



# Transit-Oriented Development as a Tool of Urban Transformation Addressed at Urban Regeneration Processes

Cristina I. Covelli

## Abstract

Transit-oriented development is a theoretical and practical framework that represents an important tool for municipalities, private actors and citizens to enhance urban transformation. Furthermore, there has been a growing interest to understand and implement this concept within urban planning practice. Mixed land use is an element that influences the transit-oriented development level of an urban area; therefore, it is important to further understand the role of this element and find paths to strengthen it and use it for urban regeneration processes. The main objective of the principle of mixed land use is to create more vibrant, well-connected and sustainable urban patterns. Adding to that, urban structures with a high mixed land use percentage provide citizens with a sufficient amount of services within walking distance and therefore decrease car dependency structures. However, areas with low mixed land use patterns will reproduce less dense, car-dependent urban areas. This research intends to provide tools to measure and assess mixed land use in an urban context so that it could be applied in urban regeneration processes. This research wishes to expand the scope of previously done studies in the sense that it will evaluate six parameters within mixed land use and at the same time expand the knowledge of the influence of TOD in urban regeneration projects. The study case that was assessed was Citylife, which is one of the biggest urban generation projects in Europe. The parameters measured were complementary uses, access to local services, access to parks and playgrounds, affordable housing, housing preservation, and business and services preservation. The methods that were used to perform the evaluation of these parameters are mapping, using geoinformation systems, specifically Qgis. Other methods used were literature review and observations. The

conclusions describe the weakest and strongest parameters that were evaluated and the way in which Citylife could increase mixed land use patterns.

## Keywords

Mixed land use • Urban regeneration • Complementary uses • Affordable housing • Access to local services • Housing preservation • Transit-oriented development • Mixed urban patterns

## 1 Research Framework

The goal of this research was to perform a mixed land use assessment of Citylife using the transit-oriented development theoretical and practical framework to highlight the importance of encouraging higher mixed land use patterns in urban regeneration processes. This research aims at understanding the implementation of the transit-oriented development mix principles in the area around an urban regeneration project in Italy and contribute to aim at a more sustainable growth pattern. Also, this research contributes to expanding the knowledge about how transit-oriented development is being implemented in Italy's urban development and land planning policies.

More in detail, this research will help to understand how TOD principles could be effectively implemented in a specific area, analyse the results and propose improvements to further contribute to transport planning and urban planning synergies and therefore thrive for planning methodologies that contribute to aim at more sustainable cities.

To develop the proposed goal, the following objectives were formulated:

- (1) Implement the transit-oriented development standard 3.0, specifically the variable mix around the Citylife urban regeneration project.

C. I. Covelli (✉)  
KTH, Stockholm, Sweden  
e-mail: [covellig.cristina@gmail.com](mailto:covellig.cristina@gmail.com)

- (2) Analyse the results of the assessment done on the area of study.
- (3) Propose enhancements to the area of study to aim at a more sustainable neighbourhood aligned with TOD principles.

Within the first objective, the assessment evaluation method was implemented within a 500 m radius surrounding the area of the Citylife urban regeneration project. The mix variable with its six subcategories included in the TOD standard 3.0 was evaluated using spatial analysis tools as well as observations, satellite images, pictures and an interview. Regarding the second objective, the evaluation was applied, and the classification of the chosen area was made accordingly to the three different categories defined by the TOD standard: Gold, Silver and Bronze. To achieve this objective, the results were analysed throughout the document and then summarized in the conclusion section. In this case the observations and literature review were used to understand the results.

The third objective was achieved through the suggestion of improvements to the variables that did not achieve the highest score. To accomplish this objective, spatial analysis was performed in order to physically place the areas in which the proposed improvements could be implemented. Within the performance of the assessment, it was also suggested how the mix variable could reach 100% of the points assigned to each subcategory.

---

## 2 Research Methodology

The methods used in this analysis were a combination of qualitative and quantitative research methods. The quantitative method used was mapping. Geographical information systems were used to score the variables that resulted from the TOD literature review. Each of the variables analysed was assessed using Qgis software. The qualitative methods were observations and a literature review which were useful to understand and interpret the spatial study that was performed. The literature review was focused on the transit-oriented development theoretical framework which intended to fulfil a comprehensive mixed land use assessment of Citylife. And the observations were performed in the area of study to understand the interaction between the dynamic and static elements of the environment.

More in detail, regarding the first method used which was mapping, geographical information systems were a useful tool to relate geographical information with variables within urban development. In this case, the Qgis software was used to score the variable of mix that resulted from the TOD literature review. The subindicators used on this scoring system included complementary uses, access to local

services, access to parks and playgrounds, affordable housing, housing preservation, and business and services preservation. Each of the subcategories analysed was assessed using the Qgis software, complemented also using statistical tools to retrieve more useful information to understand the spatial results. The statistical analysis was used to build up the ratios needed to unveil the relationship between the analysed variables. The majority of the ratios were shown as a percentage. The ratios that were expressed in percentage were complementary uses and affordable housing.

The second method was observations. A direct on-site observation was performed, specifically, unstructured observations were used to walk around the chosen area of study and analyse how easy was it to walk and get from the transit station Tre Torri to the commercial areas next to it as well as the residential areas.

The third method used was online satellite imagery. The method was used to analyse variables using satellite pictures of the area and sample areas. Specifically, this method was useful to analyse the transformation and urban regeneration that took part during the process in the periods before and after the construction of the Citylife project.

The fourth method was a literature review. This qualitative method allowed further analysis of the spatial information constructed using the first method. It was important to make a comprehensive literature review to understand and analyse the TOD variables and parameters.

The most important steps followed during the research were first to make a comprehensive literature review and research. After that, it was necessary to make sufficient data collection to measure all six subcategories. Also, structure the study visits which took place during the period from January to April 2020. Then, the data was processed, and most results were produced. After gathering all the information that was collected the overall evaluation and recommendations were made. The last part of the research focuses on the final reflections and conclusions.

---

## 3 Transit-Oriented Development and Mixed Land Use in Citylife

Transit-oriented development of a theoretical and practical framework encourages sustainable mobility patterns in the sense that it intends to diversify land use. With the help of this tool, private actors, public organizations, citizens and NGOs can aim at making cities more accessible, safer and more attractive. Urban regeneration projects constitute an important tool for urban planners to use urban land in the most efficient way possible. Subsequently using the TOD framework in urban regeneration processes can unveil guidelines to enhance urban development in a sustainable

way. According to Bertolini, transit-oriented development (TOD) is a concept that aims at building sustainable mobility patterns based on high synergies between land and transport planning. The main essence of this concept is to encourage sustainable means of transportation, build denser and more mixed neighbourhoods and shift away from car-dependent urban areas. This concept has evolved, including more variables that add more complex and integral solutions to shift away from car-dependent urban structures (Curtis et al., 2009).

Areas around a transit station have the highest opportunities to develop high TODness levels. In particular, in Milan, areas around railway stations represent core zones where synergies between land and transport planning could be achieved. Furthermore, within the TOD concept, transit stations represent the node area where mixed land use patterns can be implemented, as well as enhancing walking and cycling networks. Also, within TOD, areas around transit stations should be dense, compact and with less space possible destined for motor vehicles (Liu et al., 2016).

Furthermore, Cervero includes other dimensions within TOD. This theoretician emphasizes the importance of smaller units of analysis such as blocks. He argues that the way blocks are structured in future urban areas is key to determining the accessibility of pedestrians and bicycle users, and how easy it would be for those actors to navigate the road network. Adding to that, the shape of the urban structure can influence car use. He states that shorter distances for pedestrians and adequate networks for bicycle users along with an appropriate mix land use can shape cities into a more sustainable future. To go over the main points of transit-oriented development, Cervero summarizes that TOD policies: “promote more walking and transit riding and less driving: pedestrian-friendly designs such as safe and

attractive sidewalks; small city blocks and a highly connected grid like street network; mixed land uses that place many destinations close to each other, including small storefront ground-floor retail in commercial districts; sufficiently high densities to justify high-quality and frequent public transport services; and community hubs and civic places that promote social interaction and a sense of belonging” (Cervero, 1993).

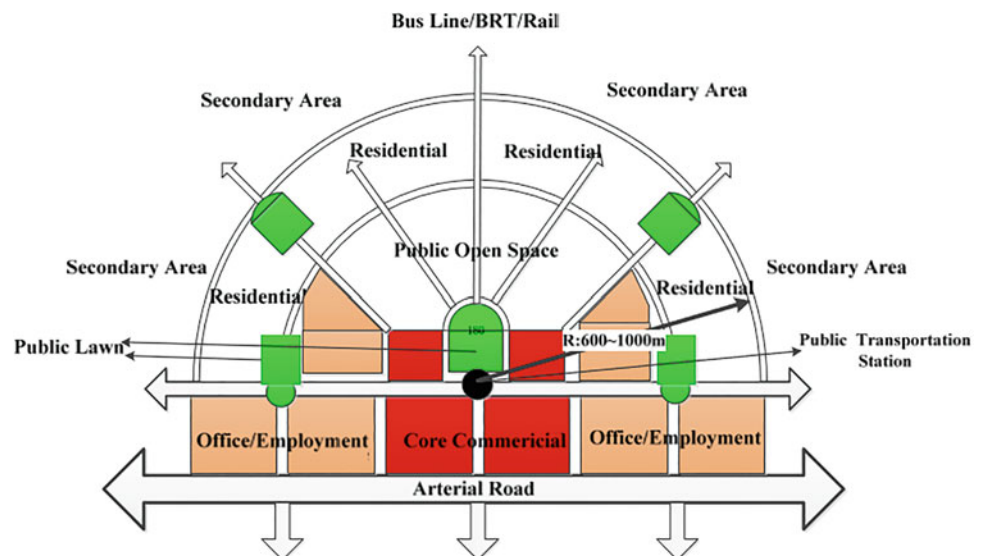
Spatially on the urban structure, the TOD model has been explained extensively by Peter Calthorpe. Researchers Mingqiao Zou et al. explained the TOD morphological model based on Calthorpe’s illustrations. Figure 1 shows a TOD area based on elements such as public transportation station, core commercial, office/employment area, TOD residential area, secondary area and public open space (Zou et al., 2014).

This model explains that within the TOD structure the areas closer to the station are the ones that should have higher development, specifically concentrated within a 500 m radius. Land use intensity starts decreasing from 600 to 1000 m away from the transit station. This model also contributes to understanding the importance of mixed land use within this concept. There is a high mix between residential, commercial, offices and transportations infrastructure. All these elements aim at reducing travel demand (Zou et al., 2014).

This demonstrates that mixed land use can be considered an important factor to aim at TOD development patterns, as it has been proved that higher mixed land use patterns discourage the use of motorized vehicles to transport and encourage walking and cycling.

Affordable housing is one of the topics that have been widely related to TOD. In this regard, the research developed by Pal explores the notion of developing affordable housing

**Fig. 1** TOD model based on Calthorpe (Source Zou et al., 2014)



projects close to transit stations. Specifically, railway stations so that citizens would have access to public transportation options. In that way “easy access to multiple modes of public transit would increase a household’s budget for housing by eliminating the financial burden of owning a car” (Pal, 2018).

Likewise, Pengjun et al. studied the relationship between the citizen’s patterns to choose the residential location and the housing prices. They stated that “When it comes to residential location choice, land use policy should be assisted by housing policy to encourage passengers to choose to live near metro station areas. The high housing prices nearby transit stations may force people, in particular, low-income people, to live far away from metro station areas” (Pengjun, 2018). In this sense, promoting affordable housing residential projects can contribute to TOD principles by aiming at a social mix by the income level of the area and increasing synergies between housing policies and transportation planning.

Transit-oriented development is a concept that contributes to the design of less car-dependent societies and urban areas. Within the theoretical framework of transit-oriented development, the Institute for Transportation and Development Policy (ITDP) formulated a standard that can be used to measure the TODness of a study area. The ITDP is an organization that promotes the use and implementation of TOD policies and best practices to actively reduce car use in cities. This tool within TOD proposes to implement practical measurement of parameters in already built cities as well as in future undeveloped areas to discourage car use and promote sustainable mobility alternatives. This tool is called the TOD standard 3.0. The following section (Sect. 5) will describe the components, variables and parameters used by this TOD standard.

### 3.1 The Citylife Case

Milan planned several urban regeneration projects in the vision 2030 of the comprehensive plan PGT (Piano di governo del territorio, 2019). This research will study one of those projects, specifically Citylife, which is planned to be one of the biggest urban regeneration projects in Europe. The TOD standard 3.0 was applied in the area around Citylife to practically assess the TODness level, specifically the mix standard was evaluated. Areas around a transit station have the highest opportunities to develop high TODness levels, and in this case Citylife represents a study case in which public transportation was key for its development. Areas around railway stations represent core zones where high synergies between land and transport planning could be achieved. Furthermore, within the TOD concept, transit

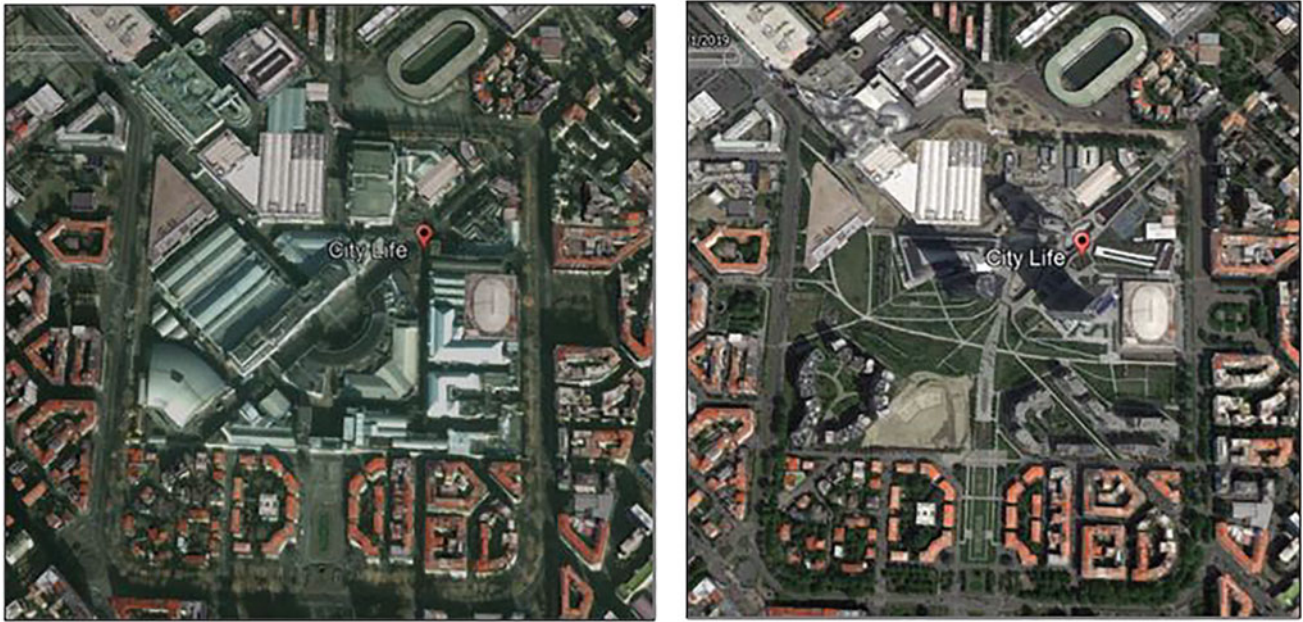
stations represent the node area where mixed land use patterns can be implemented. Also, within TOD developments, areas around transit stations should be dense, compact and with less space possible destined for motor vehicles (Liu et al., 2016).

In 2015, the metro station “Tre Torri” was built as part of the expansion of subway line 5, which aimed to connect the new inhabitants and visitors of the area. According to the TOD model, the urban environment should be based on elements such as public transportation stations, core commercial areas, office/employment areas, TOD residential areas, secondary areas and public open spaces (Zou et al., 2014). This theory explains that within the TOD structure the areas closer to the public transport stations are the ones that should have higher development, specifically concentrated within a 500 m radius. There is a high mix between residential, commercial, offices and transportations infrastructure. All these elements aim at reducing travel demand (Zou et al., 2014). Within TOD there is a strong link between mixed land use and public transport ridership. According to Sarkar et al. “land-use mix was found to be strongly associated with the choice preference of public transport. The coefficients were positive for public and nonmotorized modes, which imply that the trip makers residing in the areas with mixed land use prefer public and nonmotorized travel modes” (Sarkar & Chunchu, 2016). This demonstrates that mixed land use can be considered an important factor to aim at TOD development patterns, as it has been proved that higher mixed land use patterns discourage the use of motorized vehicles to transport and encourage walking and cycling.

In this case, Citylife urban structure represents an area with intense use combining high rise residential, commercial, offices and recreational uses. Higher intensity use areas next to transit stations are also known as urban cores, and urban cores have different types and vary according to their function “there is a desirability core (Stojanovski, 2013), the most desirable TOD zone in the center. The morphological effect on architecture and cityscapes is visible firstly in the TOD CORE zone. The TOD CORE zones are tentative and question the traditional urban design heuristics about walking distances” (Stojanovski, 2015). These core zones areas around a transit station which are reachable within walking distance stand as a valuable element to foster a sustainable urban land use pattern. Under this description Citylife could be considered as a TOD core which enables residents and visitors to be served by a wide array of services within walking distance and foster a high quality of life, decreasing car-dependent patterns.

Milan planning authorities, private developers and citizens involved in the formulation and development of the Citylife project conceived the urban regeneration of an area





**Fig. 2** Milan conference centre hall in 2021 (left); current Citylife project (2020) (Source Google Earth)

that was previously destined as a conference centre. The objective was to include Citylife area into the urban tissue as a vibrant and active part of the city, as stated by Citylife official website: “CityLife is the urban redevelopment project of the Portello district of Milan. This area was previously occupied by the Fiera Milano City and to give new life to the neighbourhood, by creating a space that would enhance the entire city, international architects were used to design the spaces” (Taccioli, 2019). Also, according to the Guiding architects studio “City life went from the former trade fair area of Milan to a new multipurpose district, with three futuristic towers in the middle, residential blocks designed for a new way to live in the city and the first urban shopping district in Italy” (Guiding architects, 2020). Figure 2 shows the physical transformation from the conference centre into the mixed-use new project called Citylife.

Planning documents such as the Milan PGT contain strategies that plan to enhance connectivity, innovation, social equity and regional cohesiveness (PGT, 2019). The specific objectives are to encourage: a connected, metropolitan and global city, a city of attractive and inclusive opportunities; a green, liveable and resilient city and a city that regenerates itself (PGT, 2019). Within the objective of urban regeneration, there are several strategies that include redevelopment and efficiency of urban land use on private and public lots. Also, it considers the equalization and transfer of building rights, recovery of abandoned and disused buildings, among others.

### 3.2 Evaluating Mixed Land Use in Citylife

The fifth principle of the TOD standard evaluation system was applied in Citylife project. More in detail, the Mix TOD principle is subdivided into six subcategories. The first is complementary uses, then access to local services, access to parks and playgrounds, and the fourth one is affordable housing. The fifth one is house preservation, and the sixth one is business and services preservation. The general objective of this parameter is to plan urban spaces adapted for a mix of income, demographics and uses. The first subcategory, complementary uses, focuses on quantifying the residential and nonresidential uses in the same area. More points are given to areas that have a higher percentage of mixed land use. The method consists of finding the mix ratio between the variables of residential and nonresidential use. For example, when the same type of land use has more than 80% of the total floor area the evaluation parameter attributes 0 points. And on the contrary, when the total of the floor area has a predominant use of 50–60%, the parameter attributes 8 points which is the highest (ITDP, 2017).

The second parameter is access to local services. This parameter measures the percentage of buildings that have proximity to the following amenities: primary schools, healthcare service or pharmacy, and source of fresh food (ITDP, 2017). In order to evaluate this parameter, the entrances of the residential buildings in the area are mapped and overlaid with a 300 m distance to the entrances of the

local services. More in detail, higher points are given to developments in which the residential buildings have a walking distance to the entrance of three local service types. On the contrary, fewer points are given to developments in which the residential buildings have close access to two or one type of local service. In this case, the three residential projects in Citylife were mapped along with the education facilities, primary and secondary schools, healthcare services and pharmacies, and supermarkets and restaurants (ITDP, 2017).

The third subcriterion is access to parks and playgrounds which measures the percentage of buildings located within a walking distance to areas such as parks or playgrounds (ITDP, 2017). To evaluate this parameter it was necessary to map the three residential complexes in Citylife along with the parks and playgrounds in the area of the project. The evaluation system gives a higher score to the projects in which at least 80% of the residential buildings are within a walking distance of 500 m of a park or a playground. It is important to highlight that the ITDP scoring system considers only the “eligible parks and playgrounds” and defines them as “at least 300 m<sup>2</sup> in area and publicly accessible 15 h or more per day. If the park or playground has shared use as school yard or physical education facility, school time can be deducted from the opening hours” (ITDP, 2017).

The fourth subcriterion is affordable housing, and this parameter measures the percentage of the housing areas that are considered within the criteria of social housing. Affordable housing is considered as “housing rent which is below 30% of the mean income in the relevant income category” (ITDP, 2017). Within this section, it is required to make a ratio between the residential housing and the affordable housing area. Higher scores are given to areas that have a higher percentage of affordable housing. The fifth subcriterion is housing preservation. This parameter intends to measure the relocation percentage of previous residential buildings that were on the lot in which the new project is built. The evaluation system gives a higher score to those projects in which the previous residential areas were relocated within a walking distance of 500 m away from the original location. In order to perform the evaluation of this subcriterion, it was necessary to find out if there were previous residential areas in Citylife, which was accomplished by a mapping time-lapse using Google Earth. Also, it was complemented with research on the previous land use of the area of study.

The last subcriterion is called business and services preservation. This subcriterion quantifies the percentage of local services that were relocated within a walking distance from the original location. To follow the evaluation process, it was necessary to identify the previous commercial uses of the area of study. In order to perform this evaluation, the previous commercial buildings were mapped. This

procedure was complemented by contacting the current shopping centre located in the area of study and requesting information about possible previous commercial activities.

## 4 Results of Mix Principle Evaluation of Citylife

After implementing the evaluation system, it was found that the best-ranked parameters within mixed land use in this area were complementary uses, access to local services and access to parks and playgrounds. However, there are several actions that could be implemented in the study area in order to improve the mixed land use level. Specifically, affordable housing and business and services preservation. Citylife obtained 17 points out of 25 possible. Table 1 shows in detail the results of the evaluation of all subcriteria considered in the evaluation of the Mix TOD principle within the Citylife development. Results will also be shown more in detail by each subcriteria.

### 4.1 Complementary Uses

The complementary uses subcategory aims to estimate the percentage of each land use category and evaluate its overall weight. With the purpose of finding complementary uses percentage, it was necessary to make a general land use map of the study area. It is required to find the total of the square meters on the project and then classify it according to the use. It was found that the total area of this project was 365.000 m<sup>2</sup> (Systematica.net, 2019). Through the revision of the detailed plans, it was found that 51% of the land is destined for residential use, whereas 34% for office space, 8.7% is commercial, 4.1% for events and 1.7% is destined for parking spaces. According to the scoring system, if the predominant use of the block is between 50 and 60%, it is awarded 8 points out of 8. In this case, Table 2 summarizes the results of the percentage of land use. This table shows that the area studied has optimal land use diversification. This subcategory obtained the maximum score. It could be recommended that other urban regeneration projects would adopt similar percentages of land use, and therefore endure a high land use diversification in the city.

### 4.2 Access to Local Services

To evaluate the access to local services subcategory, the residential buildings of *Citylife* were mapped. Also, three different types of local services were mapped and then the distance between the two layers was quantified and analysed. The first type of service was food, so all supermarkets, small

**Table 1** Mix standard results of Citylife

Mix				
Objective A. Opportunities and services are within a short walking distance of where people live and work, and the public space is activated over extended hours				
5.A.1 Complementary Uses	Residential and nonresidential uses within the same or adjacent blocks	Max score 8	Obtained score 8	Predominant use is 51%
5.A.2 Access to Local Services	Percentage of buildings that are within walking distance of an elementary or primary school, a healthcare service or pharmacy, and a source of fresh food	3	3	80% of buildings have access to two types of services
5.A.3 Access to Parks and Playgrounds	Percentage of buildings located within a 500-m walking distance of a park or playground	1	1	100% of the buildings were located within 300 square meters from a playground, park or green area
Objective B. Diverse demographics and income ranges are included among local residents				
5.B.1 Affordable Housing	Percentage of total residential units provided as affordable housing	8	1	0% of the housing market has a selling price below 30% of the mean of the selling price
5.B.2 Housing Preservation	Percentage of households living on site before the project that is maintained or relocated within walking distance	3	3	No relocation; there were no any previous housing projects
5.B.3 Business and Services Preservation	Percentage of pre-existing local resident-serving businesses and services on the project site that are maintained on site or relocated within walking distance	2	1	0% of the local businesses were relocated within a 500 m radius
Total score: 17/25				

**Table 2** Land use Citylife

Land use	Square meters	Percentage	Project
Residential	188,000	51%	Residenza Hadid Residenza Libeskind
Commercial	32,000	8.7%	Shopping district
Offices	124,000	34%	Tre Torri Citylife; Torre Hadid: 177 m, 39 floors. Torre Isozaki: 209 m, 46 floors. Torre Libeskind: 175 m, 28 floors
Events	15,000	4.1%	Palazzo Scintille
Green areas	173,000 (6,000 flower field)		Green areas. Gli Orti Fioriti di CityLife
Parking	7,000	1.7%	Underground parking spaces
	Total: 365,000 square meters		

stores, bakeries, pubs, cafes, wine shops, fast food services and restaurants were mapped. After that, the second type of service was mapped including all the schools, libraries and

kindergartens in the area. Lastly, type 3 of local services was mapped, identifying all hospitals, dentists, veterinaries and pharmacies (ITDP, 2017). After the overlaying analysis, it





Milano's PGT includes Urban regeneration actions in *Citylife*. As programmed projects it mentions a park and playground. Regarding ongoing projects, it includes Alberature park. As for already finished spaces it illustrates squares such as piazza Burri, piazza Elsa Morante and piazza Tre Torri. Also, it illustrates the finished railway station called Tre Torri, which is part of the metro network. The project is surrounded by new pedestrian and cyclable spaces.

"Urban regeneration Will be at the center of future developments" Strategic plan of Milan

**Fig. 3** Milan PGT Citylife urban regeneration spaces (Source Milano's PGT, 2009)

### Types of local services



Type 1:  
supermarkets, wine  
stores, restaurants,  
bakery, fast food,  
café, pub

Type 2: Schools,  
libraries,  
kindergarten.

Type 3: Dentist,  
pharmacies,  
hospitals,  
veterinary.

**Fig. 4** Types of local services (Source own work, 2020)

was found that 100% of the buildings in the area have access to at least two different types of services. According to the scoring system, the study area is awarded three points. Figure 3 illustrates the Qgis result (see Fig. 4). Even though this parameter got a sufficient score, there is space for improvement. The types of services offered in the area could be more diversified and accessible to the residential areas in a higher percentage than 80%. It is important that services related to education are provided in a more extensive way in urban regeneration projects so that citizens would lower car use for the shortest trips and would use sustainable transport mobility alternatives.

### 4.3 Access to Parks and Playgrounds

This subcategory evaluates and classifies the proximity between residential buildings and eligible green areas. Eligible green areas are parks or playgrounds bigger than 300 square meters. In order to perform this evaluation, it was necessary to identify and map the residential buildings in *Citylife* as well as the eligible green areas and measure the distance between them. The evaluation revealed that 100% of the residential buildings in the area are located within 500 m of an eligible park, playground or green area. In this case, it was attributed 1 point which is the highest score



possible (ITDP, 2017). The evaluation of this subcategory received the highest score, so there are no further suggestions in this regard in *Citylife*. Figure 4 shows the Qgis result (see Fig. 5). This area has 173,000 sqm of a public park inside the area of the project (Distribuzione moderna, 2020).

#### 4.4 Affordable Housing

This parameter measures the percentage of affordable housing within the area of study. In Italy there are three types of affordable housing projects: subsidized, assisted and agreed housing (Wang, 2019). According to Wang, Italy is lacking affordable housing policies compared to other European countries: “The public housing stock in Milan is just 5% of all the dwellings, similar with the average percentage of Italy, which is 4% (Pittini et al. 2015). This number is very low compared with other countries, such as Netherlands (36%), Great Britain (22%), and France (20%), which shows Italy is actually a country lacking of social housing stock” (Wang, 2019). Under this analysis the concept of subsidized housing will be used. Following the notion of subsidized housing, it was found that 0% of the project was destined for affordable housing units.

Citylife has two residential projects designed by the architect Libeskind (see Fig. 6b) and the other one by Zaha Hadid (see Fig. 6a). Libeskind project is worth “150-million-dollars (...) These residences are quite exclusive and costly apartments for wealthy people, indeed”

(Inexhibit, 2020). In fact, the last three apartments are being sold at 9,400 euro per square meter on average, whilst the average price for a square meter in city life is 6,450 euro (Citylife, 2020). Similarly, the residential complex designed by Zaha Hadid cost about \$3,500 per square foot and has double-height penthouses, called sky villas, provided with generous-sized panoramic terraces (Inexhibit, 2020). According to immobiliare.it, in Milan the housing price on average is 4,179 euro per square meter which makes Citylife 120% more expensive (Immobiliare.it, 2020). *Citylife* is located in the highest price range in the city. Figure 7 illustrates the housing price per square meter according to the geographical area of the city of Milan (see Fig. 7).

These conditions award the area 1 point out of 8 possible points. The ITDP (Institute for Transportation and Development Policy) stresses the importance of the role of affordable housing policies to effectively promote social mix and social wellbeing. As this subcategory got the lowest score possible, it is important to reflect on the inclusion of socio-economic diversity within urban regeneration projects in Milan. The Mix TOD evaluation systems encourage social mix and therefore it envisions the inclusion of at least 15% of the total project of affordable housing that has at least a 30% lower market value. In order to achieve that, it is imperative that diverse types of actors like private developers, civil organizations and municipal governmental agencies partner up to formulate projects where a wider range of market prices are available for citizens that have lower income.

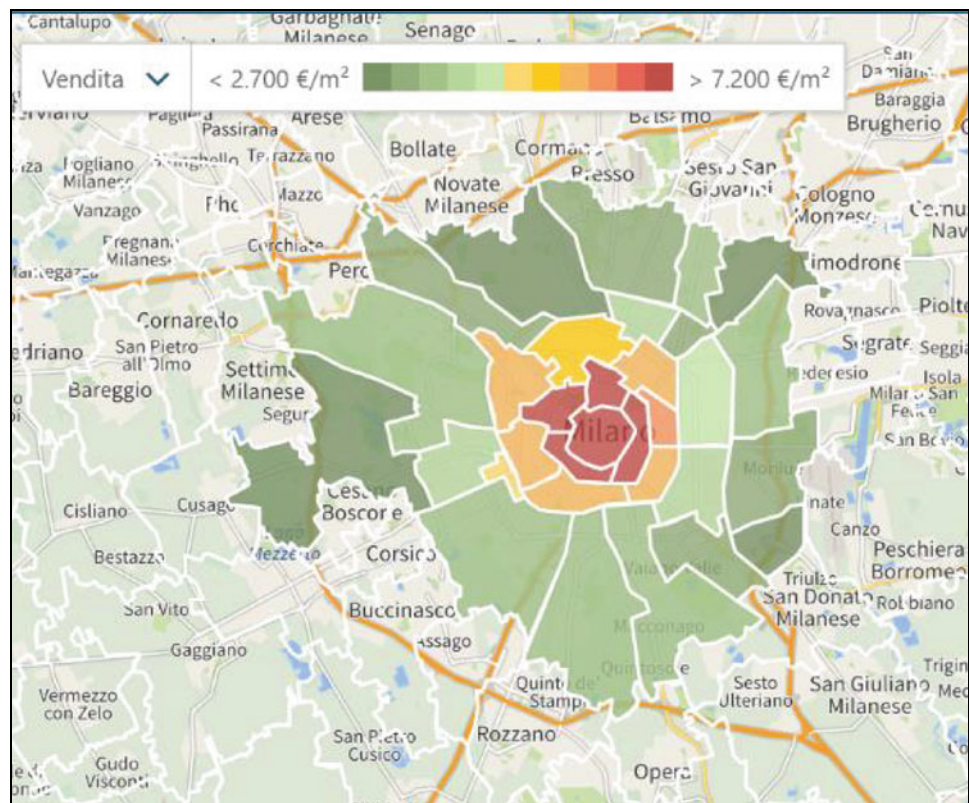
**Fig. 5** Access to parks and playgrounds (Source own work, 2020)





**Fig. 6** Residential areas **a** Zaha Hadid **b** Libeskind (Source Citylife's website, 2020)

**Fig. 7** Residential price per square meter Milan February 2020 (Source Immobiliare.it, 2020)



#### 4.5 Housing Preservation

The housing preservation subcategory evaluates the percentage of households that were relocated within a walking distance from the original location of the site. This subcategory gives a higher score to the projects in which households are relocated within 250 m of walking distance from the lot where they were living previously. Projects that relocate people within a 500 m walking distance are given 2 points. If the project considers relocating less than 100% of the households within a 500 m radius, it receives 0 points

(ITDP, 2017). On the site where Citylife took place, there was a conference hall with 20 exhibition halls, with a total volume of about 2,500,000 m<sup>3</sup> (Citylife, 2020). The previous structure was demolished in 2007, so the lot could be used for urban regeneration development; nevertheless, 120 trees that were on the lot were relocated and recovered into different parks in the city of Milan (Citylife, 2020). Since there were not previously built residential areas there were no housing relocations. In this case the study area gets a total of 3 points. In this respect, it is possible to suggest that future developments relocate 100% of the households living in the



area previous to the project within a 250 m radius (ITDP, 2017). Within this parameter, *Citylife* got the highest score by default and there are no further recommendations to be made.

#### 4.6 Business and Services Preservation

This subcategory evaluates the percentage of business and services that were relocated within a 500 m radius from the original location. The score system gives a maximum of 2 points to those projects that relocate previous businesses and services within a 500 m radius. In this case, through an inquiry to Maria Antonietta Morello, the press office contact of the *Citylife* shopping district, it was possible to find out that there were not any commercial activities in place before the arrival of the project (Morello, 2020). However, through a mapping analysis of the area, it was found that inside the lot of the conference hall there was a Hotel called Fiera Congress and a restaurant called Spizzico (Google earth, 2020). The hotel was relocated along with the conference hall to the periphery of the city, 8.5 km away from the original location. On the other hand, the restaurant was not relocated. In this case, the area is awarded a total of 1 point as the previous commercial facilities were not relocated within a walking distance. Regarding this subcategory, it is important to point out that even though there was not a strong commercial activity before the construction of the *Citylife* development, the relocation of the previous commercial uses should have been made in the area close to the original location. Relocation of commercial activities is important to preserve the socio-economic conditions of the place and include the old tenants in possible new developments.

## 5 Conclusions

Within the ITDP standard that evaluates the TODness level, Mix stands as the variable with the highest weight on the scoring system. This research evaluated the Mix TODness level of an urban regeneration project in Milan. The result awarded *Citylife* a total score of 17 out of 25 possible points. The overall result is sufficient to comply with a silver classification according to TOD standards; nevertheless, there are specific parameters that could improve. More in detail, *Citylife* got the highest score in the parameter of access to parks and playgrounds as 100% of the buildings were located within a 300 m<sup>2</sup> radius of a playground, park or green area. Nevertheless, it is important to highlight that plain green areas should not be considered necessarily as parks or playgrounds are also important to consider the quality of the space. Parks or playgrounds should be set as a

space where people can enjoy nature, but also that certain urban furniture and facilities need to be placed in order to make the space attractive for children and adults.

Also, *Citylife* got the highest score awarded for the complementary use parameter. This analysis revealed that land use in *Citylife* has a high diversification. The assessment performed in the area of study demonstrates that most of the development has low predominant land use, which provides diversified land uses for inhabitants and visitors. The most predominant land use was residential, which represents 51% of the total area, followed by commercial which stands for 34% of the area. These results are aligned with the ideal distribution of land use patterns according to the TODness level, where the predominant land use ideally should not be more than 50–60% of the total area of the project. This result could be an important guideline to be incorporated in future developments and further promote mixed land patterns in urban regeneration processes where *Citylife* could be taken as a positive example.

Likewise, the parameter of access to local services got a high result on this assessment. The results regarding the access to local services revealed that 100% of the buildings in the area have access to at least three types of local services. Also, in this regard, *Citylife* could be set as a positive example for urban regeneration developments. It is important to highlight the importance of the proximity of residential buildings to certain services such as healthcare facilities, pharmacies, education and fresh food supplies. Specifically, projects should provide access to at least three types of services to 80% of the residential buildings or higher (ITDP, 2017). Also, by default, *Citylife* had the best possible score on the parameter that measures housing preservation due to the inexistence of previous residential activities on the lot that was used to build the project. In this respect, it could be highlighted that for future urban regeneration developments it is important to relocate 100% of the households within a 250 m radius of the previous location.

On the other hand, there are certain aspects that could be enhanced within the Mix TODness level in *Citylife*. *Citylife* did not relocate all previous commercial uses, so in this case the assessment was awarded 1 point, which is the lowest score possible. Within the parameter of affordable housing, it was found that 0% of the housing market has a selling price that is below 30% of the mean of the selling price of the area nor does it belong to the category of subsidized housing or affordable housing. In order to aim at the highest score, *Citylife* would need to increase at least 20% of housing projects that have a selling price 30% below the mean of the area or that could be categorized as affordable housing according to Italian standards. It is relevant to point out that in order to achieve this objective it is imperative to cooperate between the private, public developers and other housing market stakeholders in order to diversify the housing offer

and make it accessible for people with different levels of income. Likewise, it is important to stress the fact that the affordable housing concept is not universal. Each country sets an affordable housing standard that best fits its socio-economic system. The ITDP recommendation is to follow the standard that establishes affordable housing as household units worth 30% less than the mean of the housing selling price.

The conditions described earlier pose a major challenge for Milan's case, as land prices and construction costs in housing projects are more expensive and scarcer than in other areas of Italy; in fact, Milan has the highest land value in Italy (Global property guide, 2020). Nevertheless, urban regeneration projects regardless of the land value could offer a percentage of affordable housing, encourage social mix and increase the quality of life of people with low income. In this sense, as the selling price of a housing unit determines the social mix of an area, if only the richest segment of the population can buy the housing units in one specific area the social mix will most likely be low. Therefore, it is important to diversify the housing price offers. In brief, Milan could have higher housing affordability offers, especially in urban regeneration projects, which is a goal that can be addressed by involving private and public stakeholders along with civil organizations involved in urban redevelopment from the very early stages.

Overall, the Mix TOD principle gives a higher score to those areas with more diversified land uses and with a higher social mix. This principle stands for the importance of providing different urban services to citizens within the same area so that it would result in a more active and vibrant space as well as achieve higher diversity in income and demographics. Within this analysis, there are subcategories that represent a greater challenge for new urban regeneration developments, such as the potential threat to economical profit caused by a high affordable housing percentage. Also, it could be challenging to provide a land use pattern where the predominant land use does not exceed 60% of the development. Adding to that, in Milan, urban practitioners have the challenge of planning urban regeneration projects next to qualifiable green areas that meet diversified land prices. But to the same extent, diversified land use and socially mixed projects could offer wide opportunities for public and private actors to provide different land patterns and less segregated neighbourhoods.

Out of the six parameters studied, three stood out as the strongest: Complementary uses, access to parks and playgrounds and access to local services. However, one parameter could not be fully assessed as there were not any housing relocations that took place on this project. On the other hand, the parameter of affordable housing and commercial relocation got the weakest score. Applying the TOD

assessment in Milan was relevant to understand the factors that can be improved in the area in order to aim at a higher Mix TODness level in future urban regeneration projects. There are some parameters that have a higher weight on the Mix TOD level. Complementary uses and affordable housing are the parameters that most influence the Mix TOD level. Since affordable housing is the weakest qualified parameter in this project and at the same time one of the most influential within the TODness level, this could be a parameter that should be prioritized in future regeneration projects in Milan. Encouraging social mix in an urban regeneration project contributes immensely to reaching a higher TODness level. This research study investigated the existing land use diversity in an urban regeneration project in Milan in order to identify the strongest and weakest parameters with the ultimate purpose of enhancing livability and increasing TODness levels in future projects. *Citylife* project has several strong parameters but also opportunities for improvement.

## References

- Beske, J., & Dixon, D. (2018). *Suburban remix creating the next generation of urban places*. Island press.
- Calthorpe, P. (1993). *The next american Metropolis: Ecology, community, and the American dream*. Princeton Architectural press.
- Cervero, R., Guerra, E., & Al, S. (2017). *Beyond mobility: Planning cities for people and places*.
- Cervero, R. (1993). *Transit-supportive development in the United States: Experiences and prospects*. UC Berkeley.
- City life S.p.A. (2020). Ultimi tre appartamenti già finiti. Retrieved from: <https://www.city-life.it/it/ultimi-tre-appartamenti-gia-finiti>
- Curtis, C., Renne, J., & Bertolini, L. (2009). *Transit oriented development making it happen*. Ashgate publishing limited.
- Distribuzione moderna. (2020). Citylife un intervento urbano da 336mila metri quadri. Retrieved from: <https://distribuzionemoderna.info/real-estate/citylife-un-intervento-urbano-da-336mila-metri-quadri>
- Dittmar, H., & Ohland, G. (2004). *The new transit town best practices in transit oriented development*. Island press.
- Furlan, R., & AlMohannadi, M., (2016). Light rail transit and land use in Qatar. *Archnet JAR*.
- Global property (2020). Price history. Retrieved from: <https://www.globalpropertyguide.com/Europe/Italy/Price-History>
- Google earth. (2020). *Comparison between 2001 and 2020 in Citylife lot*. Retrieved from: 45°28'42.18" N 9°09'27.68" E
- Guiding architects (2020). Contemporary urban developments a rebirth of Milan. Retrieved from: <http://www.guiding-architects.net/tours/contemporary-urban-developments-a-rebirth-of-milan/>
- Immobiliare italiana (2020). Immobiliare.it
- Inexhibit. (2020). Daniel Libeskind case study. Retrieved from: <https://www.inexhibit.com/case-studies/daniel-libeskind-citylife-residences-milan/>
- ITDP (2017). TOD standard (3rd uppl.). New York.
- Liu, C., Erdogan, S., Ma, T., & Ducca, F., (2016). How to increase rail ridership in Maryland: Direct ridership models for policy guidance. *KTH*.
- Morello, M. A. (2020). Interview hel on march 17th 2020.



- Ming, W., Zhang Yu, H., & Changa, J. (2016). Alternative transit-oriented development evaluation in sustainable built environment planning. *Transportation Research Procedia*, 3220–3232.
- Papa, E., & Bertolini, L. (2015). Accessibility and transit-oriented development in European metropolitan areas. *Journal of Transport Geography*, 70–83.
- Pengjun, Z. (2018). Suburbanization, land use of TOD and lifestyle mobility in the suburbs. *JTLU*, 195–215.
- Piano di governo del territorio. (2019). PGT. Retrieved from: <https://www.comune.milano.it/aree-tematiche/urbanistica-ed-edilizia/pgt-approvato-e-vigente-milano-2030>
- Sarkar, P., & Chunchu, M. (2016). Quantification and analysis of land-use effects on travel behavior in smaller Indian cities: Case study of Agartala. *American Society of Civil Engineers*.
- Sohonia, A., Thomas, M., & Rao, K. (2016). *Application of the concept of transit oriented development to a suburban neighborhood*. Elsevier.
- Stojanovski, T. (2013). *Public transportation systems for urban planners and designers: The urban morphology of public transportation systems*.
- Stojanovski, T. (2014). Transit-oriented development (TOD): Analyzing urban development and research gate.
- Stojanovski, T. (2015). The morphological effect of public transportation systems on cities: Urban analysis of transit-oriented development (TOD) in Swedish cities.
- Systematica. (2019). Citylife development. Retrieved from: <http://www.systematica.net/project/citylife-development/>.
- Taccioli, L. (2019). Citylife il quartiere più moderno d'Italia. Retrieved from: <https://www.lorenzotaccioli.it/citylife-il-quartiere-piu-moderno-ditalia/#le-residenze-hadid-di-city-life>
- Transportation research board. (2004). *Transit-oriented development in the United States*. Transportation research board.
- University of California. (2007). Histories of transit-oriented development: Perspectives on the development of the TOD concept real estate and transit, urban and social movements, concept protagonist.
- Wang, S. (2019). *The regeneration of social housing estates in Italy*. Retrieved from: file:///C:/Users/Cristina/Downloads/2017\_10\_WANG%20(1).pdf
- Zou, M., Lin, X., Mao, C., Ke, Z., & Li, M. (2014). Review on the theory and planning principle of transit-oriented development. *KTH*.