values: 00 – land plot; 10 – building; 20 – structure; 30 – linear engineering facility; 40 – independent part of a building; 50 – complex object; 60 – object under

construction. The values of OBJ and PART must remain unchanged within a single ROOT after initial assignment, and CHK must ensure automatic integrity checking of the record.

Typical examples might look like this: for a land plot – ROOT:00:0000:0000:00:CHK; for a building located on that plot – ROOT:10:0001:0000:00:CHK; for an apartment in this building – ROOT:40:0001:0127:00:CHK. In this model, the apartment does not “drop out” of the chain but directly inherits the land root through the building. This is the end-to-end tracing logic—from the plot to its spatially and legally related components—that is currently missing in Ukraine.

At the same time, the system must function even when the land parcel has not yet been formally established. This is of fundamental importance for new construction projects, unfinished construction sites, certain infrastructure projects, or for existing buildings where the structure has historically existed but the land cadastral registration is delayed. For such cases, a special mode MOD = 01 is proposed with a temporary root ROOT-TEMP, which is generated based on the territory code, centroid coordinates, assignment date, and check characters. Such a temporary UINM should not disappear without a trace after the land parcel is formed; it should be converted into an archival alias and remain in the correspondence table, while the object is assigned a permanent UINM based on the cadastral number of the land parcel.

For complex objects comprising multiple land parcels, one should not mechanically concatenate all cadastral numbers into a single string. This approach makes the identifier unstable: simply adding or removing a single parcel would require changing the number. For such cases, the MOD = 02 mode is proposed, in which the complex object is assigned a separate UINM with its own OBJ, and the relationship with the set of land parcels is recorded in the mandatory component composition table. In other words, the cadastral number remains the basis of the link but does not compromise the stability of the complex object’s identifier itself.

The division and consolidation of objects should be regulated separately. The general rule should be as follows: an identifier is never reused. If a land plot is divided or merged, the old ROOT is given archive status, and the new land plots receive new ROOTs, which corresponds to the established logic of cadastral numbering [17; 18]. If a building or an independent part thereof is divided, the old UINM of the corresponding level is archived, and the newly created objects receive new OBJ or PART codes; in this case, the registry must maintain a mandatory parent-child relationship between the previous and new identifiers. A similar principle has already been implemented in the construction object identifier, where, in the event of a division or merger, the previous identifier is canceled, and new ones are generated with a reference to the parent object [10].

The regulatory implementation of the UREI will require at least three levels of changes. At the legislative level, it is necessary to establish the very concept of a unified real estate identifier, its legal status as a mandatory cross-registry key, and the list of registries required to use it. At the level of subordinate regulations, the technical structure of the UREI, the assignment procedure, lifecycle changes, correspondence tables, and archiving rules must be established. At the data and API level, a mandatory foreign key to the UREI must be implemented for the State Land Cadastre, the State Register of Real Estate Rights, the Register of Construction Activities, the Register of Buildings and Structures, the Register of Addresses, and the Urban Planning Cadastre. The proposed UREI structure is presented in Table 4, and the lifecycle rules are presented in Table 5.

Table 4 - Proposed structure of the Unified Real Estate Identifier (UREI)

Element	Format	Content	Principle of stability
ROOT	Normalized cadastral number or temporary ROOT-TEMP	Root spatial element	Permanent for the duration of the object's existence; after the plot is formed, the temporary code is archived
LVL	2 digits	Object level: plot, building, structure, part, complex, etc.	Does not change unless the old object is terminated and a new one is created
OBJ	4 digits	Sequential number of the building/structure/facility	Unique within ROOT

		within ROOT	
PART	4 digits	Sequential number of the independent part of the object	“0000” for an object without an independent part
MOD	2 digits	Formatting mode: standard, temporary, comprehensive, etc.	Allows for the correct interpretation of exceptional cases
CHK	2 digits	Checksum	Protection against technical copying errors

Note: Original work.

Particular emphasis should be placed on the role of cadastral zoning as the spatial basis for identifying real estate. It is this zoning that provides the system with a “stage” on which all other objects appear. A cadastral zone and a cadastral quarter are not secondary administrative “props”; they are legally established spatial cells of the state’s land registry [3; 8]. Through them, a land parcel is integrated into the national coordinate and accounting system. A UINM that would ignore this layer and start, for example, with an address or an internal registry number, would be detached from the most stable spatial foundation.

Table 5 - UREI Lifecycle Rules

Event	Action with ID	Inheritance rule	Comment
Initial formation of a land parcel	A new ROOT is assigned	No predecessor	ROOT is the primary spatial root
Initial registration of a building on a formed parcel	A UREI is created with LVL=10/20/30	A reference to ROOT is required	OBJ is unique within ROOT
Initial registration of an apartment/office	A UREI is created with LVL=40	A reference to ROOT and OBJ is required	PART is unique within the corresponding OBJ
Property without a formed parcel	A temporary UREI is created, MOD=01	After the section is formed, it is mapped to a permanent code	The temporary code is not deleted but archived
Division of a property	Old UREI are archived; new UINMs are created	The registry maintains the “parent-child” relationship	The number is not reused
Merger of properties	The identifiers of the source objects are archived; a new one is created	The “child–parent” relationship is stored in the registry	Applies to plots, buildings, and parts
Complex multi-parcel property	A separate UREI is created, MOD=02	The list of ROOT components is maintained in a separate table	Concatenation of multiple cadastral numbers is avoided

Event	Action with ID	Inheritance rule	Comment
Demolition/cessation of existence	UREI is assigned archive status	A new code is not assigned unless a new object has been created	The archive code is not reused

Note: Original concept.

At the same time, we must not overlook the critical aspects of this issue. Establishing cadastral zones and blocks using traditional methods is a resource-intensive planning process. It requires cartographic and land-surveying work, boundary verification, approval, and updating. Therefore, from the perspective of pure computational logic, the idea of simpler analytical zoning based on the grid of topographic maps or another regular grid may seem attractive. Such a grid would not require the separate “creation” of blocks as design entities each time. However, for the Ukrainian system, a complete transition to an abstract grid would be unjustifiably disruptive, as it would sever identification from the already established body of cadastral data, administrative practice, and the field-level clarity of boundaries. A hybrid approach appears more promising: retaining the current cadastral zoning as the legal framework for identification, while using regular analytical grids as an auxiliary tool for statistics, mass appraisal, monitoring, and spatial analytics.

In practical terms, the introduction of the UREI has several immediate effects. The first is legal: it becomes possible to automatically track rights, restrictions, and encumbrances from the land parcel to the building and further to its individual components. The second is fiscal: land tax, rent, property tax, mass appraisal, and other tax procedures are linked by a common object key. The third is urban planning: it becomes possible to automatically verify the compliance of an object’s legal status with its spatial and planning characteristics. The fourth is anti-corruption and evidentiary: it reduces the scope for manipulation of textual addresses, duplication of objects, and invisible “gaps” between the cadastre and the rights registry.

Equally important is the impact on government statistics and analytics. When different systems rely on different primary keys, any cross-system statistics are either approximate or costly. With the introduction of the UREI, the government gains the ability to aggregate data by object, rather than merely by textual similarity of records.

This is critical for assessing building density, infrastructure load, calculating the tax base, analyzing the restoration of damaged housing, and managing public easements, protected areas, and other spatial restrictions.

Therefore, a forward-looking Ukrainian model should not be based on a choice between “land” and “buildings,” but rather on a properly organized hierarchy. A land plot should remain the primary spatial unit, a building or structure—a derivative but independent level, and an apartment, office, non-residential space, or parking space—the next level of detail. It is precisely this hierarchy that allows for the combination of the Ukrainian concept of the separate objectivity of land and improvements with the practical need for a comprehensive, unambiguous, and machine-readable link between them.

Conclusions and prospects for further research

The study provides grounds for several general conclusions. First, Ukraine has historically developed a polycentric model of real estate identification, in which different systems use different primary keys: the State Land Cadastre uses the cadastral number of the land plot, the State Register of Real Estate uses the registration number of the object, the Unified State Electronic System in the Construction Sector uses the unique identifier of the construction object, and the address contour is currently being developed [3–16]. This model allows for data exchange but does not provide a unified ontology of the object.

Second, Ukrainian legal tradition already contained the prerequisites for creating a land-based system for identifying buildings and their parts. Early acts on cadastral numbering not only established the spatial-hierarchical nature of the cadastral number but also oriented it toward linkage with other cadastres and registers [17; 18]. This indicates that the proposed UREI model does not contradict the Ukrainian system but rather develops its original logic.

Third, cadastral zoning and the cadastral number of a land parcel should remain the most stable spatial basis for unified identification in Ukraine. An address is critically important for localization and service processes, but cannot replace the spatial primacy of a land parcel; the State Register of Property Rights registration

number is a strong registry key, but not a spatial key; the building identifier is a valuable lifecycle tool, but is not rooted in the land parcel [4; 8; 10; 12].

Fourth, the proposed unified real estate identifier in the structure ROOT : LVL : OBJ : PART : MOD : CHK allows combining the spatial basis of a land plot with the hierarchical identification of buildings, structures, and their independent parts, as well as providing for special modes for objects without a defined land plot and for complex multi-component objects. Its key advantage is the ability to perform end-to-end machine-readable tracing of the chain “land – building – part of a building – address – right – restriction.”

Fifth, the implementation of the UREI should be viewed as a separate government data reform, rather than as a technical addition to existing registries. It requires changes to legislation, subordinate regulations, data models, application programming interfaces, and identifier lifecycle rules. Prospects for further research include formalizing the UREI XML/JSON schema, developing a checksum algorithm, modeling transitions between temporary and permanent identification modes, and developing a 3D component for complex real estate and engineering infrastructure objects.

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А.Г. Мартин, Н.В.Мединська, О.В. Тихенко, О.М. Цвях, О.А. Коваленко

ПЕРСПЕКТИВИ ЗАПРОВАДЖЕННЯ УНІФІКОВАНОГО ІДЕНТИФІКАТОРА ОБ'ЄКТІВ НЕРУХОМОГО МАЙНА В УКРАЇНІ

Анотація. У статті досліджено проблему фрагментарної ідентифікації нерухомості в Україні та обґрунтовано потребу переходу від сукупності відомчих ідентифікаційних ключів до єдиного уніфікованого ідентифікатора об'єктів нерухомого майна. Актуальність теми зумовлена тим, що різні державні інформаційні системи описують один і той самий економічний і правовий об'єкт через різні первинні ключі: Державний земельний кадастр – через кадастровий номер земельної ділянки, Державний реєстр речових прав на нерухоме майно – через реєстраційний номер об'єкта та пов'язані атрибути, Єдина державна електронна система у сфері будівництва – через власний ідентифікатор об'єкта будівництва. Метою дослідження є формування правової та технічної моделі уніфікованого ідентифікатора, здатного забезпечити однозначний зв'язок «земельна ділянка – будівля (споруда) – частина будівлі – адреса – права та обмеження». Методологічну основу становлять формально-юридичні, системно-структурні, порівняльно-правові, логіко-семантичні та інформаційно-модельні методи. Розкрито історичну еволюцію ідентифікації нерухомості в Україні, детально проаналізовано структуру кадастрового номера земельної ділянки, ідентифікатора об'єкта будівництва, ідентифікаторів адресного середовища та реєстраційного номера об'єкта нерухомого майна. Доведено, що чинна модель інтегрованості переважно транспортує дані між реєстрами, але не створює спільної онтології об'єкта. Запропоновано багаторівневий уніфікований ідентифікатор нерухомого майна, в основі якого лежить кадастровий номер земельної ділянки, а також спеціальні режими для об'єктів без сформованої земельної ділянки та для комплексних багатокомпонентних об'єктів. Наукова новизна полягає у поєднанні принципів та методичних підходів кадастрового зонування з принципами багатовимірних цифрових ідентифікаторів. Практичне значення результатів полягає у можливості створення наскрізної системи ідентифікації прав, обмежень, обтяжень, оподаткування та управління у сфері земельних відносин, містобудування і державної реєстрації.

Ключові слова: уніфікований ідентифікатор; нерухоме майно; кадастровий номер; Державний земельний кадастр; Державний реєстр речових прав; Єдина державна електронна система у сфері будівництва; адресний реєстр; інтероперабельність даних.