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Article

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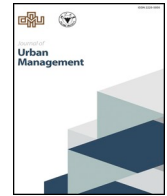
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Qatar National Museum-Transit oriented development: The masterplan for the urban regeneration of a ‘green TOD’

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ABSTRACT

Over the past two decades, a growing number of communities have pursued light rail transit (LRT) and Transit-Oriented Developments (TODs) as part of an integrated transportation and land use strategy to revitalize and/or regenerate the built environment of worldwide cities. In the past few decades, Doha, the capital city of the State of Qatar, has experienced an extraordinary and rapid urban growth, caused by Post-WWII oil and natural gas production, which has transformed the country's economy. As a result, the State of Qatar has invested large funds into the transformation of Doha's built environment and the construction of major urban public transit systems [i.e., the Doha Metro, the Lusail LRT, and a bus rapid transit (BRT)].

This research study explores the urban development of Qatar National Museum's (QNM) Transit Village (TOD) located along Doha Metro's Gold Line, in the proximity of Doha Cornice, the Museum of Islamic Art and MIA Park. The research study aims to propose a masterplan for the urban regeneration of QNM's transit village, based on a Green Urbanism and TOD design strategy.

1. Introduction

The city of Doha is facing the need for planning transit-oriented developments (TODs) aiming at regenerating transit urban villages, where livability and/or quality of life is enhanced. The ongoing construction of the new Doha-metro system in the State of Qatar, which encompasses the development of approximately 100 metro stations distributed along four main lines, provide an opportunity to address a comprehensive strategy for the urban regeneration of the major transit villages (TODs) along the metropolitan premises (R. Furlan & Saeed, 2019). Among these urban villages, Qatar National Museum (QNM) is considered one of the most relevant settlements (Raffaello Furlan & Faggion, 2015). Currently, seen the limited available studies exploring the process of urban regeneration of transit villages in Doha, this research study focuses on the master planning of the distinctive QNM-TOD. The study aims at revealing a detailed approach for the urban regeneration of the settlement through a master planning proposal conceived through a (A) green urbanism and (B) TOD design strategy. (see Fig. 6 and 7 and 23–29)

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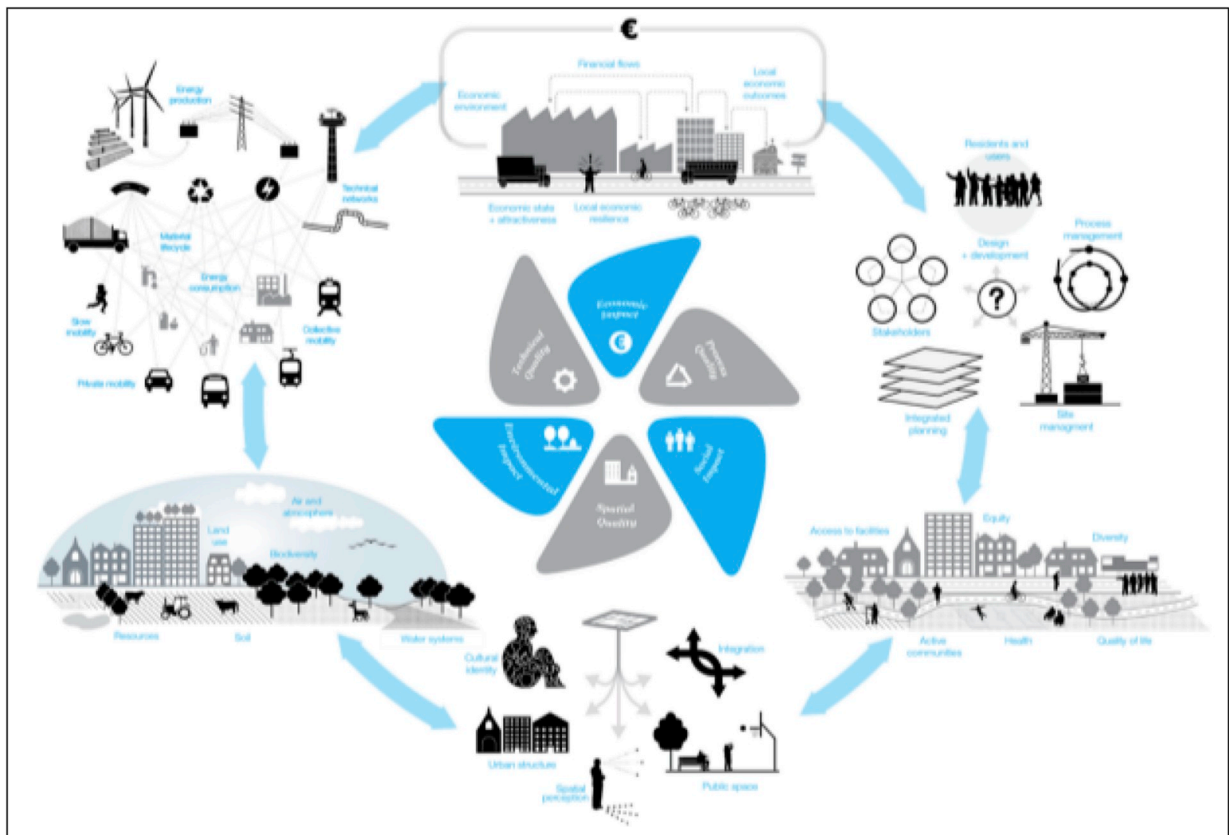


Fig. 1. Sustainable Urbanism Fields (Source (Hill et al.,):

2. Literature Review

Sustainable urbanism

During the late 1960s and early 1970s, ecological and urban crises triggered the introduction of the sustainable urbanism movement. The hasty industrialization period of the past 200 years showed its affect through various scales on the environment (climate change and global warming), reaching a collapsing point. The urban crisis showed its effect for two reasons: (1) the rapid sprawling of cities into the outskirts and surrounding farmlands and (2) the rapid expansion leading to extreme urban deterioration, affecting the quality of urban life (Gehl, 2010; Gehl & Svarre, 2013; Marcotullio & McGranahan, 2007).

In general, sustainability is defined as meeting the needs of the present without compromising the ability to meet future needs. When sustainability is linked to the urban context, it is considered as a new framework for the purpose of the development, design and management of cities (Haas, 2012; Stevenson, 2013). It is highly associated with architecture, urban planning, and urban design, and takes great consideration in creating an equitable urban development on economic and social levels. Therefore, there is a strong synergy between sustainable development and social justice, resilience, health and safety, and green economic growth (Adhya, Plowright, & Stevens, 2010; Haas, 2012; Kasioumi, 2011).

Sustainable urbanism is considered a self-aware movement that proposes various tactics and principles for applying sustainability of urban design (Brown, Dixon, & Gillham, 2014). Scholars argue that (Fig. 1), there are six fields that sustainable urbanism is concerned with: (1) Social Impact, (2) Spatial Quality, (3) Environmental quality, (4) Technical quality, (5) Economic impact and (6) Process Quality (Hill, Paep, & Reeth,). Each field is concerned with specific aspects and themes, as shown in Fig. 2.

In addition, the Freiburg charter introduced 12 principles of sustainable urbanism that apply in accordance with settlement typology. The principles to achieve a sustainable city are: (1) City of diversity, safety and tolerance, (2) City of neighborhoods, (3) City of short distance, (4) Urban development along public transport routes (High-Density Model), (5) City of education, science and culture, (6) City of commerce, economy and employment, (7) City of nature and environment, (8) City of quality design, (9) City of long-term planning, (10) City of communication, (11) Reliability, obligation, and fairness, and (12) City of cooperation, participation, and partnership (Daseking, 2014). The listed principles are the basis for creating sustainable developments by: (1) maintaining local identity and encouraging cultural variety, (2) proposing and developing public transport and taking them into consideration when developing cities, (3) source management and improvement of both underdeveloped and developed parts of the city, (4) introducing and linking green areas, (5) construction and public space quality, (6) social equity and efficient use of land, (7) developing various

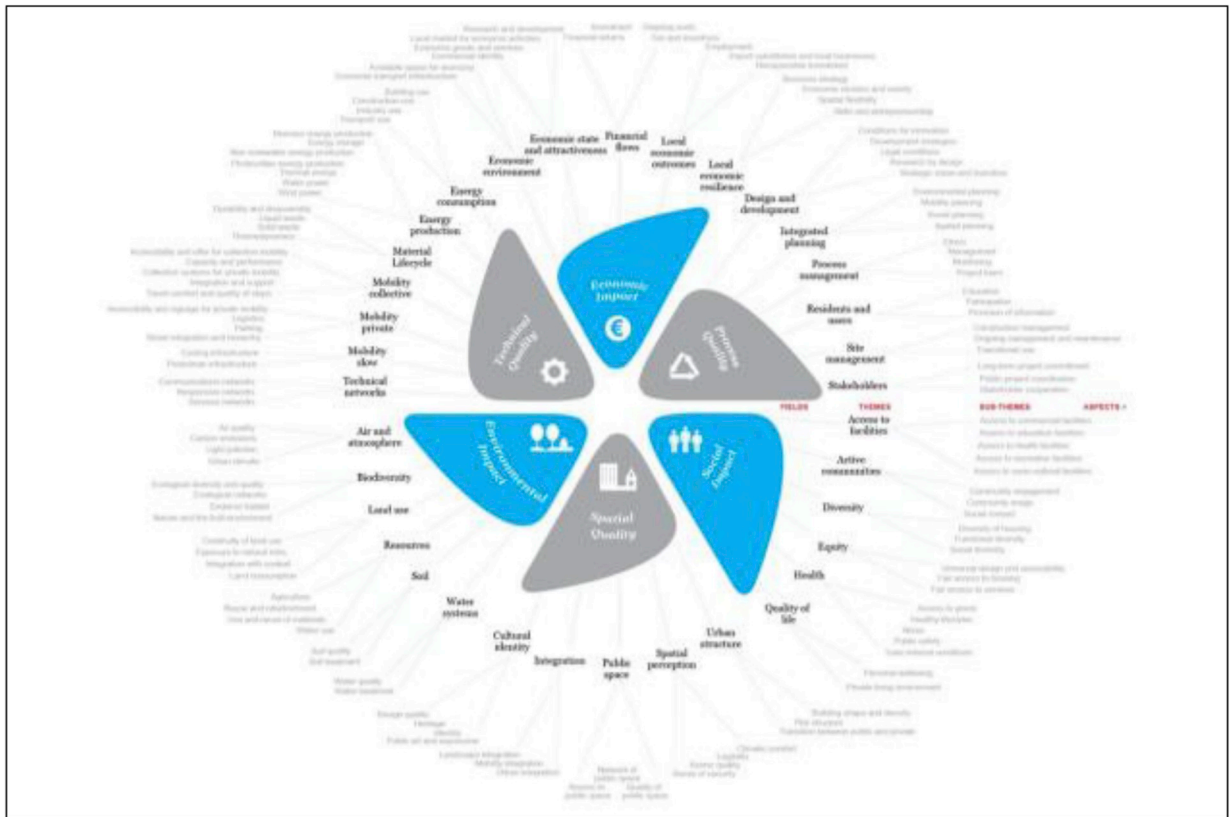


Fig. 2. Sustainable Urbanism Themes (Source (Hill et al.,):

housing options, (8) securing and creating innovative jobs, and (9) encouraging the involvement of diverse parties (Daseking, 2014).

Green urbanism

Green urbanism is concerned with the interaction of the urban environment and the ecosystems to generate a beneficial community for people and the natural environment. The movement encourages dense development, energy efficiency, revitalization of post-industrial zones, and endorsement of sustainable development, both socially and environmentally (Beatley, 2000; Carmona, Tiesdell, Heath, & Oc, 2010). Lehmann (2010) and Roggema (2017) define green urbanism as an interdisciplinary movement, which needs collaboration between various disciplines, such as urban planners, ecologists, engineers, landscape architects, sociologists and economist. Green urbanism unites the views of (A) ecologists, concerned with ecological footprint, (B) public health administrators, concerned with the effect of pollution, and (C) economists, concerned with real estate prices (Roggema, 2017) (see Fig. 3).

Green urbanism is described by Lehmann (2010) as ‘common sense urbanism’ since it focuses on not only the technical aspects of creating a sustainable city but also on how to create a health community, both environmentally and socially. The triple zero concept of creating zero energy use, waste and emission introduces 15 principles to be addressed when approaching urban design projects. However, each unique design requires emphasis on different principles following a specific approach. The green urbanism principles (Fig. 4) are: (1) understanding climate and context, (2) renewable energy, (3) zero waste, (4) water management and quality, (5) biodiversity, (6) sustainable modes of transportation and compact polycentric cities, (7) the use of local materials, (8) densifying existing districts with mixed-use developments, (9) development of green buildings and districts, (10) focusing on livability and quality of life, (11) local food production and supply, (12) fostering the identity and sense of place through balancing conservation and new developments, (13) the urban governance and leadership concerned with policies and decision making, (14) education and knowledge, and (15) developing countries strategies (Lehmann, 2010; Roggema, 2017) (see Fig. 5).

Two breakthroughs in the history of city planning -the introduction of automobiles and climate change-have led to modern city models. In the 1980s the population increased rapidly and as a result number of households increased. Whilst the need for housing and for urban space kept high demand, urban planners and designers urged the need to address the negative effects of urban sprawl: therefore, the proposed compact city concept, aiming at a high-density mixed-use and intensified urban form, was seen as an approach capable of ending urban sprawl. Namely, the concept of the compact city is based on four cardinal principles.

- Density: urban activities should be located closer together to ensure better access to services and facilities via public transport,

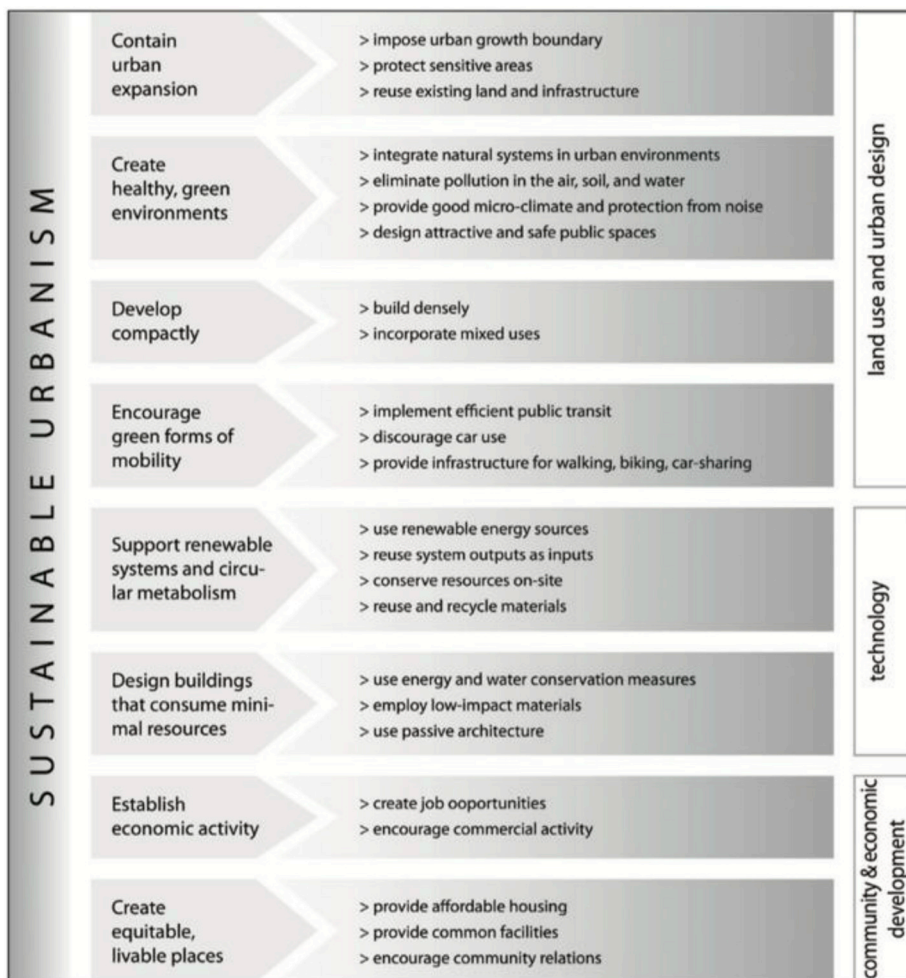


Fig. 3. Principles of sustainable urbanism (Source (Kasioumi, 2011):

walking, and cycling, and more efficient utility and infrastructure provision;

- Intensification: urban developments should occur in existing urban areas rather than in suburbs;
- Mix of uses: different activities should be mixed horizontally, requiring different land uses and facilities;
- Human scale: achieving a better quality of life, and therefore consideration of the effects of the local environment should be given greater emphasis;

In the 21st century, the idea of compact cities, prompted by the need to shift from fragmented urban settlements, was led by the green urbanism movement. The adoption of combined principles derived from green urbanism and transit-oriented development (TOD) encouraged the development of green, sustainable cities, where the need of creating more pedestrian-oriented and less car-focused areas is continuously gaining acceptance from scholars. With the shift toward sustainable cities, green TODs represent the future of cities and communities, aiming at shaping livable, compact, walkable and green public centers (Bernick & Cervero, 1997; R.; Cervero, 1998; R.; Furlan et al., 2018; Lehmann, 2010; Newman, 2015).

Transit-oriented development and sustainable urban regeneration

TOD model is generally considered a mixed-use development located near and oriented towards public multi-modal transport facilities. Commonly, it features urban compactness, pedestrian and cycle-friendly environments, public spaces near stations, acting as community hubs. TOD emerged in the last decades as a dominant planning strategy to mitigate present-day environmental and/or sustainability's problems: the creation of walkable, multi-use nodes within the centers and outskirts of cities that depend on density by the fusion of public transportation and land use practices is the basic approach of TOD (P. Calthorpe, 2011; R. Furlan & Alattar, 2017; R. Furlan & Almohannadi, 2016; Jacobson & Forsyth, 2008). TOD introduced various models and terminologies such as "Transit villages" and "Transit-friendly design" (Peter Calthorpe, 1993; R. Cervero, 1998; Robert Cervero, Ferrell, & Murphy, 2002; Dittmar & Ohland, 2004; Tumlin, Millard-Ball, & Seigman, 2003). Calthorpe (1993) defines TOD as "a mixed-use community within an average

Principle	Aspects
Climate and context	Site’s climate conditions, orientation and compactness, landscape, topography and resources, maintain complexity, own methods, and tailored strategies for every district take advantage of local potentials
Renewable energy	Availability of local renewables (energy potentials [72], city district as a producer of energy, distributed energy supply through decentralized systems, local storage, smart grid, energy efficiency, co-gen, cascading exergy principles, intelligent building management.
Zero-waste	Circular, closed loop, turn waste into resource, reduce, reuse, recycle, and compost waste to produce energy, remanufacturing, balance in nitrogen cycle
Water	Reduce consumption, efficiency of use, water quality, aquatic habitats, city as a water catchment area, storm water retention and flood management, rainwater harvesting, local treatment of waste-water, safe water and sanitation, algae, integrated urban water cycle planning, black and grey water treatment, dual water systems, drought resistant crops
Landscape and urban biodiversity	Local biodiversity, habitat, ecology, wildlife rehabilitation, forest conservation, urban vegetation, inner city gardens and urban agriculture, mitigating Urban Heat island effects, tree planting, restoring stream and river banks, de-pavements, carbon storage
Sustainable transport and good public space in compact poly-centric cities	Public space network, post fossil mobility, access to public transport, safe bicycle ways, smart vehicles, walkable city, streetscapes for healthy active lifestyle, medium dense housing typologies
Local materials with less embodied energy	Advanced materials technology, local materials, modular prefabrication, lightweight structures, disassembly, resource recovery, reuse building components
Density and retrofitting existing districts	Densification of the city, mixed use urban infill, retrofitting inefficient building stock, better land use planning, public space upgrading, adaptive reuse, city above the city, self-sufficiency
Passive design for buildings and districts	Low energy, zero-emission design, reduce energy use, compact solar architecture, bioclimatic architecture, design for disassembly, solar architecture, flexibility in plans, energy generating buildings
Liveability and mixed use	Affordable housing, healthy community, social inclusion, mixed use, liveable and flexible housing typologies, secure tenure, diversity, integrating a diversity of economic and cultural activities,
Local food and short supply chains	Local food production, regional supply, urban farming and agriculture, community and allotment gardens, roof gardens, urban market garden, paper bags, recycling, organic produce
Identity and sense of place	Public health, cultural identity, urban heritage, air quality, distinct environment, grassroots strategies, affordable studio space, creativity of government and citizens, health, activities and safety
Urban governance and leadership	Evolutionary and adaptive policies, decision making, and responsibility shared with empowered citizenry, enabling citizens, updating building codes, improve planning participation, integrated public awareness, legislating controls on density and urban sprawl, support high quality densification, finance low-to-no-carbon pathways, eliminate fossil fuel subsidies, certify urban development projects
Education, research and knowledge	Up-skilling, knowledge dissemination, primary and secondary school teaching programs, university as a think tank, redefine education of architects, foundation of centre for sustainable urban development

Fig. 4. Principles of green urbanism (Source (Roggema, 2017):

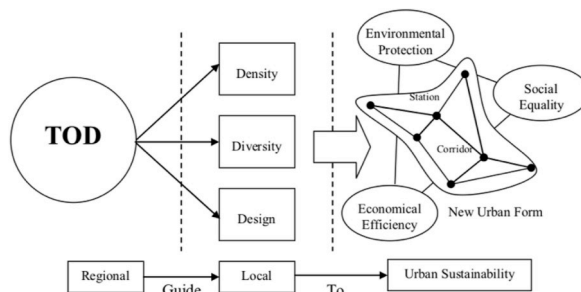


Fig. 5. Transit-oriented development and urban sustainability (Source(Li & Lai, 2014):

2000-foot walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car.” Simply, TOD is the creation of a mixed-use, dense, walkable and compact development around a transit node (Robert Cervero et al., 2002).

TOD is about the planning of places for users to live, work, shop and relax, diminishing the reliance on the use of private vehicles (R. Furlan, Zaina, & Zaina, 2016; Jacobson & Forsyth, 2008). TOD is based on transit, tackling pedestrian, cycling and automobile use reduction is of major importance (Peter Calthorpe & Fulton, 2001; Dittmar & Ohland, 2004; Seigman, 2003; Tumlin et al., 2003). TODs are based on the three dimensions (3Ds) of (1) Density (higher urban density within a 400–600 m radius), (2) Diversity (mixed

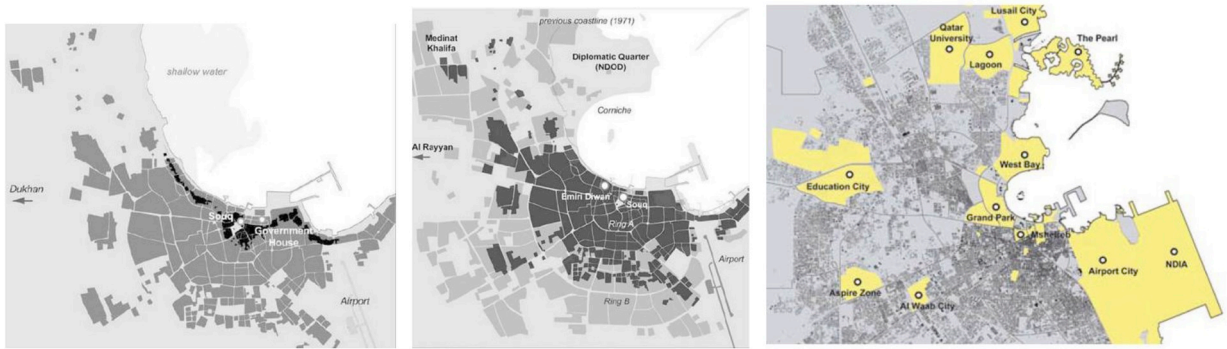


Fig. 6. Doha's settlement areas in 1947 and 1971 (left), 1971 and 1988 (middle), and 2008 (right) highlighting the location of mega projects (Source (Salama & Wiedmann, 2013):

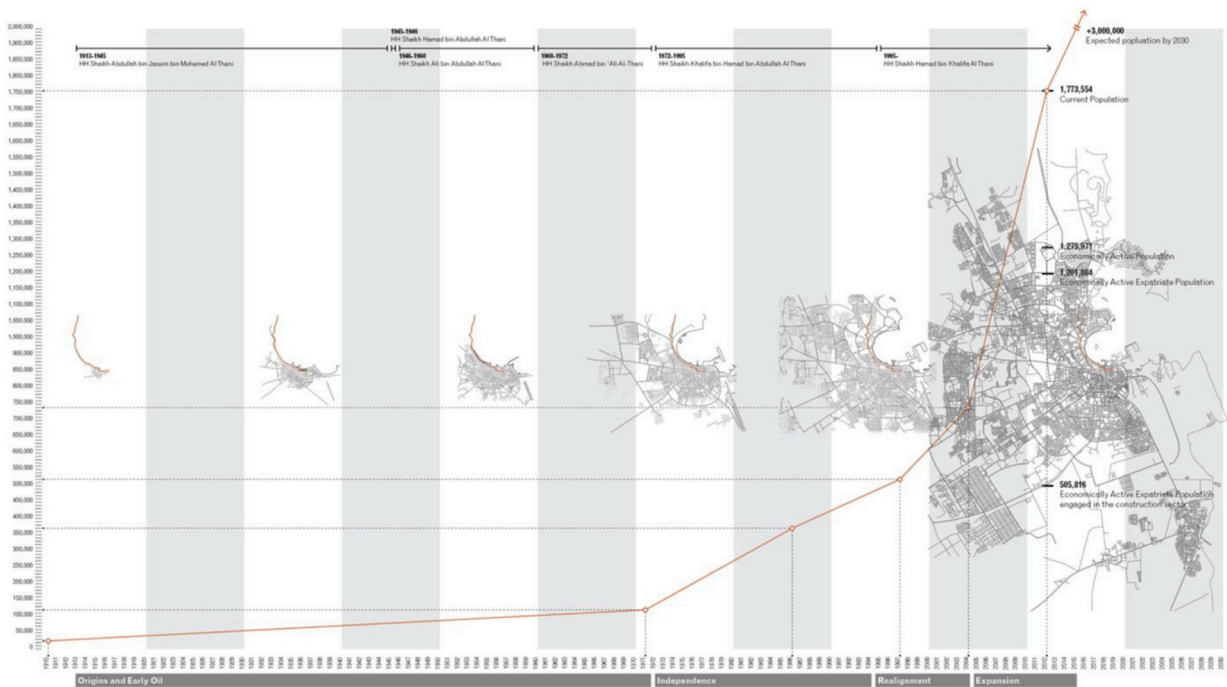


Fig. 7. The urban growth of Doha (Source: Scenes and Speculations from an Emerging City).

land-use, multiple housing options, and transportation modes), and (3) Design (livable, walkable, accessible, and connective design) (Zaina, Zaina, & Furlan, 2016). The three strategies leading the TOD allow to create a sustainable, green TODs achieving (1) environmental protection (shifting development to transit stations instead of ecological, protected areas), (2) economic efficiency (higher dependency on transit usage, helping in spiking the economic development near them through mixed-use, and high density), and (3) social equality (creation of multiple housing types, with various transport modes supporting justice) (Li & Lai, 2014).

TOD principles are based on the 3Ds as discussed above –density, diversity, and design–yet if we combine the concept of TOD with green urbanism, then the new theme of “Green TOD” emerges. This introduces two more principles to mitigate: (1) reducing surface parking and (2) solar energy production. The green TODs can mark a 35% decrease in carbon footprint in comparison to usual development (Robert Cervero & Cathleen, 2011).

The creation of TOD is highly beneficial to compacted cities or cities facing urban sprawling. TOD-based planning is beneficial for: (1) providing multiple mobility modes acting as a connected activity nodes line based on transit, yet allowing pedestrian, bicycle, and automobile access, (2) increasing the public security level by creating busy nodes providing eyes on the street day and night, (3) increasing the percentage of transit transport users, (4) reducing the vehicle miles travelled (VMT), (5) reducing driving costs and increasing incomes, (5) mitigating air pollution and energy usage, (6) conserving open spaces and lands, (7) increasing economic development, (8) supplying affordable housing, and (9) reducing infrastructure expenditure (Maryland Department of Transportation, 2003).

TODs in the state of Qatar

Before 1939, the economy of Qatar was mainly dependent on pearl diving and fishing. In 1937 oil was discovered in the region, but large-scale oil production began only after WWII. The profitable economy based on oil exportation allowed the nation to invest large funds in infrastructure development for the modern urbanization in Doha, which rapidly transformed the metropolitan built environment. First revenue from oil was invested in the construction of an airport and the development of a road connection between Dukhan, Doha and the airport. A major impact on settlement pattern was observed in the 1950s and 1960s. Basic infrastructures, such as roads, water supply network, and electrical grids, were constructed around the same time. The development of roads encouraged the use of automobiles, which significantly impacted the urban form of the city (R. Furlan & Al-Mohannadi, 2018, 2019; R. Furlan & Alfaraidy, 2017; R. Furlan & AlSuwaidi, 2018).

The increased use of private autovehicles (cars) enabled low-density urban development away from the city center, generating sprawling. The new housing policies allowed free plots for Qataris and interest-free loans for housing construction. To avail the center of the city for modern urban development, free plots measuring between 600 m² and 1000 m² were offered in the outskirts of the northwest of the city, such as Al Rayyan, Madinat Khalifa, and Al Gharrafa, for the indigenous population residing in the old Doha area. Interest-free loans and free architectural and engineering services enabled ingent housing construction (Remali, Salama, Wiedmann, & Ibrahim, 2016; Rizzo, 2013; Salama & Wiedmann, 2013). These financial incentives were much higher compared with the market price of the plots in the inner city. For the first time, Qataris moved from the inner city to the outer areas of the city. Thus, the new suburbs became the residence of Qataris (R. Furlan, 2016; R. Furlan & Faggion, 2017; R. Furlan & Petruccioli, 2016; R. Furlan, Petruccioli, & Jamaledin, 2019; R. Furlan & Sipe, 2017).

The year 1995 can be considered the start of the globalization period for the nation. Under liberalization strategies, public investment in Education City and Aspire Zone triggered developments in the western areas of Doha, such as Al Waab City. Private developers focus on residential development on the West bay business district, the northern part, such as West Bay Lagoon, and development within the Diplomatic district, which led to premier high-rise properties due to their high-value land. As a consequence, Al Sadd, peripheral area of the old city center, attracted office development because of its accessibility to Doha expressway (R. Furlan & Saeed, 2017; R. Furlan & Saleh, 2018; Rizzo, 2013).

Furthermore, the private sector overtook the urban planning of the country because of the incentives provided to them. This led to low-density, unorganized development, planned without proper services and amenities. It created a mismatch in the daily patterns of the residents between the places of their work and their residence. High traffic congestion is one consequence of such developments. The present structure of the city is fragmented in nature without centers and subentries. Lastly, large public investments in infrastructure and mega developments by state-owned institutions and their various public–private partnerships resulted in a construction boom in Doha, driven by local, regional, and international investors and motivated by fast returns (R. Furlan & Al-Harami, 2019; R. Furlan & ElGihani, 2018; Salama & Wiedmann, 2013).

Some of the major challenges in the urban form of Doha can be summarized as follows:

- (1) Land Use: lack of integration of amenities, services, and infrastructure; increased traffic congestion due to mismatching in the land use pattern because of adaptation of Western zoning concept of downtown and suburbia;
- (2) Transportation: heavy dependency on private automobiles and lack of mass public transportation;
- (3) Use of unsustainable building materials and environmental control mechanisms;
- (4) Western model suburbia low-rise housing development at outer area of the city;
- (5) Density: fragmentation due to vacant land parcels;
- (6) Deteriorated quality of inner city.

Therefore, the introduction of TOD in Qatar can contribute to solve major problems, currently addressed by the sprawled the built environment. The strategy of adapting TOD in Qatar was addressed on the Qatar National Development Framework (QNDF-2032). TODs can contribute to the establishment of urban growth boundaries to ensure that the land is utilized in a more efficient-compact manner by limiting urban sprawl. TODs are aimed to increase the commercial and community activities and concurrently decrease congestion through the introduction of mixed-use development. This strategy is undertaken to move toward a more sustainable growth path, by preserving the natural environment (Environment, 2014; General Secretariat for Development Planning, 2008). An additional booster of the TOD plan is the hosting of the 2022-FIFA World Cup, for which Qatar committed to develop mega projects and major public transportation networks, including the Doha Metro, Lusail light rail transit and the bus rapid transit (Adham, 2008; AlMohannadi, Zaina, Zaina, & Furlan, 2015; Furlan & Sipe, 2017; Zaina et al., 2016).

Namely, Doha Metro is planned in two phases: (1) the first phase consists of three different lines (Red, Gold, and Green) to be operational (with 37 stations) by 2019; (2) the second phase consists of the Blue line (with 60 stations) to be operational by 2026. The location of the stations plays an important part in the plan of the TOD line and/or the urban regeneration of the major transit villages. The Red line represents the coast line passing from Lusail to Al Wakra. The Green line, known as the educational line, comes from the west and passes through the educational city. The Gold line is the historic line passing through and with stations places in major cultural and historical areas, such as Souq Waqif, Msheireb, and Qatar National Museum (QNM) (Qatar Rail).

3. Methodology

The research aims (1) to review the relevant literature about the disciplinary and geographical context; (2) to analyze the existing

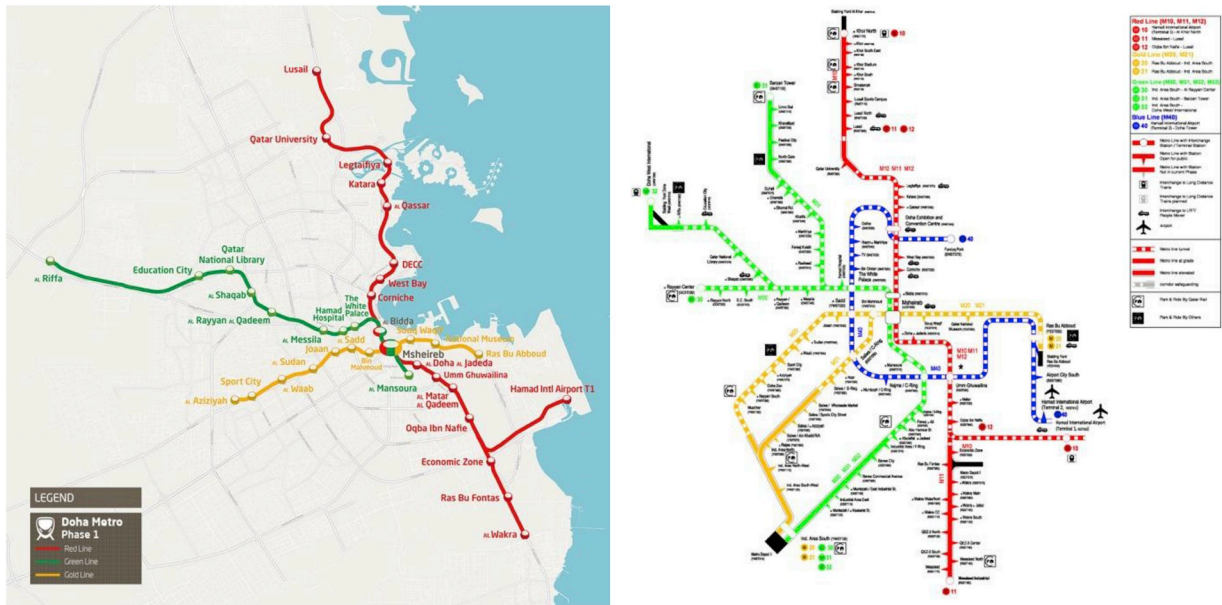


Fig. 8. Qatar Rail Doha Metro network and routes (Source: (Qatar Rail).

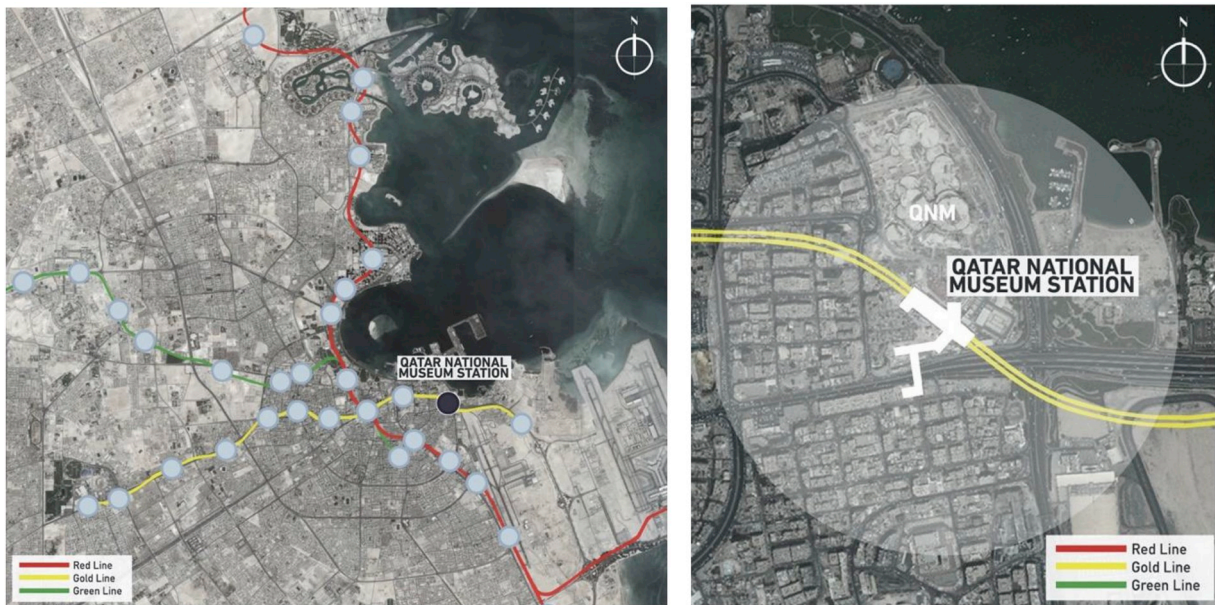


Fig. 9. Location of QNM station along the Gold line (source: The authors). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

site conditions; (3) to conceive a masterplan; (4) to define the guidelines for the QNM-TOD, located along the Doha metro Gold line (Creswell, 1994; Denzin & Lincoln, 2005; Ragin, 1994; Yin, 2003). Given the complexity of the effort and the fast-track schedule, the overall process was structured along a six-month period.

This research study was structured as follow:

1. Literature Review: the disciplinary context, (1) sustainable urbanism, (2) green urbanism, and (3) TOD, and the geographical context were reviewed in order to investigate the key-principles to be followed for the conception of the QNM-TOD.
2. Site Analysis: the existing conditions of the site were investigated through (A) site observation and visits, (B) the analysis of visual material [maps, drawings, areal views and historical photographs], (C) structured interviews with residents, practitioners, stakeholders and authorities [i.e. Ministry of Municipality and Environment (MME), Qatar Rail, Qatar Museums Authority, Ashghal Public Works Authority].

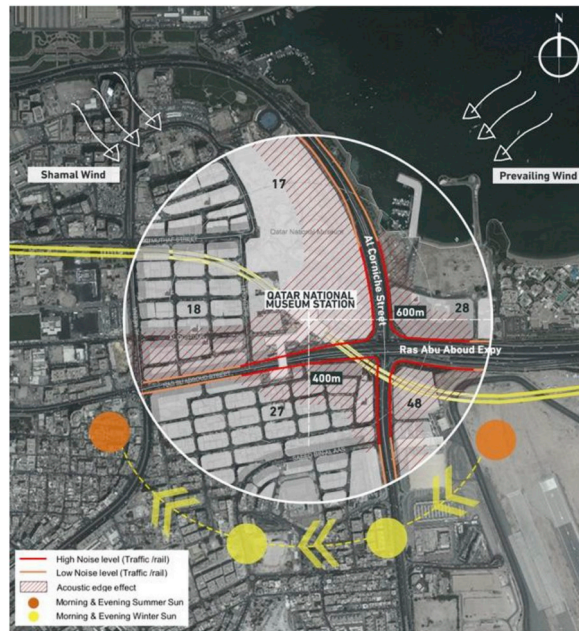


Fig. 10. External influence (Source: the Authors).

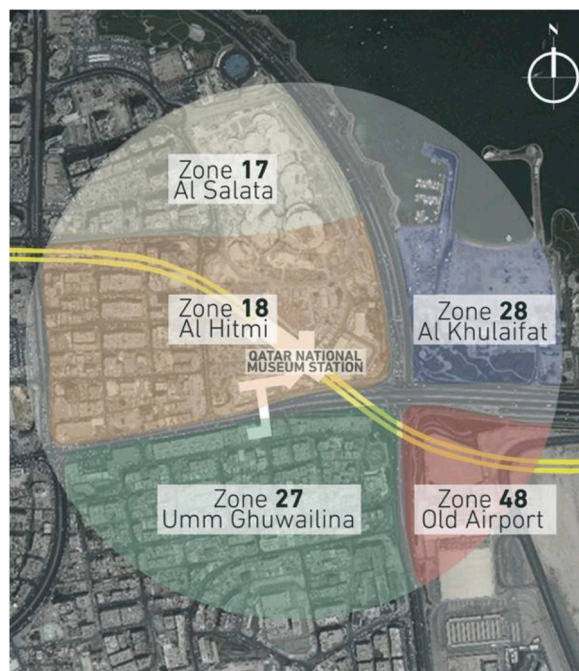


Fig. 11. Zoning within TOD boundary (Source: the Authors).

3. Masterplan definition: The QMN-TOD masterplan proposal is conceived through a green urbanism and TOD design strategy [3Ds]: (1) Density (higher urban density within a 400–600 m radius), (2) Diversity (mixed land-use, multiple housing option, ad transportation modes) and (3) Design (livable, walkable, accessible, and connective design).
4. Masterplan guidelines: guidelines for the comprehensive execution of the masterplan were explored and defined in order to implement the authoritative legislation to act.

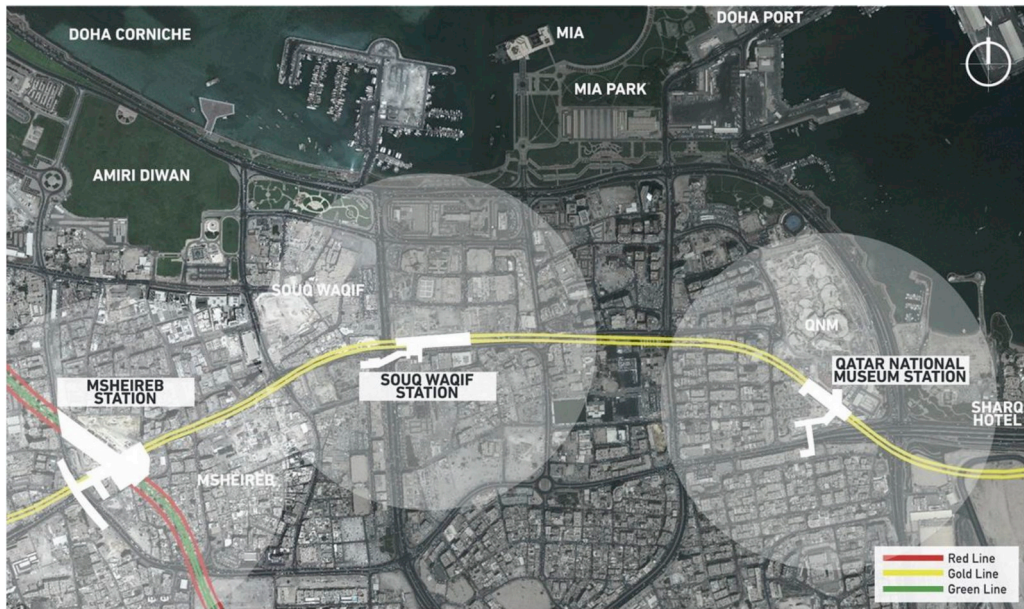


Fig. 12. QNM Station context (Source: Author).



Fig. 13. Land use map (Source: the Authors).



Fig. 14. Building height (Source: the Authors).

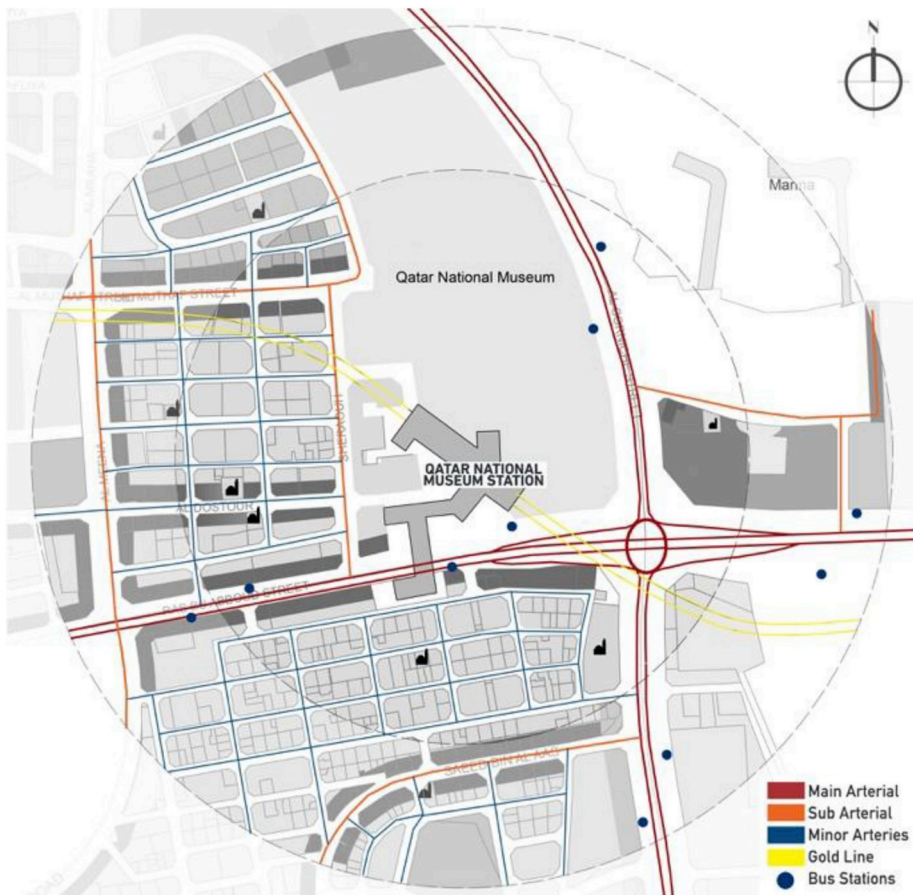


Fig. 15. Vehicular access (Source: the Authors).

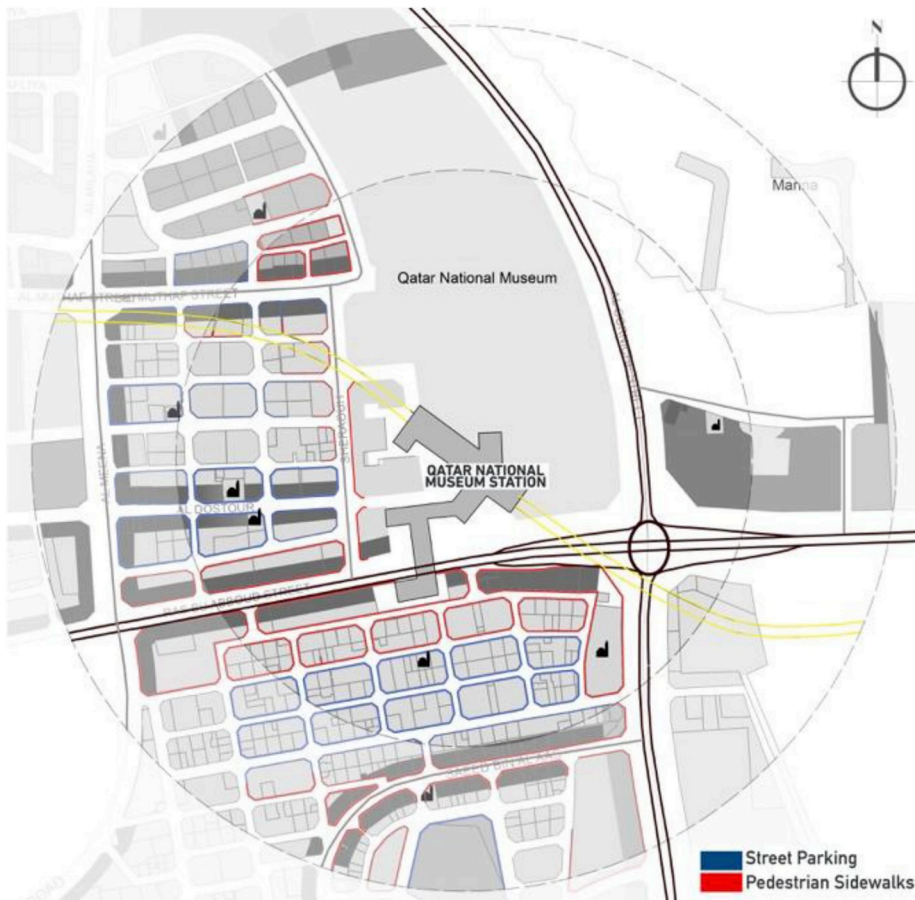


Fig. 16. Building edges (Source: the Authors).

4. Findings

The findings are structured into the QNM-TOD's (1) site analysis, (2) master-plan and (3) planning-guidelines, which are, in turn, aligning with a design strategy based on the integration of land use and transport systems. While land use focuses on the 3Ds (density, diversity, and design), connectivity and viability, public realm, walkability and accessibility, transport systems are related to the existing and under-construction public transport modes [i.e., the Doha Metro, the Lusail LRT, and a bus rapid transit (BRT)] (see Fig. 8).

Site analysis

Location and theme

QNM Station is located along the Gold Line of the Doha Metro Project, on the eastern side of Qatar, as shown in Fig. 9, in the vicinity of the neighborhoods of Al Salata, Al Hitmi, Umm Ghuwailina, Al Khulaifat, Old Airport [covering zones 17, 18, 27, 28, and 48, as per Qatar Zoning Map (Fig. 10)] and of the new Qatar National museum, along the crossing of Al Corniche Street and Ras Abu Aboud Expressway. The train station is to be located underground, with access to the ground level by stairs and elevators (see Fig. 11).

The transit village covers an area of 1.13 km², with a 600m radius (0.38 mile), which is considered a comfortable walkable distance. QNM Station is going to be connected with the stations of the Souq Waqif and Msheireb (the Heritage-Historic districts), therefore aiming at creating a cultural link in the old Doha. Moreover, the transit village, connected to the Museum of Islamic Art and the MIA park [creating yet another link to a significant cultural area] is also surrounded with large parks. Therefore, the urban village can act as a green zone connecting to the MIA Park and Doha Corniche and reflecting the opposite edge of the corniche green area, yet with an historic-heritage theme (see Fig. 12).

Land use: diversity and density

Two major roads cross through the site: Al Corniche Street, which connects the Doha Corniche to the West Bay area, and Ras Abu Aboud Expressway, which connects al Diwan Street to the airport area. Concerning the diversity of the land use, as shown in Fig. 13,

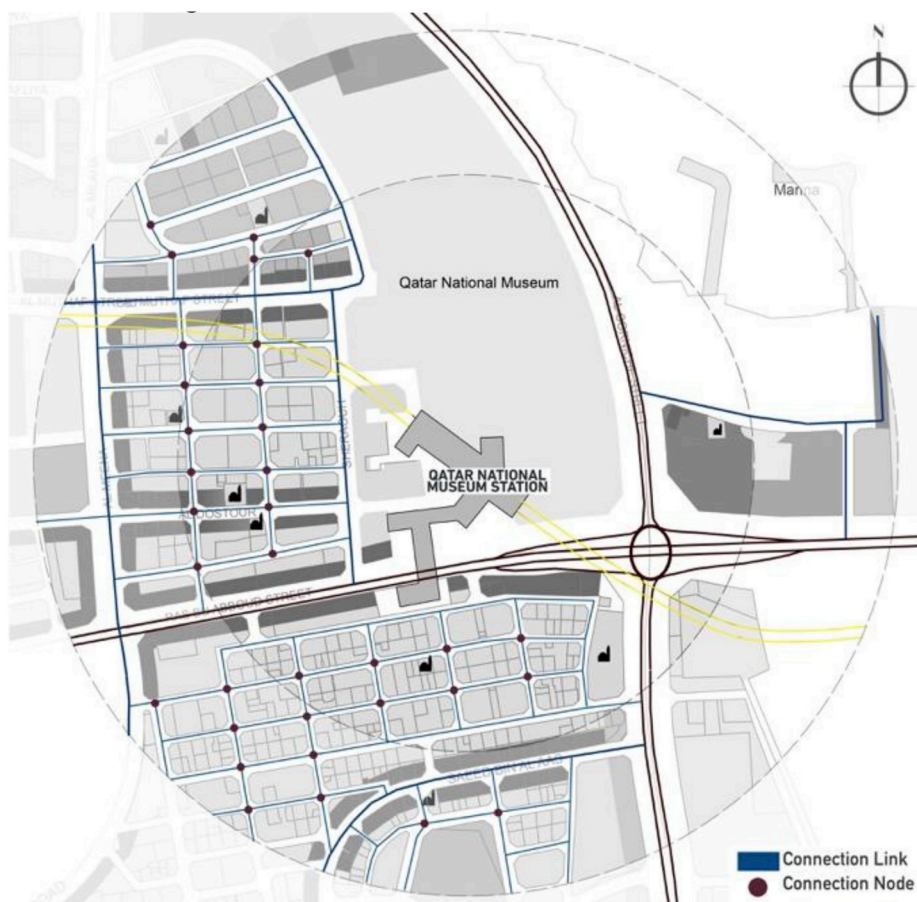


Fig. 17. Nodes and connectivity (Source: the Authors).

nearly 20% of the area is marked as a special-use district consisting of QNM Zone, Old Airport Zone, and the piers by the corniche. The highest percentage of land is related to residential use covering almost all the plots within zones 18 and 27. The mixed-use commercial frontage, low in percentage compared with residential use, surrounds the different neighborhoods facing the main and minor access roads. Zone 17 mainly consists of commercial offices complementing the different uses within the planned TOD area. The QNM Station is surrounded by a diverse land use: residential, commercial, offices, special use and vacant lots. However, the domination of residential use limits the possibilities of the TOD, as the station is located nearby the new Qatar National museum project and in proximity to the waterfront. Therefore, a more diverse commercial approach should be addressed (see Fig. 14).

As for the density and building height of the area, it ranges variously from G + 5 stories to over G + 10 stories corresponding to the use. Zone 17 displays the highest towers -commercial offices- which are over G + 10 stories. Zone 18 ranges from less than G + 5 stories to over G + 10 stories and is the most diverse in density. Zone 27 is dominated by towers that range from G + 5 to G + 7 stories because the land use is mainly residential. Zones 28 and 48 are mostly vacant plots with two medium parks covering the corners of the zones. It is vital for the TOD development to have a high-density level; therefore, within zones 18 and 28 it is auspicious to follow the principles providing more dense areas, which increases commercial, work, and housing opportunities.

Connectivity and public realm

The dominant transportation system within the site is provided by private auto vehicles. The site accommodates various roads types, ranging from main expressways to major arteries connecting the plots. The main expressways have three lanes on each side, as shown in Figs. 15 and 20. The sub-arteries have two lanes on each side, where the minor arteries have one street lane on each side, as shown in Fig. 20. Various bus stations can be found in proximity to the metro station, ranging from 100m to 600m, which will support the dependency on public transportation connecting to the metro station (Fig. 15). As per the vehicular access, Fig. 16 shows the availability of on-street parking areas in front of the buildings, yet it is not an apposite aspect for all cases because it is causing congestion. Moreover, the availability of a pedestrian sidewalk can be identified, as marked in Fig. 17, mainly in Zone 27 within the residential zone; yet it can be clearly seen that there is no visible or major consideration of the public realm as no pedestrian or bicycle paths are currently visible. As Figs. 17 and 18 show, multiple connection nodes are visible within the different zones, yet are poorly designed for pedestrian use because they are mainly car accessed and congested due to the dense use and poor parking area management. Those areas can be easily developed into green squares acting as public common spaces between residential or



Fig. 18. Aerial views of site access (Source: the Authors).

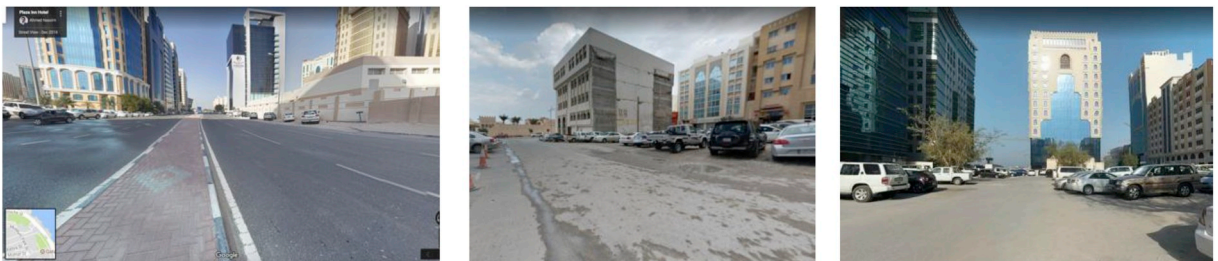


Fig. 19. Nodes within the TOD

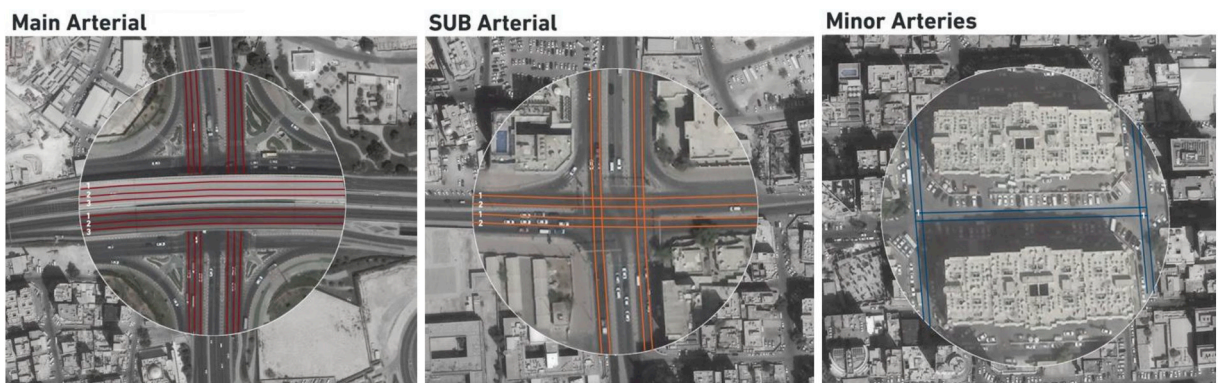


Fig. 20. Vehicular access.

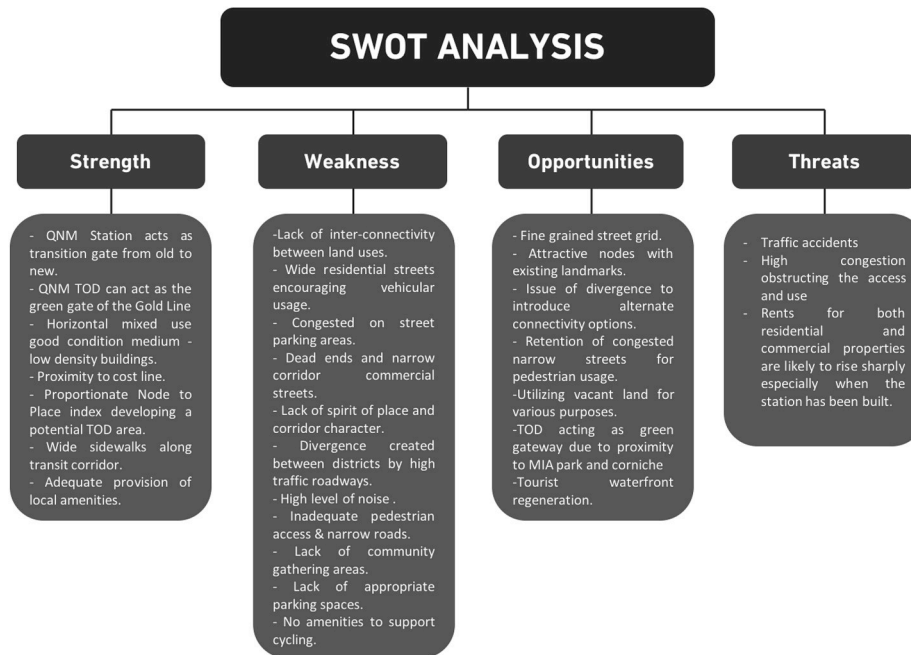


Fig. 21. SWOT analysis (Source: the Authors).

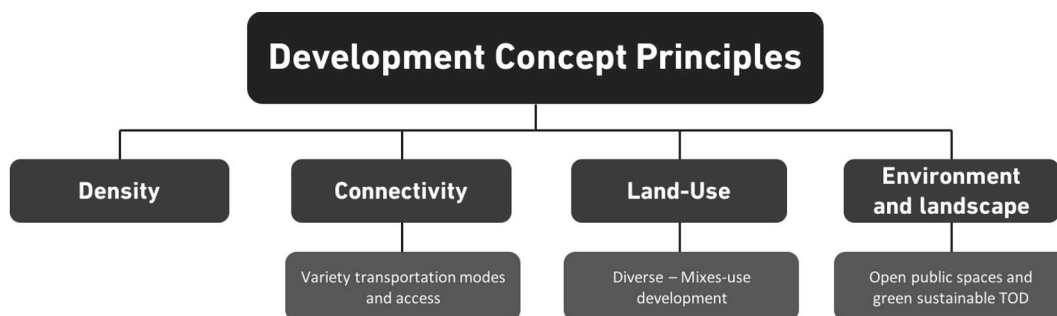


Fig. 22. Concept principles (Source: the Authors).

commercial uses (see Fig. 19).

SWOT analysis: opportunities and challenges

The analysis of the site, as per the categories listed and explained in the previous section, allows the researchers for theorizing the strengths, weaknesses, opportunities and threats (SWOT) for developing a TOD within the QNM transit village (Fig. 21). This holds a great opportunity compared with other TODs along the Doha metro line because it is located next to the QNM Project and in proximity to the waterfront of the corniche, and it can be linked directly to the Museum of Islamic Art and its park. Moreover, big vacant lands are an opportunity for redevelopments to provide more desirable uses. Parks surrounding the station are a great strength, acting as a green gateway to complement the opposite side of the corniche and building grand landscaped pedestrian areas to be developed. The weakness of the TODs is that in their current state, they are highly residential. It would be better to convert them into a more commercial, touristic zone due to its special use in lowering residential density. The opportunity of the site is that it holds a great chance in improving the livability and public realm of the area (see Fig. 22).

QNM-TOD masterplan and guidelines

The masterplan for the QNM-TOD is conceived through a strategy based on developing a livable and vital transit node, focusing on the need of the community to utilizing daily-use facilities and areas, fostering human interaction and, as a result, shaping an engaging, pleasurable and high-quality life urban environment. The conceptualization of the TOD is led by the need to address three leading key factors: (1) diverse transportation and access modes (access and connectivity); (2) land-use (diverse, dense, and mixed-use); (3) natural environment areas (landscape, connectivity to public spaces, parks and corniche waterfront). In addition, the

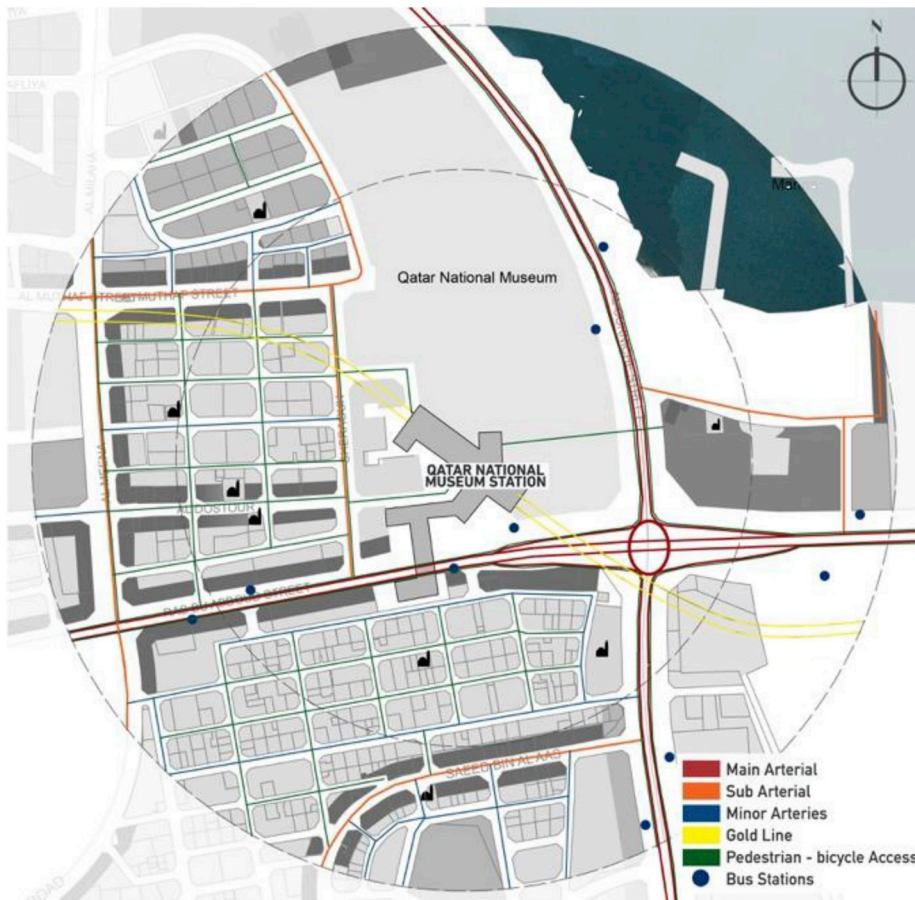


Fig. 23. Proposed connectivity (Source: the Authors).

proposed masterplan concurrently aims at minimizing suburban sprawling and enhancing quality of life of the users (inhabitants), as envisaged by sustainable and green urbanism's theorists and scholars.

Connectivity: transportation systems

The connectivity of QNM-TOD is enhanced through the use of different transportation systems. Streets should be planned to accommodate different needs of circulation of pedestrians, bicycles and vehicles, providing a pleasant and comprehensively connected area and easy to access to the users. Streets should provide pedestrian access through sidewalks and bicycle paths. Therefore, street-design is to focus on the following:

- Connectivity of the metro station with the surroundings to create a main flow point allowing multimode access;
- The need to enhance pedestrian access and bicycle paths;
- The introduction of trees, seating shaded areas creating green corridors (part of the public realm);
- The conversion of minor arteries between buildings into pedestrian corridors, connected to green sub-arterial boulevards;
- The replacement of parking areas for residential, commercial and offices with various multilevel parking (allowing to reuse large parking lots as public landscaped areas);
- Connecting the station to the opposite cornice waterfront, currently acting as one of the most significant public realm of Doha.

Land-use: diversity mixed-use

The area is mainly utilized for residential purposes, with commercial-office edges and a large area of special use zone, as shown in Fig. 13. Following the principles of TOD envisioning a diverse mixed-use development, the zone is to include connections to high-quality workforce and market rate housing, office space, retail, culture and entertainment destinations. The TOD should also comprise commercial, tourist and cultural uses. Due to the lack of parking spaces, multiple parking towers should be planned in close proximity of high-density areas, in order to encourage pedestrian access to central areas of the TOD.

Density: neighborhoods

The density within the existing transit village varies according to the included zones. As for zones 17 and 18, the density is not



Fig. 24. Proposed land-use (Source: the Authors).

recommended to go any higher in order not to overpower the new Qatar National Museum project, which represent the landmark of the area. As for zone 27, density is to be increased (namely, for residential use). Zone 28 should be planned with extremely low density in order to not obstruct the view of the corniche from the main street and from the new museum. This zone should comprise parks with low-density commercial and souq/market areas distributed along the corniche line. Zone 48 was not taken into consideration as only a small portion is included within the 600 mt TOD range.

Nodes as open public spaces

Nodes between the buildings act as areas utilized for the community's gatherings and/or social interactions. Within zones 17, 18 and 27, all nodes intersecting along pedestrian access lines are to be converted into open public gardens and enjoyed by visitors and residents alike, creating a green sustainable chain of pocket gardens.

Comprehensive planning proposal

5. Conclusion and discussion

The shape of the built environment determines the character and/or identity of the area. Namely, the settlement's spatial form has a dominant impact on the users' livability and/or quality of life. Despite scholars' argument, over the past two decades, pedestrian-oriented developments, aiming at creating livable, walkable public areas, have been neglected, leading to lifeless settlements, whose spatial form affected negatively social interactions and/or social capital of users. In addition, scholars argue that contemporary cities and/or urban settlements are planned/ designed to accommodate mainly vehicular accessibility and circulation, neglecting other means of movements, such as pedestrian and/or bicycle network (Elsheshtawy, 2004). Therefore, in order to enhance the users' livability and/or quality of life for the QNM-TOD, the proposed masterplan is based on a strategy envisioned through the following key-factors:

Walkability and connectivity:



Fig. 25. Proposed height (Source: the Authors).



Fig. 26. Proposed nodes (Source: the Authors).



Fig. 27. Design proposal (Source: the Authors).

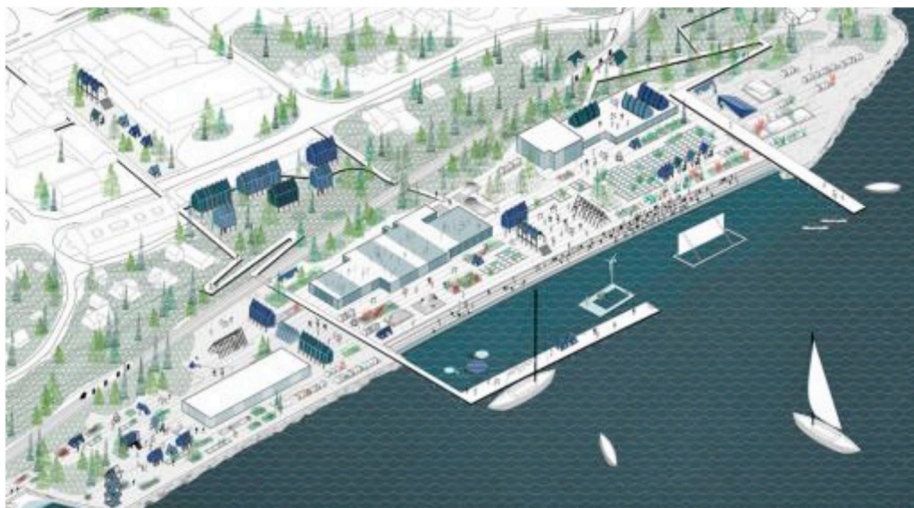


Fig. 28. Proposed waterfront, (source (Fabulism Office, 2018):

- Creating open/public pedestrian network along the TOD, including shaded and landscaped seating zones;
- Enhance pedestrian accessibility at ground level;
- Creating an unobstructed bicycles network;
- Connecting various public and private transportation systems within the urban settlement;
- Connecting and integrating mixed-use areas through pedestrian and bicycle network;

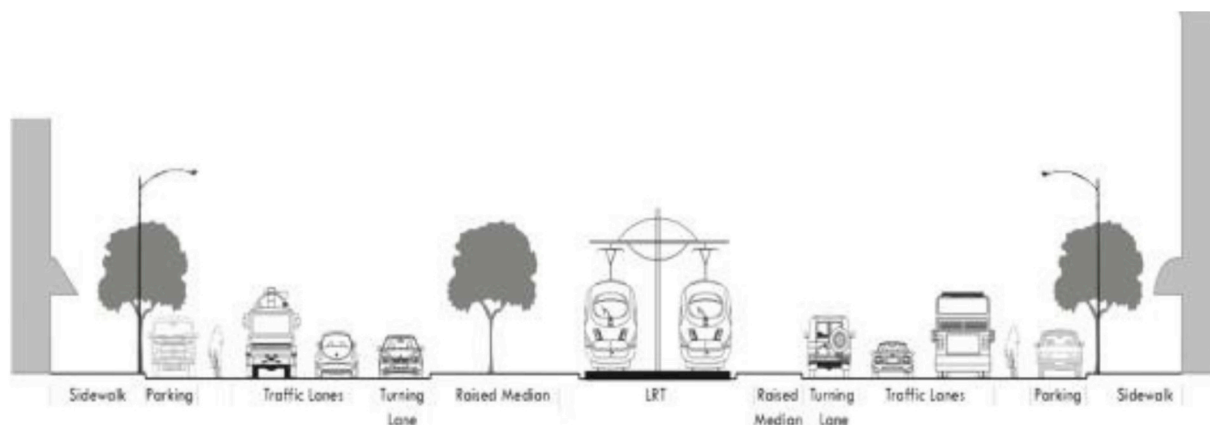


Fig. 29. Street cross-Section (Source: Maryland (Departement of transportation)).

– Planning parking towers;

Land-use and diversity.

- Increasing density and diversity by proposing various mixed-use development;
- Prioritizing compact built forms;
- Introducing multiple open green areas ranging in size, with large parks for the public and smaller pocket gardens for more private use;

Public Realm:

- Enhancing connectivity between major and minor streets and open spaces (paved and/or landscaped);
- Conceiving open spaces with various views on/from the urban settlement;

Contribution to knowledge

Integrating land-use and multi-use transport systems is a decisive approach aiming in creating vital and livable communities -and/or transit villages-within the Doha's urban structure. Also, it is envisaged that the current transport investments from the municipality of Doha will greatly increase the demand for local property development.

Namely, the proposed masterplan for the QNM-TOD contributes to define a planning approach for the urban regeneration of the transit village and the area in the proximity of the cultural zone of old Doha. As Qatar National Vision (QNV-2030) addresses the national need to plan and sustain TODs aiming at enhancing quality of life of the users, this research study contributes to diminish the gaps in knowledge related to TODs in Qatar and GCC countries.

This research study is significant to urban planning in the State of Qatar, because the proposed masterplan, conceived upon a detailed approach for the urban regeneration of the settlement, envisioned through (A) green urbanism and (B) a TOD design strategy, support the definition and implementation of key-concepts to be adopted for the urban development of the selected QNM-TOD. In turn, the outcome from this research study, based on a collaborative decision-making process, can act as a leading example of coordinated rail transit and urban development's masterplan/approach, guiding similar up-coming concepts of Doha's municipal developments.

Implications for practice and advancement of research

A remarkable issue raised during the research study relates to the extent to which cultural identity and/or culture as a way of life can contribute to the urban regeneration of urban settlements. As a result, further studies analyzing the relationship between cultural identity and built form, namely at urban and architectural scale, could be engaged (1) to provide a deep understanding of how culture as a way of life can impact on the spatial form of transit villages in Qatar and (2) to define a comprehensive framework for the future development of transit villages in Doha. In turn, the dialectical relations between the built environment and its cultural urban identity would contribute to shape an integrated urban planning strategy for establishing Doha as the cultural, economic and service hub of Middle East, which is the ambitious and prestigious role envisioned by QNV-2030 for the State of Qatar.

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