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ARCHITECTURAL AND URBAN TRANSFORMATIONS OF LARGE HOUSING ESTATE RELATED TO FUNCTIONAL DIVERSIFICATION: CASE OF KELENFÖLD IN BUDAPEST

Hlib ANTYPENKO*, Melinda BENKŐ

Department of Urban Planning and Design, Faculty of Architecture, Budapest University of Technology and Economics, Budapest, Hungary

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Abstract. Large housing estates (LHEs) is a global product of modern planning and architecture based on the concept of the functional city. However, during the last decades, these inherited mass housing neighborhoods have been gradually transformed in their social and physical context. Much of this change is due to functional diversification of LHEs following rising consummation demands. The objective of the research is to create a general simple typology discovering this phenomenon and providing a method to make case study analysis and comparative studies. How to classify functional diversification and morphological transformations in LHEs in general? What are the functional and morphological values that were preserved from modern development period and what are the new characteristics of contemporary transformations? What are the special characteristics of the functional diversification in a post-socialist city? Kelenföld case study from Budapest is introduced to test the typology by using local documents and fieldwork methods in architecture: mapping, morphological analysis, and photo making. Kelenföld is one of the best located and the first LHE in Budapest realized with large panel technology in the 60's, being today intensively developed and favored by its users.

Keywords: Budapest, functional city, functional diversification, large housing estate, typology of transformation, urban renewal.

Introduction – LHEs socialist past and post-socialist present

Large housing estates (LHEs) is a housing typology that originated in Europe in the mid XX century as a respond to the post-WWII housing shortage, employment driven migration, and general need for modernization of the living urban space (Glendining, 2021). In Central and Eastern Europe (CEE), however, it was also a political instrument of communist regimes to form a new society, therefore became fundamental component of modern planned cities (Power, 1997). In its original planning concept, LHEs followed the ideas of the "functional city" created before WWII as part of the modern movement and internationally declared by the Athens Charter in 1933 (Musterd & van Kempen, 2005). The principal idea of the functional city laid in clear zoning of the three essential urban functions – housing, working, and recreation, where traffic was described as a linking element (Gold, 1998). Whereas, during the mass housing production period, residential buildings and public facilities had to be implemented through industrial means of prefabrication (Harbusch et al., 2014). From architecture point of view, large housing estates were meant to be socialist-modernist and free from any historical reference, owing to influences of Le Corbusier (Berman, 1982). In most of CEE countries, including Hungary, prefabricated LHEs construction started by the first fifteen-year housing programs in early 1960s and ended with the political and economic change ignited by the collapse of the Soviet Union at the end of 1980s. This 30-year, so called panel period is the time when LHEs were being constructed in the socialist cities using similar urban and architecture methods. Equality was set to be the key ideological goal for residential planning, where everyone had to have a comparable access to the comparable public amenities (Metspalu & Hess, 2018). Land use program for housing estate planning and construction, general master plan, typification of building design and dwelling units were developed by specialized central planning and design institutes under state control (Murie et al., 2003). These institutes managed to develop norms for typification/standardization not

*Corresponding author. E-mail: *hlib100694@gmail.com*

only for the prefabricated architecture but for the urban space and composition of the housing estates as whole. At the same time, with much of the similar looking architecture and urban elements, LHEs had exceptions in architecture and space design, depending on the country and even within the same city (Engel, 2019). Nonetheless, by the end of 1980s most of the socialist cities of CEE region inherited large housing estates with strict functional division, good basic public facilities and green areas, but missing urbanity.

In post-socialist countries, after 1990, aimed at devising a radically different approach to financing, construction, and distribution of flats, thus liberating the state from its previous commitments, the reform involved drastic reduction of state funding and market control of residential construction (Struyk, 1996). According to national policies, the destiny of public facilities and open space present divergent stories. In Hungary, residential buildings became condominiums privately owned by residents, meanwhile public buildings and open space remained public but the property of the city and not of the state (Benkő, 2015). After this transition period, in which the LHEs were neglected and abandoned, nowadays some of them being in very good position within a dynamic city, entered in a new development phase (Jovanovic & Ratkaj, 2014). It is notable, that at the time of their construction, LHEs were glorified for quickly and cost-effectively dealing with the housing deficit, while offering relatively good housing conditions and necessary public functions (Dekker et al., 2005), whilst in its later periods of development are often stigmatized and become underrated residential areas. This negative evaluation of LHEs is often a subject to the obvious physical deterioration, the monotony and low energy efficiency of the prefabricated buildings, and lack of urban functions compared to the more attractive city centers (Neducin et al., 2019). Today, several decades after their construction, all these and many other factors lead to the physical transformation of the inherited urban form and architecture of LHEs.

1. Functional diversification of LHEs

Functional zoning with public functions related to the socialist lifestyle of the original plans of LHEs is now being challenged by the rising consumption demands and general need for modernization. This phenomenon can be called functional diversification. In other words, it is a renewal process that works against the original functional division trying to use the existing advantages (e.g. urban position and infrastructure, green areas, population density, etc.) to shape LHEs as a contemporary mixed-use development (Hirt, 2012). This mixed-use development, however, does not always have a positive impact on the original urban composition of LHEs. Taking into consideration this atypical functional change within the inherited urban structure of LHEs, the paper aims to test a methodology of transformations based on functional diversification using a special Hungarian case study: Kelenföld LHE. It has a special position within the city: geographically is very well located, in addition it was the first LHE to be built by soviet panel technology in Budapest. As consequence, its social status was always good, and in today's capitalism (Szabó & Burneika, 2020), its location became a main value giving chance for actual complex developments (Balla et al., 2017).

How to classify functional diversification based on the characteristics of the physical environment of LHEs in general? How functional diversification affected the redevelopment of the urban form and architecture profile of the estate after 1990? What are the functional and morphological values that were preserved from socialist development period and what are the new characteristics of contemporary transformations in Kelenföld LHE?

2. Methods to create a functional typology

The objective of the research is to create a general simple typology related to the functional diversification of the large housing estates that can be valuable in any situation.

Taking as a reference the hierarchy of basic elements of urban form by Kropf (2014), where urban form is characterized by built and open space elements, we introduced two main morphological categories: the mass and void, and their functional subcategories: residential or public buildings; transport or recreational space (Table 1). The following paragraph explains components of this functional typology.

The research uses literature with multidisciplinary approach, analyses planning documents, however, it focuses on the architecture and urban design phenomenon of selected case study – Kelenföld LHE in Budapest. This case study is introduced to test the developed typology by using local documents and fieldwork methods in architecture: mapping, morphological analysis, and photo making.

The main built function of LHEs is residential (A1), as it presents most buildings on the site. Depending on the country and region of LHEs' location the typology of housing buildings varies. In addition to this, structural and technical variations of LHEs' residential buildings provided different opportunities for the integration of other functions in it at the time of construction and later when they were being transformed. It is also notable that roofs in all the housing types were always technical areas and remain as such till today. In general, apart from common belief that housing buildings in LHEs were monofunctional it is not true. Many of these buildings, even in the socialist times had ground floor space reserved for public services like grocery shops and post offices. It is notable that such buildings were placed next to the major transport and pedestrian routs, while their monofunctional counterparts were always nestled inside the housing estate.

Besides some basic daily services which could be found on the ground floors of residential buildings, the

Table 1. Typology of functions in LHEs (source: author, 2022)

A. MASS [BUILDINGS]		B. VOID [OPEN SPACE]	
A1. Residential	A2. Public	B1. Transport	B2. Recreation
dwelling units and common spaces of the building (staircase, storage, garage, rooftop)	facilities of the urban infrastructure: stations, parking or technical buildings	road system, parking	playgrounds, sport fields, small green areas between buildings
	1st level: primary schools, kindergartens, day nursery, grocery shops and retail outlets		
	2nd level: banks, post offices, culture clubs, special stores, cinemas		green urban park, public space, open-air market, outdoor stadium
	3rd level: administration buildings, large cultural centres, theatres, museums		

more complex cultural, social, and medical facilities were distributed in standalone buildings (Karro, 1975). In the Soviet Union these functions were planned according to the "stepped system of public function distribution" (A2). It had a goal to provide large housing areas with necessary public function related to the socialist lifestyle, and therefore pre-defined access to workplaces, services, and recreational facilities (Yanitsky, 2009). This system consisted of three levels based on the frequency of use. On the 1st level called "daily" basic functions had to be the most accessible to the residents, e.g. kindergartens had to be placed within 300 m, primary schools, groceries 500 m radius around a residential building. 2nd level was called "periodical" with public functions, such as post office, clubs, special stores, cinemas, etc. These functions were presumed to be accessed via the walking distance or by public transport. Last, the 3rd level called "occasional" included functions of the city level importance such as administration buildings, large cultural centers, theaters, museums, and parks. These functions could be placed outside the LHE, but within 30–40 minutes public transport travel distance. All these calculations were achieved empirically in the Soviet research institutes after a careful study of daily activities of the Soviet people (Kartashova & Zhavoronkova, 1971).

The linking element between built functional elements of LHEs is the open space itself. Largely inspired by the Ebenezer Howard Garden City and later modernist principles for urban space design of Athens Charter, the open space of LHEs was initially envisioned as an urban park for all, where robust vegetation played identifying role. It may seem that the main function of the LHEs' space is a continues urban green, in fact, starting from its socialist period of development it had several other important functions related to recreation and transport. Roughly it can be divided to transport(B1) and landscape/recreation zones (B2). Transport elements are car and pedestrian roads/paths, and parking areas. Landscape and recreation are the remaining zones where trees and other plants grow forming park areas or if left unmaintained transitional green zones. Green areas in LHEs cover approximately 40–45% of the total land (Treija et al., 2013). These vast open areas of LHEs contain functions related to sport, leisure, and rarely retail. This includes sport and playgrounds/fields, dog walking parks (common for post-socialist development of LHEs), and outdoor markets.

3. Kelenföld case study

The Hungarian capital Budapest has 13 large housing estates (Figure 1) planned for more than 20 000 inhabitants realized during two 15-year mass housing programs between 1960 and 1990 (Losonczy et al., 2020). The first LHE to be built by panel technology – Kelenföld, is now one of the most developing residential areas of the Hungarian capital. The construction of Kelenföld LHE started in 1966 to the large extend as a greenfield project next to the historic urban core of Budapest, and to a lesser extent as a reconstruction of the existing district in the area of the Kelenföld railway station (Balla, 2021). From the very beginning the whole development was limited to the west and north by the railroad (Figure 2). To the east the estate was bordering industrial zone, that would stretch up to the riverbank of Danube. Now, most of these riverbank industrial zones are redeveloping for residential, commercial and business use, with some of the most rapid contemporary developments in Budapest.

The original planning concept divided Kelenföld housing estate in four parts by the major traffic axes: West-East direction by the Etele street to provide a connection between the railway station, the industrial zone and Danube River, and North-South direction, the Tétényi street as the main axis for public transport towards Budapest center. Each of the four parts of Kelenföld estate functioned as a school district, having independently all of the 1st level public functions (schools and kindergartens) to ensure daily accessibility by its residents. Following the Soviet

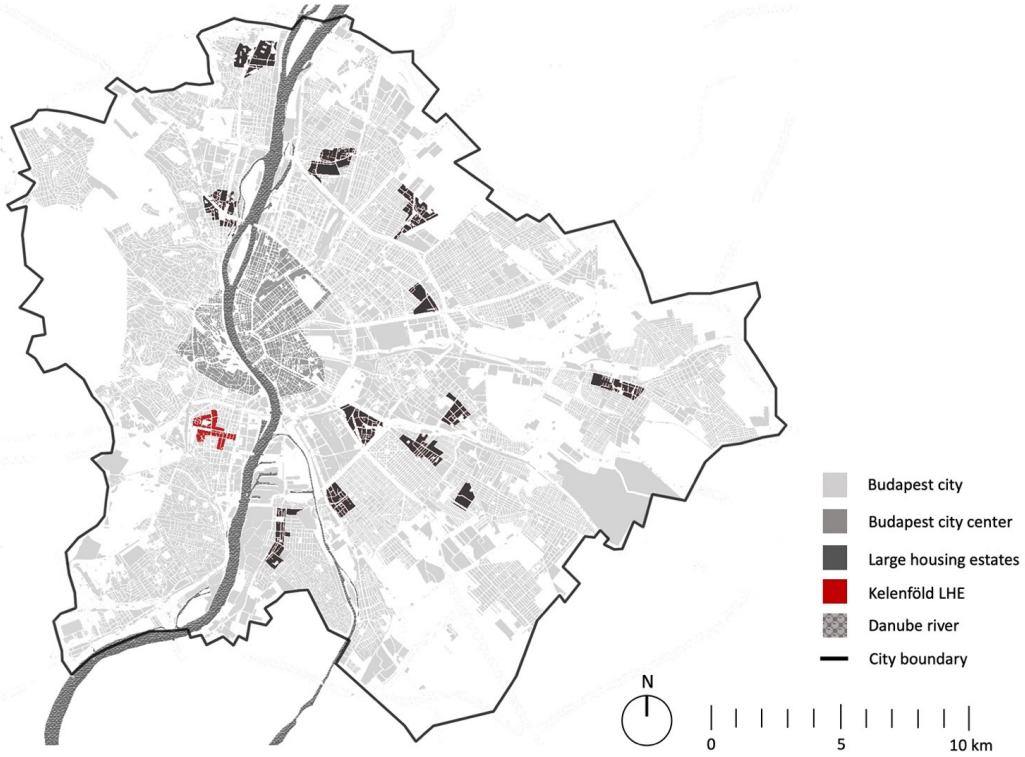

Figure 1. Kelenföld and 12 other LHEs on Budapest map (source: author)

Figure 2. Kelenföld LHE seen from Est, 1970 (source: Fortepan, 2022)

principals of LHEs planning children's facilities were placed in the inner parts of the four residential zones, whilst grocery shops and other basic services appeared to be at the crossroads and along the main traffic ways. In the 1971 Budapest General Plan the goal to establish a new sub-center in this area was formulated. As a result, at the intersection of Etele and Tétényi streets a 2nd level public center with a district park were planned and completed in 1980. The public center had all the necessary function typical for socialist time LHEs and was architecturally grouped as one complex of buildings. The central green park, so called Bikás park became a new urban park with outdoor recreation facilities.

4. Typology of transformation in Kelenföld LHE

Following the established functional typology (Table 1) this chapter will analyze the character of urban transformations that happened in Kelenföld LHE after 1990 due to infrastructure development and socio-economic changes resulting in functional diversification (Figure 3).

4.1. Residential buildings

Kelenföld was the first housing estate of Budapest realized with Soviet panels prefabricated in the new housing factory. The construction started in 1966 when only 3 types of 10 story high slabs and towers were being used. These residential buildings had no public functions, but obviously offered common spaces for their inhabitants: the staircases, storage and parking areas in the basement or ground floor zone. Some of these buildings today host smaller businesses on the ground floor in the privatized flats. At the beginning of the 70's, three 15 story high towers were built using monolete concrete technology for only residential function, after 1990 their functional composition has not changed. In the last phase at the beginning of 80's, a new building type, so-called "house with legs" appeared along the Etele street. In these residential buildings, the ground floor area had solely public

Figure 3. Kelenföld LHE actual structure and functional composition, 2022 (source: author)

function, giving space for retail and services, thus, creating promenade along the Etele street. It still functions today, as smaller businesses continue to utilize ground floor of these buildings (Figure 4).

In Hungary, after 1990's privatization, slabs and towers became independents condominiums. Consequently, none of the residential panel buildings were demolished or drastically transformed. But due to the "Panel program" initiated in 2000, some of the condominiums applied and realized a technical renovation (exterior insulation and painting of the facades). Nevertheless, due to excellent position, infrastructure development, and social composition of Kelenföld (Kovacs et al., 2018), three new housing projects appeared in the housing estate. In Hungary, this is not a typical phenomenon, while other modern housing estates are being stigmatized and shrink. Two of these contemporary residential developments have a fenced plot and can only be accessed by its residents. However, the biggest one realized on the area of the former business center in the "city center" of Kelenföld along the Bikás park, has a ground floor designated for public use (Figure 5). This new building complex consists of three 10 story high residential towers which accommodate 168 apartments, and their ground floor zone is supposed to become a rented office space.

Figure 4. Use and reuse of the ground floor in panel buildings the "legs" residential buildings from the 80's (source: author)

Figure 5. Contemporary residential complex along the Bikás park (source: author)

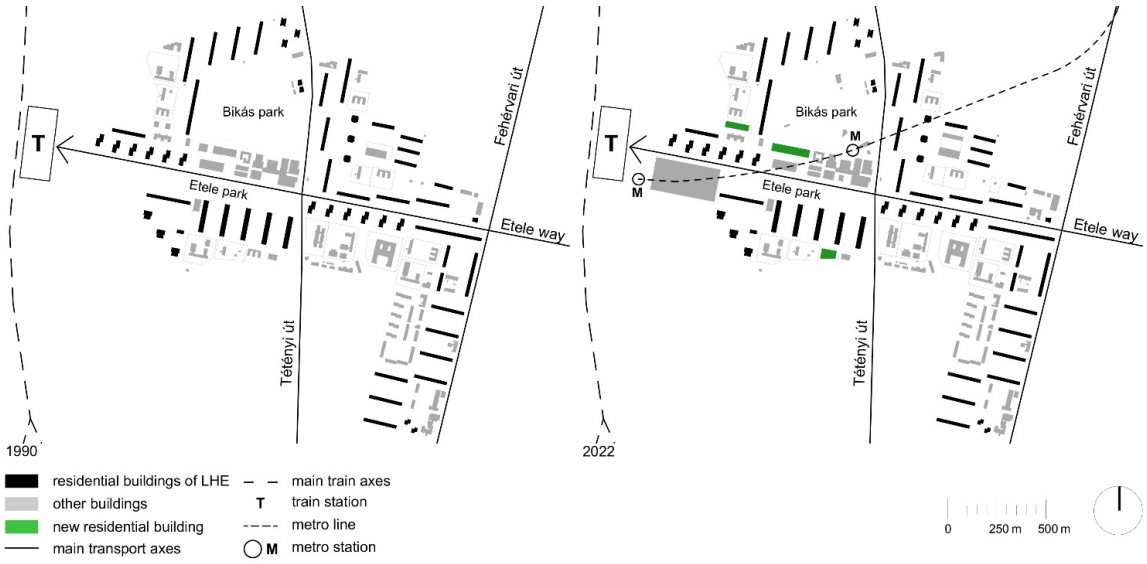

Figure 6. Kelenföld residential buildings in 1990 and 2022 (source: author)

We can state that the functional diversification is not a typical phenomenon in the residential buildings, because the panel slabs and towers are generally located far from the streets and their physical structure and appearance do not give good options for public utilizations (Figure 6). In addition, the developments of new public facilities (see next part) work against the existence of small commerce and services in the housing estate.

4.2. Public buildings

In Kelenföld LHE, four "school districts" were formulated and functioned (NW: Keveháza, NE: Mérnök, SE: Leiningen, NW: Bikszádi) with the same building types forming an educational complex of primary school (6–14 years), kindergartens (3–6 years), nurseries (0–3 years). Kelenföld housing estate, as every housing estate in Hungary, started shrinking after 1990. Due to ageing, shrinkage of population, and social policy changes most of the daily nursery were closed and primary schools are reorganized. The Mérnök school has been demolished and replaced by SZÁMALK-Salesian Post-Secondary Institute, thus becoming a state importance institution no-longer belonging to the housing estate or the 1st level function. Besides that, other 1st level public facilities have not really changed functionally. Architecturally they also didn't change a lot, except for repairments of the facades and interiors.

The core of the public function was, however, established in the so-called "city center" of Kelenföld next to the Bikás park. Architects of Kelenföld city center visioned it as a key functional element to bring the estate a "non-sleeping" character. The first building of the complex, the ABC store was opened on March 17, 1975. Olimpia cinema named in honor of the 1980 Moscow Olympics, was built in the last phase of the Kelenföld "city center" construction in 1979 (Pesti, 2019). The "city center" also had a restaurant, an office center, a cultural center and a library. The cultural center was the capital's first complex cultural institution and had to serve primarily the Kelenföld housing estate purposes, but finally it became important for the whole district with its facilities designed for performances, literary evenings, concerts, and various professional group events. This modern commercial and cultural center, as one of the key examples of Hungary, was selected for the Othernity project of the 2021 Venice Biennale (Othernity, 2021).

With the opening of M4 metro line in Budapest in 2014, 2 metro stops (Bikás park and Kelenföld) appeared within the area of Kelenföld LHE, establishing a stronger connection of the estate with the rest of the city. Kelenföld railway station with a metro stop are now becoming a booming area for the real estate investment. Almost 45 years later Kelenföld city center changed its function and architecture character to a certain extent (Figure 7). The Olimpia cinema stopped working in 2000, the office center building was demolished and now being replaced by a residential

Figure 7. Kelenföld former 2-story high public center, at the crossroad of Etele and Tétényi streets, 2022 (source: author)

Figure 8. Fast-food restaurant from the 90s developed next to former cultural centre Kelenföld LHE, 2022 (source: author)

Figure 9. Etele street view: Kelenföld LHE with renovated panel slabs and the ETELE shopping mall opened in 2021 (source: author)

complex. The market building remains unrenovated with new retail and public services inside, as well as a new building for the fast-food restaurant placed nearby (Figure 8). In general, today Kelenföld city center is being alienated from the contemporary renovation works of Bikás park and real estate construction nearby, thus losing its original importance. Last years, real estate had a huge pressure on the district municipality to sale the complex for demolishment and redevelopment to a high-density mixed-use area. Due to local protest and actual economic changes, maybe this drastic transformation won't be realized soon.

The newly built Etele Plaza used the excellent urban position being at the developing Budapest's Western Gate. European and national funding helped to realize the infrastructure development of Hungary's biggest intermodal hub (renewed Kelenföld railway station, new metro line terminus, new tram line terminus, new bus terminus, P+R parkings) at the edge of a populated housing estate. As a result, the shopping mall built in 2021 placed between the housing estate and the hub creates a new functional center of the city scale importance: 180 shops, 1300 parking places, cinema, cafes, and restaurants. The huge closed box of the shopping mall appears to be on the border of LHE, and opened only towards the hub forming a new gate for the housing estate (Figure 9). All these developments transformed the original urban composition of this area, and the Etele street connecting the hub and the Danube became the main axis of the neighborhood.

Another functional center that is being developed now is located at the eastern edge of the LHE on the Etele street. The former one-story high department store from socialist time is now replaced by a multistory business center. In addition to that, in 2014, next to the business center a Catholic church was constructed, which adds 3rd level cultural function to the LHE (Figure 10).

Besides this large-scale functional diversification of the housing estate, the transport and green area developments resulted in construction of some new public buildings as well: e.g., the Bikás park metro station in the middle of the LHE, tram and bus station pavilions, and several new

Figure 10. Kelenföld public buildings in 1990 and 2022 (source: author)

public facilities in the central park: "Újbudai" sport center, restaurant, public toilet.

Today, Kelenföld housing estate can be classified as a mix-use area, where several former public facilities exist together with new public buildings realized on the site of former industrial, educational and office buildings along the reevaluated Etele axes and around the renewed central green park.

4.3. Open space related to transport function

Following the basic principles of modernism, Kelenföld LHE has a free planning composition of buildings floating in the green open space, the backbone of such urban structure is transport/road system or circulation. Roads and pedestrian paths divide the space of the housing estate forming smaller and more defined functional groups. In Kelenföld as in the majority of LHEs, parking spaces are set outdoors directly to the residential and public buildings. Regardless, the increase of car users in post-socialist time, the area for car parking in Kelenföld has not considerably changed, with an exception of linear parking space between the Bikás park and city center of Kelenföld, which was recently reduced in size in favor of green park space. Parking lots itself were renovated with new pavement materials.

Thanks to the urban infrastructure developments, the whole neighborhood is renewed following sustainable urban transport concept. Busy buses are replaced by the new metro (M4) and tram line (T1), so the air pollution is reduced. The inner zone of the Etele street became a green tram lane, new separated cycling lines also serve the area. Pedestrian roads and footpaths have also been renewed, especially those belonging to the renovated parks and courtyards increasing the walking condition everywhere within the LHE.

4.4. Open space related to recreation function

The remaining open space is given to the district parks, courtyards, and transition green spaces (Figure 11). In case of Kelenföld district parks are Bikás and Etele parks placed in the center of the estate. These open spaces are the most renovated and developed from functional and design points of view. Etele park remains a green boulevard without additional public function. Bikás park was and still is a multifunctional urban park with considerable renovations and additional public functions like sport- and playgrounds (Figure 12).

Courtyards are the smaller scale park areas in the housing estates that play satellite green space function and have a more private character in comparison to the district parks (Figure 13). In LHEs courtyards were designed in-between the residential buildings and as fenced areas belonging to schools, kindergartens, hospitals. In Kelenföld, residential courtyards have playgrounds, dog walking areas, and recreation areas with benches. Courtyards are placed between 2 residential building, with one building being directly attached to it and the other being separated from it by road and parking (Figure 14). Most of the courtyards have been considerably improved recently with the instalment of a new equipment and fresh landscape design. One of the courtyards in the bottom right quarter of the estate acquired a community garden. It is notable that the majority of functional spaces in the courtyards are now fenced, this comes from the current Hungarian regulations. School and kindergarten courtyards have not changed its function but were also renovated and now consist of mainly sport and playgrounds.

Transition spaces are the remaining open areas that have no specific function but serve as buffer green zones. These are the areas next to the roads or unmaintained parts of residential courtyards or urban parks.

Figure 11. Kelenföld open space in 1990 and 2022 (source: author)

Figure 12. Kelenföld' central green park, the Bikás, 2018 (source: author)

Figure 13. Kelenföld residential courtyard view, 2022 (source: author)

Figure 14. Kelenföld residential courtyard view on the parking and entrance area, 2022 (source: author)

5. Results and discussions

In (Table 2) the summery of architecture and urban transformation related to functional diversification of Kelenföld LHE is presented. The results for building and open space functions' transformation are grouped by renovation/transformation, demolishment/replacement, and new development. Most of the renovation carried in Kelenföld is related to the open space and landscape function. District parks and residential courtyards were transformed significantly after 1990. Both of the building functions share minor transformations, mainly related to the technical condition of the buildings and space reuse for new functions.

Table 2. Types of architecture and urban transformations in Kelenföld LHE (source: author, 2022)

	Renovation/transformation	Demolishment/replacement	New development
Residential buildings	Effect of the privatization: some of the ground floor spaces are reused for public functions (local shops, services) Panel program: facades renovation building by building funding (insulation, painting) Individual appropriation (e.g. balcony, entrance)	No	Three new market based housing developments
Public buildings	Renovation / renewal of some buildings Functional changes / e.g. daily nursery became an office	Demolition of a primary school and construction of a higher educational institution Demolition of a sub-center and construction of an office building and a Catholic church Demolition of an office complex and construction of residential complex	– Etele plaza shopping mall – Bikás park metro stop, sport center, restaurant, public toilet
Transport related open space	Roads and parking improvement Tram lane and cycling path along the Etele street	Some parking places at the edge of the Bikás park became green surface	No
Recreational open space	Bikas park renovation Etele park renovation Small open "courtyards" renovation	Playgrounds by EU norms Renewal of sport fields	No new green zone but functional diversification e.g.: – Dog walking parks – Fences – Sport and playgrounds – Community garden

With the few public buildings demolished in the estate most of them were replaced with new functional elements. At the same time, none of the residential buildings from socialist time were demolished. Three new housing projects doesn't change the panel character of the estate and are generally monofunctional developments. The road system and its functional elements also remained the same, with an exception of Bikas Park parking space reduction. Most of the new developments can be seen in the open space and built public functions. Most noticeable changes are in the center of the estate and at its borders.

Conclusions

The aim of the paper was to create a typology of architecture and urban elements in LHEs using their functional character and see how these elements changed in time. The typology is working and obviously could be applied in different situations to understand the contemporary divergent stories of LHEs: shrinkage, intensification, informal changes, etc. However, it could be useful to realize comparative studies to discover architectural and socio-economic differences in national or international level, as well.

Kelenföld case tests the method and presents a special functional diversification phenomenon, which is not typical for all the housing estates. Here, the infrastructure and real estate developments provoked some morphological changes: Etele street became the main axis of the urban structure, new buildings replaced previous one with bigger and higher volumes, and as a consequence the inner organization of LHE was modified. However, the changes are planned and new elements work together with the inherited estate. Panel housing remains monotonous both functionally and architecturally, with some contemporary housing projects emerging on the site. Likewise, panel housing, built public facilities of the 1st level can be improved architecturally or even replaced with new buildings in the future, but even now they function well. Functional strengthening of the perimeter of the estate goes against the original concept of Kelenföld "city center" that had to become a functional dominant of the estate, however, it can be an effective strategy today, preserving the housing estate from excessive noise, traffic, and human movement. Today, Kelenföld "city center" looks, neglected, compared to its socialist past. It could still get functional and architectural enhancement, making it attractive but not too busy and central for the rest of the city. On the other hand, Bikás and Etele parks functions and urban qualities were improved, now they play central public role in the estate. Residential courtyards become more mixed use, but not proportionally, with some courtyards being more redeveloped and attractive, while others not. Afterall, Kelenföld architecture and urban transformations related to functional diversification is largely a result not only of its good position within the city, but contemporary urban infrastructure developments and the inherited modern environment providing good living conditions.

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