# Developing Transit-oriented Strategies for Sanandaj City Center, Iran

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## Abstract

Over recent decades, "Transit-oriented development" has been developed as a new approach based on sustainability concepts. This approach is mainly concerning coordinated action between land use planning and transportation planning which tries to create a clean, people friendly, livable and dynamic community with growing local economy. Today, old urban centers face enormous challenges in terms of their physical and functional aspects. One of these is traffic congestion caused by heavy movement of private cars. In this regard, this paper tries to mitigate the current challenges and to enhance the quality of Sanandaj city center life, using TOD principles. To do this, SWOT analysis is the main approach of the paper to evaluate the existing conditions of the city centre to reach the suitable strategies. Considering main aim of research, three objectives including increasing spatial and functional sustainability, increasing accessibility and providing sustainable transport options along with easy pedestrian movement, and reducing environmental challenges have been outlined to conceptualize the suitable strategies of the research. The findings show that if TOD is to be widely adopted as a real alternative to automobile-oriented urban pattern, it needs to capture a broad market view from both sides of private and public sectors. Nevertheless, it is really the public sector that is asked to take the lead, set the stage, develop polices and offer important subsidies and assistance to support the creation of TOD in the city centre.

**Keywords:** Transit- oriented development, public transportation, transit center, Sanandaj downtown, SWOT analysis

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## 1. Introduction

After industrial revolution, car and automobile dependency frequently increased. In this era, City centers as the core of the cities became the main arena of vehicle daily trips due to concentration of different uses such as residential, commercial and services. Due to such values, traffic congestion and resulting impacts such as air and noise pollution became the main challenges of city centers in developing countries. The main reason of these challenges is due to lack of coordination between land use planning and transportation policies. To cope with this, policy makers usually try to decrease car dependency in such areas. In this regard, "New urbanism and smart growth movements" started to deal with this challenge using a compact and dense development, transit-oriented communities and creation of walkability and bikeability neighborhoods as effective sustainable approaches for reducing car dependency [Barla et al., 2011; Williams et al., 2000]. A new and effective approach to achieve sustainability goal is "Transit-Oriented Development (TOD)". Within Smart Growth and New Urbanism movements, TOD emphasis on developing public transportation; this provides healthy and pedestrian-friendly communities with dynamic economy. TOD is a process concerning with development of mixed-use areas with public services around a transit station (like LRT , BRT , Bus) with high efficiency and high quality [Cervero, 1998]. TOD strategy integrates land use and transport functions to prevent urban sprawl and transform a city [Cervero et al., 2004; Newman and Kenworthy, 2006]. It is generally defined as a development located within a 10 minute walk, or approximately 0.5 mile, from a light rail, heavy rail, or commuter rail station. It also includes development along heavily used bus and bus rapid transit corridors [American Planning Association, 2006: 450]. Under right conditions, it can be a boon to local communities, especially when coupled with proactive public assistance [Cervero et al., 2004].

While many of Iranian cities face challenges caused by sprawling resulting from waves of rural and inter-urban migrations, it is predictable that the problems will gradually increase and the notion of sustainability face great threats. To examine these challenges and threats, Sanandaj City, located in western part of Iran, has been selected as the case study of this research to pursue some aspects of TOD. Same as other cities, Sanandaj has also experienced the pattern of sprawl development mainly due to the topographic feature of the city's natural context and the wave of migration from rural areas. Outward growth of Sanandaj has expanded the city boundaries leading to more car dependency by people to commute between city centers and surrounding areas. City centre of Sanandaj contained valuable socio-spatial aspects of Kurdistan region. For this reason, it is the main converging point of the city structure and daily trips of the city residents usually make them meet together there.

Considering these points and resulting heavy traffic within the city centre, this paper analyzes the existing spatial condition of the city centre focusing mainly on the catchment area around Naser-Khosro Transit Centre to provide best strategies suitable for enhancing the quality of life within the area.

## 2. Background

Although the concept of TOD was mainly recognized in line with the work of Calthrope [Calthrope, 1993], most of the post-World War II new towns in Japan, Sweden, and France have contained some aspects of TOD. Urban regenerated areas in Poland and outward development in Denmark encompassed local principals of TOD in their planning that support mixed uses and bikeability. Regarding these points, some of researchers believe that TOD is mainly originated from urban planning and design principles of European cities. In Europe, bus station is not just for transit of people, but a social place containing compact settlements, a mixed use pattern of functions while encourage people to use public transportation [Bernick and Cervero 1997 quoted by Chisholm, 2002]. However, these principles do not completely match the main principles of TOD originated from USA [Brown et al., 2009; Knowles, 2012]. In recent decades, use of TOD has become a useful approach in development of American cities against urban sprawl. Particularly, this is more important and obvious in reduction use of fossil fuels and energy consumption [Chisholm, 2002]. In addition to USA, in some large Asian cities including Hong Kong,

Singapore and Tokyo, TOD was very successful and has delivered compact and very high density urban development around rail transit stations [Cervero, 1998]. In these cities, high use of cheap rail transit helps to reduce demand of private car ownership and use [Knowles, 2012]. Using TOD strategy in Curitiba city in Brazil has improved environmental conditions and brought forward socio-economic sustainability over last decades [Goodman et al., 1995]. Considering these results, TOD could be considered as a useful approach for development of cities. In practical cases, TOD mainly focused on developed sites and suburban neighborhoods as case studies around the world. They have often emphasized and worked on large scale projects within urban and regional scales and few studies focused on the small scale projects, same as city centers. Song and Oh worked on the city of Seoul and found that applying TOD planning principles can achieve a significant positive impact on forming a Transit- Oriented city. Due to the low urban density in American cities, they stressed that TOD principles must be carefully applied in the city of Seoul [Song and Oh, 2011]. Loo et al. claimed that residents living in TOD neighborhood used transit more frequently than people having similar socio-economic characteristics but living elsewhere [Loo et al., 2010]. Using regression model, Bailey concluded that households living within ¾ mile of public transportation services in USA, spend less fuel independent of their own use of public transportation. Moreover, residents of TOD neighborhoods have slight attitude towards vehicle ownership and driving, and tend to do more walking, cycling and to use public transportation compared to other neighborhoods [Bailey, 2007].

To date, few studies have been done on developing TOD at urban areas particularly within the city centers. These studies mainly focused on the TOD concepts and emphasized its use in Iranian cities. For example, in a study conducted by Abbasszadegan et al (2011) in the city of Tehran, it was revealed that the public transportation routes are not in line with TOD characteristics and in some cases they are in contrary with neighborhood concepts [Abbasszadegan et al., 2011]. In another study, Metro and BRT development were recognized as key and crucial steps in improving and solving urban problems regarding the main trend of TOD [Behzadfar and Zabihi, 2011]. They stressed that TOD should be included in Master and Detailed Plans.

## 3. Methodology

This main approach of this study is based on a descriptive case-study. The data were collected from Sanandaj Master Plans and direct observations of the catchment area of Naser-Khosro transit center. The data analyses were conducted using SWOT technique leading to the strategies. To reach the strategies, three stages have been used (Figure1).

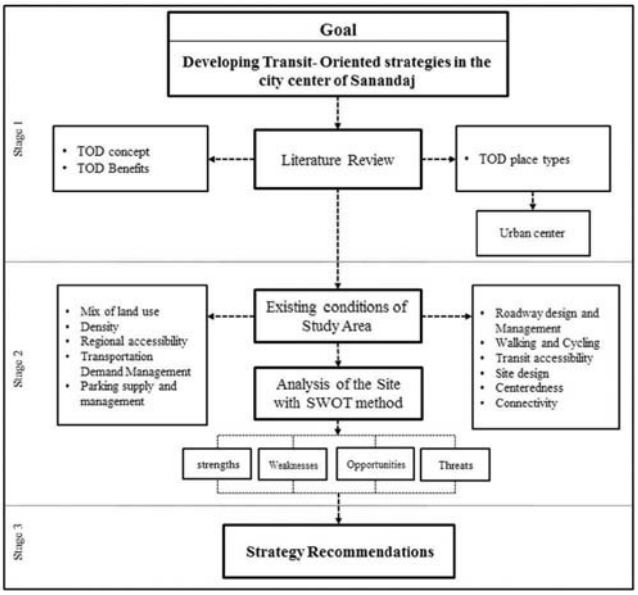


Figure 1. Research methodology structure

Stage I. Foundational elements of TOD were identified and main principles of mixed use urban centers were derived from literature review and case studies.

Stage II. The research study area includes a catchment area of 600 meters radii from the Naser-Khosro transit center in the city centre of Sanandaj (Figure 3). It covers 101 hectares. After identification of the catchment area, different data including land use, density, connectivity, site design, centeredness, parking supply and management, walking and cycling conditions, etc. were collected. The collected data were analyzed using SWOT method considering four elements of strengths and weaknesses as internal aspects, and opportunities and threats as external aspects of the study area. SWOT analysis can provide a framework for analyzing a situation and developing suitable strategies and tactics; a basis for assessing core capabilities and competences; the evidence for, and key to, change and success and also provide a stimulus to participate in a group experience (Saaty, 1987). In this study, SWOT analysis was applied to develop strategies and action plans for successful implementation of TOD initiatives for city center of Sanandaj.

Stage III. At the last stage of research, strategies were derived from the process of SWOT analysis to cope with existing challenges of the study area regarding the TOD principles.

## 4. Results

### 4.1 Existing Conditions

The city of Sanandaj, as the capital of Kurdistan Province, is one of the main cities in the western part of Iran having experienced a huge wave of migration from rural areas (Figure 2).

Sanandaj city center, Naser-Khosro transit center is located, in the traditional core of the city and is the main converging point of the city structure. For this reason, it attracts most of the daily trips within the city and its hinterland. Apart from this, due to deterioration of urban fabric of quarters in the city center and problems of their regeneration, most of the inter-urban migrations have been directed towards this part and it became an area for the poor. It also attracts many informal jobs such as peddlers. Another important issue is in relation to the lack of sufficient link between land use pattern and travel demand within the city in general. Due to such concentration and problems, public transportation is one of the important solutions regarding urban sustainability approach toward the city center development. Within the case study area, Naser-Khosro Bus station is the only transit center including 3700 $m^2$ with 9 bus lines for the whole city of Sanandaj.

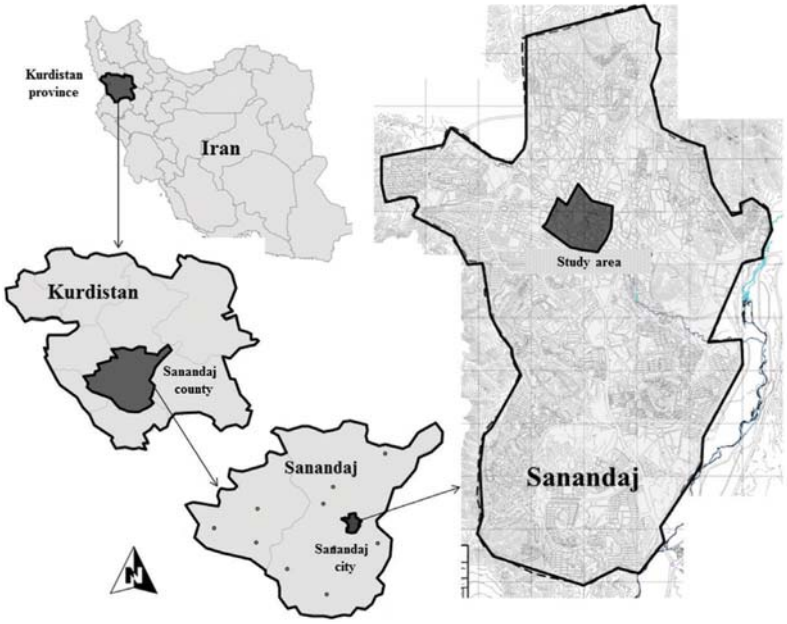


Figure 2. Study area location in Sanandaj

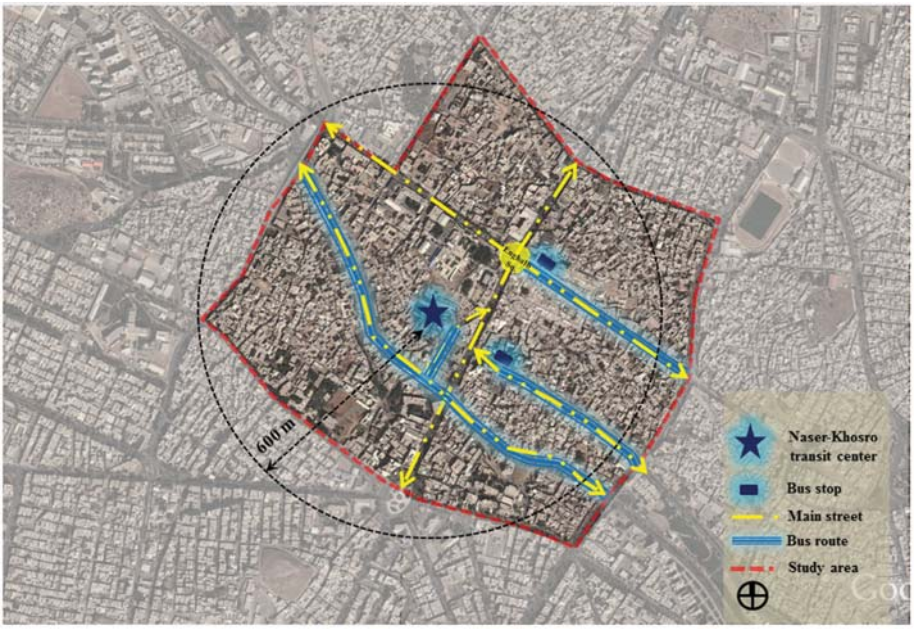


Figure 3. Location of Naser-Khosro transit center in study area

Study area included different uses including residential (most area), cultural, commercial, educational, administrative, green space and transportation. More importantly, most of the historical and valuable places of Sanandaj, lie in this area. Urban grain of the study area is small and constitutes narrow and twisted routes. The average of building height is two floors and its maximum is five floors (Figure 4). Net population density is 334 and gross density is 220 people per hectares. In comparing with the whole city, it encompasses a high density which reduced residential per capita to 18 $m^2$ [5](HUPO, 2011).

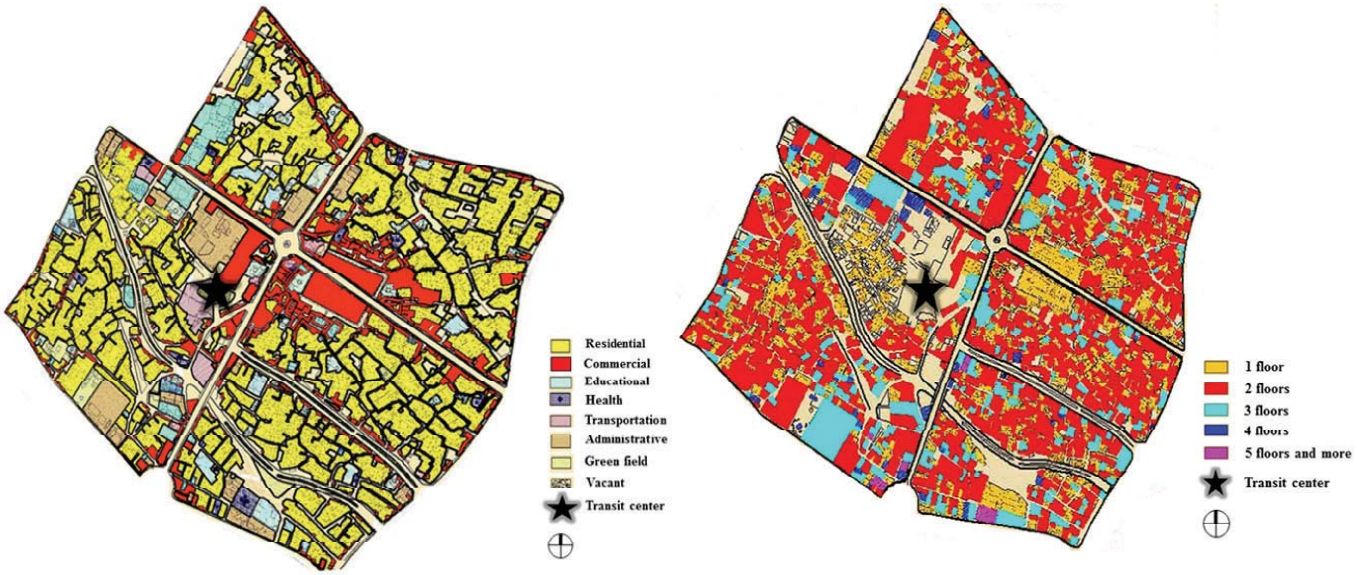


Figure 4. Land use pattern (a) and floors in study area (b)

Due to the organic pattern of streets network, particularly the existing of dead-end ones, permeability of the area is too weak and most parts of the catchment area are mainly in line with pedestrian-oriented character. But orthogonal street layouts have been imposed on the exiting organic fabric by modern movement created major problem for pedestrian network connectivity and safety of movement (Figure 5).

The Above features indicate that the catchment area has no sufficient hierarchy of street network and space for efficient movement and stops of public transportation system. Apart from Naser-Khosro transit center, there are only two bus stops in the catchment area. Due to lack of sufficient parking areas, the cars are usually parked on both sides of the streets and this usually slows down the traffic movement and increases traffic congestion.

**4.2 SWOT Analysis of the Study Area**

One of the analytical methods developed in urban studies is SWOT analysis. This method includes some stages from analyzing the existing conditions using a framework of internal strengths and weaknesses and external opportunities and threats to presenting strategies. As explained in the methodology, the data includes those features that affect travel behavior of residents within the catchment area. In the following table, those features have been categorized under three components including land use, mobility, and environmental features.

**4.3 Strategy Recommendations**

After summarizing and putting the main features of the study area into the SWOT analysis framework, in this stage suitable strategies were outlined regarding main aim and objectives proposed for the effective role of TOD in future development of the study area (Table 2). To implement these strategies, it is very important to consider the role of public sector in the planning processes.

Figure 5. Organic patterns of streets in the catchment area

Table1. Analysis of the site by SWOT

| SWOT | Internal Analysis | | External Analysis | |
|---|---|---|---|---|
| | Strengths | Weaknesses | Opportunities | Threats |
| **Landuse features** (Such as centeredness, mixture, density, site design, etc.) | • Historical background of the study area and existing symbolic building and spaces<br>• Centralization of urban services and attractive commercial, tourists and historical uses<br>• High population density<br>• Mixed uses<br>• High level of its results in increasing sense of responsibility particularly sense of place | • High prices of property values<br>• shortage of green and recreational spaces<br>• lack of public uses and poor urban infrastructures<br>• Existence of incompatible uses such as auto repair shops workshops<br>• The problem of urban regeneration restoration of old building due to the labyrinth pattern of street network<br>• Topographical features of the site and the problem of Naser-Khosro transit center development and operation | • Existence of vacant lands and deteriorated buildings for redeveloping based on TOD guidelines<br>• Compactness of urban fabric<br>• High level of economic dynamic and market demand | • Lack of coordination between land use planning and urban transportation may lead to more deterioration of the physical aspects of the site<br>• High level of land use change from residential to commercial and its result in weakening livability ig the area during the night |
| **Mobility features** (Such as accessibility, connectivity, walking and cycling, roadway design, etc.) | • High permeability of pedestrian movement due to vernacular and organic structure of the site;<br>• Pedestrian-oriented character of the street network | • Topographical features of the site and the problem of people movement and accessibility of the site<br>• Car dependency, traffic congestion and crowding<br>• high volume of traffic and low capacity of streets<br>• Weak hierarchy of street network and poor connectivity of pedestrian and bicycle ways<br>• Poor accessibility of people to the public transportation stops | • People tendency to public transportation due to its low cost | • Inefficiency of bus transit function due to low level of service (LOS) in some parameters (for example hours of service, coverage area, headway time and etc.)<br>• Inefficiency of public policy in restricting vehicles movement |
| **Environmental Features** | | • Air and noise pollution caused by traffic congestion<br>• Lack of green spaces in the study area; | • Existence of vacant land | • Existence of dust in air In combination with other Suspended particles which effects residents health |

## 5. Conclusions

Transit Oriented Development (TOD) has been increasingly promoted as a solution to the problems of urban growth throughout the world. While rail has been the focus of most planning for TOD, this paper emphasizes on bus transit center in the city center of Sanandaj, Iran. Based on results obtained from the process of SWOT analysis, a number of strategies were proposed for the study area regarding the main aim and objectives of the research including Increasing spatial and functional sustainability, increasing accessibility and providing sustainable transport options along with easy pedestrian movement, and reducing environmental challenges. It has been clearly demonstrated that there are many pieces that need to be in place for TOD to succeed in the city center. If TOD is to be widely adopted as a real alternative to automobile-oriented urban pattern, it needs to capture a broad market view from both sides of private and public sectors. Nevertheless, it is really the public sector that is asked to take the lead, set the stage, develop polices, and offer important subsidies and assistance to support the creation of TOD in the city centre. The actions of the public sector are influenced to a great extent by the attitudes of the public, since it is taxation that defines public revenue. Apart from this, it is important to do some changes in provision of urban development plans, policies, and related actions to highlight the role, status and pave the way for implementation of TOD principles.

## 6. Acknowledgment

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Table2. Main aim, objectives and TOD strategies for developing the study area

| Aim | Objectives | Strategies |
|---|---|---|
| Improving the quality of urban life and creating a livable city centre | Increasing spatial and functional sustainability | • Density of buildings needs to be increased around bus stations and along main streets and decreased towards residential areas<br>• providing a range of housing options likes single family, low-rise and high rise buildings<br>• Regeneration and reconstruction of deteriorated buildings and providing sustainable housing for residents<br>• Enhancing social dimension and identity of neighborhoods regarding their historical characters<br>• Providing public uses such as primary schools, shops, sport complexes, playgrounds, etc. within neighborhoods and locating key services nearby bus stations<br>• Green spaces, parks, and recreational places should be provided as an integral part of landuse alternatives at urban scale<br>• Replacing incompatible uses with compatible ones as pedestrian-friendly uses<br>• using vacant lands for transportation amenities and public uses and public spaces at strengthen social interaction and decrease car use dependency<br>• Putting some items within the terms of reference in urban development plans to highlight the role, status of TOD principles |
| | Increasing accessibility and providing sustainable transport options along with easy pedestrian movement | • Encouraging pedestrian movement and restricting use of cars in central part and around transit center via choosing sustainable modes of transportation such as bicycle and Para-transit systems and increasing efficiency of bus transit to increase accessibility of the area<br>• selecting new bus stops along bus line to increase accessibility of residents to public transportation and decrease Vehicle Mile of Travel(VMT) of residents and other people like site visitors,<br>• Distribution of small and shared parking spaces within the study area away from Naser-Khosro transit center and restrict side parking along streets |
| | Reducing environmental challenges | • Development of green spaces<br>• Reducing vehicle trips by defining traffic restriction boundary<br>• Controlling noise and air pollutions<br>• Increasing parking costs nearby bus transit center and along main streets<br>• Developing Eco-mobility (pedestrian, cycling, ...) |

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