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Transit-Oriented Development: Removing Barriers And Realizing Goals Through LEED-ND

Melissa N. Lotito
Ryerson University

TRANSIT-ORIENTED DEVELOPMENT: REMOVING BARRIERS AND REALIZING GOALS THROUGH LEED-ND

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ABSTRACT

In a response to the effects of sprawl and the growth pressures that face the City of Toronto and the rest of the Province of Ontario, Transit-Oriented Development (TOD) can be implemented as a smart growth tool that can provide a meaningful sustainable alternative to conventional development practices. This research paper explores TOD in all of its capacities, context, design principles and the benefits and barriers that encourage or inhibit its execution. With a lack of effective performance measures in the current literature, this report aims to respond to the question: *Can LEED-ND assist in addressing the main goals, objectives and barriers of TOD?* LEED-ND is a rating system that shares the same smart growth and new urbanist concepts as TOD. The various categories of the LEED-ND system help to analyze TODs by more than just design elements and instead help to put focus on the sustainable and social objectives.

Key words: Transit Oriented Development, Toronto, Smart Growth, New Urbanism, LEED-ND

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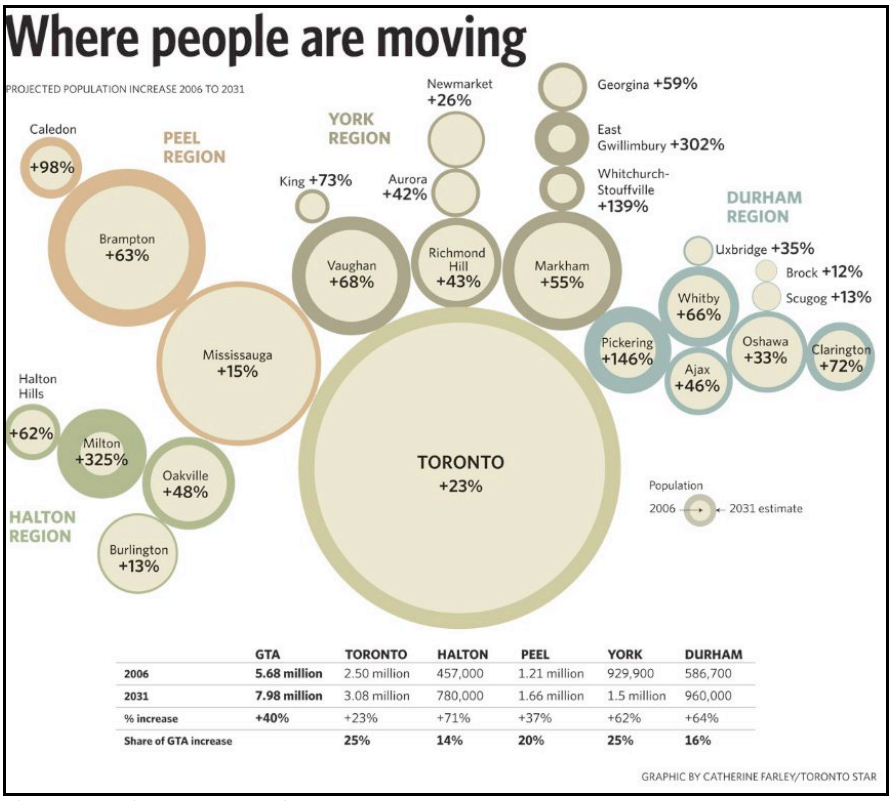
INTRODUCTION

Urban sprawl and its effects has been a growing issue for many North American cities. The Greater Toronto Area (GTA) is ranked as one of the fastest growing larger cities in North America (Neill et al., 2003). The GTA's auto-oriented growth patterns and its increasingly rapid growth have challenged infrastructure and land supplies (Nieweler, 2004). A Sierra Club of Canada Report (2003) examined the differences between the cost and benefits between the land-use decisions that have stimulated low-density sprawl development at the outer edges of urban centres throughout Ontario. According to the report, southern Ontario could pay more than $69 billion for new roads, sewer and water networks over the next 25 years. Ontario's towns and cities have been growing at record rates, creating car dominated landscapes that have exacerbated highway gridlock, have put a strain on government spending for infrastructure expansion and lastly have increased pollution.

Urban centres, like Toronto, were originally planned to make life easier, where people could live and work in close proximity to daily needs (Neill et al., 2003 cited Fenniak, 2002), however according to the Toronto Dominion Bank, sprawl has drawn employment and population away from the urban cores (Neill et al., 2003). Sprawl can be defined as uncontrolled, unplanned, irresponsible low-density development on an

urban periphery that extends far beyond existing infrastructure and areas of employment (Neill et al., 2003 cited Jackson and Kochitzky, 2001). Sprawl has created an immense amount of traffic congestion and is currently costing the GTA economy $6 billion a year (Gombu, 2011). Figure 1 demonstrates that population increases between 2006 and 2031, for several municipalities within the GTA, far exceed the population increases expected for the City of Toronto.



	GTA	TORONTO	HALTON	PEEL	YORK	DURHAM
2006	5.68 million	2.50 million	457,000	1.21 million	929,900	586,700
2031	7.98 million	3.08 million	780,000	1.66 million	1.5 million	960,000
% increase	+40%	+23%	+71%	+37%	+62%	+64%
Share of GTA increase		25%	14%	20%	25%	16%

Figure 1: Projected Population Increases
Source: Catherine Farley (2011) from www.torontostar.ca

This forecasted growth will only intensify the issues surrounding current land uses and car dependency will likely remain. In recent years there have been key responses to overcoming the rising effects of sprawl throughout

the planning and development communities. Consideration has been given to alternative smart growth management strategies that will revitalize transit corridors and give people the choice to abandon their cars and choose more effective options like public transit, walking or cycling.

Transit Oriented Development (TOD) can be considered a revival or re-invention of past practices of models that encouraged a meaningful relationship between transit and development. Calthorpe in his foreword in The New Transit Town (2004) describes how urban development and transit were once partners in city building; however, this balance between the two has been disrupted due to sprawl. Although, he claims a new balance is emerging that is integrating a new urban form. Today's TODs are best at providing alternative mobility choices and has become a fundamental approach to combating sprawl and intensifying urban transit areas that are underutilized. TOD is a new form of development that results in places and regions that meet the demand for location-efficient mixed-use neighbourhoods, supports regional economic growth strategies and increased housing choice and affordability (Dittmar and Ohland, 2004). A basic definition of TOD is any type of development that is "oriented" to a transit station (Venner and Ecola, 2007). One of the struggles with TOD is that no single, universal definition exists; academics

have formed definitions based on characteristics and objectives because of this. And so TOD is defined here based on some of its characteristics which generally include: a mix of residential and commercial development located within the same structure; fairly high densities, with about 20 or more residential units per acre; and land area that is within a 5-15 minute walk of a transit station (*ibid.*).

As Toronto, along with the rest of Ontario, face growth pressures, TOD can be seen as a method to managing this growth. Even though TOD is just one smart growth strategy, it is a strategy that can maximize the benefits of transit investments and provide a meaningful alternative to traditional development that changes the status quo at the local level.

In the last five decades, Toronto has adopted policies relating to residential density. It is an urban city that has long been known for its public transit orientation and metropolitan-wide planning capacity (Filion et al., 2006). There has been on-going coordination between high residential density and high quality public transit services in Toronto (*ibid.*). Density related policies throughout Toronto during these decades have not been proven to elevate walking or transit use as much as they could have (*ibid.*). In the last decade or so, there has been a substantial market that exists for TODs that provide a new form of walkable, mixed-use urban

development around transit (Belzer and Autler, 2002a). This smart growth tool has been used to curb sprawl and achieve sustainable development has received serious attention across North America.

RESEARCH PURPOSE AND QUESTION

The purpose of this research is to understand how North America has responded to sprawl, particularly through TOD, which is considered a smart growth tool but more importantly how TOD can move forward through higher-level initiatives that address sustainable development. TOD will be explored in all of its capacities, its history, its current state and design typologies, and the benefits and impediments that encourage or inhibit its execution. Furthermore, in order for planners, local authorities and developers to manage TOD and create successful and smart development, TOD must be supported by evaluation mechanisms that help to analyze developments pre and post construction periods. However, the ability to assess measurable benefits is not always possible as data sources are difficult to retrieve; but setting performance indicators is important in allowing planners and developers the ability to adapt the indicators and choose objectives, which are context appropriate.

Leadership in Energy and Environmental Design for Neighbourhood Development (LEED-ND) initiative has been selected and examined for discussion. Overall, the main intent of this research paper is to determine and recommend how this initiative can play a role in furthering TOD into the future. The report is intended to begin a discussion around how TOD can be realized by developers, planners, transit agencies, and most

importantly, communities through a specific initiative that ultimately addresses the overall objectives of TOD. The study of this initiative is not intended to be exhaustive but instead is aimed to provide an overview, in hopes of stimulating future discussion and more in-depth research. The question that will be addressed within this report is: *Can LEED-ND assist in addressing the main goals, objectives and barriers of TOD?*

METHODOLOGY

The first portion of this research is descriptive in nature, it involved a review of secondary data relating to TOD and its various aspects, smart growth and evaluation mechanisms developed and proposed to assess TOD outcomes. The literature that was consulted consisted of published academic studies, as well as, government and independent reports. Relevant seminars, dissertations, and books were also consulted.

Once the literature was reviewed it was evident that a range of performance measures and indicators have been developed and explored. In recognition of this, LEED-ND was chosen for examination, which is not completely TOD based but incorporates a wide range of sustainability themes that could potentially be adopted into future TOD projects in addition to performance indicators already set out in the literature.

Limitations exist in this research that should be addressed. Due to time constraints the review of literature is not exhaustive and may not reflect a complete depiction of all evaluation mechanisms currently found in the literature. As well, primary data was not collected and the report relies on secondary data to address the research question and provide recommendations; this may have narrowed the scope of

recommendations and outcomes. Finally, the research did not attempt to apply or test any of the initiatives to specific TOD case studies; therefore the scope of the research simply was an examination of what initiatives exist and how they can address TOD objectives.

BACKGROUND

THE RISE OF SMART GROWTH

In the last decade or so planners, decision-makers and relevant stakeholders have been focusing on smart growth as a key response to overcoming sprawl, leading to more sustainable communities (Canadian Urban Transit Association, 2004). This significant smart growth movement has created much interest across Canada and the United States creating progressive smart growth management strategies (*ibid.*). Attempting to combat against greenfield development the Province of Ontario developed a growth plan for the Greater Golden Horseshoe Area which helps to address issues of sprawl and puts focus on transit-supportive land uses.

The Smart Growth Canada Network identifies various principles of smart growth. Two significant principles, for the purposes of this report, include: renewing existing communities in a way that directs development away from unsettled areas, and instead encourages growth toward more built up urban areas; and focusing on implementation by utilizing planning processes, along with maximizing tools and incentives to facilitate private sector investment in order to achieve smart growth solutions. Smart growth is defined as, the combination of land use and development practices that preserve the natural environment while enhancing the

quality of life in communities, it also promotes compact and multi-use developments where mobility is expanded, built up areas are either infilled, redeveloped or adaptively re-used (Canadian Urban Transit Association, 2004; Porter, 2002). There is no dispute as to what smart growth is and what it can ultimately achieve for the future of cities, however, what is not clear-cut amongst sectors of politics, industry developers and the public is where growth goes and what it looks like, that is the lingering struggle (Canadian Urban Transit Association, 2004). However, forging linkages between transit improvements and community development activities can create new opportunities towards a shift in urban development patterns (Federal Transit Administration, 1999). It is recognized that sprawl creates 'mobility deficiencies' (*ibid.*). But one fundamental approach that will ensure smart growth is put into action and achieved on the ground, is through the promotion and successful implementation of TOD.

SMART DEVELOPMENT IN TORONTO

According to the Growth Plan for the Greater Golden Horseshoe, 2006, there are growing traffic congestion issues that are difficult to respond to with efficient public transit because of sprawling communities; this is also a challenge since there are an increasing number of automobiles travelling to and from urban centres, resulting in clogged transportation corridors.

The Plan addresses these challenges through policy directions that support transit-supportive densities with a healthy mix of residential and employment land uses, as well as, identifying and supporting a transportation network that links urban growth centres through a multi-modal system anchored by efficient public transit.

Furthermore, the Plan has a set out a vision for 2031 that will allow people choices for easy travel between urban centres. The vision foresees a public transit system that is fast, convenient and affordable, yet identifying that the automobile will remain a significant mode of transport but will be one of many effective choices, like walking and cycling.

These policies and visions are important to enforce because the Greater Golden Horseshoe is one of the fastest growing regions in all of North America. The population is expected to grow by an additional 3.7 million (from 2001) to 11.5 million by 2031. This growth will account for 80 per cent of Ontario's population growth. The magnitude of this growth means that careful development choices must be made. TOD can recognizably become a key focus in helping to manage this extensive urban growth. The focus on transit is reflected in the statements of the Plan, it envisions the increase of intensification in existing built-up areas with focuses on urban growth centres, intensification corridors, major transit station areas,

brownfield sites and greyfields. The Plan also states that allowing for this concentration of new development in these areas and creating revitalization of urban growth centres will help to accommodate the growth of additional people and create centres that can be meeting places, public institutions, and transit hubs. Each centre has the potential to be a mixed-use and transit-supportive community.

The implementation of TOD can be a realistic solution that can address the statements and visions of the Growth Plan, 2006 and the City of Toronto Official Plan that stresses "growth must be directed to transit-accessible locations that can best accommodate population growth and employment growth". Certain areas within the City of Toronto have successfully addressed the challenge of growth, nodes such as the North York Centre have benefited from the region's growth, while other areas have stagnated or declined (Nieweller, 2004). There are currently areas in parts of Scarborough and North York where many greyfield and brownfield sites are located near good existing and future transit locations (*ibid.*). These areas have great potential for TOD, especially along the Sheppard transit corridor and the proposed extensions that are being considered for this line. There is also existing infrastructure in many areas along the Sheppard line that can be maximized and revitalized to create new transit areas that support all or most of the characteristics of TOD.

If TOD is going to be a realized smart development opportunity, especially in Toronto, a city that is facing challenges to growing congestion, there is a need for a substantial mechanism that can evaluate the sustainability of TOD developments, not only in Toronto but other similar major cities as well.

DEFINING TRANSIT ORIENTED DEVELOPMENT

Despite the many adopted definitions, Peter Calthorpe, an architect and New Urbanist, founded one of the original definitions of TOD. Calthorpe's "The Next American Metropolis" was the first book to define TOD. As illustrated in *Figure 2*, Calthorpe (1993) describes TODs as:

> *A mixed-use community within an average 2,000-foot walking distance of a transit stop and a core commercial area. TODs mix residential, retail, office, open space and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot or car. (p.56)*

According to Calthorpe (1993), the Integration of transportation and land use as illustrated in *Figure 2* is a key factor in TOD. Commercial, employment and residential uses, along with public spaces and a transit stop are each located with a periphery of no greater than 2000 feet. When referring to "transit" in TOD, it includes a variety of modes and systems that can be found in many cities. These include: heavy rail (suburban and urban), light rail transit (LRT), streetcar, bus rapid transit (BRT) and express bus (Muley, 2011). Calthorpe (1993) asserts that a 600 metre walking distance to a transit station is a walking distance that is ideal and comfortable.

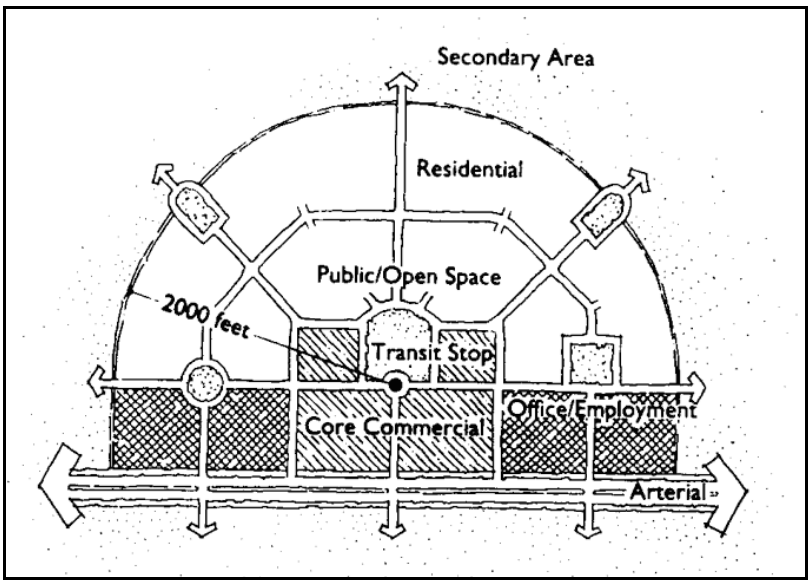


Figure 2: Diagram of Peter Calthorpe's illustration of Transit Oriented Development.
Source: The Next American Metropolis, Ecology, Community and the American Dream (1993).

Since a universal definition does not exist, the precise definition of a TOD can vary throughout the literature; however the common understanding of what a TOD is and what it achieves can be defined by other academics as: mixed-used, high-density development activity that is oriented to a transit station, whether existing or planned, that is pedestrian-oriented and located within a five to fifteen minute walk of a transit station (Goodwill and Hendricks, 2002; Renne and Wells, 2003; Venner and Ecola, 2007). TOD is also seen as a sustainable form of development that is known to enhance other forms of mobility by decreasing the reliance on the automobile and encouraging transit use, walking and biking (Goodwill and Hendricks, 2002; Renne and Wells, 2003). This also relates to the definition of TOD through a transit

perspective, the urban opportunities that exist from TOD are significant. TOD builds transit ridership, provides an alternative to driving, enhances service and enriches existing and future neighbourhoods (Dunphy, 2005).

Many definitions relate to smart-growth and sustainability principles while others focus strictly on design characteristics. Calthorpe who has been influential among planners since the beginning of the 1990s, has established urban design principles associated with TOD (Dittmar and Ohland, 2004). Recognizing the principles of TOD is an effective way to understand what TOD is and what it aims to accomplish. In summary, Calthorpe's principles of TOD in *The Next American Metropolis* include: regional growth that is compact and transit-supportive; housing, jobs, retail and public amenities are located in walking distance to a transit stop with pedestrian-friendly street networks; housing is provided in a mix of types, densities and costs; high quality open space is preserved that is sensitive to habitat; and lastly, infill and redevelopment are encouraged and executed along transit corridors within existing neighbourhoods (Dittmar and Ohland, 2004).

Although built form is not the only necessary element that needs careful consideration when developing TODs, there are definitions that focus solely on built form rather than sustainability and urban design. Cervero

and Kockelman (1997) describe how new urbanism and transit oriented development share three transportation objectives: 1) reduce the number of motorized trips, known as trip degeneration; 2) increase the share of trips that are non-motorized; and 3) reduce travel distances and increase vehicle occupancy levels, this encourages shorter trips and more travel through transit and ride-sharing. They also emphasize that new urbanists have argued for changing the three dimensions of the built environment, they call this the 3Ds – density, diversity and design – these 3Ds are what will achieve the objectives set out above.

Overall, TOD can be defined by its form and design, its functions and objectives or through its sustainable qualities. With the great range of definitions there is also a range of common typologies of TODs that will be outlined in the next section. However, regardless of how TOD is defined and its characteristics that form its typologies the subsequent sections of this report will summarize the common benefits that are sought and challenges that arise despite definition and type.

TOD TYPOLOGIES

TOD types depend upon the mix of uses and intensities and densities located within the development but also depend on present or planned transit types and community context (Renaissance Planning Group, 2011). As an example, a commuter TOD connecting outer neighbourhoods to a downtown core may be residentially rich, minimally dense with large parking supply. While in contrast an urban core TOD would instead be rich in office and employment, have greater densities and intensities of development and contain very little parking supply. It is important to classify and identify TODs at its different levels since their attributes vary depending on their placement within regions, communities or neighbourhoods. Dittmar and Ohland (2004) establish various characteristics of TODs and how they take form. The various TOD types encompass urban and suburban land uses, they include: urban downtown, urban neighbourhood, suburban centre, suburban neighbourhood, neighbourhood transit zone and commuter town centre. The typologies have been broken down into four categories in order give an overview of the characteristics that generally shape the design and functionality of TODs dependent on land use.

URBAN TYPOLOGIES

The urban typologies that Dittmar and Ohland (2004) have identified above, usually contain a land-use mix of primary office, urban entertainment, multifamily housing and retail with a housing density between 20-60 units per acre or more. Because of such high densities, these core urban areas are able to accommodate a substantial growth of jobs and housing (Futurewise, 2009). These urban types provide 18-24 hour, well-connected multi-modal transit service (*ibid.*). The regional connectivity of urban typologies is medium to high with all transit modes found in the urban downtown and all but heavy rail found in the urban neighbourhood (Dittmar and Ohland, 2004). The dense, well-connected street grids that support mobility and the high quality public realm of these typologies are illustrated in *Figures 3 and 4*.

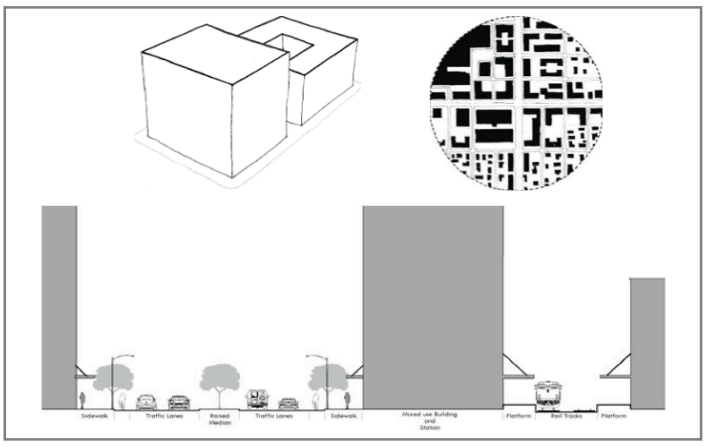


Figure 3: Urban form of a Regional Centre typology that includes downtown urban cores.
Source: Renaissance Planning Group (2011)

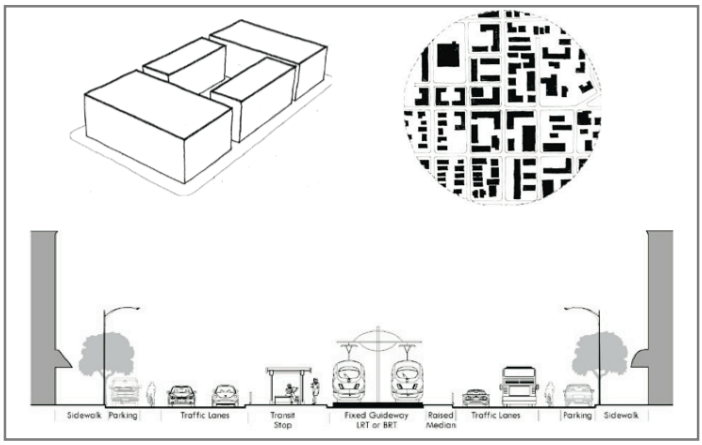


Figure 4: Urban form of a Community Centre typology that includes urban and town centres.
Source: Renaissance Planning Group (2011)

SUBURBAN TYPOLOGIES

The suburban centre and the suburban neighbourhood do not contain many similarities compared to the urban typologies. The suburban centre contains primary office, entertainment and retail uses with multifamily housing; while the suburban neighbourhood contains only local retail and local office. The housing densities of each of these typologies are quite different as well. The suburban centre could contain a minimum density of 50 units per acre or more while only a minimum of 12 units per acre can be found in a suburban neighbourhood typology. Transit frequencies are greater in the suburban centre as well, providing high access to urban and regional hubs.

NEIGHBOURHOOD TYPOLOGIES

Neighbourhood Transit Zones (as illustrated in *Figure 5*) are dominated by residential uses and contain some neighbourhood local retail. Neighbourhood types can be found in older urban areas or newer suburban developments (Renaissance Planning Group, 2011). The minimum housing densities are the lowest of all the TOD types,

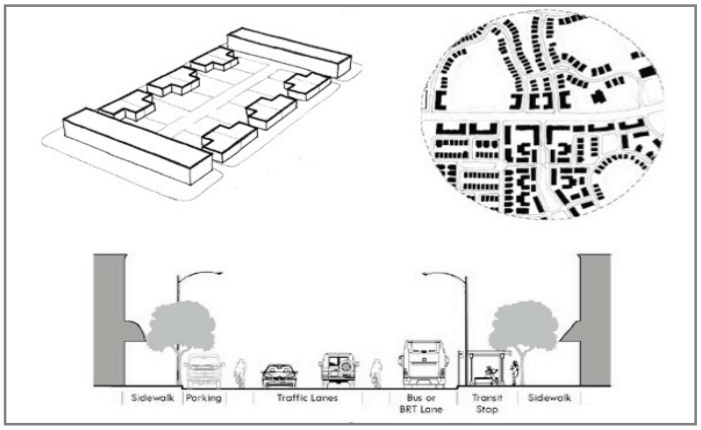


Figure 5: Urban form of a Neighbourhood Centre typology, that is dominated by residential uses.
Source: Renaissance Planning Group (2011)

with only a minimum of 7 units per acre dominated by townhomes and single-family homes (Dittmar and Ohland, 2004). The regional connectivity of this typology is very low and transit frequencies (mainly bus modes) are generally between 20-30 minutes dependent upon demand (*ibid.*).

COMMUTER TOWN CENTRE

Commuter station areas are generally situated along the periphery of a metropolitan core, and sited along highway corridors limiting the opportunities to create a vibrant neighbourhood centre around the station (Futurewise, 2009). This typology may contain a retail centre and a high degree of surrounding residential land uses. It is rather similar to neighbourhood typologies because of its lack of land uses, low densities and housing types (Dittmar and Ohland, 2004). The Commuter Town Centre generally contains a minimum of 12 units per acre with a mix of townhomes, single-family homes and multifamily. With commuter rail and rapid bus as transit modes, regional connectivity is still low within this TOD type (*ibid.*). Additionally, commuter types have insufficient street connectivity for walking and biking since primary station access tends to be via park and ride facilities or through feeder bus services. Transit frequencies are demand responsive and are only high during peak hours. Overall, the commuter town centre ranks very low in terms of land use

and connectivity in comparison to other typologies, as demonstrated by the matrix in *Figure* 6.

It is evident that TOD types are unique and encompass several distinct neighbourhoods, land uses, topographies and patterns but it has been stated that for the purposes of measuring the performance of TODs, a comparative model, like the matrix seen below in *Figure* 6 makes it easier to do so (Futurewise, 2009).

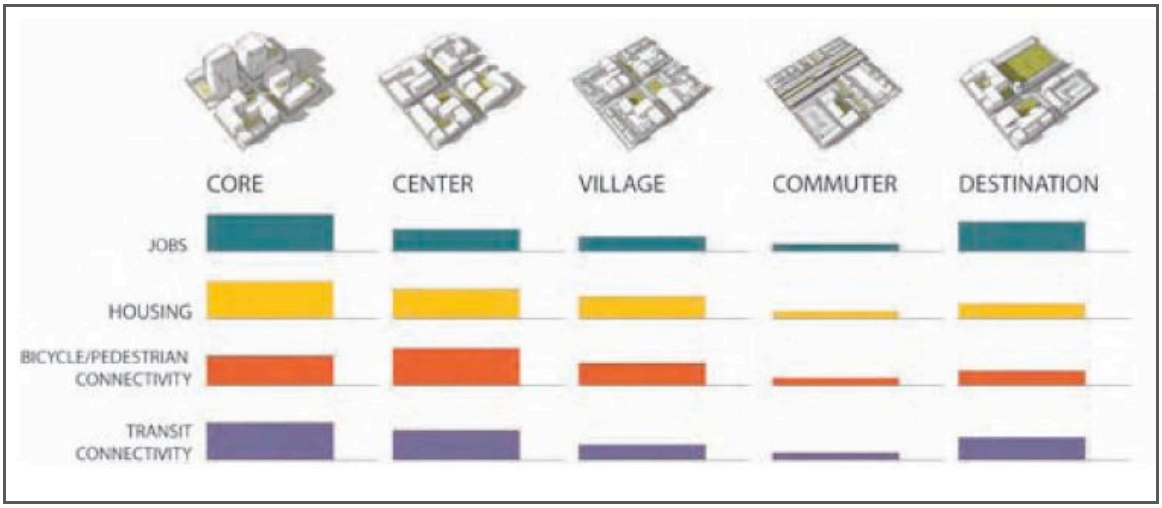


Figure 6: Station Area Typology
Source: Futurewise's Transit-Oriented Communities Program www.futurewise.org/toc

This typology matrix was informed by the typologies just described from Dittmar and Ohland's *The New Transit Town*. The comparison of typologies across the matrix helps to evaluate and understand the differences between station areas and can also help predict what types will perform highly on various social and environmental outcomes.

As this section demonstrates, many land use and infrastructure characteristics influence the types of TODs that exist. It can be concluded that performance measures tend to be weakened depending on the types of TODs being analyzed. It would be expected that some TODs would perform more highly than others based on certain attributes like intense land uses and better infrastructure, however, other social and environmental indicators may fall short. It is important to acknowledge that station areas are not static; with changing policies, infrastructure investments and shifting demographics there will always be a need for performance goals and measures to help inform and encourage high performance TODs.

THE GROWTH OF TOD

TOD became a prominent area of focus during the mid-1990s when the debate around smart growth was occurring. However, TOD has roots dating back much further in Toronto when development nodes evolved around transit. During the 1800s corridors evolved around streetcar lines, these areas were dense, diverse, pedestrian friendly and most importantly supportive of transit (Canadian Urban Transit Association, 2004). Streetcar suburbs expanded throughout Toronto during the first three decades of the 20th century. Prime examples of these suburbs include: The Upper and Lower Beaches, The Danforth, Bloor-West Village, and St. Clair Avenue West (Gormick, 2004). Streetcar lines and the adjacent residential communities were typically developed by a single owner who built transit to add value to the residential development, in doing so, residents were provided with a link between jobs at the urban centre and the residential communities in the peripheries (Belzer and Autler, 2002a). Much of Toronto's established stable residential and retail districts developed because of the expanding streetcar network (Gormick, 2004). The connections between jobs, shopping, schools, medical services, and entertainment made these areas viable and attractive (*ibid.*). During this time, transit was built to serve the developments of private developers; therefore, 'development oriented transit' is a phrase that best suits this time period, transit was considered an enabler for real estate

development (Belzer and Autler, 2002a; Carlton, 2007). Certainly, the idea that transit might orient development or vice versa is not new (Carlton, 2007). It is quite evident that the streetcar suburbs of this era are early illustrations of what cities are now calling TOD; it is simply a revival of past practices.

The streetcar suburb era reached its decline with the rise of the automobile. The dominance of the automobile drew ridership away, while at the same time, encouraged outer suburban development (Gormick, 2004). Transit ridership fell dramatically across North America during the period of 1945-1975 (*ibid.*). The change in preference of transportation resulted in the end of a relationship between development and transit (Belzer and Autler, 2002a). Development could no longer depend on transit and so developers did not continue with the business of building transportation systems. Congestion worsened throughout North American cities and even though buses and underground rail were still in operation the stations that were built had little regard for the local place (*ibid.*). Evident still today, many stations were characterized by large amounts of parking which did not provide any added value to creating connections and vibrant neighbourhoods. This era is commonly referred to as 'Auto-Oriented Development' (Carlton, 2007). It was not until after

this failure that transit agencies began to learn that they could lease their land to generate revenue.

Throughout the 1970s and 1980s great attention was given to lease revenue as a development financial tool (Carlton, 2007). This form of development known as 'Transit-Related Development' played a prominent role throughout the 1990s; it was a form of profitable real estate development that generated revenue for transit agencies. Belzer and Autler (2002a), describe that this type of development is problematic in terms of trying to define a relationship between transit and development since projects during this era were based purely on financial rationale; this ignored any sustainable transport principles that are evident today.

In recent years, transit agencies have looked far beyond the financial return of projects, this change in perspective is due to increased evidence of the benefits yielded from the relationship between transit and development (Belzer and Autler, 2002a). Today, TOD is viewed as a way to get more out of transit investments by increasing ridership on transit corridors within lower density areas. TOD is now commonly being considered as a smart growth tool. Projects have recently been underway all across North America (Canadian Urban Transit Association, 2004). At present, there is a re-emphasis on the relationship between

transit and development, although decisions-makers, developers, local and regional governments need to stray from their conventional ideas of what this type of relationship has offered in the past and instead realize the additional possibilities that can be achieved.

This long history of efforts to improve accessibility and the environment through compact development at transit stations can be linked to various potential benefits, as well as, challenges.

POTENTIAL BENEFITS OF TOD

Belzer and Autler (2002a), identify a number of trends that have occurred in the last decade through the growing shifts in the landscape of transit and development. The paper recognizes: growing transit ridership, increased investment in transit (even in traditionally auto-dominated cities), greater recognition of the advantages of linking development and transit. However, the article also makes note that over the course of research it has been brought to light that there is minimal understanding of the full range of benefits that can be achieved with TOD. An article in *Development Magazine* (2000), written in a developer's perspective, has also acknowledged that TOD may be one of the least understood and most underused forms of development that boasts the highest potential. The lack of understanding of potential benefits is reflected in projects that appear unambitious in their efforts or projects that have an overly narrow view of the range of possible benefits (Belzer and Autler, 2002a).

Additionally, Belzer and Autler (2002a) have recognized that, TOD can work in a beneficial way and can realize its full potentials if it is not considered a utopian vision; it must instead operate within the constraints of the market and realistic expectations of behavior and lifestyle patterns. TOD must be flexible to the market and lifestyle patterns that are ever

changing, as well, policy choices and socio-cultural trends dictate the forms TOD may take.

TODs can provide benefits regionally, locally and on an individual basis (Holmes and van Hemert, 2008). The potential benefits are spread amongst, the transit agency, local governments, society and individuals who live and work within the TOD area (Goodwill and Hendricks, 2002). Governments benefit financially from TOD at the local level in several ways. TOD areas promote local businesses and retail, which in turn increases retail sales. The increases in property value that stems from public investment in new transit routes can be captured, while also, the increase in economic activity, creates a larger tax base for local governments. Lastly, it has been found that TODs can reduce infrastructure costs for local governments up to 25%. The compactness and high density of TODs lowers infrastructure costs that are often associated with dispersed development (like roads, parking facilities, schools, sewer and water lines etc.) (Canadian Urban Transit Association, 2004; Goodwill and Hendricks, 2002; Holmes and van Hemert, 2008; Renne and Wells, 2005).

In addition to economic benefits, TODs provide environmentally sustainable modes of transport resulting in many indirect environmental

benefits. The Canadian Urban Transit Association (2004) has identified that the public will benefit indirectly from: reduced traffic congestion, fuel consumption, pollution, sprawl and preserved open space. Well connected, compact environments with a mix of land uses helps to encourage more walking and biking trips. The clustering of commercial and public services near transit within walking distance of where people live and work will help to decrease the demand of the automobile, reducing overall traffic congestion (Goodwill and Hendricks, 2002). However, this also reduces the need to travel outside of the TOD area leading to environmental benefits like decreased pollution and improved air quality (*ibid.*). In Cevero's (1994) study on ridership impacts in Californian TODs, it was concluded that residents living in TODs were five times more likely to commute by transit compared to suburban residents. The Puget Sound Regional Council in their Transit-Oriented Development Workbook have also indicated that residents living near transit stations are five to six times more likely to use transit to commute to work than other residents also living within the region. This evidence appears to support indications that TODs help to shift modal patterns and steer people away from the automobile toward more sustainable forms of travel, such as walking, transit or cycling; in turn creating environmental benefits and healthy communities.

Finally, residents living within TOD environments can realize the many social benefits that exist due to compact development, integrated land uses and pedestrian friendly environments. There is a tradeoff when living within TODs, higher density in exchange for greater access, this means greater access to amenities with pedestrian-friendly shopping streets, and better public spaces to compensate for a lack of private space (Belzer and Autler, 2002b). This increased access is especially a societal benefit for people of lower incomes and transit-dependent people who tend to be heavy transit users (TDM Encyclopedia, Victoria Transport Policy Institute, 2011). However this access is not limited to the TOD itself, having transit facilities nearby helps to connect residents to the greater region as well.

Another claimed societal advantage of TODs is that they can bring together a mix of people from diverse backgrounds into one vibrant community (Bernick and Cervero, 1997). This can be achieved through various housing choices, including affordable housing, located within the same development, such as single-family homes and townhomes, which are developed alongside apartments and condominiums (Belzer and Autler, 2002b). Aside from the housing mix, the mix of housing with employment, retail and recreational uses diversifies the types of movement all in one area while also reestablishing places where people

can congregate and develop a sense of community (Brinklow, 2010; Goodwill and Hendricks, 2002).

POTENTIAL BARRIERS OF TOD

One main challenge of TOD is that there lacks a clear and precise definition, confusion of the concept has become an issue because TOD has been used to describe developments with very limited access to transit (Belzer and Autler, 2002b; Carlton, 2007). Belzer and Autler (2002b) claim that the absence of an global definition exacerbates the overall challenges toward implementation because there is no real agreement about what TOD should functionally accomplish. The reprecussion of this is that there is no framework that can be developed to weigh trade-offs in order to make choices about how to balance TOD goals (Belzer and Autler, 2002b).

TODs come together through the involvement of a broad range of staekholders, such as: local governments, developers, lenders, community groups, transit agencies and often times federal governments who help to fund the transit; this creates great complexity when implementing these types of projects (Belzer and Autler, 2002a). Even when projects set standards and aim towards achieving all potential benefits, the multifaceted arrangement of execution for these projects can be quite discouraging (*ibid.*). This participation of many more staekholders than a typical residential development is a hard enough challenge of its own, especially when each stakeholder brings their own set of goals to the

negotiating table (Belzer and Autler, 2002b; Carlton, 2007). The goals of each actor are often disparate and are constantly running parallel to each other (Belzer and Autler, 2002b). The goals are obvious to suit the needs of each individual actor, for example, transit agencies are generally concerned with maximizing revenue from joint development projects on their property, while residents and community groups may have goals to limit local traffic within the community.

Additionally, TOD also calls for a mix of uses, which requires multiple skill sets and commingles different risk profiles in a single project (Carlton, 2007). This adds another level to the complicated arrangement of actors. Lack of on the ground projects that demonstrate how this type of mix-used TOD can work successfully (Renne and Newman, 2002). This lack of built success is what reserves developers from building TOD projects more frequently. The risks associated with TOD relative to other conventional developments are too great, since market flows toward profit and the returns on TOD are not quite proven, creating a heavy deterrent for developers who believe they are at risk (Carlton, 2007). Because of this unproven market, financiers tend to stay with conventional developments that have been proven successful more often than not (Renne and Newman, 2002).

The third main challenge of TOD is the fragmented regulatory, institutional and policy environment that exists in many cities. This lack of collaboration among governments and angencies creates another deterrent for developers (Belzer and Autler, 2002b, Renne, 2005). It is difficult for projects to move forward in the planning process with an environment which is complex and has contradictory regulations (Belzer and Autler, 2002b). From a local government survey conducted in Western Australia, it was determined that the highest related impediment of TOD was a lack of collaboration among governments and agencies and that greater collaboration was needed (Renne, 2005).

Identifying the benefits and barriers of TOD is crucial for developing a set of objectives that aim to create the most benefits possible. However, when focusing on the physical aspects of TOD, such as high density served by transit this leads to a 'binary notion of success or failure', as Belzer and Autler (2002b) describe it. Many have recognized that there are no straight-forward standards or systems that exist to measure the different degrees of success by a way of performance standards and outcomes (Belzer and Autler, 2002b; Carlton, 2007; Renne and Wells, 2005).

Other challenges that exist that planners and developers face while attempting to develop successful TODs have been identified by the Canadian Mortgage and Housing Corporation (CMHC). Local community concerns or better known as NIMBYism generates resistance to increased density and a perception that transit stations will increase traffic. This can cause project delays, increased costs and essentially block projects from being developed. Other challenges that were identified include: zoning that is not supportive of transit oriented uses or densities; the existing conditions of communities are not conducive to transit ridership due to street patterns, pedestrian links, density and land use mix; developments near traffic corridors, bus and rail lines may require special design features in order to control vibration and noise; and lastly transit authority policies and rules may restrict certain land uses or require car-oriented design, which leads to an oversupply parking. CMHC (2009) confirmed that in the Canadian TOD case studies that were researched, the challenges that were identified were either overcome or not encountered, however, transit station design was a on-going challenge in most case studies.

ASSESSING TODS

THE LACK OF EFFECTIVE ASSESSMENTS

Much research has attempted to develop a concrete framework that would effectively measure the outcomes of TOD. A review of current evaluation methodologies for TOD by Niles and Nelson (1999a) has indicated that all have revealed limitations. Another study has concluded that little empirical research has been conducted that holistically measures TOD outcomes (Renne and Wells, 2005). This study indicates that investment in any type of infrastructure is often made without fully understanding the outcomes. Renne and Wells (2005) make clear that few planners and policymakers evaluate the successes or failures of projects and this leads to poor decision-making and a continued cycle of mistakes. Belzer and Autler (2002b) agree that functional outcomes should be the focus of TOD leading to better judgment of the success of TOD projects on the basis of their ability to provide measureable benefits. This leads to the argument that techniques to define performance outcomes of TODs should look beyond the physical elements of design standards and instead combine this with standards that are more functional and that focus on the sustainability goals of TOD. Additionally, Renne and Wells (2005) assert that objective measures can be established to examine both the positive and negative outcomes of TOD, and without indicators, success cannot be truly measured. What can be determined

from the study of literature by Deepti (2011) is that no performance measure framework is thoroughly effective; there still remain flaws in attempting to collect all the data necessary for measurement. However, studies have directed attention to assessing TODs in a more holistic manner, which helps to provide a framework that outlines performance outcomes that are not necessarily based on design principles.

In the table below, Niles and Nelson (1999b) have identified a number of factors that determine the success of TODs.

FACTOR	**Station-area**	**Regional success**
Number of TODs (& station areas)		X
Transit quality		X
Transit technology		X
Street pattern	X	X
Station-area parking	X	X
Employment and housing density	X	X
Commercial mix	X	X
Retail siting criteria		X
Regional market structure		X
Consumer activity patterns		X
Travel behavior/trip chaining		X
Zoning flexibility		X
Resident reactions	X	X
Housing type preference/life style & life stage		X
Self-selection in residential choice	X	X
Government policies		

Table 1: Factors determining the success of TOD Source: Niles and Nelson (1999b)

Similarly, as expressed in *Table 2*, Muley (2011) has selected appropriate TOD measures that should be used when assessing the suitability of a TOD.

TOD attribute	Measure of assessment
Land use mix	Presence of diverse land uses, self containment
Road infrastructure	Layout of road network, its quality and connectivity to major transport corridors
Infrastructure for walking	Provision of sidewalks, quality of sidewalks and secured pedestrian crossings
Infrastructure for cycling	Dedicated bicycle tracks or bicycle lanes, its connectivity to bicycle network and secured parking for bicycles
Location of nearest public transit node	Major public transport node accessible within easily walkable distance (400m)
Quality of public transport	Level of service for transit availability and comfort and convenience
Parking supply	Optimum parking supply

Table 2: Measures for Assessing the Suitability of TOD
Source: Muley (2011)

The factors listed in both *Table 1* and *Table 2* exhibit some elements that reach beyond design; although design and physical attributes play a substantial role within these methods there is little that establishes other sustainable factors. However, by analyzing these factors it helps to recognize that the successful outcomes of TOD should contain environmental, economic and social sustainability goals in addition to physical design goals.

Once again, assessing TODs needs to be pushed further than simply using good physical design principles to measure performance outcomes. Belzer and Autler (2002a and 2002b) have developed three key performance criteria; the proposed framework focuses on the outcomes

and goals of TOD that are non-design related but rather relate directly to sustainability principles. The outcomes and goals include: location efficiency, choice and value recapture/financial return.

Location efficiency simply converts driving from a necessity into an option; it has the ability to minimize automobile dependence. Location efficiency requires that neighbourhoods provide high-quality transit, a mix of uses, as well as, pedestrian-friendly design. Other critical factors of location efficiency include net residential density, transit frequency and quality, access to community amenities and high quality pedestrian environments. Although, there has been little evidence or research on the ability of location-efficiency to affect travel behavior, as Belzer and Autler (2002a) clarify, it does not undermine TOD and location-efficient neighbourhoods. They emphasize that the main outcome to identify is choice; location efficient neighbourhoods make these choices possible whereas other conventional developments do not. This performance outcome can be quantified through measures such as parking demand, automobile ownership, mode split and vehicle miles travelled. Belzer and Autler (2002b) indicate that if benefits are not yielded in these areas, it is difficult to reinforce that TOD is meaningful.

Providing choice in housing, mobility and shopping creates an effective neighbourhood TOD. "TOD involves function far more than form" (Belzer and Autler, 2002a, Pg. 14), choice and various options are the functional objectives of TOD. TOD can provide a broad range of options by offering internal diversity to a development. Instead of residents having no choice but to live in a single-family home, shop at auto-oriented retail centres, drive to work, drive their children to activities, TOD can provide alternative options to this (Belzer and Autler, 2002a). TOD makes available apartments, town homes and single-family homes that accommodate most family structures, income levels and life stages. It can also allow residents the choice of small retail shops, specialty shops and larger retail outlets all in one place but it also provides the opportunity to travel by foot , bicycle or on transit.

Finally, Belzer and Autler (2002a and 2002b) describe value recapture/financial return as the outcome that can create value for developers, communities and households. For developers, TOD is financially viable and profitable because projects generally require less costly parking which in turn lowers construction costs. Also, these savings from reduced parking costs can be captured by households as well as local governments. For individuals, households and communities lower transportation spending and housing costs are financial benefits.

Residents of denser, transit rich neighbourhoods spend less on automobile transportation.

Further to Belzer and Autler's (2002a and 2002b) performance criteria that can be used to evaluate a projects function and outcome, Renne (2009) developed a method to evaluate the sustainability of TODs based on aspects of outcomes; these included: travel behaviour, the local economy, the natural environment, the built environment, the social environment and the policy context. He states that economic, environmental and social goals are all inherent in land use and transport policies. This clarifies that TODs involve much more than design. Design must cross boundaries with elements, like those that Renne (2009) has framed in order to better assess TODs and encourage sustainable development.

A RECOMMENDATION FOR LEED-ND TO HELP GUIDE THE OBJECTIVES OF TOD

TOD has become a tool that has grown out of smart growth and new urbanist movements that shares much of the same goals. TOD has sought to promote the basic concepts of new urbanism (Renne and Wells, 2005). While it has also been said that smart growth and new urbanism interests are shared with the green buildings movement with its standards for green building in Leadership in Energy and Environmental Design (LEED) (Milosovicova, 2008 cited Farr, 2008). Smart growth aims to take advantage of compact building design so that natural areas can be preserved. New urbanism is focused on creating walkable and mixed-use neighbourhoods. While green buildings are concerned with the urban heat island effects, stormwater filtration and the cost of a buildings' life cycle (*ibid.*). Even though each movement differs in their history, approach and focus, they are mutually concerned with economic, social and environmental reform (*ibid.*).

The smart growth, new urbanism and green building movements on their own are only considered essential stepping-stones. A recommendation has been formed that considers using the movements as a cooperative whole, that provides a new framework that will encourage and support a truly sustainable lifestyle that will build upon the principles of all three movements (Milosovicova, 2008 cited Farr, 2008). It is the term sustainable

urbanism that brings together all three movements into a healthier lifestyle, one where communities are well designed for a high quality of life because people have the choice to meet their daily needs on foot and transit (Milosovicova, 2008).

Integrating the features and benefits of urbanism with those of environmentalism has always been a struggle yet a demand for many communities and developments (Milosovicova, 2008 cited Farr, 2008). However, this integration is yet to develop, as a consensus on a unified standard is something that urbanists and environmentalists cannot agree upon. Urbanists resist environmental performance and in turn environmentalists oppose urbanist developments (*ibid.*).

Attempting to create a standard that will merge the benefits and features of the various movements into a cohesive whole can be a challenge. However, LEED-ND is believed to be the initiative that will achieve this. LEED-ND expands upon the focus of LEED and broadens its scope by looking beyond the scale of the individual building and instead looks to address infrastructure and entire neighbourhood-scale developments (Milosovicova, 2008).

Other sources have emphasized that LEED-ND can become the next step for TOD (American Public Transit Association, 2009; Carlton, 2007; Canada Mortgage and Housing Corporation, 2009). TOD features and objectives can be achieved through LEED-ND while also being able to meet municipal objectives for sustainable growth management, contributing to vibrant, liveable and walkable neighbourhoods (Canada Mortgage and Housing Corporation, 2009). LEED-ND is a standard that defines what constitutes smart, sustainable land development (Milosovicova, 2008 cited Farr, 2008). Developers, planners and local officials can take advantage of this rating system and help TOD become part of new and existing neighbourhoods.

LEED-ND has innovatively merged social issues such as housing diversity, affordable housing, and community participation with urban design attributes such as walkability, connectivity and a mix of uses into a neighbourhood-scale rating system. Each of these issues plays a role in making TODs effective and sustainably valuable. It is estimated that 2.6 billion people worldwide will be housed in new developments (Milosovicova, 2008 cited Farr, 2008). It is a challenge to build every project in North America to sustainable urbanist principles. What is even more difficult is integrating the human and natural systems of sustainable urbanism when a specific framework is unwritten (*ibid.*).

With LEED-ND, TOD goals can be realized, giving interdisciplinary stakeholders like planners, engineers, architects and developers an enticing and helpful benchmark that can reform the perceptions of TODs and influence the planning and development communities and guide its development into the future. It has been summarized by the Director of the New Urbanism and the Natural Resources Defense Council (NRDC) Smart Growth Program that the pilot projects initiated through LEED-ND have been overwhelmingly located in more urban and more transit-accessible places with a decrease in driving rates than average neighbourhoods (Carlton, 2007 cited Benfield). This is said to be encouraging news, in particular for future TODs (Carlton, 2007). However, it must also be recognized that there are some aspects of the standards within the LEED-ND rating system that limit the TOD goals that can ultimately be achieved.

The following sections outline the LEED-ND system and provide insight into how TOD goals and barriers are addressed within this initiative. As well, the barriers that exist within the system will be touched upon.

THE CONTEXT OF LEED-ND

The original LEED initiative was formed by the committee of the U.S. Green

Building Council (USGBC), its first pilot project was launched in 1998 and since then, LEED has become the most widely-used green building certification system in the United States (Natural Resources Defense Council, 2011). LEED made its way to Canada and the rest of the world, as of the beginning of 2011, there were more than 7,000 LEED-certified projects in the United States, as well as around the world, there was also approximately 23,000 more registered projects awaiting future certification (*ibid.*). In 2003, plans began to construct a similar system that builds on the concepts of LEED, but instead on a neighbourhood scale. After numerous pilot programs (many found in Canada, see *Table 3*), LEED-ND was fully launched in 2010.

The development of LEED-ND in Canada was through the collaboration between the U.S. Green Building Council and the Canada Green Building Council (CaGBC) to develop the Canadian Alternative Compliance Paths (ACPs) for the LEED-ND rating

Number of Registered Pilot Projects in Canada as of June 3, 2009: 24
Number of Provinces with Pilots: 4

Locations:

Batawa Community	Quinte West	ON
CFB Rockcliffe Redevelopment	Ottawa	ON
Currie Barracks	Calgary	AB
Dockside Green	Victoria	BC
Eco-Quartier, St-Marc Sur Richelieu	St-Marc Sur Richelieu	QC
Faubourg Boisbriand	Boisbriand	QC
Garrison Crossing	Chilliwack	BC
Harmony	Md Of Rocky View	AB
Metrogate	Toronto	ON
North Oakville East Secondary Plan	Oakville	ON
Preston Meadows	Cambridge	ON
Quartier Sur Le Fleuve	Montreal	QC
Rainbow Hill	Victoria	BC
Southeast False Creek Neighbourhood	Vancouver	BC
Squamish Waterfront	Squamish	BC
Strathearn Masterplan	Edmonton	AB
Technopole Angus	Montreal	QC
The Village at Griesbach, Stage 8	Edmonton	AB
Toronto Waterfront Area 1	Toronto	ON
Twinhills - Sustainable Tod Greenfield	Calgary	AB
UdeM - Campus Outremont	Montreal	QC
Wesbrook Place Neighbourhood Plan	Vancouver	BC
Westhills Green Community	Langford	BC
Whistler Athletes Village	Whistler	BC

Table 3: LEED-ND Pilot Projects in Canada
Source: Canada Green Building Council

system. (*ibid.*). Developing a Canadian version of LEED-ND has benefitted by the system taking into account unique attributes in the Canadian marketplace. The ACPs were also developed for Canadian LEED-ND projects in order to provide guidance for portions of the rating system that contain U.S. specific standards or wording (Congress for the New Urbanism et al., 2011).

The LEED-ND rating system is made up of prerequisites that all projects must abide by, as well as a set of credits, which are optional. There are 110 possible points that can be achieved through the five categories. The four levels of certification include: Certified (40-49 points), Silver (50-59 points), Gold (60-79 points), and Platinum (80-106 points) (Congress for the New Urbanism et al., 2011).

The prerequisites and credits are used as general statements of intent, specific performance thresholds or prescriptive measures (U.S. Green Building Council, 2012). The rating system is divided into four categories: Smart Location and Linkage, Neighbourhood Pattern and Design, Green Infrastructure and Buildings and lastly Innovation and Design Process. Smart location focuses on the location of a project where existing infrastructure exists, minimizing the need for new infrastructure and automobile use, which is the primary focus of smart growth.

Neighbourhood Pattern and Design is concerned with the walkability, land uses and urban design elements of the project, creating neighbourhood designs that are conducive to walking and transit, which are key objectives of new urbanism. The category of Green Infrastructure and Buildings encourages the design, construction and retrofit of buildings that utilize green building practices, such as energy and water efficiency. And finally, Innovation and Design Process encourages exemplary performance in the requirements set by the LEED-ND rating system and/or innovative performance in green building, smart growth or new urbanist categories that are not specifically included or addressed in the rating system (Milosovicova, 2008; U.S. Green Building Council, 2012).

Furthermore, projects may incorporate whole neighbourhoods, portions of neighbourhoods or multiple neighbourhoods. There is no minimum of maximum standards for the size of a neighbourhood, however, the committee's research has determined that a reasonable minimum size is at least two habitable buildings and an appropriate maximum size to be considered for a neighbourhood is 320 acres.

Overall, LEED-ND is a practical tool and is quite achievable in many aspects. There is a heavy emphasis on the proximity and provision of public transit and alternatives to the car (Canada Mortgage and Housing

Corporation, 2009). The transit-related credits within the rating system are significant for TOD to achieve LEED-ND while other categories help to maximize the sustainable goals of TOD as well. The following section will outline how the goals and barriers of TOD are addressed within the LEED ND system in order to help rationalize if and how this initiative can help advance the successful implementation of TOD.

REMOVING BARRIERS & REALIZING GOALS

The most appropriate categories of the LEED-ND system for TOD projects are Smart Location and Linkage (SLL) and Neighbourhood Pattern and Design (NPD). Beginning with SLL, there are obvious TOD goals that are achieved within this category, the intent of SLL is:

> *To encourage development within and near existing communities and public transit infrastructure. To encourage improvement and redevelopment of existing cities, suburbs, and towns while limiting the expansion of the development footprint in the region to appropriate circumstances.* (Congress for the New Urbanism et al., 2011, Pg. 1)

Additionally, the category intends to reduce vehicle trips and vehicle kilometres travelled (VKT). As mentioned earlier in this report, TODs aim to reduce dependence on the automobile; within this category TODs can succeed in this aspect. Based on a survey of residents of TODs in Dallas,

Fort Worth and Austin, Texas, moving into TODs decreases vehicle miles travelled by an average of 15 percent, which is about 3,500 miles per year (Clower, 2011). The SLL category has five prerequisites, one that enforces smart location; one of the options under this prerequisite ensures that the project is located on a transit corridor or a route with adequate transit service (Congress for the New Urbanism et al., 2011). Therefore, it is more than likely that a TOD can meet its main objective of maintaining a direct connection to a transit stop. This option requires that the project be located on a site with existing and/or planned transit service with at least 50 percent of the proposed dwelling units and non-residential building entrances are within a 400 metre walking distance of a bus and/or street car stops; or within a 800 metre walking distance of bus rapid transit stops, or light or heavy rail stations (*ibid.*). This enforces Calthorpe's ideals of a TOD, as previously mentioned, a 600 metre walking distance to a transit stop is most comfortable. Furthermore, SLL Credit 3: Locations with Reduced Automobile Dependence, also encourages development in locations shown to have multimodal transportation choices or reduced motor vehicle use based on, options for credit include: Transit-Served Location or Dissemination Areas with Low Automobile Mode Split or Low VKT (Congress for the New Urbanism et al., 2011).

The highest achievable credits available under SLL are for Preferred Locations. The intent of this credit is to encourage development within existing cities, suburbs and towns, to reduce development pressure beyond the limits of existing development and to conserve the natural and financial resources that are needed for the construction and maintenance of infrastructure (Congress for the New Urbanism et al., 2011). Projects are able to achieve any combination of the requirements offered, the two that relate specifically to TOD are Location Type and Connectivity. The project can be located in one of the following locations to earn credits:

1. A previously developed site that is not an adjacent site or an infill site (1 points);
2. An adjacent site that is also a previously developed site (2 points);
3. An infill site that is not previously a developed site (3 points) and
4. An infill site that is also a previously developed site (5 points) (Congress for the New Urbanism et al., 2011).

Connectivity ensures that the project is located in an area that has existing connectivity within 800 metres of the project boundary (see *Table 4*).

Intersections per square kilometre	Intersections per square mile	Points
≥ 77 and < 97	≥ 200 and < 250	1
≥ 97 and < 116	≥ 250 and < 300	2
≥ 116 and < 135	≥ 300 and < 350	3
≥ 135 and < 154	≥ 350 and < 400	4
≥ 154	≥ 400	5

Table 4: Points for Connectivity within 800 metres of a project
Source: Congress for the New Urbanism et al., 2011

Location of a project is significant in many respects. TOD embodies the goals of accommodating future growth to compact and diverse areas that are connected to regional systems, "[The goal is to] channel growth to the places that are best suited for it" (Belzer and Autler, 2002a, Pg. 16). This prerequisite of LEED-ND is an important component as the location of developments dictate how the development will ultimately function. Those located in urban areas concentrated around transit means that when a significant number of origins and destinations in the region are well linked to a station (and other surrounding communities), transit, walking and cycling become more viable options (Belzer and Autler, 2002a). This is why the SLL category is such a crucial component of LEED-ND. Creating more benefits than costs on both a regional and local scale is a main goal of TOD (Renne and Wells, 2005). TOD can only make a meaningful difference in development patterns if it reflects upon the region and not exclusively its local area (Renne and Wells, 2005 cited Dunphy, 1995). The response to this in LEED-ND is that projects also be

located adjacent to existing developed neighbourhoods with assets and connectivity.

Many projects with LEED-ND will be projects directly near transit and will be in urban areas helping to direct growth into places with existing infrastructure and amenities (Congress for the New Urbanism et al., 2011). LEED-ND is a tool that directly complements regional and provincial planning strategies. As highlighted earlier in this report the *Growth Plan* envisions the increase of intensification in existing built-up areas with focuses on urban growth centres, intensification corridors, and major transit station areas. With the LEED-ND system, TOD can be developed as an infill project, incorporated into existing urban fabrics and benefit from existing or planned transit connections, TOD intensifies urban areas that are underutilized supporting the objectives of the *Growth Plan*.

Other highlights of the SLL category include Credit 4: Bicycle Network and Storage and Credit 5: Housing and Jobs Proximity. TOD helps to facilitate the use of alternative transit modes like walking, cycling and public transit. LEED-ND helps to achieve this objective, although not a prerequisite the credit promotes bicycling and transportation efficiency, including a reduction in VKT. In order to achieve points for this credit, each project must meet one of three requirements. Each of the requirements

contributes to making cycling a viable option within the neighbourhood. The project must connect to other existing bicycle networks, ensuring that networks are in place that connect to schools, employment centres and at least ten diverse uses that are within 5 kilometres of the project boundary (Congress for the New Urbanism et al., 2011).

And finally, the last TOD applicable credit, Housing and Jobs Proximity, encourages a balanced community with a diversity of uses and employment opportunities for its residents (*ibid.*). Each of the options under this credit requires that the project be within an 800 metre walking distance of existing full-time-equivalent jobs (*ibid.*). This credit helps to establish the healthy-mix of land uses that TOD strives for.

Furthermore, this credit contains an option for a project with an Affordable Residential Component. Affordability is a main objective for TOD, as stated previously, TOD helps to meet the demand for increased housing choices and affordability in urban areas but it must be stressed that this is an option for LEED-ND and not a requirement. The case for affordable housing choices is not made an important enough factor in LEED-ND, there should be a stronger emphasis on social aspects of sustainability, as Garde (2009) emphasizes, he stresses that there should be more credits assigned to projects which incorporate affordable housing.

Others have noted that the issue of affordability becomes complicated by budgetary priorities, as building green costs extra money and affordable housing cuts developer profits there could be many competing causes (Weber, 2010 cited Sinha, 2008). Moreover, many believe that the affordability issue lay beyond the scope of LEED-ND (Weber, 2010). Therefore other measures should be explored in order to encourage this need for affordability, as it is claimed that a mix of people from diverse backgrounds is a societal advantage (Bernick and Cervero, 1997).

Moving on to the second category of LEED-ND that assists in achieving TOD objectives, Neighbourhood Pattern and Design. The first prerequisite, Walkable Streets, similar to other sections of the system, aims to reduce VKTs and promotes transportation efficiency (Congress for the New Urbanism et al., 2011). The main requirements of this prerequisite are that 90 percent of new building frontages face a public space – street, square, park or plaza – but not a parking lot, as well continuous sidewalks or equivalent all-weather provisions for walking are provided along both sides of 90 percent of streets or frontages within the project. NPD Credit 1 provides optional points regarding Walkable Streets, projects can earn up to a maximum of 12 points. Points can be obtained for minimum building façade setbacks, functional building entries at minimum average

distances, limits on lengths of blank walls along sidewalks and design of target speeds for safe pedestrian and bicycle travel.

Compact development is the second prerequisite for Neighbourhood Pattern and Design and its intent is to conserve land (Congress for the New Urbanism et al., 2011). This links quite well to the Smart Location category, as projects in urban areas should be compact with achievable densities in order to support growth strategies. Compact Development promotes walkability and transportation efficiency, as a required option projects must ensures that they are built in transit corridors as specified in SLL. They must also be built to the specified densities according to the walking distances established in the SLL category (*ibid.*). For residential components located within the walk distances, 12 or more dwelling units per acre of buildable land must be available for residential uses, for the residential components that fall outside the walk distances, 7 or more dwelling units per acre must be achieved (*ibid.*). This requirement is further detailed in NPD Credit 2 for Compact Development where one to six points can be achieved (see *Table 5*).

Residential density (DU/hectare)	Residential density (DU/acre)	Nonresidential density (FAR)	Points
> 25 and ≤ 32	> 10 and ≤ 13	> 0.75 and ≤ 1.0	1
> 32 and ≤ 45	> 13 and ≤ 18	> 1.0 and ≤ 1.25	2
> 45 and ≤ 62	> 18 and ≤ 25	> 1.25 and ≤ 1.75	3
> 62 and ≤ 94	> 25 and ≤ 38	> 1.75 and ≤ 2.25	4
> 94 and ≤ 156	> 38 and ≤ 63	> 2.25 and ≤ 3.0	5
> 156	> 63	> 3.0	6
DU = dwelling unit; FAR = floor-area ratio.			

Table 5: Points for density per acre (hectare) of buildable land
Source: Congress for the New Urbanism et al., 2011

The prerequisites and credits just explained assist TODs in achieving compact, walkable neighbourhoods. Studies in various metro areas have shown that denser residential development within an easy walk of a TOD centre and transit station will generate more walk trips, which may substitute for vehicle trips (Niles and Nelson, 1999 cited Moudon et al., 1997; Cervero and Kockelman, 1997). Street patterns help to support TOD objectives through sidewalks and streetscapes that encourage walking and narrow streets and other traffic calming features that discourage driving (Niles and Nelson, 1999). Studies on these aspects of TODs have suggested positive impacts have resulted from these elements (Niles and Nelson, 1999 cited Crane and Crepeau, 1998; Boarnet and Sarimento, 1996).

Mixed-Use Neighbourhood Centres is Credit 3 of the NPD category. The credit aims to cluster diverse land uses in accessible neighbourhood and regional centres to encourage daily walking, biking and transit use

(Congress for the New Urbanism et al., 2011). The requirement for all projects aiming to achieve this credit is to locate and/or design the project such that 50 percent of its dwelling units are within a 400 metre walking distance of a particular number of diverse uses which are set out depending on square footage (*ibid.*). The diverse uses must be at least one Food Retail store and at least one other establishment from each of two other categories, Community-Serving Retail, Services or Civic and Community Facilities. It is stated that mixed-use as well as single use projects can fare well in the LEED-ND program (National Resources Defense Council, 2012). However, single-use projects are not an objective of TOD, the Mixed-Use Credit has been criticized for not having a baseline mixed-use standard as a prerequisite (Benfield, 2009). Separation of land-uses are the effects of sprawl and smart growth initiatives, like TOD, are trying to address this issue by creating neighbourhoods with diverse functions, either existing or newly built. Therefore, attempting to enforce that each project maintain a level of diverse uses creates a challenge because it is not a prerequisite that must be met. The land use mix at a TOD is important, especially for integrating various activity nodes by providing greater accessibility. The diverse land uses produce and attract various trip types (Muley, 2011) and so the objective of TOD will not always be met if the requirement is only optional, this must be noted since it has

been recognized that various trip types are found when several types land uses are combined.

A Reduced Parking Footprint, which is Credit 5 of the NPD category, is vital to one of the many successes of TODs, this is because large numbers of parking spaces may attract, or produce, more car trips which in turn would lessen the objective of a pedestrian friendly neighbourhood, defeating the overall purpose of a TOD (Muley, 2011). The intent of this credit is to design parking that will help to increase the pedestrian orientation of projects and minimize the adverse environmental effects of parking facilities (Congress for the New Urbanism et al., 2011). It is required of this credit that non-residential buildings and multi-unit residential buildings either do not build new off-street parking lots, or locate their parking lots at the side or rear of buildings. The new constructed parking lots are required to only use 20 percent of the total development footprint (*ibid.*). It is difficult to say if this credit helps to achieve TOD objectives, this credit is appears to be under estimated in this system, as only 1 point can be gained. As well, underground or multi-storey parking facilities permitted to be constructed to provide additional capacity, which is reasonable since TOD does not disregard the automobile. However, TODs are designed to be pedestrian and transit friendly and the potential for this to be enhanced and for the reduction of automobile travel, parking

demand and supply at TOD centres must be moderated (Niles and Nelson, 1999). There does not seem to be any standards or limitations put in place in the instance that a parking garage is constructed. Furthermore, Option 5 of Unbundling Parking, found under Credit 8: Transportation Demand Management requires that 90 percent of multi-unit residential units and/or non-residential square footage and their associated parking spaces are sold or rented separately from the units. This obviously has a great impact on the lower price that people will pay for the units, however, this still does not eliminate the extensive amount of parking that is usually required for residential developments. Until that is resolved, TOD cannot be successful in all of its objectives.

Finally, the NPD credit for Community Outreach and Involvement is extremely useful in assisting TOD into the future. TOD is often misunderstood and is usually resisted by local communities; this credit can play a lead role in removing the barrier of resistance for the implementation of developments. The credit's intent is to encourage responsiveness to community needs by involving the people that directly work and live within the community in which a project is being developed (Congress for the New Urbanism et al., 2011). There are various optional requirements that can be achieved, the first, Community Outreach, requires developers to meet with adjacent property owners, residents,

business owners, workers, the local officials and planners in order to solicit and record their input on the proposed developers, this is required to be done prior to commencing a design. This option also requires developers to work directly with community associations and/or the local government to help facilitate an open community meeting other than other required official meetings. Once the public has provided input on the proposed project, developers are required to modify the conceptual design as a direct result of community input or if modifications are not prepared, the developer must explain why (*ibid.*). The second option, involves a charrette in addition to the first option. This interactive workshop must be held for a minimum of 2 days (*ibid.*). In addition to complying with Option 1, Option 3 requires an endorsement from an ongoing local or regional nongovernmental program that reviews and endorses smart growth development projects under a rating and/or jury system (*ibid.*). Citizen engagement is said to be crucial to the success of specific projects (U.S. Green Building Council, 2012). By engaging citizens and local governments the resistance to new projects and smart growth initiatives can be reduced through a community-led planning process (*ibid.*).

Overall, this section has attempted to respond to the overall research question of this report. It can be concluded that there are certain objectives of TOD that can be assisted by the LEED-ND system. The main

intent of each category and credit that were analyzed has one common theme, and that is to reduce VKT and create neighbourhoods that accommodate and encourage various transit modes. This main common objective throughout the LEED-ND system directly addressed and enforced the same main goal of TOD. Through LEED-ND, it can be expected that TODs will be successful in this aspect. However, as acknowledged there are certain aspects of LEED-ND that would not perform well in assisting with other TOD goals that are considered crucial factors for its success.

RECOMMENDATIONS

These final sections of the report will discuss how TOD and LEED-ND can successfully move forward together by addressing the present barriers and considering incentives that can entice further implementation.

ADDRESSING THE BARRIERS

There are two barriers that exist that have an effect on the implementation of both TOD and LEED-ND that this section will specifically address, recommendations on how these barriers should be addressed will also be provided.

1. ***Zoning codes, regulations and policies are not always supportive of smart growth initiatives, achieving each of the objectives of TOD and LEED-ND can add many more layers to the development process that are not usually present within conventional developments.*** The zoning, land-use and regulatory constraints make it 'difficult', 'onerous', 'costly' or 'impossible' for sustainable development to occur (U.S. Green Building Council, 2012). Developers tend to stray away from the conventional developments because of this restricted framework that can often put pressures on project timelines. It should be proposed that planning officials recognize that more can be done for the successful and easy implementation of TODs for zoning and planning purposes. The revisions of zoning laws could help to better align with the objectives of both TOD

and LEED-ND and help address specific issues relating to parking requirements and mixed-use development. Performance zoning or design-based zoning, which both offer a high degree of flexibility, by dictating acceptable levels and standards without necessarily dictating land-uses (*ibid.*), could be considered. Performance zoning is less prescriptive in nature and fewer limitations would be placed on projects attempting to achieve sustainable objectives.

Zoning revisions have been implemented in Michigan and Ohio in order to help mitigate the gap between policy and sustainable development. Grand Rapids, Michigan, created a new zoning code that follows a performance based model, with the new zoning ordinance, planning staff realized that many new projects could be eligible for a larger number of LEED-ND points. In Cleveland, Ohio, LEED-ND pilot projects gave the city an opportunity to creatively re-think how to create policies and tools that would support sustainable development. A Green Team made up of managers and planning staff reviewed and located where barriers existed within LEED-ND projects, in order to identify possible zoning changes that would help facilitate the implementation of these projects in local neighbourhoods.

2. ***Many LEED-ND credits may be neglected because of the time and money associated with them, thus reducing the implementation of potential TOD objectives.*** Developers tend to reach for what is 'do-able', that means attempting to achieve credits that are cost-effective and they do reach further to more ambitious credits that may cost more (Garde, 2009). There are arguments for and against this system that allows developers to pick and choose what credits they want to implement within their project. Some feel it is useful in order for developers to choose which sustainable goals are most appropriate for their site since some credits may not be applicable (Royal Roads University, 2011). While the other side of this, is that some developers may choose to overlook credits that are just too hard and too costly to achieve. As previously discussed, there are certain credits that are vital to the success of TOD, like affordable housing, reduced parking standards, mixed-use, it should be argued for more prerequisites that help to achieve these specific goals. However, this also creates the risk of developers ignoring the whole system entirely, and that is why the case for incentives should be made.

INCORPORATING INCENTIVES

Because LEED-ND and TOD are voluntary measures that developers can choose to endeavor or not, it is difficult to encourage these sustainable development tools. As stated earlier, developers are often hesitant about

TOD mainly for financial reasons. Currently there is little incentive to develop these types of projects. In order to drive TOD and LEED-ND forward, incentives should be established that would increase the attractiveness and provide some sort of benefit to developers.

1. ***Many developers struggle with parking demand because it is a financial burden; parking reduction must be made a top priority for municipalities in order to achieve a successful LEED-ND and TOD project.*** And as illustrated earlier, the parking reduction as a LEED-ND credit is weak in this regard. This could be the one area where developers are enticed to incorporate LEED-ND into their projects, since a reduction in parking means a reduction in construction costs. This is significant for developers because the average cost of a parking structure is approximately $10,000 per space and underground parking is approximately $15,000 to $20,000 per space (Litman, 2011). However, the system does not seem to set any real, hard specifics when it comes to parking. It is vague and unclear how parking will ultimately be reduced. Developers do not typically favour parking requirements; in order to maintain a profit they must increase their costs of units. One parking space per unit generally increases a unit's cost by 12.5 percent (*ibid.*). Parking standards are ineffective in matching supply with demand because the number of vehicles per unit varies quite significantly amongst residents (*ibid.*). According to a study, parking requirements are the

greatest regulatory burden placed on developers, about four times greater than development fees combined (Litman, 2011 cited Shoup, 1999).

Standards for parking are often excessive and projects like TODs do not require such prescriptive standards. Most municipalities set a standard for a minimum amount of parking spaces, it is recommended that a maximum allowable amount is more reflective of what LEED-ND and TOD are aiming to achieve. Parking requirement relaxation for the number of required parking stalls has already become an incentive for developers in the City of Kamloops. The incentive is part of a neighbourhood plan that has an incentive program and development review system that encourages green infrastructure (Stewart, 2009).

2. ***Other incentives should be established to steer developers in the direction of LEED-ND and TOD.*** The question of whether government incentives should be developed in order to guide developers has been debated (Weber, 2010). In interviews with developers, Weber (2010), established that some developers are convinced that subsidies and funding mechanisms will be needed to entice developers to further implement these types of projects. While others feel that there is already a market for TOD and if developers are able to figure the details of that

market there should not be any reason why they could not figure out how to incorporate LEED-ND as well (*ibid.*).

Local governments across the U.S. have found that targeted financial and development incentives are the most effective strategies that encourage sustainable development. They have found it effective in encouraging adoption of best-practices and spurs innovation and demand for this type of development (U.S. Green Building Council, 2012). As an example, in 2007 Illinois became the first state to pass legislation related to LEED-ND, The Green Neighbourhood Grant Act provides funding equivalent to 1.5 percent of development costs each year, this can be achieved for up to three selected projects that have received any level of LEED-ND certification (Weber, 2010 cited Illinois General Assembly, 2007).

Other incentive strategies as indicated by the U.S. Green Building Council, (2012), include: *Expedited Review/Permit Processing,* where the reduction in the duration of review for building permits can be quite appealing to local developers. This also allows municipalities to offer an incentive that is significant yet requires little or no financial investment on their part; *Tax Credit* incentives can be extended to developers who achieve measurable sustainable neighbourhood goals, these incentives have a short term cost however increased property values can offset the

reduction in tax over time; *Fee Reductions or Waivers* can be established for municipalities that charge fees for permit reviews or other planning processes; and finally *Grants* have been established by U.S. local governments to entice construction of sustainable neighbourhoods.

Feasibility is an obvious concern for developers, it has its merits and local governments should more readily respond with strategies that will further encourage the implementation of LEED-ND and TOD. The City of Hamilton has reacted by creating a LEED Grant Program that they believe provides an economic catalyst for sustainable building and sustainable land development practices. The purpose of the program is for the City to share in the burdens of construction cost, consultation, energy modeling and certification fees with the applicant (City of Hamilton, 2012).

Financial incentives will be what will drive developers towards these options. Feasibility is a concern and with the many costly risks involved with LEED-ND and TOD projects as discussed, incentive approaches should address developer apprehension.

CONCLUSIONS

This report has provided a wide range of background on smart growth and development and has examined how TOD has become a fundamental tool in achieving smart growth on the ground. The context, typologies, growth, benefits and challenges of TOD provide an outlined understanding of TOD and its objectives. With focused goals and inhibiting barriers it is often difficult for TOD to continuing emerging, for developers the financial risk is too great and financial incentive too little and for local residents there lacks a clear understanding of TODs function and there exists a fear and resistance towards increased density in their neighbourhoods. Additionally, it has been claimed that there are no straightforward standards or systems, like performance indicators, that can determine the success of TODs; this has caused many developers and stakeholders to become apprehensive towards this type of development. Because of the inhibitors toward successful implementation and the recognition in the literature of the lack of effective assessments for TOD, the report aimed to determine whether LEED-ND – a system that shares the same smart growth and new urbanist concepts as TOD – could assist in addressing the main goals, objectives and barriers of TOD. TODs are considered special property developments that need to be evaluated differently from conventional developments and should be assessed as a complete system that considers its entire

social and design characteristics (Muley, 2011). It is important for TOD to be analyzed by more than just its design elements and LEED-ND assists in doing so. The LEED-ND system was only broadly analyzed and constitutes only a partial examination concerning how TOD can effectively be addressed by the various standards that the system requires. Although, there are standards of LEED-ND that directly address TOD objectives, there are other standards that can be justified, yet are weak in direction and detail, while others are simply not relevant. Therefore, the analysis of this system and its relevance for addressing TODs has only stimulated a discussion around how TOD can essentially move closer to success.

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