MATCHING TRANSIT AND OPEN PUBLIC SPACES

Open space oriented transit for successful transit oriented development in Guadalajara

by

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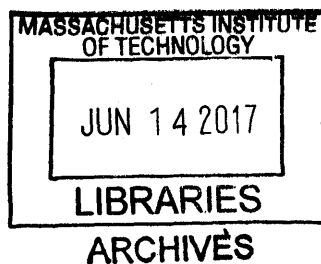May 24, 2017

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ABSTRACT

The way we perceive the urban environment affects the choices we make and therefore our behavior. This fact has an important effect when we navigate a city. How urban spaces are laid out will influence our decisions and have repercussions in our travel choices. There is therefore a connection between urban spatial experience and transportation systems.

With a large number of cities considering transit oriented development (TOD) – an urban model whose goal is to align urban development to public transportation patterns by creating walkable, mixed and diverse neighborhoods – as the primary planning solution to solve their accessibility problems, the connection between the urban image and the transit system is crucial. If planners want to bring people closer to transit systems and increase ridership, they will need to improve the perception people have about the system and further construct a modified set of travel preferences.

Both urban space and the process of navigation are, in general, composed linear features related to movement (paths) and point features that define origins and destinations (nodes). Within the different types of nodal elements, open spaces have a particular condition; their openness allow people to perceive a larger portion of their surroundings, easing the process of wayfinding and enhancing the sense of place, which is highly valuable for the construction of true communities.

This thesis explores the role of open spaces, not only as attractive urban amenities and recreational spaces, but as organizing elements of the territory and anchors for the transit system arrival points. I explore Guadalajara, Mexico, a city with an important central network of open spaces. The city is currently making a significant investment in transit and is looking towards TOD for its planning solutions. I intend to use Guadalajara as a mean to show how open public spaces can be used as primary elements to structure transit systems and to enhance the creation of place around stations.

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Keywords:

public transit, public spaces, open spaces, Guadalajara, image of the city, transit oriented development.

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1. INTRODUCTION

Society needs for people to ride public transportation. Our cities cannot afford adding vehicles to their streets, increasing congestion and damaging the environment. Even with the development of cleaner and more efficient auto technologies such as electric and autonomous vehicles, the usage of space needed for this transportation mode is still massive, especially in denser urban cores.

As urban expansion increases the transportation problem in cities, turning our attention back to public transit as backbone of urban mobility and away from car-oriented development is becoming a more recurrent trend around the world. In the same way that sustainability and resiliency are now fundamental concepts for planners, Transit Oriented Development (TOD) is now part of the everyday urban planning lexicon. The role of transit as a way to improve mobility, particularly in low-income sectors of the population, is increasingly being recognized (ITDP, 2014; Suzuki, Cervero, & Iuchi, 2013). For example, in North America, while central urban areas are becoming more attractive for development thanks to their accessibility, suburban areas are becoming cities in their own right and there is a stronger interest in transit use and transit investment (Belzer & Autler, 2002, p. 1).

For developing cities in the Global-South, the effort to impulse TOD policies and projects acquire a more relevant role. The design of cities and transit systems that enhance accessibility and affordability, and the promotion of non-motorization policies and low-fare public transport are fundamental to benefit the poorer population. This also includes higher densities, diverse land uses, and the design of high-quality, safe, walkable and bikable urban environments (Cervero, 2013, p. 20; Suzuki et al., 2013, p. 1). Based on these TOD frameworks, urban designers have therefore a fundamental role in easing the way for transit oriented development and policies to be implemented both in developed and developing cities. Designers are critical participants in the success of TOD.

The fundamental goal of the transit-oriented development ideal and other similar strategies is, to put it in simpler terms, to make development in cities follow transit patterns. This requires changing people's travel behavior so they use public transit to move within the city aiming for a more sustainable and efficient use of the urban space. TOD depends on greater use of public transit, more walking, more biking and less driving. The use of public transportation has to make rational sense to the user. It has to be perceived as a better, faster and more convenient transportation mode. Thus, in order for people change their travel behavior, they need to have a positive perception of transit to modify their preferences.

The behaviorist perspective views people and their behavior as the result of what they learn and perceive from their environment. According to the *Theory of Behavioral Choice,* developed at-large by McFadden, behavior is the result of a rational process where preferences defined by personal experiences and perceptions of the reality are evaluated while considering external constraints (McFadden, 2000; Miller & Prentice, 2013). People's perception of the observable information affects the outcome of the process. This means that the way reality is laid out will modify behavior. Each individual has, to a greater or lesser extent, a singular perception of reality even with the same information, although there could exist some agreement in the general perception of reality between members of the same group.

Among urban designers, no one has connected how perception is built with the elements that comprise the urban environment better than Kevin Lynch (Lynch, 1960, 1972, 1981, 1990). It has been almost six decades since Lynch published his now legendary book *The Image of the City*, where, based on observations and interviews of city residents, he enlisted and detailed the elements –paths, edges, districts, nodes and landmarks– that produce and structure the mental image of the city and their characteristics. A large part of his research and academic work focuses on how the urban environment stimulates and feeds people's everyday perceptions, defining the mental image that individuals and groups create of their surroundings, especially in western cities. Lynch's work also explores the organization of the physical elements that compose the urban environment, and the way they suggest directions and relationships, which as a whole, assemble the city image we perceive.

Designers in general, care about producing a reaction in the user to whatever we are designing. We seek to establish a connection between design and an individual or group. "Aesthetics involves judgments of taste based on feelings of pleasure or displeasure" (Stamps, I.I.I., & a.E., 2000, p. 35). There is an emotional reaction to the experience of using or looking at any designed object. As urban designers, our

task is the same: cities must enter into dialogue with their inhabitants and produce memorable experiences that then play a part in people's behavior. We as designers are partially responsible, along with others such as engineers, transportation planners, and politicians, for connecting urban infrastructure with the city's physical layout and with its people.

In general, the role of urban design in shaping people's perception and wayfinding behavior has been substantially examined (Appleyard, 1973; Golledge, 1999; Golledge & Gärling, 2004; Golledge & Spector, 1978; King & Golledge, 1978; Lynch, 1960, 1981; Nasar, 1998) but the designer's role must consider public transit systems too. If cities actually want to reverse car-oriented trends, change people's behavior and promote the use of transit, transportation systems not only have to be efficient, but also their designers must work so they are also memorable. As Kevin Lynch puts it, "city design can focus on the *journeys* by which people actually experience cities. City trips are enjoyed or suffered, but they are remembered" (Lynch, 1990, p. 503). Public transit systems are crucial for a more sustainable and equitable city development, but the function of transit has to be greater than that; it has to be memorable for the users and inhabitants. This document aspires to reconcile the role of urban designers and their regard for aesthetics, and the practical analytical perspective of transportation planners and engineers.

This thesis explores the role of a particular component within the urban form: open public spaces, and their connection to public transit systems. Inspired primarily by Lynch's *The Image of the City* (Lynch, 1960), the thesis examines how open public spaces operate as *nodes* or *anchors* that root the user's urban experience (Golledge & Spector, 1978). It focuses on how nodes have a primary function as arrival points playing a fundamental part in the in-motion experience of the city. This thesis aspires to make a case for the importance of open public spaces in creating memorable experiences, encouraging social encounters and easing wayfinding. It aims to cement the significance of establishing a connection between a public transportation access point and an open public space (node/anchor) in order to match the anchor experience in both the urban environment and the transit system, and therefore favorably modify people's perception of transit.

Further, this thesis uses the city of Guadalajara, Mexico, as a case study of how open spaces have been relevant for the city's development history. It seeks to lay out an example of what could happen if transit stops do align and match with open public spaces. The city of Guadalajara is currently experiencing an important urban planning renaissance, in which government authorities and non-profit organizations have

been pushing for more sustainable and compact development in the metropolitan region. The city is also on the verge of expanding its public transit network, making this place a fertile area in which to explore TOD schemes and innovative urban form structures. It is also a city with a rich urban design history, where strong design ideas have continuously transformed the face of the urban region.

1.1   MOTIVATION

The idea for this thesis has its origin in a professional experience in 2011. At that time, I was collaborating with a group of architecture and urban design firms from Guadalajara in an urban design project for a proposed tram in the municipality of Zapopan[1]. During the preliminary work, we discussed with the transportation planning consultants the possibility of moving one of the stations about 80 meters in order to align it with an existing park, a church and a health clinic. Our intention was to take advantage of the existing neighborhood urban form and land uses in order to promote place-making around the tram station. Although for us in the design team it was to some extent an obvious decision supported by the context analysis, for the transportation planners it meant changing the distance between stations from its half-mile ideal, which would alter the system's efficiency in some extent.

There is a case to be made for the importance of the quality of a transit user's experience as a way to affect their behavior. For designers, the significance of a user's emotional reaction might be obvious, but emotional responses must also be relevant for the other aspects involved in defining urban development and infrastructure projects, such as urban and transit engineers. If TOD is to be a dominating urban development trend in both developed and developing cities, then the relationship between transit systems and urban structures is crucial for reasons beyond simple efficiency. TOD aims to gravitate development around transit access points (especially mass transit stations), therefore there is a recognition of transit's nodal role and value potential. Embracing the impact open nodes have for wayfinding and the creation of a mental image of the urban environment, as well as for the experience quality of transit users, adds on the attempt to consolidate transit nodes as vibrant urban centers that attract economic development and social buoyancy.

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[1] The municipality of Zapopan is part of the Metropolitan Area of Guadalajara (MAG). After almost a year of work, the tram project was canceled due to external factors.

TOD standards already address the importance of high-quality public spaces and urban design (ctsEMBARQ Mexico, 2013; ITDP, 2014; National Association of City Transportation Officials (NACTO), 2016). Having walkable districts that are accessible and secure, walkways with visual connection to the building's interior and permeable frontages, and sheltered and comfortable public spaces are some of the many guidelines in the available documents. These TOD standards also emphasize the relevance of limiting the size of city blocks to ease connectivity. But in general, the literature contains little analysis about how different urban layouts can result in not only more accessible (smaller block sizes), but also more *imageable*[2]. The overall intent of this thesis, is to make the case for how transit access points If paired with open spaces can be made more legible and imageable, and therefore be defined as identifiable places, creating value out of this sense of place.

Following the TOD trend, in Mexico there have been efforts by academics, urban planners, NGOs and others institutions to promote the implementation of TOD policies as a response to the urban challenges that Mexican cities face. In Mexico City for example, with its large subway and Bus Rapid Transit (BRT) infrastructure, numerous documents have been produced in the last few years regarding TOD guidelines and implementation strategies (ctsEMBARQ Mexico, 2013; ITDP Mexico, 2014; ITDP Mexico & Herrera, 2015; ITDP Mexico & Medina, 2012; ITDP Mexico, Medina, & Veloz, 2013; MIT DUSP, 2016). These documents tackle topics ranging from development patterns, and transportation modeling to affordability and policy. Similar to other TOD standards, their approach to urban design is oriented toward walkability and quality guidelines.

Within this context Guadalajara, Mexico's second largest metropolitan area[3], finds itself in an inflection point for its urban development. Critical public investment is underway while the city is also looking at TOD strategies as a trend to follow. Some of the main reasons why Guadalajara is a particular case for TOD implementation in Mexico and for the purpose of this thesis are:

- Mexico's federal government is currently building the city's third light rail transit (LRT) line, whose path will link the central districts of the three municipalities with the largest share of population in

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[2] As defined by Kevin Lynch (Lynch, 1960; p. 9)

[3] The Metropolitan Area of Guadalajara had 4,865,122 people according to the Mexican National Institute of Statistics and Geography (INEGI in Spanish) latest 2015 Inter-census survey. The next full national census will occur in 2020. (INEGI, n.d.)

the Metropolitan Area of Guadalajara (MAG)[4]. Along with this LRT project, each of these municipalities and the state government are planning to invest money in public space projects around key stations. Notable is the project known as "Paseo Alcalde", which seeks to create a 2.5 km. walkway over the LRT line segment that crosses Guadalajara's historical downtown (currently a highly-traveled roadway) while connecting several historical parks and public squares.

- Many of the institutions involved in promoting transit oriented development in Mexico City, several of which were invited by the city's municipal and state authorities looking to take advantage of the infrastructure investment, are now developing similar TOD implementation documents for the MAG (Cuadra Urbanismo, 2016; ITDP Mexico & Herrera, 2015; ITDP Mexico, Medina, & Patlán, 2015).

- The recently formed Metropolitan Planning Institute (IMEPLAN), one of the first metropolitan planning agencies in Mexico with legal reach, last year published the first Metropolitan Territorial Ordinance Plan (POTmet) the MAG has seen since the 1980s. This plan sets as guiding principles the promotion of a "compact, close, connected and equitable city"; and urges all municipal zoning plans to consider TOD standards as a way to limit urban dispersion (IMEPLAN, 2016).

- Within the context of this new Metropolitan Plan, the municipality of Guadalajara has already approved a new zoning bylaw, which for the first time allows development bonuses and parking reductions in areas around mass transit stations (Municipio de Guadalajara, 2016).

- The municipality of Guadalajara, followed recently by Zapopan and San Pedro Tlaquepaque, started an urban education program centered on promoting "Free sidewalks" (Banquetas Libres in Spanish), which is a colloquial name for any pedestrian-oriented public space. This program aims to educate the general population about the importance of having obstacle-free public spaces and also to set pedestrian safety as the highest priority (Municipio de Guadalajara, n.d.).

- In terms of urban form, the structure of Guadalajara's central area is composed of small, walkable, square-shaped blocks, and a rich network public spaces. Further, with the construction of the third rail line, this central area will largely consolidate its public transit connectivity.

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[4] These municipalities are: Guadalajara, Zapopan and San Pedro Tlaquepaque. The MAG is legally conformed by 6 central municipalities: Guadalajara, San Pedro Tlaquepaque, Tonalá, Zapopan, Tlajomulco de Zúñiga, El Salto; and 3 peripheral: Juanacatlán, Ixtlahuacán de los Membrillos and Zapoptlanejo. (Gobierno del Estado de Jalisco, n.d.-a; IMEPLAN, n.d.-b)

With transit infrastructure under construction, different local planning documents under review, and the interest of municipal authorities in developing public space projects and attracting development around future and existing transit stations, there is a window of opportunity to discuss how the city can benefit from its public space network in order to create valuable places to anchor successful TOD districts. By dissecting the essence of how open spaces function as arrival points and wayfinding references, Guadalajara could set a reference not only for Mexico but other developing cities on how to elevate open public spaces as structural elements of development patterns, regarding the role of public spaces beyond their amenity quality and more as a key element to take into account in any development decision-making process.

1.2   RESEARCH QUESTIONS

The main objectives of this thesis are first to establish how matching open public spaces with transit access points creates both a legible and imageable city form and transit system, and therefore key in the perception of "place" that will boost the creation of value in transit oriented development districts. Second, to apply this concept in the central area of the city of Guadalajara, where current urban planning conditions and the area's physical layout together form a fertile terrain for the establishment of TOD districts. The thesis aims to answer the following questions:

- *Are transit lines and transit nodes related to imageable city principles as outlined by Lynch? What role does open public space play as anchor nodes connecting city form and transit systems? How by pairing open spaces and transit stops, can alter perception and increase the place's value?*

- *Are transit and public spaces related in Guadalajara? How can the existence or non-existence of these alignments determine urban design and development strategies around transit access points in the central district of Guadalajara taking into account by the city's own development history and, more importantly, lessons from the reviewed urban design, transportation, and perception theory?*

1.3 METHODS

The first part of this analysis will consist in understanding the theoretical background linking human behavior to transit systems and to city-form elements. As has been briefly introduced, there are arguments that support the use of the behaviorist perspective to understanding both city image-formation and transit system mental maps.

Four different theoretical topics will be consulted: perception and behavior theories; environmental images, urban form and wayfinding theories; Place-making concepts; and transit-oriented development theories. This theoretical background is intended to offer a solid foundation supporting further analysis in the case of Guadalajara.

Following the comprehensive theoretical analysis, the second half of the thesis will consist of first understanding the historical and current urban planning, transportation planning and urban design frameworks that have been applied in the city. There have been many of recent reports and documents that address the challenges of TOD in Guadalajara and that offer an insight on the current geo-spatial and demographic conditions of the city and its transit system. Reviewed TOD implementation reports have identified the Central District of Guadalajara as one of the most suitable areas of the city to apply TOD policies (ITDP Mexico & Herrera, 2015; ITDP Mexico et al., 2015), therefore this thesis will limit its analysis to the central district of the city and that district's mass transit stations.

Finally, the thesis will draw from the lessons from the examined theory, from the history of Guadalajara's development and urban structure, and from the previously identified challenges involved in applying TOD concepts in the city, to offer a spatial analysis of the current open space network in the district and their relationship with both the urban structure and the location of the different mass transit stations in the city. For the purpose of this thesis, only the light rail stations will be considered because of their scale and because of the fact that they offer a clearer framework to analyze a potential match between transit stops and open spaces.

Expected Results

In general, based on my personal experiences as a native resident of Guadalajara, I am aware of the richness of the city's downtown urban structure. My personal insight has been from the beginning a motivator to pursuit this topic. I expect the thesis to show the following results.

First, I expect it to show a clear theoretical connection between the construction of personal preferences (in this case towards transit) and the roles of open public spaces as a territory and city image organizer and easing of wayfinding. Also, to show a connection between the presence of an identifiable open space at the heart of a TOD zone and the attraction of value and place-making potential.

Second, I expect the application of the theoretical background, together with the current and historical analysis of the city's urban form and urban planning, to give a clear light on why open spaces are a key feature of the urban environment for the city of Guadalajara. Furthermore, I expect for these lessons to be applicable to other cities in the western hemisphere, in both developed and developing countries, in their pursuit of the successful application of the transit-oriented development model.

2. THEORETICAL BACKGROUND

2.1 PERCEPTION AND BEHAVIOR

From social sciences such as psychology to professions like urban and transportation planning and design, understating why people (users, individuals, inhabitants) behave as they do offers insights on how to seek solutions to any related problem. Specifically for this thesis purpose, it is important to comprehend the psychological foundations of how behavior is determined in order to understand how, for example, a city layout or a transportation system can play a crucial role in people's understanding of their surroundings and so influence urban development patterns.
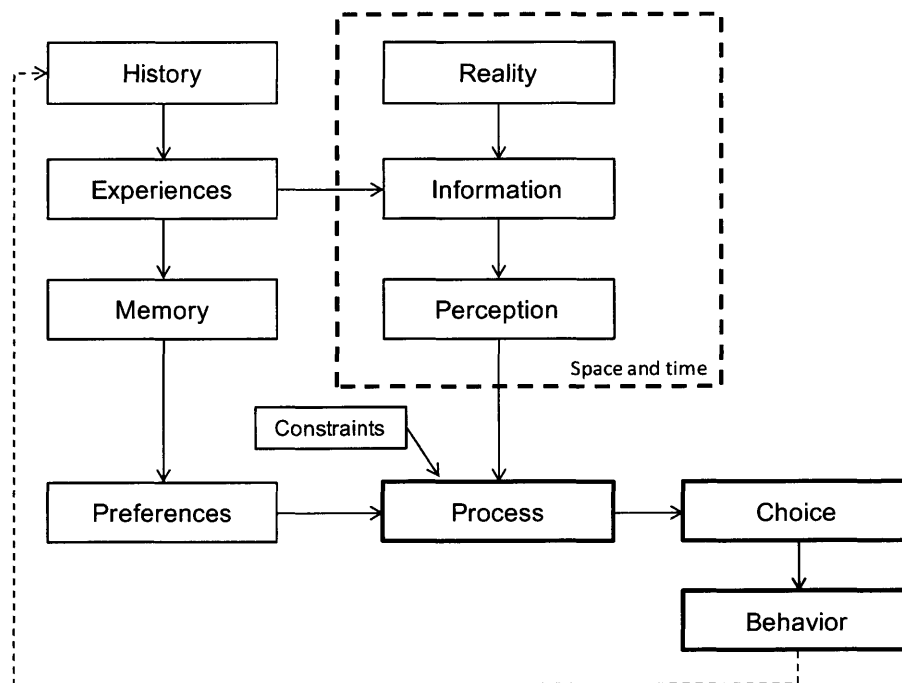
Figure 2.1 Theory of Behavior Choice.
Source: Modified from Jinhua Zhao (2016) who draws from on McFadden, Simon, Khaneman, and others

Choices, that later translate into behavior, are the result of rational processes in which personal preferences and the perception of reality are assessed (Figure 2.1). Some of these processes happen consciously but others unconsciously. According to the *Theory of Behavior Choice* developed by the Nobel laureate in Economics, Daniel McFadden (McFadden, 2000), there are two different determinants of this choice process: the one internal and intangible arising from (personal) history and introducing preferences based on previous experience, and the other physical and observable: the perception of reality (space and time) according to the information (of any kind) provide by the environment. The process also involves the effect of constraints, which are external to both personal experience and the observable information.

There are many reasons why is desirable to modify an individual's or group's behavior. The possibility of influencing the decision-making processes that define behavior is vital to many of the key policy challenges in areas such as planning, transportation, health, finance and climate change (Dolan et al., 2012). Any profession that requires some degree of connection to social affairs has to deal with changing human behavior. In some cases policies are needed to help people "close the gap between aspiration and action" (Miller & Prentice, 2013, p. 301); in others, modifying the physical environment is the means of changing perception. But no matter which path for behavior change is to be followed, they all alter elements involved in the behavior choice process.

To modify behavior, we can either manipulate the observed information, in order to shape the individual's (or group) preferences, or else construct experiences that will later change memory. Nevertheless, both paths are related, given that a frequent alteration of one's perception can later produce a different set of memories that will shape preferences. To some extent, and emerging from behavioral decision research, people's preferences can be, and often are, constructed (Lichtenstein & Slovic, 2006). Changing contexts by influencing the environment within which people act has proven to be essential to the alteration human behavior (Dolan et al., 2012; Mehta & Bosson, 2010).

By publishing new policies or modifying how the observable information is displayed, we are influencing people's perception to create a different set of preferences. In other words, we are organizing the context (spatial and temporal) in which people make their decisions, as an attempt to alter their behavior, so that it aligns with whatever desirable outcome is intended.

Behavior, perception and the built environment

The urban design profession has as its main job the physical alteration and construction of environment. Working with urban form means to deal precisely with how urban context is laid out and organized. Urban designers' primary materials are elements that create tangible and observable urban space. Designers care about how spaces look, how they feel, and how these elements relate to each other producing at the end a physical product. Given the clear relationship between the environment and human behavior, any action that modifies spatial information will then alter those behaviors, therefore designers are in some extent choice architects (Zhao 2016). Urban designers have the power to make design decisions that will modify perceptions and construct preferences.

Designers, then, have the obligation to further understand how different urban environment arrangements produce different choices, and how people perceive and experience the city. More importantly, given that cities are an agglomeration of people, the focus should not be only about each individual's choice process, but rather how the mass of people agree and construct a collective set of preferences. Although each individual creates their own image of reality, there seem to exist agreements within members of a group of people (a group that is defined by their social, cultural and geographical or demographical conditions) (Lynch, 1960, pp. 7, 123). In general, most of the group members in a region will consciously or unconsciously agree on which environment organization makes more sense to them, leading professionals to have better signals on how to produce the desirable behavioral outcome. Planners and designers must focus on these collective mental maps in order to examine which urban elements are more likely to have a stronger impact on behavior.

We experience the city while we navigate it. The way we perceive urban environments, that is, the creation of mental images, has its primary function in "permitting purposeful mobility" (Lynch, 1960, p. 124). What we purposefully observe or ignore, whatever information from the urban context we include or discard in our mental image, has been intriguing researchers for several decades. Donald Appleyard categorized three dominant types of urban perception: "operational, responsive and inferential" (Appleyard, 1973). The first one happens as people use or operate the city and consciously make use of the elements the space provides. People may better remember details from traffic intersections, subway stations, the park where they eat their lunch. Responsive perception is more passive. It refers to whatever we are less conscious that we observe and assimilate. Shapes, colors, sounds, anything that catches our senses while we move around. This type of perception is the one that Lynch called "imageability". Finally,

inferential perception is the one that happens in a more probabilistic nature. It happens when we match new experience with the coding system we assemble as we mature, based on our previous experiences. It is the history that will later trigger memories to shape preferences in our behavior-choice process.

We encode, store, and manipulate experienced and perceived information that can be spatially referenced to create mental or cognitive maps to navigate the city. Wayfinding involves "the process of finding a path in an actual environment between an origin and a destination that has previously not necessarily been visited" (Golledge & Gärling, 2004, p. 505). The recognizable patterns in the environment, that will ease (or not) navigation in the urban setting, are the essential data that will inform our travel decision and choices. And given that wayfinding is the fundamental purpose of urban perception and of the creation of environmental mental images, the theoretical relationship between urban design and transportation planning is evident.

Transportation planning is accustomed to approach behavior choice as a way to design policies. Pricing policy based on transfer behavior or nudging users toward travel-pattern changes by altering information provided such as maps (Guo, 2008, 2011), are some of the transportation examples of this. Interestingly, there have been cases where some policies have shown effects in people's perception beyond transportation. In a study by Janet Vertesi about the effects of London's iconic tube map on Londoners' representation of urban space, it was shown that the map not only eased navigation within the subway system but further became a graphical interface to understand the city, modifying the perception Londoners had of the urban environment (Vertesi, 2008). Consequently, if in this example transit information modified urban perception, then it may also be true the other way around. City form and urban design may be able to modify perception towards transit. In the case of London, the tube's map altered how the people thought their city looked like, therefore the way the city looks might modify the people's impression of the transit system. For transit-oriented policy this is highly relevant. If the primary goal is to change behavior so people use transit, then the connection between the urban layout and transit is a powerful tool to construct different preferences to support these new choices.

In conclusion, and putting it in simpler terms, the elements that create and organize the urban environment, and that will be described further in this chapter, are the means to alter perception and influence people's mental images of their cities. These elements relate not only to the aesthetic result of the urban space but to the functional task of permitting purposeful mobility and navigation. The work by

Lynch, Appleyard, and Golledge, among others, is connected to a deep understanding of human behavior and as an attempt to de-codify the elements of (urban) reality that later influence the behavior-choice process.

2.2   THE IMAGE OF THE CITY AND OPEN SPACES

As already introduced, Kevin Lynch is a cornerstone for this thesis. His work linking urban design and urban perception sets out a clear and easy-to-follow theory that explains how city form modifies people's perception. In *The Image of the City* (1960), Lynch focuses on how people in the process of wayfinding hold a generalized mental image of the physical world. This cognitive image is the result of immediate observation and past experiences (Lynch, 1960, p. 4). Just as in the previously discussed *Theory of Behavior Choice,* Lynch's image of the city concept determines that the mental image people construct of the urban environment is the result of the process of combining perception of reality and memory-based preferences. Moreover, he states that a clear and distinctive urban environment, in addition to offering a sense of security while navigating, "heightens the potential depth and intensity of the human experience" (Lynch, 1960, p. 5). A clear city image is not only about a rational wayfinding process but also about triggering feelings and associations (Nasar, 1998, p. 8).

The built environment is a channel of non-verbal communication (Rapaport, 1990). The procedure of building the environmental images is straight-forward: it is the result of a two-way process between an observer and what is perceived, in this case, the urban environment. Reality offers information that suggests relations and directions while the receivers selects and organizes what they perceive. Depending on how the information is presented to the observer, then the resulting image can be more or less coherent.

According to Lynch, the environmental image must be analyzed based on three principles: *identity*: how each object is recognized from other things; *structure:* the pattern of relationships organizing the objects; and *meaning*: the emotional response to what is perceived (Lynch, 1960, p. 8). Meaning can be *denotative*, aligned with the object recognition, *connotative,* the emotional values associated with the object, and *abstract,* referring to broader values (Nasar, 1998, pp. 6–7). Together these three components are what produce and modify our perception. Identity and structure are fundamental parts of legible spaces but is not sufficient for a complete image of the city. Human beings also associate

feelings and meanings, both positive and negative, with their rational observations, so meanings are equally relevant to the image construction.

In addition to the three image components, Lynch introduces the concept of *Imageability:* the physical quality of the observable objects that produce and evoke a strong image in any given observer. It is this responsive perception that will catch our senses, according to Appleyard. In highly imageable environments, objects are not only identifiable but are "presented sharply and intensely to the senses" (Lynch, 1960, p. 10). While we need structure and identity to evaluate the perceived environment, to have a more memorable perception that can later influence further experiences, some elements must stand out as references; they need to be highly imageable. Having a clear impression of the spatial structure (information) contributes to the vividness of the image and produces a coherent image of the environment, easing wayfinding and creating significance that will produce meaningful experiences. If the urban environment is visibly organized, the observers will be able to feed their surroundings with their own meanings, then the spaces become truly unmistakable places.

Paths and Nodes

Probably the most relevant innovation for urban designers and the study of urban perception in *The Image of the City* was Lynch's introduction and definition of five elements of urban form. These elements were identified after multiple observations and interviews in which Lynch asked local residents to sketch maps of their city based on their memories.

- *Paths:* linear channels or routes along which the individuals perceive the city while moving through them such as streets, walkways or transit lines.
- *Edges:* linear elements, that are not paths to the observer and function as boundaries or barriers such as waterfronts, rivers, railroads.
- *Districts:* larger sections of the city that have some recognizable identity and homogeneity and character that distinguish it from other areas.
- *Nodes:* strategic focal points of interest and intensive activity to and from which the observer is traveling such as intersections, plazas, and squares.
- *Landmarks:* reference points that unlike the nodes, the observer cannot enter, they are usually physical objects of different scale such as monuments, towers, hills.

None of these elements exists in isolation, that is, cities are formed by a collection of them. These elements normally overlap and intersect one another. A city is, then, a system where "districts are structured by nodes, defined by edges, penetrated by paths, and sprinkled with landmarks" (Lynch, 1960, pp. 48–49).

Path Edge Node District Landmark
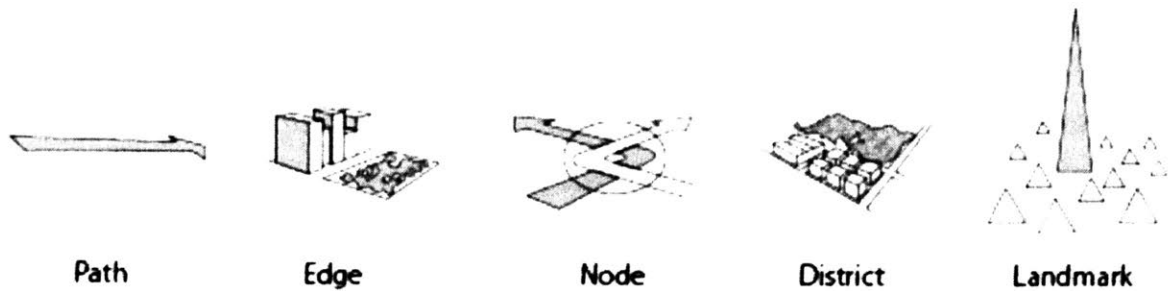
Figure 2.2 The Image of City five elements.
Source: Lynch, 1960

Overall, in Lynch's theory, paths and nodes are the larger portion of elements that form the city. Based on his interviews, paths were the predominant city element, although it depended on how familiar the individual was with the urban environment (Lynch, 1960, p. 49). He states that paths are the metropolitan-wide structural element that connected and intersect the other four types. Paths are normally identifiable and continuous and tend to have directionality and scale as result of how they connect and order known landmarks and nodes along their way. Paths are elements that people tended to perceive based on origin and destination points.

Nodes, on the other hand, are precisely those points that structure the paths' direction. They are strategic *foci,* or anchor points, where city dwellers can enter and root their experience. While paths refer to linear movement along the city, nodes are the points of departure or arrival. In theory, any street or path intersection is a node given that they are in some extent decision points, but in general, most junctions do not have enough notoriety to be *imaged* beyond a simple incidental confluence of trails. Moreover, to build a structured and clear mental image, the city cannot handle too many nodal centers (Lynch, 1960, p. 75). Instead, what is really relevant for city observers are those intersections where a transportation break happens; the location where a journey starts or ends, places where people change their transportation mode, or where the scale of the system changes. These are junctions where important

decisions must be made so people increase their attention and tend to perceive surrounding elements with more clarity (Lynch, 1960, pp. 72–73).

Nodes can be important even if they do not have a strong physical form; they can be recognized based on their functional role within the journey. But if the node has a defined form, then as Lynch says, "the impact is much stronger. The node becomes memorable" (Lynch, 1960, p. 76). A stronger and more defined form occurs if the node has sharp and clear boundaries and, more importantly, if it offers objects of attention and reference (landmarks) (Lynch, 1960, p. 102, 1990). Landmarks can serve as reinforcement, increasing the anchor effect of the node. And in many cases, afar from Lynch's differentiation between landmarks and nodes, the node as place and not an external reference object, functions as a landmark (Golledge, 1999, p. 17). Paths then are channels, nodes are intensifications, and landmarks are accents or features. This understanding of movement and arrivals will be relevant later, to link city-form elements with transportation systems.
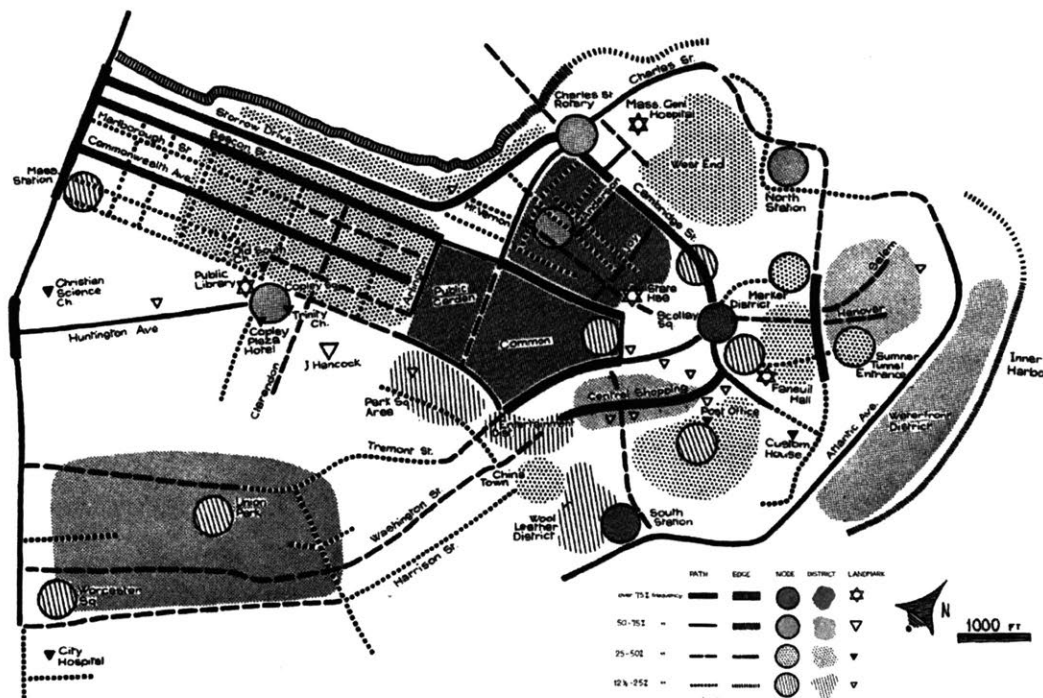
Figure 2.3 Kevin Lynch's diagram of Boston's Image based on interviews.
Source: Lynch, 1960

As mentioned, for Lynch out of the five elements that construct the image of the city, paths are the dominant component as the city-wide organizers. Given that city residents and visitors use paths to move around they are seen as primary organization source. Paths have direct interrelations with the other

elements; they connect nodes and landmarks across different edge-delimited districts. It is at important path intersections and termini that nodal junctions occur almost automatically and are critical moments in the observer's journey. Nodes, then, become the place of arrival while being strengthened by the presence of landmarks and guarantee special attention from the observer given their relationship with the paths (Lynch, 1960, p. 84).

When Lynch's city elements are represented in a city diagram (Figure 2.3), the result is an intricate system where paths produce and connect nodes surrounded by landmarks and penetrate districts at different scales according to the strength of the image evoked by each element. Based on the method that he derived from his interviews, paths can be identified as the features that gives structure to the urban system.

For Reginald Golledge, a behavioral geographer pioneer, there was an agreement between other scholars, that wayfinding and cognitive maps are formed by point, linear, areas and surface elements[5] (Golledge, 1999, p. 15). Together these components construct the elaborate system that produces our city images. More importantly, he stated that for the observer primary nodes and/or landmarks function like anchor points as the key organizing structure of the urban environment (Couclelis et al., 1987; Golledge & Gärling, 2004; Golledge & Spector, 1978). These anchors, which are connected by paths or links, consist in the significant feature of the environment. In his *Anchor Point Theory*, Golledge states that urban forms are imaged as a linked-node configuration (Figure 2.4). The environmental cues that observers have from their surroundings are "imaged as being located at specific places in the environment" (Golledge & Spector, 1978, p. 406).
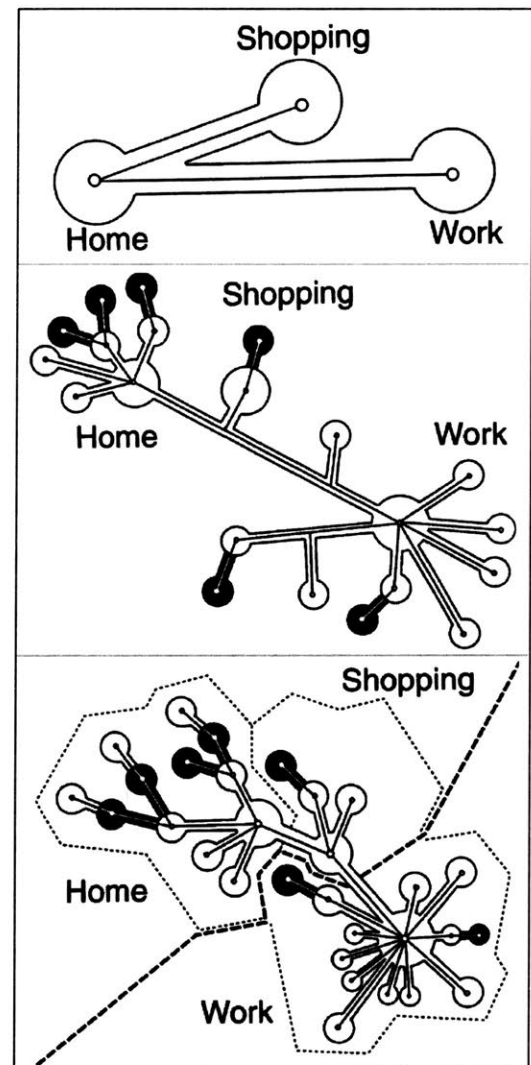
Figure 2.4 Anchor Point Theory.
Source: Golledge, 1999

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[5] In a clear similarity to Lynch's Image of the city elements, where paths/edges=lines, nodes/landmarks = points, districts=areas

People tend to define *personalized anchors*, which are determined by each individual's personal activities such as their home or work locations; and *common anchors*, those that are significant places in the environment and are recognizable for many (Golledge & Gärling, 2004, p. 503). Therefore, while some anchors function as reference locations on an individual basis, mainstream features become recognizable places shared by a group.

When comparing Lynch and Golledge's approaches, each has a different organizing element: for Lynch space is organized by paths and for Golledge by anchors; the two systems consist in foci and connectors. Based on this, it is possible to state that within the "Lynchian" catalog of elements, nodes (reinforced by landmarks) and paths are two basic elements in mental-image construction and to the act of traveling. If observers create their image of the city while they move, then it is clear that the two basic cognitive elements are those where they move along (paths) and those where they stay (nodes/anchors).

Nodes and Transit

Transportation networks are also formed by a collection of paths and nodes. It happens the same in cognitive maps, transportation networks represent linear movements to connect an origin and a destination. A transportation system's goal is to attract as many passengers as possible while being efficient and creating a positive impact in their environment (Vuchic, 2005, p. 186). In order to achieve this, transit lines follow several design features to affect transit service and attract passengers, such as maximization of area coverage and operating speed. Additionally, transit lines pursue the fulfillment of each passenger's *travel desire,* which means each route tries to closely follow major origin-destination (O-D) points and patterns to attract the maximum number of travelers (Vuchic, 2005, p. 187); all the while keeping travel paths as direct as possible and simplifying connections and transfers. The assessment of these travel paths produces a multiplicity of network typologies that are structures that aim to connect as many mainstream nodes or major O-Ds while producing efficient path systems and connections (Brunn, 2007, pp. 46–48). The result are network typologies that look like rationalized structures seeking to efficiently connect Golledge's *anchor points* (Figure 2.5).

It is not by chance, then, that when we compare environmental cognitive maps schemes, such as the ones presented by Lynch and Golledge, and public transportation systems, they both look alike (Figure 2.6). In the end the constant between them is movement. Urban perception is constructed while people

travel to connect their O-D in which transportation systems are obviously set to provide a service for those travels. Therefore, the values and concerns that urban designers share with respect to the physical and spatial outcome of the relationship of these city image elements, are or should be equally relevant to the definition of transportation systems.
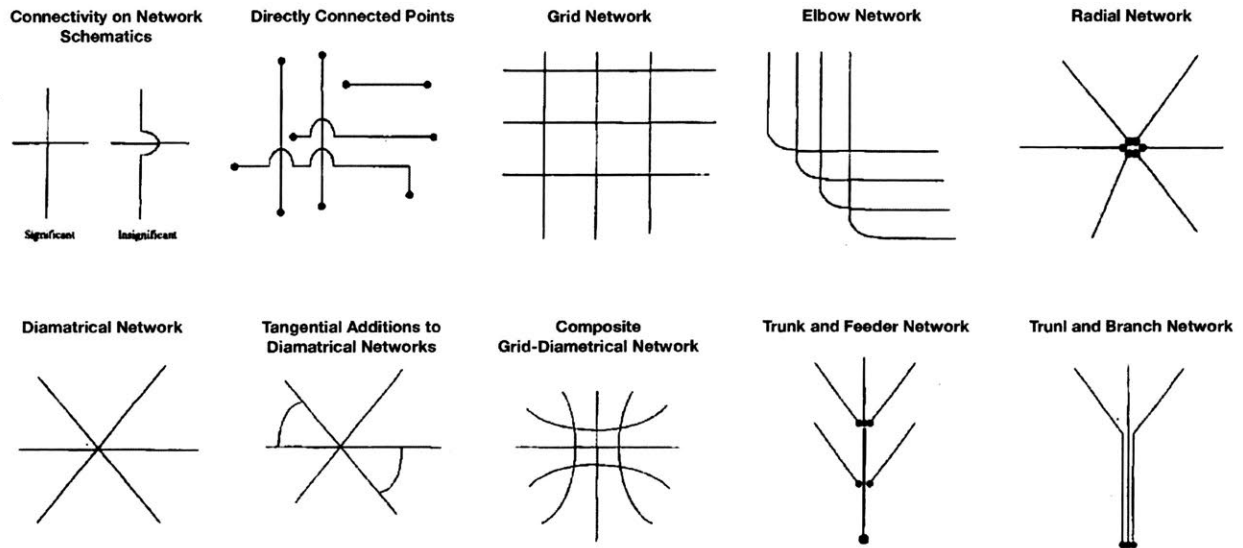
Figure 2.5 Spatial Typology of Fixed-Route Networks.
Source: Brunn, 2007
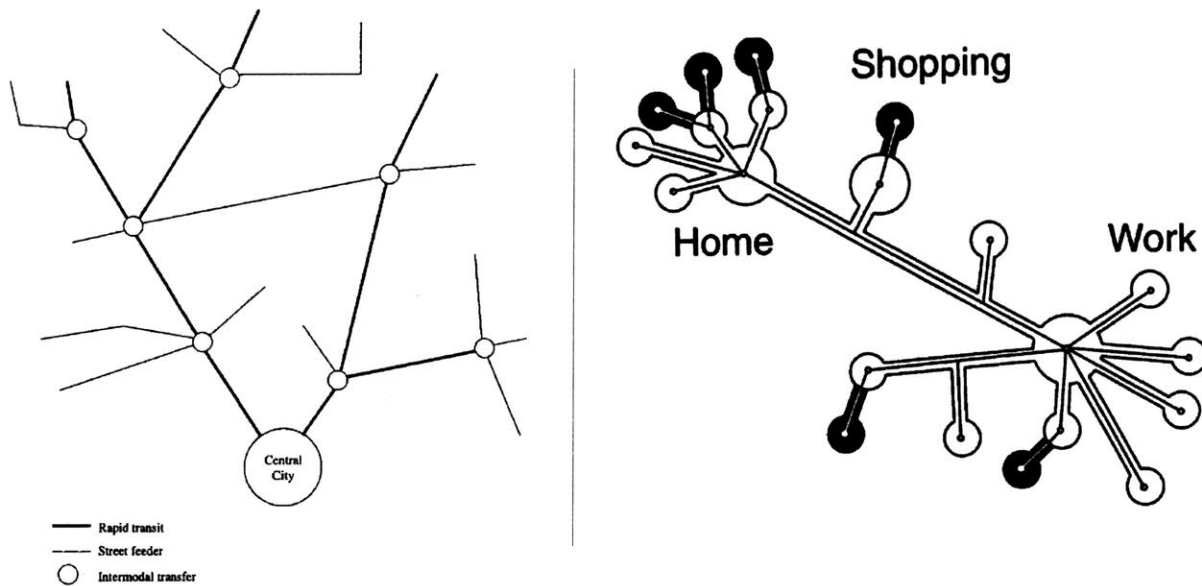
Figure 2.6 Comparison between an integrated transit network scheme and Golledge's Anchor Point theory.
Source: Vuchic, 2005 and Golledge, 1999

Models linking spatial behavior and travel choice have been more common for the last decades (McFadden in Golledge & Gärling, 2004, p. 507). Unfortunately, the transportation planning profession in general has not found ways to operationalized and incorporate such spatial cognition models, particularly the construction of cognitive maps and wayfinding (Golledge & Gärling, 2004); although as referenced before, there have been some examples where this is starting to happen (Vertesi, 2008). Golledge maintained that:

> Cognitive maps must become a part of the modeling process in that they are summaries of what is known about the network over which travel must take place; they provide information on what is known about the location, possible destinations, and feasible alternatives for any choice; and they provide a means for spatializing attribute information by attaching values and belief or preference ratings or measures to specific geocoded places. (Golledge & Gärling, 2004, p. 507)

Transportation systems must be easy to use, which means they should be completely legible, with the system routes, paths and transfers easy to follow, and the destinations clearly defined (Lynch, 1990, p. 421). In terms of legibility, Lynch stated that primary junctions or transportation breaks have an undeniable importance for the observer (Lynch, 1960, pp. 72–73), and that junction nodes happen almost inevitably in major intersections and termini which reinforce those critical moments in each individual's journey (Lynch, 1960, p. 84). It can be said that those breaks in transportation are precisely the points where transportation networks and city form must convene. Specifically for transit, these breaks will be the system's stations, stops or any kind of access points.

The mental image of the city has an impact on the travel choice process through a number of means: travelers' choosing destinations from among those that were brought to their attention, their awareness of those destinations' spatial relations, and the traveler's degree of familiarity with the environment (Golledge & Gärling, 2004, p. 507). Consequently, what is critical is that those nodes (or anchors) that the generalized city image and the transportation network share are where decisions are made by users so people tend to be more noticeable of their surroundings. This means that any element located at these junctions will probably be assumed by the user to be relevant for the system and the city image.

Furthermore, those nodes "are not only strengthened by the presence of landmarks but provide a setting which almost guarantees attention for any such mark" (Lynch, 1960, p. 84). Lynch affirms that If both decision point and city nodes are set to match, then the city node will receive even more attention, where

such match has to be visible and expressive. Where "the traveler must see how he enters the node, where the break occurs, how he goes around" (Lynch, 1960, pp. 102–103). The alignment between systems (transit and city), then, is crucial if we are aiming to promote urban environments where the transportation modal split prioritize transit over private motor vehicles. Moreover, it is important to emphasize that, based on what was asserted by Lynch, not only the alignment but a clear, legible, expressive imageable space is needed.

Misalignments can happen when the movement channels (paths) exist in sharp separation from its surrounding elements. This is significantly evident for railroads and subways where they normally run disconnected from the world, in many cases buried from the observable city image. Underground infrastructure like subways and subterranean corridors are disorienting; there are no references and landmarks (Whyte, 2001). The only connections these hidden paths have with the rest of the environment are when the transit lines come up to the surface or at the surface entrances of the stations. Such entrances will then become strategic nodes for the city (Lynch, 1960, pp. 57, 74). These strategic nodes have a significant impact in the image construction and need to be associated with the city form above and related to key superficial features.

Both transit systems and environmental images share journeys as their reason for existence. They both are defined based on the identification of generalized O-Ds and the movement along the links between them. In many cases those links are entirely detached from the urban form and do not offer imageable experiences. At those times then the point features where both systems connect acquire even more relevance. Transit access points like subway, LRT or BRT stations or even bus stops are gateways to districts and communities (NACTO, 2016), becoming, on their own scale, city nodes.

Open Spaces

Building on what has already been stated, it is reasonable to say that the possibility to observe one's surroundings and assimilate as much information from the environment as possible, is a fundamental quality expected from nodes. Given the attention that nodes receive from the observers when decisions have to be made, it is important that they clearly display all the relevant information necessary for the processing of such decisions. It is in this context that urban open spaces attain a distinct place within the design components of the city.

Historically, open, accessible and central spaces had functioned as the heart of cities. Town squares were often used as markets, gathering areas, spaces for ceremonies and celebrations, as outdoors living and meeting places (Marcus & Francis, 1990, p. 1). While some of the activities that used to be intrinsic to urban open spaces have changed, their relevance and the multiplicity of benefits these spaces provide, especially in denser urban areas, is undisputed (Woolley, 2003). Open spaces are needed for public life to thrive (Marcus & Francis, 1990) as they offer a wide range of benefits and opportunities to the urban residents (Francis, 2003; Woolley, 2003). These benefits range from issues like public health and environment to social and economic opportunities (Woolley, 2003). Thus it is clear, as has been studied in a diverse range of urban planning subjects, that open spaces perform an essential set of tasks that improve the quality of the urban experience. Very little however has been done to address their role in the construction of urban perception.

Among from different sources, there is a consensus that open urban spaces can be classified by their scale or size along with their urban role and uses (Francis, 2003; Lynch, 1981; Marcus & Francis, 1990; Woolley, 2003). While Lynch classifies the open spaces as regional, urban parks, squares, linear parks and playgrounds, Woolley sorts the typologies as domestic, neighborhood and civic urban spaces, mixing roles with sizes. For Marcus and Francis, the categories are urban plazas, neighborhood parks, *miniparks*, campus outdoor space, and social open spaces (housing, day care centers, hospitals). Overall all the lists deal with the uses of the open spaces within their function in the city context, together with their size.

In an aim to define what *open* stands for, Lynch provided a wide range of concepts and meanings linked to the idea of openness. For him the meaning of open can be understood as: "free to be entered or used, unobstructed, unrestricted, accessible, available, exposed, extended, candid, undetermined, loose, disengaged, responsive, ready to hear or see as open in open heart, open eyes, open hand, open mind, open house, open city" (Lynch, 1990, p. 396). Open spaces could then be understood as all the unbuilt or uncovered areas in the urban environment that are open to be used freely and unrestrictedly by people (Lynch, 1990, p. 396), as places that allow different types of activities including necessary, optional and social activities (Gehl, 1987 in Woolley, 2003). Open spaces are places where people have the opportunity to act freely beyond the ownership, size, and landscape character (Lynch, 1990, p. 396).

However, in addition to their unconstrained quality, open spaces could be defined as those places that offer an unobstructed and exposed view of their immediate surroundings. It is again Lynch who offers an

insight of how "The Openness of open space" (1965) (Lynch, 1990) not only refers to the freedom of use but also "extends the understanding of self and of environment" (Lynch, 1990, p. 398); where "orientation to the city itself can be improved by contrast, and by the views which are opened up" (Lynch, 1960, 1990). Is in this manner that Lynch makes a direct link between open spaces and the construction of the environmental image of the city:

> Open spaces play still another major role. Because of their openness to sight, their contrast to the most characteristic regions of a city, and the grand scale continuities they can provide, they are very effective in visibly explaining the organization and nature of the city environment. (Lynch, 1990, p. 406)

Open spaces can provide, on different scales, means to establish visual relationships with the observable environment. Whether it is a large-scale panorama like the one offered by the Charles river reservoir in Boston, where the sight opens wide to allow a view of a unique range of the downtown's landmarks (Lynch, 1990), or a smaller but still valuable opening that offers a frame to display other of the district's elements like a city square for a civic building or a church atrium. By providing contrast between solid and void (figure-ground), these openings decompress the density of the urban environment (Figure 2.7).
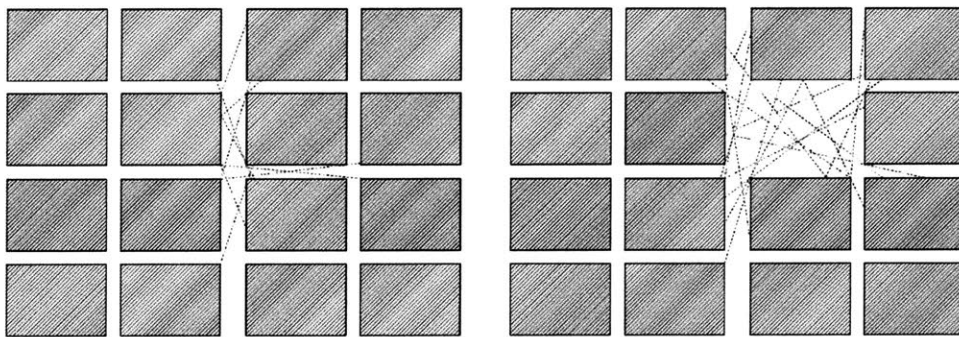
Figure 2.7 Decompression of the urban space. Opening of sight lines.

Similar to the way lobbies or reception areas in high-rises open up the space next to vertical circulations in each level in order to present the space, gather crowds and ease in-building wayfinding; open spaces in cities, paired to access points, can operate in the same fashion. By matching open public spaces with urban transportation systems, these spaces can function as vestibules to the neighborhood, and district, and to the transportation system itself. Transit stations and stops are the first contact residents have with the system as stations interact with the surrounding urban fabric and function as gateways to the

community (NACTO, 2016). The *transit foyer* is identified by Marcus and Francis (1990) as "a type of plaza space created for easy access in and out of heavily used public transit terminals" (Marcus & Francis, 1990, p. 16). They identified that most of the activities were normally limited to passing through, captive users, and in some occasions, attract vendors and people watchers. They limited this type of plazas to subway entry places and bus terminals. Although they limit their definition of the *transit foyer* to heavily used transit, in the same way open spaces can be found at different scales according to their uses and sizes; those *foyers* could equally function as vestibules for different scale transit access points.

Finally, urban open spaces are relevant not only in terms of their individual role but also as part of a network. For Lynch, open spaces that are meant to be used in a daily basis should be not only close to their users but connected by identifiable paths. Hence "a network of relatively small spaces, well distributed within the urban system may be more useful than the large tracts which look so well on land-use maps" (Lynch, 1990, p. 400); which can work only if the open spaces "are large enough to establish its own special character (a size which may often be astonishingly small)". Furthermore, this network of open spaces scattered in a district can help to define a unique character. When there exists an articulation of public spaces connecting neighborhoods and their people, they are not only enjoyment areas but also establish "a balance between people and their environment" (Rogers, 1999). This means that the open space not only functions as a focal point but connects the neighborhoods and strenghten communitites (Lo, Yiu, & Lo, 2003).

In sum, open spaces are a primary resource to visibly convey the organization of the environment while also functioning as a gateway to both the city and the transit system. And as has been stated, there is a direct connection between perception, behavior, and construction of preferences; therefore open public spaces serve as unique places to lay out the observable information of the environment that will support the choice process and strength the anchor role of the node within the observer's perception.

2.3   PLACE-MAKING

What is a place? In geography, place and space have different meanings. A space is abstract, a meaningless location, while place refers to locations created by experiences and have been imbued with specific values. A place can be seen as a "space with meaning" (Tuan, 1977). The concept of *place* in

the urban environment context can be understood as an attractor around which a community or city district gravitates, as an urban space with meaning for its users and community residents.

Sense of Place and Place-making

A *sense of place* is about identity which is the extent a person can recognize a place as being recognizable from other spaces. It has a unique, lively and particular character of its own and that effect is maintained by a group or community (Lynch, 1981, p. 131). Places are what make great cities what they are; they are what we remember of any city environment that we visit and are what makes a city identifiable (Project for Public Spaces, 2000). Places are those urban spaces that embrace the city image principles defined by Lynch: identity and meaning supported and defined by legible structure (Lynch, 1960).

Creating a place depends not only on design-driven practice, but it also includes different disciplines to address the complex issues that involved. (Project for Public Spaces, 2000). Great public spaces are those where people celebrate, social and economic exchanges happen, friends run into each other, and where different cultures mix. (Project for Public Spaces, n.d.-b) For Fred Kent, founder of the *Project for Public Spaces,* a nonprofit planning and design and organization specialized in the creation and research of public spaces, and who pioneered the concept of *place-making,* the sense of place is more important that the design itself. A good place has less to do with its aesthetics and more about the uses, comfort and how legible the space is (Architectural Record, 2000).

Place-making then refers, as its name literally explains: to the action of creating places; to developing a sense of place in specific areas of the environment; and to the act of adding meaning and defining the identity of a space by designing better cities for people (Gehl, 2010; Palermo & Ponzini, 2015). Project for Public Spaces defines place-making as:

> Place-making refers to a collaborative process by which we can shape our public realm in order to maximize shared value. More than just promoting better urban design, Place-making facilitates creative patterns of use, paying particular attention to the physical, cultural, and social identities that define a place and support its ongoing evolution. (Project for Public Spaces, n.d.-a)

Place-making seeks to place people in the center of urban design and is inspired by focusing on the social and cultural importance of livable communities and attractive public spaces (Project for Public Spaces, n.d.-a). Project for Public Spaces promotes several guidelines for the place-making practice that seek to integrate the community into a cohesive vision, translate the shared vision into a plan and ensure

the implementation of the plan (Project for Public Spaces, 2000). Place-making also should also be symbolic, civic and socially engaged while opening new opportunities for designers and urban developers (Palermo & Ponzini, 2015); after all, a place not only gives identity to a city, but also helps the environment, provides settings for cultural activities and delivers economic benefits (Project for Public Spaces, 2000). They have also published a place-making framework which defines the elements that create a successful place. In this framework, PPS defines four core areas of actions: uses and activities, sociability, comfort and image, access and linkages (Figure 2.8).
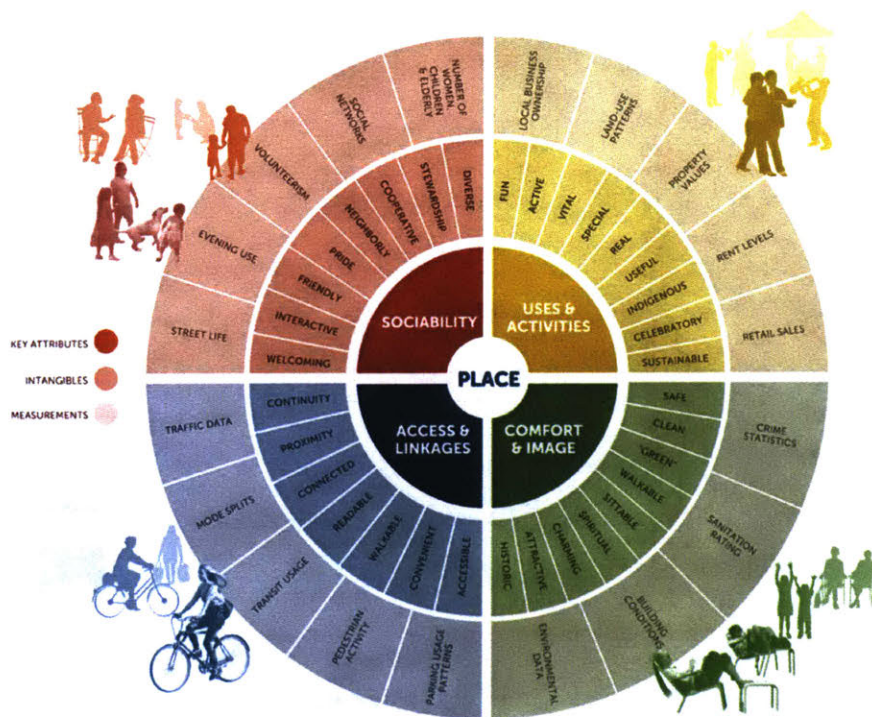
Figure 2.8 What creates a successful place
Source: Project for Public Spaces

The creation of places is linked to the creation of value. Attractive public spaces have measurable economic benefits for the neighborhood (Project for Public Spaces, 2000). A park can increase land value or an active square may increase the real estate prime rent values. Having an identifiable place, with character and which stands out from its surroundings, can be meaningful for users and residents, and is not only valuable for the city but also for urban developers. For many developers, place-making can be seen as a natural effect of their field which is to settle the most attractive property in the market. "This means recognizing three immediate place-making functions in urban development processes: market value, product innovation, and territorial marketing" (Palermo & Ponzini, 2015, p. 35). When a place is

defined, it functions as an attractor of people and uses, and therefore of value (Figure 2.9). For transit-oriented development then, place-making around transit access points is not only an amenity but rather a necessity for its success.
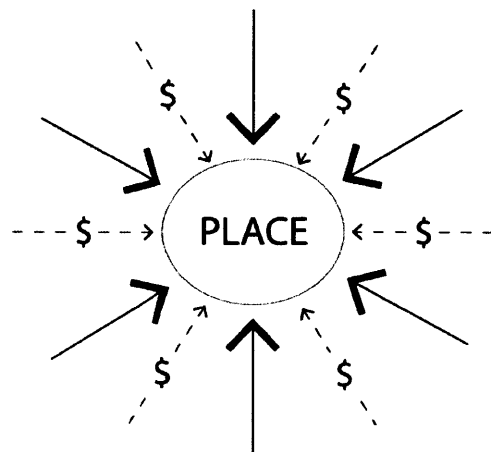
Figure 2.9 Place as gravitational force. Value attractor.

Nodes and Places

Returning to Lynch's five image of the city elements and linking to it some of the previously examined theory with the concept of place-making, it is possible to say that in order for city nodes to become true anchors in the individual's cognitive map, these nodes must carry a sense of place. If nodes were defined as point features in the city that root the observer's experience and normally align with function and transportation breaks, then they are highly identifiable. They have a great potential of developing a genuine identity and provide meaningful experiences to people. It has also been stated open spaces are components that facilitate the process of wayfinding thanks to the sight opening that they provide. Therefore, nodes that already perform or will perform a transportation break function like every transit access point, and that pair with an open public space that offer visual openings and have critical advantages in defining a defined sense of place that can attract urban development value.

Furthermore, "if the environment is visibly organized and sharply identified, then the citizen can inform it with his own meaning and connections. Then it will become a true place, remarkable and unmistakable" (Lynch, 1960, p. 92). What Lynch is saying here is that although we aim for free and unobstructed open spaces, such spaces also have to be defined and framed. They must offer directionality and hierarchy. Controls on heights, setbacks and spacing can help to define open spaces on a different scale. At nodes, greater height and the location of landmarks can also frame and organize the system of nodes that may run along the transit path (Figure 2.10).
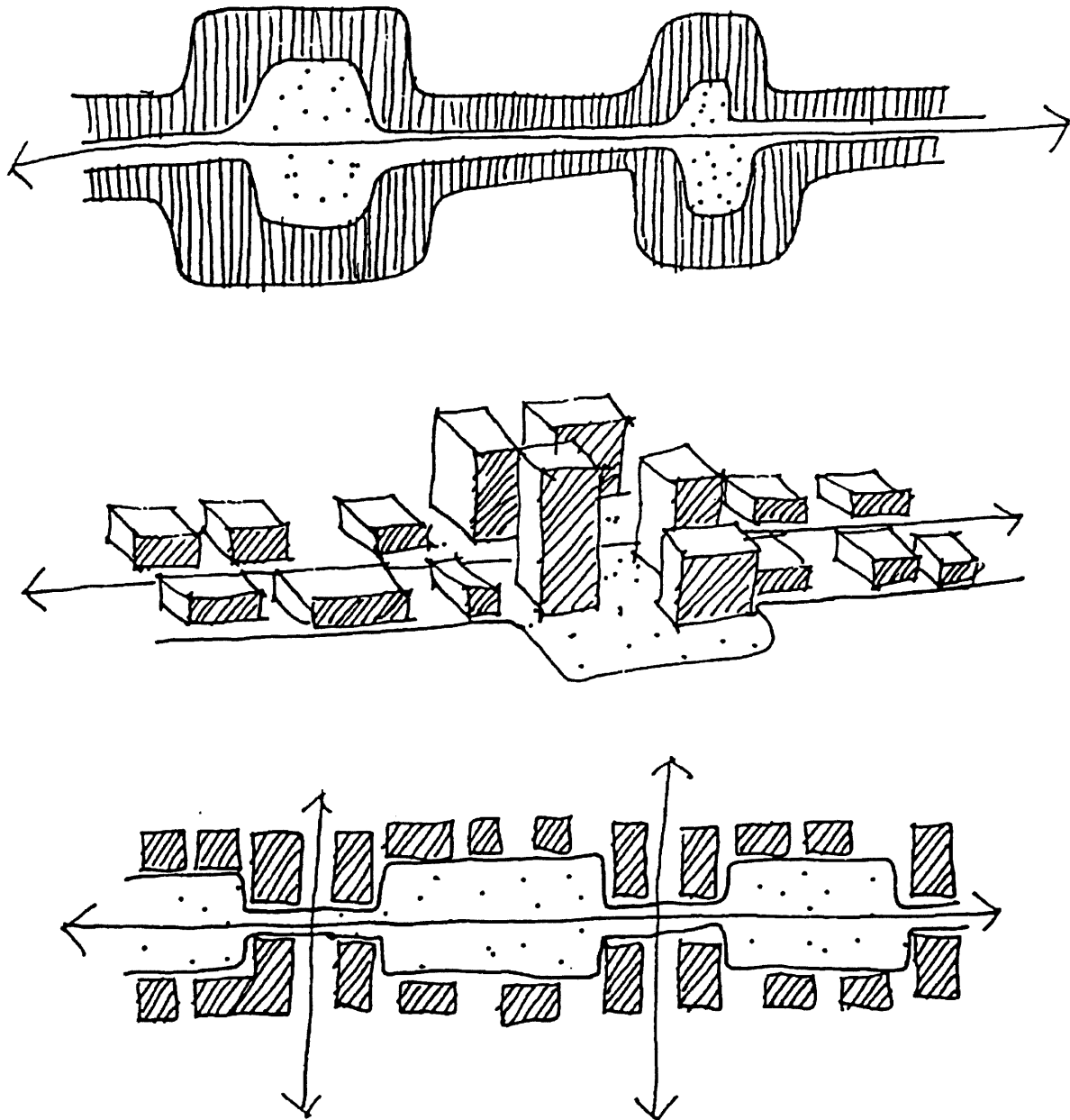
Figure 2.10 Nodes possibilities along paths and strips.
Source: Lynch, 1990, p. 613

2.4   TRANSIT ORIENTED DEVELOPMENT STANDARDS

Governments and professionals are looking towards the improvement of transit infrastructure and changes in development patterns as a way to respond to the rapid urbanization trend and the dramatic increase of motorization in most of the cities around the globe (ITDP, 2014; ITDP Mexico, 2014; Suzuki et al., 2013), and particularly in developing countries (Cervero, 2013). It is within this setting that the Transit Oriented Development (TOD) concept aims to effectively coordinate urban development with transit infrastructure. TOD refers to compact, mix-used, dense, pedestrian and bicycle-friendly development that happens along public transit systems (ctsEMBARQ Mexico, 2013; Fernandez Reyes, 2016; ITDP, 2014; ITDP Mexico et al., 2013; Suzuki et al., 2013). TOD promotes transit investment and emphasizes its integration with land-use policy. Furthermore, some authors stress that TOD should involve the building of full-scale walkable mixed-use communities or neighborhoods, not just isolated developments adjacent to transit (Calthorpe, 1993; ITDP, 2014; ITDP Mexico et al., 2013).

Although there is no standardized definition of how TOD neighborhoods are defined and what specific strategies are necessary, all the consulted literature agreed on a wide range of topics such as: investment to improve transportation systems, new zoning bylaws, policies that promote affordable and mixed-income housing, economic development strategies to attract employment, and urban design guidelines, among others. Some institutions have developed their own TOD criteria to set a clearer framework to follow. For example, the Institute for Transportation and Development Policy (ITDP) published a *TOD Standard* (ITDP, 2014) based on experiences around the world they outlined eight TOD principles which are further elaborated into performance objectives and metrics (Table 1). What some have defined as the "4 Ds" – distance, density, diversity and design (Dunphy, 2004; Ewing & Cervero, 2001) may be the clearest way to summarize the many topics that are involved in TOD.

Walk	Develop neighborhoods that promote walking
Cycle	Prioritize non-motorized transport networks
Connect	Create dense networks of streets and paths
Transit	Locate development near high-quality public transport
Mix	Plan for mixed use
Densify	Optimize density and transit capacity
Compact	Create regions with short commutes
Shift	Increase mobility by regulating parking and road use

Table 1 ITDP's Principles of Urban Development for Transport in Urban Life
Source: Adapted from TOD Standard (ITDP, 2014, p. 7)

Overall TOD involves considering full-scale areas around transit access points, the physical form of the city fabric around it, the quality of the urban space, the policies to promote diversity in all the considerable subjects; all in order to create healthy environments where people are encouraged to prefer transit systems as their primary transportation mode and complement it with walking and biking for short distance travel. "Central to the utility of these concepts is their implications to travel behavior: the way we choose to get around, the frequency of trips, and the distance of each journey" (Calthorpe, 1993, p. 46).

Urban Form and Walkable blocks

In order for TOD to successfully develop, it is important that planners understand the relationship between the built environment, land use patterns and travel behavior (Crane, 1996). The built environment and related subjects such as urban form and urban design, land use patterns, density, are strongly influenced by transit as transit patronage is influenced by urban structure, density and land use mix (Attoe, 1988; Chen & Zegras, 2016; Ewing & Cervero, 2001; Parsons Brinckerhoff Quade and Douglas Inc., 1996). For transit systems, walking accessibility of the catchment area is crucial. There is evidence that denser, more mixed and well-connected areas encourage walking and transit travel (Chen & Zegras, 2016; Ewing & Cervero, 2001). While for example, neighborhoods with a higher mix of land uses can induce more walking (Ewing & Cervero, 2001), the percentage of four-way intersections as a measure of connectivity can also determine how walkable a region could be (Chen & Zegras, 2016).

Most of the TOD definitions consider an area around the transit station where development can happen and still be consider to be connected to the transit system. These catchment areas are defined by what the literature consider to be the "walkable distance" a potential user would walk to actually consider using the transit system. There is no consensus on what a reasonable walking distance is, and the literature presents with different metrics. As early as 1993, Peter Calthorpe stated that TOD is "a mix-use community within an average 2,000-foot (610 m) walking distance of a transit stop and core commercial area" (Calthorpe, 1993, p. 56). Other TOD documents consider up to half a mile (800 m) – roughly 10-minute walk – (Guerra, Cervero, & Tischler, 2012; ITDP Mexico & Medina, 2012), 500 meters (for direct service stations) (ITDP, 2014) or even up to a maximum walk distance of 1 kilometer to a high-capacity transit station (ITDP, 2014, p. 48) or 1km in "effective linear trajectory" (considering the urban structure) (ctsEMBARQ Mexico, 2013). Furthermore, catchment areas can be constructed by a pure Euclidian buffer with a circumference of a given radius from the transit station centroid, or by a network buffer which

shows the actually walkable distance determined by the urban structure (Chen & Zegras, 2016; Ewing & Cervero, 2001; Fernandez Reyes, 2016). What is important to note is that regardless of the chosen catchment radius distance from the station, TOD refers to a complete region surrounding the transit access point, and more importantly that the urban structure plays a significant role in how walkable that region is, or at least, perceived.

TOD Standards like ITDP's (2014) and EMBARQ's (2013) consider several metrics to measure how favorable the urban form or urban structure is within the determined catchment area. Some of these metrics are:

- City Blocks size: The maximum length a block should have to make walking an appealing alternative. Having smaller blocks create a denser urban network.
- Ratio of pedestrian intersections: Related to the size of the blocks, this metric is a ratio of pedestrian intersections to motor vehicle intersections.
- Road/sidewalk continuity: How continuous the road and pathways infrastructure is. If it connects more than one neighborhood, or if it encounters barriers, in particular for pedestrians.

All those metrics can affect travel times and therefore travel decisions. As summarized by Ewing and Cervero (2001) plenty of studies have decidedly related urban form and travel behavior. Based on the analysis of urban form metrics, it has been shown that "Gridlike street networks improve walk and transit access by offering relatively direct routes and alternatives" (Ewing & Cervero, 2001, p. 100). Denser and more continuous networks have proven to improve the walkability of the catchment area around a centroid. Denser structures provide with a higher ratio of pedestrian/motor intersections, and tend to reduce the length of the city blocks. All of this improves the walkability of the neighborhood (Figure 2.11).
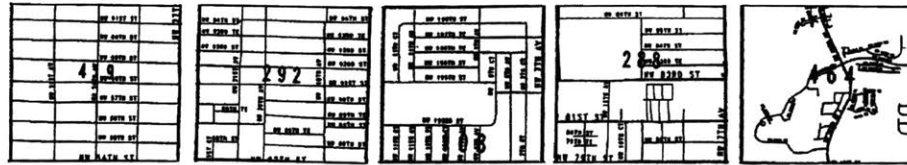
Categorization of street networks. From pure grid to pure curvilinear

(a)   (b)
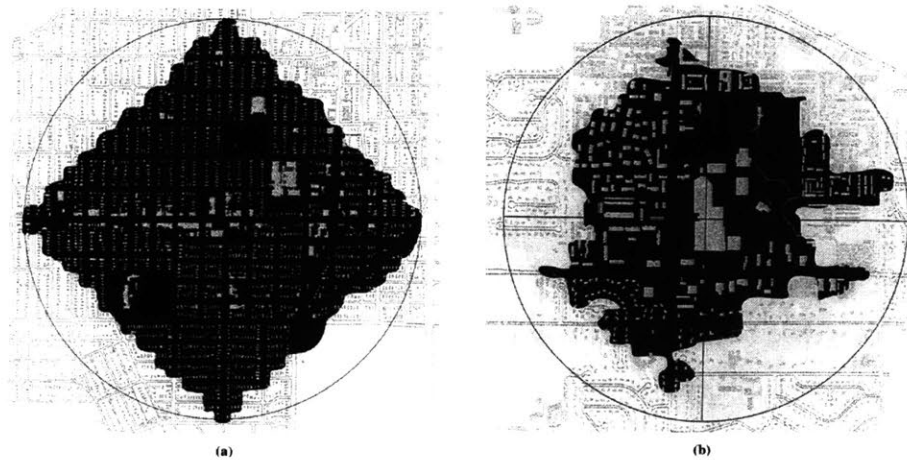
Half-mile walking distance contours at comparable densities. Grid network vs. Curvilinear network

Figure 2.11 Urban Network structure accessibility.
Source: Ewing & Cervero, 2001, p. 102

When in 1993, New Urbanist planner Peter Calthorpe presented his vision for *The Next American Metropolis*, he placed TOD as the central idea for future development. He outlined a set of urban design guidelines that rather than dealing only with aesthetics and architectural principles like typical design guidelines would do, they aimed to define a "new context and direction for the built environment – for the way we develop our communities, neighborhoods, districts, and regions" (Calthorpe, 1993, p. 41). In other words, he addressed that in order for TOD to effectively occur, then planners and designer would need to redefine the structure of the urban environment and therefore its relationships with transit infrastructure. His definition of the TOD scheme emphasized its nodal structure, which to him "should focus on a commercial center, civic uses and a potential transit stop" (Calthorpe, 1993, p. 42) (Figure 2.12).
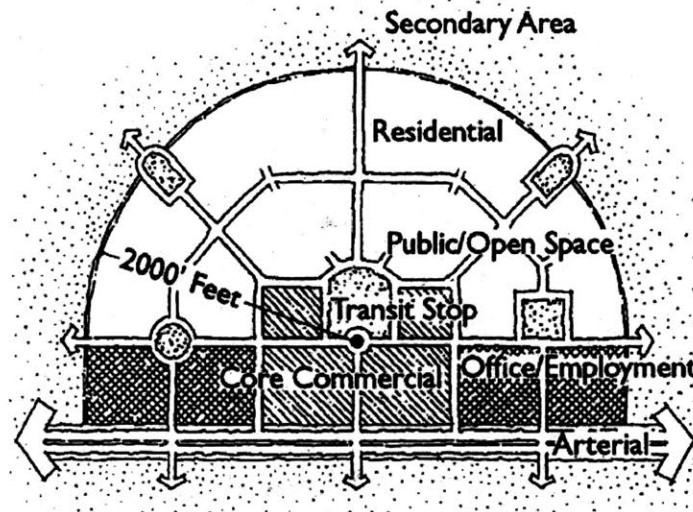
Figure 2.12 Transit Oriented Development Diagram.
Source: Calthorpe, 1993, p. 56

New Urbanism theory has been highly criticized for producing more suburbanization instead of compact and less car-oriented developments, claims that some new urbanists rebut (Ellis, 2002). While Calthorpe himself insisted that TOD could exist without transit (Calthorpe, 1993, p. 42), which is to some extent contradictory with the literal concept of TOD, his scheme, in essence, establishes the importance of urban form structure and urban design in regards to transit development. The role of urban design in the definition of the transit system catchment area is a clear example of how relevant design can be to determine travel modal splits and define the user's transportation mode preference. In sum, a plethora of TOD literature shows a clear regard for the correlation between built environment, its structure and the planning of public transportation systems.

Quality of public spaces

A pedestrian and bicycle-friendly area is not only determined by the urban structure but also by the quality of the environment's infrastructure and design. The character of the space, the way it looks and feels is also relevant in the relationship between built environment and travel (Ewing & Cervero, 2001, p. 101). It can influence perception and alter travel behavior.

Having walkable areas surrounding the transit stop is, as already mention, fundamental for successful TOD. "Walking is the most natural, affordable, healthy and clean mode of travel for short distances, and

a necessary component of the vast majority of transit trips. As such, walking is a fundamental building block of sustainable transport." (ITDP, 2014, p. 19). To make walking appealing for transit users and neighborhood residents, the environment has to be appealing by prioritizing good infrastructure, security, active and vibrant pedestrian realm, and level of comfort (ctsEMBARQ Mexico, 2013; ITDP, 2014). Some of the metrics and criteria that TOD standards consider to evaluate the walkability of the TOD district are:

- *Infrastructure and safety*: pedestrian network completeness (sidewalk infrastructure quality), intersections with secure and accessible crosswalks in all directions, sidewalks are organized and the pedestrian flow segment is well defined and spacious enough.
- *Activity and Vibrancy:* Transparent or visually active building frontage, higher number of entrances along the block segment, mix of uses in the ground levels
- *Comfort:* Existence of shade and shelter amenities like trees or shading structures, resting areas and urban furniture.

For cycling-friendly environments to encourage people to use this transportation mode as a short distance travel alternative, most of the objectives are about safety and infrastructure. The relatable metrics are completeness and connectivity of the cycling network, cycling safety infrastructure like cycle tracks and lanes or supply of cycle parking in transit stops and buildings.

TOD and Open Spaces

Most of the consulted literature that includes some TOD guidelines on urban design did not mention any special provision on open public spaces as part of the ideal urban structure to encourage TOD. From the literature, Calthorpe's 1993 vision did emphasize that public uses, parks, and plazas are required for the neighborhood success. He stated that "the structure of a TOD is built around accessible and convenient public facilities and spaces" (Calthorpe, 1993, p. 59). These spaces will then help in the creation of a "strong sense of community, participation, identity, and conviviality". The role of parks and plazas is to act as meeting places, recreational activities. They further ease "views and linkages to streets and other public spaces and buildings", views that must be reinforced by design elements (Calthorpe, 1993, p. 93). As it is noticeable in his TOD scheme (Figure 2.12), he even included a "Public/Open Space" adjacent to the location of the transit stop as part of the essential elements of TOD. Where a centrally located open recreational space will benefit by being next to civic services and transit (Calthorpe, 1993, pp. 59, 90).

The *TOD Guide for Urban Communities by EMBARQ* (2013) also makes a distinctive notation on the importance of "creating public spaces that are planned as part of an interconnected system of spaces, access to a variety of open consolidated spaces with different types and sizes" (ctsEMBARQ Mexico, 2013, p. 74). They further outline that for those public spaces success it is important they are well connected by pedestrian and cycling infrastructure and coordinate the space activities with the adjacent commercial and public facilities.

Open spaces therefore are a crucial element in the definition of both the structure and the urban life of the TOD neighborhood or district. They serve as meeting places and community builders, they organize the space by reinforcing sights lines and visual links and they must be interconnected by pedestrian and cycling infrastructure creating a public space network across the region.

The creation of place as a TOD objective

The final objective of any TOD district is to become an attractor of development, activity, and residents. The nodal/anchor quality of the transit-oriented paradigm makes the creation of *place*, as it was previously defined, indispensable. Any successful TOD district should have a sense of belonging among its residents and provide the area with its own identity (ctsEMBARQ Mexico, 2013, p. 81). It must then, have a *sense of place*. It has to be identifiable and meaningful. This can be achieved by reinforcing the area's environmental, historical, cultural or architectural character. Any existing values in the area have the potential for creating a place identity by taking advantage of elements such as local flora and fauna, archeological and historical heritage, local and regional traditions, pre-existing buildings (ctsEMBARQ Mexico, 2013, p. 81).

Furthermore, the creation of a sense of place can empower the development of the community located within the TOD zone and increase the number of potential users in a transit system. "A focus on place-making can bring the ridership goals of the transit agency and the livability goals of the community together" (Project for Public Spaces, 1997, p. 7). The creation of place starts with the proper location of the stop in order for it to "contribute positively to the experience of that place" (Project for Public Spaces, 1997, p. 7). Having a recognizable place means it has a higher value potential. It is easier to be marketed, promoted and sell. Transit can make areas of a city to "be on the map". Transit stations, especially mass transit, have the potential of defining the real estate visibility of entire regions of the city (Vertesi, 2008, p.

14). The success of any urban area that implement TOD policies relies in understanding the role transit has as place-maker and as the center of community life. Starting with the attractiveness of the transit station or stop itself, the experience of the user will be the ultimate stimulus for "commercial redevelopment and neighborhood renewal" (Project for Public Spaces, 1997, p. 11).

2.5 CONCLUSIONS

If TOD aims for development in cities to follow transit patterns it needs people to prefer transit over other transportation options. It needs transit riders living and working closing to the transit system. What this theoretical background showed was a clear connection between positive travel behavior towards transit, the consequence of the user's perception and experience, and the importance recognizable places. Further this section made a case for urban open spaces as city features that potentiate the existence of a recognizable place, and in particular for TOD districts, a place defined by having legible and clearer environments around transit stations thanks to the existence of open public spaces.

Some of the conclusions resulting from this theory review are:

- Pairing a transit stop with an open space can improve the legibility of the transit system by placing the access point in a visually identifiable space.
- Open spaces, thanks to their sight opening, will help in the wayfinding process and in the creation of each user's mental image of the transit node. Legibility is crucial to the anchor's identity and sense of place definition.
- By displaying a transit stop's surroundings in a clearer and more legible way, the existence of open spaces could change the observer's perception of the area, modifying their behavioral choice, and in the long-run able to construct a different preference towards transit.
- The open space's scale and size matters. Such space is valuable not only because of its openness but also because of the way it is framed and sharply defined. In the case or transit stops, the size of the open space must be first of all in agreement with the scale of the transit stop itself, and second, considering that too much open space could end diluting the desired compactness of a TOD node.
- TOD seeks to develop and brand identifiable nodes and open spaces are remarkable urban features to achieve such identity and imagebility.

The proposed urban structure model for a TOD zone is one where a controlled and spatially defined urban park or squared is paired with the transit stop at the center of the district (Figure 2.13). This central open space will not only serve as the station's urban vestibule and as the gateway to the neighborhood, but also as the beating heart of the community that will attract denser development and mixed-uses. In this district model, development would occur in a radial progression with this central open space as the starting point. The central open space will then be center of community and commercial life.

1 - Transit Stop   **3/4 - Development Density Progression**
2 - Open Space   **5 - Catchment Buffers**
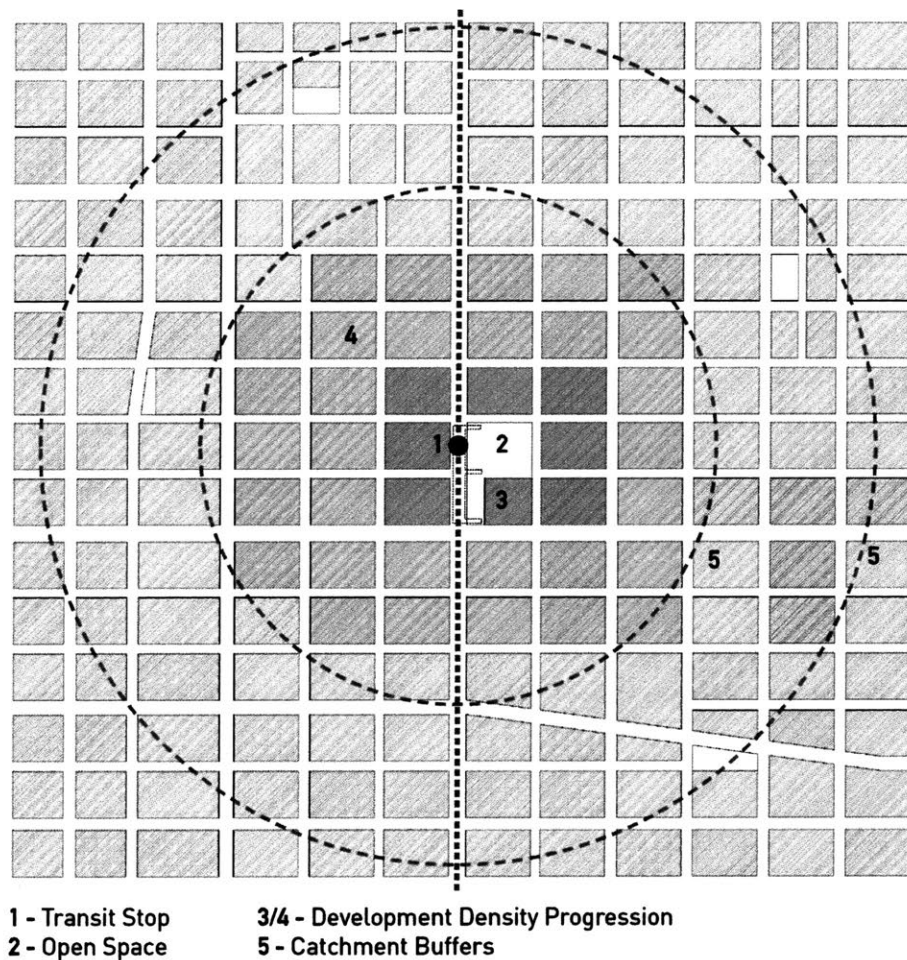
Figure 2.13 TOD district urban structure model with an open public space as the neighborhood's heart.

3. GUADALAJARA'S CENTRAL DISTRICT

3.1 GUADALAJARA'S CONTEXT

The Metropolitan Area of Guadalajara (MAG), is the second largest urban agglomeration in Mexico. According to the Metropolitan Planning Institute (IMEPLAN), the MAG comprises 9 municipalities and covers a surface of 326,546 hectares (1,260 sq. mi) of which 22% of the area (72,463 ha) is urbanized. This low urbanized area percentage is because most of the region's population is located in the central municipalities. The recent incorporation of the municipality of Zapotlanejo, which only 1.6% of its 72,233 ha. are urbanized, increased the percentage of non-urbanized territory (IMEPLAN, n.d.-b) (Figure 3.1).
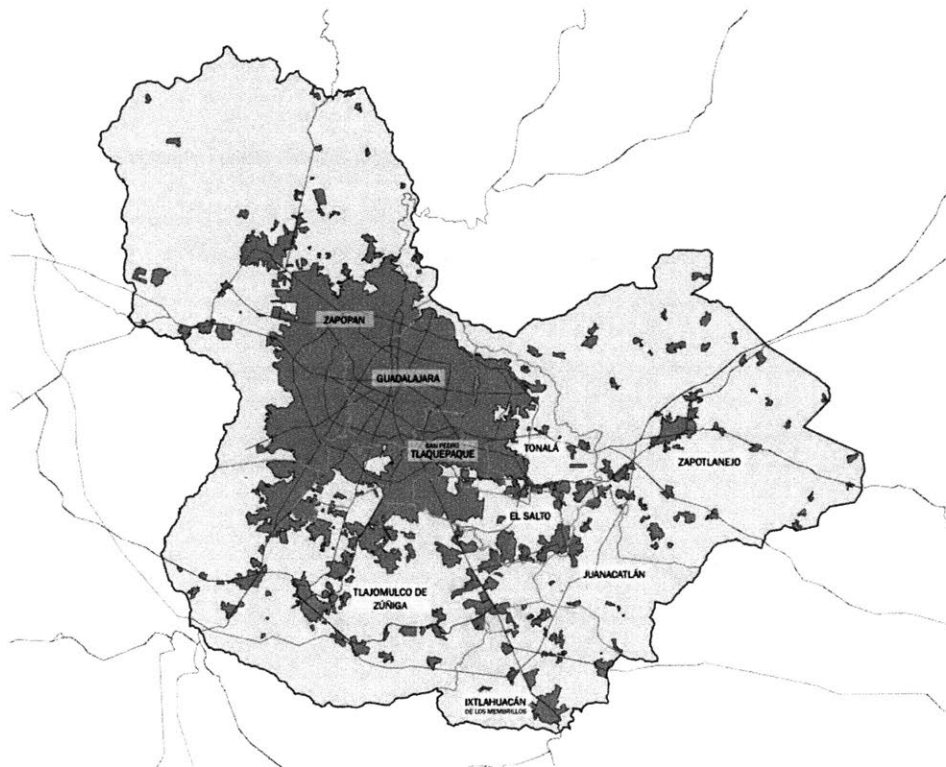
Figure 3.1 Metropolitan Area of Guadalajara. Municipalities and Urbanized areas.
Source: Author with data from IMEPLAN (2017)

For the last decades, the metropolitan area has been adding surface in a higher rate than population, which has decreased the urban density. Moreover, the urban expansion has been an incentive for a fast increase in the motorization rate. The annual growth rates of registered cars are growing faster than surface and population rates (Figure 3.2)
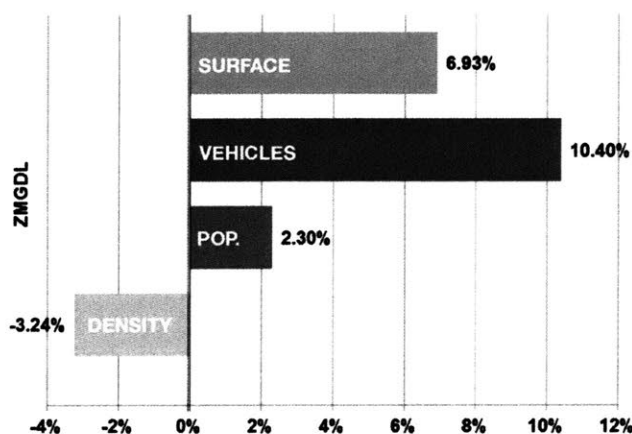
Figure 3.2 Annual Growth rates (MAG 1990-2010). Density, Population, Vehicles and Urban Surface.
Source: Modified from ITDP Mexico (2015)

The municipality of Guadalajara, Jalisco's state capital, is the epicenter of the region. With around 1.46 million people, it still has the largest percentage of the population of the MAG, closely followed by the municipality of Zapopan (Table 2). It also has the higher density of the region, with more of 100 inhabitants per urbanized hectare. The overall density of the of the MAG is 67 inhabitants per urbanized hectare (IMEPLAN, 2016). Guadalajara, as many other central municipalities in metropolitan regions in the country, is losing population to the outer districts. Fundamentally, the occurring phenomenon is that the core of the metropolitan region is getting emptier while the peripheries continue to sprawl.

	2010	% of inner MAG population in 2010	2015	% of inner MAG population in 2015	Population Change
Guadalajara	1,495,189	34%	1,460,148	31%	-0.02
Zapopan	1,243,756	28%	1,332,272	28%	0.07
San Pedro Tlaquepaque	608,114	14%	664,193	14%	0.09
Tonalá	478,689	11%	536,111	11%	0.12
Tlajomulco de Zúñiga	416,626	10%	549,442	12%	0.32
El Salto	138,226	3%	183,437	4%	0.33
TOTAL	4,380,600	100%	4,725,603	100%	0.08

Table 2 Inner MAG municipalities Population 2010-2015.
Source: Data from INEGI and CONAPO

Within the municipality of Guadalajara, its central district, which includes the historic downtown, is one of the areas where this population loss is more tangible. The population exodus has left the area with one of the lowest densities of the metropolitan area and a large amount of empty residential units. In the very core of the downtown's historic heritage protection polygon, most of the existing housing units have now completely disappeared, leaving a hole in the center of the city with no residential uses (Figure 3.3). (See Appendix B for additional maps).

DENSITY OF INHABITANTS BY BLOCK (POP/KM²)   PERCENTAGE OF UNOCCUPIED RESIDENTIAL UNITS BY BLOCK
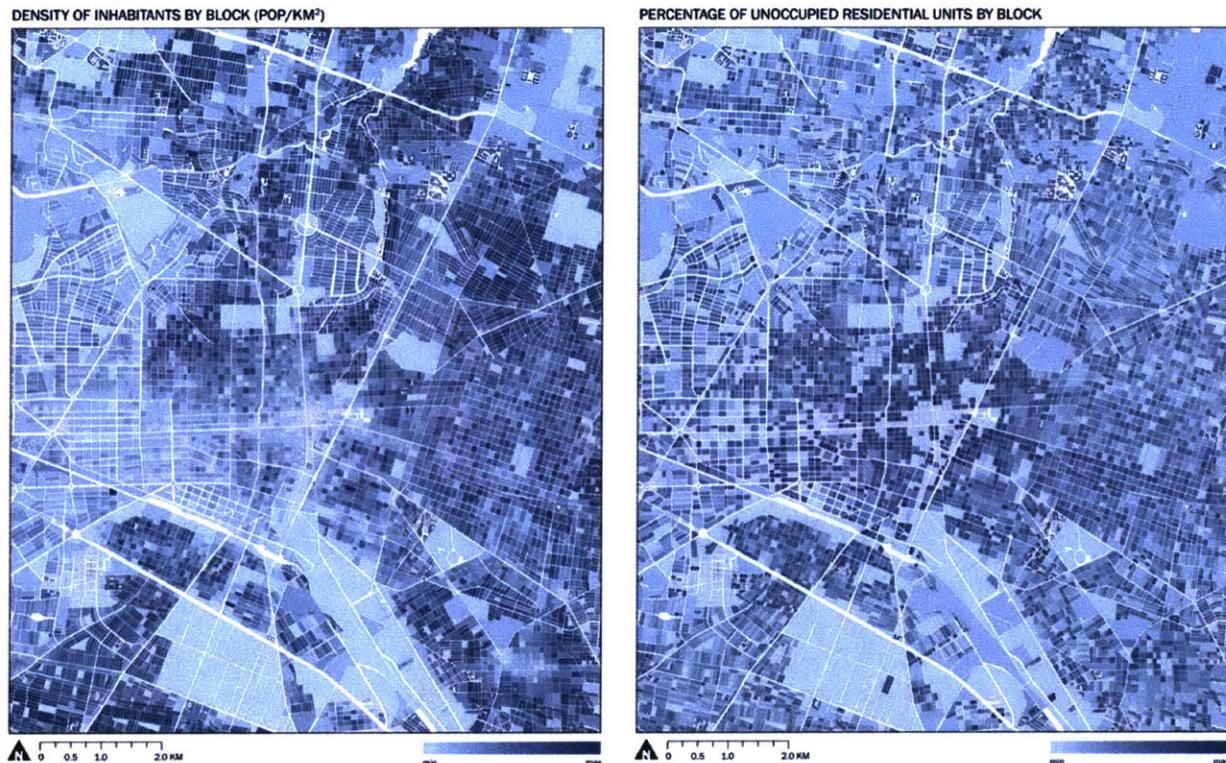
Figure 3.3 Population Density and Unoccupied housing units. Guadalajara's Central Area.
Source: Author with data from IMEPLAN (2017)

On land uses, at the central district, the missing residential uses are being replaced by commercial uses and services. The very center of the city is now mostly occupied by businesses and governmental uses which makes the area a destination for city residents looking for specific economic and services transactions. As one moves away from the center, the mixture of uses improves, especially on the western side of the city, but then is largely dominated by mostly residential uses (ITDP Mexico et al., 2015, pp. 30–31). It is important to consider that the heritage protection regulations in the historic area are also a factor for the abandonment of buildings in the area, or its conversion to non-residential uses.

Urban amenities (health, education, social assistance, cultural and religious uses) are oversupplied in the central district. The area presents enough amenities to supply beyond the population that lives there. Part of the explanation is the low density but also that many of the amenities in the central area serve the entire MAG population, attracting an important number on trips from other parts of the city to the downtown. This also reinforce the assumption that commercial and service uses are pushing residential uses out of the city center (ITDP Mexico et al., 2015, p. 34).

Different government authorities have recognized the abandonment problem in the city center. There have been several attempts to bring additional uses to the city's downtown, with a high interest in introducing housing projects. One of the main efforts was the 2011 Pan American Games. The city's initial proposal for the athlete's village was located in the surroundings of what is known as *Alameda* or Morelos Park, next to main historical city core. The intention was to later transform the village into several housing units, hotels and offices, but due to political and financial pressures the project was unfortunately moved to the outskirts of the city, in Zapopan. The same site was later included in what its known as the *Creative Digital City* (Ciudad Creativa Digital –CCD– in Spanish), an ambitious masterplan promoted by the three levels of government to develop a new innovation district with the *Alameda* as its heart. CCD's masterplan is still in its initial phase, with the first building now under construction and some of the catalyzing and urban regeneration projects close to start.

The central district of Guadalajara is then an area with a massive amount of abandoned housing units, very low density, a high number of urban amenities, and as it will be explained later on, with the best massive public transportation coverage in the entire metropolitan area inserted within an accessible and walkable grid-shaped urban structure supplied by a large amount of public open spaces. Based on these reasons, this district in Guadalajara has an enormous potential for developing transit-oriented strategies and a great location where observe the TOD place-making potential by linking the city form structure and public spaces with the public transit systems.

Urban Planning

Guadalajara is currently experiencing a transformation of its metropolitan and urban planning dynamics. During almost the last decade, the state of Jalisco and the different municipalities in the MAG have been rearranging the way the metropolitan coordination happened in the region. After years of academic pleas

and political discussions, by mid-2008 the State's Constitution was modified establishing that while fulfilling their federal constitutional mandate that states that only the municipal level of government is the one responsible for the physical planning of the territory, all the MAG's municipalities were required to coordinate their planning processes, and defined the mechanisms to be follow in order to formally declare a metropolitan area (IMEPLAN, n.d.-a). After the Metropolitan Area was legally established in 2009, it was until February 2011 when the legislature approved the Metropolitan Coordination Bill. This bill defined: the conformation of metropolitan areas and the requirement of at least three metropolitan coordination bodies: The Metropolitan Coordination Board (formed by each municipal president and the state's governor) as the political body, the Metropolitan Planning Institute (IMEPLAN in Spanish) as the technical body and the Metropolitan Citizen Council as the citizen body (IMEPLAN, n.d.-c).

As a result of this new planning reality in the MAG, the IMEPLAN published in 2015 what is called the Metropolitan Territorial Ordinance Plan (POTmet), the first for the city since the 1980s. This new plan defined basic urban development principles for all the municipal entities and set a new organizing scheme for the metropolitan region. The main take-outs from the POTmet are:

- The metropolitan plan impulses a *C3E city vision* (a city with compact, close, connected and equitable communities) as a response to the problems of dispersion, disconnection and inequality in the city (IMEPLAN, 2016, p. 14). This vision in some extent resembles to TOD's 4Ds: distance, density, diversity and design (Dunphy, 2004).

- The plan's central concept is the definition of a *Polycentric model* for the city. This model fosters "a spatial de-concentration of activities, reducing daily displacements and favoring the rational use of land" (IMEPLAN, 2016, p. 256). This means that in order to fully achieve an integrated metropolitan area the urban agglomeration should be seen as a network of different centralities or nodes that demand the definition of strong links between them. The POTmet states that "it is necessary to connect the nodes through large-scale processes in the mass public transport and non-motorized mobility options" (IMEPLAN, 2016, p. 265). To strength the urban structure it also asks for the establishment of strategic renovation polygons, beyond any municipal border and aligned to the identified centralities. The Plan further develops a methodology to define and identify these *centralities* based on population, land uses, infrastructure and development activity. These centralities are classified according to their scale and relevance as: *metropolitan, peripheral, satellites, and emergent* (IMEPLAN, 2016, p. 281).

- The plan also develops a set of *structural axes* that connect these centralities and organize both the road and transit systems, and creates a system of *metropolitan corridors* (IMEPLAN, 2016, pp. 290–306).

As instructed by the POTmet, which required all municipalities to update their regulations to include the metropolitan plan's new provisions and strategies, the municipal government of Guadalajara recently published a brand-new zoning bylaw. Rebranded as *Integral Management Bylaw of the Municipality of Guadalajara (Reglamento para la Gestión Integral del Municipio de Guadalajara* in Spanish) (Municipio de Guadalajara, 2016), it introduced new development mechanisms to effectively promote a more compact and connected city, while pushing for more diverse land uses in every neighborhood.

One of the most important elements to emanate from the regulation is the introduction of the *Special Urban Intervention Polygon (PIUE in Spanish)*, which are areas of the city that could apply for special normativity and development rights. The main listed criteria to approve a new PIUE includes any area of the city within 500 meters from a mass-transit corridor. Being part of a PIUE for example, allows a 70% reduction in the parking requirements, and up to a 100% reduction if the PIUE is located in a Heritage Protection zone. It also includes development incentives like transfer development rights or the discount in building permit fees if the development includes active mix-use ground floors and green sustainable strategies (Municipio de Guadalajara, 2016, p. 50).

Additionally, to the changes in the government urban planning organization and principles, the city has been experiencing an important paradigm shift in regard to mobility and public spaces. For the last decade, cycling and civil organizations in Guadalajara have been pushing for adopting new urban planning and design strategies in order to situate pedestrians and cyclist at the top of the mobility priorities. After years of effort and with some of these organizations' leaders now as part of the municipal governments, there has been a huge increase in the public investment of non-motorized mobility projects: like the bike-sharing system *Mi Bici Pública* and a road behavior education program. The three largest municipalities, led by Guadalajara, have been implementing since 2015 an ambitious program to educate city residents about the importance of respecting pedestrian areas, sidewalks and cycling infrastructure (Municipio de Guadalajara, n.d.).

Henceforth, the Metropolitan Area is undergoing a critical moment in its urban planning field. The profound changes in the city's planning organization along with the core development model shift expressed by

the new planning documents, and the public programs and projects, offer a window of opportunity to introduce better urban practices and innovative methodologies to intervene the urban environment.

TOD in Guadalajara

The concept of transit-oriented development has also been included within the new planning and zoning documents. The POTmet itself makes direct reference to the TOD model saying it is "an effective model to counteract urban sprawl and the growing population loss the central city is experimenting" and that it "strengthens the polycentric model and the metropolitan structure by linking urban components around an integrated public transport system with non-motorized mobility actions" (IMEPLAN, 2016, p. 327). The new city management and zoning bylaw also makes a reference of TOD polygons and as already mentioned, the concept of the PIUEs has a clear resemblance to what some literature refers as TOD zones or districts.

As a result of the previously stated, several public and private organizations have already developed documents and reports about TOD in the MAG. The Institute for Transportation and Development Policy in Mexico (ITDP Mexico) for example, produced several documents that included a general analysis of the opportunities to develop TOD in Guadalajara (ITDP Mexico & Herrera, 2015), a more detailed analysis of the city, its physical and demographical conditions and the identification of areas with TOD potential in the MAG (ITDP Mexico et al., 2015), and a model of implementation of TOD in the city (ITDP Mexico, Medina, & Patlán, 2016). Likewise, ctsEMBARQ, in coordination with ITDP, published a series of reports on mitigation strategies for green-house emissions related to TOD corridors in the Guadalajara (ctsEMBARQ Mexico, 2016). These documents, along with other literature produced for a nation-wide TOD policy (ctsEMBARQ Mexico, 2013; ITDP Mexico & Medina, 2012; ITDP Mexico et al., 2013) are a great foundation for the city in order to implement TOD strategies in the short and mid-term.

Nevertheless, none of this documentation for Guadalajara specify any strategy related to the city's urban-form and structure, and even less about its public space network. While it was exposed in Chapter 2 how the built environment has been recognized as a crucial element for TOD, none of the documents for Guadalajara refer to the city's urban structure. The TOD reports so far have only addressed TOD zones boundaries and implementation strategies and then make reference to other TOD standards for further information about specific development strategies.

3.2 GUADALAJARA'S MASS TRANIST SYSTEM

System Overview

Guadalajara's current operating mass transit system consists of two light rail (LRT) lines known as *Tren Ligero* and one Bus Rapid Transit (BRT) line. Tren Ligero's Line 1 (L1) travels north-south following *Calzada Federalismo* and *Avenida Colón*. *Calzada Federalismo's* wide section was built across downtown in the 1970s and since its conception included a tunnel for a potential subway system that initially operated as a trolleybus-based BRT system. The tunnel was later converted into the first Tren Ligero line of the city. Line 1 runs underground in the central district and above ground in the rest of the city. The LRT Line 2 (L2) travels east-west under *Avenida Juarez/Javier Mina* and was built entirely underground in the mid-nineties. The single BRT line called *Macrobus,* goes along *Calzada Independencia.* It was developed in 2010 and it was conceived to be the first route of a more ambitious BRT network that has been placed on-hold since then (Figure 3.4).

Additionally, there is a third LRT line (L3) currently under construction that will cross the MAG northwest-southeast. It follows what it known as the *Metropolitan Diagonal* which consists in a diagonal path that will link the three main metropolitan downtowns: Guadalajara, Zapopan and San Pedro Tlaquepaque. Line 3 is being built by Mexico's Federal Ministry of Communications and Transportation and has been design to be an elevated train except for the section that traverses the historic downtown area of the municipality of Guadalajara where it is being built 30 meters' underground. As today, the construction of the third LRT line is still in process and is expected to be completed by the end of 2018 or early 2019.

The metropolitan transit system is completed by an east-west trolleybus line across Guadalajara's downtown and two bus-operated extensions to the LRT Line 2 known as *SITREN.* All these different transit systems are managed and mostly operated by SITEUR, a public agency run by the State of Jalisco.
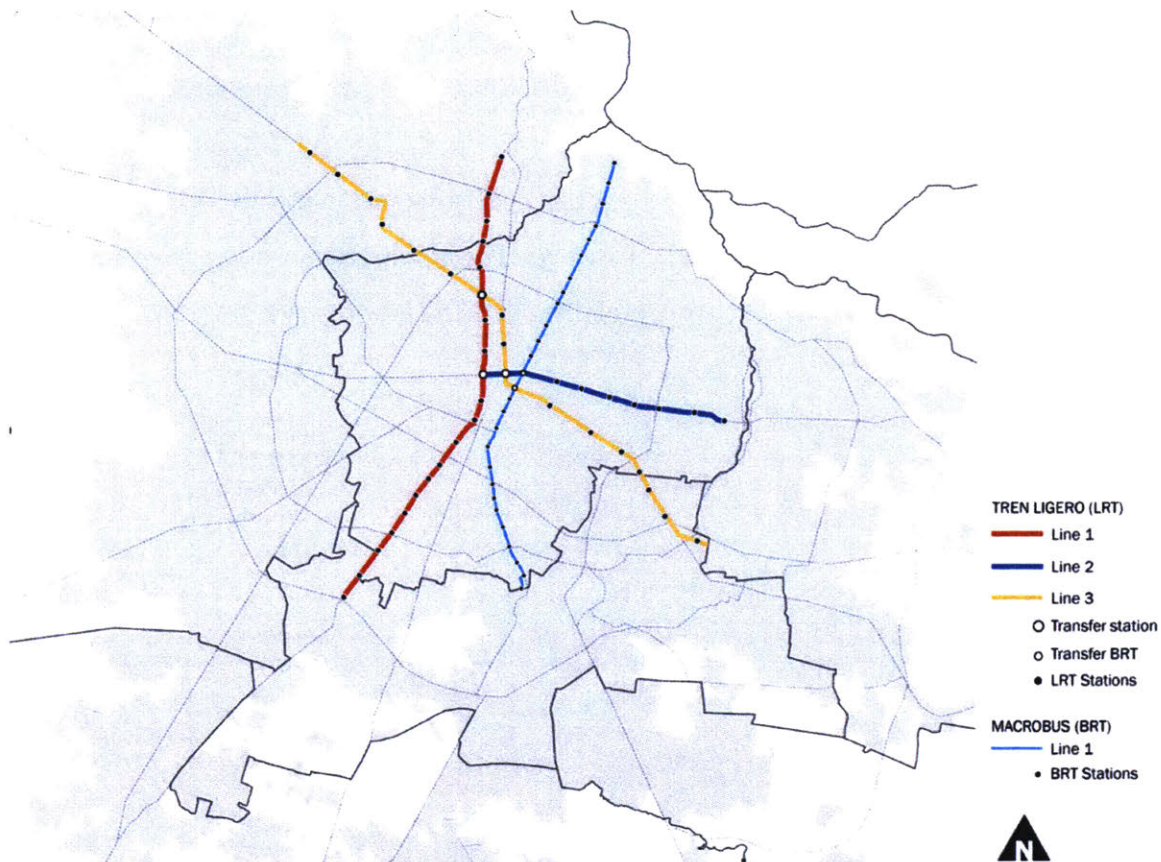
Figure 3.4 Metropolitan Area of Guadalajara Mass Transit System Map. (Expected by 2018)
Source: Author with data from SITEUR and IMEPLAN

The rest of the public transit in the metropolitan area is offered by a large list of bus routes operated by a variated collection of concession holders and driver alliances. Most of this routes function by a man-bus structure, which means that buses on a same route can be owned by several individuals rather than in one integrated company. In recent days the State's Ministry of Mobility started the operation of the very first *company-route* as part of what has been called *Integrated Transportation System (Sistema Integrado de Transporte* – SITRAN in Spanish) and it is the first of eighteen Metropolitan Trunk Corridors included in the POTmet (TraficoZMG, 2017). These Trunk Corridors, although still are a private concession, they are expected to be integrated with the SITEUR-managed services starting with the introduction of a unique electronic fare system (Ramirez Gallo, 2017).

Additionally, the Metropolitan Area recently started its public bike sharing system, called *Mi Bici Pública*. After almost three years, and a slow start, the system just celebrated its first 2 million rides and spans across the three central metropolitan municipalities (BKT Bici Publica, n.d.). In the municipality of

Guadalajara, most of the coverage is concentrated on the west side of the city, from the downtown to the mostly mid-class residential neighborhoods in the west, although it also covers popular-class neighborhoods in northern part of the central district. The system in Zapopan and San Pedro Tlaquepaque is still limited to the surrounding of the historical and touristic downtowns (Figure 3.5). As a result of this program jointly with the hard work of cycling associations, there has also been a large public investment in building cycling infrastructure like protected cycle tracks and bike lanes, mostly across the urban core and along main urban corridors.
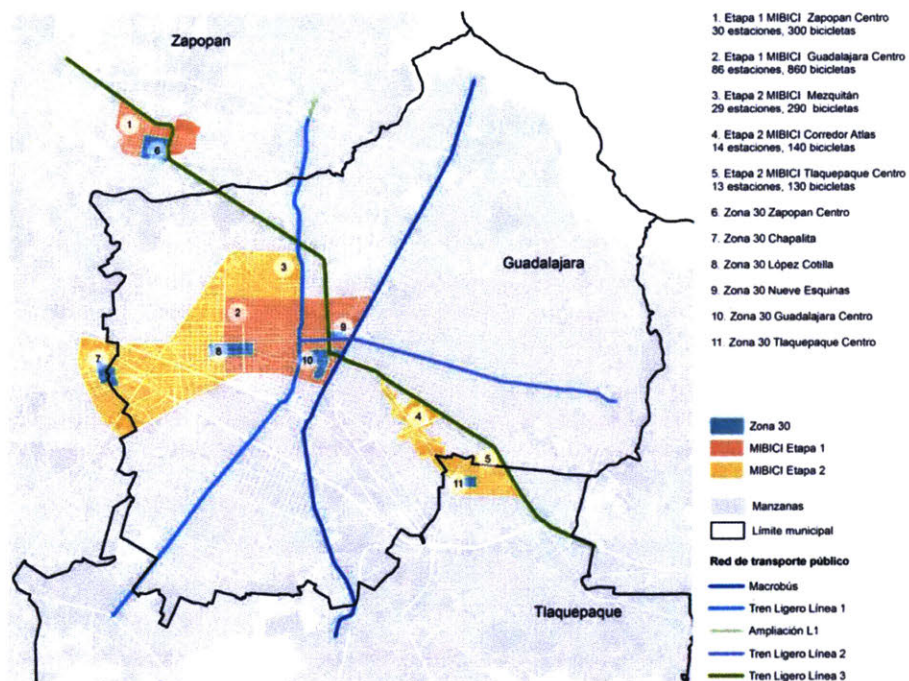
Figure 3.5 Bike-sharing coverage.
Source: ITDP Mexico et al., 2015, p. 36

System service coverage

As seen in Figure 3.4, Guadalajara's mass transit system mostly covers the eastern half of the city. The current two LRT lines plus the BRT are almost exclusively serving half of the city, while the west side only relies in one of the SITREN feeders and regular buses. There are plenty of reasons for this phenomenon to happen, but by looking at the demographic maps of the city the explanation is quite obvious: the city is severely divided in two, with the less-dense west side being regarded as a wealthier and more "developed" area of the city. In the west side of the MAG the ownership of private vehicles is higher so there is no urgency from the authorities to provide mass transit service. The segregation of the city founds its roots to the very foundational structure of the city as it will be discussed later.

The *Macrobus* and the two existing lines of *Tren Ligero* are currently serving around 12% of the total population of the MAG within a coverage area of 800 meters of radius from the transit corridor. With the construction of line 3, this service coverage will increase to almost 19% (ITDP Mexico et al., 2015, p. 17). This means that the mass transit needs to rapidly add more service lines or/and move more people closer to existing and planned transit coverage area. The introduction of the so-called Trunk corridors, will ease some of the problem by improving the feeding process to the massive service, but it will not be enough.

By looking at the catchment buffers around the LRT and BRT stations that show the system's coverage, it is clear that the central district stands out in terms of coverage (Figure 3.6). In the central district, the buffers overlap creating a large area that covers the entire historic downtown. Paradoxically, while a premise of an efficient mass transit system is for it to travel across areas where more potential riders are located, the area with denser transit service is precisely one of the regions with more abandoned houses in the MAG or where there are no housing options at all. The central district of Guadalajara has become a highly-demanded destination during day activities, but mostly nobody lives there. Downtown Guadalajara is a congested very active district of the city during the day, and gets completely empty during the night. This is a challenge but also a huge window of opportunity to introduce new developments and add permanent residents to the area. This supports the city and private organizations intentions to look into TOD strategies as a source of solutions and ideas. The city, and specially the downtown area has potential to take advantage of its existing transit infrastructure and create development nodes around them.
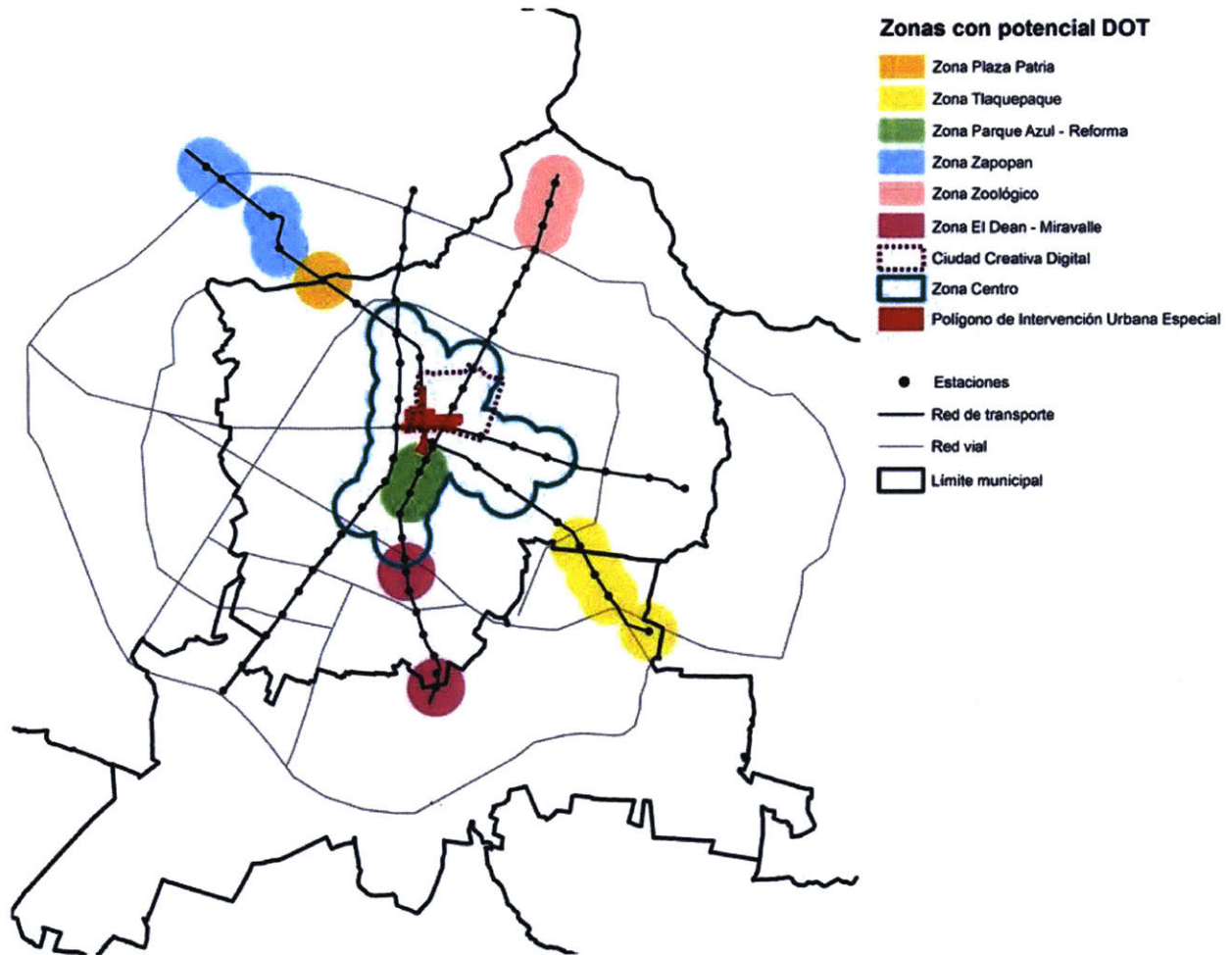
Figure 3.6 MAG's TOD Potential zones. 800 m buffers from the LRT and BRT station centroids.
Source: ITDP Mexico et al., 2015, p. 52

Central District coverage analysis

As was discussed, there is no consensus on what is the walkable distance around the station in order to calculate the catchment area. The radius distance range from 500 meters up to one kilometer. For the purpose of this analysis two different buffer distances were considered: 500 meters, which corresponds to de distance set by the *Integral Management Bylaw of the Municipality of Guadalajara* to define a *Special Urban Intervention Polygon* around transit corridors (Municipio de Guadalajara, 2016, p. 50), and an 800 meter radius, based on the reports made by ITDP Mexico on Guadalajara's TOD implementation (ITDP Mexico et al., 2015) and as was defined by Guerra, Cervero and Tischler as the 10 minute walk distance

(Guerra et al., 2012). The 500m Euclidian buffer will be consider as the immediate influence to the neighborhood and the 800m buffer as the expanded TOD zone. Additionally, and although some documents like ITDP's have also included the BRT line as a mass transit system in their TOD potential areas analysis, only the light-rail stations were used in the analysis.

The resulting map by doing the catchment area analysis for Guadalajara's Central District shows how well served most of the district is (Figure 3.7). The catchment areas show that most of the LRT stations in the district have a shared influence area with a station of another line. The immediate influence area (the 500m buffer) of multiple stations intersect creating in some cases a partnership between the stations and their service areas. Mezquitán Station (L1) and Normal Station (L3) for example are so close to each other that they share and important part of their immediate catchment area. In this case, the stations' area of influence should be considered jointly, rather than individually. The station partnership will affect the definition of possible development patterns.

The same happens with Refugio station (L1) and Santuario station (L3), where the immediate catchment areas intersect over the neighborhood of *El Santuario.* The station pairing effect is even clearer for the stops in the historic downtown. In this area, where we must remember concur with the region with no residential uses left, three stations are partnered. The immediate influence of Universidad station (L1)/Catedral station (L3), San Juan de Dios Station (L2) and Independencia Sur station (L3) are totally combined. Finally, the remaining central district stops, Juarez (L1/L2), Avila Camacho (L1)/Federalismo (L3), Mexicaltzingo (L1), Washington (L1), Belisario Dominguez (L2) and Plaza de la Bandera (L3) immediate influence functions individually, although as part of the large downtown TOD zone.

MEZQUITAN
AVILA CAMACHO
FEDERALISMO
NORMAL
REFUGIO
SANTUARIO
JUÁREZ
CATEDRAL
S. JUAN DE DIOS
UNIVERSIDAD
BELISARIO DOMÍNGUEZ
INDEPENDENCIA SUR
MEXICALTZINGO
PLAZA DE LA BANDERA
WASHINGTON

N
0   0.25   0.50   1.0 KM

500M Buffer
800M Buffer

TREN LIGERO (LRT)   MACROBUS (BRT)
Line 1   Line 1
Line 2
Line 3

Figure 3.7 Tren Ligero catchment areas in Guadalajara's Central District.
Source: Author with data from SITEUR and IMEPLAN

3.3 CITY FORM AND PUBLIC SPACE NETWORK

In the referenced literature, it was stated that one of the most important elements of a successful TOD zone analysis was consider the urban environment, its structure and land uses patterns. Having small blocks, continuous walkable connections and paths, higher number of 4-way intersections, were some of the necessary metrics to have a walkable area. For truly walkable neighborhoods necessary for TOD urban form should be legible and well connected. As stated by Ewing and Cervero, grid-like structures stand out as an urban form that improves walk and transit access and offer more direct routes and alternatives (Ewing & Cervero, 2001, p. 100).

Guadalajara's Central District has a very clear, squared-shape grid urban structure, which then offers even more potential to develop TOD in the already highly transit-served district. An analysis of the city's originative structure is then needed as part of any to-be-successful TOD proposal.

Historic evolution of the city form

Guadalajara's urban layout, as in many other Hispanic-American cities, were the result of Spanish urban design guidelines that predate their arrival to the New World. What started as popular knowledge of urban development, was later included in royal documents in the early XVI century to finally being summarized and detailed in the *City and Town Planning Ordinances of the Law of Indies* by King Philipp II in 1573, thirty years after Guadalajara's fourth and last settlement in the Atemajac Valley in February 1542 (López Moreno, 2001). The ordinances were very detailed instructions on how to build new settlements in Spain's new American dominions. These ordinances specified where the settlements should be built, how to respond to climatic issues, the food supply, the hierarchy of the settlement among other town-planning concerns (Nuttall, 1921).

The urban model consisted in a checkboard layout, an almost perfect-square grid with streets oriented north-south and east-west and the definition of a central public square to function as the core of every town. This central square, known as *Plaza de Armas*, was surrounded by the civil authority, like court houses and the town hall, and the church represented by the parish or in Guadalajara's case, a Cathedral. This square was also the starting point for eight main streets –known then as royal streets–, one from each edge and corner of the squared-shape plaza, that functioned as axes and from which the rest of the town grid was to be organized (López Moreno, 2001, pp. 21, 28; Nuttall, 1921, p. 744). The first

settlement of the city comprised twelve squared blocks, all located on the west bank of the *San Juan de Dios river*. This river would be later become relevant for the development of the city form: it would be the reason for the first irregularities to the perfect grid and it functioned a physical and social barrier for the city (López Moreno, 2001, p. 23). The river, later to become boulevard, has been since the beginning a divisor between higher classes in the west and more popular classes in the east. Nowadays the city still experiences that effect, and is clearly expressed in the region's demographics: the east has lower indexes of education and wealth and higher population density and number of dwellers per residence.

The territorial structure on which the city was founded had as main principle the functional integration of the urban and rural activities. It was a scheme that instead of closing the city focusing only on the urban activities, it opened itself with the intention of colonizing the surrounding territory (López Moreno, 2001, p. 26). The urban structure based on a central main square allowed a radial process of development, with the main streets able to continue as long as necessary, extending until any defined territorial border.

The perfect checkboard grid conceived for the city, the translation of the plan to the physical space was affected by the landscape, and the challenges of laying out the paths on site. Therefore, the resulting structure was a regular and orthogonal grid and not the perfect squared-form intended. Nevertheless, this divergences in the structure still preserved a remarkable homogeneity (López Moreno, 2001, p. 29). This grid urban form defined a very clear core for the city, from which everything else was organized. It also created a foci and destination impossible to be ignored that had had an important effect in the city's further development patterns and still has an effect today.

The different religious buildings like monasteries and convents served as main structural elements of the city layout. First, the location of four peripheral convents, one on each cardinal point, formed an *urban cross* with the *Plaza de Armas* in its intersection. Furthermore, those religious sites plus others located along the periphery of the young city, served as the organizing component of neighborhoods, specially in the city's west quarters. They became smaller anchors for the everyday life of each borough or *barrio* (López Moreno, 2001, p. 51). This urban structure based on the religious buildings is going to be relevant in the further analysis because this convents and churches had atriums and orchards that later became many of the central district's open spaces.

The city continued its expansion largely based on the original grid scheme. Although some adjustments are noticeable, mainly due landscape features, Guadalajara preserved its regular orthogonal structure. By the beginning of the 20th century the first out of two major modifications to the city's urban structure. The San Juan de Dios river and its tributary streams were diverted into pipes and replaced with a boulevard and streets. This engineering project transformed the street connections between the east and west parts of the city (López Moreno, 2001, pp. 153–155). Then, in the 1950s, and as a response to the rising motorization, the city was "crucified". The two main pathways that originally formed the urban cross connecting the convents, now known as *Juarez* and *Alcalde* Avenues, were enlarged. Tens of city blocks were partially demolished to allocate the additional road lanes, destroying old colonial churches, palaces and colonial residences (Ruiz, 2015, p. 30). The highly-centralized organization of the city led the city planners to decide that there was no other option given that "all the traffic and transit was required to cross the central city" (Figure 3.8).
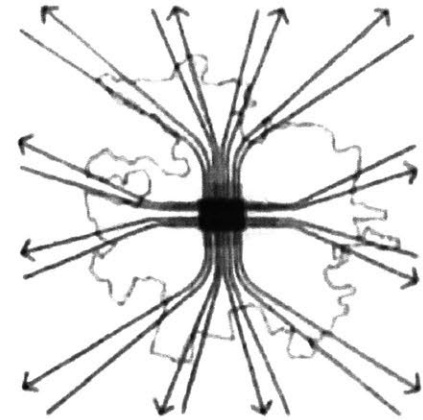
EL CENTRO PUNTO OBLIGADO DE PASO EN LOS SISTEMAS DE TRANSPORTE PÚBLICO

Figure 3.8 1950s Urban Transportation System Organization Scheme. Source: Ruiz, 2015

Additionally to the enlargement of the main roads in the downtown, the government that time also decided to demolish several blocks around the Cathedral to form what is known as the *Cruz de Plazas,* a group of squares forming cross surrounding the Cathedral. Two blocks east to the Cathedral, one block to the north and the one to the west were cleared out and together with the original Plaza de Armas south to the Cathedral, they formed a Latin Cross-shaped system of public spaces with the Cathedral at its center (Ruiz, 2015). This ambitious project also caused a severe loss of heritage buildings, but added a significantly large amount of new open public space to the area.

Central District's city form and structure today

Besides the drastic alteration of the urban space in the 20th century, the central district of Guadalajara maintains a homogeneous urban structure dominated by its orthogonal grid. The city's grid is formed by mostly squared blocks of around 70 to 80 meters per side, within the ideals set by the discussed accessibility metrics. The overall urban layout is clear and organized. Because of the block sizes and shapes, the grid structure that maximizes the intersection density, plus the fact that the topography is

mostly flat, based on the previously cited TOD standards, the area is as good as it can get for walkability in terms of urban structure.

Most of the streets in the central district are one way traffic except a couple of larger avenues like *Avenida Alcalde* and *Calzada Federalismo*, which run north-south. As mentioned, *Avenida Alcalde* was one of the streets widen in the fifties, while *Calzada Federalismo* was opened in 1974 as a solution for the unbearable downtown traffic. To open Federalismo up to its 50-meter-wide street-section (165 feet) it was required to demolished several narrow blocks of what used to be a very walkable area. The other main access roads are *Calzada Independencia*, which runs on top of the former San Juan de Dios River, and *Hidalgo Avenue* and *Juarez Avenue*, which run across the very heart of the city, were also enlarged, and used to be two way avenues but they were modified in the nineties. As mentioned, each of these widen streets also function as the mass transit corridors: Calzada Federalismo, Avenida Juarez and Avenida Alcalde for the light rail, Calzada Independencia for the BRT and Avenida Hidalgo for the trolleybus line.

Figure 3.9 Satellite view of Guadalajara's historic downtown.
Source: Image from Google Earth

Figure 3.10 Guadalajara's Central District Figure Ground map. Blue areas indicate usable open spaces (parks, squares, promenades)

In terms of building morphology, most of the central district buildings are a couple of stories high, with the exceptions of buildings along the metropolitan corridors that were enlarged. There is a height limitation in the area within the historical area, which limits the building heights under the total height of the Cathedral towers. The city's central district is protected by two different heritage zones: Perimeter A, which is defined by the edge of the city by 1900. Any project within this area necessarily requires the approval of the National Institute of Anthropology and History. Perimeter B is an area that protects any historic or artistic work that dates after the 1900s and is protected by the Direction of Culture. Both perimeters forbid the demolition or alteration of the city fabric. Additionally to these two perimeters, the municipal government recently approved the first PIUE for the historic center, and covers only the core of the district where most of the historical monuments are located.

Traditional Neighborhood Structure

Guadalajara, as many other Hispanic-American cities, was organized, almost since its origins, as a linked agglomeration of neighborhoods. They are the place where the everyday life occurred and where the city's inhabitants found their initial sense of belonging.

> "The neighborhood has traditionally been a social and spatial organizing element; a specific territory in the urban fabric, regularly associated to a church or another landmark, in which its inhabitants develop a particular way of life within their own culture. The neighborhood is an urban unit that generates identity and sense of belonging; a functionally autonomous, heterogeneous and multifunctional area". (López Moreno, 2001, p. 65)

The traditional neighborhood structure in some extent was a replica of the general scheme from which the entire town was modeled: A public space where to locate the civil and religious urban amenities and from which the rest of the urban structure was laid out. In most of the cases, the first neighborhoods in Guadalajara resulted from the parochial division of the city (López Moreno, 2001, p. 65), where the church or convent served as community center and where other social services such as health care, dispensaries and educational facilities where located.

Neighborhoods were also composed according to the economic and trade activities of the area or later on the city's development, around non-religious public landmark buildings. The presence of a local market or trading space was indispensable for the neighborhood's everyday activities. The church, the square,

the market, and in some cases the community center normally part of the religious complex, were the essential elements of the neighborhood.

Some of the first neighborhoods in the city were: *San Juan de Dios, El Carmen, Santo Domingo, El Santuario, Jesus Maria, San Sebastian Analco, Mexicaltzingo,* all of these organized around of a religious facility, or the neighborhood of *La Estrella,* one of the few that was conformed because of the physical features of the territory and not because of a religious building (López Moreno, 2001, pp. 65–72).

Most of the traditional neighborhoods' elements still exist today, and maintain their relevant role defining the neighborhood's identity and culture. As mentioned, the main heritage buildings lefts are the churches and religious buildings that originally defined the development around them. With the Central District identified as a key area where to implement TOD policies, the understanding of the traditional elements that originally defined the neighborhood and organized the urban components of the physical space is key. Any successful TOD district should impulse the construction of a sense of place. The existing values in these traditional areas have the potential to create a place identity by taking advantage of preexisting elements.

Public Space Network

Guadalajara's central district, as a result of its historical and morphological conception, is an area served with a robust amount of open public spaces. The value of open civil spaces has been in the city's foundational planning principles. As it has been discussed, the Hispanic-American city scheme, from which Guadalajara is built, had as its main feature a public central square. This means that the city's foundational urban form and organizing structure was anchored by an open public space. The central plaza had a role beyond its recreational and community center function and served as the organizing element of the urban environment. In this urban organization typology, the central plaza is the city's pivotal element from where all the other components are laid out (Figure 3.11). The open space exists not as a consequence of other design decision but as the starting point.

This was not groundbreaking, considering how much relevance as congregation and community builders open civil spaces had had through history, but it is important to highlight how in the case of the Hispanic-American city, it was regarded as the top element in the planning ordinances for new towns. Further, it produces a mental connection between the communal place and open public space. The central square

was set to be the community builder. It framed the public-used buildings and accentuated the perception of where the central point was located. The square was the first component to be laid out from the entire town scheme.
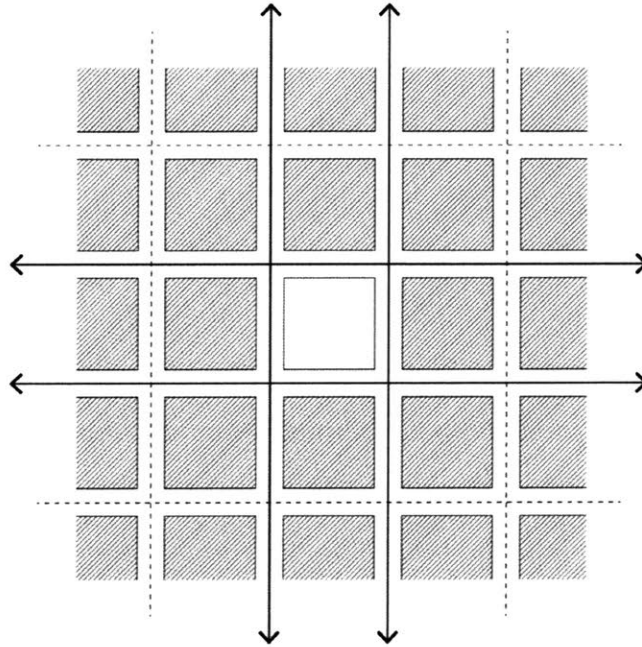
Figure 3.11 Main Square as the structural element of the territory

This can explain why scattered around the rest of the foundational city, and attached to other landmarks, - especially religious buildings-, there was always some kind of open space. Most of the main religious and civic buildings had, whenever possible, an open space attached to them in the form of atriums, gardens, and plazas. They served as vestibules for the building, permitting vistas and panoramas allowing to establish important relationships between the location and the building. Even small openings helped to frame the public buildings for the surrounding neighborhood (Lynch, 1990, p. 406). All these different size spaces, scattered in the colonial city, resulted in a nourished network of openings sprinkled in the denser and compressed city form.

The juxtaposition of all these open spaces endowed the city with a solid base that helped to further develop a distributed network of public spaces. Since the city's early periods it is possible to identify the system of solid blocks and sequence of openings (Figure 3.12). In addition, as a result of many convents being fractioned to continue the rigid grid or allocate new streets because the development and expansion of the city, old orchards and interior gardens provided green open areas that in some cases

were transformed into parks or squares. The clearer example was the *El Carmen* convent, at the western point of the urban cross. After being secularized, the convent was used to build a prison that was later demolished to extend Juarez Avenue. Part of the old convent's orchard was preserved and today is the *Revolución Park*, in the intersection of Federalismo Road and Juarez Avenue and where the transfer station between the LRT lines 1 and 2 is located. The remaining open spaces and their churches are fundamentally most of the remains of the historical colonial city.
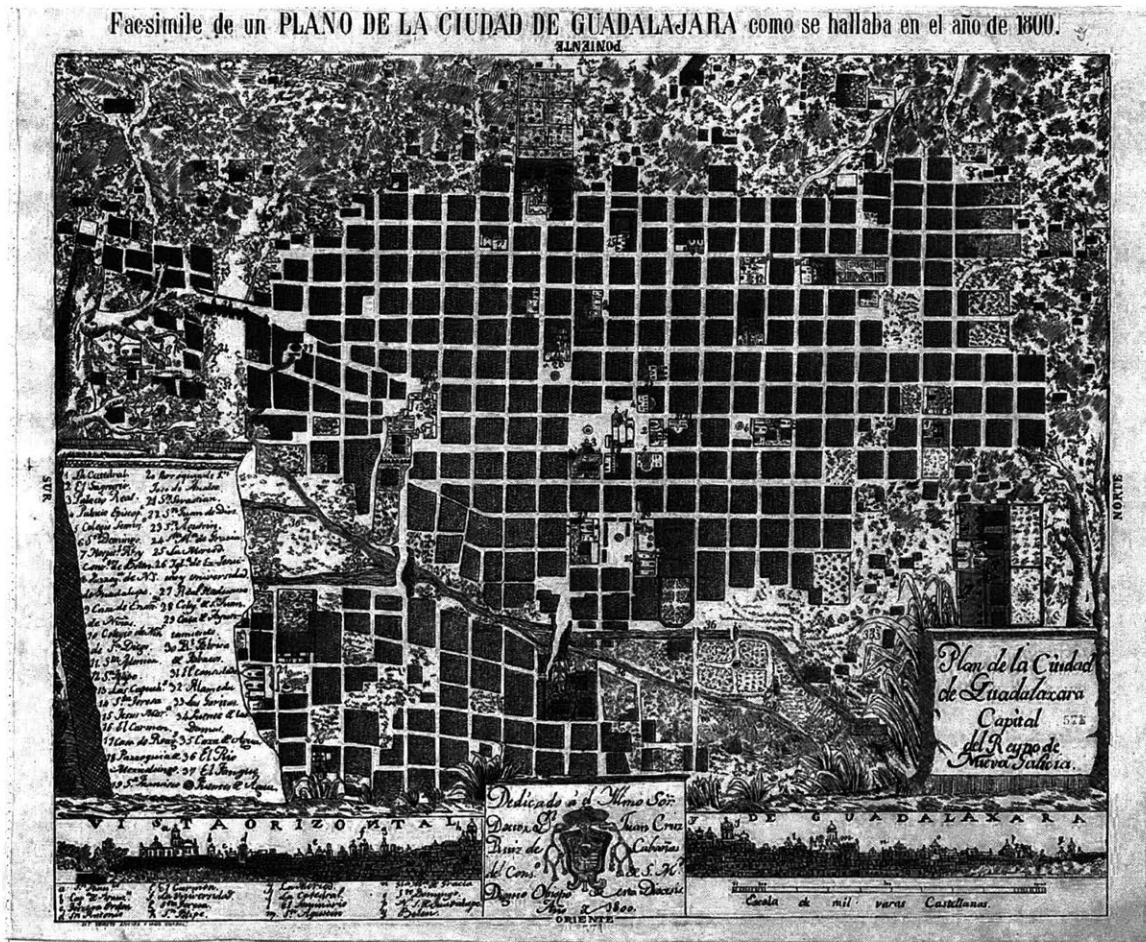
Figure 3.12 Map of Guadalajara in 1800.
Source: Municipality of Guadalajara. Archive

The construction of the *Cruz de Plazas* in the 1950s expanded the anchor effect of the main square towards a larger system of interconnected spaces. Although this controversial project demanded the demolition of all the buildings in some of the oldest blocks in the city and dramatically modified the historical urban fabric, the city gained a large amount of new open space in its very core. While the

opening of wider streets introduced heavier traffic to the downtown, the *Cruz de Plazas* in some extent balanced the transaction. The new cross-shaped system rapidly became a reference in the image of the historic downtown. Additionally, the new squares network not only created new openings but also made the links between them more relevant which led to future traffic calming projects in the area.

For the last couple of decades, the city has been pedestrianizing streets in the core of the historical downtown to connect all the scattered open spaces and landmarks in a more continuous and legible way. Today, many of the streets closer to the *Cruz de Plazas* are closed to vehicular traffic or have limited access, creating a large pedestrian-only area around the most central blocks of the city. In a drastic addition to the network, the once enlarged Alcalde Avenue is currently being converted into *Paseo Alcalde* (Alcalde Promenade) as part of the mitigation works associated to the new LRT line built under the street. This project consists in a 2.5 kilometers-long mostly pedestrian boulevard along the entire section of the avenue that crosses the city center (Gobierno del Estado de Jalisco, n.d.-b) and it is planned to be completed by the time the LRT line 3 is inaugurated. Paseo Alcalde will radically transform the entire open public space network of the area. The long promenade will work as a public space backbone for all the other existing squares and parks, while consolidating three spacious pedestrian zones around some of the oldest churches, the cathedral, and aligned to the future LRT Line 3 stations (Figure 3.13). Furthermore, the creation of this large linear public space will be a way to heal the severe scar produced by the opening of a multi-lane road across the city's heart half a century ago.
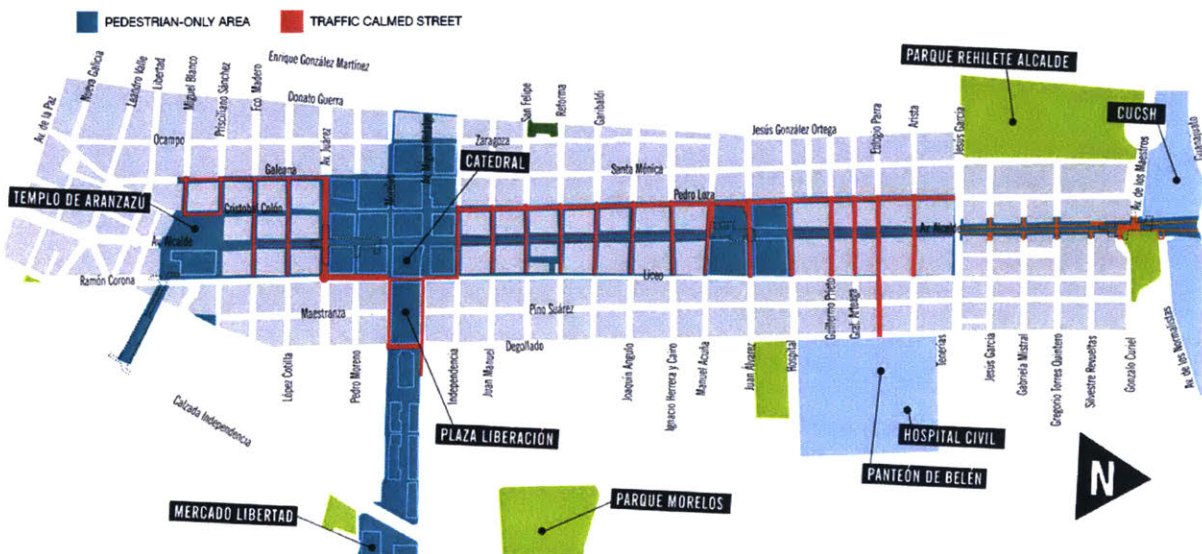
Figure 3.13 Paseo Alcalde Project.
Source: Modified from El Informador, 2016

Moving away to the historic downtown's surrounding neighborhoods, we continue to find open spaces distributed in Guadalajara's central district. Some are the remnants of old convents like the already mentioned centric *Revolución Park,* atriums of churches like the ones in colonial-time *barrios* of *Mezquitán* and *Mexicaltzingo*, or the botanic garden conceived as the vestibular space for the first hospital of the city. Others are vestiges of the now buried San Juan de Dios river watershed: the already mentioned *Alameda* or *Morelos Park,* where the Digital Creative City is intended to be developed, which was an island in the river and was always preserved as a natural feature, and the *Agua Azul Park* in the south which was the location of the river spring and used to have a large water reservoir now lost. Additionally, two other large spaces stand out from the district's urban fabric: The *Alcalde Park* up in the north, which is an ample park that include recreational activities and recently incorporated an aquarium to its amenities, and the *Mezquitán Cemetery* in the north-west that although it is still functioning as a burial place and it is surrounded by border wall, is still an opening in the city fabric that has important potential to function as a working open public space[6].

The central district of Guadalajara is served by an abundance of open public spaces of different scales and functions (Figure 3.14). Some of these spaces in many cases play roles beyond their recreational appeal and become community builders and neighborhood organizers. Some others could truly become the locus of their neighborhood but currently are underutilized. The richness of Guadalajara's open space network has to potential to become a major player in the definition of development patterns and the execution of TOD proposals and repopulation efforts. Their organization as linked or potentially linked spaces, and their proximity to each other, open the possibility of structuring them in a Lynchian understanding of the environment, as place-maker nodes and connecting paths. It is in the city's own DNA to use open spaces as structural elements of the territory. Moving forward to develop TOD proposals, it is fundamental that the analysis of the open space network gets placed as one of the primary argument in the process.

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[6] There have been some initial voices suggesting the transformation of the cemetery into an open park for the community, A Change.org petition (https://www.change.org/p/ayuntamiento-de-guadalajara-convertir-el-panteón-de-mezquitán-a-un-gran-parque-público) was started some time ago but it has gain no momentum.

Open Public Spaces
Parks, Squares, Promenades

Heritage Protection Polygon A

Heritage Protection Polygon B

0   0.25   0.50   1.0 KM
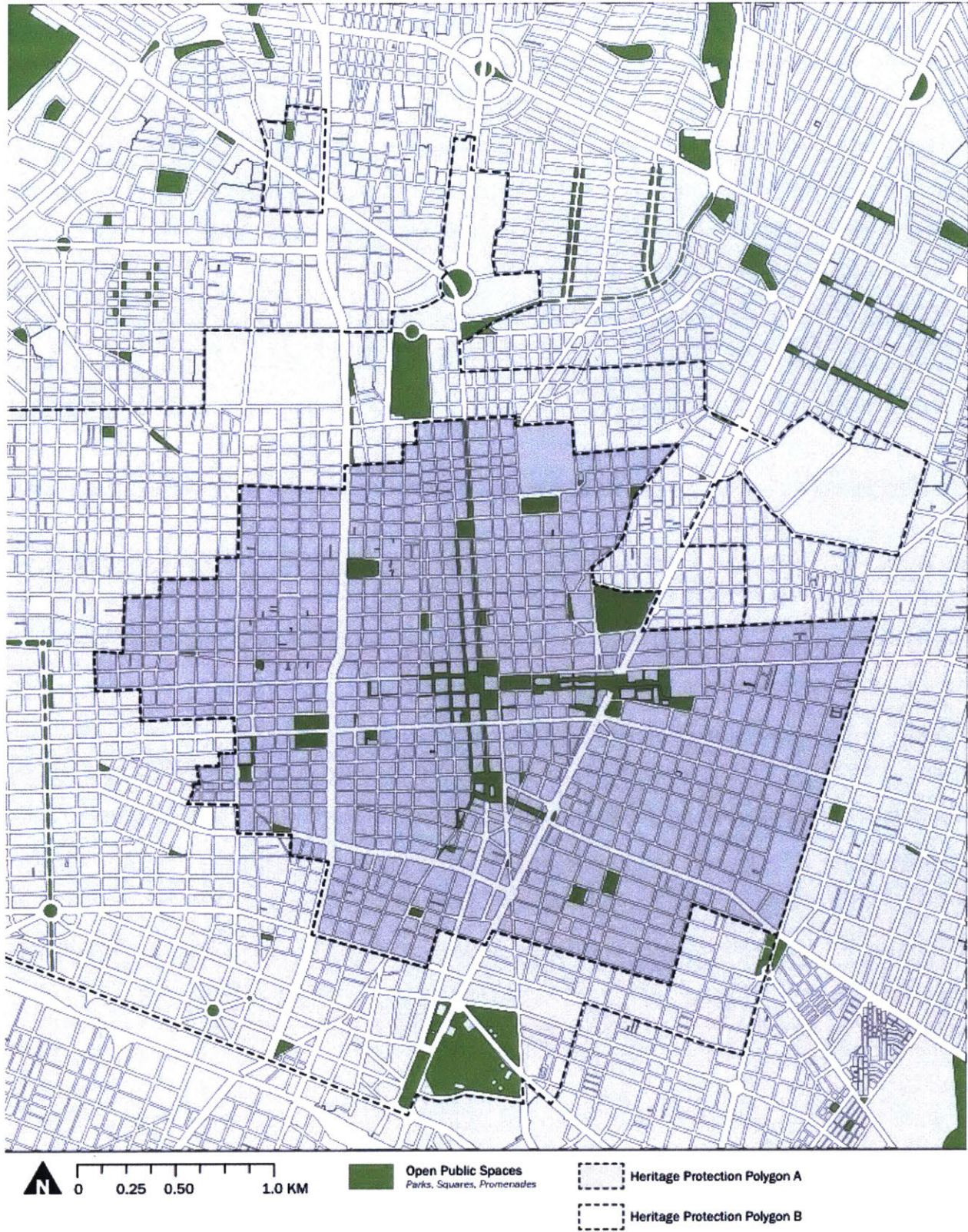
Figure 3.14 Guadalajara's Central District Open Public Space Network

4. MATCHING TRANSIT AND OPEN PUBLIC SPACES

4.1 TOD Potential

The Central District of the municipality of Guadalajara is an area where the three light rail lines, the BRT line and the bike sharing systems come together. Together with the current low density, the amount of abandoned housing and the high number of urban amenities makes this district a unique area in the city to develop TOD. As it has been identified in previous studies, this district is a highly valuable region where to implement TOD. Overall both the official documents like the POTmet and external reports like the ones produced by ITDP Mexico agree that the Central District of Guadalajara is one of the more attractive areas where to attract new development and increase population density.

Nevertheless, so far in the TOD potential studies there has been no reference to the urban structure of the city nor the central district. Such a relevant element of the TOD analysis has been disregarded. In addition to the demographics and transit coverage advantages of the area, having a walkable urban structure really is what makes the district such a rich place for TOD. The area's urban structure is ideal to have pedestrian and bicycle friendly communities. Probably beyond the great accessibility that the area has thanks to all the transportations modes coming together here, what really makes this area a great catch for developing TOD in all its extent, is the urban fabric that surrounds the transit stations. The size of the blocks, the continuity of paths, the regularity of the grid surrounding the transit access points, all these factors produce an ideal place where encourage development to happen.

Moreover, and as it has been discussed in the previous chapter, the central area of Guadalajara has not only a regular legible structure, but it is completed with an evenly distributed system of public spaces that, as it will be shown, can function not only as the neighborhood's heart but as the transit stop urban

vestibule. Each of the open public spaces that can be found close-by or on top of a LRT stations have the potential to function as place-markers, perception anchors and image nodes.

4.2 Lessons from the theory

Transit-oriented development's nodal scheme relies on creating a solid and identifiable place in the urban fabric. A sense of place occurs when the area has identity and character, when its legible and imageable. A true place is the result of visually organized environments, where people can easily obtain information of its surroundings to feed their decision-making process and influence their behavior. The theoretical background showed that the principles for a successful place are also the principles for a imageable city; both involve the same elements that take part in the behavior choice process. TOD, then, aims for the creation of places, and for establishing imageable places that produces memorable experiences; experiences that can be used to the benefit of the transit system itself. Creating a better perception of the system and nudging people to prefer transit, involves then a proper layout of the information that the users will observe. This includes the structure of the urban environment, the process of wayfinding, and the creation of images of the urban space.

In this context, open spaces are the component of the city that addresses all of the above. Openness not only creates clearer and wider sight lines which ease the process of wayfinding and improves the visibility of the environment's information to be observed, they also create places by being identifiable areas within built-up city blocks. This is why the proposed TOD urban structure model placed a central and sharply defined open space as the heart of the community and as the density attractor. The *transit foyer* described by Marcus & Francis (1990) have a role beyond easing the access to the station and become the activity foci in the TOD district.

For Guadalajara, this is highly relevant. The city's district that has been identified as one of the main suitable areas where to apply TOD policies, is one that is rich in open public spaces. Such spaces are strategically located, easing the process of place-making, and they are or will be in many cases, connected between each other by walkable linear paths. These are open spaces that can be identified for their imageability and wayfinding role, their place-making potential, and could also be because of the transit stop associated to them. The existence of a spatial match between Guadalajara's downtown open spaces and the existing and future transit stations is a huge opportunity to boost the system by creating

unmistaken places that include the transit stations as part of the community's core. Some of the main theory lessons for Guadalajara, and from the city's own planning history include:

- Small-block-grid-like urban fabric provide with denser and more continuous networks in benefit of the walkable quality of the district (Ewing & Cervero, 2001). They offer alternatives for pedestrians, beneficing the possibility of attracting more riders to the transit system. The checkboard urban structure is precisely one of the most relevant features in Guadalajara's downtown.

- Open spaces can indeed become the center of the community. They are particularly attractive for place-making strategies. Furthermore, everyday open spaces, this is, urban parks and squares, should be connected by identifiable links, where a network of small spaces are more useful than large regional-scale open spaces, to boost place-making in a TOD zone (Lynch, 1990, p. 400). For Guadalajara's downtown, given its urban structure with scattered small-scaled open spaces, this is a direct applicable lesson. The rich open space network in the district can truly become an operational feature to foster mix uses and attract people, while strengthening the surrounding community (Lo et al., 2003). Guadalajara's planning history based on the Hispanic-American city model, showed a clear way to use a public space as the central feature that organizes the surrounding territory.

- Sharply organized open spaces become "true places" (Lynch, 1960). The definition of setbacks, height limits, and building spacing are urban design strategies that can clearly define or dilute the open space. They are also strategies that could solve the lack of enough open space for an identifiable square to be located. For example, future development around a transit stop that lacks of enough open space to open sight lines could be required to include setbacks to free some space around the node.

- The creation of a sense of place is essential for the success of a TOD zone. An identifiable place benefits both the existing and/or future community in the area and the transit system ridership attraction (Project for Public Spaces, 1997). An unmistakable sense of place even benefits real estate developers and economic development by producing an identifiable and unique environment that can be branded and promoted (Palermo & Ponzini, 2015). The neighborhoods in Guadalajara's central district offer a unique range of characteristics that can be used to brand the TOD zone. Some of the transit stations are inserted in highly historical areas with a large

concentration of monuments; others in traditional neighborhoods like El Santuario; and a few others in the periphery are located in areas with larger parcels, where more ambitious development can be considered, or closer to existing industrial uses. There is plenty of material to define a sense of place for each transit station and its respective TOD area.

- Landmarks located in nodes help to produce a sharper and better defined image of the node. The presence of landmarks reinforces the anchor quality of a transportation break and reciprocally the node strengthens the visibility and imageability of the landmark (Golledge, 1999; Lynch, 1960). For Guadalajara, the downtown area is populated with historical monuments that in many cases are paired with and open space and the transit stop. The remaining churches from the old religious complexes or the civil buildings are landmarks that enrich the place's narrative and spatial quality.

For users/residents, a match between transit stops and open spaces means that the "openness of the open space" (Lynch, 1990) will offer the necessary contrast with the built-up environment. It will create more open sight lines for the user to perceive its departure or destination. The existence of a clearly defined open node will frame the space and give character to the node becoming, as Lynch said, "a true place" (Lynch, 1960, p. 92). For an observer's cognitive map of that region of the city it could also means that the anchor the station already has from a transit user's perspective, will match the anchor the public space is from the city resident's point of view. Finally, being able to match the image of the city with the perception of the transit system, based on the theory, can have an impact on how people perceive the *Tren Ligero* thanks on a better arrival or departure experience.

From a developer's perspective, the existence of an open space attached to the transit stop offers a recognizable feature for branding their developments. The open node not only gives more possible visual connection for any project located immediately next to the open space, it adds amenities services, and branding potential. Furthermore, thanks to the transfer of development rights, there is an opportunity for developers to add some of the unused potential in the open space's parcels and be added to their own projects.

Finally, from the city's interests' perspective, open spaces along transit stops means the potential to reverse the depopulation that has been happening in the area. There are thousands of hectares of urban space that already have services and urban amenities, but no people using them 24/7. By being

conscious of the mental-image-building process, the city planning authorities can strengthen nodes, consolidate paths and redefine districts, attract development, and revitalizing places for people to be interested in moving back in and economic development to arise.

4.3 Open Public Spaces as TOD organizing element

As was discussed, open public spaces have larger roles beyond their recreational uses. They can be key pieces in the definition of an urban structure and in many cases, like the Plaza de Armas in Guadalajara, be the main urban component from which the rest of the environment will be organized. Matching transit and open spaces refers to acknowledging the role open spaces can have in the definition of TOD neighborhoods and pursuit for them to have a direct alignment with the transit systems. The relevance of pairing open spaces with transit systems starts with vestibule they create for the city and the transit stop, and is further expanded to become the definitive spatial organizer.

By overlapping the Central District's transit system coverage (the 500m and 800m buffers) and the public space network it was possible to identify that almost all the LRT stations within the district match with an open space on surface. As enlisted on Table 3, from the 13 stations[7], 10 of them had a matching open space aligning on top of the stations. All these spaces correspond to identifiable and defined spaces such as public parks and civic squares. From the three stations with no open space match, the two along line 1 have very wide sidewalks that offer enough space for the access, but cannot be considered a demarcated open public space.

Station	Line	Open Public Space Match	Station	Line	Open Public Space Match
Ávila Camacho / Federalismo*	1 / 3	*No open space*	Juárez	1 / 2	Parque Revolución
Mezquitán	1	Small square + Cementery	Catedral / Universidad	3	Plaza de Armas
Normal	3	Parque Chopin	Universidad	2	Plaza Universidad
Refugio	1	Parque del Refugio	San Juan de Dios	2	Plaza San Juan de Dios
Santuario	3	Jardín del Santuario	Belisario Dominguez	2	*No open space*
Mexicaltzingo	1	*No open space*	Independencia Sur	3	Jardín San Francisco
Washington	1	Plaza del Federalismo	Plaza de la Bandera	3	Plaza de la Bandera

* Federalismo is an elevated station. Transfer to underground Avila Camacho station

Table 3 Central District LRT Stations with their Open Public Space Match

[7] Table 1 Includes 15 station names, but two of them are the transfer between line 3 and line 1 and 2. Up to today, there is no official definition on merging the stations' names or if they will maintain the two of them separated.

These open public spaces could be set to be the spatial organizers of future TOD zones on each of the sites. Each matching square/park and transit stop could function the same way the main central square did in the Hispanic-American city model, in which the central open space gave direction and organization to the surrounding development. These paired open spaces could also function similar to how in traditional neighborhoods, civil and religious buildings included an open space to frame the urban amenity and construct a sense of community. Furthermore, while the matching space are the main urban feature in each of the TOD zones given its alignment with the transit node, the other open spaces scattered within the immediate influence area and their relationships and links to the TOD zone central open space are equally important and should be included in the analysis. The system of linked small urban squares and parks with the open space that functions as the *transit foyer* as the central anchor for the TOD area, is the district-wide match between the transit system and the urban form.

Figure 4.1 Satellite picture with transit lines and matching open spaces.
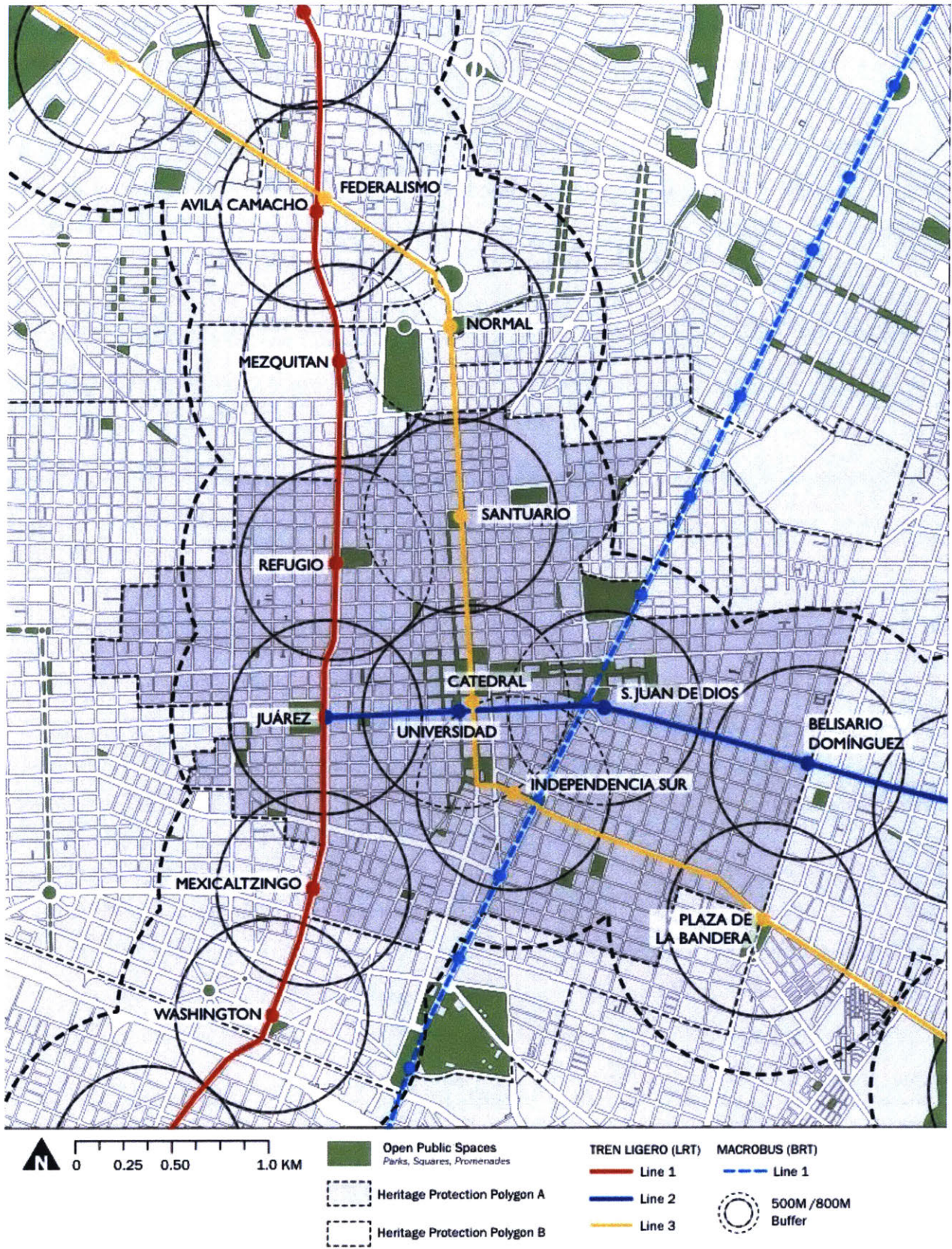*Source: Image from Google Earth.*

Figure 4.2 Central District's Open Public Spaces and LRT Stations

Based on the already described anchor and place-maker roles in the environment, the pairing of transit stops and open spaces should be a goal for any transit station, but at the same time could be seen as the starting point of a spatial analysis of how the match could affect the TOD potential in each of the stations. Each station/open space combo has its own characteristics and values, but they all share the potential of becoming development attractors with their respective open space as the heart of the community. (See Appendix A).

Two implementation examples

For the stations that were previously identified as partnered because of the relationship of their catchment areas, the initial analysis driven by the open space/transit match shows how this match could define development patterns.

Mezquitán (L1) / Normal (L3):

Mezquitán station has a small square next to transit stop and in front of the existing "flowers market". This small square could serve as the station foyer. and it is adjacent to the Mezquitán Cemetery which although currently is not integrated with its surroundings, it offers an important potential for a future open space. Meanwhile Normal Station is currently under construction beneath of the park known as *Parque Chopin*. The station will function as a transfer area for local buses, therefore the gathering place on top of the station would be helpful to improve the user's experience and to be the station street-level lobby.

Nevertheless, the large *Alcalde Park* located in the middle of the paired catchment area, is the open space that really structures the neighborhood. In this case, each station should take advantage of their respective matching parks to enhance the visual connection between the surroundings and the entrances to the station; but as for *Parque Alcalde*, the large park should function as the great central piece in the TOD plan for the neighborhood. The closeness of the two stations allow for this park to become the real place-maker open space from which the rest of the area should be developed. In a similar fashion to a central square in the old foundational scheme, the large central park can be the open space that gathers civil and community services and attract new residential developments around it.

Further, the city, under the new schemes proposed in the recently approved zoning bylaw, should encourage development surrounding the park by transferring development rights from the non-developed

area of the park to the surrounding parcels. Actually, in the last years, some real estate projects have been located immediate to the park, as part of the speculation driven by the upcoming new LRT line. As shown in Figure 4.3, the two streets north and south to the park are the ones where the connection between the two LRT station can happen. These connections, with the park as a central space, also structure where to incentivize higher development. In this particular case, rather than place the center of the radial development pattern in each of the station, it is located in the intersection of the catchment areas, which occurs where park is located. The size and weight Parque Alcalde has in the neighborhood is what makes it the public space that will drive the development patterns in the area.
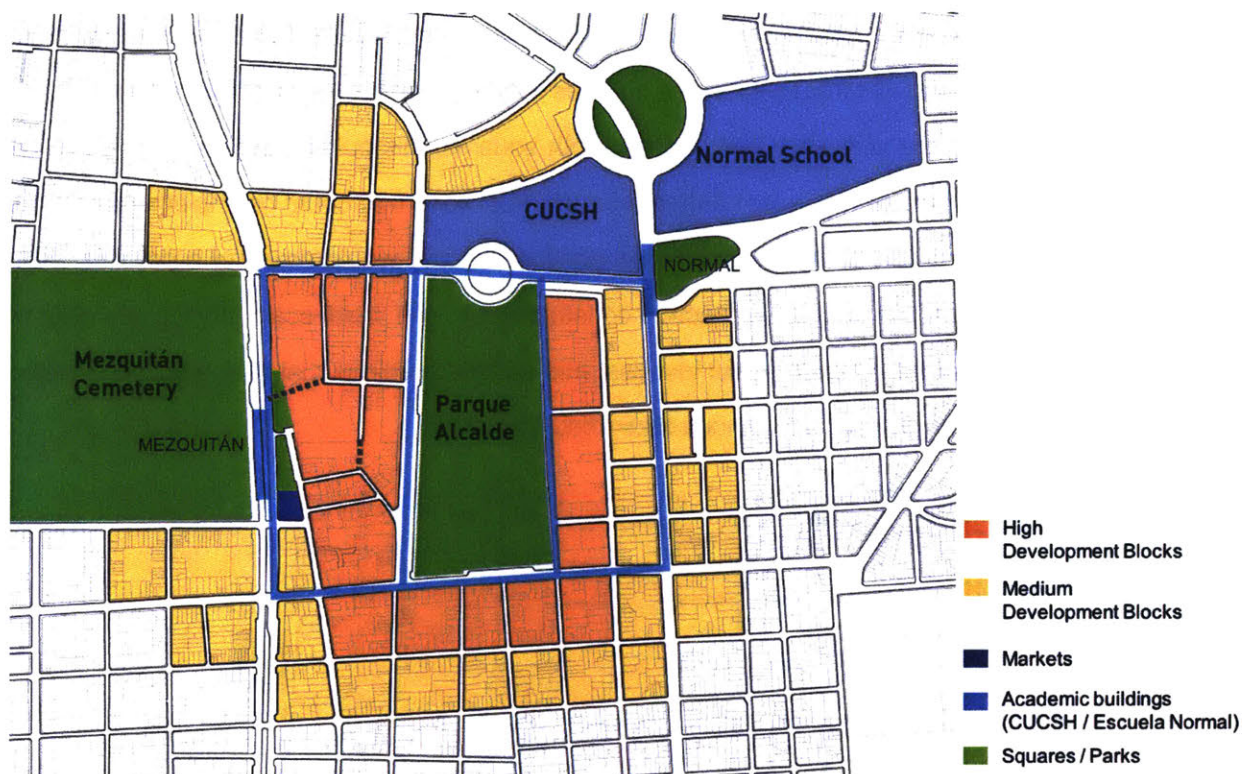
Figure 4.3 Mezquitán / Normal Stations Open Space Relationship

Refugio (L1) / Santuario (L3):

These two partnered stations are in a more sensitive area given their location inside the heritage-protection polygon. Both stations present a similar urban layout in their surroundings: the station is not only paired with a public garden, but also with an old church. For the Santuario station this urban layout has its roots back to the foundation of the *El Santuario* neighborhood in the 1800s, when public housing was built next to the *Santuario de Guadalupe* (Guadalupe's Virgin Shrine). In covenant with the traditional

neighborhood structure, the *barrio* also has a public market centrally located, and that happens to also be along the connecting path between the two stations. The pairing stations with their respective parks and churches, plus the market in between, not only gives character to the neighborhood, but it could be tremendously useful for place-making purposes. The existing churches are the landmarks the literature identified features that enhance the nodal condition of the parks. The landmarks, in combination with the transit stations, provide these parks with the potential to be unique places within the TOD potential zones.

Each of the open spaces matching the stations may function as binary system of main squares from where the development patterns are laid out (Figure 4.4). As learn from the discussed literature by Lynch, there is the potential of using the network of smaller open spaces as the feature that drives the character of the site. By prolonging lines out from each of the squares to link the rest of the neighborhood and more importantly, by enhancing the pathways that connect both squares, this public space system could be the anchor piece to define the development patterns for the TOD zone that could be implemented in the area. The proposed link, driven by the open spaces location, is what would organize a potential TOD proposal in the area. Given the heritage protection constraints and the small-scale blocks, this area of the central district TOD should be oriented for low-rise, mid-density buildings that take advantage of the history of the area reoccupy the currently underutilized housing stock.
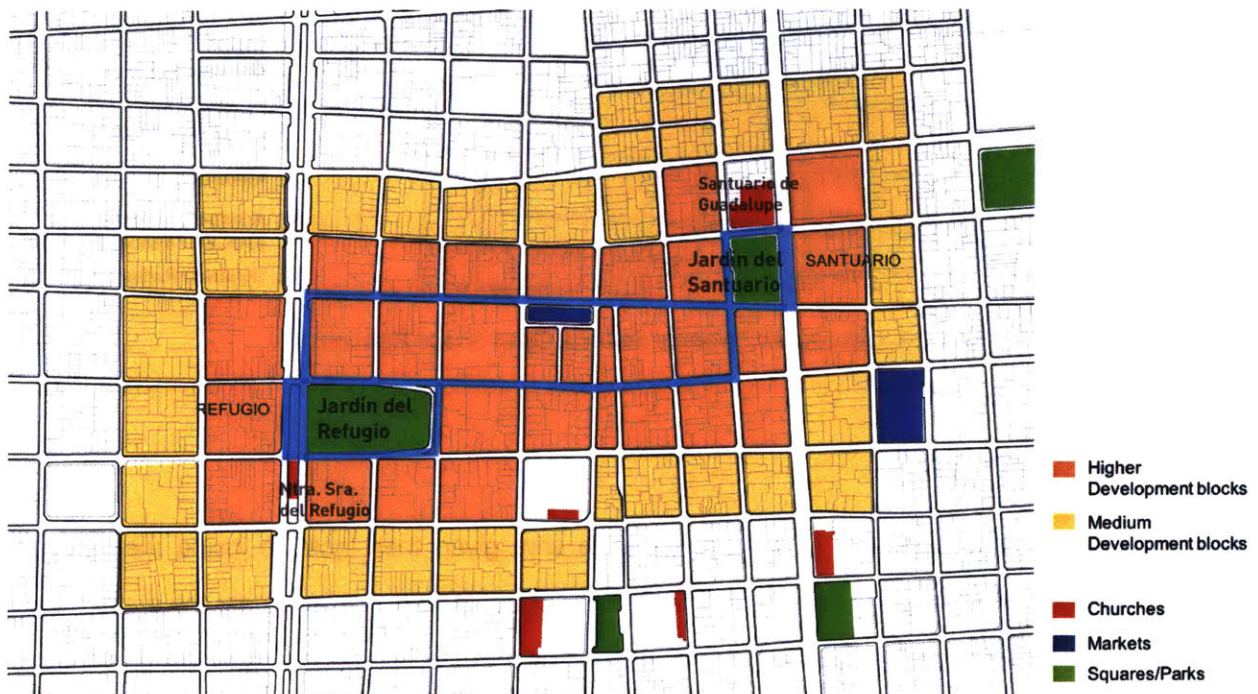
Figure 4.4 Refugio / Santuario Stations Open Space Relationship

Parque Revolución

There is a particular instance of a match between an open public space and transit that is worth highlighting. Juarez Station is currently, and until the new LRT line is operational, the only transfer station in the Tren Ligero system. This station is located under the *Parque Revolución*, which is the remnant of the old orchard of the *El Carmen* convent and the old prison that was demolished in the fifties. It is located not only in the intersection of lines 1 and 2 of the LRT system and the departure site for the SITREN and Trolleybus service, but also in the street intersection of the north-south (*Calzada Federalismo*) and east-west (*Avenida Juarez*) corridors that practically structure the central district's road system.

Similar to the way the foundational central square was used as starting point for the radial development of the city, *Parque Revolución* can be approached as the initial point for a re-structure of the Central District based on the transit infrastructure. Parque Revolución could be framed as the new *Plaza de Armas* for transit-oriented development in the central district. It has the potential to become the central place from where the rest of the surrounding nodes are organized.

Figure 4.5 Parque Revolución and Juárez Tren Ligero underground station.
Photo by: Juan de la Cruz

The site has function as a transfer station for about twenty years. It has become the downtown's mass transit western gateway. It is an active public space that is used by daily commuters and passing pedestrians. It also becomes the heart of a recreational Sunday walkway called *Via RecreActiva,* which closes Juarez Avenue every Sunday mornings to allow city residents to enjoy walking, biking or other activities along the avenue. It is already an identifiable place but it has lacked of the governmental impulse to cash-out the transit infrastructure investment as real estate development. If there is a place where Guadalajara's TOD efforts should have started years ago, is the zone around Juarez station / Parque Revolución.

The park's role as one of the main transit modal exchange points of the MAG offers the potential for the park to become an attractor of new development to the surrounding parcels. Using the park as the anchor, development should be radially located, starting with the denser uses around the park and further expand along the main corridors that crosses the park (Figure 4.6).
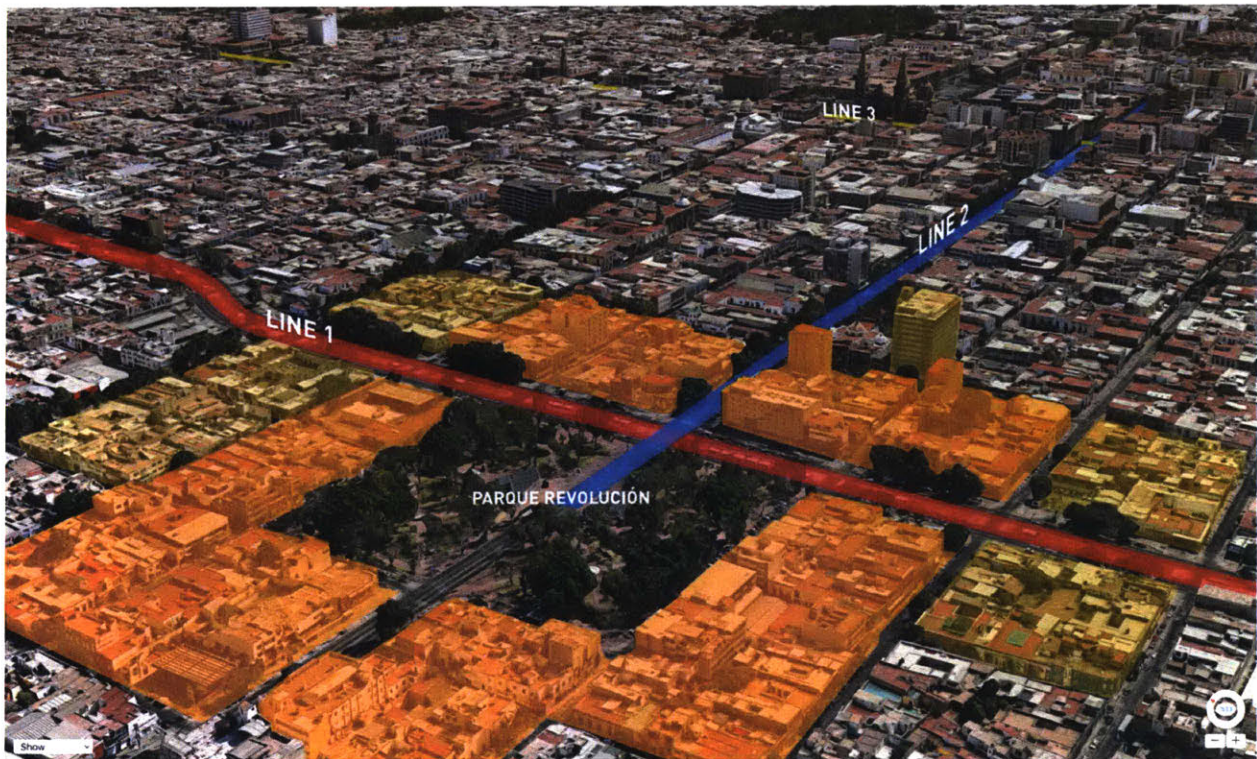
Figure 4.6 Parque Revolución radial development pattern. The park as the heart of the neighborhood.
Source: Image from Google Earth

Moreover, by not being immediately close to the foundational city blocks, there is in some extent less heritage-conservation pressure in the neighborhood. Nevertheless, this is a park with a large history of its own, since it is a vestige of an old convent's private orchard. When the prison that later exited on site was demolished to open *Avenida Juarez,* the surrounding parcels where used by the modernist architecture school of Guadalajara and endowed the area with some of the initial works of the functionalist movement. It is particularly important that the architectural and traditional character of the neighborhood is preserved and enhanced in favor of the place-making efforts. The park itself was designed by famous architect Luis Barragán but was later heavily modified to include the transit station. In recent years, it was partially restored based on Barragán's design, but the project only considered the aesthetic results but no how to potentiate the park to attract TOD.

The park's history has already brand it as an identifiable place that no development has taken advantage of. This space has a unique potential to be a value attractor but still lacks of a clear link to an identifiable landmark. Interestingly blocks away from the park, remnants of the old convent are also preserved, but as a result of the city's development, the former convent cloister and church are now a block away from the park. There is a potential connection to be done between the former convent and the park that occupies the land of the old orchard. This could strengthen and sharpen the image of the park and complement the place-making potential of the site even further.

Figure 4.7 Parque Revolución. Photo © Luis Romo via Flickr

5. CONCLUSIONS

5.1 GENERAL LESSONS

Open public spaces are a unique urban feature that ease wayfinding, help to convey the information to the user, and serve as anchors for place-making around transit stops. They have the potential not only to be an urban amenity for to enjoying recreational activities or just stopping by for a break; they can be defining anchors in the urban structure and pivotal elements in the delineation of development patterns. Open spaces can be the heart of TOD proposals, the locus required for place-making, the fundamental anchors in people's metal maps, nodes where paths converge, and organizing elements to lay out the observable reality's information so the observer can nourish its perception and define its behavior choice.

The relationship between transit stations and open spaces is relevant even in different stages of urban and transportation planning. Aiming for an alignment between open spaces and transit nodes is relevant both in transportation projects that start from scratch and for those systems that have already being laid out like the case of Guadalajara.

- New Projects: bearing in mind of the development potential that open space can add to a transit-served area, it is logical to state that whenever a city is considering the design and construction of a new line, the Origin-Destination study may need to include the physical structure of the people's commutes. It should ask, not only where the majority of the potential users' departure and arrive, but what is the urban structure around those O-D points and where are the open available nodes that could be linked via the incoming transit line.

- Consolidated urban areas and systems: As in the case of Guadalajara, cities may approach TOD aiming to re-densify their already urbanized areas. In these cases, both the urban structure and at least part of the transit system will be already in place. Still, understanding the role of open

spaces and the values of well-defined and framed places provide with strategies to facilitate the connection between urban form and transit systems. In cases like Guadalajara's downtown the urban structure will already has open spaces matched or nearly matched with transit stops. In those cases, the challenge is to understand the dynamics of the neighborhood and the organizing role of the open space in order to determine development patterns.

In cases where there is no such space available, the lessons are still relevant. Areas without open space can reach for *tactical urbanism* strategies to gain urban space to create *places*. The essence of having a matching open space is to have an identifiable urban component in which to root the experience of the user and lay out the observable information. *Tactical urbanism* offers remarkable results with very abridged elements in framing places.

Ideas are scalable

Further, the concept of framing places to create a clearer connection between the transit system and the urban environment does not exclude of mass transit systems. Most of the transit service that is provided in cities relies on regular buses. Bus stops are in many cases the only gateway to a community and the only link between neighborhoods and the rest of the urban environment.

It would be unrealistic to say that every bus stop should also have a matching open space, but as was explained for the open-space-less transit stations, bus stops can learn from the framing and organizing principles of open spaces. Dignifying the bus stop requires not only proper infrastructure like shading and sitting areas or the right signage, it should also aim in producing an identifiable place around the stop. By using different materials in sidewalks and roads, or rising the street to simulate a square, or introducing specific vegetation to produce a different environment than the rest of the neighborhood, are just a few ideas of the possibilities in space-limited stops.

Transit stops have different scales, and so should the spaces around them. A regional mass transit station's massive scale should be matched by an equally memorable open space and development pattern around it. A local train station may only need a neighborhood scale park or plaza. A local bus stop only needs a decorous arrival point that still respects the framing and place-making principles that open spaces follow.

Guadalajara

Guadalajara's centennial public squares and plazas were from the city's beginning the epicenter of the activity of each of their neighborhoods, there is now an opportunity of taking advantage of the existing and future transit to bring back urban life. The urban structure of the Central District is an invaluable asset to the TOD efforts in the city and it should be a key factor in the decision-making process for both authorities and developers.

The fact that all the existing and future LRT stations in the district are underground, are also a great advantage for producing better quality urban environments. Still, the lack of access to public information on the upcoming stations' design is a point of concern and, it was a limitation to further develop recommendations. The location of the entrances to the station will be key in the success of failure of the place-making efforts in each of the matching open public spaces. Stair entrances and elevator shafts should be located facing the open spaces, encouraging people to use the urban parks or squares.

For the rest of the stations in the system, beyond the central district, the challenge is greater. Given that most of the new stations will be elevated and that the remaining station from line 1 are on the ground level, there will be an additional challenge to successfully integrating the station with its surroundings. Some new stations are considering open squares to frame the new structure, as with the case of the station in downtown Zapopan, still there is very limited information available about how the stairs and elevators from project were design and planned and how will land on the ground level. Ideally an open space should be considered to frame each of the station and more importantly to relieve some of the compression that having an elevated structure will produce.

5.2 FURTHER RESEARCH

For further possibilities of this work, it would be very relevant and valuable to do some research on the experience-building process. Do users have a better experience in transit stations that have a matching, defined open space? Some consulted literature initially showed that the relationship between open spaces and cognitive maps can be identified (He, 2014), but it will be significantly relevant to explore the if people explicitly acknowledge the existence of an open space in their transit experience, if the open space does affect the experience but not consciously or if the open space has no measurable impact in people's perception of the space.

There are also multiple international cases, particularly European cities, that followed similar historical development patterns to Guadalajara. It would be relevant to further analyze how these matches are happening and whether they have been able to boost their development around transit because of the presence of imageable open spaces. Further, to analyze if iconic transit facilities in such cities explicitly address the potential that according to the theory, open spaces have on a site.

Finally, in support of the aspiration that the idea open spaces are relevant for producing true places next to transit, is scalable to smaller modes of public transportation. Further research could show specific urban design and tactical urbanism practices to support place-making strategies in smaller scale transit.
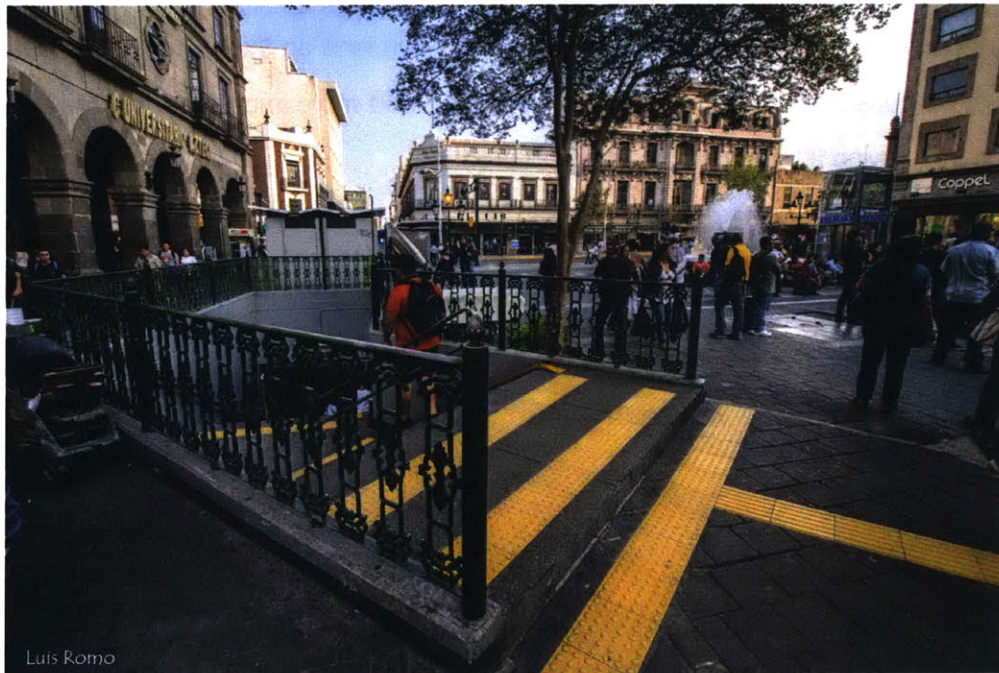

Figure 5.1 Universidad station plaza. Photo: © Luis Romo via Flickr

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APPENDIX A – LRT Stations + Open Spaces Maps
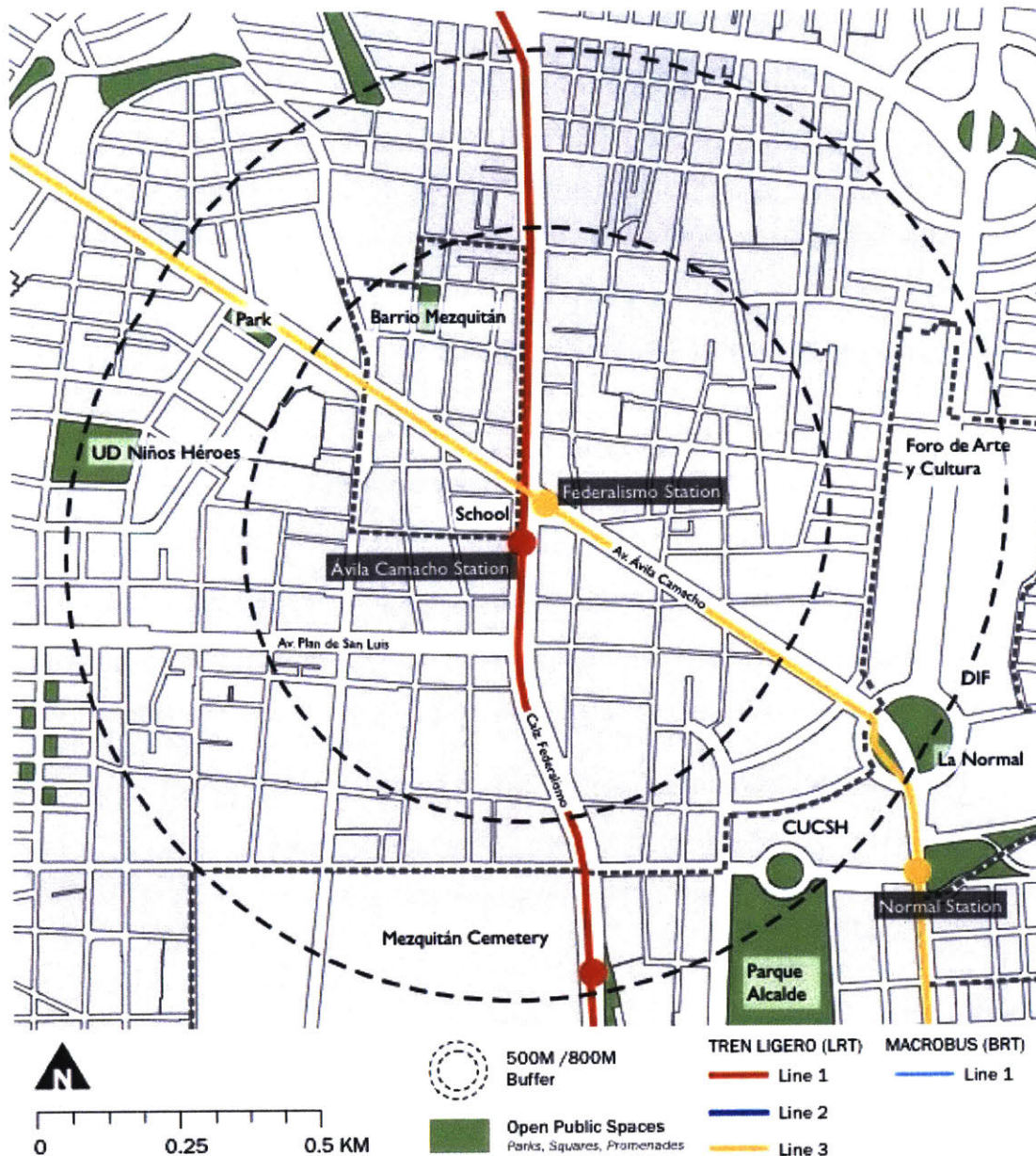
Station: Ávila Camacho (L1) / Federalismo (L3)   **Matching Open Space:** None

Assessment: The biggest challenge for this station is to solve the elevated-underground transfer between lines 3 and 1. The presence of the elevated station without any open space next to it will cast significant shadows in the intersection. While in terms of accessibility this will be a highly attractive area for TOD, will not be the case for the quality of the surrounding environment. The current traffic intersection is capacious. It will be vital to repurpose some of the street section and the corner space to enhance the pedestrian infrastructure. Further, it should be a priority to redevelop an adjacent parcel to allocate a mixed-use project that includes an open urban square. The large school parcel in the southwest corner also offers an opportunity to develop an urban amenity to potentiate the sense of place.

500M /800M Buffer	TREN LIGERO (LRT)	MACROBUS (BRT)
	Line 1	Line 1
	Line 2	
Open Public Spaces Parks, Squares, Promenades	Line 3	

0   0.25   0.5 KM

Station: Mezquitán (L1)   **Matching Open Space:** Flowers Market Esplanade/Mezquitán Cemetery

Assessment: As mentioned in Chapter 3 and 4, given the proximity between Mezquitán station and Normal station, both of them are paired. The space between them should be of particular interest. Particular to the station itself, the main challenges are related to the pedestrian connectivity. Unlike the rest of the downtown Guadalajara, this is an area with important accessibility barriers. Mezquitán Cemetery impedes connections on the west side of the area. Additionally, east of the LRT stop, there are some accessibility problems given the large block adjacent to the station. If development is set to be attracted to the area, this block should be subdivided and create pedestrian connections. Finally, Parque Alcalde itself given its size could be consider a barrier if its edges are not open for pedestrian access as they are today. The connection between Mezquitán Station and Normal Station is vital for the consolidation of this neighborhood with the park at the core of the community.

Station: Normal (L3)   **Matching Open Space:** Parque Chopin

Assessment: As mentioned, Normal Station is paired with Mezquitán given its proximity. The location of Parque Alcalde between both of them creates a very attractive space where the park could be the beating center of the community. Some real estate development is actually already happening next to the park. The station itself will be located paired with Parque Chopin, which will allocate a local bus transfer station underneath. It would be important that this park is kept and strengthen as the station urban lobby. Still, because of the presence of Parque Alcalde and the roundabout up in the north, this triad of spaces and their relationships will be crucial to organize the development to be attracted in the area. The large underutilized government facilities in the north, offer space for more compact development. While Parque Chopin would function as the station's immediate lobby, Parque Alcalde and the Normal roundabout would be the real estate development attractors.

Legend:
- 500M / 800M Buffer
- Open Public Spaces — Parks, Squares, Promenades
- TREN LIGERO (LRT): Line 1, Line 2, Line 3
- MACROBUS (BRT): Line 1
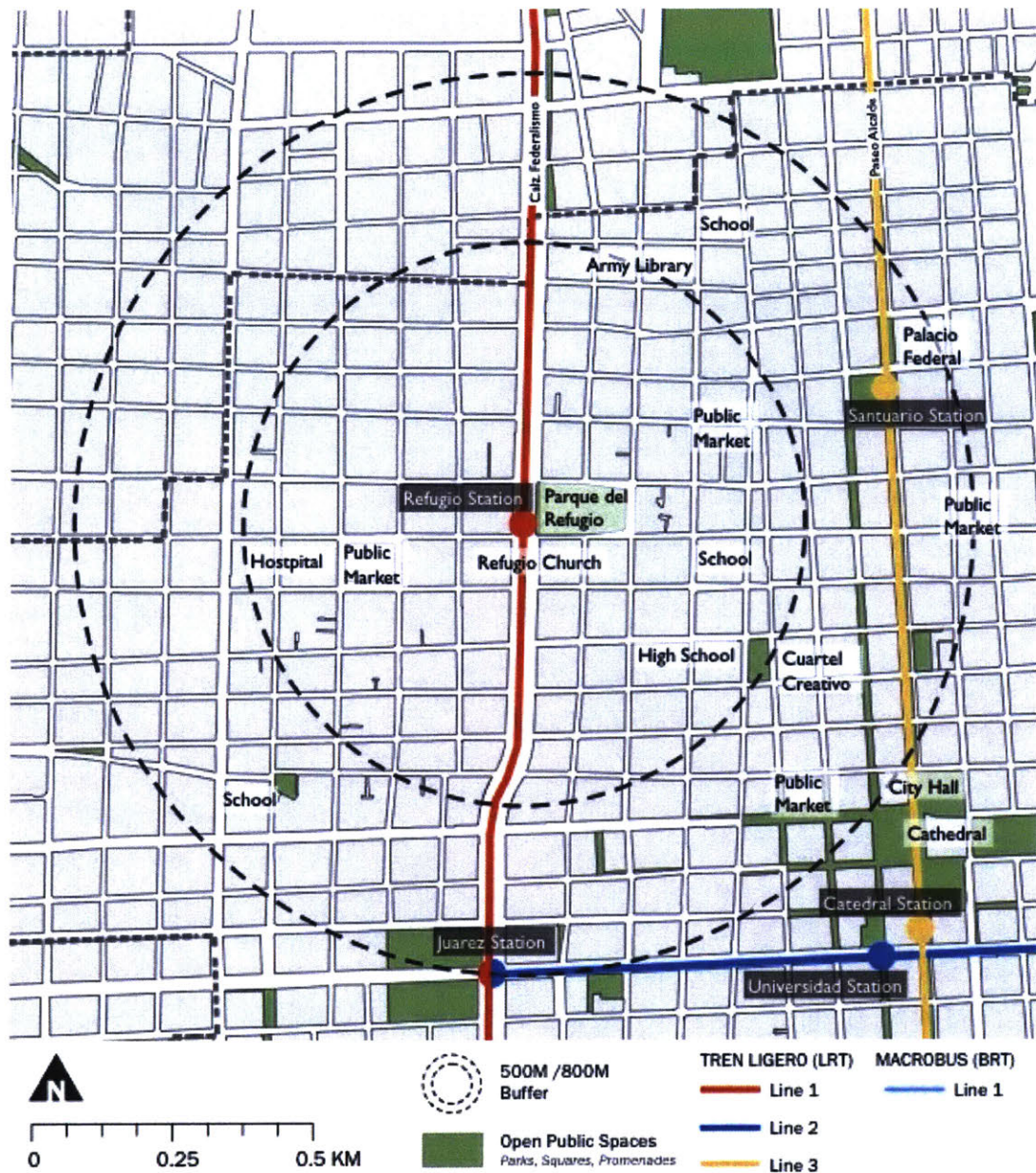
Station: Refugio (L1)   **Matching Open Space:** Parque del Refugio

Assessment: Currently, Parque del Refugio is an underutilized urban park, partially because of its deficient urban and landscape design but also because of the lack of activities in its surroundings. The transit stop, church, park combo is a rich asset to brand and create a sense of place in the area. Further, as it was mentioned in chapter 4, its proximity to Santuario station makes the link between Parque del Refugio and Jardín del Santuario highly relevant. The station is immersed in a mostly residential neighborhood with a large number of unoccupied units, but at the same time it's a place where the remaining residents are rooted to the site history and traditions.

Mezquitán Station

Parque Alcalde

Belén Cemetery

School

Army Library

Hospital Civil

Palacio Federal

Santuario de Guadalupe

Botanic Garden

Santuario Station

Public Market

Jardín del Santuario

Public Market

Parque del Refugio

Refugio Station

School

School

Alameda

High School

Cuartel Creativo

Ciudad Creativa Digital

Mercado Corona

City Hall

Cathedral

Calz. Federalismo

Paseo Alcalde

N

0   0.25   0.5 KM

500M /800M Buffer

Open Public Spaces
Parks, Squares, Promenades

TREN LIGERO (LRT)
Line 1
Line 2
Line 3

MACROBUS (BRT)
Line 1

Station: Santuario (L3)   **Matching Open Space:** Jardín del Santuario

Assessment: Once a very buoyant neighborhood, El Santuario maintains some of its historical aura. The incoming transit stop and the pedestrianization of Avenida Alcalde will expand the open space infrastructure next to the old Santuario de Guadalupe. Overall, the neighborhood offers an important amount of unoccupied housing units, a rich network of open spaces and a valuable set of traditions. At the same time, it is located within the heritage protection polygon which set development restrictions.

Nevertheless, Jardín Santuario, by replicating the central square model for the Hispanic American city, should function as the anchor for the community and connect with the surrounding open spaces, specially towards Parque del Refugio and the Refugio Station.
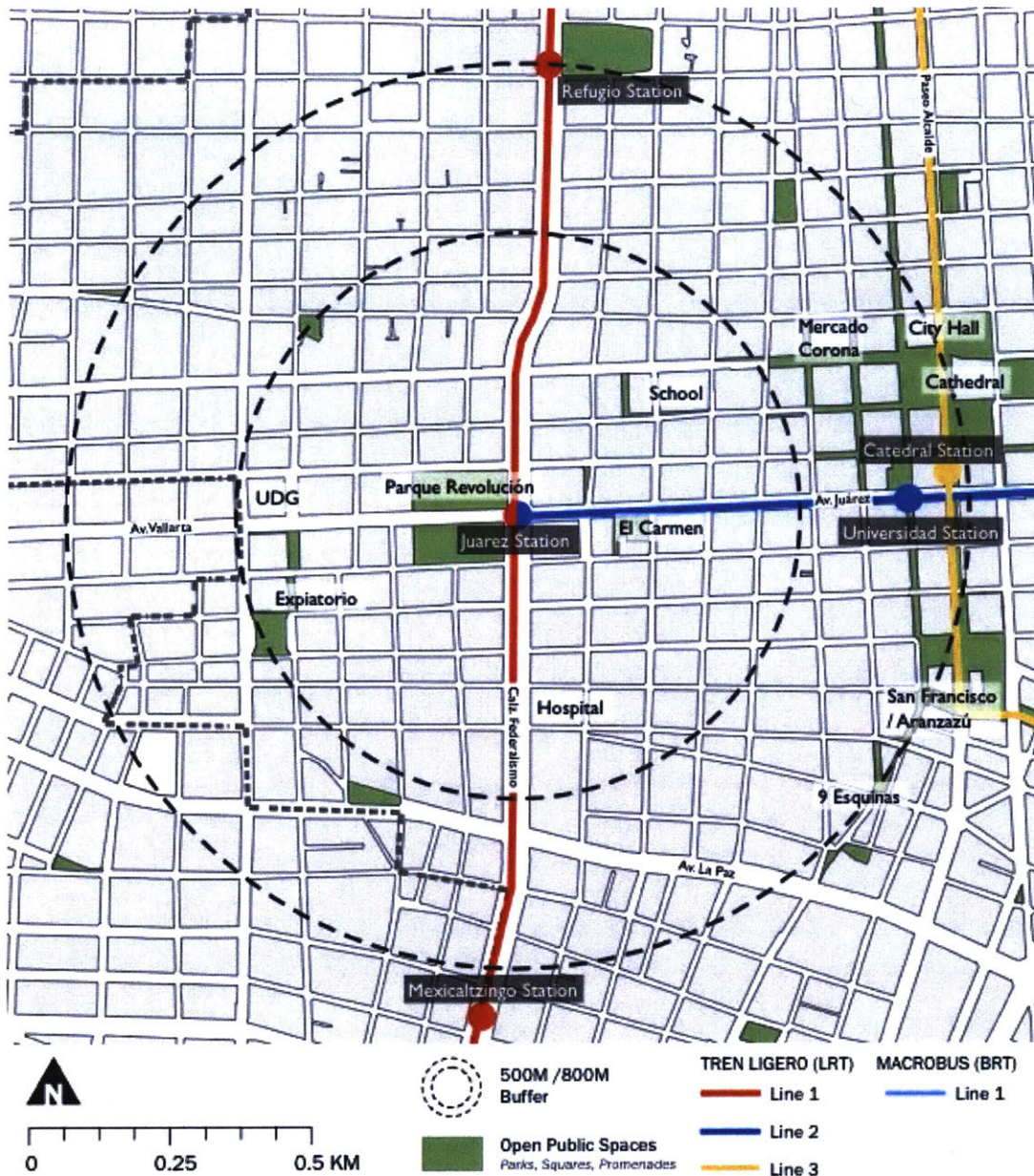
Station: Juárez (L1/L2)   **Matching Open Space:** Parque Revolución

Assessment: As mentioned, Juárez station and Parque Revolución, thanks of currently being the only transfer station in the Tren Ligero system, functions as the transit gateway to Guadalajara's downtown. The park is also one of the most utilized open spaces in the area, especially during the weekends. But regardless of the park's central location, the has not been any policy to encourage development to happen around it. While it is located within the heritage protection polygon, there are few historical monuments left on the area as a result of the demolitions that happen in the 20th century. This offers an opportunity for some mid-income development to arise in the area. The park could even be developed as Guadalajara's TOD Plaza de Armas (as in the Hispanic American city ideal), as the origin point for the TOD policies in the district.
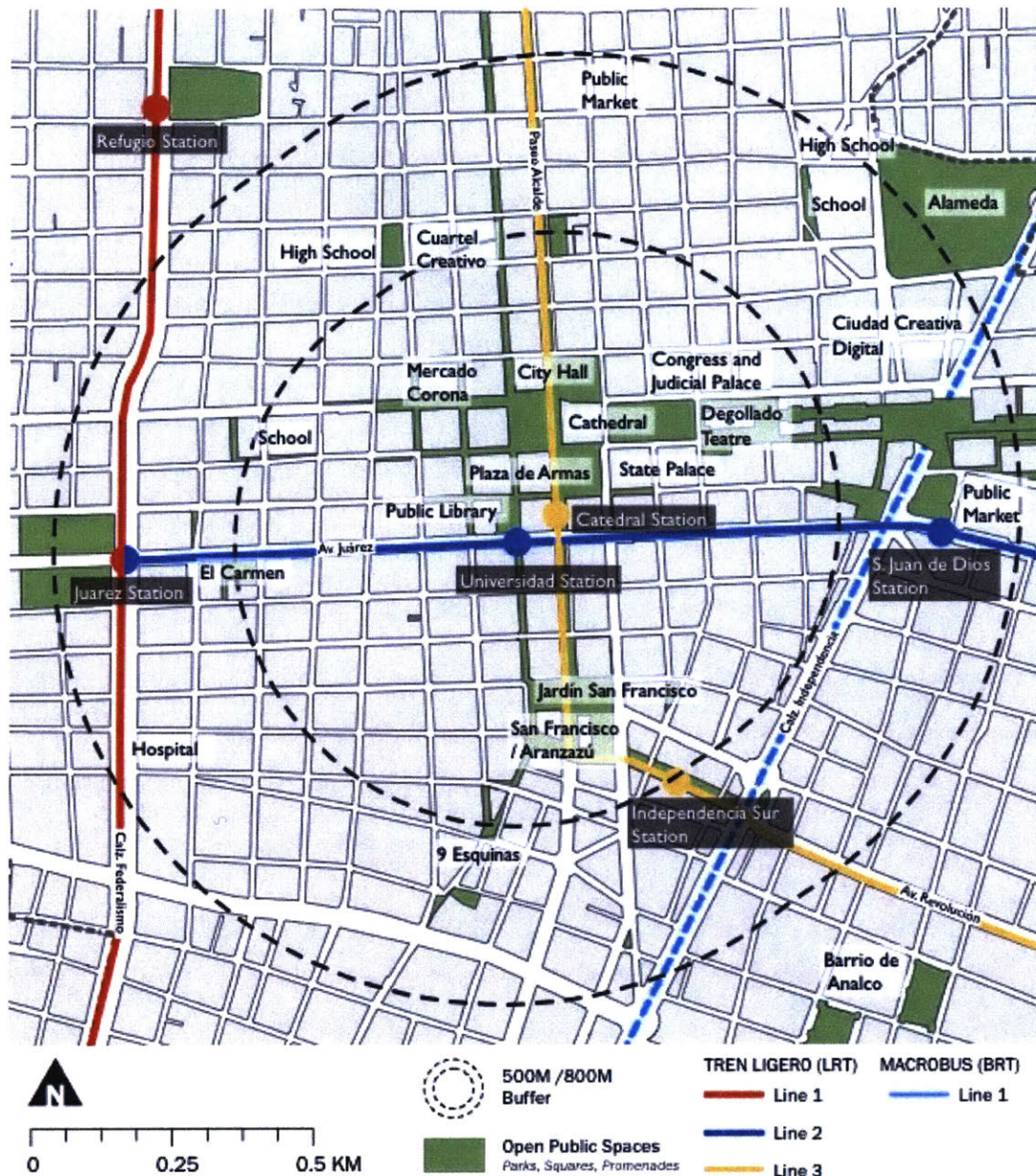
Station: Universidad (L2) / Catedral (L3)

Matching Open Space: Plaza Universidad / Plaza de Armas

Assessment: First, the station should have a unified identity, this is, one name. Practically this is the station that serves the historical core of downtown Guadalajara. It is inserted in the heart of the extensive network of squares and parks that the district already has and will be enhanced by the pedestrianization of Avenida Alcalde. The northern half of the catchment area is filled with governmental and cultural buildings. It is the touristic heart of the city. On the other hand, the southern half, between Plaza de Armas and Jardín San Francisco, offers no touristic use opening the door for the introduction of some residential uses, with the complexity of being in the area with the most expensive land of the district. Nevertheless, the richness of the open space network and the historical identity gives the station the potential to become the cultural heart of the city.

500M /800M Buffer

Open Public Spaces
Parks, Squares, Promenades

TREN LIGERO (LRT)
Line 1
Line 2
Line 3

MACROBUS (BRT)
Line 1

0   0.25   0.5 KM

Station: San Juan de Dios (L2)   **Matching Open Space:** Plaza de San Juan de Dios

Assessment: This station is part of the downtown triad along with Universidad/Catedral station and Independencia Sur. As such, it serves an area rich in historical monuments and cultural/touristic uses. Like in Universidad/Catedral, the southern half of the catchment area consists in an area more suitable for residential-oriented uses. Plaza San Juan de Dios has been recently renovated, as an attempt to improve its spatial quality and function as a better vestibule for the transit stop. Finally, the connection with the BRT is critical. The street intersection should be redesign to ease pedestrian connections and facilitate transfers between the LRT and the BRT.

Station: Independencia Sur (3)   **Matching Open Space:** Jardín San Francisco

Assessment: Although the station itself will not be actually paired with Jardín San Francisco, the pedestrianization of the surroundings will serve as an extension of the existing open space. The station and its linear pedestrian space will function as a connection between the convent buildings linked to the downtown's open space network, and the existing BRT station.

The station will also serve the historic neighborhood of Analco. This opens the possibility of finally connect the old churches and squares with the downtown core. These central stations main challenge is to find a way to introduce residential uses in an area filled with commercial, touristic and governmental activities, and with very expensive land. However, the rich public space offers some of the most identifiable and imageable regions of the entire city.

N

| 0 | 0.25 | 0.5 KM |

- - - **500M /800M Buffer**

Open Public Spaces
Parks, Squares, Promenades

TREN LIGERO (LRT)   **MACROBUS (BRT)**
Line 1   Line 1
Line 2
Line 3

Station: Belisario Domínguez (L2)   **Matching Open Space:** None

Assessment: If Belisario Domínguez is set to be developed as a TOD zone, it needs to have a more legible and imageable node. Currently, the station is located in a four-way intersection without any landmark or space to visually anchor it to the urban environment. It has a nearby park with a school next to it that could be potentiated by attracting some development around it, but the station still needs a physical identifiable node. The area has potential to attract residential uses. Any project next to the station should have a set back from the property line to open-up the sight lines and create a small urban square.
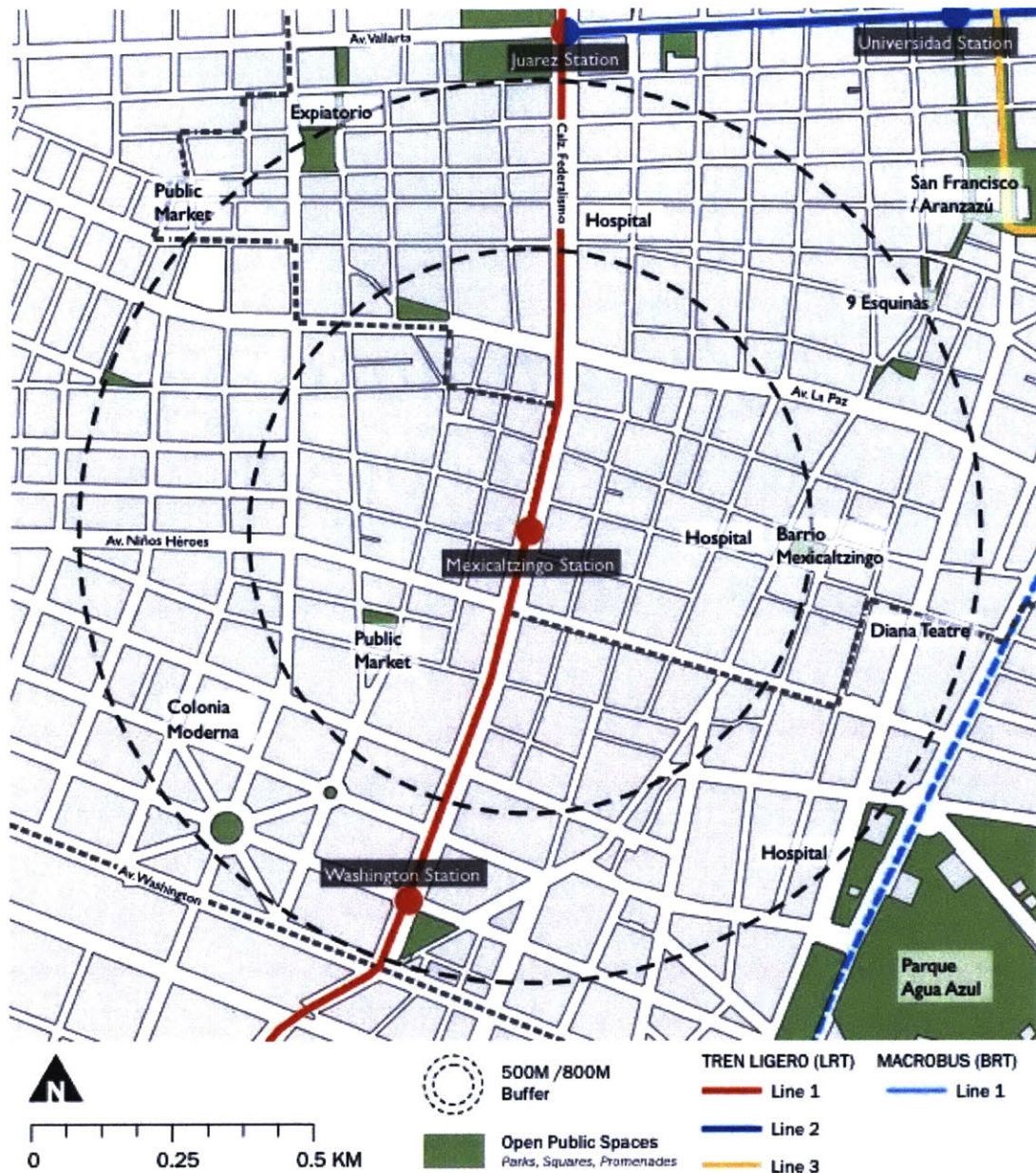
Station: Mexicaltzingo (L1)   **Matching Open Space:** None

Assessment: There is not a clear anchor for the TOD area due to the lack of an open space pairing the station. Nevertheless, Calzada Federalismo has a wide street section that provides with generous sidewalks. This could be used, as in the rest of Calzada Federalismo, to promote a highly active ground level in the buildings around the station accesses. Because of its proximity to Parque Revolución, this station rather functions as an adjacent TOD area and therefore the scale of public space pairing the station could be more modest. Nevertheless, the pedestrian connection to the open spaces within the area and the station are vital. Finally, any new development to happen adjacent to the LRT station can be the one to provide a clearer open space to function as urban vestibule for the transit stop.
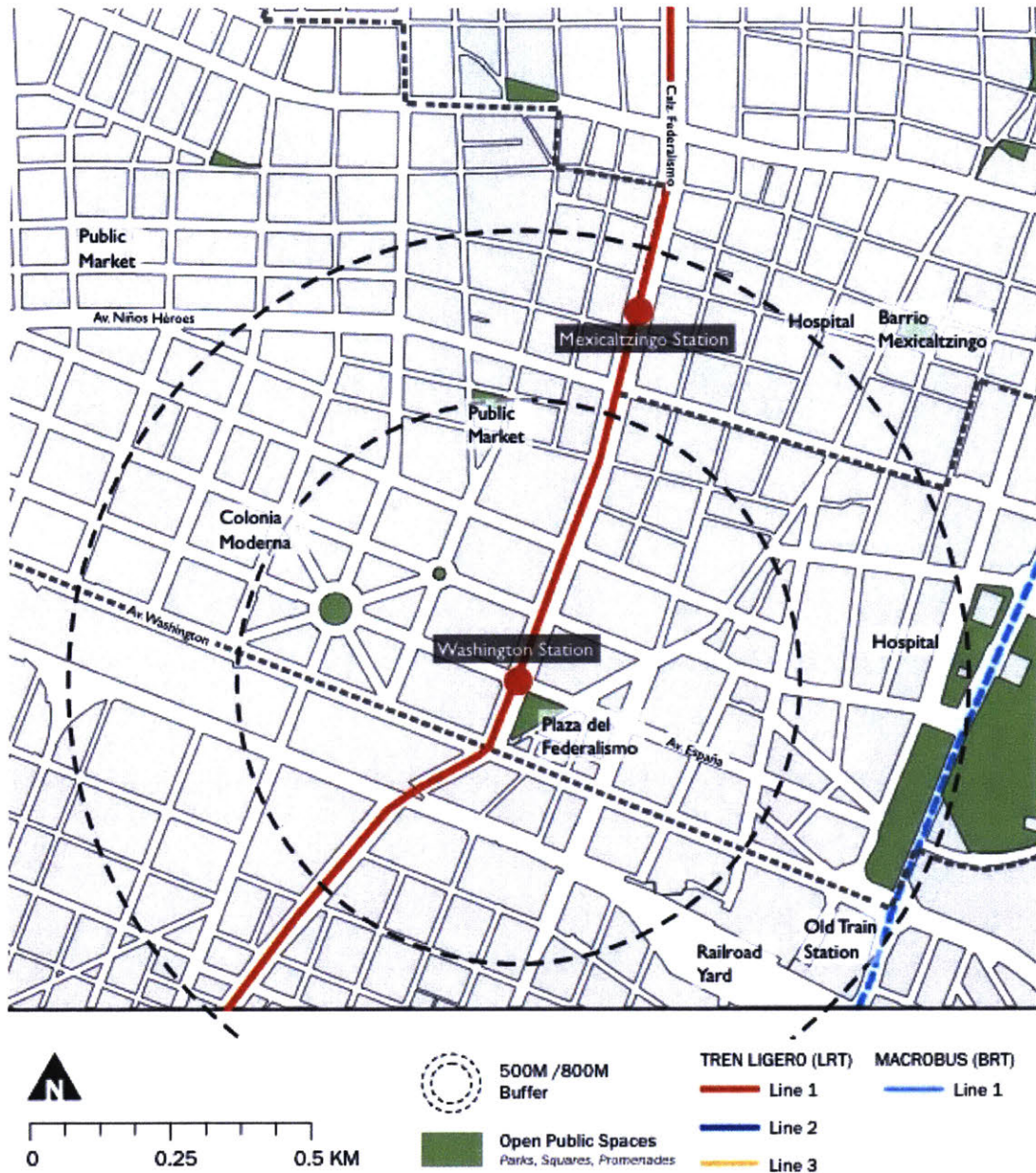
Station: Plaza de la Bandera   **Matching Open Space:** Plaza de la Bandera

Assessment: Plaza de la Bandera already is an important traffic intersection for the east side of the municipality. The space already functions as a vehicular node and with the introduction of the train station it could further evolve into the gate to the southeast of Guadalajara. Further, thanks to the space available in the intersection it could allow the construction of an underground transfer station for local buses. The construction of the square decades ago produced a landmark for the neighborhood. All of these factors offer material to further develop a true sense of place. Any TOD zone around the LRT station, should promote development around the open square and parks that form Plaza de la Bandera.

It will be very important to foster stronger pedestrian connections between Plaza de la Bandera with its station and relevant amenities like the public market close-by, the Military Hospital/Museum complex, and the school along Revolución Avenue.

Station: Washington (L1)   **Matching Open Space:** Plaza del Federalismo

Assessment: Washington Station is located between residential areas like Colonia Moderna and more industrially active parcel on its east side. The public square that was built next to the station could be seen as both the border between these uses and as the place where both uses come together. The vehicular ramps from Calzada Federalismo's tunnel form a barrier that blocks the connection between both sides. Avenida España could become the main pedestrian path by connecting the roundabout at Colonia Moderna's core, the LRT station with its public square, and Plaza Juárez next to the Agua Azul park, but the ramps' barrier need to be solved. Further, the parcels surrounding Plaza del Federalismo could attract more development to become the heart of the TOD zone.

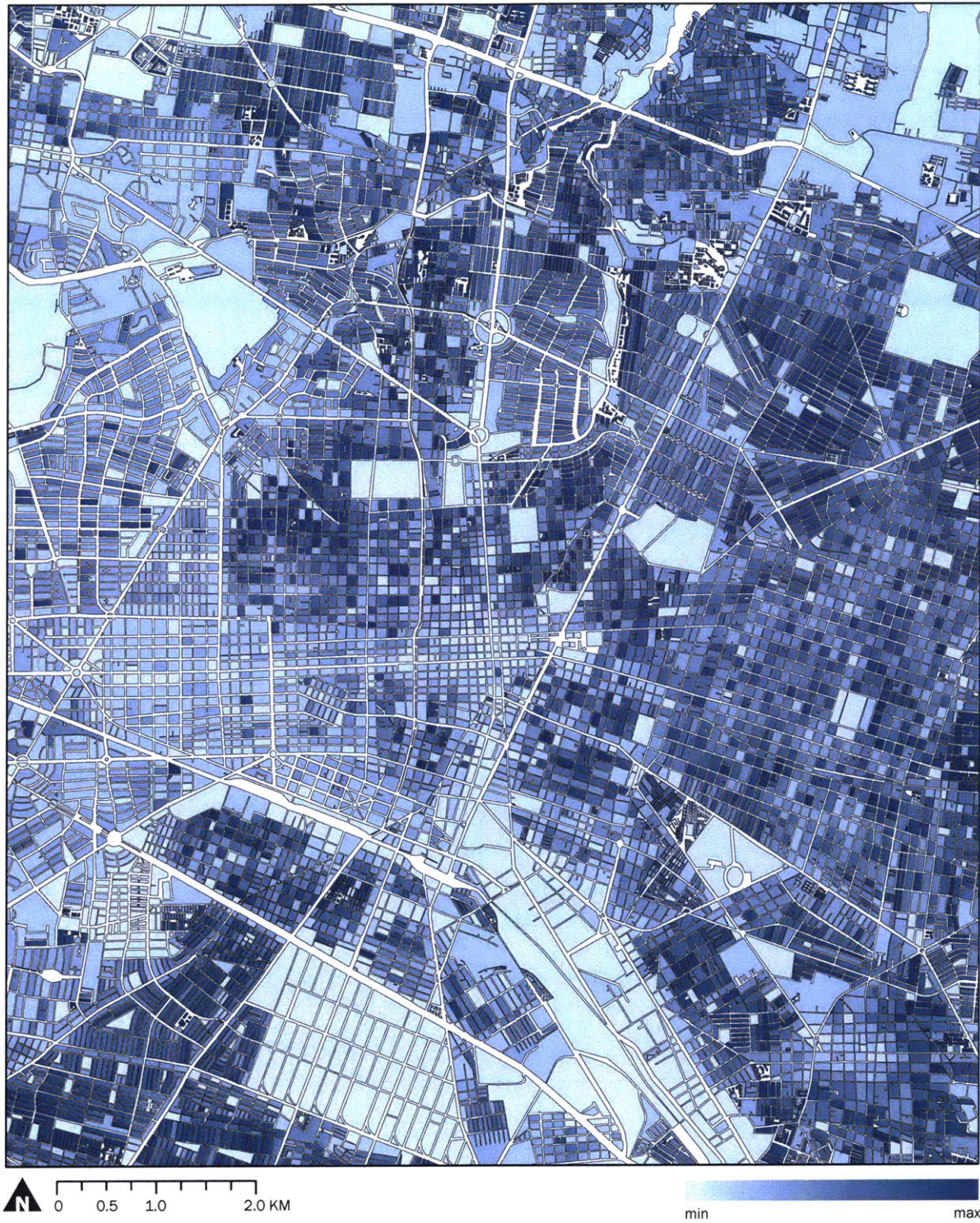# APPENDIX B – Guadalajara's Central District Demographics

DENSITY OF INHABITANTS BY BLOCK (POP/KM^2)

N
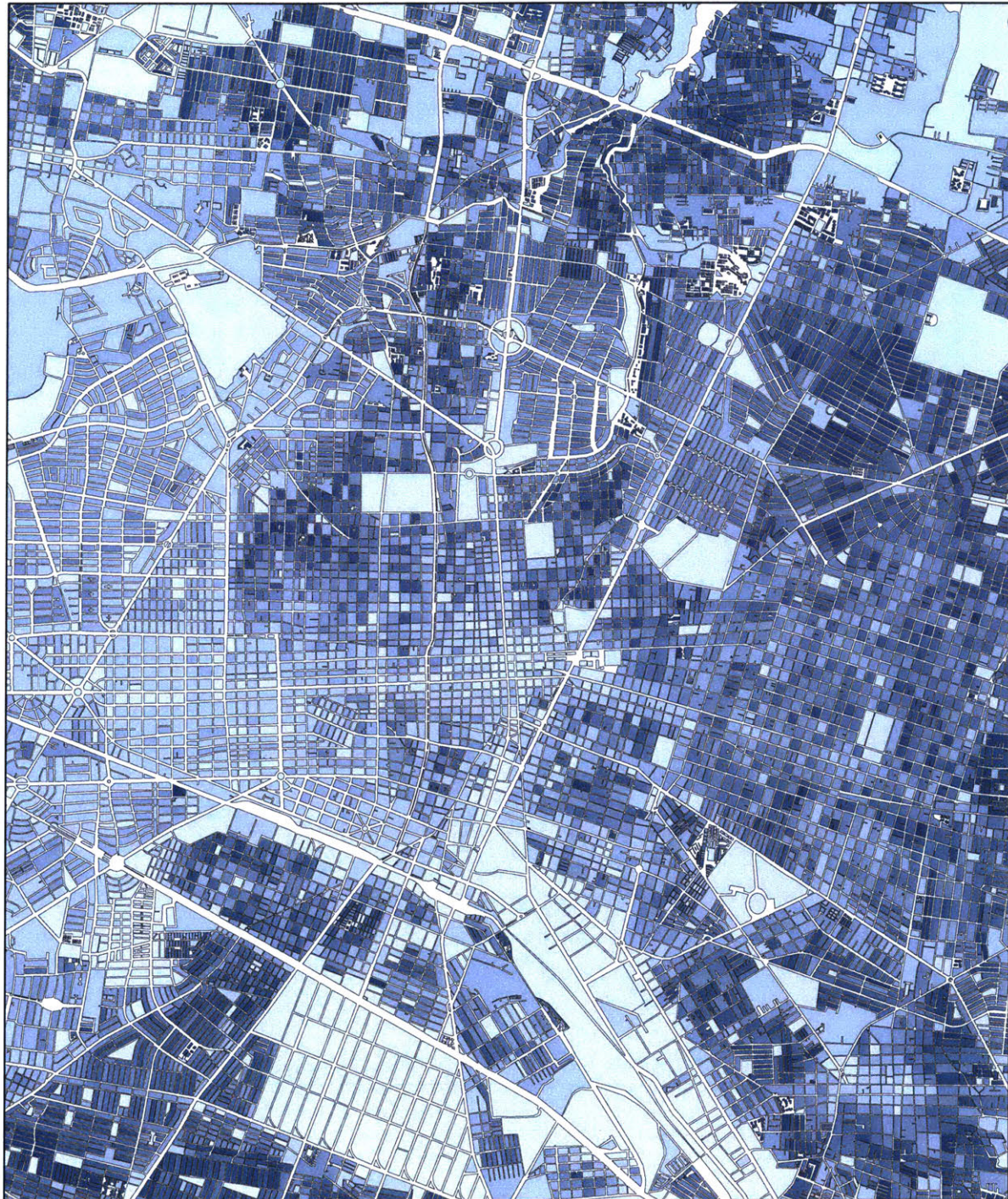
0   0.5   1.0   2.0 KM

min   max

DENSITY OF RESIDENTIAL UNITS BY BLOCK (UNITS/KM²)

N   0   0.5   1.0   2.0 KM

min   max

PERCENTAGE OF UNOCCUPIED RESIDENTIAL UNITS BY BLOCK

0   0.5   1.0   2.0 KM

min   max