

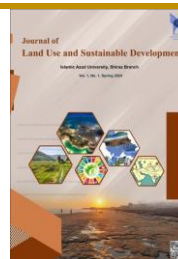


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Locating Potential Areas for Tourism Development with an Emphasis on Transportation Development: A Case Study of Tonekabon City

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Abstract

Transportation is a cornerstone of the tourism industry, which is considered one of the most important and lucrative global resources at the dawn of the third millennium. The primary assumption of public transportation development based on sustainable tourism is increasing tourist satisfaction. Additionally, one of the most advanced urban development perspectives that can initiate improvements in current urban conditions and serve as an effective step toward sustainable development is TOD. Suitable, reliable, comfortable, fast, and affordable transportation facilities are prerequisites for tourism development, as tourists consider both cost and time in their decisions. The choice of transportation system or the availability of an appropriate system affects these two factors when accessing tourist destinations. The objective of this research is to apply a transit-oriented development approach to enhance tourism in Tonekabon. The study is applied and descriptive-analytical in nature, utilizing documentary research, observation, and questionnaires for data collection. Additionally, the Fuzzy IHWP method is used to locate potential tourism zones with an emphasis on transit-oriented development. The results indicate that the northern, central, and coastal areas of the city, covering 29% of its total area, have high potential for locating public transportation stations such as taxi stands, vans, bus terminals, and bicycle lanes. Finally, recommendations are provided, including widening streets, establishing bicycle lanes, concentrating and increasing commercial, service, and recreational-hospitality activities in the coastal area, improving taxi services to all areas, widening the main bridge connecting the east and west of the city, and constructing public parking near terminals and the coastline.

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INTRODUCTION

One of the most advanced urban development perspectives that can initiate improvements in current urban conditions and serve as an effective step toward sustainable development is Transit-Oriented Development (TOD) (Shahabian, 2011:123). Suitable, reliable, comfortable, fast, and affordable transportation facilities are prerequisites for tourism development, as tourists consider both cost and time in their decisions. Transit-oriented development models, including public transit-based and corridor development models, guide urban growth around public transportation axes. Public transportation planning at any scale provides opportunities for dense, mixed-use development and can serve as a sustainable mobility solution in urban areas.

Transportation infrastructure and high-quality, easy accessibility for tourists are among the most critical requirements for establishing any tourist destination. Most developed tourist regions have extensive and well-organized transportation networks. The importance of transportation systems varies for tourists in different countries, but transportation lies at the heart of the tourism industry. The efficiency, comfort, safety, and health of this system determine the quality of the travel experience. In fact, there is a direct correlation between the advancement of transportation systems and the growth of global tourism.

This research aims to identify and locate areas with potential for tourism development, emphasizing transit-oriented development. The significance of this study stems from the fact that Tonekabon is a focal point for tourists, yet due to its public transportation challenges, it requires long-term planning for sustainable tourism development.

Theoretical Framework

Tourism and Sustainable Tourism: One of the most significant social developments in contemporary societies is the emphasis on leisure as a fundamental need in technology-dominated lives (Hosseini Nia, 2017:32). In line with this shift, tourism has emerged as a key leisure activity, significantly impacting human environments, economies, and livelihoods (Jelincic, 2016:5). Scientific studies indicate that tourism is one of the most resource- and energy-intensive industries (Shahdadi et al., 2019:293), and this trend is expected to continue (Hayllar et al., 2014:11).

Additionally, tourism has expanded from historical sites to natural environments (Seydi et al., 2018:66), with coastal areas becoming increasingly important destinations (Seyed Alipour & Eghbali, 2014:130).

Sustainable tourism refers to a form of tourism that manages all resources in a way that preserves cultural integrity, ecological processes, and life-support systems (Ramadanzadeh Lasboei et al., 2014:312). To achieve this, indicators must be defined to assess tourism sustainability (Ranjbarian & Zahedi, 2012:181).

A conceptual model illustrates the relationship between urban tourism, sustainability, and sustainable urban development, combining three key dimensions: society (vibrant community), economy (robust economy), and ecology (healthy environment) (Habib & Hosseini Nia, 2012:112).

Given that the case study is a coastal city, sustainable coastal tourism is also discussed. According to the World Tourism Organization, coastal tourism attracts the largest number of travelers globally. The enduring popularity of beaches, combined with their ecological fragility, has heightened planners' awareness of sustainable development in these areas (Seydi et al., 2018:66).

Coastal zones are closely linked to nearby urban centers, hosting a concentration of human activities such as commerce, trade, energy, fishing, settlement, and tourism (Samat & Harun, 2013:390). Due to the constraints of narrow coastal strips between land and sea, tourist destinations in these areas face intensified human pressures, leading to environmental degradation. Thus, evaluating and monitoring land use and activity expansion in urban coastal areas is increasingly critical (Ramadanzadeh Lasboei et al., 2014:312).

Sustainable Development Based on Public Transportation:

The scope of sustainable transportation can relate to the entire city, a part of the city, or even a short distance, such as the space between two small squares. However, certain foundational concepts must already be in place to validate its existence. These include the integration of the transportation system, comprehensive coverage of the entire city, positive interaction and complementarity with other transportation systems, and compatibility with the

environment and human habitation (Kashani Jo & Mofidi Shemirani, 2009:5).

Transportation system integration occurs when systems are interconnected in such a way that no system disrupts another. Transportation systems must cover the entire city so that no area remains without a defined transportation system (Dittmar, 2004:8). Moreover, it is every person's right to live in a clean environment free from pollution. Under no circumstances should transportation infrastructure hinder the well-being of people or the surrounding nature. It should cause the least possible harm to the livable environment, and urban planners and officials must always seek to compensate for the damages caused by transportation infrastructure.

One of the most advanced perspectives on urban development, which can initiate the improvement of current urban conditions and serve as an effective step toward sustainable development, is Transit-Oriented Development (TOD). Today, urban theorists believe that public transportation alone is not enough to change development patterns and create meaningful transformations in urban form. Hence, they emphasize integrating public transportation systems into the city's foundation, with TOD being a suitable strategy for this purpose (Sarлак & Parizadi, 2018:20). TOD emphasizes the mutual relationship between public transportation and urban development. It is essentially an urban development model centered around public transportation, forming around hubs and stations such as bus terminals and metro stations (Abbaszadegan et al., 2012:26). Many definitions of TOD have been proposed, with

the most comprehensive one belonging to Peter Calthorpe:

Transit-Oriented Development is an approach that ensures harmony between urban development patterns and the layout of high-capacity public transportation networks. This approach is implemented through mixed-use projects located within walking distance (500 to 800 meters) of public transit stations. The design, layout, and mix of land uses emphasize creating pedestrian-friendly environments and promoting public transit use. A blend of residential, commercial, office, open, and public spaces within walkable distances facilitates mobility for residents and workers via public transport, bicycles, or walking."* (Alizadeh & Abdi, 2016:42).

Placement Indicators for Public Transportation:

Urban public transportation is a networked system that establishes logical relationships between trip generators and users. Numerous case studies confirm the connection between transportation and urban form (Nguyen et al., 2017:3110). Extensive research has been conducted on the placement indicators of public transit hubs, highlighting the strong correlation between mixed land use, density, and citizens' willingness to walk or cycle.

Factors such as appropriate street gradient, optimal sidewalk-to-road width ratios, detailed path design elements (e.g., vegetation and street furniture), higher permeability of pathways to increase public transit options, and the provision of cycling infrastructure encourage citizens to use public and, particularly, non-motorized transportation (An, 2009:79).

Table 1: Physical Indicators for Siting Public Transportation Stations (Sources: Hayllar et al. (2014:11), Alizadeh & Abdi (2016:42), Kashani Jo & Mofidi Shemirani (2009:5))

Indicators	Descriptions
Urban Fabric Indicators	
Building Density	Total number of buildings in a given urban area
Population Density	Population count per unit area
Floor Area Ratio (FAR)	Total built-up area relative to the urban fabric area
Building Height Density	Total building height relative to the urban fabric area
Building Capacity Density	Total built-up floor area relative to the urban fabric area
Urban Fabric Structure	Spatial arrangement of buildings in relation to one another
Street Design Indicators	
Street Width	Total width of the passageway, including all attachments
Sidewalk Width	Dedicated pedestrian width (excluding peripheral services)
Path Design Details	Presence of architectural elements in pedestrian path design
Physical Enclosure	Height-to-width ratio of the street
Urban Connectivity	Number of intersections and permeability within the urban fabric

Research on Tourism Development Based on Transportation:

Several studies have explored the link between tourism development and transportation. Below is a review of selected domestic and international literature:

Javadi-Pour & Daryani (2016) in their paper "Tourism Development with a Transit-Oriented Development (TOD) Approach" argue that leveraging the benefits of an efficient public transportation system is essential for urban tourism development (Javadi-Pour & Daryani, 2016:36).

Shad et al. (2016) in "The Role of Transportation in the Tourism Industry" emphasize the critical interdependence between transportation and tourism. Key findings include the necessity of involving tourism stakeholders in transportation planning and recognizing the shared benefits of urban transportation and tourism sectors (Shad et al., 2016:59).

Eslam Shoaar & Jamali Basir (2014) in "Tourism Development with an Emphasis on Sustainable Transportation" stress that high-quality and easily accessible transportation systems are among the most crucial requirements for modern tourism. They also examine the direct relationship between transportation systems and the tourism industry (Eslam Shoaar & Jamali Basir, 2014:63).

Van Trong & Shimizu (2017) in "The Impact of Transportation on Tourism Promotion: A Literature Review on the Application of General Equilibrium Models" analyze the use of Computable General Equilibrium (CGE) models in empirical studies assessing transportation's influence on tourism. They argue that integrating transportation factors into CGE models is vital for accurately evaluating transportation's role in tourism (Nguyen & Shimizu, 2017:3105).

Khan et al. (2016) in "Tourism Competitiveness Indicators: The Impact of Air, Rail, Travel Services, and Transportation on International Tourism" investigate the effects of air, rail, and land transportation on domestic and international tourism across 19 tourist destinations from 1990 to 2014. OLS regression results indicate that air and rail transport, along with open trade policies, positively impact tourism competitiveness, whereas travel services and certain transport factors negatively affect the industry's competitive index (Khan et

al., 2016:138).

Methodology

From a methodological perspective, research refers to the application of scientific methods to solve a problem or answer a question. It is a systematic, logical, and precise process aimed at addressing issues and understanding relationships between variables (McNally, 2000:60).

Given the objectives and nature of this study, the research method is descriptive-analytical (exploratory and case study-based). Data collection was conducted through:

- Field observations
- Library research
- Questionnaires

Data Analysis Method

The study employs the Fuzzy IHWP (Inverse Hierarchical Weighted Prioritization) model for analysis. The expert panel consisted of approximately 100 specialists, from which 48 individuals were selected as the sample group using targeted sampling based on Cochran's formula.

Steps for Generating the Tourism Potential Zoning Map with Emphasis on Public Transportation

Data Organization: Primary and accessible maps of selected indicators were structured.

Data Classification & Calculation: Organized maps were categorized and computed based on database types (nominal, ordinal, interval, etc.).

Weighting & Scoring: Data layers were graded and scored according to their importance.

IHWP Model Calculations: Each layer was processed using the IHWP model.

Final Map Integration: Based on indicator scores, maps were merged to produce the final zoning map.

The scoring of selected layers for site selection was calculated using the following mathematical relationships (Abazarlou, 2013:140):

$$j = D - (N - i)X$$

$$X = \frac{D}{N}$$

Where:

j = Score obtained for different categories of each indicator

N = Number of categories per indicator

i = Assigned numerical value for different

categories of each indicator

Study Area

The study area is the coastal city of Tonekabon, located in the western part of Mazandaran Province along the Rasht-Chalus route. According to the latest population census in 2016, its population amounts to 55,434 people. The city lies between two main arteries: one in the southernmost part of the city (the Tonekabon bypass) and the other in the northern part, which is the Rasulian axis, continuing as Imam Khomeini Street.

Tonekabon, with its natural potentials (such as the sea, beaches, waterfalls, forests, mountains, and a favorable climate), as well as its historical and cultural assets, is today considered one of the most important domestic tourist destinations in Iran. Its location along the coastal tourism route of the Caspian Sea and its proximity to Tehran are among the most significant spatial-geographical factors that have placed this city at the center of attention for travelers seeking tourism activities.

In recent years, however, Tonekabon has faced detrimental developments, including uncontrolled construction in elevated areas, deforestation for villa construction, encroachment on forested areas by various fish farming projects, and the establishment of poorly equipped and improperly designed temporary tourist facilities. Most critically, after the construction of an incomplete, inadequate, and poorly planned urban bypass, Tonekabon's status as a tourist destination has sharply declined.

Tonekabon is an urban area with a fully occupied fabric, though some parts of its coastline remain usable for tourism. Given the existing tourism infrastructure, only through principled management—such as the development of public transportation—can it become one of the country's major tourist-receiving cities. Additionally, Tonekabon, apart from its coastal potential, benefits from a very narrow plain that lies extremely close to the sea, allowing tourists to reach the shore in a short time. This advantage, under the application of a public transportation development approach, can effectively enhance tourism.

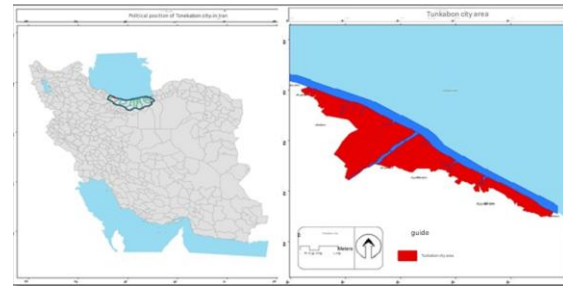


Figure 1: Location of Tonekabon city

Results and Discussion

Given the main research objective of identifying areas suitable for tourism development with an emphasis on transit-oriented development (TOD), the following technical calculations are performed in this section.

First Stage: Determining the Data Matrix

Given the nature of the subject, the necessity of using modern information systems, and the complex and diverse structure of urban fabrics, several different indicators—such as the level of service of the road network and intersections, population density, etc.—are examined to identify areas suitable for tourism development with an emphasis on transit-oriented development.

Second Stage: Applying the Delphi Survey Method to Derive Weighting Assumptions

In this stage, assumptions are made for the eight research indicators based on the study's objectives, as presented in Table 2.

Third Stage: Weighting the Indicators Based on the IHWP Model

In the Delphi model, the eight mentioned indicators are ranked in different categories with varying degrees of importance based on expert opinions. Accordingly, the most important indicator for tourism development with an emphasis on TOD is assigned a value of 5, while the least important is assigned a value of 1.

As seen in the maps, access to public transportation (mainly taxis) is somewhat adequate in the city center, but it remains limited in most parts of the city. Improving access along the coastal tourist zone is recommended. Additionally, the lack of taxi stands near the passenger terminal is one of the challenges in developing public transportation in Tonekabon.

Land-use mix in Tonekabon, particularly in central areas and along Cheshmeh Kileh, is relatively good. However, there is a need to define commercial, recreational, and hospitality

uses along the tourist coastline. The primary arterial hierarchy is well-distributed from west to east but requires the introduction of public transit routes and even bicycle lanes along the tourist coastline—except in the eastern part of the city, particularly along the coast, where high population density necessitates enhanced public transportation.

There are only four public parking lots in the city, indicating a shortage, especially in the western and eastern parts. The city center has the lowest level of service and requires improvements such as new bus routes and additional taxi stands to enhance transit-oriented development.

Some intersections in the city have a low level of service, indicating slow traffic flow, especially during tourist seasons, and require geometric improvements. High building density is linked to land-use mix, which is most evident in the central part of the city, while the

eastern part has less potential for public transportation development under this indicator.

Fourth Stage: Overlaying the Maps

In this stage, the final map is prepared by classifying the data into five distinct categories (from very low to very high development) in terms of areas suitable for tourism attraction with an emphasis on TOD. This allows for changes in land use, identification of critical zones, site selection for new developments, etc. In Figure (4), tourism development zones are marked in green.

As seen in Figure (3), the city center and coastline are highly suitable for this purpose. About 29% of the city has high potential for defining taxi and van stands, bus routes, and bicycle lanes, while 34% (marked in red and orange on the map) have lower potential for TOD.

Table 2: Degree of importance of indicators resulting from the Delphi questionnaire

Weighting Assumptions	Inverse Rank	Rank	Indicator
Increased accessibility reduces personal car usage, and neighborhood units in central areas use cars 10–30% less.	8	1	Access to taxi stations
Mixed land use reduces personal car travel distance and increases the use of alternative modes such as cycling.	7	2	Density and land use mix
Increased accessibility reduces personal car usage, and neighborhood units in central areas use cars 10–30% less.	6	3	Access to the transportation network
Increased density leads to a reduction in per capita car travel. Every 10% increase in urban density reduces vehicle miles traveled by 2–3%.	5	4	Population density
Due to distancing from traffic problems, personal car commuting decreases, and the tendency to use public transportation increases.	4	5	Distance from low-service-level intersections
Due to distancing from traffic problems, personal car commuting decreases, and the tendency to use public transportation increases.	3	6	Distance from low-service-level routes
Increased accessibility reduces personal car usage, and the fewer public parking spaces available, the greater the inclination to use non-motorized transport and walking.	2	7	Access to parking lots
Increased density leads to a reduction in per capita car travel. Every 10% increase in urban density reduces vehicle miles traveled by 2–3%.	1	8	Building density

Table 3: Weighting Indicators for Suitable Tourism Zones with Emphasis on Public Transportation

Indicator	Classification	x	i	Description
Land Use Density & Mix	< 2.0	1.04	1	Very Low
	2.0–4.0	2.08	2	Low
	4.0–6.0	4.02	3	Moderate
	6.0–8.0	5.06	4	High
	8.0–10.0	7.00	5	Very High
Access to Taxi Stations	< 200 m	1.06	1	Excellent
	200–500 m	1.06	4	Good
	500–1000 m	1.06	3	Average
	1000–1500 m	1.06	2	Poor
	> 1500 m	1.06	5	Very Poor
Transport Network Hierarchy	Grade 1 Arterial	2.00	3	Primary
	Grade 2 Arterial	2.00	2	Secondary
	Collector/Distributor	2.00	1	Local
Population Density	< 100 p/ha	1.52	1	Very Low
	100–120 p/ha	2.05	2	Low
	120–140 p/ha	3.57	3	Moderate
	> 140 p/ha	5.00	4	High
Access to Parking	< 200 m	0.08	5	Excellent
	200–400 m	0.08	4	Good
	400–600 m	0.08	3	Average
	600–1000 m	0.08	2	Poor
	> 1000 m	0.08	1	Very Poor
Distance from Low-Service Roads	< 100 m	0.06	1	Very Poor

Indicator	Classification	x	i	Description
	100–150 m	0.06	2	Poor
	150–300 m	0.06	3	Moderate
	300–500 m	0.06	4	Good
	> 500 m	0.06	5	Excellent
Distance from Low-Service Intersections	< 100 m	0.33	1	Very Poor
	100–200 m	0.33	2	Poor
	200–300 m	0.33	3	Moderate
	300–400 m	0.33	4	Good
	400–500 m	0.33	5	Very Good
	> 500 m	0.33	6	Excellent
Building Density	< 5%	0.33	1	Very Low
	5–6%	0.33	2	Low
	> 6%	0.33	3	Moderate

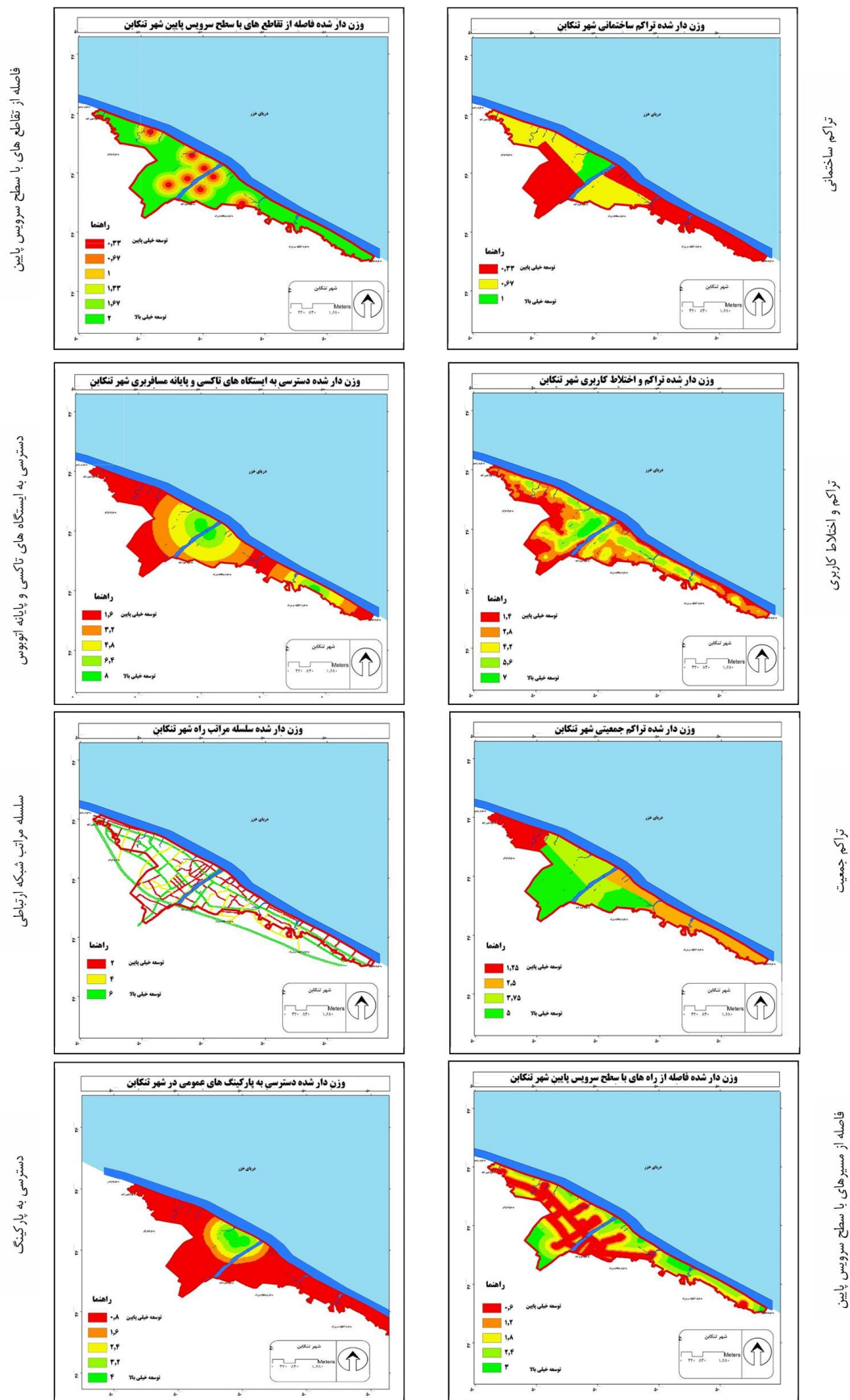


Figure 2: Weighted indicators for locating tourism-prone areas with an emphasis on development-oriented transportation using the IHWP model

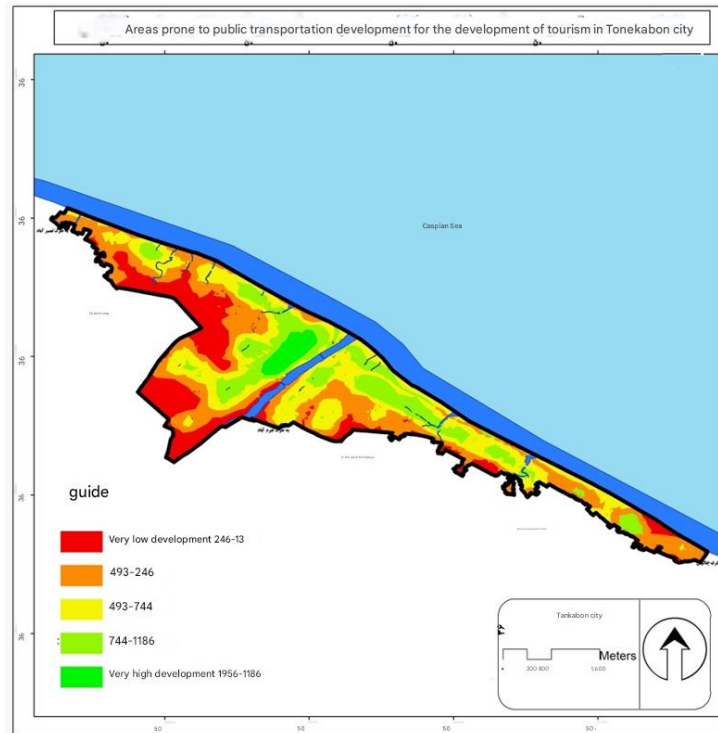


Figure 3: Location of tourism-prone areas with an emphasis on development-oriented transportation using the IHWP model

Conclusion

Potential areas for tourism development with emphasis on transit-oriented development in Tonekabon city were located using the IHWP model in GIS software. For locating, 8 indicators were used including: access to taxi stations, density and mixed land use, access to transportation network, population density, distance from low-service-level intersections, distance from low-service-level routes, access to parking lots, and building density. The results of this section show that the city center and coastal strip are suitable for this purpose, with 29% of the city having high potential for establishing taxi and van stations, bus routes and bicycle paths, while 34% of the city has lower potential for transit-oriented development.

- Concentration and increase of commercial-service and recreational-hospitality activities in the coastal area of the city

- The necessity of creating a ring network to provide rapid transit between main areas of the city without passing through central zones
- Definition of bus routes and increase of taxi stations in central streets of the city to reduce area traffic
- Creation of public parking especially near terminals and the coastline
- Establishment of proper taxi service to all areas (especially around the city)
- Widening of the main connecting bridge between east and west of the city
- The necessity of constructing another bridge over Cheshmeh Kileh river connecting Takhti and Mirza Shirazi streets
- Construction of bicycle paths especially along the city coastline
- Creation of intercity bus service from various cities to Tonekabon as a tourism city.

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