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Evaluation of the worn texture of the region 4 in Tabriz, Iran, with an emphasis on increasing populatability

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Abstract

Today, due to the increase in population and the development of cities in areas where cities do not have enough land for development due to various reasons, such as natural obstacles, worn-out tissues are considered as urban potentials for development, which the ability to plan and provide land and the development of the city exists in these contexts. Therefore, these contexts need to be identified, planned and regulated by rules and laws and implementation. The purpose of the current research is to evaluate the worn-out texture of the 4th region of Tabriz with an emphasis on increasing population. The research method used is a descriptive-analytical method and the desired indicators of residential buildings analysis with GIS. The results of the research showed that in terms of the efficiency of building parts, they are in an unfavorable condition, and the criteria compiled for the modification of these structures will lead to an increase in the efficiency of buildings and residential parts compared to the situation before the intervention.

1. Introduction

The worn texture of urban areas refers to spaces within the legal limits of cities that have experienced physical decay, lack access to public transportation, amenities, and infrastructure, have a low value in terms of location, environment, and economy [1]. In general, the decay of any phenomenon is caused by a decrease in its functionality. Whenever the life of a certain part of the city slows down or comes to a standstill due to any reason, that part of the urban fabric enters a process of decay [2]. Urban decay occurs when a fabric or its internal elements have worn out either due to age or lack of technical planning and supervision in its development. These fabrics suffer from the poverty of residents and owners, which lacks the potential for self-renovation, and there is also a lack of investor interest [3]. In Iran, various factors have affected the living conditions in cities since 1961, including an increase in the urban population, changes in family status, and changes in residential patterns due to consumer demand for modernization [1].

Residential building is a crucial aspect of the built environment that influences the quality of life and urban form of a city. The built environment plays a crucial role in the development and functioning of a city, and its quality directly affects the health, safety, and well-being of residents. Residential areas are a vital aspect of the built environment, and they play a pivotal role in shaping the urban form and character of a city [4]. The worn texture of residential areas is an important aspect of the built environment that has a significant impact on the quality of life of residents and the overall attractiveness of a city. Therefore, it is essential to evaluate the worn texture of residential areas in Tabriz, Iran, and to develop effective strategies to improve their populatability [5]. The impact of the decay of the built urban fabric on the fabric of cities is so significant that according to the Supreme Council of Architecture and Planning, three characteristics have been identified for identifying decaying areas. Two of these characteristics, namely, microstructure and decay of the building, are related to the housing section [6]. Inappropriate housing in run-down urban fabric is one of the contributing factors to problems related to the formation and intensification of problems such as the departure of native residents, the decline of their

attachment and identity, and a decrease in their interest in repairing and maintaining their homes, which leads to negative developments in the neighborhood [6]. It seems that the housing in the old urban fabric has problems from the point of view of architecture. In terms of foundation, the form of the plot, the configuration of the parts, their arrangement, density, occupation of the unit and lighting. they generally have problems in workability and have lost their former usability or workability has decreased.

Tabriz is one of the most important cities in Iran, located in the northwestern region. It is one of the oldest and most prosperous cities with a rich culture and civilization. The worn texture of residential areas is an important aspect of the urban fabric of Tabriz, and it has a significant impact on the urban form and character of the city [5,7]. The worn texture of residentials is a result of the interaction between natural and built environments, and it is an important aspect of the city's architecture and culture. In Tabriz city as well, with the attention to its historical age, it has various old and historical neighborhoods with a fabric of various ages. Around 43% of Tabriz's dilapidated fabric is in region 4, with a population of 44613 people. So, buildings in the study area are not in a good architectural situation and rules and regulations on dilapidated fabrics will increase the useability of these units [7]. However, due to various factors such as urbanization, industrialization, and insufficient preservation measures, the unique texture of residential areas in Tabriz has been affected. Therefore, it is essential to evaluate the current state of the worn texture of residential areas in Tabriz and to determine the most effective strategies to increase their populatability. However, any policy-making and regeneration in this area by urban planners and managers should lead to a more stable city in the future and the coming years [8]. This study explores the evaluation of the worn texture of residential areas in the region 4 of Tabriz, Iran, with an emphasis on increasing their populatability. The goal of this study is to determine the most effective strategies to preserve and enhance the unique texture of residential areas in Tabriz and to ensure their sustainability and attractivity for future generations.

2. Material and Method

This research is currently practical in terms of usage - development and in terms of descriptive - analytical approach. The collected data is obtained through observation and recording of information, as well as from existing investigations, statistics, official and unofficial documents, and organizational documents. After evaluating the population characteristics and the number of residential units in the 4th region in terms of area and also the area of the worn-out texture of the region, the indicators related to residential parts (Examining parts in terms of area, Compatibility of residential parts and Access to residential parts) and the indicators of residential buildings (Density of people in a residential unit, Household density in residential unit, The average number of rooms in a residential unit, Average room for each household, The average area of infrastructure of residential units, per capita under the residential building, Floors of residential units, Quality of buildings and Construction Density) were introduced. After defining the important factors affecting the performance of parts and assessing the characteristics of parts towards the population tolerance range of the studied region has been analyzed with GIS.

2.1. Study Area

The study area in this research is a part of Tabriz's dilapidated fabric located within region 4, which, with an area of about 2550 hectares. The minimum elevation of the region is 1335 meters and the maximum is 1406 meters. Thus, the small elevation difference of around 70 meters and the large area indicated the non-incline, flat land in this region [5,7]. Therefore, there is no topographical or incline limitation in this region. The region, due to its location within Tabriz's dilapidated fabric, has been selected as a representative sample for measuring the usability of housing "Figure 1".

3. Results

3.1. Demographic characteristics of the Region 4

Region 4 of Tabriz municipality is located next to regions 6, 8, 10, 7, 3. This region is south of Khayyam Street and 22 Bahman, west of Najati, Ranjbar and Bahar Street, north of Kheliyan and Azadi Expressway. Its area is 2550 hectares. According to the census of the year 2016 in region 4 of Tabriz, 315,183 people and 102,481 families lived. This was the Most populated region in Tabriz city. According to the census of 2011, the population of region 4 was equal to 316,126 people and the number of households was 96,889. By comparing the population of 2011 and 2016, it was concluded that the growth rate of region 4 in these years was equal to -0.05. In other words, the population of region 4 has decreased compared to 2011.

Considering the population and area mentioned previously, the total usable area of the region is 80.9 square meters. Considering the amount of land used and the remaining free and green areas, we see that the region has 1163 square meters of built-up area. The remaining green and free spaces are equal to 1387 hectares. These amounts correspond to a share of 45.5 and 54.5 percent, respectively. Most of the service spaces in the region are related to parks and green spaces, educational and administrative buildings and recreational facilities with an area

of 52.6 and 30.7 and 10 hectares, respectively. About 66% of the region's services are in this area. Approximately 213 hectares of service deficiency is in the whole region, of which about 51% is a deficit of neighborhood services, 24% is a deficit of regional services and 25% is a deficit of regional scale services and the residential area is about 875 hectares.

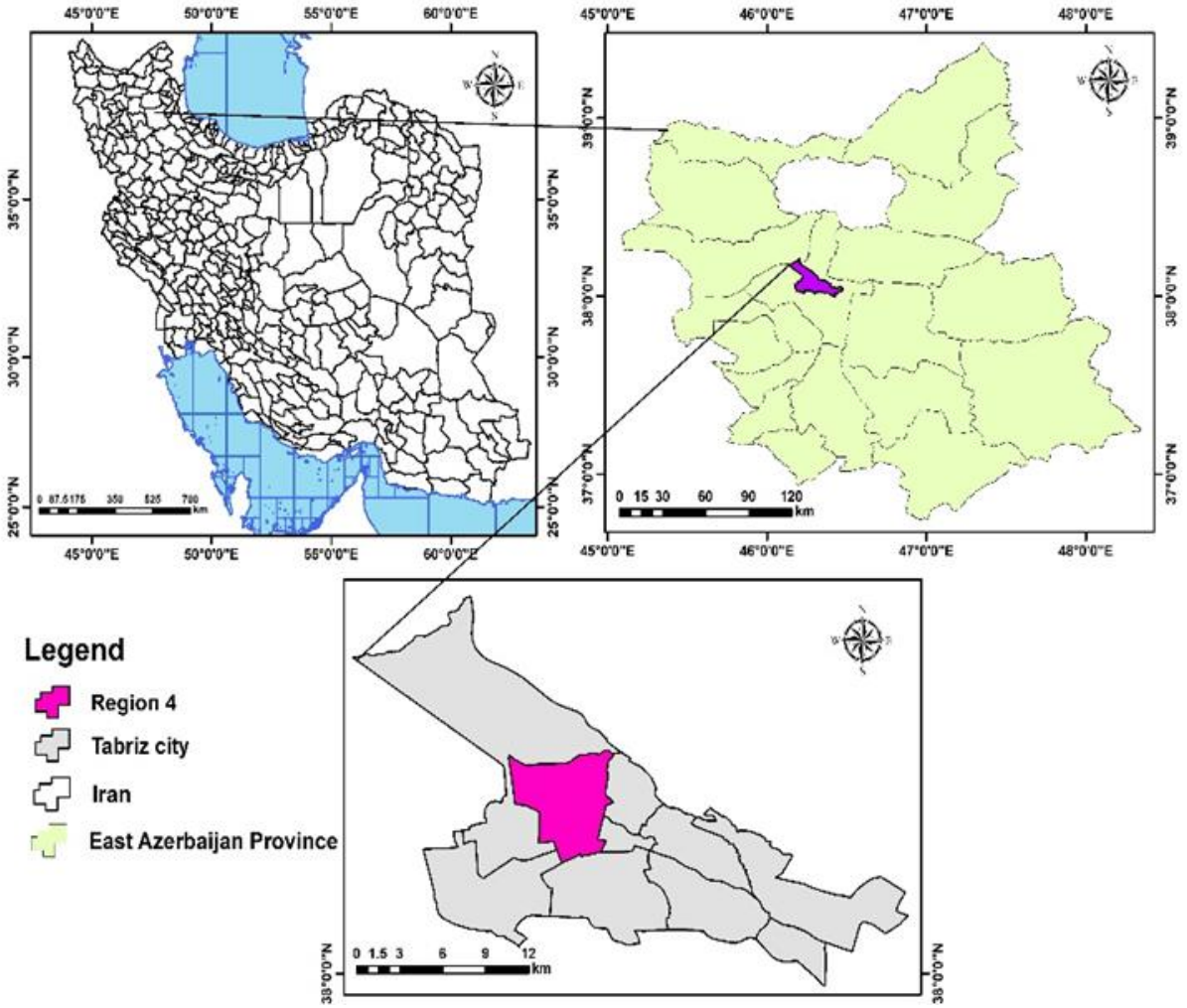

Figure 1. Map of the geographical location of the study area.

3.2. The number of residential units in region 4 according to area

Out of the total 92,845 residential units in region 4, 46045 units or 49.6% of the residential units have an area of less than 100 square meters "Table 1".

Table 1. The division of residential units by area.

down- 50 square meters	51-75 square meters	76-80 square meters	80-100 square meters	101-150 square meters	151-200 square meters	201-300 square meters	301-500 square meters	501-up square meters
12664	22948	778	9655	20141	18137	5947	2100	475

3.3. Worn texture area of Region 4

Region 4 has the highest rate of worn-out area with 43% of its total area "Table 2".

Table 2. The area of worn texture of the region and the whole city.

Region Area	Worn texture area	Percentage of worn texture in region area	Percentage of worn texture in city area	Area percentage worn texture to total area worn texture City
2540	1100	43%	0.22%	44%

3.4. Indicators related to residential parts

3.4.1. Examining parts in terms of area

Examination of the region shows that the granularity of the areas in the region is evident in such a way that, 6726 pieces or 68.6% of the pieces have an area of less than 150 sq meters. In the Tabriz development plan, the minimum area of the residential areas is 150 sq meters, assuming an occupation rate of 60%, about half of the residential areas in the area of study will have an area less than 90 sq meters. Granulation of plots is one of the main characteristics of worn-out areas in Iran. According to the research, more than half of the pieces have an area less than 200 square meters, 46.4% of the plots are less than 100 square meters. Most of them are within the range of 50 to 100 square meters. After analyzing, it was found that the condition of the plots was not favorable from the point of view of area "Figure 2". Considering that in the Tabriz Development Plan, the minimum area for partitioning in worn-out areas is 150 square meters, and in the new area it is 175 square meters, it can be concluded that the area condition is not favorable and the granularity in the study area is evident "Table 3".

Table 3. Area of residential plots.

Area of parts	Number	Percent
Under 50 square meters	901	9.2
Between 50 and 100 square meters	3509	35.8
Between 100 and 150 square meters	2316	23.6
Between 150 and 175 square meters	949	9..7
Between 175 and 200 square meters	800	8.2
Between 200 and 250 square meters	830	8.5
Between 250 and 300 square meters	261	2.7
Above 300 square meters	235	2.4
Total	9801	100

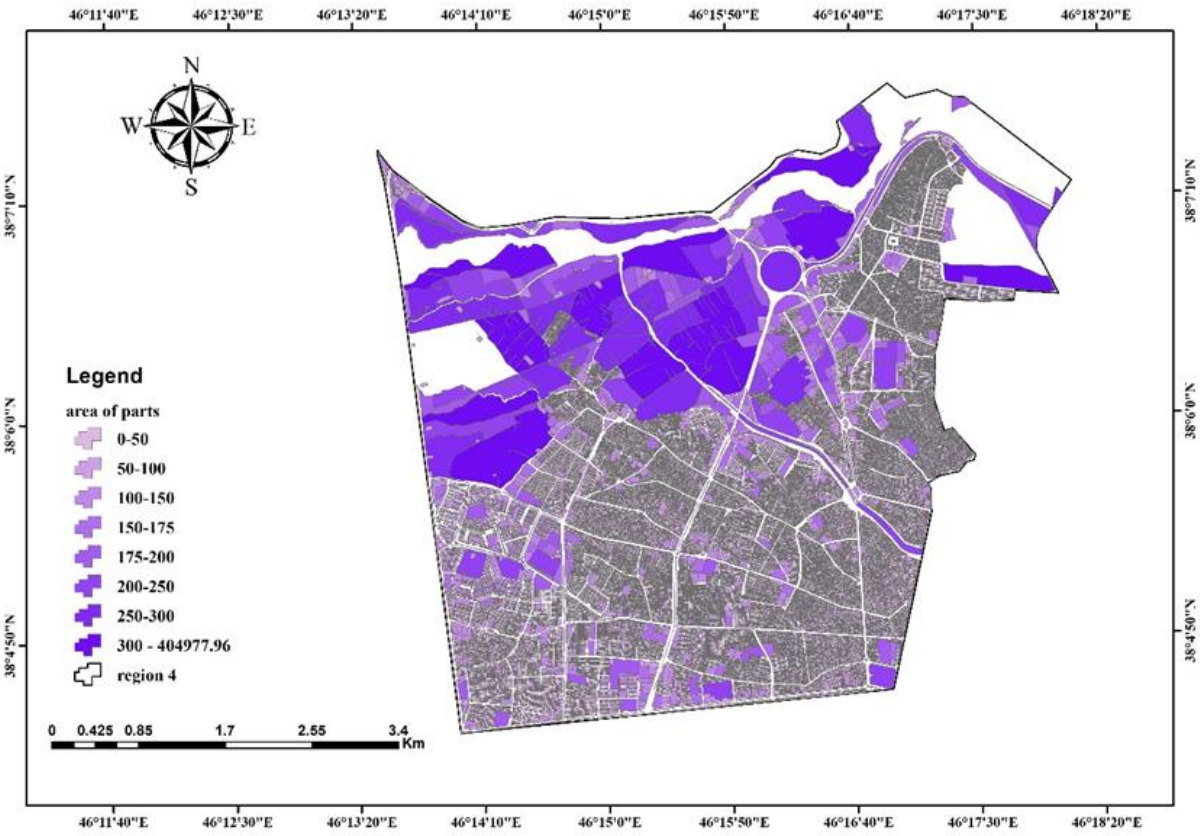

Figure 2. Area of residential plots.

3.4.2. Compatibility of residential parts

Considering that the studied area is a residential area, it is necessary to measure the compatibility of other uses with residential parts. The number of uses in the area was measured in terms of compatibility with the residential area with medium density, and the following results were obtained, according to the studies, about 97.5% of the

parts are compatible with residential use. Therefore, in terms of compatibility, the limited state is in favorable conditions and only 1.4% of parts are incompatible and relatively incompatible "Figure 3" & "Table 4".

Table 4. Compatibility of parts.

Compatibility of users	Number	Percent
Compatible	11286	97.5
Relatively compatible	4	0.03
Incompatible	6	0.1
Relatively inconsistent	152	1.3
Indifferent	128	1.1
Total	11576	100

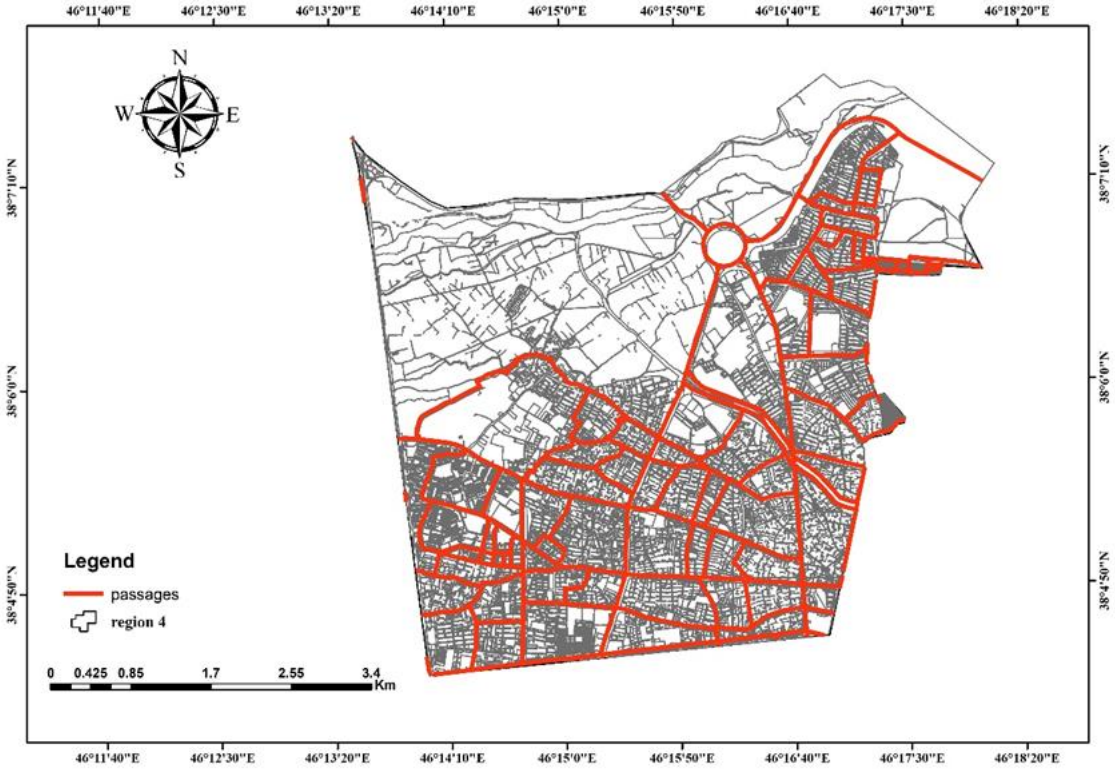

Figure 3. Map of roads adjacent to parts.

3.4.3. Access to residential parts

Impenetrability as one of the most key qualities needed in a city, as well as the role of the road network, in addition to creating access as the routes of relief and crisis management, is very important when needed. The width of the network of passages and accesses defined for each block and residential lot should be such that, in addition to creating access, it does not cause shadowing and aristocracy of the parts on the adjacent parts, and there is a legal distance between the parts to protect privacy. According to the analysis, among the accesses defined for the parts, nearly 80% of the parts have an access of less than 6 meters. Therefore, the access of 80% of the parts is inappropriate. In other words, new approaches should be defined for 80% of parts "Table 5".

Table 5. The width of the passages adjacent to the parts.

Passages width	Number of adjacent pieces	Percent
Less than 6 meters	7774	79.83
8 meters passage	998	10.7
10 meters passage	278	2.4
12 meters passage	99	1.1
14 meters passage	98	1
18 meters passage	212	1.9
21 meters passage	179	1.6
22 meters passage	19	0.2
24 meters passage	75	0.7
32 meters passage	15	0.2
36 meters passage	2	0.02
Total	9801	100

3.5. Indicators related to residential buildings

3.5.1. Density of people in a residential unit

Considering that the population of the study area is 44,613 people and the number of residential units is 13,826 according to the Equation 1.

$$Density\ of\ people\ in\ a\ residential\ unit = \frac{Population}{Number\ of\ residential\ units} \quad (1)$$

The density of people in a residential unit in the study area is equal to 3.2 people, which means that there are 3 people in each residential unit on average.

3.5.2. Household density in residential unit

This ratio is obtained by dividing the number of households by the number of residential units in the study area. The number of households is 13,519 and the number of residential units is 13,826 according to the Equation 2.

$$Household\ density\ in\ residential\ unit = \frac{Number\ of\ households}{Number\ of\ residential\ units} \quad (2)$$

The result of this ratio is equal to 1 which indicates that the number of households living in each housing unit is 1 household.

3.5.3. The average number of rooms in a residential unit

The number of residential units in the area is 13,826 units and the total number of rooms in the area under study is 30,417, which is defined according to the Equation 3.

$$average\ number\ of\ rooms\ in\ a\ residential\ unit = \frac{number\ of\ rooms\ in\ the\ entire\ area}{Number\ of\ residential\ units} \quad (3)$$

The ratio of these two indicators is equal to 2.2, which means that the average number of rooms for each residential unit is approximately equal to 2.

3.5.4. Average room for each household

The number of rooms in the study area is 30417 rooms and the number of households is 13519 according to the Equation 4.

$$Average\ room\ for\ family = \frac{Total\ number\ of\ rooms}{the\ whole\ household} \quad (4)$$

This ratio is equal to 2.2. Therefore, on average, there are 2 rooms for each household.

3.5.5. The average area of infrastructure of residential units

This index indicates the average level of residential units. This index is calculated based on the ratio between the total area of the permitted infrastructure of the total area of the piece. The low level of this index is a sign of undesirable residential density (Equation 5).

$$Residential\ Units\ Infrastructure = \frac{Total\ Infrastructure\ Level}{Sum\ of\ parts\ levels} * 100 \quad (5)$$

The amount of this index according to the ratio defined for the study area is equal to 63. In other words, the average residential infrastructure in the study area is 63, which indicates the unfavorable density and smallness of the study area.

3.5.6. Per capita under the residential building

This index is one of the key indicators for knowing the housing situation. It determines the habitable space for each person on average, which increases according to the level of income and development of the country. Per

capita under construction in low-income countries is 6 square meters and in high-income countries is 35 square meters. The per capita residential infrastructure for big cities in Iran is suggested as an average of 25 square meters. This index is obtained from the ratio of the levels dedicated to infrastructures to the population of the area (Equation 6).

$$Residential\ infrastructure\ per\ capita = \frac{The\ level\ dedicated\ to\ infrastructure}{Population\ of\ area} \quad (6)$$

The value of this index for the studied area with a population of 44,613 is equal to 19, which is lower than the average value of the index defined for metropolises, which indicates the low level of living in the area.

3.5.7. Floors of residential units

The existing buildings in the region are divided into 10 categories in terms of the number of floors, and in total 60.15% of the residential units are 1-story, which accounts for the largest number of residential units. Therefore, most of the buildings are single family. According to the results obtained in this quarter, about 61% of residential buildings are 1 story and single household. According to the index of the area of parts and also the floor index, we conclude that the constructed buildings have a 1 story with an area of less than 150 have a long history. What the cities of developed countries are looking for today is more density of population and vertical development of cities instead of horizontal development. Therefore, there is a need to modify worn buildings by assembling parts and increasing density "Figure 4" & "Table 6".

Table 6. Floors of residential buildings.

Floors	Number of parts	Percent
0	1	0.01
1 floor	5898	60.15
2 floors	3030	30.92
3 floors	466	4.75
4 floors	277	2.83
5 floors	98	1
6 floors	29	0.3
7 floors	3	0.03
11 floors	1	0.01
21 floors	1	0.01
Total	9801	100

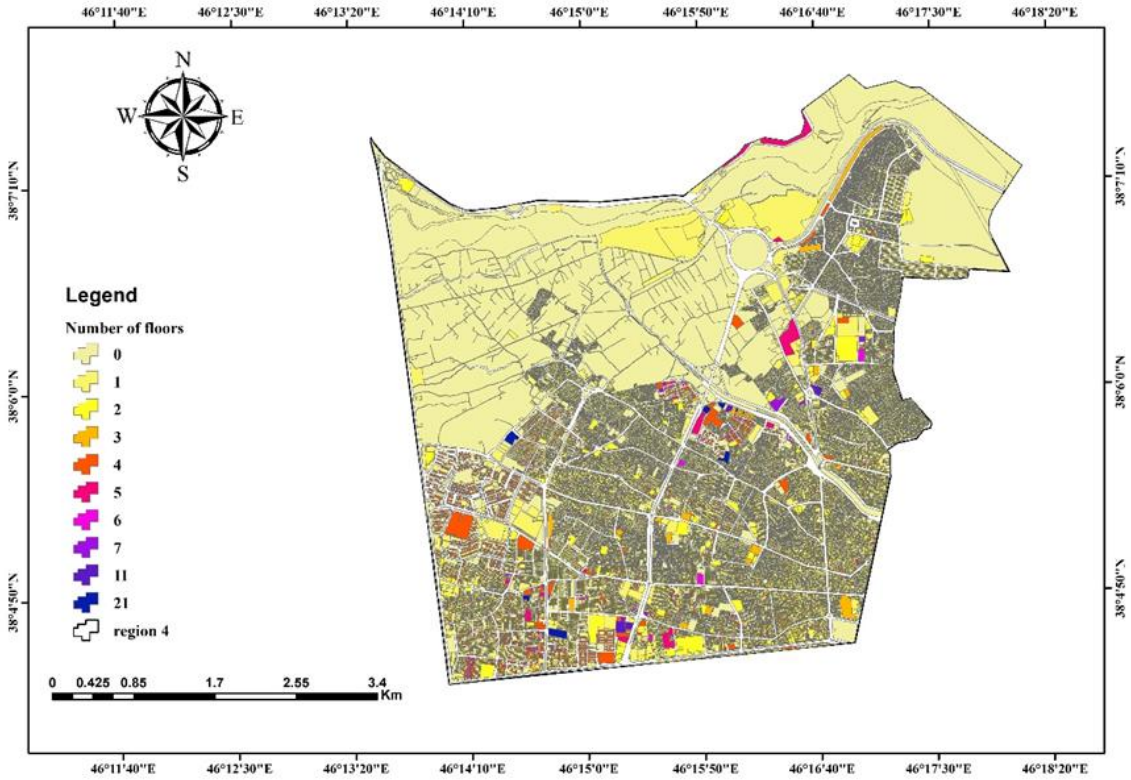

Figure 4. Floors of residential units in the study area.

3.5.8. Quality of buildings

The studied area is considered one of the worn texture areas, where most of the residential parts are in an unfavorable condition in terms of quality, and the wear and tear of the buildings is one of the obvious features of this area. Among the parts in the studied area, nearly 70% of the parts are in worn and damaged condition. which indicates the poor efficiency of these residential buildings. that this wear and tear is caused by the passage of time (the age of the building), the effect of the weather, or improper and undesirable maintenance. The wear and tear of a building, in addition to affecting the body of the building, also affects the materials and resistance of the building. Therefore, the safety of buildings decreases under the influence of the mentioned factors, and as a result of any natural or human accident, there is a possibility of causing damage to the residents "Figure 5" & "Table 7".

Table 7. The quality of the building.

Quality of building	Number	Percent
Under Construction	132	1.3
worn out	6725	68.6
can be kept	1688	17.2
ruined	54	0.6
restoration	205	2.1
newly built	997	10.2
Total	9801	100

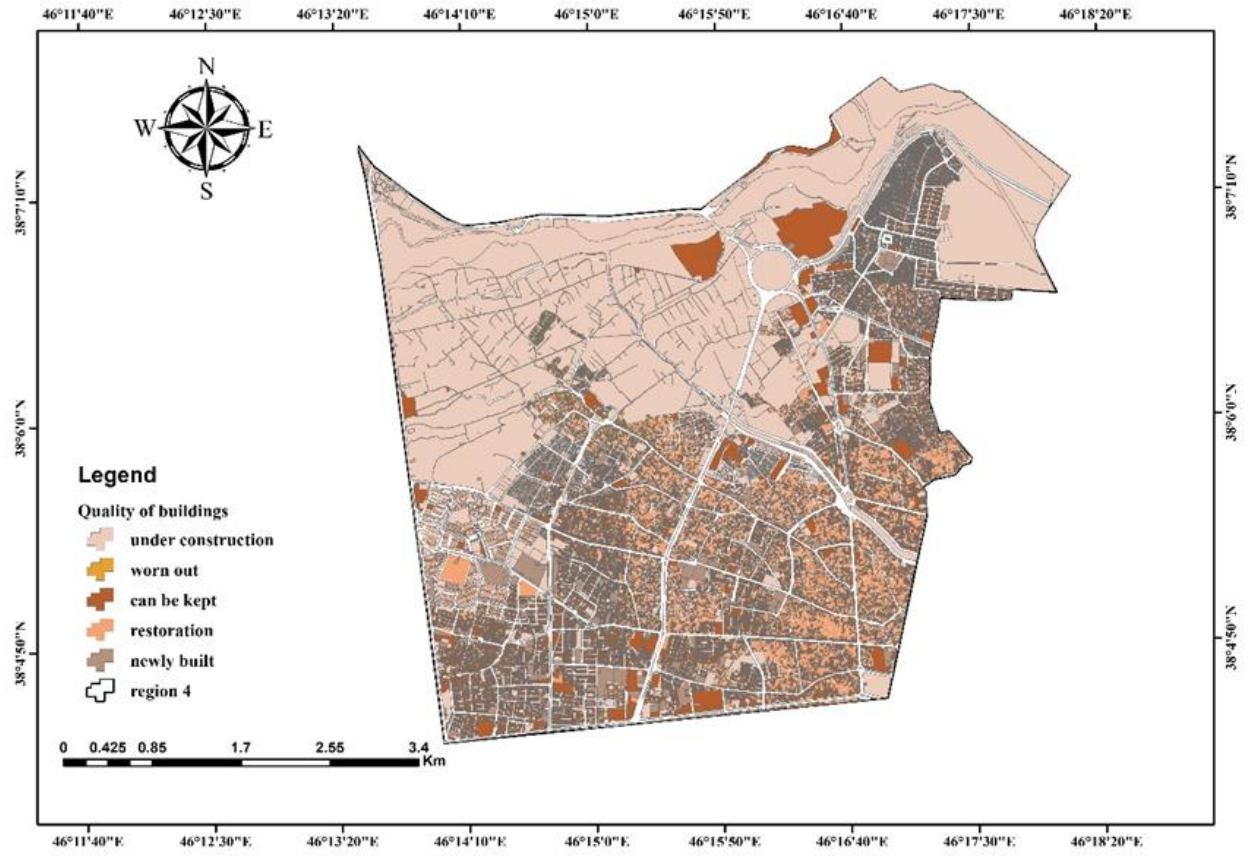

Figure 5. Building quality map of the studied area.

3.5.9. Construction Density

Density of buildings is the most important criterion in determining the number of floors and height of buildings. Residential standards that differ from the types of congestion proposed should be flexible and adaptable to different local conditions. This also depends on the priorities that are considered in housing planning of each city according to the defined criteria for the building floors and the density of the population in the building and coordinating the residential building with other buildings in a way that does not disturb the texture of the neighborhood or city [7]. Another important factor for defining the building density criteria is maintaining privacy and non-aristocracy and another factor is that the way the building is located in different angles creates different shade in different seasons of the year and different times of day. Therefore, there are necessary criteria for controlling building density "Table 8".

Table 8. Construction density of Tabriz city.

Maximum building density	Maximum floors	Passage width
180	3	4
240	4	6
240	4	8
300	5	10
300	5	12
300	5	14
360	6	16
360	6	18
420	7	20
420	7	24

The criteria in the Table 8 have been compiled for Tabriz city, but these criteria have not been observed and implemented in the study area, and 307 pieces are inconsistent with the proposed criteria. According to the criteria mentioned in the Table 8, the maximum number of floors for a 4-meter passage is 3-story buildings. However, in the scope of the case, 131 buildings with 3 floors and more than 3 floors are located in 1- and 2-meter passages. 87 plots are located above 3 floors in a 4-meter passage. 9 buildings above 4 floors are located in the vicinity of 5-meter passages, while the maximum floors defined for 6-meter passages are 4 floors, and 45 buildings above 4 floors are located in 6-meter passages. The set limit for 8-meter plots is 4 floors, while 23 plots with 5 and 6 floors are located near 8-meter passages.

4. Conclusion

The wear and tear of urban texture is a problem that most of the cities of the country are facing, and the organization of such urban planners, texture is a great importance [9]. worn-out tissues have become to separate areas with a lot of antiquity and worn-out tissues have created an economic recession and many problems for residents in access to new infrastructure and transportation services [10].

Today, due to the increase in population and the development of cities in areas where cities do not have enough land for development due to various reasons, such as natural obstacles, worn-out tissues are considered as urban potentials for development, which the ability to plan and provide land and the development of the city exists in these contexts. Therefore, these contexts need to be identified, planned and regulated by rules and laws and implementation. In dilapidated contexts, many facilities and spaces are old and dilapidated and need to be reconstructed. Many new facilities for life have not yet been created in these areas. Therefore, these contexts are facing a lack of living and welfare facilities. Due to the unfavorable economic situation, the residents of these areas often cannot solve these problems, and due to the lack of economic efficiency, the private sector is often unwilling to invest in these areas. They have lost their usefulness for their old inhabitants and gradually the inhabitants have migrated from these contexts [11].

The objective of this study was to evaluate the worn texture of region 4 in Tabriz, Iran and to propose strategies for increasing its populatability. According to the studies carried out in this research, the housings in the dilapidated context are in a poor condition both in terms of the indicators related to the plot and the residential building, so it is necessary to pay attention to the components related to the residential plots. Also, in the renovation of old structures, the category of culture and climate should be prioritized in improvement and renovation projects. Also, it indicated that a significant portion of the region is characterized by poor quality of infrastructure, lack of green spaces and public open spaces and low population density. The major factor contributing to these issues is the lack of a comprehensive urban development plan for the region which led to uncontrolled urbanization and poor land-use planning. Therefore, it is essential that the Regional Planning Organization and other relevant stakeholders develop a comprehensive urban development plan for the region to ensure the sustainable and inclusive development of the area. This plan should address issues including infrastructure, green and public open spaces, and the overall livability of the area. Furthermore, to enhance the populatability of the region, it is important to involve local communities in the planning process and to take into account their needs and interests. The cooperation and coordination of all relevant stakeholders, including local residents, stakeholders, and the private sector, is essential to achieve this objective.

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Author contributions

Shiva Sattarzadeh Salehi: Methodology, Software, Writing-Original draft preparation, Writing-Reviewing and Editing, Investigation **Firouz Jafari:** Conceptualization, Validation, Data curation, Visualization, Writing-Reviewing and Editing

Conflicts of interest

The authors declare no conflicts of interest.

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