© by PSP Volume 31– No. 08A/2022 pages 8281-8290 Fresenius Environmental Bulletin

DETERMINATION OF URBAN REGENERATION AREAS IN TURKEY: CURRENT APPROACH AND SUGGESTIONS FOR SUSTAINABLE DEVELOPMENT

Ezgi Sezgin*, Ali Tunc, Tahsin Yomralioglu

Istanbul Technical University, Department of Geomatics Engineering, 34469 Maslak, Istanbul, Turkey

ABSTRACT

Urban regeneration (UR) is a crucial city planning tool used by local and central governments in order to reduce the impacts of disasters and design sustainable cities. It is important to accelerate the process when it comes to the loss of lives. In order to take measures against disasters quickly and to design disaster resistant cities by taking advantage of the new and facilitator Law, more than 250 areas across the country have been determined as project areas According to The Law on the Regeneration of Areas under Disaster Risk, commonly known as the Urban Regeneration Law (No.6306, May 2012). Due to insufficient information in the Regulation, there are differences in practice. There is a need for a more comprehensive regulation to set every point clear and transparent to develop UR projects sustainably. In this study, a workflow diagram has been designed. This will be useful to standardized the UR process. The required data for the determination of UR areas according to the related legislation has been specified. A geographical data model for the determination of UR project areas has been designed and its relationship with national and international data standards has been established. Spatial Unit, Party, Governmental Utility, Illegal Condition of Buildings data classes were modelled. They will be beneficial for managing the UR process from the data management point of view. Using Unified Modelling Language (UML) diagrams to model the geographical data will enable institutions and data managers to operate together and manage urban data efficiently.

KEYWORDS:
Urban Regeneration (UR), Disaster Risk, Geographical Data Model, Unified Modelling Language (UML)

INTRODUCTION

Rapid urbanization has always been a challenging management issue for governments in developing countries. On average, today's developing countries have seen urban share increases of 8 percent between 1985 and 2005 [1]. Similarly, in Turkey, since the late 1950s, rapid urbanization was experienced, and the period's effects are still visible. The decline in agriculture and the rise of Turkey's industrial sector has rapidly increased migration from the country to town. From the 1980s, the cities globally experienced a restructuring and transformation process due to the economic restructuring and globalization [2]. Cities that are not ready for such a rapid population increase, especially megacities such as Istanbul, Ankara, and Izmir, have faced housing problems that resulted in slums and urban sprawl. Today, cities accommodate over 75 percent of the country's population and contribute substantially to its industrially-competitive economy [3].

As the urban population lags behind the rural population, the disaster risks in these urban settlements are increasing daily. Due to high population density and high population growth in the cities, mostly in the developing countries, they are not properly and adequately prepared for disaster resilience [4]. Governments use Urban Regeneration (UR) projects in order to reduce the impacts of disasters and design livable cities. UR represents an opportunity for sustainable development and smart growth of cities [5]. Even though the primary purpose of the UR concept was commonly accepted as to develop new urban spaces, the policy and its instruments have been used in solving many other urban problems such as the regeneration of illegal settlements. Lately, the procedure is also used for disaster risk management, mitigation or recovery, and a tool for facing disaster risks in cities [2].

As an important global socio-economic development tool worldwide, UR has transformed from focusing on large-scale and modernized physical transformations to addressing diversity, sustainability, equality, and livability in the city [6]. In Turkey, UR projects are important urban development tools to reduce disaster risk and design vulnerable cities. UR projects are comprehensive projects involving many stakeholders and lots of properties. For this reason, a large number of spatial data must be operated coordinately. This interoperability can be possible only with standards and have to be supported with a fit for purpose legislation.

Despite the legal arrangements, there are some differences in interpretation and implementation.

There is a need for holistic development to implement the UR projects and design sustainable and disaster-resilient cities. This study fundamentally aimed to develop data models for UR Project Area determination. According to the legislation, UR background and project process in Turkey and related data were defined in Section 2 (Urban Regeneration in Turkey). In order to ensure interoperability, data models were developed, which are compatible with national (TRGIS: Turkish National GIS) and international (Infrastructure for Spatial Information in Europe (INSPIRE), International Organization for Standardization-ISO/TC211) geographical data models and contribute to national data models from the urban development point of view. Interoperability of geographical data models was ensured through Unified Modelling Language (UML) (detailed information provided in Section 3-Methodology). Accordingly, a workflow diagram was designed, and the required data for the determination of UR areas was formed based on the related legislation. After defining the current approach to UR area determination, proposed data models were given in Section 4 (Results). This study contributes to authorities for sustainable and resilient urban planning and carrying out the UR projects effectively.

URBAN REGENERATION IN TURKEY

While urbanization was steadily increasing during the 1950s-70s, it was during the 1980s that Turkey experienced a significant surge of rural migrants to cities, causing a rapid expansion of informal areas in urban settlements. After that, a permissive tenure regime granted squatters on the urban public land legal status that prompted both households and host municipalities to invest in their dwellings and neighborhood infrastructure [3]. This adoption of Turkey paved the way for other migrants and other illegal settlements. Urban redevelopment activities started with the demolishment of slums; after the rapid population growth, urban land in need of new inhabitants tried to be reproduced through regeneration projects. In the 1980s urban development became more important as a political tool, and this directly impacted the legislative Regulation, for example, Development Law (1985) and Mass Housing Law (1984) [7]. The UR projects were developed by municipalities and the Housing Development Administration (TOKI) in the light of new responsibilities transferred from the State by-laws.

In the 2000s, in cities where deconstruction took place with the industrial revolution, another reconstruction period was observed involving the transformation of spaces into different flow areas [8]. With the rapid urbanization and the expansion, various problems occurred related to urban demography, urban land, and the planning environment. [9].

In Turkey, central and local administrations executed unsuccessful urbanization applications since the 50s, which showed they were incapable of developing urban lands. After the early 90s, developing organized, healthy, and livable urban areas underlie the development planning and implementation. After the Marmara Earthquake, which hit in 1999, revealed the necessity to re-evaluate UR attempts [10]. Even though many lessons were taken and the politicians gave promises, only a few years later, the 2011 Van Earthquake occurred. After the damage caused by the Van earthquake, the government took severe steps, and the final legislative arrangements were then made [7].

Over the years, various legislations dealing with different aspects of urban renewal and regeneration in Turkey were enacted (Table 1). In 1966, 775 numbered Slum ("Gecekondu" in Turkish) Law came into force and it was only focused on rehabilitation of existing slums. It is followed by the 2985 numbered and 1984 dated Mass Housing Law which aims transformation of slum areas, promotion of safe housing in the context of urban regeneration. The 5104 numbered North Ankara Entrance Urban Regeneration Project Law that is issued in 2004, is to improve physical condition and environment of the north Ankara entrance and its surroundings. With the Municipality Law numbered 5393 and dated 2005, municipalities are authorized to implement urban regeneration and renewal projects. Although the powers and responsibilities were not clear in this law, many UR projects have been implemented in accordance with this law. 2005 dated and 5366 numbered Law on the Protection of Deteriorated Historical and Cultural Heritage through Renewal and Re-use focuses on reconstruction and restoration of protected areas and their surroundings. These legislations were not dealing with the problem from a holistic view to offer a sustainable solution to urbanization problems.

In addition to the fact that these laws were not comprehensive, the government wanted to take quick measures for buildings that are not resistant to disasters. With the lessons taken from the past natural disasters and their devastating results, the Ministry of Environment and Urbanization developed a new framework [9]. In 2012 the Law on Transformation of the Areas under Disaster Risk No. 6306, widely known as the Urban Regeneration Law had enacted.

This Law aims to define the procedures and principles on rehabilitation, clearance, and renewal of risky areas and risky buildings to constitute healthy and safe housing and environment, under the terms of the technical and artistic norms and standards.

TABLE 1
Legislative background of UR in Turkey (Adapted from [7])

Date	Law	Authority	Aim
1966	Slum Law	Municipality, TOKI	Rehabilitation of existing slums.
1984	Mass Housing Law	TOKI	Transformation of slum areas and the promotion of safe dwellings in disaster areas.
2004	North Ankara Entrance Urban Regeneration Project Law	Ankara Metropolitan Municipality	To improve the physical condition and environment of the North Ankara entrance and its surroundings.
2005	Municipality Law	Municipality, Metropolitan Municipality	To implement UR projects to take measures against disaster risk.
2005	Protection of Deteriorated Historical and Cultural Heritage through Renewal and Re-use	Municipality, Metropolitan Municipality, Cultural Heritage Preservation Board	Reconstruction and restoration of protected areas and their surroundings, to take precaution against disaster risk.
2012	Law on Transformation of the Areas under Disaster Risk	Ministry of Environment, Urbanization and Climate Change	Define the procedures and principles on rehabilitation, clearance and renewal of risky areas and buildings.

The Law does affect the construction and real estate sectors significantly. As highlighted in the presentation about UR implementations in the context of the Law no.6306 by the Ministry (2018), 594.000 buildings countrywide were detected as risky buildings where 662.000 buildings were included in the nearly 250-risky area designation. In total, 4.152.000 people were within risky buildings and risk areas in Turkey [11]. UR Action Plan, the new road map of UR in Turkey, has been prepared and announced by the Ministry of Environment and Urbanization. According to the Action plan, more than 80 thousand citizens lost their lives in 56 earthquakes of 6 or more magnitude in the last century. And other statistical information (Figure 1) on UR was given in the Action Plan. The Ministry has been planning to renew 1.5 million houses, which were determined as a priority, out of 6.7 million houses. that need to be regenerated within five years and within this framework, to ensure the renewal of 300 thousand houses every year, 100 thousand of which are in Istanbul. [12].

FIGURE 1
UR in Turkey with Numbers

METHODOLOGY

In addition to being more comprehensive than previous UR laws, the latest UR Law (6306) has many advantages for public and private investors, such as reduced taxes and housing benefits. For this reason, administrators and inventors preferred to implement UR projects within the Law numbered 6306 in order to benefit from the advantages provided in many phases and to get project impacts faster. For this reason, within this study, the Law numbered 6306 and its implementation Regulation have been examined as it is the latest and most frequently applied UR law in Turkey. The Law and the Regulation have been analyzed in detail to determine UR project steps. The current work aims to define the standard working steps and the data used and produced for each step necessary for UR projects.

In order to obtain the most productive and sustainable results from UR, the first step is to determine the project area precisely. Although the requirements to determine one area as a UR area were stated in the Regulation, there may occur differences in practice. The UR procedure needs to be standardized in large scale projects that involve large numbers of stakeholders. In this way, the differences that may arise in practice can be eliminated, and transparency can be established in real-life applications. It is certain to implement a transparent and participatory application in practice since people's property rights have also interfered with the UR projects. Therefore, it is necessary to ensure that the same steps are carried out in each project, depending on the area's specifications. For this purpose, the criteria in the project area determination and the actors in the process must be clearly stated.

In this study, Turkish National GIS standards have been outlined. UML was used to create the conceptual scheme for geospatial data management, and the properties of the data themes were designed with UML in an object-oriented relational structure [13]. For this reason, within the scope of interoperability, process and data diagrams are created with UML. Therefore, the model proposed in this study will be able to function under national standards.

TABLE 2
Urban Regeneration Area Proposal File

UR Project Are Proposal File	Legal Basis	Definition	Essential Data	Project Area Proposal Due to	Legal Basis	Definition	Additional Data Acc. To Due
	Article 5, Sub-article 1(a)	Technical report that the area has the risk of causing loss of life and property due to the ground structure or conditions of buildigs	Technical report (related to ground structure and conditions of buildings) (Geological Data and Building Data)	Ground Conditions	Artide 5, Ssub-artide 1(e)	If the area is determined as project area due to ground conditions;	Geotechnical study
	Article 5, Sub-article 1(b)	a document and the information about existence of an area which was determined formally as area exposed to disaster according to the Disaster Law	Disaster Exposed Zone (Land Use Data)	Conditions of Buildings	Artide 5, Sub-artide 1(f)	Analyze report according to the Annex A of Principles for determining risky structures;	Building Data
	Article 5, Sub-article 1(c)	A coordinated restriction map that shows the size of the area and Implementation Development Plan if available.	Coordinated Restriction Map Implementation Development Plan	Damage in Built Environme nt	Artide 5, Sub-artide 2(a)	Places where public order and security are disturbed, Insufficient planning and infrastructure services	Infmstrucutre Services Breakdowns and Interruptions
	Article 5, Sub-article 1(c)	List of the state-owned (public) properties should be provided from Land Registry Office and attached to the file.	Orthoimagery				
	Article 5, Sub-article 1(d)	Location of the area should be plotted on a satellite image or orthophoto.	Land Registry Information	Illegal Conditions of Buildings	Artide 5, Sub-artide 2(b)	At least 65% of the total number of buildings on the area are contrary to the zoning legislation or were built without a building license.	Building Data Implementation Development Plans

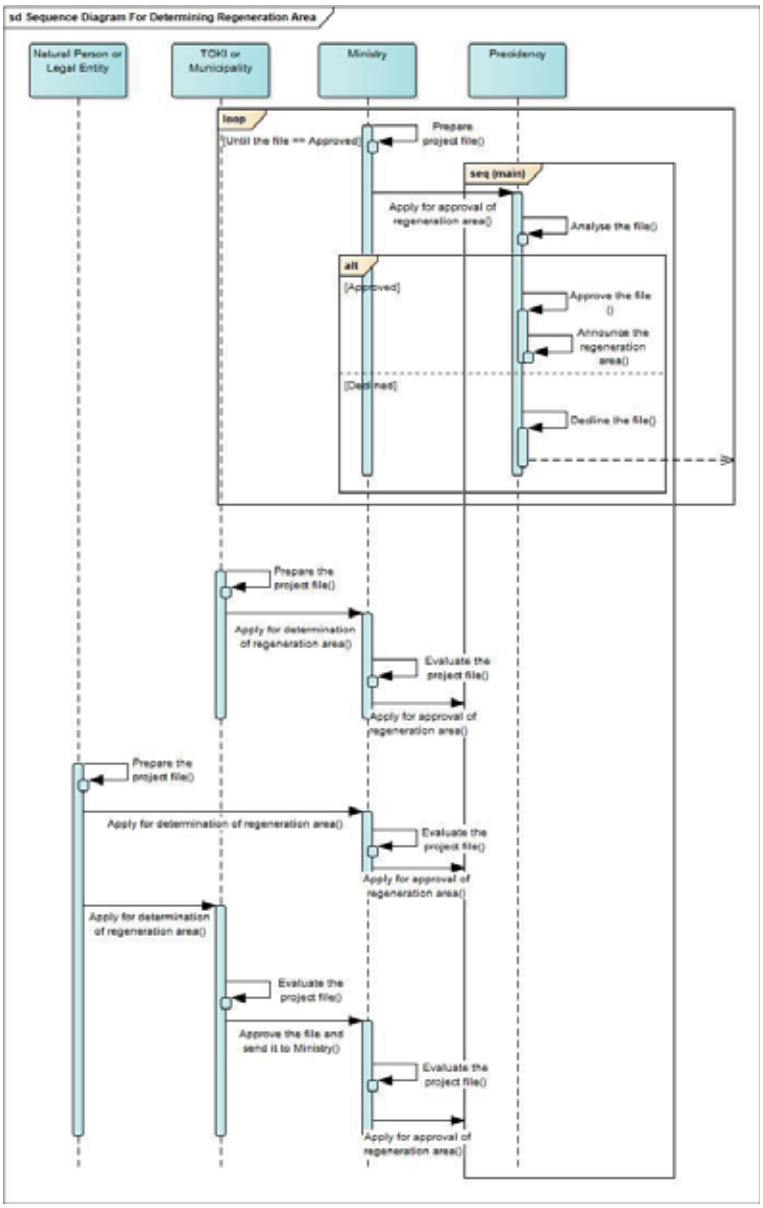

FIGURE 2
UML Sequence Diagram of UR Project Area Determination

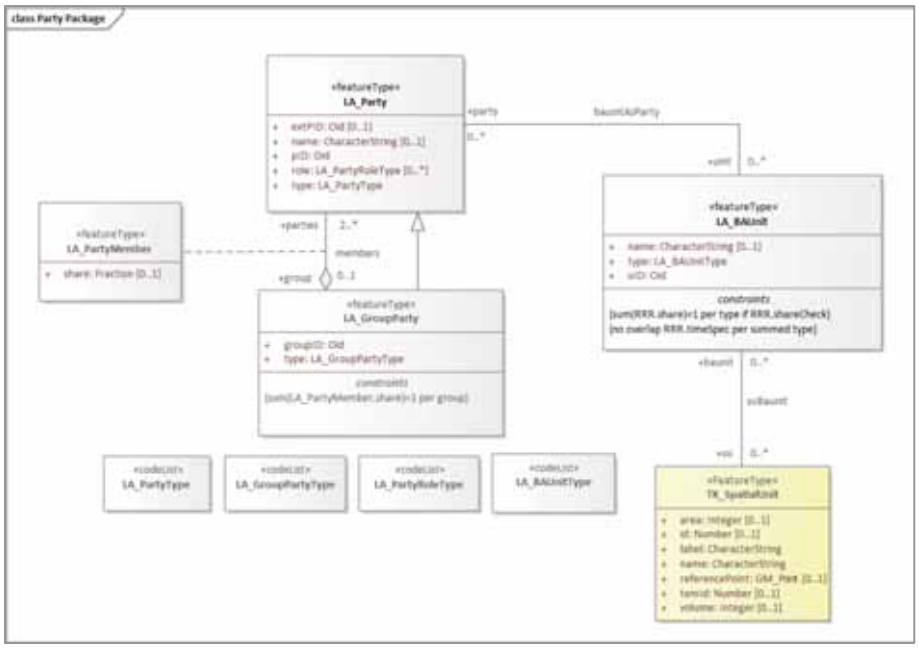

FIGURE 3
LADM Party Package (Adapted from [18])

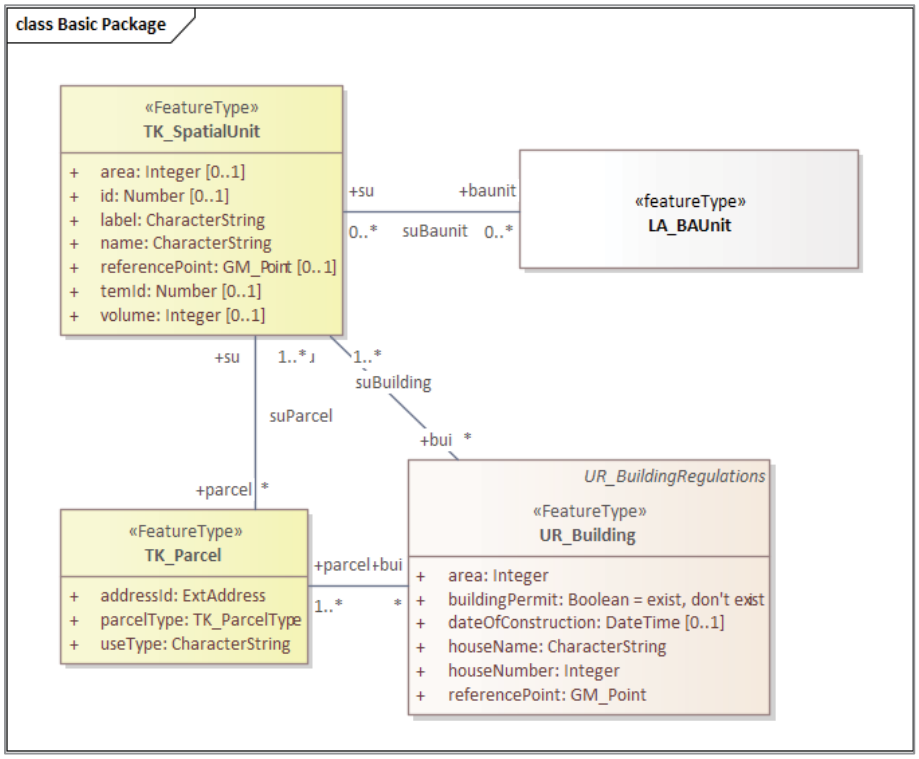

FIGURE 4
TK_Spatial Unit and Associations (Adapted from [20])

Legislative Analyze. The legislative analysis was conducted to present the work steps for the determination of UR areas. The legislation was examined to highlight every step where spatial data was used and produced in the regeneration process. This content may be a map/plan production or a reporting, service, duty, and need. Since UR projects are one of the most used city planning tools in our country, it is important to present the process conceptually to eliminate practice differences. The actors in UR projects were also determined. The authorizations and responsibilities were also introduced, and the process became transparent and participatory for all stakeholders. While the Regulation furnishes the Ministry with authority, the Municipality, TOKİ, and real or private legal entities within the area can also make a proposition for UR in that area.

As a result of the detailed examination of the Regulation of Law No. 6306, UR project area determination steps and actors were defined and visualized with a UML Sequence diagram (Figure 2). As a result of the legislative analysis, it was observed that who/what did the work, the order in which the work was done and whether the work step was synchronous or asynchronous. When we consider these reasons, the UML Sequence diagram was found appropriate to be used.

Data Requirement Analyze. The next step after determining the UR Project steps is to define urban data flow. The corresponding articles in the UR regulation were examined in terms of spatial data usage and production. A large number of spatial data are used in UR projects that concern large areas and many rightful owners. Producing these data under national data standards will allow the process to continue faster for decision-makers and project executives. Since one of UR projects' primary goals is disaster risk reduction, accurate selection of priority regeneration areas is critical in terms of loss of life and property.

According to Article 5 of the UR Regulation, UR project areas' determination can be done due to different reasons. Technical requirements and procedures for each situation are defined in the Regulation. There exist a data/documents list essential for each case and additional data/document to the UR proposal file according to the different scenarios. Four justifications of the UR area decision and additional data/document were illustrated in Table 2.

Modeling. A proposal to the national GI model has been formed of data and their contents required in the UR project area determination. An object-oriented geographical data model was designed independently from software and hardware [14].

While designing a framework and researching modeling, INSPIRE Data Specifications, National GIS (TRGIS), and ISO 19152:2012 Land Administration Domain Model (LADM) have been reviewed. For any sections of the data model, these data standards were consolidated as fitted, and sometimes they were customized. For the other sections of the data model, a fit for purpose design has been made. The UR data model classes were prefixed by UR_ to differentiate them from other classes in the complete model.

UML class diagrams were drawn for the classes and attributes proposed to be interoperated with national standards. UML class diagram shows a system's classes and their attributes and the relations between the system's objects. The data and attributes that were not previously defined in the documentation of standards but that will be used or produced during the determination of UR areas were specified

INSPIRE Data Specifications. INSPIRE would offer access to spatial data via network services, and the data that would be made available follow the structure of a harmonized data specification to achieve interoperability. INSPIRE has thematic domains (34 in total) grouped in 3 annexes because of different priorities, different timelines, and deadlines to implement data components of the INSPIRE directive [15]. Some of the thematic domains were Buildings, Land Use, Geology, Ortho-Imagery, Utility, and Governmental Services, etc., which have been reviewed while modeling phase.

LADM. ISO 19152:2012 Land Administration Domain Model (LADM) is an abstract model that focuses on land administration's legal and geographical aspects. In particular, it aims to standardize cadastral systems, while the domain of land administration is expected to other land-related public registries (e.g., address, land use and land cover, property taxation, and valuation databases) [16].

The core LADM is based on four basic classes: Class LA_Party, Class LA_RRR, Class LA_BAUnit, Class LA_SpatialUnit. LA_Party and LA_BAUnit classes were fitted the UR data model (Figure 3). They were used in their current state. TK_SpatialUnit was compatible with LA_SpatialUnit, and it was suitable for the UR data model, so it was included in the model. Spatial Unit described existing cadastral/available features while Basic Administrative Unit (BAUnit) described land registry records. Technically and spatially recorded spatial units, registration of these spatial units or their combinations' and related parties with basic administrative units and their relations would enable users/designers to analyze housing structure and state-owned properties in the area.

The Party Package includes the LA_Party class, which represents natural and legal people, and the LA_GroupParty class representing the groups consisting of a number of parties both of which play a role in land administration [17]. LADM Party package would allow users/designers to analyze parties on the UR Project Area, their types(private/public), and their shares.

TRGIS. TRGIS follows the ISO/TC211 Geographic Information/Geomatics Committee and Open Geospatial Consortium (OGC) standards for the interoperability of the geographic data sets and services. Data specifications and exchange standards have been developed for data themes to meet national data requirements and to accommodate geographic data on the TRGIS portal infrastructure [13]. TRGIS.TK (Land Registry and Cadastre), TRGIS.BI (Building), TRGIS.Geology and some other themes of the TRGIS were reviewed in terms of UR project data requirements.

TK_SpatialUnit and TK_Parcel (Figure 4) were adopted from the Land Registry and Cadastre

Theme (TRGIS.TK). The Land Registry and Cadastre Theme spatially implies the term 'cadastre parcel', which is the smallest homogenous unit of land for which property rights and correspondingly immovable properties are defined [19]. For UR project areas, parcels and buildings have been the basic units to analyze risk and decide the project area.

Most contents of TRGIS.BI were also adopted to the UR data model, but those were not adequate to meet all requirements. UR_Building feature was also designed to make any related analyses such as, housing structure and risky buildings on the area, places where public order and security were disturbed, buildings on the area contrary to the zoning legislation, etc. TRGIS. Geology theme, compatible with INSPIRE Geology data specifications, was also reviewed and referred.

RESULTS

As seen in the data requirement and legislative analysis sections, the data needed for UR project area determination wasn't sufficient. Essential data and data required for each condition have been specified, and the geographical data model for UR projects has been designed compatible with existing data standards. While creating the model, the UR project area (<<FeatureType>>UR_ProjectArea) and other related data and associations were revealed by UML.

Primarily the Essential Package (Table 3) including project area (<<FeatureType>> UR_ProjectArea) and its boundary (<<FeatureType>>UR_Boundary) and coordinations (<<FeatureType>>UR_Point), has been developed, corresponding to the related article of the legislation '*a coordinated restriction map that shows the size of the area'*. To *plot the location of the area on a satellite image or orthophoto*, ortho imagery class (<<FeatureType>>UR_OrthoImagery) and place "*the areas exposed to disaster according to Law 15.05.1959 dated and No.7269 Disaster Law"* restricted areas (<<FeatureType>>UR_RestrictedAreas) have been produced. Also, spatial plans of the area must be included in the proposal file, so spatial plan (<<FeatureType>>UR_SpatialPlan) has been included in the model. Building class (<<FeatureType>>UR_Building) has been developed that it would be possible to analyze and report *conditions of buildings.*

After the Essential Package has been developed, Ground Package (Table 4) has been examined. According to the legislation, a geotechnical study must be performed if the area is determined as a project area due to ground conditions. Geological Feature (<<FeatureClass>>UR_GeologicalFeature)

has been developed in addition to the Essential Package. In the class data and attributes obtained from geotechnical surveys, such as fault and active fault features (<<FeatureType>>UR_Fault), the geological formation of the soil (<<FeatureType>>UR_GeologicalFormation) and ground water level (<<FeatureType>>UR_GroundWater) and lithological information of the ground (<<FeatureType>>UR_Geotechnic) have been modeled. Borehole purpose values and Lithology values (<<CodeList>> in pink) were adopted from TRGIS.Geology data specifications [21].

TABLE 3
UR Data Model Essential Package

EssentialPackage	
Feature	Enumeration
UR_ProjectArea	UR_InsInChargeType
TK_SpatialUnit	TK_ParcelType
TK_Parcel	UR_RestrictedAreaType
UR_Tag	UR_OrthoImageryType
UR_Building	UR_PlanType
UR_Boundary	
UR_Point	
UR_RestrictedAreas	
UR_OrthoImagery	
UR_SpatialPlan	

TABLE 4
UR Data Model Ground Package

GroundPackage	
Feature	Enumeration
UR_ProjectArea	GE_BoreholePurposeValue
UR_GeologicalFeature	GE_LithologyValue
UR_BoreHole	UR_LocalSiteClass
UR_Geotechnic	UR_SettlementSuitabilityType
UR_Groundwater	UR_SoilGroupType
UR_Fault	
UR_ActiveFault	
UR_GeologicalFormation	

In Building Package (Table 5), additional data due to conditions of buildings were revealed. The legislation referred to the Annex A of Principles for Determining Risky Structures, which describes the evaluation procedures of reinforced concrete buildings (<<FeatureType>>UR_ReinforcedConcrete) and masonry buildings (<<FeatureType>>UR_Masonry). With its features and attributes, the Building Package has been conveniently designed to answer all principles.

TABLE 5
UR Data Model Building Package

BuildingPackage
Feature
UR_ProjectArea
TK_ParcelType
UR_Building
UR_ReinforcedConcrete
UR_Masonry

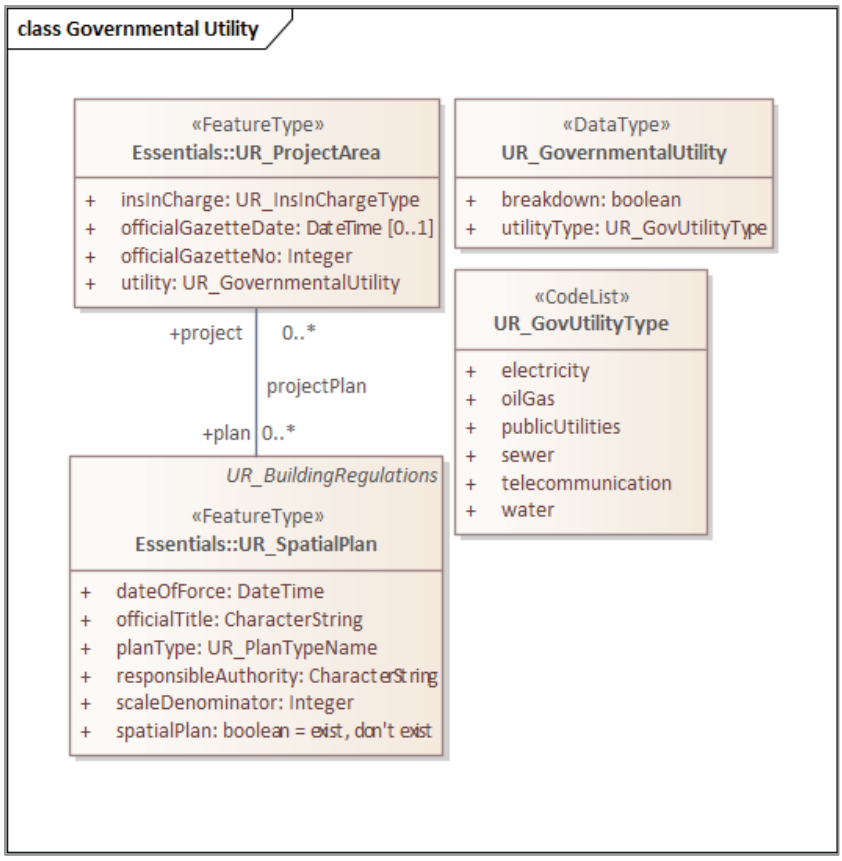

FIGURE 5
UR Model Governmental Utility Package

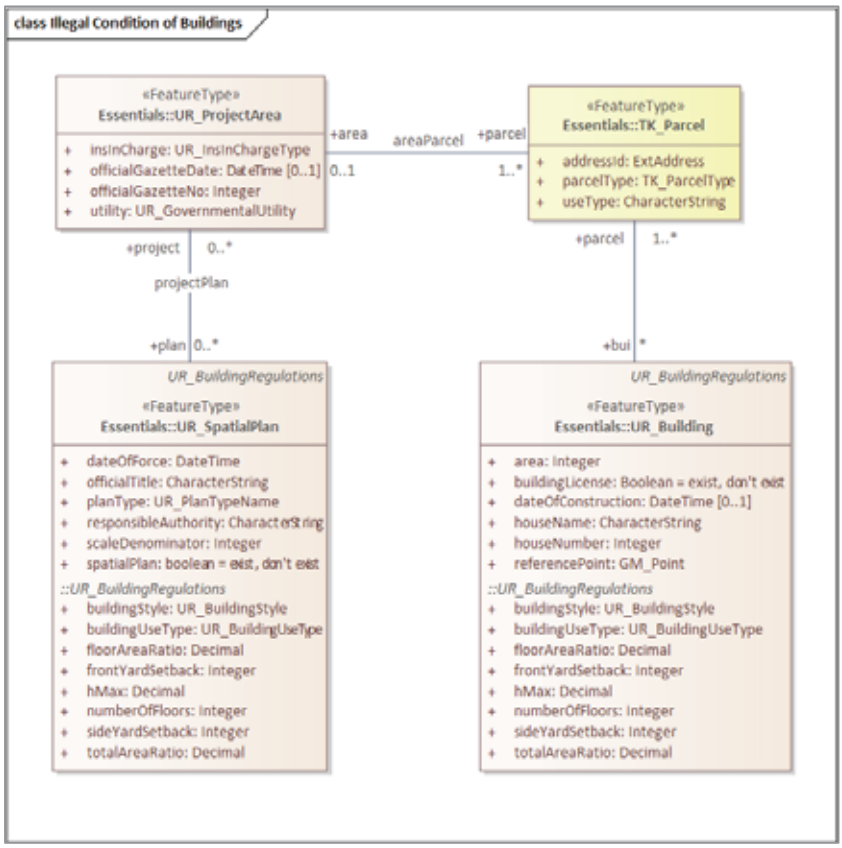

FIGURE 6
UR Model Illegal Condition of Buildings Package

Governmental Utility Package (Figure 5) has been designed to summarize damage in the built environment and insufficient planning. Spatial plan feature (<<FeatureType>>UR_SpatialPlan) has been revealed to analyze the sufficiency of planning infrastructure of the area and governmental utility as an attribute of the project area to examine the utility services provided by governments and their breakdowns and interruptions.

Illegal Conditions of Buildings Package (Figure 6) has been developed to determine the number of illegal buildings in the area which have been built contrary to the zoning legislation. A class (<<FeatureType>>UR_BuildingRegulation>>) has been proposed to compare building regulations allowed by implementation plans with the existing buildings' conditions. Building class (<<FeatureType>>UR_Building>>) and Spatial plan class (<<FeatureType>>UR_SpatialPlan>>) have inherited the building regulation's attributes. If at least 65% of the total number of buildings have been built contrary to the zoning legislation, then the project area can be determined. Besides, buildings constructed without a building license can be detected.

CONCLUSIONS

This study describes a geographical data model for the determination of UR project areas. This model is designed to facilitate decision-making and expedite the process concerning national and international data standards. UML diagrams have been used for modeling to ensure interoperability. This model could be integrated directly with current information management systems and geodatabases. This geographical data model also allows decision-makers and administrators to implement sustainable projects and transparent management of cities.

With the model created in this study, a model-based approach has been used under national and international standards for geographical data interoperability. Many challenges are overcome for the functioning of UR projects as data models enable users to manage data more quickly and efficiently. Since the model is designed with UML application schemes, it will provide advantages such as integrating current information systems and eliminating duplicated information. Hazard vulnerability can also be achieved rapidly with quickly prepared and technically complete and accurate urban data.

REFERENCES

[1] Coulibaly, S., Deichmann, U. K., Freire, M. E., Gill, I. S., Goh, C., Kopp, A. D., ... & Ross-Larson, B. (2008). World Development Report 2009: Reshaping Economic Geography (No. 43738). The World Bank. https://openknowledge.worldbank.org/handle/10986/5991 (Accessed date: 01.09.2021)

[2] Adıkutlu, S. (2019). Resilience to Disasters: Lessons from Turkish Urban Regeneration Experiences. Master's Thesis. Middle East Technical University

[3] Karam, S. G. (2015). Rise of the Anatolian Tigers: Turkey Urbanization Review (No. 87180). The World Bank. https://openknowledge.worldbank.org/handle/10986/22388 (Accessed date: 05.08.2021)

[4] Arya, A. (2016). Post Disaster Urban Redevelopment Sustainable Redevelopment of Kathmandu Valley After Earthquake. Master's Thesis. The Faculty of Engineering Sciences at The University of Duisburg-Essen.

[5] Manganelli, B., Tataranna, S., Pontrandolfi, P. (2020). A Model to Support the Decision-Making in Urban Regeneration, Land Use Policy. 99,104865. ISSN 0264-8377.

[6] Gittell, R. J. (1992). Renewing Cities. Princeton University Press. ISBN 0691042934

[7] Candas, E., Flacke, J., Yomralioglu, T. (2016). Understanding Urban Regeneration in Turkey. International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences. 41.

[8] Tekeli, İ. (2011a). Settling Systems and Settling History Articles. Istanbul: Tarih Vakfı Yurt Yayınları. Pg. 483–498 (In Turkish).

[9] Habitat III, T. (2014). National Report. The Ministry of Environment and Urbanization, Ankara–Turkey. https://habitat3.org/wp-content/uploads/turkey-habitat-iii-national-report_final_v2.pdf (Accessed date: 01.08.2021)

[10] Tunc, A., Yomralioglu, T. (2016), Evaluating the Ownership Structure in Land Regeneration Applications (7980). In: FIG Working Week 2016 Proceedings. 2-6 May. Christchurch, New Zealand. https://www.fig.net/resources/proceedings/fig_proceedings/fig2016/papers/ts06a/TS06A_tunc_yomralioglu_7980.pdf (Accessed date: 08.01.2021)

[11] CSB. (2018). The Ministry of Environment and Urbanization, Presentation on the Law no.6306 and Urban Regeneration. Ankara.

[12] Urban Regeneration Action Plan. (2019). The Ministry of Environment and Urbanization. https://csb.gov.tr/kentsel-donusum-eylem-plani-aciklandi-bakanlik-faaliyetleri-28602 (Accessed date: 10.06.2021)

[13] Aydinoglu, A. C., Kara, A., Yomralioglu, T. (Eds.). (2012). TUCBS Conceptual Model Components. Ministry of Environment and Urbanization, General Directorate of GIS, Ankara, https://webdosya.csb.gov.tr/db/cbs/editor dosya/TUCBS_KavramsalModel1_1.pdf (Accessed date: 08.01.2021)
[14] Tastan, B., Aydinoglu, A. C. (2020). An Approach for Determining Disaster Risk As A Part of National Data Models. Fresen. Environ. Bull. 29(1), 6-18.
[15] INSPIRE (2018) Training Document.. https://www.geo-train.eu/modules/Basics_of_inspire_data_specifications/update/pdf/inspire_Data_specifications_01-18.pdf (Accessed date: 01.08.2021)
[16] Cagdas, V., Kara, A., Van Oosterom, P., Lemmen, C., Işıkdağ, Ü., Kathmann, R., and Stubkjær, E. (2016). An Initial Design of ISO 19152: 2012 LADM Based Valuation and Taxation Data Model. ISPRS Journal of Photogrammetry and Remote Sensing. 4, 145-154.
[17] International Organization for Standardization. (2012). Geographic information - Land Administration Domain Model (LADM). (ISO 19152, 2012).
[18] Lemmen, C. H. J. (2012). A Domain Model for Land Administration. Ph.D. Thesis Technical University Delft. ITC Dissertation 210. ISBN: 978-90-77029-31-2. 96 https://www.iso.org/standard/51206.html (Accessed date: 01.09. 2021)
[19] Aydinoglu, A. C., Bovkir, R. (2017). Generic Land Registry and Cadastre Data Model Supporting Interoperability Based on International Standards for Turkey. Land Use Policy. 68, 59-71.
[20] Aydinoglu, A. C., Kara, A., Yomralioglu, T. (Eds.). (2012). TUCBS Land Registry and Cadastre Data Specifications Document. Ministry of Environment and Urbanization, General Directorate of GIS, Ankara. https://webdosya. csb.gov.tr/db/cbs/editordosya/TUCBS_TK1_1.pdf (Accessed date: 08.01.2021)
[21] TUCBS (2020) Geology Data Specifications Document. (n.d.). https://webdosya.csb.gov.tr /db/jvsb/webmenu/webmenu12148.pdf (Accessed date: 01.12.2020)

Received: **25.03.2022**
Accepted: **17.04.2022**

CORRESPONDING AUTHOR:

Ezgi Sezgin
Department of Geomatics Engineering,
Istanbul Technical University, 34469
Istanbul – Turkey

E-mail: ecandas@itu.edu.tr