Building the Iron Horse:

The Evolving Transportation and Land Use Planning Philosophy towards Calgary's Light Rail Transit System

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Many cities today are contemplating major investments in rail transit systems, especially Light Rail Transit (LRT), to address two significant planning issues which have characterized North American metropolitan growth patterns: increasing automobile use and decentralizing population and employment. Proponents of these systems argue that by building rail transit, travel behaviour and land use patterns can be changed. The experience in cities which have built these systems is mixed, but transportation and land use outcomes typically go hand-in-hand: San Diego, Denver, and Portland have increased transit ridership and intensification in station areas, whereas Buffalo and Cleveland have had minimal change occur as a result of investments in LRT. Calgary, Alberta presents an interesting case as its LRT system, first opened in 1981, generates tremendous ridership but has had relatively modest land use change in station areas.

This thesis aims to understand why intensification has been so marginal at many stations, and to uncover what are the unique facets of Calgary's experience which shaped this outcome. The approach taken is to examine the evolution of the City of Calgary's planning philosophy towards transportation and land use since the need for rapid transit was first identified in 1966. This evolution is also placed within the context of the particularly severe cyclical economic forces that influenced both the city's growth and policy planning approaches taken to manage this growth.

The research finds that the combination of transportation and land use policy, in conjunction with market forces, which existed during the design, construction and operation of the first three LRT lines favoured intensification in Calgary's downtown and low-density decentralization in suburban areas. However, the evolution of planning policy and market forces indicate that this less likely to be true in the future, both in the near and long term. The City is transitioning from a highly centralized mono-centric city to a poly-centric and increasingly multi-modal metropolitan region. The LRT, and other transit service, will be a key means of facilitating and managing this transformation.

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Chapter 1: Introduction

A significant issue facing cities today, especially those in North America, is the continued trend toward decentralization of population and jobs. Stimulated by changing market forces and rising auto ownership, this decentralization, or sprawl, has created several negative externalities. The most visible of these is an increased dependence on automobiles for mobility (Newman & Kenworthy, 1999). Cities have grown into polycentric regions with major activity nodes connected by major freeways, and dispersed travel patterns (Anas, Arnott & Small, 1998; Casello, 2007). Consequently transit ridership has suffered as land uses and transportation networks evolved to facilitate travel by private vehicle.

The growing cost of these externalities – rising congestion, costs of building and maintaining infrastructure among others – presents a significant challenge for planners. One solution planners have turned to is using public transit to change travel behaviour and development patterns, especially rail-based transit. The justification put forward for these investments includes attracting trips that would otherwise be made by the automobile but also the potential to shape land use by encouraging intensification in station areas. Since the 1970s dozens of new rail systems have been built in Canada and the United States, and several more are proposed, often with the aim of achieving transportation and land use changes.

The rise of the New Urbanism school of thought in the late 1980s helped to further refine these aims, principally through what became known as Transit-Oriented Development (TOD). This development concept advocates a design-based approach in making changes to travel behaviour. Through pedestrian-oriented streetscapes, dense mixed use environments, and access to a transit station to provide regional mobility, it is believed will generate three transportation changes: reducing the number of vehicle trips, shortening the length of remaining vehicle trips, and increasing the number of trips by walking, cycling, and transit (Cervero & Kockelman, 1997).

However, evidence to support changes in land use as a result of investments in rail transit since the 1970s have been mixed. Some cities have been highly successful in increasing transit mode share and

seeing intensification in station areas, including: Washington, DC, San Francisco, and Portland, OR. Several others have seen little change in both transit ridership and land use patterns; notable examples include Cleveland and Buffalo.

Calgary presents a unique case within this context: the City has been able to generate high ridership on the LRT system, yet land use impacts in station areas have been modest. Furthermore, while many of the LRT systems that have not stimulated land use change are in cities that are struggling economically, Calgary's economy has been rapidly expanding for much of its history.

1.1 Research Questions

The seemingly contradictory outcomes in the Calgary case provide the inspiration for this thesis. The primary research question that this thesis seeks to answer is: Why has Calgary's investment in its LRT system not produced the desired land use impacts in station areas? Several sub-questions are also examined which narrow the scope of study. These include:

- If land use impacts did occur as a result of Calgary's LRT system, where and how did they occur?
- Are there unique characteristics in Calgary's previous transportation and land use policy which shaped these changes?
- What influence did market forces have in facilitating or inhibiting land use changes? and,
- Are the transportation and land use planning policies currently in use likely to change Calgary's previous experience and realize goals of intensifying LRT station areas?

The research presented here aims to answer these questions by studying the evolution of transportation and land use planning in Calgary over a set of four eras which represent different planning philosophies adopted by the City (**further defined in 1.3**). Particular emphasis is placed on four themes which demonstrate the interaction between these two planning approaches, and the resulting outcomes in shaping transportation behaviour and the spatial pattern of development in the city. These are: The Role of Downtown; Transit Planning & Service; Land Use Planning & Policy; and, Parking.

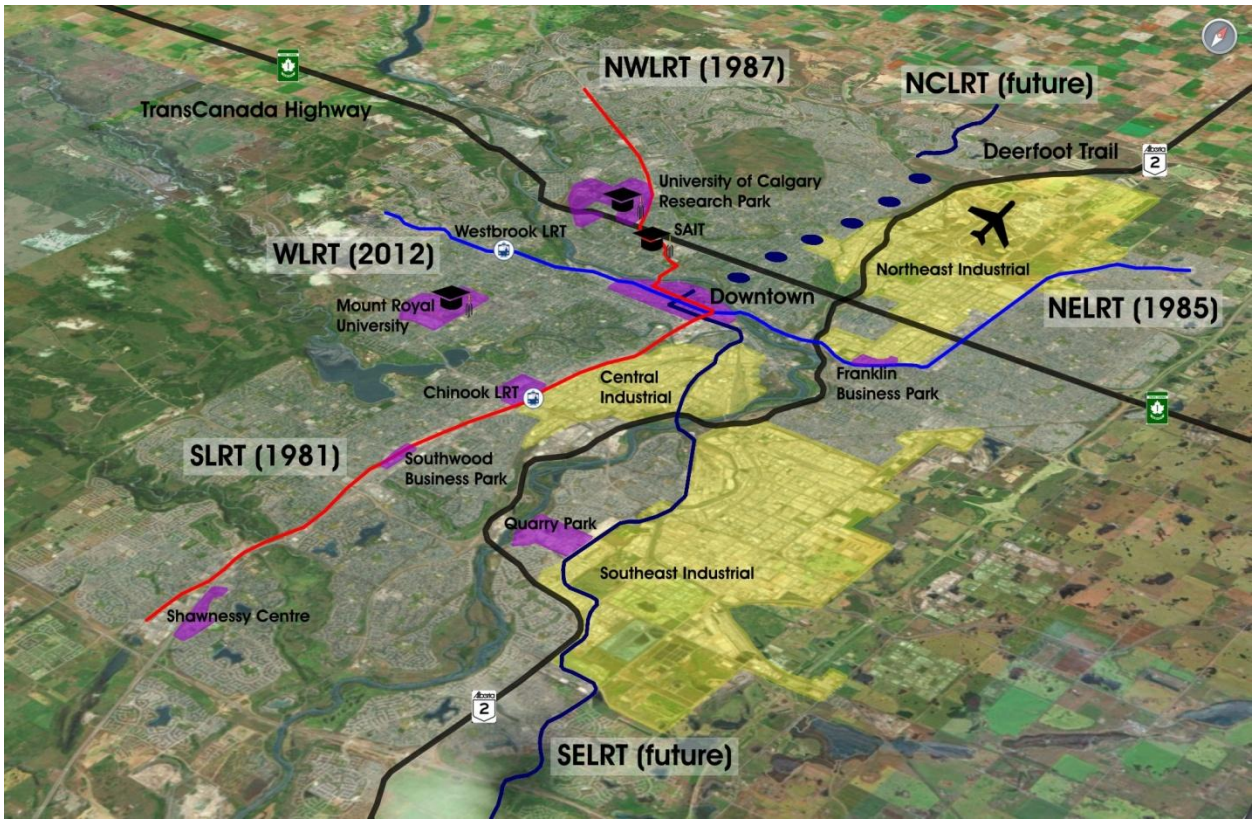
1.2 Introduction to Calgary

The city of Calgary is home to over 1.1 million people. Located in western Canada in the foothills of the Rocky Mountains, Calgary is the centre of Canada's petroleum industry with as many as 75% of the firms in Calgary's downtown directly or indirectly associated with oil and gas (Colliers International, 2013). This dependency on a single industry has contributed to Calgary enduring particularly severe boom and bust cycles, which have caused strain on providing municipal services and infrastructure.

Spatially, the city is characterized by suburbs of predominantly single family homes arranged around a single, hyper-dense commercial core. As a result, the city is also often cited as a Canadian textbook definition of sprawl, with high rates of vehicle kilometres travelled per person and a low overall metropolitan density (Newman & Kenworthy, 1999). In recent years, more than 95% of new population growth has occurred on the suburban fringe (City of Calgary Land Use Planning & Policy, 2013). The City also exhibits a significant jobs-housing imbalance: 71% of the city's office space is in or near downtown (Avison Young, 2013), while industrial employment is concentrated on the east side of the city. With continued suburban growth, residents in the west and the north in particular are left far from potential employment.

Calgary presents an interesting case study for transit and land use planners in that, despite the challenges of decentralization, Calgary's LRT (known locally as the C-Train) has been tremendously successful in attracting riders. Beginning with the opening of the South LRT line in 1981, today the network comprises four LRT lines extending from downtown, with 56km of track and 44 stations (**Map 1**). The average weekday ridership of 290,000 is the highest of any LRT system in North America (APTA, 2013), and only Boston's Green Line generates more daily boardings per route kilometre. Calgary's LRT system has also contributed to more than 50% of downtown workers commuting by transit (Gandia, 2012). However, most station areas continue to be characterized by large auto-oriented land uses and park-and-ride facilities. New development in station areas has been sporadic, and not always supportive of the transit lines.

Map 1 - Calgary's LRT Network and Concentrations of Office & Industrial Employment
(Image: Apple Maps)



Calgary is also unique among major Canadian cities in that over 90% of the metropolitan area population reside under the jurisdiction of one municipal government. By operating as a uni-city, the City of Calgary has been able exert a greater degree of control over its growth and development. This is a benefit to this research as it enables the study of land use and transportation planning issues through a singular polity, with less emphasis on external considerations. However, this greater control also enabled the City to maintain a high degree of centralization in its Central Business District. This position, supported by the City, created several important impacts on transportation and land use, not the least of which is the motivation to build the rapid transit system that is the focus of this thesis.

1.3 Scope of Thesis

There is a considerable degree of complexity in understanding the relationship between transportation and land use; several factors contribute to shaping this connection and in various ways. Built form variables such as density and mixed land uses influence travel patterns by spatially distributing the locations where people start and end a trip. Conversely, the relative costs of transportation affect the overall spatial pattern of cities. This influence can be felt both in terms of aggregated travel demand, such as the economic benefits of agglomerating, or in individual mode choice. Examples of the latter include the presence or absence of transit service, or the price of parking. All are explored in depth in the literature review.

These themes are also reflected in the analysis of Calgary. The inclusion of transit and land use planning as topics of analysis are self-explanatory, but the role of downtown and parking bears some elaboration. The Role of Downtown serves two purposes in this research. First, the City's long standing policy goal of supporting a strong downtown and centralizing employment was directly responsible for implementing rapid transit. As such, consideration of its relative importance had a strong influence on transit planning, and ridership became highly dependent on the downtown market. As is discussed, it is only when this importance began to decline that planners started emphasizing how transit could be used as a mobility solution and land use shaping tool elsewhere in the city. Secondly, utilizing downtown as a unit of analysis serves as a reasonable proxy for the role of economic trends and agglomerative forces in the city. Nowhere else are the effects of Calgary's boom and bust cycles more visible. Furthermore, the narrative which follows downtown also reveals the relationship between agglomerative benefits and the cost of transportation.

The discussion of parking is included primarily because this is the most prominent example of policies utilized by the city to support centralization in downtown. The restrictive parking policy in downtown undoubtedly created a strong disincentive for automobile use, but in conjunction with the LRT system and its park-and-ride facilities actually contributed to keeping downtown transportation costs low.

By dispersing transportation externalities – congestion, noise, parking costs – typically associated with central business districts, Calgary's parking policy strongly supported agglomerative forces in the core. Outside of downtown, the discussion of parking reflects the City's position on suburban mobility, in other words the degree of support towards encouraging or discouraging transit use.

The two chapters devoted to the city present a historical narrative of evolving planning philosophies, their implementation, and the resulting transportation and land use outcomes. To enable a contextual understanding of the environment in which planning decisions were made, the topics – Role of Downtown, Transit Planning & Service, Land Use Policy, Parking – are organized into four eras of analysis:

- Inception (1966-1976): The origins of Calgary's LRT system, planning policy in this era was predominantly auto-focused. The planning philosophy for rapid transit was somewhat dichotomous. While travel demand for downtown was to be met primarily by new roads, rapid transit would contribute to reduce congestion on these roadways. New parking restrictions were enacted in downtown which would further reduce vehicular traffic by encouraging transit ridership. Consideration of the LRT's land use shaping potential was decidedly laissez-faire in that the presence of the system alone would stimulate these changes.
- First Generation (1976-1990): The construction of the first three LRT lines took place in this era, and was marked by an economic boom followed by recession and stagnation. High rates of population growth in the 1970s necessitated quickly extending improved transit service into high growth corridors, yet these were planned as low density subdivisions. Any potential momentum toward intensification in these corridors was lost as the lines opened at the start of the recession. The decisions to expedite construction, maximize system length, and minimize cost led all three initial lines to be built in expressway medians and along a freight railway. Although a land use study was conducted for one of the three LRT lines, it was only done so

after construction had already started. Downtown parking policies were relaxed, and the availability of parking increased concurrent with lapsing transit ridership.

- Evaluation & Transition (1990-2000): The opening of the LRT lines did little to improve transit ridership in the city. Ridership, both per capita and overall, had fallen during the recession and had only recovered by the early 1990s. Nearly all new development continued to occur on the suburban fringe, and the density of new communities was decreasing. The City, concerned over these trends, moved to enact new land use policies to intensify suburbs and be more proactive about integrating transit into neighbourhood design.
- Second Generation (2000-present): Implementing new land use policies were successful; new suburbs increased in density and the proportion of multi-family housing increased. Despite increasing transit ridership and increasing transit mode share to downtown, automobile use still accounted for three-quarters of all trips. The City moved to implement policies to encourage intensification in a series of Activity Centres and Corridors, while planning a Primary Transit Network that would link these nodes. These policies supported the objective of doubling the citywide transit mode share over the coming decades. A new LRT line was constructed serving west Calgary, with planning for this line including land use considerations and redevelopment potential which influenced the physical design. Parking policy was strengthened in downtown, and the first steps were taken to expand these policies to suburban contexts.

Following discussion of these four eras, I present a case study of how land use policies were implemented in LRT station areas. The case study contrasts station area plans adopted in 1980 for three stations on the South LRT line, and two contemporary plans adopted in 2008 and 2009 at Westbrook Station (West LRT) and Chinook (South LRT) (**Map 1**).

This comparison demonstrates the relatively lax implementation strategy utilized in the 1980s for station area intensification, and lack of support for transit-supportive development through City Council

decision making. The two modern examples, by contrast, show a greater degree of support for intensification, a larger role for the City in facilitating redevelopment, and the willingness to implement appropriate development control to mandate compliance with station area planning policy.

More specifically, the Westbrook case study also demonstrates how modern planning philosophy has been implemented without an existing LRT line and its legacy of past planning decisions. Furthermore, by conducting a land use study prior to approving the West LRT the consideration of its potential impacts on land use and redevelopment potential exerted greater influence on the design of the line; planning staff feel that these design changes will improve market interest in the station area.

1.4 Organization of Thesis

Chapter two discusses literature on several variables associated with encouraging transit ridership and intensification, which include: impacting travel behaviour through built form variables of density and mixed uses; influencing land use by building new transportation infrastructure; improving accessibility as a result of transit network design; examining the relationship parking has with both land use characteristics and travel choices; and, identifying opportunities for transit operators and governments to facilitate TOD development in station areas. The result of this review establishes a set of best practices to which Calgary's planning philosophy is compared.

Chapter three outlines the methods utilized in this thesis, including: overall research design, selecting documents for analysis, and choosing case study sites. The section also discusses some of the limitations in the chosen approach.

Chapter four provides a historical narrative of the City's planning policies towards transportation and land use from 1966 – when the need for rapid transit was identified – to the present. The goal of this section is to present not only the policies which were directed specifically towards the LRT, but also a broader view of general policies and trends which shaped city growth and influenced the degree to which land use changes were made as a result of the investment in LRT.

In chapter five, case studies are presented at four stations: Chinook, Southland, and Heritage Stations on the South LRT line, and Westbrook Station on the new West LRT line. These examples demonstrate concretely the change in planning approach from when Calgary's LRT lines were first opened to today.

Chapter six focuses on drawing key lessons from the themes discussed in the preceding two chapters.

In the final chapter, conclusions are drawn based on the evolution of Calgary's planning philosophy towards its LRT system, and research questions are addressed. Although policy recommendations are made, the most significant implication of this research for Calgary's decision makers is presented as a question. Will they commit to the philosophy for growth and mobility which has emerged over the course of this narrative and which is most consistent with identified best practices? Future research areas are also discussed.

Chapter 2: Literature Review

The topic of Transit-Oriented Development (TOD) has come into prevalent use not only in planning literature, but increasingly in planning practice. There are many reasons why governments and planning authorities may pursue this form of development, including increasing transit ridership, efficient use of existing infrastructure and achieving higher fiscal returns on the often substantial investment made in transit. These outcomes are achieved because Transit-Oriented Development as a development concept will result in meaningful impacts in travel behaviour, especially in reducing reliance on the automobile. Cervero and Kockelman (1997) further defined the transportation impact objectives of TODs into three principal goals: TODs should reduce the number of vehicle trips; remaining vehicle trips should be shorter and better utilized by carrying more people; and finally that the number of trips by alternative modes should be increased relative to vehicle trips.

The above definition serves as a useful organizational tool in evaluating the potential impact of TODs, but what specifically defines it as a development concept? Emerging out of New Urbanism, as a paradigm TOD is heavily influenced by concepts of walkability, pedestrian scaled design, and mixed use or complete communities. The spatial extent of TODs can vary due to numerous circumstances, but generally are defined as including those areas within a 400-600m radius of a transit station, or the longest distance an average person is likely to walk (Untermann, 1984; Calthorpe, 1993). Peter Calthorpe (1993) provides one of the earliest and still commonly cited discussions of TOD design. He argues that TODs should contain "moderate and high-density housing, along with complementary public uses, jobs, retail and services, [which] are concentrated in mixed-use developments at strategic points along the regional transit system" (Calthorpe, 1993, 41). He further elaborates that walkability is the most critical element which supports this development pattern; there is little incentive to switch from vehicular modes if the environment is not built to support walking as a comfortable and desirable mode. This speaks to a fundamental aspect of TOD theory: that travel behaviour is not meaningfully impacted simply through increasing disincentives for vehicles, but that competitive and desirable alternatives must be provided to

enable travelers to make the switch (Calthorpe, 1993, 46). Thus a successful TOD is ultimately a combination of land use policies and designs geared towards the non-motorized traveler and a robust transit service that provides mobility for trips beyond the range of a typical walk or bike ride.

This literature review will examine several principal themes. The first is to evaluate the land use and design aspects of TOD to determine whether they create the expected impacts on transit ridership. This will include a discussion of density and diversity (or mixed uses). Another typical aspect usually examined, the design of the urban environment, will be approached from the concept of connectivity rather than physical design, and is included in the second major theme.

This second theme will explore to what extent the mobility and accessibility benefits of transit can support the creation of intensive and walkable urbanism, especially in areas where this did not exist previously. This will include discussing how transit networks influence the overall accessibility of land and the potential for agglomerative forces to create intensification, but also how accessibility to transit on a localized level can facilitate changes in travel behaviour. Thus, accessibility includes two operative assumptions: transit can expand the network capacity for additional trips, and transit can convert existing trips from other modes to transit.

Another theme in this literature review will be that of parking. A significant aspect of both the physical design of an area and as an amenity for automobiles, the provision of parking facilities is a critical factor in transportation behaviour. The analysis presented will include how parking can act as an incentive for auto travel when it is free, and as a significant disincentive when it is priced correctly, but also how it creates tension in transit station areas between its function as a node in a transportation network and as a place or community.

Finally, I will explore some of the opportunities and barriers that impact the transportation-land use connection. Factors such as the economics of development and land use policies can contribute to the

success or failure of efforts to implement TOD, so it is important for planning agencies to be cognizant of these factors and to plan around them.

2.1 Land Use Impacts on Transportation

A significant portion of research on TODs has focused on how land use variables affect travel behaviour. While there are numerous such variables that can be analyzed, the two most commonly used are density (the intensity of land use) and diversity (the mix of land uses). Furthermore, both of these variables figure prominently in the TOD plans of many cities, including Calgary, which aim to increase the intensity and diversity of station environments in order to generate ridership.

Density

The evidence of the effect of density on transportation seems to be mixed, at least when taken in isolation of other factors. The most consistent and significant impacts of density in the literature is in reducing vehicle use. Several studies found that a doubling of density within an area was associated with a 20-30% drop in Vehicle Kilometres Travelled (Cervero, 1993; Holtzclaw, 1994; Dock & Swenson, 2003). Holtzclaw (1994) in particular found that the impact of density was three times as significant as improved transit service in affecting vehicle use. The number of vehicle trips generated was also found to be reduced with increases to density, even if this density was not uniform throughout a region. A modelling study on the I-35W corridor in Minneapolis found that with conventional development patterns, future growth would contribute to a 10% increase in the number of vehicle trips generated. In contrast, the study finds that concentrating development into TODs would produce a net reduction of 1-3% in vehicle trips (Dock & Swenson, 2003).

The density of residential areas seems to have a positive impact on transit ridership, although the range of the expected impact shows some inconsistency. One study of 100 metropolitan areas in the United States found that density could increase transit ridership by up to 10% while decreasing vehicle ownership by up to 0.5 per household (Ewing, Pendall, Chen, 2003). Other researchers found that

doubling density could increase ridership by as much as 60% (Parsons Brinckerhoff Quade & Douglas, 1996; Newman & Kenworthy, 1999). However, the relationship does not seem to be linear. The most significant changes in ridership can be expected when moving from a low to moderate (medium) density (Cervero, 1996; Newman & Kenworthy, 1999). Higher densities seem to be associated with increased rates of walking rather than transit (Cervero, 1996).

The literature shows a much stronger correlation between employment density and transit ridership. Chatman (2003) found that the average workplace density of a non-driver was 5,600 employees per square kilometre, but only 2,300/km^2 for auto commuters. In Toronto, three high density employment nodes outside of the CBD were found to have transit mode shares between two to eight times larger than for low density employment nodes in comparable locations (Filion, 2001). However, the relationship again does not seem to be quite linear. While finding that employment density to be a significant influence on encouraging transit and walk trips, Frank and Pivo (1994) found the greatest shifts from single-occupant vehicles occurred between 50-123 employees per hectare, and again above 185 employees per hectare.

Some of the effect of employment density is certainly attributable to the influence of the central business district (CBD). One well cited study found that both the magnitude and density of central business districts was a key driver of transit ridership (Pushkarev & Zupan, 1977). Others have also found that transit mode shares were higher for CBDs than for suburban employment concentrations (Filion, 2001; Dill, 2003). Another possible explanation why the relationship between density and transit use is higher for employment than residential land could lie in differing elasticities in mode choice. Workers are less likely to choose their workplace based on land use characteristics, and so may be more responsive to changes in the relative cost of travel by a given mode (Chatman, 2003).

So why are the results for density and transit use so mixed? A plausible explanation is that density itself may not be a causal variable, but an aggregation of more determinative factors (Ewing &

Cervero, 2010). Dense areas are more likely to provide an environment that is pedestrian friendly, and thus transit friendly, while fewer low-density areas provide this level of amenity (Parsons Brinckerhoff Quade & Douglas, 1996). Dense environments are also much more likely to provide better transit service. Even with similar rates of transit use, a dense area will have more people which generate higher ridership. This in turn is likely to see service improvements to accommodate the increased volume, especially in the frequency of service (Casello, 2003). Typically the level of density required for 30 minute headways is 17.3 units per hectare; yet at 75 units per hectare headways of 10 minutes can be justified by transit operators (Cervero, 1993). This improvement in service may make transit a more competitive alternative for travel, and begin generating feedback loops as increasing ridership justifies further service improvements (Calthorpe, 1993). Dense environments also generate disutility for automobile use: increasing congestion externalities by concentrating more people within a given area, and increasing parking charges associated with the higher land values found there (Casello, 2003). The most likely conclusion is that density does influence mode choice to some degree independent of other factors, but that this effect is likely magnified when considered in conjunction with other aspects.

Diversity

The spatial distribution of land uses is another common theme in transit-oriented development research. Proponents of TODs argue that by mixing land uses in an area both horizontally (among buildings) and vertically (within buildings) trip lengths can be sufficiently shortened so alternative modes of transportation become much more competitive with the personal vehicle. This seems to be most pronounced in facilitating higher rates of active transportation, primarily walking (Handy, 1992; Kockelman, 1997; Rajamani, et al., 2003). However, within studies that have examined the significance of mixed uses on walking this relationship has been found to be highly varied, even within the same metropolitan region on datasets separated by only 3 years.

In their research in greater Seattle in 1989, Frank and Pivo (1994) found that, when controlling for non-urban form variables, the impact of mixed land uses was significant only in the case of walking commute trips. Contrasting this was a study utilizing travel diary data from King County in 1992 (McCormack, Rutherford & Wilkinson, 2001). Focusing on two neighbourhoods in North Seattle, Queen Anne and Wallingford, the authors found that having retail uses within 600 metres of a household yielded a 20% higher walk mode share for shopping trips than the county as a whole, even if the trip was not to the proximate retail strip. Furthermore, the proportion of all trips made within 3.2 kilometres of home in these two neighbourhoods was twice as high as the county average. When compared against North Seattle as whole, which did not exhibit the same land use diversity, residents of Queen Anne and Wallingford were also found to be more affluent, owned fewer vehicles and drove their vehicles less. Both of these Seattle studies examined over 1,600 households and 15,000 individual trips. A key difference seemed to have been how data were aggregated, with Frank and Pivo's study aggregating data to the census tract level which may have diluted the localized effects of mixed land use.

Mixing land use does not appear to have a significant impact on transit ridership, at least not as a completely independent variable. In a national study in the United States, Cervero (1996) found that mixed land uses were less than one-fourth as significant as density in predicting transit commuting, although this relationship was strengthened when mixed uses occurred simultaneously with higher densities. The small impact of land use diversity may be due to the influence being felt mainly at the smaller scale of a pedestrian, rather than the more regional scale of transit trips. The King County study did show that transit trips undertaken by residents of the two study neighbourhoods were shorter on average than North Seattle as a whole, but the share of transit commuters was similar at 16 and 18 percent respectively (McCormack, Rutherford & Wilkinson, 2001).

Land use diversity appears to have an impact on transit use when it obviates the need for a vehicle for non-work trips. One such example is in allowing trip-chaining, or the ability to combine multiple trip segments into one larger trip. While the effect of this was somewhat modest, the probability

of commuting by transit increased when commercial uses were located near the home end of a trip (Cervero & Kockelman, 1997) and decreased as the distance to commercial services increased (Cervero, 1996). A stronger correlation between land use mix and commuting by transit is found when commercial uses were located in employment areas (Cervero, 2006). In a study of Los Angeles employers who introduced transit incentives, businesses in areas with mixed land uses had twice the share of transit commuters (6.4%) as those areas with none (2.9%) (Cambridge Systematics, 1994). This is likely due to a lower need for a vehicle to make trips during the work day; nearly all trips shorter than 400m that began and ended at a workplace were made by walking (Cervero, 2006).

Limitations of Land Use Characteristics

Although land use characteristics do seem to affect travel behaviour, many researchers note that these are not always the most significant factors nor can a definitive statement be made about the causality of these relationships. The two most common alternative explanations for travel behaviour in the literature are the socio-economic characteristics of households and self-selection.

The socio-economic status of a household can be especially impactful on travel choices. One study found that while density has a strong negative association with the probability of commuting by automobile, vehicle ownership showed a stronger positive association which exceeded this effect (Cervero, 1996). Other researchers also concluded that socio-economic variables held greater explanatory power in mode choice than did built environment variables (McNally & Kulkarni, 1997; Hess & Almeida, 2007). Another study, in Portland, Oregon, found that the single most significant variable influencing the likelihood of walking for non-work trips was not being Caucasian (Rajamani, et al., 2003). However, this study also found evidence that households with access to automobiles show some elasticity in their mode choice. The likelihood of commuting by automobile weakened considerably when household income was below $50,000, which the authors felt was attributable to the cost of operating the vehicle beginning to negate the benefits of mobility. As this income threshold was almost $10,000 higher than the median

household income for Portland in the 2000 U.S. Census, this finding sheds doubt on the notion that vehicle ownership or indeed income can fully explain mode choice.

Another common explanation for correlations between built form and travel behaviour is that of self-selection. The explanation follows the intuitive logic that people who have a predisposed desire to use a particular mode will be more likely to concentrate in areas that are supportive of this inclination. Thus, TODs should be expected to have a higher concentration of people who want to use transit than the population of a city as a whole (Kockelman, 1997). Thus, although some researchers have noted that built environment variables are still significant in explaining mode choice even when self-selection is controlled for (Ewing & Cervero, 2010), self-selection does play an important role in travel behaviour. This is especially true in comparative studies where one typology is deemed transit-supportive, such as TODs, and is corroborated in several studies. A survey of TOD residents in Portland, Oregon found that workers who commuted by transit were significantly more likely to cite access to transit as an important determinant in choosing their home than vehicle commuters (Dill, 2006). In a broader survey of Californians who lived near rail transit stations, Lund (2006) found that people who cited access to transit as an important factor in their home choice were 12 to 40 times more likely to use transit as residents who did not cite this factor.

The role of self-selection in travel behaviour may be problematic in drawing significant conclusions from built form variables, but there is a compelling reason why this should not be the case in planning practice. If households are self-selecting into TODs in order to improve accessibility to transit and mobility options, this indicates that there is economic demand for this type of development. The depth of this demand may be unknown in all markets, but "even if self-selection explains a large share of the effects of mode choice, this should not detract from the finding that these developments are providing a desired housing option that facilitates such choices" (Dill, 2006, vii).

Another limitation with using built form variables has little to do with explaining travel behaviour, but is the result of limitations in research designs. The most significant of these is that the availability of data may be aggregated into scales and units that might not best represent land use factors (Boarnet & Sarimiento, 1998). One such case is what is termed the Modifiable Area Boundary problem, where units are not representative of the pattern they are representing. Studying Seattle, researchers found that at the census tract level only 40,000 residents lived at densities above 25 people per hectare and these areas were clustered near the CBD; when data were analyzed at the block level over 400,000 residents lived at densities above 25 people per hectare and were more widely distributed in the region (Hess, Moudon & Logsdon, 2001). The authors noted that boundaries of two commonly used spatial units in such analyses, census tracts and transportation analysis zones, typically occur along major roadways. As dense environments are more likely to locate on major roadways, this boundary may bisect these clusters, diluting their characteristics with surrounding areas that may be less dense.

Another common example of unrepresentative data is entropy (or dissimilarity) indices which are used by some researchers to operationalize a mixed use variable (Hess, Moudon & Logsdon, 2001). Some of the problems that this method can create are assigning similar values of diversity to residential and office areas as to retail and industrial areas. Furthermore as data are aggregated into the unit of analysis, even at the block level, an area with a finely grained mix of uses could receive the same value as an area with two large different uses but in the same spatial proportion.

The size of the unit of analysis may also influence the likelihood of a given transportation outcome. While researchers seek to explain travel behaviour, the likelihood of a given mode of travel is defined by spatial constraints and thus may prevent a direct comparison at the same scale of analysis. For instance, smaller units of analysis may find significant correlations for walk trips but find no strong relationship for vehicles (Boarnet & Crane, 2001), while larger units may exceed the longest walk trip and thus find no significant correlation (Ewing, Pendall & Chen, 2003).

2.2 Influence of Accessibility and Mobility on Land Use

The concept of transportation accessibility and mobility is discussed in the next two sections. In this section the focus is placed on how transportation networks affect the spatial distribution and intensity of land uses within a region. With an understanding of this relationship, the next section shows how changes in transit network design can improve the land use shaping potential of these investments by increasing the likelihood of riding transit.

The principal means by which transportation can influence land uses is by offering accessibility. Since all transportation infrastructure occupies a defined space, the accessibility of land is not evenly distributed but a function of a given area's connectivity to the transportation network. Indeed one of the main benefits, and problems, with automobiles is that they have increased a person's mobility to such an extent that most destinations are readily accessible, significantly weakening this transport-land use connection (Newman & Kenworthy, 1999). However some locations in the urban landscape continue to be more desirable than others, which should not be the case if all destinations were truly equally accessible and location didn't matter. This is especially significant in the context of Calgary, where even today one-third of all regional jobs are located within only a few square kilometres in a hyper-dense central business district. There must be other factors other than strictly transportation which explain this. One theory that has been extensively studied is the potential for agglomeration economies.

The roots of agglomeration theory can be traced to the work of Alfred Marshall (1920). His assertion was that the spatial concentration of manufacturing yielded three major benefits to a firm: access to a concentrated and skilled labour pool which increased productivity; local knowledge spillovers both through formal and informal interaction among employees of various firms; and the availability of local non-traded specialized inputs. Thus firms in these concentrations could offer a higher degree of productivity which improved their competitiveness with decentralized firms in similar industries. Jane Jacobs (1969) would later define another form of agglomeration economies which she termed urbanization agglomeration, where a diverse marketplace benefited both producers by offering a diverse

range of inputs which could lower costs and open the potential for recombining these inputs into new products and services, but also for consumers by allowing competitive choices of these goods and services.

The relationship between agglomeration economies and transportation is significant, because while these benefits are considerable, the scale of these activities is a function of the ability for the market to access these goods and services. Excepting major port cities, before the construction of the first railroads, manufacturing was defined by small scale activities limited by high transportation costs; manufacturing was decentralized to serve smaller localized markets (Krugman, 1991). However, as investments were made in railroads, port facilities, and roadways the marginal cost of transport decreased, allowing producers to concentrate in fewer and larger markets which minimized aggregated transportation costs and offered a return to scale (Krugman, 1991; Anas, Arnott & Small, 1998). Finally, this process generates a positive feedback loop. As more producers locate in a given centre, the diversity of goods and services available increases the attractiveness of that market; more consumers are drawn to the market which in turn will attract further production (Krugman, 1991).

Agglomeration economics also applies within metropolitan regions, and for the same reasons. Producers will cluster in locations central to their market to minimize transportation costs for both production and to enable consumer access. This clustering has the additional benefit that by increasing the number of possible destinations for a consumer within an area, its overall desirability for consumers is increased by enabling multiple needs to be accommodated, mitigating transportation costs in both money and time (Litman, 2012). As a result, these areas become more desirable for producers, yielding increased land values.

Agglomeration and Transport Costs – Reaching Equilibrium

Understanding the interaction between the benefits and costs associated with agglomeration is useful in explaining the spatial patterns of activity within metropolitan regions. While the benefits of clustering can be considerable, it also generates negative externalities. The most significant of these is congestion. As a centre becomes desirable, the amount of travel both approaching the centre and within it may exceed the capacity of its infrastructure. As these congestion costs increase, they may exceed the benefit to a firm of remaining in a centre (Anas, Arnot & Small, 1998). If this is the case, firms may decentralize to a location that better serves their market. Researchers typically explain this process using equilibrium models.

Equilibrium models provide considerable insight into how agglomeration economics have shaped cities, especially in explaining why some cities remain monocentric while others develop into polycentric conurbations. Where agglomerative forces are high, and transport costs are low, the former is dominant and the resulting spatial pattern should favour a monocentric city (Fujita & Ogawa, 1982). Polycentricity may arise out of two scenarios. Transportation costs may exceed the benefit of agglomeration; this may be due to congestion generated by a high degree of clustering but also the expansion of the urban fringe where new residents are simply too far from the centre to benefit from its services (Anas, Arnott & Small, 1998). This causes the dominant centre to become unstable, and firms may relocate to large new centres which are more highly accessible, what Garreau (1991) termed as "edge cities." Another potential outcome is that agglomerative forces may be weak: with low transport costs there are no compelling reasons to cluster and firm activity will become dispersed through a region (Fujita & Ogawa, 1982). This type of polycentricity will create a dispersed land use pattern with few true "centres." These outcomes occur in an ideal market, but municipal governance has a significant role to play in facilitating the development of new centres: "downtowns may be overcrowded because no developer has managed to assemble land or obtain zoning variances needed to establish a much needed satellite center" (Anas, Arnott & Small, 1998, 1460).

Accessibility and Transportation Costs – The Role of Infrastructure

Investments in transportation infrastructure impact the degree of agglomeration that can be realized. Simply, not all locations are equally accessible, and the quality of infrastructure determines the capacity for activity to occur at a given location by regulating the cost of travel. The first freeways radiated from central cities, reinforcing CBD-oriented travel patterns and allowing further intensification of activities to occur in those central regions; successive freeways, especially beltways, created new highly accessible development nodes in suburbs (Handy, 2005). This was especially true where freeways intersected, such as the well known example at Tyson's Corner (Garreau, 1991).

Within this context of a network of freeways linking suburban activity centres, transit does not provide a significant increase in accessibility for most areas (Knight & Trygg, 1977; Porter, 1998). Rather, investments in transit systems seem to impact accessibility most where automobile transportation costs are high (Parsons Brinckerhoff Quade & Douglas, 1996; Handy, 2005; Casello, 2007). Handy (2005) explained some of the factors which could contribute to higher auto costs: high levels of congestion, limited space for road expansion, or pricing policies such as parking costs.

Thus it can be expected that the primary land use impacts of transit would be felt in those areas where the most significant change in accessibility was made: lowering the cost of transport relative to the benefit of agglomerating. A study of rail-transit in California found that employment gains in station areas after the introduction of transit were modest except where there was a pre-existing concentration of higher density residential or employment uses, which saw consistent positive and significant gains in employment (Kolko, 2011). Similar outcomes were found in Denver: half of all new commercial development and one-quarter of residential development in station areas occurred downtown with the majority of the remainder at three existing suburban centres (Ratner & Goetz, 2013). Conversely, researchers who were modelling the land use impacts of a proposed LRT system in Hamilton, Ontario,

felt that a lack of the preconditions of congestion and centralizing employment would result in little land use change (Lavery & Kanaroglou, 2012).

2.3 Accessibility and Transit Network Design

Agglomerative forces contribute to the understanding that transportation infrastructure still plays a significant role in shaping land use patterns. This section focuses specifically on transit service, and how accessibility (or utility) outcomes can be improved through network design. In other words, how can designing better transportation networks improve transit's desirability as a travel choice and thus its ability to shape land use. Within the context of Calgary, this provides a meaningful comparison to understand how previous decision making in transit design contributed to changes in ridership patterns, and projecting what may be expected from recent and significant shifts in transit policy in the city.

For most cities, the central business district (CBD) is the most important market for transit trips. Many transit systems reflect this in their spatial geometry, radiating outward from the central city. The concentration of trip ends in a relatively small area contributes to an efficient land use pattern from the perspective of transit service (Pushkarev & Zupan, 1977; Parsons Brinckerhoff Quade & Douglas, 1996). However, the relative accessibility of downtown, and other regional subcentres, has also been shown to impact travel behaviours (Ewing & Cervero, 2010). As the distance from the CBD increases the proportion of residents who work in the CBD will decrease, with a corresponding decrease of potential riders (Pushkarev & Zupan, 1977). While one response may to be concentrate residents (and riders) by intensifying station areas, transit ridership may also be increased by improving accessibility.

Using the definition that accessibility permits a person to realize a trip purpose, an ideal transit service is one that improves the number of possible destinations from an origin point. For travel by transit, or active modes, this transportation-land use connection is strong (Newman & Kenworthy, 1999). If a person does not have access to an automobile, a potential place of employment that is closer but unserved by transit would be significantly less attractive than one that is further but served by a bus route.

More simply: the probability that somebody will use transit for a particular trip is strengthened if the trip origins and destinations are located near transit service (Parsons Brinckerhoff Quade & Douglas, 1996).

Accessibility – Origin Characteristics

The principal means of accessing transit service is by walking. Even riders who drive to a train station ultimately connect to the service by walking from the parking lot. So transit service which is closer and available by direct and comfortable routes will encourage greater ridership (Ewing & Cervero, 2010). While evidence of the value of proximity has been found even for basic bus services (Rajamani, et al., 2003; Ewing & Cervero, 2010) the effect is more strongly pronounced with rail-based systems. In California, 6.7% of residents within 800m of a rail transit station commuted to work by rail, compared to only 1.1% of residents within rail served counties but beyond 800m of a station (Kolko, 2011). Similar findings were found where residents near the Bay Area Rapid Transit (BART) system were five times more likely to commute by rail than other residents of the same city (Cervero, 1994). In Toronto, a study found that less than quarter of residents within 400m of a subway commuted to work by automobile, while one-third of residents between 800-1600m of a station did so (Crowley, et al., 2009).

As these examples show, the proximity benefit decays quite quickly. Most passengers are willing to walk about 400m to a bus stop, while for rail systems a likely walk radius is 800m (Kittelson & Associates, et al., 2003). In Portland, Oregon, 90% of LRT commuters within 400m of Orenco Station walked to the station while only 70% of residents did so between 400-800m (Dill, 2006). The distance a person is willing to walk can also be affected by a change in grade. A study in Pittsburgh found that walk distances decreased considerably with grade changes above 5% (Kittelson & Associates, et al., 2003). Duncan (2011) found that grade changes as small as 2% can impact walk lengths, especially when trip origins were more than 650m from a rail station.

Another variable affecting walk distances is cultural. Cervero (1994) found that Canadian transit commuters, in addition to having higher rates of transit use near stations, were more likely to walk longer

distances to access transit. Similar results were found by Kittelson & Associates (2003): while 10-20% of Washington, DC, residents walked more than 400m to a bus stop, 30% of Calgary residents were willing to do so.

Although proximity is an important feature there are also other variables at trip origins that can increase the likelihood of using transit, among them service frequency (Beimborn, Greenwald & Jin, 2003). As transit service arrives more often, onerous wait times can be minimized while permitting spontaneous trips by transit. Cervero (2006) also found that higher feeder bus frequencies to rail stations will increase the likelihood that a person will commute by rail. Higher frequency service has also been shown to increase the distance a passenger is willing to walk to access the service (Cervero, 1993; Kittelson & Associates, et al., 2003).

Accessibility – Destination Characteristics

The likelihood of using transit is also affected by how the service connects to the destination end of the trip. Cervero (1994) found that the two most significant indicators as to whether a station area resident would commute by rail were if the final destination was near a station and if parking was free. There is also evidence that suggests that the accessibility at the destination end of a transit trip may be more significant than at its origin. Kolko (2011) found that the distance decay from the transit station was much steeper for employment (destination) than residential (origin) land uses. A study of three rail systems in the San Francisco Bay area found that for each system transit ridership at the work end of a trip was highest within 400m of the station, then 400-800m, and finally sites beyond 800m (Dill, 2003).

One of the reasons put forward why proximity seems to matter so much at destination ends of transit trips is the restricted mobility options: “unlike the home end of the trip, where there are many options for accessing transit, generally, walking is the only available option at the work end” (Barnes, 2005, 12). This assertion is supported by a travel survey in Portland: only 15% of LRT commuters

transferred from rail to bus to reach their final destination, and almost all final destinations for transit trips were within a 15 minute walk of the destination station (Dill, 2006).

Two variables stand out as particularly significant in assessing destination accessibility is the relative level of transit service offered and the influence of the CBD. A study of three subregional employment centres in Toronto offers an example of the former (Filion, 2001). Despite similar levels of employment density, the centres showed considerable variation in transit commuting mode share. The author noted that "the intercentre differences in transit use appear to mirror closely the quality of their transit services" (Filion, 2001, 155): North York, located on one of Toronto's subway lines, had more than twice the transit mode share (22.4%) as Mississauga (9.3%) which was only served directly by bus services. However, even Mississauga's mode share was significantly greater than two employment control areas which were poorly served by transit. A similar, albeit much stronger, finding was found in San Francisco: the transit mode share of employees at selected firms that relocated from downtown San Francisco to suburban campuses that had only modest levels of bus service fell from 58% to only 3% (Cervero & Landis, 1992).

The influence of a CBD was also considerable in explaining transit mode shares at destinations. In Washington, DC, downtown employment sites within 300m of a subway station had three times the transit commute mode share as sites with similar proximity to the subway in suburban downtowns (Cervero, 2006). In Toronto, the 22.4% transit commute mode share at North York was still significantly lower than the 48.8% for the CBD (Filion, 2001). This CBD effect is likely also attributable to the level of transit service offered, especially the scope of a transit system.

Accessibility and Connectivity

The characteristics of areas serving as trip origins and destinations are each individually important, but their influence on travel behaviour is magnified when considered together. This highlights the importance of designing transit networks that better match origin and destinations: "poor transit accessibility at either end of the trip results in poor transit ridership between those pairs" (Cervero, 1993, 1). Transit services which offer better connectivity will thus likely have correspondingly greater impacts on encouraging transit use, and passengers will be willing to walk further to access them (Kittelson & Associates, et al., 2003). This seems to be especially true for choice transit users: ridership rates were influenced more significantly by out-of vehicle time (access, wait, transfer) than in-vehicle travel time (Beimborn, Greenwald & Jin, 2003). Two studies focused on the three rapid transit rail services in the San Francisco Bay Area offer further evidence of this value.[1]

The first study identified that the rate of transit use was highest on BART, then the CalTrain commuter train, and finally the Santa Clara LRT (Dill, 2003). The author also observed that the distance decay for walking access to the systems followed the same order. While the author felt this could be partly the result of built environment variables that make walking more comfortable to BART, she also noted that the diversity of destinations reachable on BART could also be a significant factor in the attractiveness of the system. Lund (2006) had similar findings in her survey of TOD residents. Although 52% of the respondents cited access to transit as a top three reason for locating in their present home, there were considerable differences between the three rail systems. Residents near BART cited access to transit as an important factor in 55-63% of cases, while CalTrain (33.9%) and Santa Clara LRT (22.2%) residents placed much lower importance on this factor.

Much of the previous literature had focused on work commute trips, but network connectivity may be a critical factor in encouraging non-work trips by transit as well: it is an indicator of overall transit

[1] The three systems are: BART, CalTrain and Santa Clara LRT

service quality but also has a direct relationship on auto ownership. As destinations become more accessible by other modes, it should be expected that the value of owning and operating a vehicle would see a corresponding decrease and lead households to shed vehicles. Researchers examining residential parking demand at TOD sites in Portland and San Francisco found that despite high transit commute mode shares at several sites, household vehicle ownership remained relatively high (Cervero, Atkins & Sullivan, 2010). The authors attributed this to the ability of transit to adequately serve work related trips, but "while transit-oriented housing might mean that more trip *origins* are near rail stops, as long as most *destinations* are not, many TOD residents still will own cars and use them for shopping, going out to eat, and the like" (Cervero, Atkins & Sullivan, 2010, 56). This was echoed in a recent study of rail transit stations in New Jersey, where one of the findings was that better bus service was more significant than the presence of a rail station in reducing vehicle ownership and use (Chatman, 2013). Residents of new housing near rail stations had nearly twice as many bus stops within a 1,600m radius than new housing beyond station areas, and owned on average 27% fewer vehicles per household. Not only were the rail station residents half as likely to commute to work by automobile, but proximity to the rail station, the number of grocery stores within 400m of home and the number of bus stops all contributed to fewer automobile grocery trips per week as well.

In considering accessibility, increasing transit connections in an area will improve its favourability for intensification. These points not only offer wider market access via multiple transit routes, but also offer a resident at that location a large diversity of potential destinations reachable by transit (Filion, 2001). Furthermore by not requiring a trip to access the node, less time is spent waiting and transferring to subsequent transit connections. These factors also have a significant implication for transit planners: "plans to improve transit mode splits should focus on system connectivity and access rather than increasing speeds along existing routes" (Beimborn, Greenwald, Jin, 2003, 9).

2.4 Parking and Travel Behaviour

One of the most significant factors which influences mode choice is the relative costs of travel by that mode. For transit systems these costs to the user are accounted for through fares. Automobile users also pay for costs of driving. However, user cognition of these costs can range from highly visible discrete expenses – fuel, tolls – to less visible ones in registration, insurance, and vehicle maintenance. However there is one aspect of vehicle use that is almost entirely unpaid directly by motorists: parking. In 1990, 99% of all vehicle trips in the United States ended at a location with free parking (Shoup, 1995). Donald Shoup, who has focused much of his research on parking issues, summarizes: "Unless the price of parking gives motorists an incentive to economize, the cost of parking does not influence decisions on whether to own or drive a car. With the cost of parking hidden in the prices of other goods and services, people cannot choose to pay less for parking by using less of it" (Shoup, 1999, 307). Thus, if the costs of consuming parking were passed onto its consumer (motorists), it would create a significant economic disincentive to use automobiles while improving the relative competitiveness of other modes. Planners in Calgary were highly cognizant of this relationship since the 1970s, and leveraged it successfully in changing travel behaviour in the downtown; yet the City has been hesitant to expand this approach to more suburban locations.

The body of research devoted to understanding the role of parking in urban travel behaviour has grown immensely within the last fifteen years. Several themes can be identified that interact directly with transit and active modes of transport. Researchers have found that the likelihood of using an automobile for local trips is positively correlated with the likelihood of buildings which were surrounded by free parking (Cervero & Kockelman, 1997; Filion, 2001). Others have found that when parking was charged at the workplace the likelihood of a person using transit for that trip could be up to four times greater (Cervero, 1994; Dill, 2006). The overall availability of parking in CBDs was also found to be significantly correlated with transit commute mode splits (Morrall & Bolger, 1996; Dill, 2003).

This literature review focuses on: parking regulations for developments; the economic impact of parking on development costs; and, the tension of a transit station as a transport node and as a community (Park-and-ride versus TOD).

Minimum Parking Regulations and Vehicle Ownership in TODs

One of the most common features of North American zoning ordinances is mandating parking for buildings. Yet these regulations exhibit considerable variation among municipalities and uses, and reference manuals of recommended requirements can base their values on very few observations. Shoup (1997, 4) noted that "half the reported parking generation rates [in the ITE Parking Generation manual] are based on four or fewer case studies, and 22 are based on a single case study." Shoup (1997) provides a thorough review of research into the diversity of parking regulations. For example, a 1971 survey of parking requirements in 66 cities found 27 different requirements for funeral homes, 20 of which were unique to that city. Another study which focused on office buildings found 0.5-6.0 employees per $93m^2$ of floor space. This raises questions about the appropriate level of parking provision for office uses. In a selection of 46 cities, office parking requirements ranged from 0.7 to 4.0 stalls per $93m^2$ (Shoup, 1999). Moreover, land use variables and employment only partially explain the variance in supply. In Kitchener-Waterloo, the least number of parking spaces per employee were observed at very high and very low densities, and the authors suggested that "the range of supply per employee suggests that government minimums are not a major factor for developers in creating parking areas" (Casello, Lapointe & Lambert, 2009, 13).

Clearly the appropriate amount of parking to be required leaves considerable margin for variation. But requiring minimum parking supply is problematic for two important reasons. First, requirements are often generated under the assumption that parking is free, and so "minimum parking requirements that meet the peak demand for free parking are, in reality, free parking requirements" (Shoup, 1997, 13). Secondly by enforcing a minimum requirement, the typical variation in parking demand which might

extend in both directions from an average demand level may now only extend in the positive (increased supply) direction (Manville, 2013). This has the effect, that in areas where parking demand may be lower due to factors such as pricing or low auto utilization, parking may be unnecessarily overprovided. In 33 multifamily developments in Victoria, BC, peak parking demand was observed to be almost half of the total parking supply (Litman, 2013).

Another possible explanation for why parking availability may exceed demand is in its opportunity cost. Casello, Lapointe & Lambert (2009) found that the highest levels of parking were found in commercially-oriented districts which they felt resulted from developers wishing to avoid a situation where parking would be constrained or limited for potential customers. Similar findings were made in Atlanta, where special districts were formed around metro stations and which had no parking requirements or density restrictions (Nelson, Meyer & Ross, 1997). Despite transit ridership rates nearly twice as high as the areas adjacent to these districts, the amount of parking provided was very similar. The authors argued that this resulted from conditions from financial backers of these projects which insisted that parking ratios were similar to competing buildings, and from developers not wishing to limit the market of tenants by under providing parking.

The question now becomes: do TODs exhibit lower parking demand and vehicle ownership than would be expected elsewhere? If true, not only would this support the assertion that TOD as a development concept supports reducing auto dependency, but that parking regulations add excessive cost to construction in these areas. In New Jersey, households between 800 and 3200m of a railway station averaged 1.67-1.77 vehicles per household (Chatman, 2013), while in Riverside-San Bernardino in California multifamily housing ranged from 1.45-1.6 per household (Willson & Roberts, 2011). While both studies tested for the influence of proximity to rail transit and found the relationship to be statistically insignificant, it is important to note that both cases the rail systems were commuter trains. As these services are typically focused on the work commute, this finding is consistent with the assertion by Cervero, Atkins & Sullivan (2010) that vehicle ownership would likely still be needed to fulfill other trip

purposes. Residents in Canadian cities also appear to exhibit lower auto ownership than in the United States: in 34 multifamily buildings in Mississauga, Ontario, an average of 1.28 vehicles per unit was observed (Litman, 2013).

Focusing on TOD areas, the results on average vehicle ownership are surprisingly consistent, with several studies noting a range of 0.9-1.1 vehicles per household (Dill, 2006; Crowley, Shalaby & Zarei, 2009; Cervero, Adkins & Sullivan, 2010). Crowley, Shalaby & Zarei (2009) offer a particularly illuminative study of the effect of proximity to rail. Toronto households within 400m of a subway station owned an average of 0.74 vehicles, while those between 400-800m owned 0.94, and 800-1600m owned 1.04. Furthermore, as land use changes occurred in the North York region of Toronto, the average vehicle ownership of households near the three subway stations in this region fell from 1.4 in 1986 to 1.18 in 2001.

TODs do appear to reduce residents' rates of automobile ownership; yet parking requirements for these areas remains quite high. In San Francisco and Portland, peak parking demand at TOD sites was 25-30% below supply (Cervero, Adkins & Sullivan, 2010). But in a survey of American cities with rail transit only one-third allowed parking reductions based on proximity to rail (Cervero, Adkins & Sullivan, 2010), despite parking availability being a particularly significant influence on the likelihood of owning and using an automobile (Chatman, 2013). This suggests there may be obstacles, or a hesitance, for cities to implement parking regulations that fit observed behaviours in rail station areas.

Impact of Parking on Development Costs in TODs

The costs of providing parking in TODs can comprise a significant portion of overall development costs. In dense environments or those where land costs are high, the cost of providing parking can be higher as stalls are typically moved into structured or underground garages. For example, in downtown Los Angeles, providing structured parking at the regulated minimum of 4 spaces per $93m^2$ of gross floor area can be as much as 40% of total construction cost (Shoup, 1997). This is also true for

residential uses: providing one structured space per residential unit can comprise between 12.5-18% of the total cost of constructing one unit (Shoup, 1997; Litman, 2013).

One potential outcome of these costs is the desire to decrease the density of development by providing unstructured surface parking. This occurred in Oakland following the implementation of minimum parking requirements for apartment housing, where the average density of new apartments fell by 30% (Shoup, 1997). Similar results were found in a model of office uses in southern California, where an increase of 1.3 stalls per 93m^2 would be expected to reduce development density by 30% (Willson, 1995). However another likely outcome is that development would occur instead on the edge of cities where the land needed to satisfy parking requirements is available at lower prices (Litman, 2013).

Market interest may exist in reducing parking requirements in central areas. When Los Angeles introduced an Adaptive Reuse Ordinance that permitted converting commercial and industrial buildings to residential uses in its downtown, the exemption from providing new parking spaces proved popular with developers (Manville, 2013). Apartments were built with 1.2 stalls per unit, similar to the existing city standard. The average number of spaces per condo unit built under the program was one-third less than the mandated 2 stalls per unit.

The potential cost savings in construction by providing less parking do appear to translate as savings to homebuyers. A study of housing within the city of San Francisco found that units without parking sold for 12-13% ($38,000-$40,000) less than those with parking, and lowered the median income needed to qualify for a mortgage by $8,000-$10,000 (Jia & Wachs, 1999). Examining the impact of the Adaptive Reuse Ordinance in Los Angeles, Manville (2013) found that apartments built under the program without bundled parking asked $200 less per month in rent, while the average condo unit without parking sold for $43,000 less than the average condo with parking. Furthermore, by interviewing developers who took advantage of the ordinance, he found that the importance of the provisions which

allowed lower parking supply increased as units were developed to a lower standard (ie – more affordable market housing).

Rail Stations as Node and Place

A significant decision that transit planners face when designing rapid transit stations is how to resolve the dichotomy of the station as a transportation node and as a community. The former often entails devoting large amounts of land for park-and-ride lots or access by other modes – bus transit for example. The latter function instead favours development that brings residential and commercial activity into the vicinity. Even in cities with similar development patterns can pursue considerably different policies. Calgary and Edmonton, similar in size and age of their rapid transit system, illustrate the trade off (Cervero, 1985). Calgary ultimately favoured providing park-and-ride; planners rationalized that the loss of potential redevelopment was offset by the more pressing need to relocate parking supply from downtown. In Edmonton, planners favoured providing pulse-timed buses to access the station, and felt that "by eliminating expansive surface lots, the longer-term potential for station-area development has been enhanced" (Cervero, 1985, 640). These decisions can have lasting impacts. Once decisions are made about the physical design of the station area, changes to the design can pose significant challenges.

Park-and-ride lots serve an important function in rapid transit networks. They are typically provided with the intent of intercepting vehicle trips that are directed to areas the transit line serves (Bolger, Colquhuon & Morrall, 1992; Duncan & Christensen, 2013), which can "act to disperse demand for constrained road and parking capacity to suburban locations with excess capacity" (Duncan & Christensen, 2013, 149). Park-and-ride lots also extend the effective catchment area for transit stations, extending the mobility benefit without requiring new lines; it is also considered a politically favourable option as it "ensures that a greater number of the taxpayers who subsidize a public transit system have access to it, [...] even if most people never actually use the transit system" (Duncan, 2010, 163). Thus,

park-and-rides are often a favourable option for station areas in low-density suburban settings where most activity occurs by car.

One criticism that is levied against this approach is that park-and-ride may limit the opportunities to generate ridership on transit by removing the economic incentive to get rid of a vehicle (Duncan, 2010). If park-and-ride is a substitute for expensive or limited parking supply in congested centres such as downtowns, then ultimately the facility is generally only useful for those trips and does little to encourage transit use to destinations where parking is free and plentiful. Furthermore, a transit agency that provides park-and-ride under the belief that it provides greater flexibility and faster travel time than using a feeder bus (Bolger, Colquhuon & Morrall, 1992) may weaken the desire to improve those feeder services due to low ridership.[2] This unintended consequence may be further magnified if trip attracting uses exist within the station area with park-and-ride. Mingardo (2013) found that 6-15% of park-and-ride users in Rotterdam, Netherlands, were simply driving to the station and then walking to their final destinations, completely bypassing the transit line; at two stations in The Hague, Netherlands, more than half of all users were "park-and-walkers".

Park-and-rides also pose significant challenges to developing station areas into TODs. Providing large blocks of land for parking purposes can create an uncomfortable environment for pedestrians can discourage walking access from surrounding neighbourhoods (Duncan, 2011). Locating park-and-ride lots farther from the station may mitigate this factor, but there is evidence that park-and-ride users may be more sensitive to walk distance than people walking from their trip origin. In Calgary, the maximum desirable walk distance for park-and-ride users to LRT stations was found to be 125-250m; stations which had walk distances up to 450m showed lower utilization rates than would otherwise be expected (Bolger, Colquhuon & Morrall, 1992).

[2] As discussed in previous sections, improving the quality of service is a strong factor in encouraging transit use.

Another considerable challenge faced is that park-and-ride lots depress market demand for TOD in the area. Stations built without parking experienced greater gentrification effects than those with parking (Kahn, 2007). Duncan (2011) also examined the housing value impacts of station parking. The presence of park-and-ride reduced the value of station area homes by almost 4%, in stations with both good and poor pedestrian environments. In an earlier study, which hypothesized the effect of removing park-and-ride on system ridership on BART, Duncan (2010) further found that some stations which served as destinations would actually increase in ridership due to the removal of a poor pedestrian environment.

Park-and-Ride and TOD Ridership

Park-and-ride lots can serve as desirable candidates for redevelopment into TODs, as they mitigate many of the land development concerns associated with redevelopment (**discussed in Section 2.5**). But this process may be difficult to implement. One of the most significant obstacles is political. Even if redevelopment does lead to a net gain in ridership, "the detriment of losing an existing rider (read constituent) is more costly than the benefit of gaining a new rider" (Willson & Menotti, 2007, 124). Replacing park-and-ride with development may also lead to a net decrease in ridership on the rapid transit line, especially if no suitable alternative exists for former drivers to access the station.

Current experiences with rapid transit systems suggest that TODs would need to attract a large number of new residents or employees to offset ridership lost as a result of removing park-and-ride spaces. Park-and-ride lots at rail stations typically generate between 0.7-1.5 daily boardings per stall (Bolger, Colquhuon & Morrall, 1992; Merriman, 1998; Kuby, Barranda & Upchurch, 2004). By comparison, station area residents generate between 0.09-0.32 daily boardings per resident (Cervero, 1994; Kuby, Barranda & Upchurch, 2004). Without replacing these parking spaces, or a significant diversion of park-and-ride users to alternative access modes, TODs could require up to 15 new residents or employees per parking space to maintain the same level of ridership. This has led some agencies to

require that prospective developers replace parking stalls near stations lost to development, as high as a 1-to-1 replacement level (Willson & Menotti, 2007).

If reductions in parking were permitted, the density of development required to maintain ridership in many stations would be significant. In San Francisco, station area development needed to replace park-and-ride ridership for most stations is estimated to have densities above 120 units or employees per hectare, well above most such existing concentrations outside of downtown environments (Duncan, 2010). While some of these stations had density thresholds below 40 units or employees per hectare, these were typically to be found in areas that were already intensively developed and had other supportive built environment characteristics which reduced reliance on the automobile as an access mode. Similar results were found by Willson & Menotti (2007), who focused on the net fiscal change to a transit agency of replacing agency-owned parking with development. They found that in areas which were already more intensively built out, a market for pricing parking existed, and station access alternatives, could realize a net fiscal benefit of losing parking in favour of development. Conversely, suburban stations where a market for charged parking did not exist and where auto dependency on station access was high, a net fiscal loss would occur due to lost ridership.

The availability of access alternatives is a crucial factor in offsetting potential ridership losses. BART seems particularly dependent on auto access to its stations. In 1998, 38% of riders boarded BART through park-and-ride, twice as many as by transit; by 2010 31% of riders were still driving to the station while transit remained unchanged (Syed, Golub & Deakin, 2009). At suburban BART stations, 80% of riders in 1993 were drivers (Cervero, 1994).

A case for the value of alternatives can be made in examining the impact of parking fees. In cities with high parking costs and limited supply in downtowns, the introduction of parking charges was found to minimally affect overall transit ridership (Pratt & Turnbull, 2004). In San Francisco and Calgary, among the most expensive downtown parking markets in North America (Colliers International, 2012),

this remained true following the introduction of charged parking at transit stations; yet the response in access mode was much different. When parking charges were introduced at several stations along BART, few riders switched to bus access; most accepted paying the fee (Syed, Golub & Deakin, 2009). When similar charges were implemented on Calgary's LRT system in 2009 park-and-ride use dropped by one-third, yet feeder bus ridership grew by 22% (Calgary Transit, 2011). This indicates that there is some elasticity in station access modes when viable alternatives exist. This relationship also works in the reverse. When a 1990 extension to Calgary's LRT system opened, which included a large park-and-ride facility, one-third of riders had previously used feeder buses to access the LRT (Bolger, Colquhuon & Morrall, 1992).

Providing efficient feeder bus service can not only offer an alternative to station access, but can also add more ridership than the provision of parking. A study of 200 LRT stations found that each bus route serving a station was associated with 123 additional daily boardings, the same as could be expected from 160 parking stalls (Kuby, Barranda & Upchurch, 2004). In another study of 11 cities, LRT stations with parking averaged 50% more ridership than without parking, but feeder bus service was associated 130% greater ridership (Parsons Brinckerhoff Quade & Douglas, 1996).

Ultimately, supplying park-and-ride spaces on a transit network appears to provide a net benefit to the transit system. However at the individual station level there is little compatibility between traditional park-and-rides and TOD. Much like intensified activity nodes, parking spaces should be thoughtfully distributed in the system where positive outcomes can be maximized (ie – drawing ridership from catchment areas not served by transit or where market interest for TOD is unlikely), while its negative impacts can be mitigated (depressing market interest in redevelopment, creating a disincentive for transit improvements).

2.5 Planning Opportunities for TOD

What can planners do to encourage TOD in station areas? The previous sections indicate that dense development with mixed uses, improved proximity to transit and quality of transit service all contribute to generating more trips by transit and active modes. Conversely, the provision of large amounts of free or underpriced parking creates an incentive to use personal vehicles. Based on these findings there are three areas in which planning agencies and governments can exercise significant influence in fostering transit supportive conditions: the physical design of the transit network, channeling market forces, and combining transit-incentives with auto-disincentives.

Designing Good Transit

The physical design of the transit network can have lasting impacts on the ability to shape land use and travel behaviour. This is especially significant for rail-based transit. Bus routes are limited only by the road network; changes in routing and service can be made over time to better reflect travel patterns. By contrast, rail systems become permanent features of the built environment. Good planning decisions with respect to alignment and station placement can support both existing travel patterns and the ability to shape future travel demand.

As most investment in rail transit systems occurs in currently developed areas, municipalities must make tradeoffs between maximizing the potential for ridership and land use change, and the financial cost of the system. One such trade-off is in deciding on the appropriate technology and network geometry of a transit line. Metro (heavy rail) systems are expensive to construct but offer the most potential benefits to riders and land use change; widely spaced stops concentrate accessibility benefits into a smaller area and faster operating speeds make them more competitive against personal vehicles (Cervero, 2009). In contrast, LRTs distribute the accessibility benefit of transit to a wider area as a result of shorter stop spacing, but have lower land use impacts due to generally lower operating speeds and thus competitiveness with autos (Cervero & Seskin, 1995; Cervero, 2009).

The scope of service to be offered presents another trade-off for planners. As discussed previously, systems which offer numerous potential destinations are more attractive to potential riders. Aggregate land use changes associated with transit are similarly increased with a broader geographic range of service: each new line benefits both the newly served corridor as well as existing lines. This has partly explained why some single-line LRT systems in the United States have experienced modest land use changes (Cervero, 2009). Faced with limited financial resources, a decision to provide a greater scope of service would lead to lower operational service characteristics.

One common result of mitigating this trade off is to follow existing transportation rights-of-way to minimize cost, especially freeways and freight rail lines. Unfortunately many such alignments severely constrict redevelopment potential into TODs (Vuchic, 2005; Cervero, 2009). Pursuing an alignment within existing transportation rights-of-way for transit first and foremost restricts the available supply of land for development. This was a motivating factor when the Washington metro system was extended into Arlington, Virginia: officials insisted that the route travel through a commercial corridor which was subsequently heavily redeveloped rather than an existing freight rail line which would have avoided these centres (Dunphy, et al., 2004).

As previously discussed, most people are only willing to walk between 400-800m to access rail transit. Highway median alignments mean that not only is a significant portion of this space devoted to vehicles (Kolko, 2011), but it also occurs in the area where the accessibility benefits of transit are highest: "freeways should go around or between urban subcentres or suburban major activity centres; transit should go through their axes and central areas to maximize convenience of pedestrian access" (Vuchic, 2005, 213). Much like parking lots, high traffic roadways are hostile environments for pedestrians; discouraging both the distance one is willing to walk and even the choice to be a pedestrian. Freeways and freight railways also typically offer poor local accessibility, which can discourage the market incentive for development (Knight & Trygg, 1977). Finally, providing access to these stations via grade

changes (bridges, tunnels) can further decrease the distance a pedestrian is willing to walk (Kittelson & Associates, et al., 2003).

Another factor which arises from these particular types of alignments is how that infrastructure has already shaped land uses, which may not be suitable for TODs. As Boarnet & Compin (1999, 92) note: "the legacy of pre-existing land uses is an important determinant of TOD implementation, and thus TOD prospects are heavily influenced by the alignment of a rail line and the placement of stations." Freight rail is typically accompanied by industrial uses, rarely appropriate as residential environments. Where the land surrounding a rail transit line is unsuitable or less desirable for residential development, it will be difficult to capture developer interest (Knight & Trygg, 1977; Porter, 1998).

Market Forces and Development Constraints

Many proponents of large transit projects often cite how the system will generate positive economic impacts for their city. But this is not the case. Investments in rail do not *create* development activity, but *shape* this activity (Knight & Trygg, 1977; Boarnet & Compin, 1999; Lavery & Kanaroglou, 2012). Consequently, the ability of transit to influence land use must be accompanied by regional economic and population growth. The same is true on a sub-regional level: transit-related growth is more likely to occur in areas where development would take place even without transit (Knight & Trygg, 1977). One study of TOD development in La Mesa, California, found that TOD itself was only one of many factors which motivated the city to redevelop in those particular areas (Boarnet & Compin, 1999).

Even in areas where market demand does exist, there are other obstacles which must be overcome to facilitate redevelopment. One significant concern is in assembling sufficient land to permit the scale of redevelopment needed for a project to be economically viable. At a major street intersection at one Toronto subway station, two corners which had 5 or fewer parcels of land were redeveloped while the other two which had more than 25 parcels of land were not (Knight & Trygg, 1977). It would take until 2008 for another corner to begin redevelopment. In San Diego, nearly all TOD sites occurred in

redevelopment zones which included tax increment financing and land assembly tools; the only site which was not in one of these zones was a 38 hectare former gravel pit under single ownership (Boarnet & Compin, 1999).

Implementing appropriate development incentives is also crucial. This extends beyond simply zoning which permits denser development. As the automobile will be the primary transportation influence on land use, especially outside of downtowns, plans should be crafted to entice market interest into providing the type of development that can overcome this influence and be transit- and pedestrian-friendly (Porter, 1998). Some of the incentives that can promote this type of development include parking reductions and density bonusing, which create economic incentives for developers (Kolko, 2011). Other strategies that public agencies can pursue include investing in infrastructure and engaging in comprehensive TOD planning around rail stations. These strategies were partly responsible for commercial properties along San Diego's Mission Valley LRT line having greater value increases than commercial properties along the city's other LRT lines (Cervero, et al., 2004). Taken together, active planning intervention and market forces can contribute to successful TODs: "where local conditions are consistent with TOD, as was the case in La Mesa, progress can be fairly rapid. Elsewhere, barriers and competing concerns carry the day" (Boarnet & Compin, 1999, 92).

Financial tools present another key piece in stimulating TODs. New transportation infrastructure typically raises the value of land which benefits from this improved accessibility (Dunphy, et al., 2004; Gihring, 2009). This is especially true in the case of rail transit "in large part because there is a finite, limited number of benefitting properties as a result of railway improvement" (Cervero, 2009, 17). Governments and transit agencies have a motivation to capture some of this value to offset the significant costs of providing this infrastructure by maximizing the development potential of these properties. Several types of financial tools have been created which can channel market forces to develop station areas while creating revenue for governments and transit operators.

The most popularly used of these is Tax Increment Financing (TIF) (Dunphy, et al., 2004; Harding, 2011). This method operates on the principle that improved infrastructure will result in higher revenues as properties increase in value or are redeveloped. In its most common form, governments will provide infrastructure improvements to a designated area through debt or bonds which are then paid back from property tax revenue generated in that district, specifically the difference (or increment) between a property's value versus a base year. In this way, governments share some of the financial risk in redeveloping an area, but improve its market desirability (Cervero, 2009; Gihring, 2009; Harding, 2011).

Another emerging financial tool is a land value tax (or split-rate tax) (Gihring, 2009). This method applies differing tax rates to the value of a land parcel and the value of the improvements on the land. By raising the tax rate on the value of land, but lowering that for improvements, the overall revenue change is neutral. But this method has two major effects on development. Property owners are much less likely to speculate on land and thus removing them from development, and more significantly, it incentivizes improving or redeveloping land to a higher use to offset the land taxes.

Combining Transit-Incentives and Auto-Disincentives

Improving the likelihood of using transit, or discouraging the use of personal vehicles, has been shown to influence travel behaviour. Undertaken individually, the literature has shown these changes to be modest. Simply increasing the cost of auto travel does little to shift trips to transit unless a reasonable level of service can be provided (Barnes, 2005). However when combined, the likelihood of using transit is increased considerably (Parsons Brinckerhoff Quade & Douglas, 1996; Casello, 2007).

In San Francisco, 92% of residents within 400m of BART that worked in downtown where parking was charged commuted by train; 45% of workers at suburban downtowns such as Walnut Creek and Pleasant Hill where parking was charged did the same, while only 2% of workers commuted by rail to stations were parking was free (Cervero, 1993). Similarly in Toronto, North York which is on the

subway line and charges for parking has more than twice the transit mode share as downtown Mississauga and Scarborough which have poorer transit service and free parking (Filion, 2001).

2.6 Summary

The key findings of this literature review indicate that although built environment characteristics can and do influence travel behaviour, these alone are insufficient to significantly alter the likelihood of mode choice unless implemented over a significant area. Rather, built environment characteristics interact with and enhance aspects of the transportation network which creates travel opportunities. Certainly even the densest of communities would see little transit use if bus service was intermittent and far away.

Factors such as density contribute most to encouraging transit use by concentrating more origins and destinations into a smaller area, and generating larger pools of potential riders which can justify service improvements. The congestion externality produced by dense environments also contributes to discouraging auto-use as more roadway users compete for a fixed amount of space. Mixed uses effectively encourage active transportation by shortening trip distances. In such situations transit ridership is a secondary product; by enabling more needs to be met without the need of a car it may be possible to get by with fewer or no vehicles and use transit instead for trips beyond walking or cycling distances.

As more transit service is offered, and that service located closer to both the origin and destination of a trip, it becomes "less expensive" to use and more desirable as a mobility option. Transit riders are almost always pedestrians for at least one end of a trip. Service which shortens the walk distance will increase the likelihood of it being utilized. This is especially true at the destination end of a trip where there are fewer mobility options.

Ultimately, Transit-Oriented Developments provide an opportunity to leverage the transportation-land use connection to realize planning objectives, specifically in lessening automobile dependency. The success of TOD as a development paradigm is significantly improved when it makes meaningful improvements to the mobility options of residents and harnesses market forces. But planners

need to be active participants in this process. The legacy of previous transportation investments continue to exert considerable influence on land use patterns, even if those investments have become largely obsolete (Anas, Arnott & Small, 1998). With the automobile continuing to be the dominant transportation influence in modern North American cities, planners must incentivize the use of alternative modes both by providing improved ability to use those modes and by creating a built environment that supports them. Simultaneously, planners should implement disincentives for auto use that will weaken its influence over travel behaviour and land use. Finally, although behaviours and preferences may change, the built environment changes much more slowly, and "an environment built to support transit will continue to support transit for generations of residents to come" (Parsons Brinckerhoff Quade & Douglas, 1996, 3).

Chapter 3: Research Methods

The research methods utilized in this thesis reflect the exploratory nature of the selected topic. Much of the existing academic literature into the transportation and land use impacts of rail transit in North America focus on a small subset of cities from which Calgary's LRT network is largely absent. Furthermore, these studies typically test for the significance of a few selected variables in explaining transportation and land use outcomes; as discussed in the literature review these include built form variables, service quality, and network connectivity. This thesis instead seeks to understand the decision-making process – or philosophy – used by municipalities to guide transportation and land use decisions. A city's philosophy influences not only the aforementioned variables included in other studies, but by extension the transportation and land use outcomes associated with rapid transit. Within the context of Calgary, this research aims to understand why such significant changes have been realized in travel behaviour yet land use change has been ostensibly so modest. To permit this understanding, the methodology must allow consideration of what decision-makers sought to achieve, but also the trends and factors to which they reacted. Given these factors, a qualitative approach is appropriate in addressing the research questions to create a chronological narrative which demonstrates the changing philosophy towards transportation and land use. This narrative is then used to identify key factors in Calgary's experience which shaped its rapid transit system, but also to compare against modern best practices.

This chapter reviews the overarching methodology guiding this analysis into Calgary's evolving planning philosophy, including discussion of how documents were selected for analysis. Next, the framework for defining the four eras in this thesis is examined. Following this, the station selection process for the TOD case study is described. Finally, the chapter concludes by reviewing some limitations in the selected approaches.

3.1 General Methods

The research presented in this thesis is primarily the result of a detailed analysis and interpretation of key plans and policies adopted by the City of Calgary since the need for rapid transit was first identified in the 1960s. With almost 50 years of planning history to review, it was necessary to define guidelines for a plan or policy to be included in this analysis. These include:

- All municipal plans as required under the Alberta Planning Act. This included Municipal Development Plans, Transportation Plans, and the Land Use Bylaw. All other plans adopted by a municipality in Alberta must be in conformance with these documents.
- All plans and policies offering direction for land use and transportation within a geographic scope that includes or is likely to include an LRT line and LRT station areas. These are primarily Area Redevelopment Plans, Station Area Plans, and LRT Land Use Studies.
- Any special study or technical plan whose scope is directed towards the development of rapid transit or land uses in rapid transit station areas.

Other documents which do not strictly fulfill these guidelines could also be added based on determination of relevance or particular significance to the research topic. Plans which were analyzed in this manner include those which were referenced heavily by previously selected plans, but also those focused on downtown or parking. Using prior contextual knowledge of the city and its rapid transit system, these two latter factors were suspected of having a high likelihood of influence on planning for Calgary's LRT system and warranted inclusion in this analysis.

In tracking the evolution of Calgary's land use and transportation planning, it was necessary to delineate eras that exhibited a cohesive philosophy to demonstrate progression. Although the specific years dividing the four eras defined are open to debate, they correspond to the planning for, and implementation of, Calgary's LRT network. Each era was further structured by three factors that together defined the nominal philosophy. First, it was necessary to identify key trends occurring within the city,

effectively creating the planning challenges needing resolution. Common trends in the eras included the general economic climate of the city (especially boom and bust cycles), travel behaviour changes, and general growth patterns. Second, the key policy changes are identified which respond to these trends, either supporting and reinforcing them or seeking to counter or correct them. Finally, the impacts of these policies are discussed, both in their immediate effects and in how they shaped trends in the subsequent era.

In establishing a planning philosophy for each respective era, it is also possible to evaluate their effectiveness in stimulating changes to travel behaviour and land use by comparing them against current transit planning best practices. These are defined here principally as the Transit-Oriented Development school of thought which is utilized by numerous North American planning departments, but also draws heavily from agglomeration economics. The differences that are found in this comparison between Calgary's experience and the idealized model then provide the basis for the answers to the research questions.

As a result, the difference between Calgary's experience, whether in planning approach or unique trends and characteristics, relative to the normative model then explain why the rapid transit outcomes in Calgary have differed from expectations that changing travel behaviour and land use are connected.

3.2 TOD Case Study – Site Selection

Following the chronological narrative presented in Chapter 4, this thesis includes a TOD case study that contrasts station area planning in the 1980s and 2000s. The purpose of this comparison is to demonstrate how differing planning philosophies can contribute to drastically different outcomes at the local level. Three LRT stations were selected for analysis from the 1980s and two in the 2000s.

In the 1980s, station area plans were prepared only for stations on the South LRT line, eliminating candidates from the Northeast and Northwest lines. Of these, Chinook, Heritage, and

Southland Stations were considered to have the highest development potential and thus served as best cases for realizing intensification.

For the 2000s, Chinook Station was retained in the analysis. It remains as a high priority site for intensification, but is also the only one of the three stations from the 1980s to have a new station area plan adopted. The second contemporary station in the case study, Westbrook, is on the newly opened West LRT line. Like the others, it carries high expectations for redevelopment. Furthermore, it demonstrates the implementation of modern planning policy without a legacy of past rapid transit planning as with stations on the other three LRT lines.

3.3 Limitations of Research Approach

The most significant limitation in the research methods outlined in this chapter is the absence of the voice of other important actors involved in this evolution. Although the plans analyzed in this thesis speak to the City's planning objectives and of important factors that planners are responding to, they are still distanced from the individuals who shaped their content. Other stakeholders, including developers and politicians, directly or indirectly shaped these plans. This is addressed partly through drawing on secondary sources such as Foran (2009) and Sandalack & Nicolai (2006), as well as market research conducted by various firms. A fuller inclusion could not be included due to constraints including the large scope of research proposed and available resources in pursuing these voices.

The other principal concern is that the qualitative approach utilized may limit the generalizability of some conclusions to other contexts. Many of the factors identified as being significant in the case of Calgary are rarely a consideration in other cities. However, while other cities may not exhibit the same cyclical economic tendencies or specialization, this research does confirm many assertions associated with TOD planning.

A final, albeit relatively minor, limitation stems from the historical scope of this thesis. Plans adopted since 1990 were relatively easy to obtain in their full form, even highly specialized and technical

documents. In contrast, some plans from the 1960s and 1970s were incomplete, and a small subset was unable to be obtained. One result of the inability to access plans is that much of the analysis of rapid transit during these earlier decades is limited to the South LRT for which the most complete set of documents was available. As this line was also the most comprehensively planned of the first three, the analysis should be considered as representative of those eras.

3.4 Summary

This chapter reviewed the research methods that have been applied in conducting this study. Utilizing a qualitative approach, this thesis seeks to construct a chronological narrative which places Calgary's rapid transit system within a broader planning context. By conducting a detailed analysis of plans and policies since the need for rapid transit was first identified, it is possible to understand what the City aimed to achieve by investing in LRT and how this view has evolved in the last 47 years. In interpreting these plans, cohesive planning philosophies were constructed that tracked this evolution. Finally, in comparing these philosophies with the best practices identified in the literature review, conclusions are drawn which explain why land use changes in Calgary associated with rapid transit have differed from normative expectations.

Chapter 4: The Evolution of Planning in Calgary

Calgary is a city that has historically been shaped and moulded by the railway. The arrival of the Canadian Pacific Railroad (CPR) in 1883 quite literally redefined the city, moving the townsite westward from its original location east of the Elbow River in present day Inglewood to concentrate along the new rail siding. Much of the early growth and development of the city followed the railway: Ogden, an early suburb, grew around the CPR yards southeast of the downtown. By 1914 streetcar lines operated by the Calgary Municipal Railway (forerunner to Calgary Transit) linked the core with its suburbs: Ogden; Mount Royal to the south; and Bowness and Montgomery to the north-west.

Following the Second World War Calgary, like many other cities, was growing rapidly with postwar resettlement. However, the discovery of oil in Leduc in 1947 magnified this growth considerably: the city's population trebled in the next 17 years to 294,924. The majority of this growth occurred in new auto-oriented subdivisions. With spreading subdivisions and rising incomes contributing to higher auto ownership, Calgary's transportation system was increasingly congested and struggling to provide necessary infrastructure for new cars.

Despite the population growth, public transit in the post-war period suffered. The last regular streetcar service ended in 1950. Annual Revenue Passengers decreased 25% between 1957 and 1964, and annual per capita rides fell from 125 to 67 over the same period (City of Calgary Engineering Department, 1967). It might have been that public transit would have largely been allowed to continue to degrade but for the desire on the part of the City to retain downtown as the primary center of employment and retail activity in the city. With the number of trips into and out of the downtown core expected to increase by 75% from 1966 to 1986, existing roadway capacities were expected to be reached and well surpassed (City of Calgary Engineering Department, 1967). It is in this context that the City of Calgary embarked on a planning process that would result in its current rapid transit system, a Light Rail Transit (LRT) system that the City hoped would redefine the city by rail once more.

This chapter reviews the evolution of the City of Calgary's planning philosophy, specifically with respect to transit and land use planning. The aim is to provide an understanding of the decisions that were made which shaped the form and function of public transit in Calgary, and their effect on changes to land use (or lack thereof). The chapter is divided into four sections: Inception (1966-1976), First Generation (1976-1990), Evaluation & Transition (1990-2000), and Second Generation (2000-present). Critical themes covered in each section include: The Role of Downtown, Transit Planning and Service, Land Use Policy, and Parking Provision. All four of these themes reveal important decisions which were made, and trends which influenced these decisions, that together shaped this evolution. More importantly, they provide explanations as to why Calgary was so successful in generating significant ridership on its LRT system and yet had such modest land use changes at suburban stations.

There are several findings demonstrated in this discussion. The LRT system did stimulate land use changes in station areas, but these were primarily concentrated in the downtown core. The City of Calgary has held a consistent policy view that favoured centralizing office employment in downtown, and has only recently taken steps to permit more significantly-scaled suburban office centres. Furthermore for much of the period discussed, this view was mirrored by market preferences. Office firms continued to locate downtown, and only when the costs of doing so became significant during the economic boom of the 2000s did the suburbs become a desirable and competitive alternative.

Land use changes at suburban stations were much more modest. This finding is attributed to several reasons. The first three LRT lines were planned in a period of rapid growth, both in downtown employment and suburban expansion. This led the City to select routes that could provide as much service as possible for a low cost, and as such the resulting alignments were often in areas that had limited potential for intensification. Furthermore, the City's restrictive parking policy for downtown saw many suburban stations provide park-and-ride spaces to offset spaces in the core. Finally, although some stations had market pressures for intensification, the economic bust and subsequent stagnation that coincided with the opening of the LRT system suppressed this demand. In the following years the City

permitted substandard development to occur in station areas, reducing the availability of land when market conditions did improve.

4.1 Inception (1966-1976):

The first mention in planning documents of the need for rapid transit service is found in the 1966 Downtown Master Plan. This began the process which resulted in Calgary's LRT network, yet it is difficult to understand the City's philosophy on transportation during this period. On one hand, rapid transit was expected to have a significant impact on land use patterns both in downtown and at suburban stations, and also accommodate an increasing portion of future CBD-oriented travel. On the other hand, plans also portrayed transit as a secondary concern in meeting the demand for travel to downtown. The future of transportation in downtown Calgary was to be oriented on a ring of freeways.

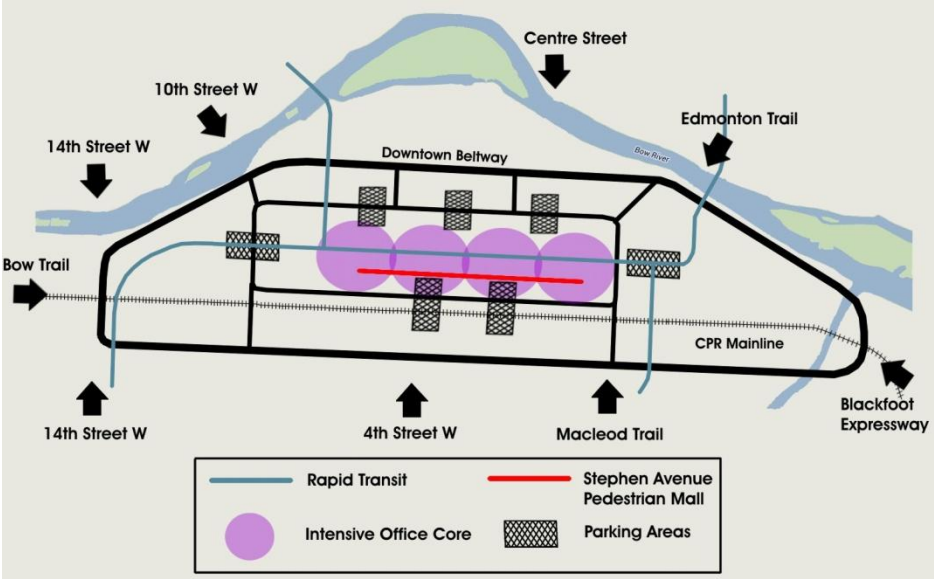
4.11 The Role of Downtown

Downtown Calgary in the 1960s was viewed in a similar manner as downtowns in many other North American cities in the period. D.J. Russell, chairman of the Planning Advisory Committee, spoke of downtown: "There is very little in Downtown Calgary that is exciting or interesting: there is much that is drab and depressing" (City of Calgary Planning Department, 1966, Statement of Objectives). The mindset of planners was on urban renewal schemes. More specifically, planners recognized that while the residential population was decreasing, the downtown had enormous potential for the city in terms of employment and as a shopping destination.

With the discovery of oil in Leduc in 1947, many petroleum businesses came to Alberta. The Barron Building helped create the first "oil patch" in the downtown, and stimulated the trend of office demand within the city. In 1966 the City projected that employment in downtown would increase from 34,600 to 59,500 over the next 20 years, nearly doubling the demand for office space (City of Calgary Planning Department, 1966). As a result, trips entering or leaving the downtown area were projected to increase by 75% by 1986. With the existing transportation network insufficient in meeting this demand, planners prepared to expand network capacity (City of Calgary Planning Department, 1966). While the

1966 Downtown Master Plan did serve as the beginnings of Calgary's eventual rapid transit system, transit was not envisioned as the primary means by which new travel would be accommodated. Instead, the 1966 Plan focused on freeway expansion.

The key infrastructure meant to relieve congestion in the downtown was a ring of freeways encircling the core area, accessing large perimeter parking garages (**Map 2**).The northern portion of this freeway, termed the 'Downtown Penetrator' in the 1963 Calgary General Plan, would require the removal of "underperforming" residential housing between downtown and the Bow River, including the outright elimination of Calgary's Chinatown.



Map 2 - Transportation Concept Plan for Downtown Calgary (Adapted from City of Calgary Planning Department, 1966)

The Downtown Penetrator was ultimately rejected as a result of community opposition that mirrored famous examples in Toronto and New York, but the clear emphasis was on facilitating automobile access to the core. Rapid transit was intended to play an ancillary role that would largely be restricted to overflow during peak commute congestion. As evidence of this planning philosophy, it is telling that the introduction to the plan begins a quote from Victor Gruen's *The Heart of Our Cities*:

> "We cannot force people into any action they don't deeply desire. If they don't wish to use public mass transportation, they just won't do it. If they don't wish to come to a place that has little to offer in opportunities, attractiveness and human experience, they will stay away in droves." (City of Calgary Planning Department, 1966, 2)

Further, a commissioned report to study transit published one year later, stated: "Under any circumstances, the automobile will continue as the principal means of travel to downtown" (Simpson & Curtin, 1967). It was clear that the city had adopted a philosophy that the automobile would be the primary method of access to the downtown, and should be accommodated thoroughly.

4.12 Transit Planning and Service

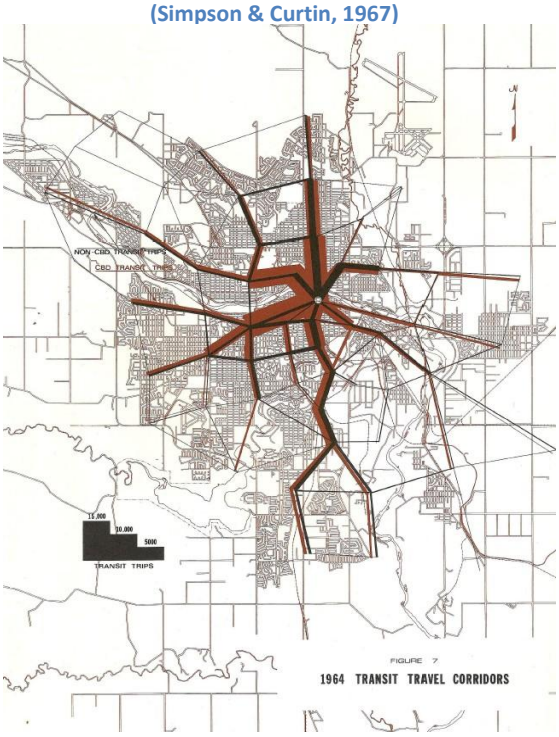
The emphasis on the automobile in meeting Calgary's future travel demand was evident in ridership projections for the transit network. Even with rapid transit, the citywide transit mode share was expected to decrease from 13.2% of all trips in 1967 to 11.5% in 1986 (City of Calgary Engineering Department, 1967). However, implementing rapid transit was expected improve transit mode share for downtown commuting trips. As several decisions needed to be made for the rapid transit system, the choices made by the City reflected this function. In 1967, 29.6% of downtown work trips were made by transit; by 1986 planners expected this to increase to 41.9% (City of Calgary Engineering Department, 1967).

The most significant of these decisions was whether to prioritize corridors with significant current transit demand, or future high growth corridors. The planned network was envisioned to travel along four corridors which demonstrated this dichotomy. The northern and western proposed lines served communities with high ridership (**Map 3**), but almost 78% of future population growth was expected to occur in the south and north-west transit corridors (Simpson & Curtin, 1967). Although planners noted that all four proposed rapid transit corridors were suitable candidates for improvement, only the north-

west and south corridors were carried forward for cost and revenue analysis (City of Calgary Engineering Department, 1967).

The City also needed to choose a preferred technology. Simpson & Curtin (1967) had originally advocated for an elevated monorail system operating on pneumatic tires (Simpson & Curtin, 1967). With an at-grade alignment selected (**see section 4.13**), the City opted to compare Busways and Light Rail Transit. Operating on the basis that the south corridor required improved transit that could offer faster service to the downtown core, and a capacity of 5,000-10,000 persons per hour per direction, a report strongly endorsed the selection of Light Rail Transit as the desired technology (City of Calgary Transportation Department, 1976b). While sharing similar capital costs, operating costs for LRT were noticeably lower in meeting projected demand: choosing LRT would save between $1.275 million and $2.853 million per year over a Busway.

Map 3 - 1964 Transit CBD Desire Lines (Simpson & Curtin, 1967)



With planning for the rapid transit system underway, City Council directed Calgary Transit System (CTS) to provide an interim service that would improve transit service in the eventual rapid transit corridors (City of Calgary Transportation Department, 1974a). This directive was given in order to test the impact that rapid transit might have on travel habits and mode share. The result of this was the Blue Arrow Bus Express System, beginning service in September 1972. The original routes approximated the eventual alignments of the future South and North-West LRT lines, with park-and-ride facilities at McMahon Stadium in the north-west and Heritage station in the south (**Map 4**). From these terminal points the routes offered limited stop service to the downtown core.

Initial results were tepid. But with steady marketing efforts daily ridership grew: from 3,360 at launch in September 1972, to 6,233 in February 1973, and 9,577 at the end of the test phase in November 1973 (City of Calgary Transportation Department, 1974a). As familiarity with the service grew so did the public perception of its utility, as the Comprehensive Review noted:

> "The Blue Arrow System was found to be very favorable; in particular the acceptance of the people in the Blue Arrow corridor. [...] It was found that the public would like to have a similar type of service in their residential areas, with a city-wide integrated system." (City of Calgary Transportation Department, 1974a, 26)

Two surveys of riders were conducted in 1973, the first on February 14, the second on November 7. They found that the Blue Arrow was quite successful at diverting trips onto public transit, with 24.5% of respondents in February having previously commuted either as an auto driver or passenger, and a further 13.2% in November (City of Calgary Transportation Department, 1973b, 1973c). Over 95% of users accessed the system either by walking or transfer from another bus. Both surveys also found that the service was attracting choice users: half of the riders in the first survey, and two-thirds in the second.

Map 4 - Blue Arrow System 1981 – Hubbell & Colquhuon, 2006

The Blue Arrow system was an important step in building ridership for the eventual rapid transit system, while providing technical and operations feedback for Calgary Transit System. The popularity of these routes generated service level increases, and in October 1973, new routes were introduced that

served corridors in the north-east and west. The system remained popular until being replaced by the LRT system in the 1980s.

4.13 Land Use Policy:

Few planning documents during this period directly speak to the land use impacts, potential or otherwise, that were expected from Calgary's rapid transit system. But there was significant dissonance between plans which projected significant intensification and the reality of growth patterns in the city. The transportation engineers retained to study transit for the original CALTS study, while propounding the primacy of the automobile, took a dramatic stance on the land use impacts of rapid transit by drawing on the experience of Toronto, which had opened the Yonge Street subway 13 years earlier. They advised that there "had never been an unsuccessful rapid transit system," and quoted G. Warren Heenan, Director of the Canadian Association of Real Estate Boards, speaking of Toronto's subway: "If an urban rapid transit system never earned a dime, it would still pay for itself a thousand times over through beneficial impact on real estate values and increased assessments" (Simpson & Curtin, 1967, 9). This attitude seemed to extend to planners at the City of Calgary, who confidently predicted that up to 100,000 residents of a projected 1986 population of 775,000 could be accommodated in high density residential development surrounding transit stations (City of Calgary Engineering Department, 1967). But, beyond conceptual maps of citywide growth patterns that designated clusters of medium and high density residential along rapid transit lines, these residential forecasts were not substantiated with detailed analysis.

The lack of specific treatment of land use impacts extended well into the 1970s, even after the final alignment of the south line had been approved in 1975 by City Council. Updates to the CALTS that focused on the rapid transit system all made specific mention of expected positive land use impacts as a result of rapid transit, but noted the lack of specific direction or study of these considerations:

> "Many important implications have not been, and some cannot be, predicted or evaluated. An urban form study is therefore urgently required to proceed concurrently with system design." (City of Calgary Transportation Department, 1976b).

> "Final route selection will await land use planning studies and public participation and all viable alignments will be examined." (City of Calgary Transportation Department, 1976c).

While a land use study for the South LRT line would eventually be conducted in the early 1980s, it seemed the need to construct the rapid transit lines to serve a rapidly growing city were a more pressing concern for the city than the impacts on the existing built area. The City faced two competing forces when faced with prioritizing rapid transit lines for construction: providing service to high growth corridors and providing improved service to areas with high existing transit ridership demand. Nearly 80% of future population growth was expected to occur towards the northwest and south. But existing ridership was strongest in two other proposed rapid transit corridors: west and north. The City opted to give priority to new growth corridors.

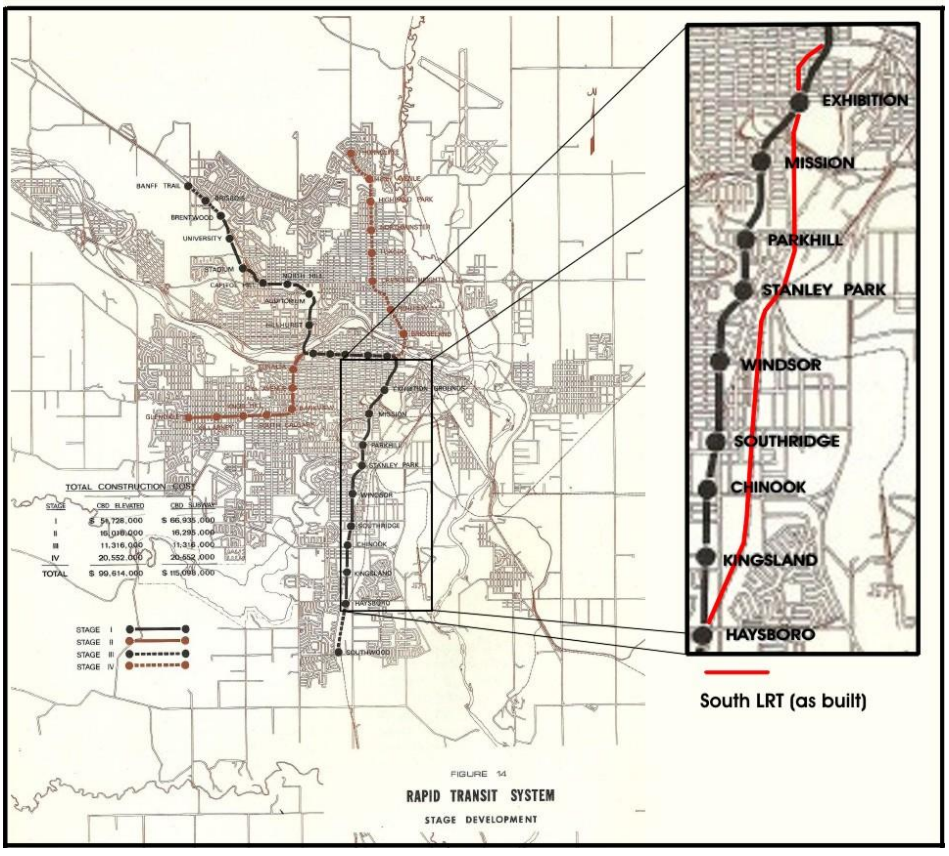
This position was further demonstrated when the north corridor, receiving a low priority in the 1967 Calgary Transportation Study despite high ridership, was altogether deleted in the 1970s. In that decade, City Council permitted the development of The Properties in northeast Calgary which had not been previously targeted for residential development. In conjunction with the rapid growth of employment east of the Deerfoot Trail expressway, this created a third major growth corridor in the city and was a significant factor in a north-easterly LRT alignment replacing the original northern route (City of Calgary Transportation Department, 1976d).

The need to extend improved transit service into these high growth corridors made the cost of the system a primary concern for the City. As rapid transit was a new concern, right-of-ways had not been preserved to accommodate the lines. Simpson & Curtin (1967) noted that Calgary had many existing freight rail rights-of-way that could permit construction of rapid transit, there was a "disparity between

available right-of-way and convenient travel for workers and shoppers." Although the consultants proposed an alignment for the South LRT which addressed these concerns, the City ultimately favoured building the LRT through an existing CPR freight corridor (City of Calgary Engineering Department, 1967; **Map 5**). This corridor certainly offered considerable cost savings, requiring minimal property acquisitions and the opportunity to provide at-grade service (although these savings were not enumerated), it offered limited potential in shaping land use change. According to Simpson & Curtin (1967, 26), "the CPR line running south from the CBD is better situated than other routes but still bypasses most of the major travel generators to the south" (Simpson & Curtin, 1967, 26). This alignment was eventually officially selected in 1975, which was not surprising given that all transportation priority studies until then were conducted using this corridor (City of Calgary Transportation Department, 1976a).

Map 5

MAP: PROPOSED RAPID TRANSIT ALIGNMENT (SIMPSON & CURTIN, 1967)



The land use impacts of LRT were not a prevailing concern during this period due to several factors. The rapid growth of the city contributed to rapidly worsening traffic congestion, especially to downtown. As a result, rapid transit would need to be quickly extended to serve high priority growth corridors to mitigate these impacts. But more importantly, it was the result of two broader policy views on the part of the City. First, the City strongly favoured maintaining a centralized office core. As a result transportation infrastructure, especially transit, was focused on facilitating trips into and out of this area. Secondly, and in direct contrast to projections of intensification in station areas, the City supported new suburban growth by approving large-scale subdivisions such as The Properties and in growth corridors to the north-west and south. These policies favoured a low-cost approach to rapid transit planning that would extend service as far as possible into these corridors to support travel to downtown. With little appreciable difference in the relative accessibility to downtown between inner suburbs and new subdivisions, and considerable land available for development in the latter, there was little incentive for the market to focus on station areas.

4.14 Parking:

A final theme to explore in this era is the treatment of parking. With daily vehicle trips into and out of the Central Study Area projected to increase from 190,000 in 1964 to 458,000 in 1986, extensive new demand for parking would be generated (City of Calgary Planning Department, 1966). This trend was reflected over the next 7 years, as transit mode share to the downtown fell by 20% while overall trips into and out of the downtown increased by 23% (City of Calgary Transportation Department, 1974b). The number of parking stalls increased even more quickly, rising by 30.4% to 25,823 in 1971 (City of Calgary Transportation Department, 1974b).

The relationship between parking supply and transit ridership did not go unnoticed by city staff. In 1972, City Council approved Development Control By-law 8600 (City of Calgary Planning Department, 1972). This new land use bylaw introduced two significant concepts that formed the basis of downtown parking policy for the next 40 years: reduced parking requirements for new development, and

a limit on how much of that parking requirement could be provided on site. The goal of these policies was also clear: "the intent to under-provide parking was to foster transit use in the Downtown" (City of Calgary Transportation Department, 2011, 6-3).

The new policy required only one parking space per 140m^2 of gross floor area, nearly three times as stringent as the old standard of one stall per workstation (approximately 50m^2) (City of Calgary Transportation Department, 2011). Furthermore, only 20% of these stalls were permitted on site. The City instituted a cash-in-lieu policy that would collect money for the balance of the required stalls, which would be used to construct publicly accessible parking garages on the downtown periphery along 5th and 9th Avenues S. The bylaw also benefited from parking economics during this period, and was broadly supported by developers:

> "At the time, parking was seen as an expensive, non-profitable component of development. Reducing the amount of parking required helped both the City and developers achieve their own goals" (City of Calgary Transportation Department, 2011, 6-3).

Parking policy developed during the 1960s and early 1970s was significant in laying substantial groundwork for future parking policies. The city identified that parking oversupply in downtown was a significant contributor to decreasing transit ridership, and moved swiftly to enact bylaws that would counter the trend. Coupled with improved Blue Arrow transit service, within eight years per capita transit ridership would exceed 90 annual trips (City of Calgary Transportation Planning, 2008a), a level not seen since the late 1950s.

4.15 Summary

The initial phase of planning for Calgary's rapid transit system was a period of growing pains. Beginning as an ancillary to the transportation network serving the downtown core, the relative importance of the transit system began to grow as planned roadway improvements were successfully

challenged and deleted. Furthermore, interim projects such as the Blue Arrow demonstrated the viability and desirability of improved transit service.

Certainly a key issue that emerges from this era is a lack of serious integration between the transportation and land use aspects of the rapid transit system. If transit lines to the north and west corridors had been prioritized instead, the increased accessibility benefit in a built up area with strong ridership would have likely attracted developer interest and stimulated intensification in station areas. However, land use policy established by the 1963 Calgary General Plan – and subsequent General Plans adopted in the 1970s – strongly supported low-density suburban expansion (Foran, 2009). The rapid growth expected in these areas led staff to prioritize rapid transit service in these corridors to accommodate trips to downtown. The following eras examine the repercussions of this disconnect.

4.2 First Generation (1976-1990):

The late 1970s saw the beginning of the next significant building boom for Calgary and population and employment growth in the city accelerated considerably. Population increased by 16.5% between 1971 and 1976, and by 26.1% from 1976 to 1981 to stand at 592,743. This period would also see remarkable changes to the skyline of downtown Calgary as numerous large office projects were completed. Employment in downtown grew from 35,000 in 1964 to 52,000 in 1976 (City of Calgary Planning Department, 1978a). This paled however to the 30,000 new jobs which were added in the next five years, reaching 82,300 in 1981 (City of Calgary Transportation Department, 1985).

As the city grew during this period, City Hall undertook a review of major planning documents. A new Downtown Plan was released in 1978 which shifted the transportation focus to transit, while a new Municipal Development Plan (MDP) was passed in 1979 which provided direction on managing growth in the city. Changes in transportation planning during this period were primarily reflected in the ongoing CALTS series of documents, including two Transportation Improvement Priority Studies (City of Calgary Transportation Department, 1979a; 1985). The planning documents published during this period reflect

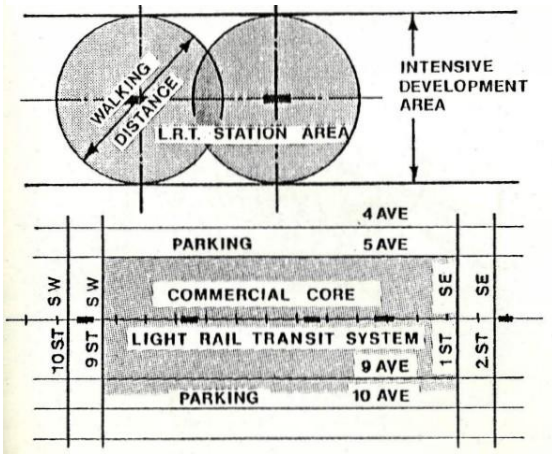
both the high levels of growth being experienced, but also a reaction to the planning principles that predominated in the 1960s.

4.21 The Role of Downtown

The 1978 Downtown Plan began by stating categorically: "The 1966 Downtown Master Plan, based on the philosophical premises of urban renewal and super-highways, is obsolete and provides a very inadequate tool for dealing with most of the problems facing us today" (City of Calgary Planning Department, 1978a, 2). Where the original plan emphasized that any person desiring to drive to downtown would be accommodated, the new plan recognized the negative implications such a policy would have on the core: requiring new roadways and extensive land for parking uses, and limited rights-of-way that would necessitate property acquisitions and demolition.

In the place of accommodating the car, transit was now considered as the most desirable means of accessing employment in the core. Roadways entering the downtown in 1976 were already at 90% capacity (City of Calgary Planning Department, 1978a). The future LRT system was seen as the key piece of transportation infrastructure that would serve travel demand to the core and permit land use changes and intensification in downtown. To this end, the Downtown Plan envisioned a linear core that would be centered within a two block radius of the LRT line. Parking uses would be directed outside of this zone (**Figure 1**).

Figure 1 - Proposed Linear Core, 1978 Downtown Plan (City of Calgary Planning Department, 1978a, 79)



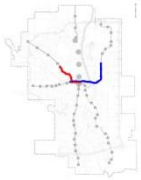
Even with the planned intensification in the core, city planners recognized that the constrained transportation network and increasing levels of congestion could limit future growth downtown. The 1978 Calgary General Municipal Plan introduced the Balanced Growth Strategy which sought to increase the

degree of office employment in suburban areas, concentrated on the rapid transit lines to the south and north-west (City of Calgary, 1978). However, there appeared to be a lack of market demand for suburban office space: a report in 1979 found that less than 2% of offices located in downtown were interested in relocating to the suburbs (Urbanics Consultants, 1979). The authors felt that the LRT system, rather than supporting office growth along LRT corridors, would instead consolidate the downtown as the primary office market in the city. Employment growth in downtown during the boom of the late 1970s supported this claim. Planners had projected that by 1986, 60,000 jobs would be downtown; in 1981, the number of actual jobs was 82,300 (City of Calgary Transportation Department, 1985).

This high rate of growth came to a sudden halt in a recession. For the first time since the Great Depression, Calgary had a net population loss in 1983 and 1984. Downtown employment growth all but dissipated; only 4,400 new jobs were created between 1981 and 1991 (Calgary GoPlan, 1994a). Although some new office towers continued to be built, including the then-tallest Petro Canada Centre in 1984, many more projects became victims of the economic downturn. Developer speculation had led to many residential properties being purchased and cleared at the periphery of downtown; when the development market stalled, many of these sites became surface parking lots for downtown commuters (City of Calgary Downtown Planning Division, 1995).

4.22 Transit Planning and Service:

This was a very active era of transit planning in Calgary. Until this point, the focus had been primarily on the South LRT line as the Transportation Department gained experience with planning and managing for a type of infrastructure new to the city. Certainly the scope of work to be done was daunting for a department which was constructing its first rapid transit line in 1978. On May 25, 1981, the South LRT line opened, quickly meeting the ridership goal of 40,000 daily riders (Hubbell & Colquhuon, 2006). The Northwest LRT was identified as the next priority for construction, but studies also had to be completed for the Northeast and West LRT lines.



The priority and staging of the two northern lines demonstrate the turbulence of infrastructure provision in this era. The 1979 Transportation Improvement Priority Study Update called for the Northwest LRT to begin in 1982 to the University of Calgary (City of Calgary Transportation Department, 1979a). In July 1980, City Council approved the Northwest LRT Functional Study to support the original priority. But the recommended alignment, which passed through the established community of Hillhurst-Sunnyside, drew considerable community opposition, causing the project to be delayed (Hubbell & Colquhuon, 2006).

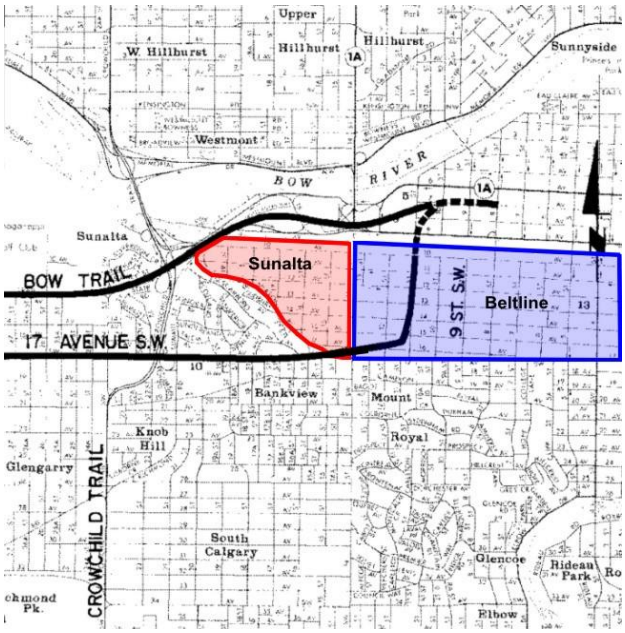
In response, planners quickly shifted to the Northeast LRT line. Originally not envisioned until the late 1980s, the Northeast LRT Functional Study was completed and received construction approval in July 1981 (City of Calgary Transportation Department, 1981). Nearly coincidentally, the revised Northwest LRT Functional Study was approved in 1982 permitting construction to begin. The Northeast LRT line would open in 1985 to be followed by its Northwest counterpart in 1987, in time provide access to venues for the 1988 Winter Olympics.

As the northern LRT lines were being prepared for construction, the Transportation Department moved to protect a future alignment for the West LRT. West Calgary was growing and several new communities were planned at the suburban edge. This work provided the opportunity to be proactive in protecting a future right-of-way. Sections of the alignment in new areas were protected as early as 1978 through the Strathcona Design Brief, and in the built up area of the city west of 37th Street by purchasing land on the north side of 17th Avenue S (City of Calgary Planning Department, 1978b; City of Calgary Transportation Department, 1979b).

The remainder of the alignment from 37th Street to downtown remained undetermined. Transportation rights-of-way between these two points were relatively constrained by existing communities, the CPR mainline, an escarpment and freeway interchanges at the intersection of Bow Trail and Crowchild Trail. In 1979 City Council tasked the Transportation Department with preparing a

comprehensive review of the West LRT, resulting in the 1983 West LRT Functional Study (City of Calgary Transportation Department, 1983). The goal of this report was to determine the optimal alignment for the future line, considering: the impact the line would have on surrounding communities; land use implications; role within the wider transportation system; and costs. Two alignments were evaluated on these stated goals (**Map 6**): the first utilizing the Bow Trail corridor, the second turning southward after downtown along 11th Street W before turning westward on 17th Avenue to meet the approved alignment at 37th Street W.

Map 6 - Proposed West LRT Alignments (Adapted from City of Calgary Transportation Department, 1983, 13)

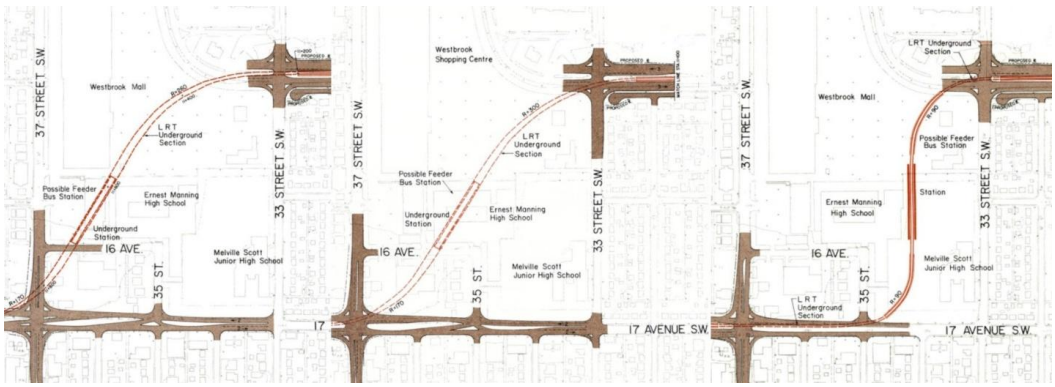


The 11th/17th alignment would serve existing communities that were already relatively dense, especially the western part of the Beltline. This alignment also had higher forecasted ridership, expecting 52,000 daily passengers versus 42,000 in the Bow Trail alignment by 2010. On the other hand, it would be much more disruptive to surrounding communities, and cost more ($249 million versus $209 million for the Bow Trail alignment). The Bow Trail alignment had many other advantages: it would serve areas west of downtown that were targeted for redevelopment, including Westbrook Mall and Sunalta which had an Area Redevelopment Plan approved in 1983 (City of Calgary Transportation Department, 1983).

Given the line's relative low priority, planning for the West LRT remained dormant until 1988. In that year, an update to the West LRT Functional Study was published, including new cost projections as well as ridership forecasts based on data collected on the operational lines (City of Calgary Transportation Department, 1988). A major consideration was the lack of density in new communities. Where the 1978 Strathcona Design Brief had anticipated 54 persons per hectare, it was building out to only 40 persons per hectare. In conjunction with data collected on the operational South LRT line, planners adjusted daily ridership projections to 28,500 on the northern Bow Trail alignment and 30,000 on the southern 11th/17th Avenue alignment. The gap in costs between the two alternatives narrowed. The Bow Trail alignment was estimated to cost $270 million, while the 11th/17th alignment would only cost $8 million more.

Despite these changes, the 1988 Update maintained the same recommendation as the 1983 Study for a Bow Trail alignment, citing improved service, fewer impacts on surrounding communities, but also emphasizing "that the redevelopment potential of the Bow Trail alignment is significant" (City of Calgary Transportation Department, 1988, 12). Council agreed, approving the entire West LRT route as recommended on October 17, 1988. Despite the assertions of the importance of redevelopment in choosing Bow Trail as a preferred alignment, and five years for potential study, a land use plan had yet to be initiated. Furthermore, the alignment of the line itself at the Westbrook Mall site had yet to be determined, nor had discussions been held with major landholders in the area (**Map 7**).

Map 7 - Proposed LRT Alignments at Westbrook Mall (City of Calgary Transportation Department, 1983, 33-38)



With the establishment of the base system of three rapid transit lines, and planning conducted on the fourth, planners updated the Transportation Infrastructure Priority Study in 1985 (City of Calgary Transportation Department, 1985). Perhaps indicative of popular public reception to the South LRT, the 1985 Update found that extending the LRT lines was a top 3 priority for residents. The Northwest LRT extension to Brentwood was considered especially significant because it offered the first Park-n-Ride facilities on that line, to capture auto users beyond the transit catchment areas. The City felt that park-and-ride was an important service to provide in meeting the transportation objectives of the LRT system. But providing this supply also created a tension in the station area between its function as a node and place; this trade-off is discussed in later sections. The extension of the Northwest LRT to Brentwood was opened for service in 1990. Other extensions were postponed because the economic recession which began in the early 1980s had begun to make itself felt; grants from The Province of Alberta which had funded transit capital projects were significantly reduced by the late 1980s (Hubbell & Colquhuon, 2006).

With economic growth and transit improvements ahead of LRT service, ridership was resurgent in the late 1970s: increasing from 67 trips per capita in 1967 to 90 at the opening of the South LRT in 1981 (City of Calgary Engineering Department, 1967; City of Calgary Transportation Department, 1993a). Transit mode share had also improved by the beginning of the 1980s, accommodating 20% of total work trips and over 43% to downtown in the AM peak (**Table 1**).

TABLE: Changes in Downtown Travel, 1971-1981

	Transit Mode Share (%)		Transit Ridership Entering Downtown (AM Peak)	Personal Vehicles Entering Downtown (AM Peak)
	City-wide	Downtown AM Peak		
1971	15.3	29.2	6,700	11,100
1981	20.2	43.2	17,400	14,600

Source: City of Calgary Transportation Department, 1993b

Table 1

While these positive trends were welcome, and counter to projections made in the early 1970s, transit ridership was still primarily driven by downtown employment. This reliance on the downtown market was readily apparent with the onset of the recession. Ridership which had totaled 53.5 million annual trips in 1981 fell by 15.9% in only 3 years (City of Calgary Transportation Planning, 2003). The recession also did more than curtail downtown employment growth. Faced with lost revenue, the City cut back on transit service. Transit operating hours per capita fell by almost 20% (City of Calgary Transportation Planning, 2008a). Although transit ridership losses were steadily recouped by 1991, this was primarily driven by population growth: after peaking at 90 trips per capita in 1981, per capita ridership dropped to the mid-70s and remained so for the next 15 years (City of Calgary Transportation Planning, 2008a).

4.23 Land Use Policy:

The late 1970s and early 1980s saw a shift in land use policy that seemingly favoured intensification, but had difficulty being put into practice. A new Planning Act was passed by the Province of Alberta in 1977, which authorized new development controls for municipalities, especially the provision for a new Direct Control (DC) land use district. A new General Municipal Plan was also passed by the City in 1978 called for a "Balanced Growth Strategy," which on the surface encouraged more growth within the existing area of the city. Finally, planners also undertook a comprehensive Land Use Study for the new South LRT to substantiate the land use claims put forward in the previous decade.

One of the more significant changes in the 1977 Planning Act was the introduction of a DC land use district. Nelson Medeiros (2011, 4), a senior planner with the City of Calgary, explains: "The DC district forms part of the land use bylaw but is essentially development control through a 'customized' regulation that permits development to be regulated in any manner council considers necessary." This broadened the scope of what council could require of prospective developers, but also gave greater flexibility in resolving planning issues compared to conventional zoning designations. Direct Control

districts would be used extensively within downtown, but were also applied to lands surrounding the rapid transit system.

The flexibility of the new land use district had significant potential in supporting the land use goals of the 1978 Calgary General Municipal Plan. This plan had called for increasing density, not just in the inner city and along the future LRT network, but in new suburbs as well (City of Calgary, 1978). However, plans were already approved for subdivisions which could accommodate over 240,000 new residents (Foran, 2009). Moreover, the "Balanced Growth Strategy" by which intensification was to be encouraged within the existing area of the city had been significantly weakened from its original intent (Foran, 2009). The Strategy sought to distribute the 120,000 new residents expected by 1991 which were not accounted for in existing community plans. Two scenarios were highly favoured by City staff, calling for more than half of these residents to be accommodated within the existing area of the city, and necessitated minimal annexation of new suburban land. As approved, the Strategy instead redistributed most of this growth into new suburban communities and significantly increased the land to be annexed. Foran (2009, 120) argues that this was the direct result of political pressure brought by developers who had speculated on land outside the city boundary, causing "the more compact urban form that had been so firmly advocated in the favoured two strategies [to be] sacrificed for a continuation of the status quo through widespread outward development."

With construction starting on the South LRT in 1978, planners finally turned to conducting a review of current land use and potential impacts in the corridor. Although the resulting LRT South Corridor Land Use Study (City of Calgary Planning Department, 1981) recommended many policies which are consistent with modern Transit-Oriented Development planning, it lacked a meaningful implementation strategy to encourage appropriate development and compliance with land use objectives. Furthermore, by enacting station area plans at all South LRT stations, it would make it problematic to focus development into the most marketable areas while creating inflated expectations for intensification that could not be supported by the market.

The framework of the Study is quite similar to modern TOD plans. Planners focused on areas within 400 metres of individual LRT stations, and recommended using DC districts or creating a new LRT district to support land use objectives. Improvements were to be made to pedestrian infrastructure, and the potential for parking reductions was discussed. Furthermore, higher density projects which might be proposed beyond this radius would only be considered if they did not degrade the marketability or development pressure on lots within the station area.

However, the Study lacked a clear implementation strategy. Consultants part of the planning process had encouraged the City to establish policies and state them explicitly "so that anyone interested is dealing with a known quantity. This in itself would remove one of the attendant risks of real estate development" (Urbanics Consultants, 1979). The consultants elaborated further by highlighting the importance of providing clear direction through appropriate zoning:

> "The only incentive required, if any, is the provision of appropriate land use classifications. A form of comprehensive development district such as "D-C" coupled with a specific development plan indicating design, land use types and densities, while allowing individual developers to formulate their own ideas within this framework was regarded as being important by developers." (Urbanics Consultants, 1979)

Despite these recommendations, the language of the plan created many obstacles to development. One of the most significant was the desire of the City to retain considerable discretion in development approval by evaluating each project on a case-by-case basis. This was especially true when the City amended the Study in 1982 with the provision that "the redesignation of selected key parcels within the 400m radius of the [LRT stations] be undertaken by the land owners rather than by the City as originally recommended" (City of Calgary Planning Department, 1981). By 1984, of 40 rezoning applications proposed, only 5 were city initiated (City of Calgary Planning & Building Department, 1984). Furthermore, while station area plans outlined desirable maximum and bonus densities, no minimum

densities were included. Without this regulation it would be difficult to mandate transit-supportive development. This combination of discretion on the part of the City in approving development and the lack of effective requirements had significant implications when market interest occurred at station areas. These outcomes are discussed in Chapter 4.

The City, while touting references to high-density mixed-use development, also only briefly addressed municipal responsibility for infrastructure improvements. Pedestrian infrastructure "would be improved" but the Study did not outline when or how. Another major barrier to redevelopment was the industrial character of many station areas. Planners acknowledged that this may inhibit residential growth, but did not outline a proactive strategy as to how the transition would be made. The solution, it seemed, was that development of large parcels would reduce this environmental constraint.

The final example of the unclear implementation strategy is the strong disconnect between the level of intensification city planners sought in the corridor and the realistic market demand for development. As part of the Study, the City retained Urbanics Consultants (1979), who were tasked with quantifying the market potential for residential and office development in the South LRT corridor to 1991. The total demand was to be assigned to each of the stations with explicit rankings. The consultants reported that the total suburban share of citywide office employment could increase from 8.4% in 1978 to 15% in 1991, two-thirds of which was expected to locate in the South LRT corridor. But the consultants also felt that most of the corridor was ill-suited for true mixed use development as it "will lack the scale and functional diversity as conventionally required in a true mixed use development. The most viable location for an integrated mixed use development is downtown" (Urbanics Consultants, 1979).

However, planners recommended intensification significantly greater than the market demand their consultants anticipated (**Table 2**). Of course planners did not expect this level of intensification to be approached prior to the 1991 horizon used for market analysis, but the lack of a rezoning strategy meant that no direction was given as to how much land would be made available, to what density, and when.

Residential projections illustrate this problem. Most of the 20,000 units would have to be constructed when the estimated citywide demand for apartments was 2,750 units per year and decreasing (Urbanics Consultants, 1979). The South LRT corridor would have to absorb most of the city-wide apartment demand to approach the density proposed in the plan.

Table 2 – Adapted from Urbanics Consultants, 1979 & City of Calgary Planning Department, 1981

Comparison of Market Demand and Recommended Density in South LRT Corridor				
Station	Market Demand		LRT South Corridor Land Use Study recommended density	
	Residential units	Office space (m2)	Residential units	Office/Retail space (m2)
Victoria Park / Stampede	1,235	9,755	3,000	83,612
Erlton / Stampede	1,490	11,148	1,000	83,612
39th Avenue (42nd Ave in sources)	790	13,006	3,150	8,361
Chinook	**1,590**	**30,751**	**5,500**	**171,869**
Heritage	**1,195**	**25,037**	**1,950**	**97,547**
Southland	**760**	**29,543**	**3,000**	**206,243**
Anderson	1,360	26,245	1,950	95,689
Total	**8,420**	**145,485**	**19,550**	**746,934**

Bolded: Stations discussed in Chapter 5 Case Study

The City of Calgary's approach to land use policy in the 1980s in many ways mirrored that of previous decades. Despite the ambitious goals for intensification, plans in this era lacked support both in market trends and policy implementation. The City's willingness to bow to developer pressure had weakened the envisioned change in growth patterns. Conversely, in station areas on the South LRT the City adopted a passive approach to fostering redevelopment. In the 1990s the City acted more decisively to address suburban expansion, but the focus was on how new communities would be developed rather than the spatial distribution of growth.

4.24 Parking

Parking policy in Calgary during the 1980s, as with the other themes discussed in this era, highlights both a growing awareness of its implications on travel behaviour but also a seeming inability to act decisively to affect these trends. City planners had drawn the connection between downtown parking provision and transit mode share rates since at least 1972. Early trends saw the ratio of parking spaces per downtown employee fall, but then increased significantly during the recessionary 1980s with corresponding declines in transit patronage to downtown. Furthermore, while planners moved to address parking as a concern for peak period commuting trips, transit was still not seen as a viable alternative in facilitating non-work trips.

As downtown employment had increased by almost sixty percent from 1976-1981, parking supply followed suit. Where 25,823 parking stalls had been provided in 1971, by 1977 over 37,572 stalls were available in the central business district (City of Calgary Planning Department, 1978a). However, the growth rate for parking remained lower than that of employment. As parking availability to 1981 grew scarcer, transit mode share continued to grow. However, the early 1980s brought significant changes to the economics of parking in downtown Calgary.

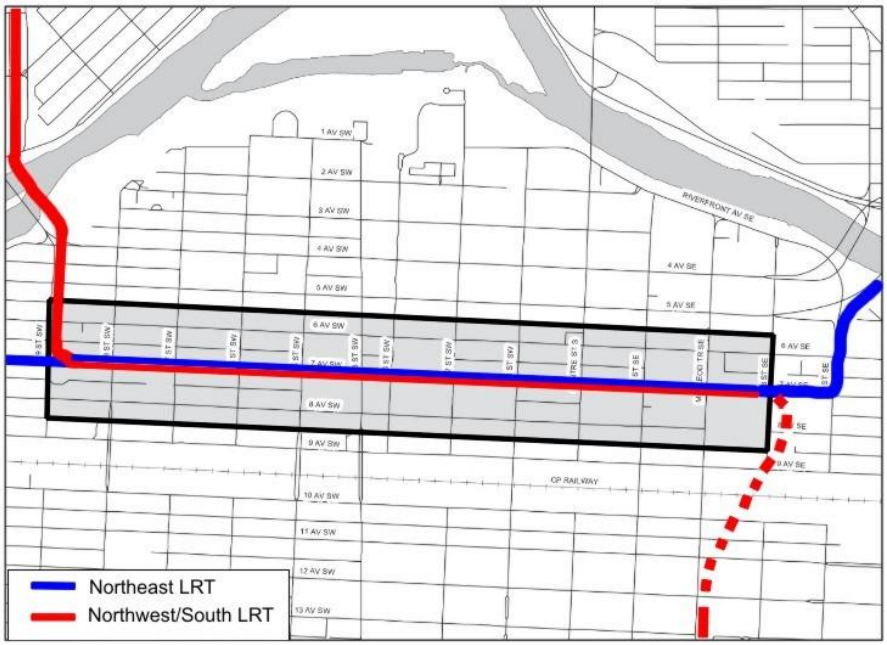
The first major change was the onset of a recession which stalled downtown employment gains. While some new projects continued to come online until the mid-1980s, many development proposals became fallow or were cancelled altogether. Some projects, such as a 64-storey second phase of First Canadian Centre, had completed below-grade parking with no employees to occupy them, opening supply for other users. Furthermore, dilapidated housing and industrial uses on the downtown periphery were also being cleared in anticipation of future development. With the economic downturn property, owners instead provided surface parking, much of which remained until the 2000s.

A second major change, this one policy changes by the City, enabled developers to effectively provide more parking. In 1982, Council approved the Core Area Policy Brief (City of Calgary Planning

Department, 1982). Addressing the boom of the late 1970s which had seen major office projects occur outside of the City's linear core area, planners sought to protect existing communities by allowing the expansion of the high density core northward to 4th Avenue S and westward to 9th Street W. It was hoped this would support the linear core concept by opening up new lands for office projects without creating spillover into residential areas. However, the Restricted Parking Area which subjected projects to cash-in-lieu payments for parking was not expanded along the expansion of the office core.

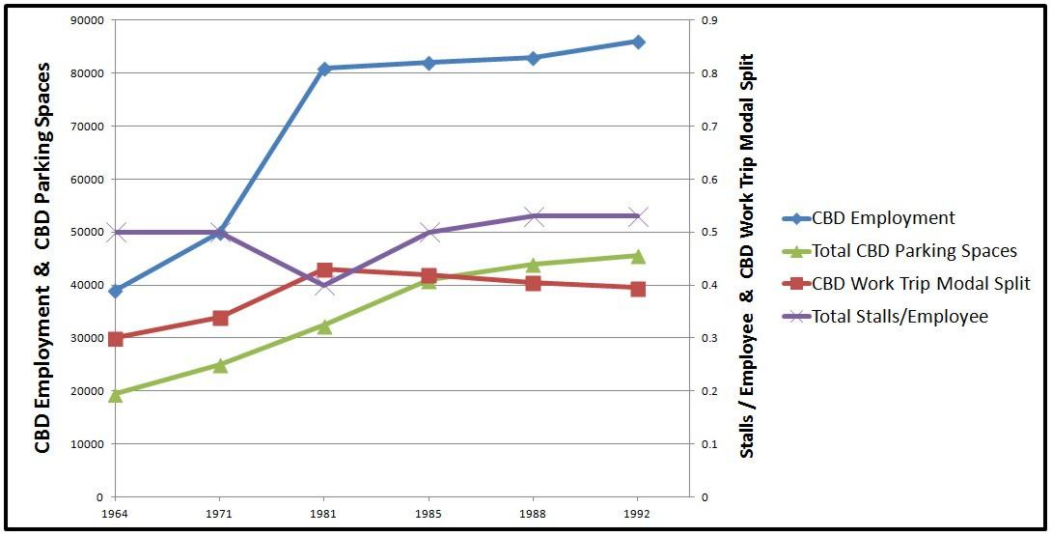
In 1984, Council further undertook two major policy changes to the cash-in-lieu system. The first policy change increased the allowable share of onsite parking within the restricted area from 20% to 50%, while the second exempted sites that had access to 5th and 9th Avenues S from the Restricted Parking Area (**Map 8**; City of Calgary Land Use Planning & Policy, 2008a). These decisions may have stemmed from a desire to stimulate development during an economic downturn, but the improving economics of parking suggest the potential influence of developers. The increasing costs of parking in downtown during the 1970s now made parking a profitable venture (City of Calgary Transportation Department, 2011).

Map 8 - Downtown Calgary Restricted Parking Area – 1984
(City of Calgary Land Use Planning & Policy, 2008, 13)



The combination of changing market forces and policy decisions had significant repercussions on downtown parking supply and development trends. The majority of office development during the 1980s and 1990s took place outside the Restricted Parking Area, primarily on sites between 4th and 5th Avenues S and along 9th Avenue S, and "marketed with 100 percent on-site parking" (City of Calgary Land Use Planning & Policy, 2008, 8). Compounding this was the public parking facilities that had been built using cash-in-lieu funds were located along these corridors as well, further enhancing the advantage of these sites relative to those within the Restricted Parking Area (City of Calgary Transportation Department, 2011). The result of these trends certainly contributed to decreasing transit mode share: the share of downtown commuters arriving at work by transit decreased from 43% in 1981 to below 40% in the next decade (**Figure 2**).

Figure 2 - Employment, Parking & Transit - Downtown Calgary 1964-1992 (Adapted from Calgary GoPlan, 1994a, 6)



Although the aforementioned changes negatively impacted parking management, the 1980s also saw steps taken to solidify parking control as a planning tool. In 1980, the City approved a new Land Use Bylaw, LUB2P80 (City of Calgary Planning & Building Department, 1980). This document reaffirmed the parking standard of 1 space for every 140m^2 gross floor area in downtown office uses, which equally affected lands both in and out of the Restricted Parking Area. Noting that existing parking supply

downtown was almost double that regulated amount, it also established a precedent for withholding new parking facilities built with cash-in-lieu funding until this supply had become more constrained (Calgary GoPlan, 1994a).

The City also began to quantify the relationship between parking supply and transit use. The 1978 Downtown Plan, while not explicitly stating a recommended mode share target, illustrated the impact a 1:140m^2 parking requirement would have on transit utilization (**Table 3**). Should the total downtown parking supply reflect this standard, a transit mode share of 67% would be expected. This analysis also proved to be relatively accurate in predicting transit mode share in the 1980s: as parking supply was roughly double the regulated amount (or 1:70m^2), a mode share of 40% was predicted.

Table 3 (City of Calgary Planning Department, 1978a)

Parking Requirements to Achieve Desired Transit Modal Split	
Transit Modal Split Target (%)	Parking Requirement (1 stall per given area) (m2)
20	53
40	70
60	107
67	139
80	232

In contrast, parking policy for suburban South LRT stations also followed a more traditional approach. As part of the LRT South Corridor Land Use Study, planners tasked IBI Group to ascertain what parking requirements would be required for given land uses in station areas and the potential for parking reduction schemes such as shared facilities (IBI Group, 1978). Conclusions from this study indicated that while more accurate parking requirements for given land uses could be determined through sampling of valid cases, sufficient data did not exist. Instead the report recommended that commercial uses provide 2.5-2.6 parking spaces per 100m^2 of net leasable area, while 1.2 parking spaces be provided

per residential unit. The report did allow that the presence of LRT could reduce vehicle ownership rates, it was felt to be marginal at between 0.05 and 0.10 vehicles per household, and thereby not significant enough to affect overall parking demand. In the view of the consultants, restrictive parking policy would only induce spillover effects into surrounding communities. These recommendations were largely supported by the LRT South Corridor Impact Monitoring Study, where a preliminary study found that "the vehicle ownership pattern of the tenants in a high-density residential development adjacent to a suburban LRT station is similar to vehicle ownership patterns of residents in a comparable non-LRT location" (City of Calgary Planning & Building Department, 1984, 14). Such a result is not surprising as it is consistent with the findings of Cervero, Atkins & Sullivan (2010) that as long as transit is not a viable alternative for most trips, car shedding is unlikely to occur.

Thus parking policy during this period presented some advancement in terms of drawing a connection between supply and demand for transit service. However, the divergent approaches towards parking policy in downtown and in the rest of the city reveal much about the City's views towards its transit system. Using the 1978 Downtown Plan's analysis of parking supply and transit mode share, the 1 stall per 40m^2 parking requirement proposed by IBI at South LRT stations would result in a transit commute mode share well below 20%. That the City agreed with these recommendations implies that transit was viewed as a competitive alternative to automobiles for downtown commute trips only: other trips required the use of a car, and restricting the availability of parking would create externalities and not changes in travel behaviour. As the City moved to strengthen parking control in downtown in the 1990s, this view towards suburban contexts predominated until the 2000s.

4.25 Summary

The period from 1976-1990 was a highly turbulent time in Calgary from a land use and transportation standpoint. A boom from the increasing economic value derived from the Alberta Oil Sands had seen the population, and downtown skyline, swell. The City successfully put three LRT lines into revenue service, and considerable inquiry had been conducted into a fourth. However, the

combination of the boom of the late 1970s and land use policies that favoured suburban expansion meant that the three operational LRT lines were planned and opened with little consideration of their land use shaping potential. Quite the opposite, land use decisions led transportation planning. With vast new growth corridors of subdivisions under construction, the congestion they created were to be mitigated by the LRT lines as residents travelled to downtown office towers. To extend LRT service into as many new suburban corridors as possible, and as far as possible, low cost alignments in expressway medians (northern LRT lines) and a freight rail corridor (South LRT) were selected.

Some of the stations opened in the 1980s could have still experienced intensification in spite of suburban oriented growth policies and unfavourable alignment choices. However, as the boom of the 1970s turned to bust in the 1980s, collapsing development activity delivered a coup de grâce. The market simply no longer existed to leverage this infrastructure to realize intensification, even in stations were new construction was taking place. Furthermore, when market conditions began to improve in the 1990s, Council was willing to permit development proposals at South LRT stations that were unsupportive of station area planning goals.

In contrast, the West LRT benefitted from its low priority and the relatively modest growth expected in that area of the city. With no readily identifiable right-of-way, planners were able to more fully consider the impacts of two potential alignments. As the difference in construction costs and ridership projections between the two narrowed over the course of the decade, a deciding factor was the potential of the Bow Trail corridor to serve redevelopment zones at Westbrook and Sunalta.

Ultimately, the key theme which emerges in this era is a City which was becoming aware of the negative implications of an auto-oriented growth pattern, but did not or could not act decisively in enacting change. The Balanced Growth Strategy, aimed at reforming the distribution of growth in the city, was weakened by political pressure from developers. At a local planning level, station area plans utilized circumspective language that showed little support to prospective developers for transit-supportive

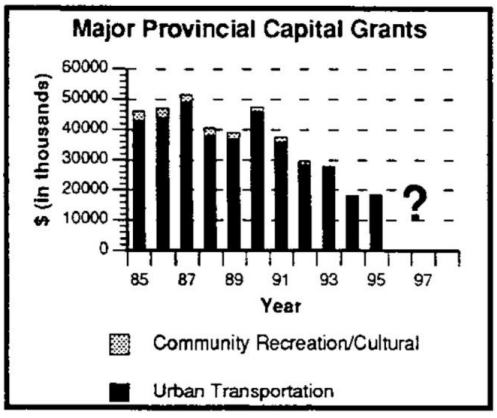
development. Rather, the plans had significant barriers for TOD-like projects: conventional suburban parking requirements, developer initiated rezoning, and the discretionary power of the City in approving development on a case-by-case basis. Lastly, the influence of the recession on planning decisions cannot be discounted. Changes to downtown parking policy made in the 1980s strongly suggest the City was attempting to stimulate new development by easing regulation of a profitable commodity in parking space.

As the City moved into the 1990s, the continued suburbanization of the city and decreasing fiscal resources to support it required more meaningful change at the policy level. As the recession faded into a period of moderate growth, the 1990s offered a respite for planners to undertake a comprehensive review of planning policy, and to prepare as Calgarians have always done for the next boom.

4.3 Evaluation & Transition (1990-2000):

Calgary in the 1990s was a city in transition. Population growth had slowed; from 1991 to 2001 the city grew by 23% to 878,866. Slower population growth was accompanied by decreasing grants from the Province, crucial in the construction of Calgary's LRT system. The new Premier Ralph Klein, who as mayor of Calgary from 1980-1989 had championed the LRT, won leadership of his party by strongly advocating for immediate reductions to the provincial deficit that had grown during the 1980s. Annual transfers to the City decreased from $50 million in 1985 to only $18 million by 1994, with grants for transportation purposes falling from $75 to $25 annually per Calgarian over the same period (**Figure 3**). Staff noted that "there is no guarantee that even this level of funding will be available in the future" (City of Calgary Planning & Building Department, 1995, 10). The role of planners largely became one of accommodating growth with reduced means. Plans approved during this period spoke to efficient use of infrastructure, and a need to establish a social

Figure 3 (City of Calgary Planning & Building Department, 1995)



consensus to guide trade-offs that would have to be made.

The suburbanization of the city continued its trend despite the growing fiscal concern it created on the municipal budget. The inner suburbs, home to almost 42% of all Calgarians in 1971, lost 20,000 residents and comprised only 21.7% of the city's population in 1991 (City of Calgary Transportation Department, 1993b). With the increasing numbers of suburban dwellers, the need for transportation infrastructure to serve this population was critical. Several new roadways were planned to accommodate increasing travel demand. However, five of the proposed links crossed the two main rivers in Calgary, the Bow and Elbow, in locations that would compromise recreational and natural areas that had become highly valued by residents (City of Calgary Transportation Department, 1995). The ensuing controversy and public outcry resulted in the first comprehensive review of Calgary's Transportation Plan since the 1960s. The plans that followed (including a new Municipal Development Plan in 1998) collectively signalled a pivotal turning point in planning policy. By the end of the 1990s, of the five river crossings that were originally deemed necessary, three would be deleted altogether and one was changed to a transit-only crossing. More significantly, the clear policy direction of the Transportation and Municipal Development Plans were successful in changing the form of suburban growth.

The new Calgary Transportation Plan, called the GoPlan, was a landmark document both for its significant policy shift on future growth, but also because it changed how the city conducted public consultation. The process to prepare the GoPlan plan began in 1992 and took four years to complete. Residents' opinions were gathered in numerous surveys and working groups; 15 residents were selected to the steering committee along with Aldermen and representatives of each department of the City. The City released over 75 publications related to the planning process for the GoPlan, including 16 volumes of a newsletter, over this four year period. The feedback from Calgarians was encouraging, and resulted in an ambitious plan that sought to accommodate a 2024 population of 1.25 million.

A key goal of the GoPlan was reducing vehicle trips, both the number and length, in order to lessen travel demand on the existing transportation network and eliminate the need for additional river crossings. Public transit was to be more prominent in meeting future transportation demand. Perhaps most importantly, the City now aimed to make transportation and land use decisions together, forming "a cornerstone of the GoPlan strategic long range planning effort" (City of Calgary Transportation Department, 1995, 1-2). While this era saw no new major transit projects, the result laid the foundation upon which transit-oriented development policy that was crafted in the 2000s, and how the City approached planning for its LRT network both as a transportation facility and land use tool.

4.31 The Role of Downtown:

The recession in the 1980s had dramatically slowed the growth and development of the downtown core. The 1990s began by continuing this trend: minimal employment gains, coupled with expanding suburban industrial zones, meant that downtown's share of all employment was eroding (**Table 4**). This trend was forecast to continue, from 24.6% in 1991 to 19.3% by 2024 (Calgary GoPlan, 1994a). Few office developments were built during the decade; when the 40 storey TD Canada Trust Tower was completed in 1991 it was the last major office tower to be built until 2000. However, the middle of the decade saw employment growth resume. GoPlan planners expected this trend to continue, predicting 112,700 jobs in downtown by 2024 (Calgary GoPlan, 1994a). This created concern in how the transportation network would accommodate this level of travel demand. The City's response was to encourage residential growth in the core in order to shift more trips into non-motorized modes, and accommodate a greater share remaining motorized trips by transit.

Recognizing that transit alone would not be sufficient in accommodating all of the increased demand, the GoPlan also aimed to increase the mode share for walking by increasing the residential population of the downtown from 10,000 in 1991 to 25,000 by 2024 (Calgary GoPlan, 1994a); further growth was also anticipated in nearby communities such as the Beltline. This policy was supported by market interest. Between 1993 and 1994 development permits were approved for over 500 new residential

units in the Eau Claire area north of downtown, a 36% increase over existing supply (City of Calgary Downtown Planning Division, 1995). Increased condominium construction also took place in the west end of downtown in the latter half of the decade.

Table 4 - (City of Calgary Transportation Department, 1993b)

Distribution of Employment in Calgary (1971-1991)		
Employment Area	**1971 Employment Share (%)**	**1991 Employment Share (%)**
Downtown & Beltline	37.9	30.0
Central Industrial	23.2	14.0
South-East Industrial	3.4	6.1
North-East Industrial	4.0	16.7
Rest of City	31.5	33.2

Even if the 2024 residential projections were met, a significant proportion of new employees in downtown would arrive by motorized modes. Should all of this travel demand be met by automobiles it would necessitate the equivalent of a ten lane roadway at contemporary modal splits (City of Calgary Transportation Department, 1995). Furthermore, staff had long been concerned by transportation externalities – noise, congestion, parking spillovers – in the inner city generated by downtown-related traffic (City of Calgary Planning Department, 1979). Clearly an auto-based solution was not desirable; even so, this possibility was removed by the deletion of the proposed South Downtown Bypass resulting from public opposition to new river crossings.

Planners moved instead to encourage greater transit use. The GoPlan set a target that by 2024, 50% of downtown commuters would arrive by transit (City of Calgary Transportation Department, 1995), a level that had not been reached in Calgary at any time during the previous thirty years. By not expanding roadways, the spare capacity of the LRT network provided a competitive alternative. Staff complemented this by re-establishing the necessity of effective parking control "to further enhance the attractiveness of transit" (City of Calgary, 1998, 32).

During the planning period for the 1995 GoPlan, downtown Calgary showed little change compared to its recent history: only 1,600 jobs were added between 1991-1996 (Calgary GoPlan, 1994a; City of Calgary Transportation Planning, 2010). However, significant economic expansion quickly resumed. By 1999 downtown employment increased by almost 14,000 to a total of 102,100 (City of Calgary Transportation Department, 2011). As the boom continued into the 2000s, the projections of GoPlan planners had clearly been far too conservative.

4.32 Transit Planning and Service:

The state of public transportation in Calgary in the early 1990s was somewhat perplexing. The enormous investment made in the LRT system resulted in three lines radiating from downtown, with 31 stations and 29 kilometres of track (Calgary Transit, 1993). All three met ridership expectations, but the number of trips taken by transit in 1991 was only marginally higher than in 1981 (**Figure 4**). Conditions in downtown contributed to this lackluster performance: job growth was slow and transit mode share had fallen from 43% in 1981 to 39% in 1991 (City of Calgary Transportation Department, 1993b). Other significant factors included reduced service hours and changing travel patterns. However, increasing concern over congestion resulting from suburban expansion resulted in the beginnings of a major shift in transit policy during this era: previously almost exclusively the domain of captive riders and downtown commuters, the City started to view transit as a transportation solution in the suburbs.

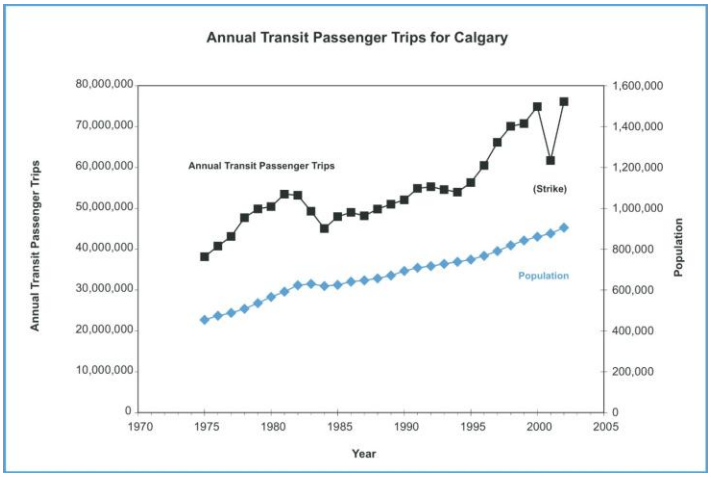


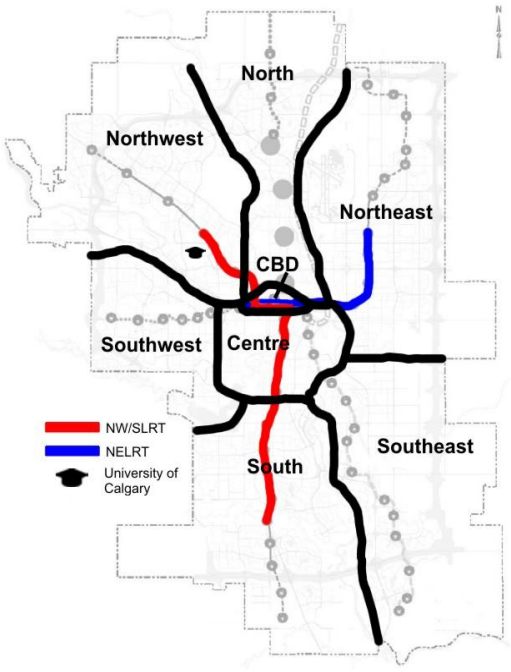
Figure 4 – Calgary Transit Ridership 1975-2002 (City of Calgary Transportation Planning, 2003, 2)

Calgarians supported improving the transit network, especially in extending the LRT lines, but were reluctant to change from auto to transit. A report on a 1992 public opinion survey states:

> "There is overwhelming support for the notion that other modes should be used instead of automobiles. However, there is clearly considerable dissonance between opinions and behaviour, as two-thirds of the survey respondents usually travel alone in automobiles. [...] Most auto users claim other modes should be used more often, however, around one-quarter of the single-occupant auto mode users are avowedly committed to continue auto use." (Calgary GoPlan, 1994b)

This was especially confounding for planners who had hoped the new LRT would build on the positive transit trends of the 1970s. Allen Swanson, then head of the Calgary Parking Authority, voiced this frustration succinctly: "We've spent half a billion dollars on the LRT System, and now that we've implemented the LRT System, we've been going the other way" (City of Calgary Transportation Department, 1993a, 7).

As no new LRT infrastructure was planned for the 1990s, efforts were made to evaluate how travel behaviour and land use patterns were changing, and the resulting implications for transit service. Planners prepared a comparison of travel behaviour between 1971 and 1991 which included trip origins and destinations during the AM peak period based on eight major travel zones in the city (City of Calgary Transportation Department, 1993b). In 1971, more than half of all automobile trips in this period ended in the Downtown or Centre zones; by 1991 this decreased to about one-third.



Map 9 - Travel Zones (adapted from City of Calgary Transportation Department, 1993b)

More auto trips were now destined for the Northeast (20,000) than either the CBD (17,600) or Centre (19,500) zones. By contrast, transit trips showed greater reliance on downtown: the CBD comprised 47.1% of a.m. peak period transit trips in 1991, up from 42.4% in 1971.

Trip purposes were also changing. Commuting to work was a diminishing segment of overall trip volumes: between 1971-1991 work trips in the a.m. peak period declined from 70% of all trips to 58% (City of Calgary Transportation Department, 1993b). Residents favoured using their cars to make these trips. The share of transit trips for non-work purposes remained relatively stable at about 5%, but vehicle trips for non-work purposes comprised more than one-quarter of vehicle trips in 1991 (**Table 5**).

A.M. Peak Non-Work Trips, by Mode (%)			
Mode	**1971**	**1981**	**1991**
Vehicle	16.2	22.3	26.6
Transit	5.2	4.9	5.7

Table 5 - (City of Calgary Transportation Department, 1993b)

In order to increase transit ridership, improvements would have to be made in two areas. Acknowledging where a strong market existed for transit, the City sought to increase downtown employment (City of Calgary, 1998, 3-3A) and endorsed the GoPlan target of a 50% transit mode share. To improve service in the suburbs, planners focused on using congestion as a transportation planning tool and increasing the number of transit service hours per capita.

Plans such as the 1979 Inner City Plan specifically mention congestion as a negative externality that required mitigation. Now, planners became increasingly favourable of using congestion as a transportation demand management tool:

> "Congestion can be used to discourage peak period or rush hour commuting, or encourage the switch from travelling by private automobile to transit and other modes. If distributed strategically, congestion can be effective in influencing how we travel and lead to reduced infrastructure costs." (City of Calgary Transportation Department, 1995, 1-7)

In addition to the disincentive to auto travel the City also moved to incentivize transit, not just to downtown but by improving service throughout the inner city and along major travel corridors (City of Calgary, 1998, 2-2.3.4G). To better address contemporary trip making patterns, GoPlan planners aimed to improve crosstown services to link major trip generating land uses such as shopping centres, hospitals and educational institutions, as well as the two new "Town Centres" intended to concentrate more employment near housing (**Map 10**).

Planners also proposed significant increases to the level of transit service hours offered. While the number of boardings per hour suggests that Calgary's system was well utilized, the amount of service hours offered per capita trailed considerably behind other major Canadian cities (**Table 6**). The GoPlan called for increasing transit service hours to 2.5 hours per capita by 2024, a 40% increase (City of Calgary Transportation Department, 1995).

Map 10 - GoPlan Proposed Transit Network (City of Calgary Transportation Department, 1995)

Table 6 – (Calgary Transit, 1993)

Comparison of Transit Service Hours in 7 Canadian Cities		
City	Service Hours per capita	Boardings per Operating Hour
Toronto	3.86	86
Montreal	3.75	82
Ottawa	2.66	50
Edmonton	2.63	47
Vancouver	2.22	42
Winnipeg	2.17	51
Calgary	***1.86***	***61***

Source: Calgary Transit, 1993

Planning for transit during the 1990s presented many challenges. Faced with dwindling capital budgets and stagnating transit ridership, the role that transit should play in the city's transportation network was at a crossroads. Limited resources had to continue to be stretched to serve new suburbs, while traditional sources of ridership demand formed a declining proportion of overall travel.

The City's policy response to this has significant implications for the evolution of planning philosophy in Calgary. Motivated by a desire to more efficiently utilize existing transportation infrastructure, transit was beginning to be viewed as a crucial element in accommodating future travel demand not only to downtown, but between key nodes in the suburbs as well. Although one-quarter of Calgarians were "avowedly committed" to auto use, residents were willing to support improvements to transit service. A transit network better suited to the dispersed trip patterns that had emerged since the 1970s opened an opportunity to induce changes in mode choice.

This new emphasis on transit, coupled with economic expansion, almost immediately showed dividends. Transit ridership grew quickly after 1995, both in overall and per capita numbers. Ridership increased by 33% to 74.9 million annual trips between 1995 and 2000, more than twice the rate of population growth. In the 2000s all three LRT lines were extended and the long-awaited West LRT began construction as funding became available from senior levels of government. But the new suburbs these services were expanding into were also different.

4.33 Land Use Policy:

In Calgary, two emerging problematic trends strongly influenced land use planning in this period. Employment was decentralizing, but it was not doing so evenly: one-third of all jobs were now east of the Deerfoot Trail freeway (Calgary Transit, 1993). This created an increasing jobs-housing imbalance that was exacerbated by a lack of adequate east-west transportation capacity to connect residents to these jobs. Furthermore, nearly all net population growth forecasted for the next 30 years was expected to occur on the suburban fringe. These suburbs were very much auto-oriented, with strongly defined separation of

land uses and street patterns that created inefficient transit routing. By the end of this era, major policy changes were enacted aimed at addressing these challenges. While the City was largely unable to decrease the share of growth at the edge of the city, these policies were more successful in improving both the jobs-housing imbalance and the design of new suburbs.

The importance of planning for suburbs was paramount in Calgary. In 1994, half of the city's population lived in a suburb built after 1970, and an incredible 96% of all housing starts between 1984 and 1994 were in greenfield areas (City of Calgary Planning & Building Department, 1995). The prevailing view for the City was that this development pattern should continue, "due to Calgarian's historically strong preference for a "suburban" lifestyle" (City of Calgary Transportation Department, 1995, 2-1). The GoPlan predicted 542,000 new residents by 2024; new suburbs at the edge of the city were expected to accommodate 98.7% of them. New suburbs were also increasingly less dense; density targets for new subdivisions approved in the 1970s, set at 17.3 units per hectare, instead were building out between 25-33% below this target (Calgary Transit, 1993). Even more recent subdivisions (1984-1994) asked Council to allow on average of 12.3 units per hectare (City of Calgary Planning & Building Department, 1995).

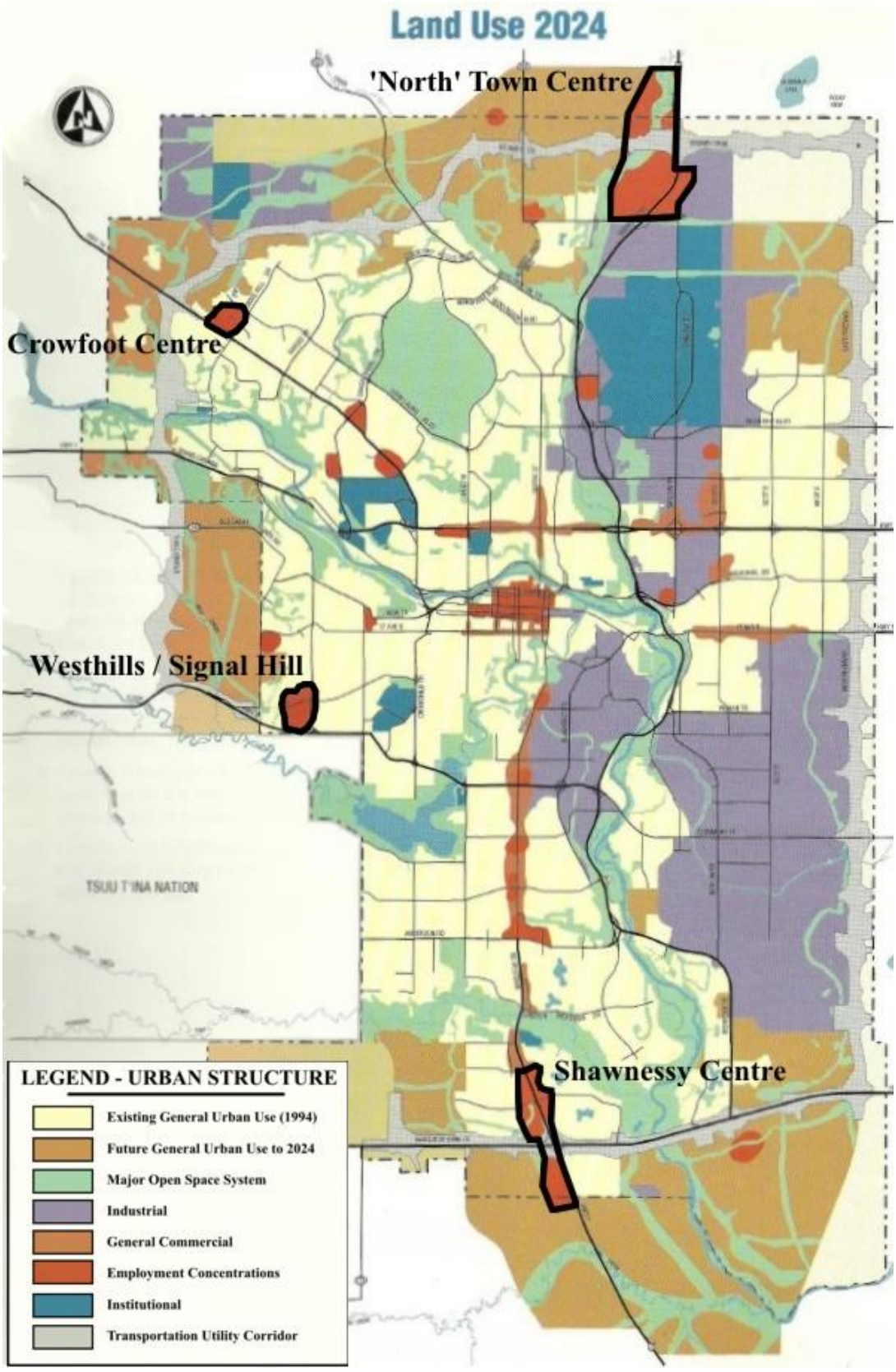
Motivated by fiscal concerns, Council committed through the GoPlan and MDP to direct population growth to corridors to the north and south rather than the west in order to improve accessibility to existing job centres (City of Calgary Transportation Department, 1995). These new suburbs would also be denser, provide a greater mix of housing, locate more services closer to residents, and be supportive of transit and pedestrian modes. This vision for suburban communities reflected a new planning emphasis on joint consideration of transportation and land use concerns. In the view of transit planners, it was "unlikely that significant change in transit use will occur in these areas in the future unless service levels are increased, changes are made to the relative costs of using auto and transit modes, and a more supportive land use occurs" (Calgary GoPlan, 1994b, 10).

These new policy directions were not without public opposition; increasing density seemed to be a key divisive issue. Calgarians endorsed alternative transportation modes, wanted environmental protection (especially for their rivers), and spoke positively about improving pedestrian environments and access to services in their communities. However, as a public survey conducted by IBI revealed: "Considerable resistance was noted to the concept of increasing housing densities to improve transportation system efficiency" (Calgary GoPlan, 1994b).

The difficulty in addressing density existed also at the planning policy level, revealed while preparing the "compact" and "dispersed" land use scenarios used to model the eventual preferred GoPlan land use concept map (**Map 11**). The "compact" scenario, with average suburban densities of 19.8 units per hectare, would produce a "significantly increased proportion of multi-family units than presently occurs and/or an increased proportion of smaller-lot single family houses. In Calgary's context, an assumed suburban density of 8 units/acre (or 19.8 units/hectare) represents a very bold assumption in every respect" (City of Calgary Planning & Building Department, 1994, 9). The densest existing suburban areas (Falconridge and Castleridge) in the mostly lower-income northeast quadrant only achieved between 14.8-16.3 units per hectare (City of Calgary Planning & Building Department, 1994). It was further noted that the desire to create "Town Centres" as major regional employment nodes would take "a very long time and requires that each Town Centre be designed with its own unique character, scale and functions" (City of Calgary Planning & Building Department, 1994, 9).

The "dispersed" model called for densities of only 9.9 units per hectare. These targets could be reached with modest multi-residential demand, only minor amendments to Area Structure Plans and no shift in overarching policy. Employment "Town Centres" in the dispersed model would be planned to accommodate employment demand. Three major centres and four secondary ones in Calgary's suburbs would contain 98,000 new jobs.

Map 11 - GoPlan Preferred Land Use Concept Map (City of Calgary Transportation Department, 1995)



The approved GoPlan required new suburbs to achieve an overall gross density of 17.3 units per hectare, while job growth was directed into mixed-use higher density centres that supported pedestrians and transit connections. Most of these jobs were focused in two town centres, or "mini-downtowns," located on the city's northern and southern extremes to address the jobs-housing imbalance (**Map 11**, 'North' and Shawnessy). The GoPlan also called for the commission of a study to provide more detailed policy ideas and recommendations to guide future growth, which helped to shape subsequent Transit-Oriented Development policy in the city: The Sustainable Suburbs Study (1995).

Sustainable Suburbs Study & Transit Friendly Design Guide:

The Sustainable Suburbs Study (City of Calgary Planning & Building Department, 1995) was intended from its outset not to be a statutory document, but a source of new policy ideas that were open to amendment through monitoring and consultation with the development community. Furthermore, "many of the criteria are fairly specific (because vague generalities are too open to interpretation) but, they need to be monitored and adjustments made as required" (City of Calgary Planning & Building Department, 1995, v).

Planners noted the marked departure of the Study from previous planning experience in Calgary: "with the exception of McKenzie Towne now under construction, most of the proposed criteria have not been used before in Calgary as a package in planning new communities" (City of Calgary Planning & Building Department, 1995, v). Coinciding with the Sustainable Suburbs Study, Calgary Transit also compiled a Transit-Friendly Design Guide (Calgary Transit, 1995) which helped to elaborate on the motivation and transit-specific treatment of certain policies the Study contained.

A key policy from the Sustainable Suburbs Study was that a community centre should be the focal point of a community of about 12,000 residents. It would act as a transit hub for the community, and should contain 5,500-7,500m^2 of retail space, anchored by a grocery store. This space should be oriented so that transit has direct access to the development, minimizing pedestrian walking distance and conflicts

from stop to store. Encouraging greater transit use has the potential benefit of reducing the need for land devoted to parking purposes. As such, the Study proposed reduced retail parking requirements from 5.5 stalls to 4-4.5 stalls per $93m^2$.

To meet the GoPlan density target of 17.3 units per hectare, the Study recommended providing a higher mix of housing choices within each community, including a mandated share of multi-residential housing between 20-60%. Furthermore, the Study included an explicit design guideline for multi-residential development to be placed near the community centre, neighbourhood nodes, and transit stops. While they need not be on the best sites, they "should not be placed in marginal locations or used as a buffer against road noise, industrial development, etc.," as had historically often been the case in Calgary (City of Calgary Planning & Building Department, 1995, 49). Staff felt that better siting, in tandem with higher design and construction quality, would help improve the image and marketability of multi-residential housing.

The Study also recommended that public transit should be a part of the design of the community. Routes and stop locations should be included in the Community Plan[3]. At least 85% of all dwelling units should be within 300 metres of a transit stop, and no more than 5% beyond 400 metres. Combined with increases in net density with improved siting, this would result in much more efficient use of transit resources in providing service to a community.

Efficient transit routing and land use distribution would also make transit more competitive with the automobile by improving the ability to trip chain. The planners were aware that the need to make multiple trip segments was an important factor in why people were reluctant to use transit: a survey revealed 65.1% of respondents needed a vehicle for personal reasons before or after work (Calgary GoPlan, 1993). Many of the services that might be required were not provided within communities, and "seldom conveniently located for transit-users" (City of Calgary Planning & Building Department, 1995,

[3] Community Plans concern development phases of Area Structure Plans.

14). A greater mix of uses would permit more trip chaining, while some larger centres such as the community centre may become independent transit destinations. However, attention should be paid to appropriate scale as "large discount stores tend to be auto oriented and are generally less appropriate next to transit stations and bus stops" (Calgary Transit, 1995, 9).

Land Use Policy - LRT

Planning around LRT stations was addressed during the decade only briefly. Consistent with the era's focus on new suburban growth, most planning documents spoke of future LRT stations rather than existing ones. With an emerging emphasis on considering land use and transportation impacts together, planners aimed to include activity centres with future LRT projects (Calgary Transit, 1995), and light rail transit stations should be located "to optimize service to communities and potential transit supportive development" (City of Calgary, 1998, 2-2.3.4H).

In developed areas, most plans spoke only broadly of the need to increase residential and employment density at LRT stations (City of Calgary, 1998, 2-2H). Planners also noted the difficulty of achieving these aims, but that "the basic principles of integration [of activity centres and LRT in developed areas] should be pursued as far as possible" (Calgary Transit, 1995, 20).

Another change in LRT-related land use policy was to refine the development aims in station areas. Several stations were identified as "secondary employment centres" in order to improve the jobs-housing balance in the suburbs (City of Calgary Land Use Planning & Policy, 2004a). Furthermore, it was necessary to "avoid unnecessary speculation and instability in communities abutting LRT stations by providing the public with an early indication of Council's intention with respect to the level of development opportunity through appropriate processes including preparation of station area plans, and/or area redevelopment plans and area structure plans" (Calgary Transit, 1995, 27).

Summary

The change in approach towards land use policy in Calgary in the 1990s was a dramatic one. Where new communities had been becoming less dense since the 1970s, the City now required developers to submit plans that included greater density, more multi-residential housing, incorporate higher levels of commercial activity, and offer the potential for more efficient transit service. The implementation of these policies should undoubtedly be viewed as a success. Many of the policy recommendations for new suburbs were adopted into bylawed regulations, and made noticeable impacts on new communities that were developed in the 2000s.

The effectiveness of the town centre policy to correct the jobs-housing imbalance was more mixed. The two planned major nodes did not develop as anticipated: the northern town centre remains undeveloped. Other planned employment concentrations, notably at Shawnessy, Crowfoot and Westhills (**Map 11**), were built largely as retail-oriented power centres. The lasting legacy of the town centres was the reorient growth corridors in the city, directed to the north and south-east. As these corridors were proximate to the large industrial zones on the east side of the city, commuters faced shorter trip lengths to these areas.

Unfortunately, no substantive effort was made to redistribute a greater share of growth into the existing area of the city. The City may have wanted to encourage intensification to reduce the strain on municipal resources, but it faced considerable opposition from developers (as seen in **section 4.23**) and residents' perceptions of density in effecting this change. Moreover, the City remained noncommittal about its role in LRT station areas. Although planners recognized a need to establish clear policy direction and support at LRT stations, the GoPlan and MDP did not substantiate this beyond broad generalizations as secondary employment centres. Similarly, the City passed on an opportunity in the 1990s to preserve land at a future LRT station – in what became Shawnessy Centre – for when market conditions had

improved for intensification, apprehensive of the acquisition costs in a time of constrained budgets (Hubbell & Colquhuon, 2006).

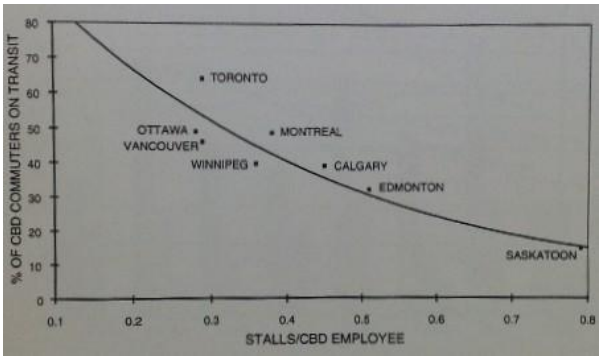
4.34 Parking:

Parking policy in downtown Calgary in the 1990s was in many respects a refinement of the approaches that originated a decade earlier. As part of the GoPlan process the City undertook a review of its parking program, which largely confirmed its policy standpoint with respect to parking provision and transit ridership. At suburban LRT stations, the City saw parking availability as an asset supporting ridership, and supporting increasing the supply. This policy realized its intended effect, and in the 1990s Calgary had the third highest number of available stalls at transit stations and the highest park-n-ride utilization rate among major Canadian cities.

The rapid increase of parking stalls in downtown Calgary finally tapered off at the start of the 1990s. In 1991, 45,260 existed within the boundaries of downtown, and another 3,000 long term stalls were available one block south of the boundary (Calgary GoPlan, 1994a). However, only 68% of the downtown supply was mandated through the City's bylaws (Calgary GoPlan, 1994a). The remainder, some 15,000 stalls, was the result of development that pre-existed the parking bylaw and undeveloped surface lots.

Having established a 50% transit mode share target for downtown in the GoPlan, the City undertook a review of what level of parking provision would be appropriate, as well as whether its current policies were sufficient, to meet the transit target. This resulted in the Calgary Downtown Parking and Transit Study (Calgary GoPlan, 1994a). During this study, staff examined parking and transit mode shares for central business districts in other major Canadian cities, determining that a 50% mode

Figure 5- Downtown Mode Share vs. Parking Stalls per Employee (Calgary GoPlan, 1994a, 5)



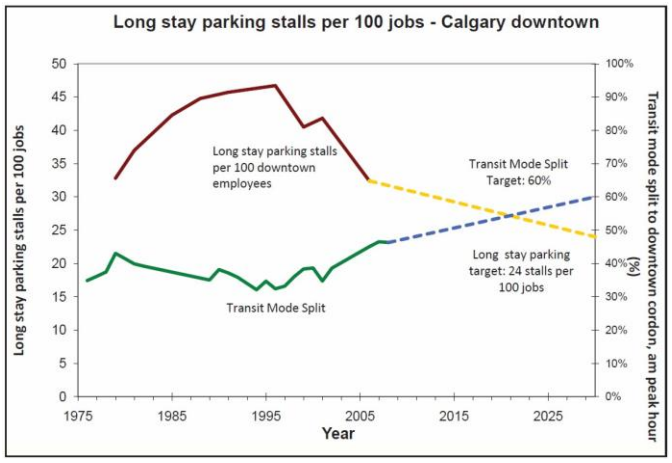
share would be reached at 0.32 stalls per downtown employee (**Figure 5**).

Under the 2P80 Land Use Bylaw, new office developments carried a maximum parking requirement of 1 stall per 140m^2(Calgary GoPlan, 1994a). With an average 1996 occupied office space per worker at 28m^2, the 2P80 bylaw provided for approximately 0.2 stalls per downtown employee, well below the necessary level to meet the mode share goal. With the GoPlan forecasting up to 15,000 new downtown residents and 30,000 new jobs by 2024, the Downtown Parking and Transit Study expected that up to 8,100 non-bylawed parking stalls would be lost to development, reducing the overall share of non-bylawed parking stalls from 32% to 22%. The results of this study supported Calgary's existing parking standards in the 2P80 Land Use Bylaw and provided additional impetus to encourage new residential development on the downtown periphery.

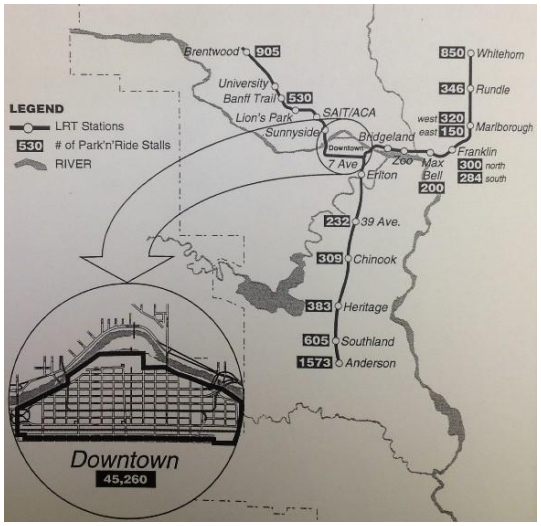
While the benefits to transit of reducing parking supply were evident, there was concern over how impactful such policies would be on drivers. In June 1992, the Downtown Parking and Transit Study team conducted a survey of 4,016 vehicle commuters in the core to reveal not only travel behaviour, but determine the elasticity of this behaviour (Calgary GoPlan, 1993). The survey revealed that changes to parking policy could yield significant changes in travel behaviour. The majority of users (62%) travelled by car for reasons of convenience, and only 44.6% reported needing their vehicle at least one day per week for work purposes. More than 50% of respondents paid parking costs themselves. When asked how expensive parking would have to become to consider alternative modes, results indicated a value of over $150 per month, an increase of 33-50% over the typical existing monthly costs of respondents. When asked what mode respondents would use instead, 58.3% reported transit, only 16.1% would carpool, while 5.8% would walk or bike. Although these results had positive implications for the City's parking policy, the survey also revealed the necessity of improving transit service. One-quarter of respondents reported that 'more convenient transit service' would encourage them to leave their vehicles behind. This trailed only 53.0% reporting 'nothing', but was twice as high as those citing 'higher vehicle and parking costs' as a reason to switch.

By the end of the 1990s, the City had commited itself to a proactive parking policy in the downtown core. By restricting the supply of parking (with the corollary increase in market price), the relative price of transit would become much more competitive with the car (Calgary Transit, 1993). It would not take long to demonstrate the strength of this relationship. With new residential construction in Eau Claire and the west end, and new office projects breaking ground, the number of parking stalls per downtown employee fell and mode share increased (**Figure 6**). By the mid-2000s, parking availability per employee returned to 1978 levels, and transit mode share approached 50%.

Figure 6 (City of Calgary Transportation Planning, 2010)



Map 12 - Parking Supply at LRT Stations & Downtown (Calgary GoPlan, 1994a, 28)



Parking policy for the suburbs was notably different, but with the same intended outcomes – to increase transit ridership. Where transit mode share was inversely related to the number of parking stalls in downtown, ridership was positively correlated to the number of suburban park-n-ride stalls per downtown employee (Calgary GoPlan, 1993). To this end, the City aimed to have between 15-20% of all LRT riders arrive at stations via automobile, diverting trips that would otherwise contribute to roadway congestion in the inner city (Calgary GoPlan, 1994c). In order to accommodate this level of ridership, the City constructed over 7,000 parking stalls throughout the LRT system, almost half of which were at the three terminal stations (**Map 12**).

The park-n-ride system was well received by commuters. In a comparison of six major Canadian cities, Calgary trailed Toronto (39,288) in Montreal (9,459) in total stalls offered, yet had the highest overall average daily utilization at 90% (Calgary GoPlan, 1994c). However, the City found few transit operators had similar policies regarding accommodating vehicle drivers at stations. Other operators, such as the Toronto Transit Commission, reported more contextually based approaches that considered station area characteristics and land use aims for each station. The extensive supply of park-n-ride became too popular. Planners had intended that 60-65% of transit riders would arrive at stations on the South LRT line by feeder bus or active modes, yet in the 1990s only 52% were doing so (Calgary GoPlan, 1994c). Edmonton, which had not favoured park-n-ride lots in building its LRT system, reported 64% of riders arriving by bus or active modes (Calgary GoPlan, 1994c).

However, there is evidence that a divergent view was beginning to emerge on what role LRT stations and their environs should play in the city. Land use policy in the city began to identify LRT stations as intensification areas for both residential and employment purposes. Furthermore, in outlining "The Role of Transit in Calgary's Future", planners at Calgary Transit recommended that parking should be limited not only in downtown but "other transit priority areas" (Calgary Transit, 1993, 12). Such a policy would be directly incompatible with viewing LRT stations uniformly as providing proxy parking for downtown. While policy currently favoured continuing to use LRT to support downtown oriented growth, network expansions in the 2000s would reduce the incentive to preserve parking spaces at former terminal stations. Dr. Robert Cervero, participating in the Future's Fair Speakers series as part of the GoPlan process, illustrated the potential that would be created:

> "Park-N-Ride, in a lot of ways, represents a real opportunity to amass significant chunks of land around stations and do something with it. It's a form of land banking. [...] As Calgary extends its light rail transit system outward, new terminuses will be created, freeing up existing land around the Anderson Station, and, say, Brentwood Station. With this land, you could do some real significant-scale master planning. [...] Developers don't want to build around transit stations

largely because many stations are surrounded by single-family homes. If you have large tracts of pre-assembled land, developers don't have to negotiate with numerous land owners." (City of Calgary Transportation Department, 1993a, 22)

4.35 Summary:

In the 1990s, considerable planning attention was given to evaluating the policies that had guided the city for the past thirty years. The City established a bold vision for growth to 2024, and planning initiatives such as the Sustainable Suburbs Study yielded new ideas in shaping the form of the suburbs. This era also marks the start of a significant shift in transportation policy: transit was increasingly viewed by planners as a means to accommodate travel demand in the suburbs. But there were also significant missed opportunities to encourage intensification in the existing communities as the attention of planning efforts was focused on the urban periphery.

The new GoPlan and MDP were highly successful implementing new regulations for subdivisions, especially with regard to density. Furthermore, many of the ideas initially proposed in the Sustainable Suburbs Study were incorporated into statutory plans. New communities now provided more housing choices and access to local services. Proposed suburbs began including a greater share of multi-residential housing oriented to major internal roadways, providing greater competitiveness for transit. The result was that communities planned in the 1990s had both greater density and transit use than their earlier counterparts (City of Calgary, 2012; City of Calgary Land Use Planning & Policy, 2012).

From a public transit standpoint, the 1990s began with concern over the effectiveness of the system in a city that was decentralizing. Ridership was stagnant, and Calgarians had expressed their "preference for a suburban lifestyle." But community opposition to new river crossings and declining grants from the province the City saw improved suburban transit service as a means to facilitate future travel. This shifting perspective took time to coalesce: immediate efforts targeted increasing per capita transit hours. But it set the stage for more substantive policy changes in the 2000s.

Downtown-oriented transit also dramatically improved during this era. A return to growth conditions and reaffirming the long-stay parking control policy contributed to an improving transit mode share. This was especially true after 1995 as residential development in Eau Claire and Downtown West removed surface parking and employment growth in the CBD accelerated.

The evolution of planning philosophy in the aforementioned themes is certainly positive, but the City of Calgary also missed opportunities during this era. Land use policy continued to favour suburban expansion, and efforts to change this were presented as difficult to implement. Rather, the City believed it could address its long-standing jobs-housing imbalance by creating major activity nodes on the edge of the city. That these centres were proximate to a planned ring road in the Transportation Utility Corridor (**Map 11, p.92**) also reveals how fragile the nascent belief was in transit as a competitive transit alternative in the suburbs.

With only modest employment growth in planned activity centres, and overt support for continued suburban residential growth, the land use challenges the City faced had been improved but not fundamentally repaired. Plans during the next era sought to remedy this. The new millennium would also see growth turn into a boom in Calgary as new towers graced the downtown skyline. More importantly, density also began to appear in the suburbs near transit. The LRT also 'boomed,' as all three lines were extended and the long awaited West LRT was built.

4.4 Second Generation (2000-Present):

At the turn of the millennium, Calgary's economy emerged from the malaise that had encumbered its growth since the 1980s. The city returned to high rates of population growth, adding over 200,000 new residents from 2001-2011 and reaching almost 1.1 million inhabitants. This level of growth was problematic both because of the increased strain on municipal resources, but also in rendering obsolete the forecasts of the 1990s which underpinned that era's major policy documents. The 2024 GoPlan target for employment was reached in 2008, and the population target is expected to be reached

by 2016 (City of Calgary Transportation Planning, 2007). By the middle of the decade, a new Municipal Development Plan and Calgary Transportation Plan was needed which built upon and strengthened the concepts of its predecessors.

With this growth came further expansion of suburban development on the urban edge. However, these new communities were increasingly dense, and generating higher rates of transit use than communities developed in the 1970s and 1980s. All three existing LRT lines needed to be extended and, due to the improved financial situation of the Provincial government, capital funds for these projects were available. More significantly, the City embarked on planning the next generation of LRT lines to the west, north and southeast. In 2013, the West LRT opened, and the city approved RouteAhead, a transit capital plan to guide investment for the next 30 years, which would require an estimated $11 billion to implement.

Finally, it was during this era that a significant shift in market forces and land use policies occurred towards the existing built area of the city. Development activity increased considerably in the inner city and several suburban nodes, fulfilling an emerging demand for infill housing and multi-residential projects. This was supported by the adoption of several plans which made substantive efforts in facilitating this shift. The City of Calgary now aimed to accommodate half of future growth in existing areas. To realize this, planners created a framework of Activity Centres and Corridors to focus intensification and a Primary Transit Network to provide high frequency rapid transit linking these nodes.

The planning objectives that had emerged since rapid transit was first proposed in 1966 were finally combined: encouraging non-automobile travel to reduce the pressure on the transport network; balancing the distribution of jobs and population within the city; using municipal resources more efficiently; and providing diverse transportation and housing options. While there remain opportunities to strengthen the policy support for Transit-Oriented Development in Calgary, the City undertook significant

and meaningful steps to implement these goals, suggesting reasons to be optimistic that long-sought land use changes will finally occur in station areas.

4.41 The Role of Downtown

In the late 1990s, the economic vitality of Calgary's downtown improved and employment growth resumed. Planners had expected that this would be the case, but had severely underestimated the degree (**Figure 7**). Staff had initially predicted a 2024 employment of 108,500, and when this level was reached in 2004 the projection was revised to 135,500 (City of Calgary Transportation Planning, 2004). This new forecast proved itself inadequate as by 2006 the city was in the midst of its biggest boom since the 1970s. From 2006-2012 more than 680,000m^2 of new office space was constructed downtown, a 23.5% increase, and employment surpassed 130,000 in 2009.

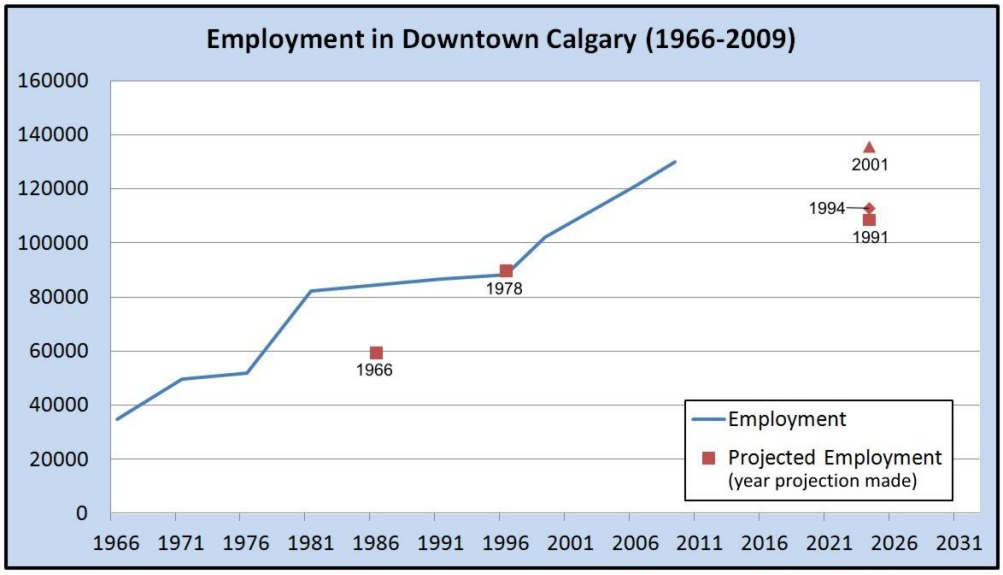


Figure 7

The effect of this boom cycle was considerable on the dynamics of the office market in Calgary. Due to the development lag time in bringing new inventory to market in downtown, the price per square metre more than doubled in two years, and vacancy rates tumbled to 0.5%. Many firms, unable to assemble sufficient space or afford leasing rates, increasingly looked to the suburbs where office space was less than two-thirds the price of urban space. From 2006-2012, the suburban market nearly matched

the pace set by downtown, adding just over 600,000m^2 of new office space, a 45% increase. Although the core continues to be the primary office market in the city, this share is decreasing rapidly, dropping from 75% in 1996 to under 65% in 2012.

The renewed vitality in the core generated enough activity that the capacity of both the transportation network and land to accommodate it was being approached. In 2001, Calgary's downtown was the 3rd densest centre of employment in Canada at 35,000 employees per square kilometre; by 2006, the density of employment downtown increased to almost 41,000/km^2 (City of Calgary Transportation Planning, 2008b). By comparison, the central business districts of Toronto and Montreal, served by heavy rail systems, ranged from 50,000-55,000 employees per square kilometre in 2001. As had been the case in earlier eras, expanding Calgary's road network was not a realistic solution, rather "growth in travel to the downtown should be accomplished by other modes of travel (transit, walking, cycling)" (City of Calgary Transportation Planning, 2010, 3).

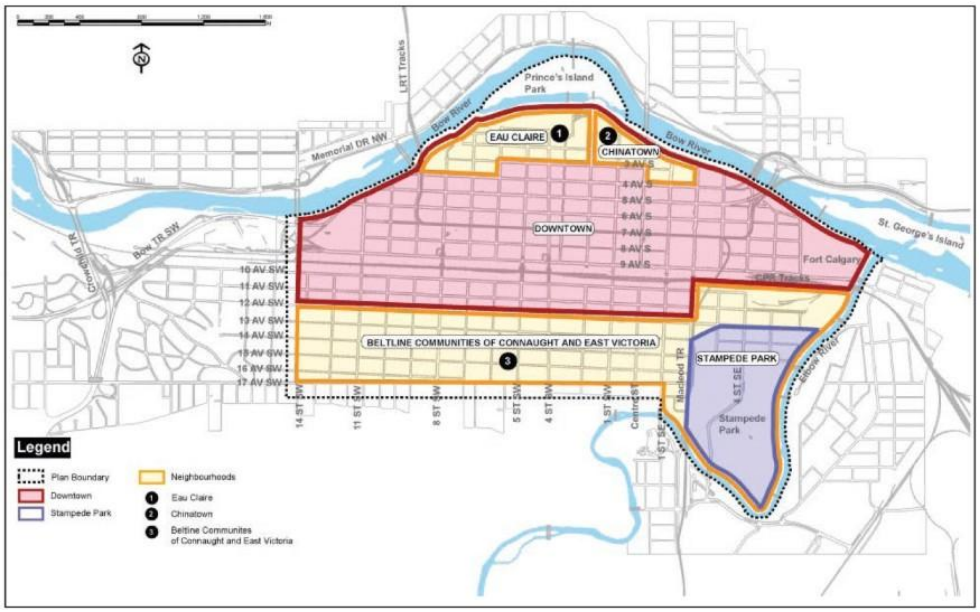
However, Calgary's LRT was increasingly congested and was beginning to approach its design capacity. The 7th Avenue transit corridor serving all three extant LRT lines and several bus routes had been designed to accommodate a peak of 36 trains per hour per direction (Clifton ND Lea, 2006). In 2005, travel on the peak load segment where the South and Northeast LRT lines entered downtown was 26 trains (60% of capacity) carrying 11,300 riders at the peak hour (80% of 3-car train capacity) (Clifton ND Lea, 2006). This necessitated accelerating plans to expand the physical capacity of the corridor through extensive reconstruction of downtown LRT platforms to accommodate 4-car trains, originally not expected to be necessary before 2018 (City of Calgary Transportation Planning, 2008b). This process was finished in the downtown by 2012, although configuring suburban platforms to the same standard is expected to take until 2015 (City of Calgary, 2012).

Another increasingly important consideration for downtown is the capacity of the land to support new development. During the 2006 boom, many of the remaining easily developable sites close to the

LRT were built upon, with the majority of remaining supply on the periphery in more residential neighbourhoods such as Downtown West End and Eau Claire. The City recognized development spillover into surrounding communities was likely, and sought to address this with the 2007 Centre City Plan (City of Calgary Land Use Planning & Policy, 2007). This document is significant for the future of downtown Calgary for two reasons: it advocates slowly expanding the downtown office core south into the Beltline, and places an emphasis on attracting a more significant residential component to the core area of the city.

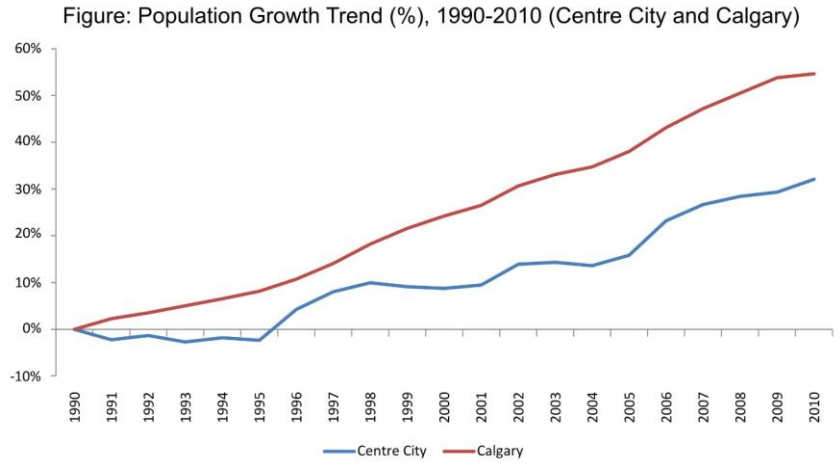
With developable land supply north of the CPR railway tracks becoming increasingly constrained, the Centre City Plan recommended expanding the downtown core south of the CPR tracks (**Map 13**). This expansion, coupled with policies favouring intensification in the Beltline itself, is intended to accommodate an additional 60,000 jobs in the study area by 2025 (City of Calgary Land Use Planning & Policy, 2007), and 110,000 by 2076 (City of Calgary, 2009a). Already a dense section of the city with 30,000 people and jobs per square kilometre, the Plan envisioned at full build out Centre City will support up to 50,000 people and jobs per square kilometre (City of Calgary Land Use Planning & Policy, 2010).

Map 13 - Centre City Study Area (City of Calgary Land Use Planning & Policy, 2007, 31)



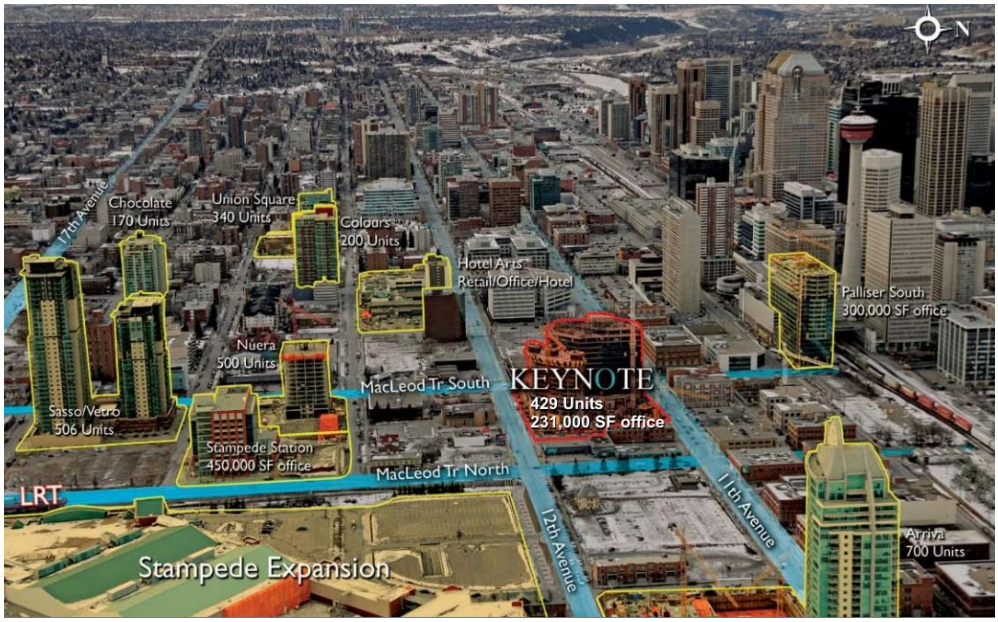
The Centre City Plan also emphasizes increasing the share of non-motorized travel by attracting new residents. Since first being identified as a major policy objective in the 1990s, the residential population of Centre City reversed its slow decline, and between 1995-2010 increased by nearly 30% to 34,527 (**Figure 8**). Although slightly behind the GoPlan projections, planners expect that this growth will accelerate, with a target of accommodating 66,000 residents by 2039 (City of Calgary Land Use Planning & Policy, 2010).

Figure 8 - (City of Calgary Land Use Planning & Policy, 2010, 18)



The Centre City Plan's objective to plan for growth outside downtown proper was highly prescient. Since 2007, residential growth in the Beltline outpaced Calgary as a whole (9.9% versus 7.0%), adding almost 2,000 new residents (City of Calgary Community & Neighbourhood Services, 2012). Two new nodes of activity emerged in areas previously in states of neglect (**Figure 9**): 1st Street SW (Chocolate, Union Square, Colours, Hotel Arts) and the area around Stampede Park (Sasso/Vetro, Nuera, Stampede Station, Keynote, Arriva). While most of the development in these areas has been residential, with 12 high-rise condominiums built or currently under construction, the area is also attracting new employment uses as well. This is especially true in the area around the Victoria Park LRT station where, in addition to over 2,400 condominium units, more than 63,000m^2 of office and retail space is expected, including a supermarket to serve local residents (Colliers International, 2010a).

Figure 9 - Select Development Activity since 2000 in Eastern Beltline (Colliers International, 2010a)



During the 2000s, downtown Calgary boomed. Even the 2008 'Great Recession' only momentarily abated growth. By 2011 vacancy and rental rates returned to their pre-recession levels, and new office construction continued. However, two fundamental changes took place which would affect the future role of the core area. The boom of 2006 showed that even the highly desirable downtown office market was not without its limits, and with escalating prices and limited supply, many firms began to favour suburban office locations. This trend was not limited to minor firms: in 2012, Imperial Oil announced plans to move their Canadian headquarters from downtown Calgary to Quarry Park, an emerging office node in Calgary's south-eastern quadrant.

The second change was the City's decision to place greater emphasis on residential uses, not commercial, in the core to meet its alternative transportation goals. The Downtown and the Beltline are now projected to receive less than one-fifth of future employment growth (City of Calgary Land Use Planning & Policy, 2012). The City recognized "that the Downtown and the even larger Centre City will reach their capacity over time, [and] it is necessary to identify and plan for other strategic areas that will

support long-term employment and population growth in locations and at intensities that will support" increased transit service (City of Calgary, 2009a, 3-4).

The most significant conclusion that can be drawn from downtown during this era is that the market forces and City policies which favoured centralization made it victim of its own success. As the costs of locating downtown – transportation, rent, parking (the latter discussed in **section 4.44**) – increased dramatically, the benefits of agglomerating have been eroded. The City's response, to lower costs by expanding LRT capacity and expand the office core into the Beltline, reflects a continued favourability to centralizing office employment. But as the suburban share of office employment continues to increase, planners have also moved to manage this shift: to ensure job growth remains accessible by transit for employees by focusing residential and employment growth near frequent and high capacity transit service.

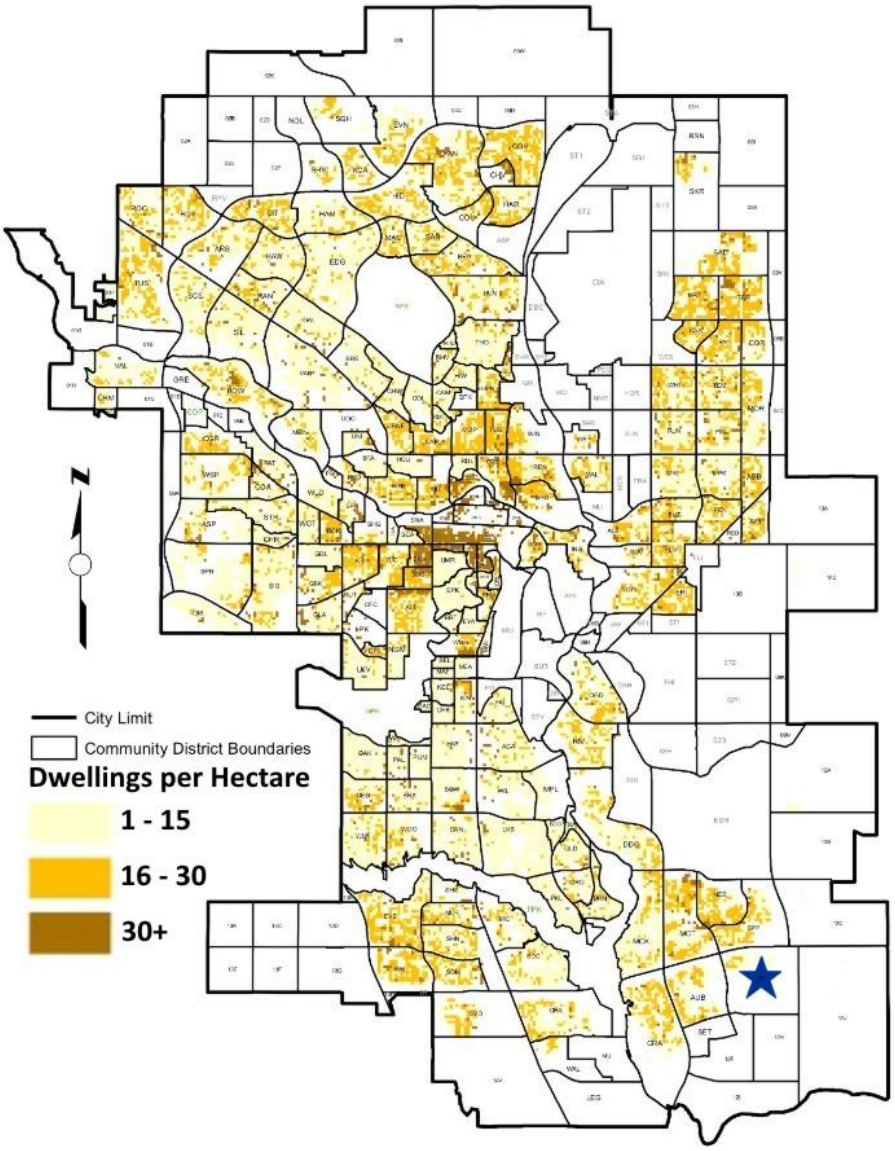
4.42 Land Use Policy

In the previous decade, the municipal government changed the manner in which the city grew on the urban edge. Ten years later, Calgary's experience showed that direction offered by plans such as the Sustainable Suburbs Study and 1998 Calgary Municipal Development Plan were highly successful in changing these land use patterns, with new suburbs exceeding intensification targets and generating higher rates of transit ridership. But by the 2000s it became apparent that even more sustainable suburbs were not sufficient in solving the transportation issues and uneven distribution of population and jobs.

Thus, land use planning policy during this era sought to increase the share of new development in existing areas. Key to achieving this goal was establishing clear direction from the City about how and where this intensification would take place. The principal method by which the City hoped to achieve this intensification was in establishing a series of 'Activity Centres' and 'Corridors' that were focused on higher-order transit service: Transit-Oriented Development.

The change in suburban development patterns in Calgary since the mid-1990s has been quite remarkable. Suburbs approved following the 1998 MDP averaged just under the density target of 17.3 units per hectare (uph). A similar increase in density occurred when the 2009 MDP raised this target: subdivision applications since 2008 have ranged between 18.8-21.2 uph (City of Calgary Land Use Planning & Policy, 2012). New communities intensified both through denser single family housing, but also clusters of multi-residential housing positioned centrally near commercial centres and transit routes.

Map 14 - Dwellings per Hectare, 2012 (City of Calgary Land Use Planning & Policy, 2012, 57)



The outline plan for a new community called Mahogany in the south-east (**Map 14**, star), demonstrates this trend. Planned for an overall density of 24.7uph, it is the densest new suburb proposed in the city to date (City of Calgary Land Use Planning & Policy, 2012). To achieve this level of intensity, 10% of the land is dedicated to multi-residential uses at a density similar to Downtown West End (138uph), with the remainder of the community averaging 13uph. More importantly, the densest development will locate along the inner circulatory roadway with bus connections to the large mixed use node at its western edge, abutting a future LRT station (**Map 15**).

Map 15 - Mahogany Proposed Land Use Map (City of Calgary Land Use Planning & Policy, 2012, 39)

Policy towards denser living also benefitted from changing market dynamics. As single family housing prices grew increasingly unaffordable during the boom, the pace of multi-residential construction increased, so much so that in 2007 multi-residential units briefly outpaced single- and semi-detached units (City of Calgary Land Use Planning & Policy, 2012). More importantly, an increasing proportion of new housing is in the existing area of the city. Since 2000 almost 20,000 multi-residential units, comprising one quarter of city supply, and 32% of all housing starts since 2007, have been added to existing areas (City of Calgary Land Use Planning & Policy, 2010, 2012). This stands in marked contrast to growth

patterns in the 1980s and 1990s when over 95% of residential construction took place in new suburbs (City of Calgary Planning & Building Department, 1995).

As a result, several previously declining communities began to register net population growth. Significantly, many of these communities are near existing or planned LRT lines (**Table 7**). Although not all communities have benefitted from these trends, planners predict that "there will be an increasing trend of development intensifying in the existing areas as policies contained in the Calgary Municipal Development Plan take effect" (City of Calgary Land Use Planning & Policy, 2012, 8).

Table 7

Population Growth in Selected Communities near LRT (2007-2011)

LRT Line	Community	Population		
		2007	2011	Change (%)
All (downtown)	Beltline	17,794	19,556	9.9%
SLRT	Haysboro	6,020	6,724	11.7%
NWLRT	Hillhurst	5,215	5,914	13.4%
NELRT	Bridgeland	4,974	5,254	5.6%
WLRT	Spruce Cliff	3,027	3,992	31.9%
SELRT (future)	Inglewood	3,291	3,473	5.5%

Source: City of Calgary Community and Neighbourhood Services

Origins of Transit-Oriented Development Policy in Calgary

Although Transit-Oriented Development (TOD) policy in Calgary can be traced to the 1995 Sustainable Suburbs Study and Transit Friendly Design Guide, these documents ultimately emphasized new greenfield development and did little to direct development towards Calgary's existing LRT station areas. Planning staff felt that while "the system has been highly successful in attracting peak trips, there remains an opportunity to attract reverse flow peak travel and off-peak ridership. [...] Optimizing use of the transit system and the lands in the vicinity of LRT stations will therefore become important inputs to future capital investment" (City of Calgary Land Use Planning & Policy, 2004b, 4).

In order to meet these objectives the City examined best practices from existing TODs in North America, finding key areas to be: encouraging appropriate types of land use; promoting density; providing an improved pedestrian network; encouraging a compact built form; and managing parking (City of Calgary Land Use Planning & Policy, 2004a). These findings were compiled into the Transit-Oriented Development Guidelines, approved in 2004, with the purpose of providing "direction for the development of areas typically within 600m of a Transit Station – an existing LRT station or BRT station where an LRT station will eventually develop" (City of Calgary Land Use Planning & Policy, 2004b, v). The Plan itself is broken down into components which corresponded to the identified best practices:

Transit-Supportive Land Use: Land uses in TODs should be evaluated on their ability to generate transit ridership and activity at all times of the day. Appropriate land uses include high intensity residential and office development, as well as commercial services oriented for the daily needs of residents. Land uses should be mixed, horizontally across sites or vertically within a site. Land uses which do not support these aims should be heavily discouraged, especially auto-oriented uses which consume large amounts of land. Specific types of land uses that should be discouraged include: gas stations, drive-through retail, big box retail and warehouse grocery stores, as well as wide lot single-detached residential.

Increasing Density Around Transit Stations: Rapid transit systems require higher densities than the community density targets established in the 1990s in order to generate sufficient ridership. More intensive development should be encouraged surrounding stations, with the highest densities immediately adjacent to the station. Density should taper off so as to integrate into surrounding communities. To support this objective in station planning areas that would be located in new communities, "densities should be established for a station planning area and not included as part of the gross community density target" (City of Calgary Land Use Planning & Policy, 2004b, 16).

Creating a Pedestrian-Oriented Design: Calgary's TOD policies should "create convenient, comfortable, direct and safe pedestrian linkages to and from all Transit Stations in order to support a walkable station

area and promote the use of transit" (City of Calgary Land Use Planning & Policy, 2004b, 18). Transportation links between major destinations in the area should be designated as primary pedestrian routes designed to have wider sidewalks, connections to regional pathways, and street-oriented buildings. New development should be expected to provide ground floor uses "that are appealing to pedestrians, such as retail, personal service, restaurants, outdoor cafes, and residences" (City of Calgary Land Use Planning & Policy, 2004b, 23).

Managing Parking, Bus and Vehicular Traffic: TOD should foster increased walk-on trips to transit which will lessen reliance on other modes to access the system. However, even if this objective is achieved, the majority of users would still be expected to arrive at LRT stations through buses and personal vehicles. TODs should continue to plan for station connectivity for all modes, especially transit. Auto trips to the area should be encouraged to be taken by other modes through providing improved local transit service and improved amenities for non-motorized modes.

To further discourage auto trips to the station area, and to lessen the impact of parking uses on the pedestrian environment, parking should be managed. This includes improved site and design standards, locating parking to the rear or sides of buildings, and surface parking developed in early stages of TOD should allow replacement with structured parking or new development in later stages. Reductions to parking requirements in station areas should also be "strongly considered" both through bylaw requirements but also with Transportation Demand Management (TDM) policies. Shared parking, providing secure bike storage facilities, and proximity to city-owned park-and-ride facilities for uses that generate most of their activity in off-peak periods may be considered in place of parking (City of Calgary Land Use Planning & Policy, 2004b, 27).

The policy objectives represented the idealized outcomes of TOD planning, but staff recognized that an implementation strategy was also needed. This was a significant departure from the strategy employed with formulating the first Station Area Plans on the South LRT line in the 1980s, which placed

the onus for achieving plan objectives entirely on developers (see Chapter 4). Planners also aimed to reverse the past practice of doing little to engage the community and create support for redevelopment.

The 2004 TOD Best Practices Handbook stated that the City should take leadership to facilitate an easier development process for private developers. The City should engage the community to provide an individualized vision for each station area, and identify the services and amenities that would be supported by the community. The goal for each station area was to establish plans "that recognize local market strengths, site opportunities and community interests. These plans will outline clear goals for TOD at the individual station and provide guidelines for land use, density, public systems, urban design and parking management" (City of Calgary Land Use Planning & Policy, 2004a, 17).

In another departure from previous policies, planning staff sought to focus TOD development on a few strategically important areas. Recognizing that the market for TOD would be limited, especially at the outset, staff sought to "identify priority stations where there is market interest, sufficient land and a reasonable opportunity for success" (City of Calgary Land Use Planning & Policy, 2004a, 17). By focusing development into these areas, the concept could be proven in the marketplace and generate subsequent and sustained interest in other station areas.

Finally, planning staff wanted a policy suite that would be market responsive, allowing developers the flexibility to adapt to changing trends over the long term. This meant permitting a measure of design that was undesirable in the ideal concept, such as surface parking, in the initial stages in order to stimulate development interest. However, these features must be designed to be adaptable to future changes, and as fuller build-out was approached should be eliminated to fit with the concept. TOD was viewed as something which would take decades to reach full build-out, and so policies should be revisited and assessed regularly to ensure progress towards the final vision.

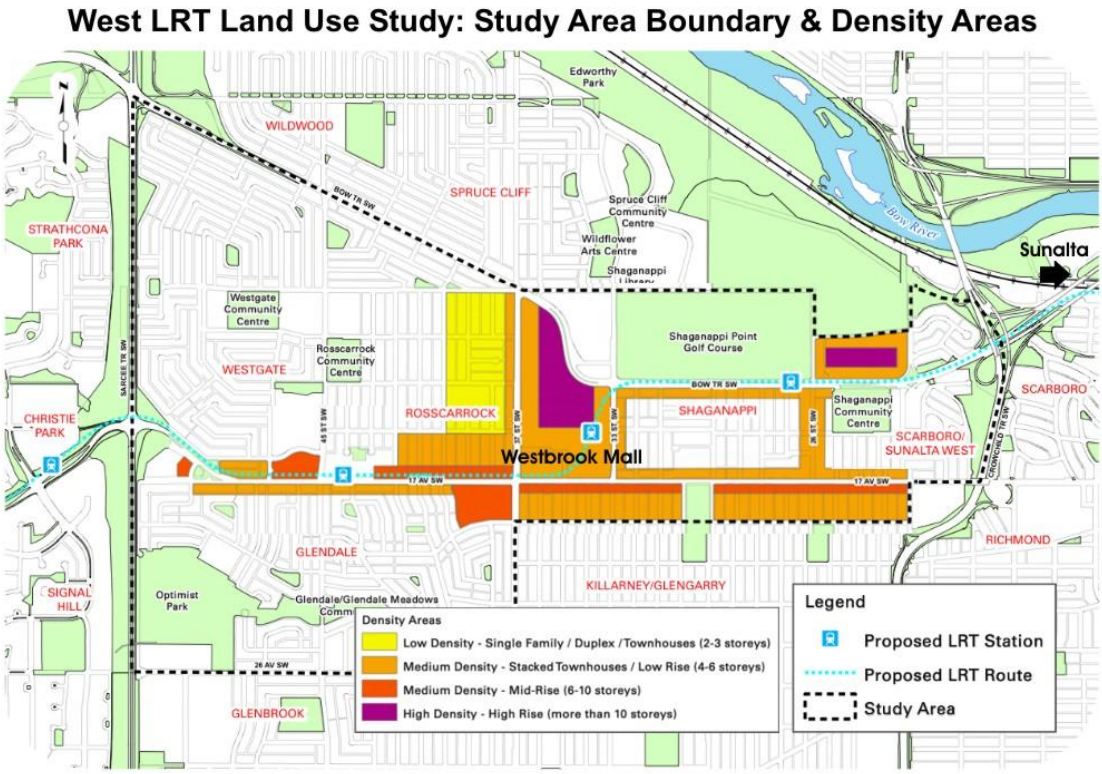
West LRT Land Use Study

The land use planning process for the West LRT project demonstrates how these TOD principles were put into practice. In the middle of the 2000s, funding opportunities became available to construct the West LRT line, the first completely new line to be built in the city since 1987. Unlike the experience with previous LRT lines, the West LRT's Land Use Study – started in November 2006 – was conducted before Council approval for constructing the line. With design work, including station placement and alignment, being done at the same time, this would permit the land use study to exert considerable influence on the physical aspects of the line (**see also section 4.43**).

The Study focused on the area between Crowchild and Sarcee Trails (**Map 16**), and included three of the six planned LRT stations on the line, focusing on "the areas with the largest potential for redevelopment in the near and mid-term" (City of Calgary Land Use Planning & Policy, 2009a, 9). The plan also aimed to "direct the right kind of redevelopment to areas where it is most appropriate and to manage development pressures outside of these priority areas so as not to diffuse planning efforts or the limited market for redevelopment" (City of Calgary Land Use Planning & Policy, 2009a, 37). Under this framework, Westbrook Station (at centre in **Map 16**) and Sunalta Station [4] received the highest priority. Planners wished to limit the scale of change that would occur elsewhere until these two stations had been sufficiently redeveloped. Accordingly, development could occur outside of these two stations if it met land use goals, but "applications that contemplate either a significant change in land use or density will not be encouraged" (City of Calgary Land Use Planning & Policy, 2009a, 39).

[4] While not within the nominal Study Area, Sunalta was identified as a significant redevelopment opportunity in meeting planning objectives for downtown.

Map 16 - (City of Calgary Land Use Planning & Policy, 2009a, 10, 22)



The Study also differed from past corridor planning in that much of its policies where shaped directly by residents. The overarching objectives of intensification and transit-supportiveness were supplied by City policy, but how this was applied to the corridor was the result of community engagement. City planners formed a Citizens Advisory Committee, put on workshops, and distributed questionnaires. Residents were invited to participate in the planning process and establish what sorts of development, activities and amenities they would like to see. These results were "used to guide the community, developers and the Development Authority in considering and developing new City plans and guidelines as well as private development proposals" (City of Calgary Land Use Planning & Policy, 2009a, 23). This resulted in seven 'Guiding Principles' for the West LRT corridor. These are:

Increase Housing: Residential development should be intensified around LRT stations and commercial corridors, while remaining sensitive to the surrounding community contexts. There should be a variety of housing types offered to accommodate a diversity of lifestyles and incomes.

Promote Mixed-Uses, Complete Communities, and Diverse Destinations: New development should include a mix of residential, office and retail commercial uses, especially in intensification areas. Land uses which do not support transit should be avoided near LRT stations. Westbrook Station should be developed to become a major destination for the surrounding communities, and should be comfortable and accessible to pedestrians.

Maintaining Safety in Neighbourhoods: New development should provide 'eyes on the street' as part of its design. Provide safe environments at LRT stations, at road crossings and in public spaces for all users.

Create a balance between Natural and Built Environment: Require improved design for open spaces, which are easily accessible by pedestrians and cyclists. Increase the amount and quality of landscaping provided both in the public and private realm.

Promote Quality Design and Character: Orient buildings to the street, locate parking away from the pedestrian environment, and ensure massing and height transitions are sensitively managed.

Offer Mobility Alternatives: Offer improved pedestrian and cycling facilities that are connected and accessible, and "allow public transit to become the preferred way to access the area and the city" (City of Calgary Land Use Planning & Policy, 2009a, 20). Alternative modes should be the primary way to access the LRT stations.

Build Memorable Public Spaces / Sense of Place: Create pedestrian friendly streetscapes with active edges to public space. Maximize sunlight exposure of public areas and mitigate the impacts of building shadows and winter weather.

Residents also helped shape priority areas and the scale of development that is envisioned. 26th Street and 45th Street Stations will be smaller in scope and offer a more limited mix of uses. Westbrook Station, on the other hand, should contain the highest density and degree of land use mix, and become a destination for shopping, entertainment and employment within that area of the city. Planners identified,

and residents supported, Westbrook Station as "one of the most significant opportunities for Transit Oriented Development along the West LRT line" (City of Calgary Transportation Department, 2007, 11; see Chapter 4).

The TOD Policy Guidelines, and resulting plans which built on it like the West LRT Land Use Study, are important documents for the City in that they provide a framework to support intensification and redevelopment in key areas. That these guidelines were so quickly incorporated into major plans reflects the rapid and deliberate shift in City policy from a growth policy focused on suburban expansion to a more balanced approach. A critical next step was to integrate these TOD principles into statutory bylaws which have legal authority to enforce compliance with transit-supportive design. In 2009, Calgary approved a new Transportation Plan and Municipal Development Plan which reflected these objectives.

A New Transportation Plan & Municipal Development Plan

As population and employment growth in the city accelerated, the plans adopted in the 1990s were increasingly becoming out of date. The result was a Council request to update the transportation and land use plans in 2006, which sought to address a persistent problem:

> "Over the last 50 years, land uses have been increasingly segregated, with homes located further and further away from jobs and amenities. Population growth has gone almost entirely to the edges of the city, while employment continues to cluster in the downtown and east industrial areas. With trip distances increasing each year, the private automobile has naturally become the preferred travel choice." (City of Calgary, 2009b, 3-2)

The City felt that the roots of this issue lay in the separate planning processes that guided transportation and land use planning, and "although each considered the needs of the other, there were some conflicting priorities and missed opportunities" (City of Calgary, 2009c, 4). Furthermore, this mismatch between land use and transportation planning was also felt to be a significant contributor to the increasing level of auto-dependency:

> "Land use and transportation have a significant impact on each other. Where land uses (homes, jobs, services and amenities) are located impacts how people travel. If destinations are far apart, the car is often the only convenient way to get around. If destinations are closer together, walking, cycling and transit can become convenient options." (City of Calgary, 2009c, 4)

Council directed staff to combine planning for the Calgary Transportation Plan (CTP) and Municipal Development Plan (MDP), in a process called Plan It. When approved in 2009, the CTP and MDP were to be considered as one "new integrated long-range land use and transportation plan for Calgary," only separated to "meet existing provincial legislation and be adopted by City Council (City of Calgary, 2009c, 17). To guide this new planning process, staff relied on a comprehensive public engagement process about how residents viewed the future of the city, called imagineCALGARY.

imagineCALGARY was an ambitious undertaking for the City. For 18 months beginning in January 2005, staff managed a 'city-led – community owned' process that gathered opinions from over 18,000 Calgarians (City of Calgary, 2006). The purpose of this exercise was to create a vision of what the city would look like in 100 years. Products that were expected included targets the City should strive towards and the development of indicators to monitor progress in meeting them.

Figure 10 - (City of Calgary, 2009d, 7)

imagineCALGARY revealed a shifting position amongst residents towards the nature of future growth. While the 1995 GoPlan showed that there was public support for alternative transportation, it now seemed Calgarians were willing to back the land use changes necessary to support these modes. Staff found that Calgarians supported increasing residential density, particularly at transit stations, near employment, and in close proximity to daily necessities and services. Targets were established to

significantly increase the number of residents and jobs near LRT stations and to increase per capita transit ridership. LRT stations, characterized "as places to drive to or take the bus to," should instead be developed as "transit-oriented development funded or supported by The City, to be given priority over current LRT park-and-ride-lots" (City of Calgary, 2006, 112 & 34).

These findings were confirmed during the Plan It process. In a phone survey conducted in November 2007, 83% of respondents stated that the city should encourage greater use of alternative transportation modes, with support highest among those between 18-34 years old; only 14% felt that current levels of vehicle use should be supported (Leger Marketing, 2008). Although nearly six in 10 respondents currently commuted by single occupancy vehicle, 71% of these would be willing to switch to transit with improved service. Interestingly, almost two-thirds of this group indicated that a change in behaviour could be made with improved bus service, with the remainder citing improved LRT service as a reason to switch.

The phone survey also found that 87% of respondents wanted the City to redevelop underutilized commercial and industrial land to higher intensities, while 83% wanted the City to develop mixed-use buildings with residences or offices above ground floor retail. When asked to prioritize which areas of the city should be intensified, half chose major nodes served by LRT or buses, with Centre City the next highest at 24%.

However, there was a view that the City could do more to support this emerging policy direction. This is a persistent theme throughout this research, that the City of Calgary often proposed progressive planning principles, but fell short in implementing them. This was echoed when planners solicited feedback from other stakeholders – institutions, developers, and advocacy groups – which desired a clear and consistent strategy to realize these policy aims:

> "Policy planning is NOT a problem at The City. Staff and politicians reiterate politically correct polices very well. The problem is at the implementation stage. Current implementation processes

have been challenging, especially from Roads and Streets departments." – Canada Lands Company (City of Calgary, 2009d, 56).

"City is open for business with greenfield developers and now needs to portray the same sentiment to redevelopers. Otherwise existing barriers will block innovative applications in the established communities." – Federation of Calgary Communities South (City of Calgary, 2009d, 56)

Creating a Recommended Direction for Land Use

The City applied the results of imagineCALGARY into the Sustainability Principles for Land Use and Mobility and Key Directions for Land Use and Mobility (**Figure 11**). The former served as a summary of the key findings, while the latter "represent the strategic moves that need to be accomplished in order to guide Calgary towards the imagineCALGARY vision and the Sustainability Principles for Land Use and Mobility" (City of Calgary, 2009a, 1-6).

By 2076, Calgary is expected to grow from about 1 million residents to more than 2.3 million, while adding more than 600,000 new jobs (City of Calgary, 2009c). To accommodate this growth in a sustainable manner, a goal was set that 50% of this growth would be within currently developed areas by 2076 (City of Calgary, 2009a). In order to minimize disruption to existing communities, and ensuring that the transportation network would be used efficiently, the City favoured directing this growth to "relatively small, dense urban centres located near major transit stations" called Activity Centres (City of Calgary, 2009c, 11). Although Centre City would continue to be the dominant centre in this scenario, it would be supported by a web of these Activity Centres linked by intensified corridors, and by improved transit service (City of Calgary, 2009d).

Figure 11 - Sustainability Principles and Key Directions for Land Use and Mobility

Sustainability Principles for Land Use and Mobility (2007)	Key Directions for Land Use and Mobility (2008)
1. Create a range of housing opportunities and choices 2. Create walkable environments 3. Foster distinctive, attractive communities with a strong sense of place 4. Provide a variety of transportation options 5. Preserve open space, agricultural land, natural beauty and critical environmental areas 6. Mix land uses 7. Strategically direct and manage redevelopment opportunities within existing areas 8. Support compact development 9. Connect people, goods and services locally, regionally and globally 10. Provide transportation services in a safe, effective, affordable and efficient manner that ensures reasonable accessibility to all areas of the city for all citizens 11. Utilize green infrastructure and buildings	1. Achieve a balance of growth between established and greenfield communities 2. Provide more choice within complete communities 3. Direct land use change within a framework of nodes and corridors 4. Link land use decisions to transit 5. Increase mobility choices 6. Develop a Primary Transit Network 7. Create complete streets 8. Optimize infrastructure

Like the 1995 GoPlan, planners developed scenarios of how the city would change based on different approaches to guiding growth. A major difference between the former and current plans was the theoretical approaches taken to developing these scenarios: current trends and policies were now represented in the Dispersed Scenario. The other two scenarios (Hybrid and Compact) utilized a backcasting method from a "desired future," useful "when dominant trends are part of the problem" (City of Calgary, 2009e, 8).

Under the Dispersed Scenario, almost three-quarters of all new population growth over the next 60 years would occur in greenfield development at the edge of the city (City of Calgary, 2009e). Such a position had significant implications for transportation infrastructure. The radial transit network needed to be extended to serve these new areas, and the growth in vehicular traffic required the current ring road under construction to be completed and a second started. The overall impression was not positive from the standpoint of intensification and alternative transportation mode use: "The Dispersed Scenario shows

increasing auto dependency compared to the current Calgary mode split, despite modest efforts to reintensify around existing LRT stations. This suggests a poor connection between the land use patterns and transportation network in that scenario" (IBI Group, 2009, A-1).

Given the undesirable results of the Dispersed Scenario, staff created a new 'Recommended Direction,' to achieve the desired level of intensification to motivate changes in travel behaviour. The Recommended Direction would reduce the costs of constructing infrastructure by 33% and require 54% less new urbanized area as compared to the Dispersed Scenario (IBI Group, 2009; **Map 17**). A more intensive built form and increased transit service would also contribute to changing travel behaviour: transit ridership per capita was expected to double (**Figure 12**).

Map 17 - Land Use Projections for Dispersed Scenario and Recommended Direction (IBI Group, 2009, 9)

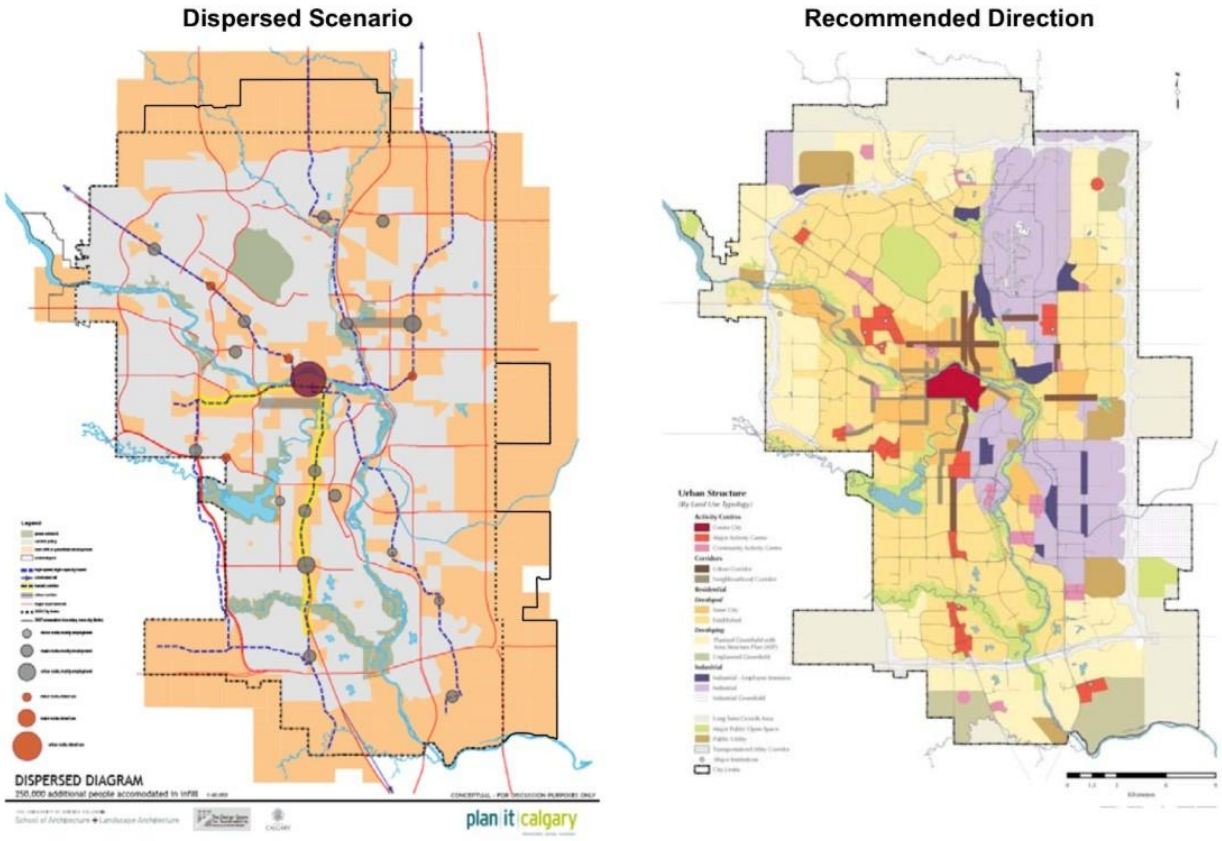


Figure 12 – Scenario Comparison of Transit Use and Service (IBI Group, 2009)

	Current	Dispersed Scenario	Recommended Direction
Transit Trips per capita	91	90	180
Transit Operating Hours per capita	2.12	1.6	3.7

The geometry of the transit network would also change under the Recommended Direction: "Unlike the current radial transit system focused on the downtown, the new primary transit system forms a grid of routes across the city, anchored by the major nodes" (IBI Group, 2009, 4). Only 74 new kilometres of track were required under the Recommended Direction versus 92 new kilometres of track in the Dispersed Scenario, reducing LRT capital costs by almost 20%. Conversely, adding higher frequency bus connections between numerous sub-centres required improvements to bus service. The City would need to purchase 1,600 new buses, 900 more than in the Dispersed Scenario (IBI Group, 2009). Despite this, at $6.2 billion, the overall capital cost of the transit system was projected to be 9% lower under the Recommended Direction.

Operating costs would not change significantly under the Recommended Direction. Intensified land use patterns would generate both a significant increase in ridership, but also improved utilization of capacity by allowing shorter trips and attracting reverse flow trips (IBI Group, 2009). Thus, while the operating subsidy for transit would increase from its current $115 million to $300 million under both scenarios, the Recommended Direction would see revenues double over the Dispersed Scenario to $500 million and increase Calgary Transit's recovery ratio to over 60% (IBI Group, 2009; **Appendix A**).

2009 Calgary Transportation Plan and Municipal Development Plan

With nearly three years of public engagement and planning complete, in 2009 the City adopted a new Calgary Transportation Plan (CTP) and Municipal Development Plan (MDP). These Plans targeted a significant decrease in automobile use: from 77% of all trips in 2009 to between 55-65% (**Figure 13**).

This was in marked contrast to the 1995 GoPlan, which projected a 75% automobile mode split despite aims at providing better transit service (City of Calgary Transportation Department, 1995).

Figure 13 - Projected Mode Share for Calgary Transportation Plan Horizon (City of Calgary, 2009b, 3-4)

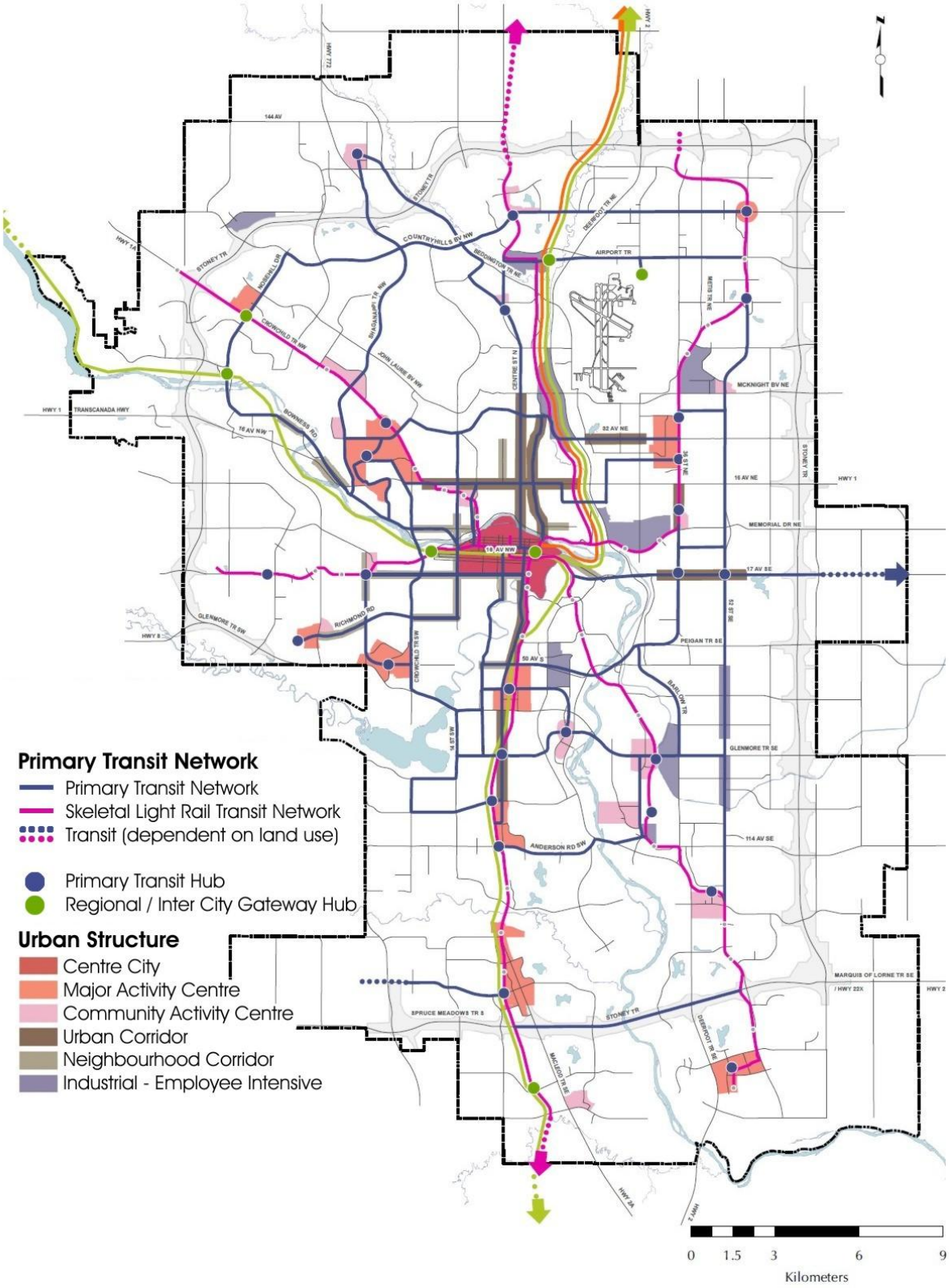
Mode of Transportation	Per cent of all daily trips	
	Current	Recommended Direction
Walk/Cycle	14%	20% - 25%
Transit	9%	15% - 20%
Vehicles (SOV & HOV)	77%	65% - 55%

The change was the direct result of evolving planning philosophy towards transportation in general and public transit in particular. Now, transit is no longer just about getting people into downtown, the City wanted it to be a desirable and even preferable mode choice throughout Calgary. More significantly, transit could be used to shape land use within the city rather than abet in its sprawl.

To support this objective, the CTP and MDP relied on two major policies: establishing a Primary Transit Network (**discussed in 4.43**), and developing "a land use framework that optimizes population and job growth within walking distance of transit" (City of Calgary, 2009a, 2-12). Setting a goal that 50% of all residents should live within walking distance of the Primary Transit Network (PTN) and 50% of future growth occur in the developed area of the city, planners created a series of Activity Centres and Corridors to be developed intensively (**Map 18**). The level of growth expected in these areas by 2076 is significant: 322,000 new residents (26.5% of all growth) and 211,000 jobs (37.5%).

The development goals for each of these activity centres were predicated upon an integrated approach to transportation and land use planning. On one hand, the type of transit that could be supported in an area was "determined almost exclusively from the land use characteristics of the area" (City of Calgary, 2009a, 2-12). The reverse could also be true, better transit service would stimulate the type of development needed to justify the service. The City opted to take the latter approach: "Link major activity centres with primary transit service sooner. This will help motivate market responses, focusing infill [...]

Map 18 - Primary Transit Network, Activity Centres, and Corridors
(City of Calgary, 2009a, Section 7 Map 3)



within walking proximity to the primary transit network." (City of Calgary, 2009d, 5). The timing envisioned for build out of both the transit network and development in these areas also reflected this position: the PTN is to be completed within 30 years, while only one-third of the eventual population growth in Activity Centres and Corridors are anticipated by this date (City of Calgary Land Use Planning & Policy, 2012). Leading development through infrastructure provision also marked a departure from the historical trend in Calgary where transportation decisions were often reactionary to changes in land use, as discussed in earlier eras.

Thus in order to maximize transportation network efficiency and to justify the improved transit service, planning staff specified targets for intensification for each activity centre and corridor type. To start, planners identified four key elements that should be satisfied by each activity centre/corridor: density, diversity, design, and distance (City of Calgary, 2009a).

Density: The minimum number of people and jobs needed to support primary transit levels of service should exceed 100 per hectare within walking distance of the network. Where the PTN intersects to form nodes, this should be increased to at least 200 people or jobs per hectare.

Diversity: Each intensified area should include a mix of uses that provides services and the ability to meet needs locally for residents and employees. Regionally, these areas can also "include a mix of uses and intensities between different transit areas, to promote counter-flow transit travel during peak commuter periods as well as support off-peak ridership" (City of Calgary, 2009a, 2-13)

Design: Each trip taken on transit begins and ends with a pedestrian trip. Improved pedestrian infrastructure and amenities should be provided that allow direct routes between destinations. The built form should include suitable design and orientation that contributes to a lively pedestrian environment.

Distance: Locate the right uses close to transit. Ridership gains are more likely if destinations are close to transit stops. Intensification should be focused within a 5 minute walk, or about 400m, of transit stops and stations.

With these four elements in place staff stratified the activity centres and corridors into five types, based on land use characteristics such as existing built form type, the presence of major land uses such as institutions or employment concentrations, development potential, and location along the PTN (City of Calgary, 2009a; **Figure 14**). Although each node should serve as a local destination within its catchment area, a variety of functions were desirable to encourage intercentre transit trips.

Figure 14 - Activity Centre and Corridor Typologies (City of Calgary, 2009a, 3-5 & 3-10)

Activity Centre	Intensity (jobs and population per gross developable hectare)*	Transit Service	Typical Key Uses
Major	200 (minimum)	One or more Primary Transit stations	One or more major institutional uses, business and employment, high and medium density residential, retail and supporting services
Community	150 (minimum)	Primary Transit Station	Institutional use (opt), retail centre, medium and high density residential, business and employment
Neighbourhood	100 (minimum)	Primary Transit station or Transit stop	Local retail and local services, medium density residential

* Intensities for each specific Activity Centre will be determined through Local Area Plans in consideration of land available for development, community context, and the opportunities to optimize infrastructure and public investment.

Corridor	Intensity (jobs and population per hectare*	Transit Service	Typical Key Uses	Street Type (See CTP)
Urban	200 (minimum)	Located on Primary Transit Network	Retail, Office, Mixed-use buildings, medium and high density residential	Urban Boulevard, support for multiple modes
Neighbourhood	100 (minimum)	Located on Primary Transit Network	Low to medium density residential, retail, mixed-use buildings	Neighbourhood Boulevard, support for multiple modes

* Intensities for each specific Corridor will be determined through Local Area Plans in consideration of land available for development, community context, and the opportunities to optimize infrastructure and public investment.

Major Activity Centres: Developed to the highest intensity, these are served by one or more primary transit stops and routes. These areas have a large land area available for redevelopment, and allow the highest density/building heights and broadest land use mix. These centres "should be developed to function as an 'urban centre' for a sub-region of the city and provide opportunities for people to work, live, shop, recreate, be entertained and meet their daily needs" (City of Calgary, 2009a, 3-7). As many of these centres are existing concentrations of retail, this role would continue, but new large format retail should "be located at the edge of a Major Activity Centre and be designed with an appropriate pedestrian-

friendly design" (City of Calgary, 2009a, 3-7). Parking is to be designed to minimize its impact on pedestrians, and ultimately be provided in structured and underground forms.

Community Activity Centres: This typology sought a more moderate level of intensification, intended to serve a few adjacent communities. These are locations that have smaller land bases available for development and limited connectivity to the PTN that could restrict its development potential. Most of the Community Activity Centres identified by the MDP "are existing commercial developments and should continue to provide a significant level of retail service" (City of Calgary, 2009a, 3-8).

Neighbourhood Activity Centres: Not identified on City land use maps, this type of centre corresponds to small mixed-use nodes within neighbourhoods. They are characterized by ground-oriented and low-rise housing at medium-density levels, while commercial uses are primarily locally-oriented. Where direct street network connections are available to higher order centres, improved pedestrian and cycling facilities should be provided.

Urban Corridor: Developed to intensities similar to Major Activity Centres, Urban Corridors will be oriented on a multi-modal boulevard with a strong focus on alternative modes of transport. They should also contain an greater mix of uses and serve employment, commercial, as well as residential functions.

Neighbourhood Corridor: This typology is similar to existing "main street" settings existing on pre-war commercial streets. As such, they are primarily assigned to those same locations to reinforce their character and development types. They should discourage auto-oriented uses and new development should be oriented to the central street.

Current Status of Activity Centres and Corridors

Following the adoption of the CTP and MDP in 2009, monitoring programs were established to observe the progress of these typologies towards development goals. The first report on this progress was made available in 2010, and noted successful trends but also challenges to be addressed (City of Calgary Land Use Planning & Policy, 2010). Population growth is occurring in all typologies (**Figure 15**), but until recently has been focused in a handful of centres, most notably near the two universities and at Westbrook Mall. However, the level of development activity in these corridors has been steadily increasing. Several major projects have received planning approval or are currently being constructed in several activity centres along the LRT.

A key challenge for planners is maintaining the desired mix of uses: where intensity targets are currently being reached it is largely due to concentrations of employment (**Figure 16**). For example, a mall site is the only Community Activity Centre currently meeting its intensity target, doing so exclusively as a result of mall employment.

Figure 15 - (City of Calgary Land Use Planning & Policy, 2010)

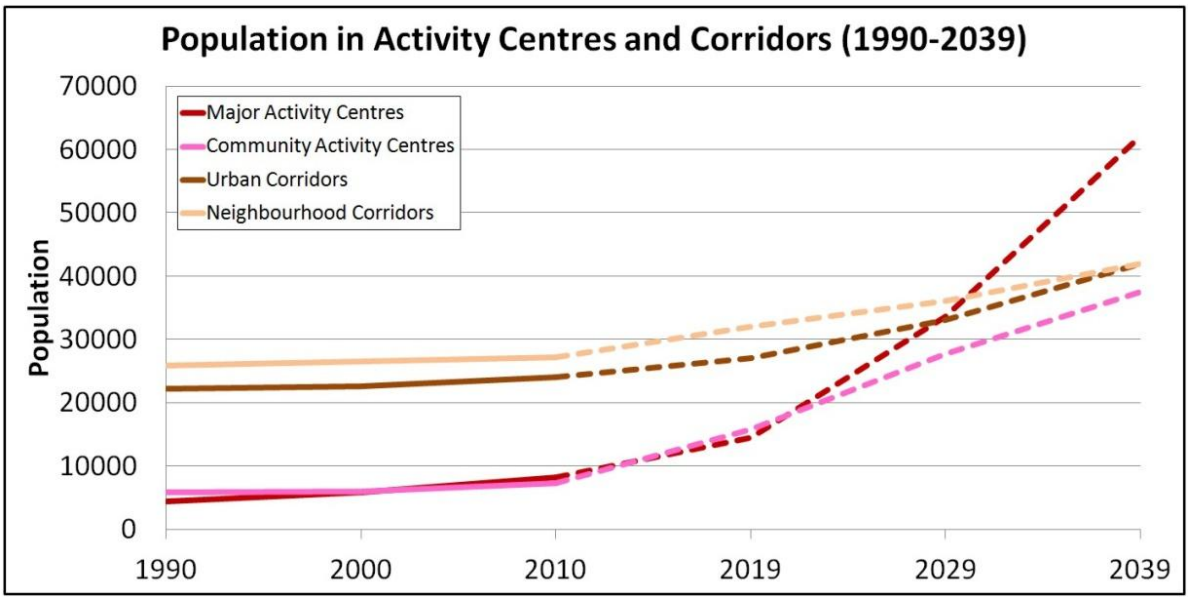
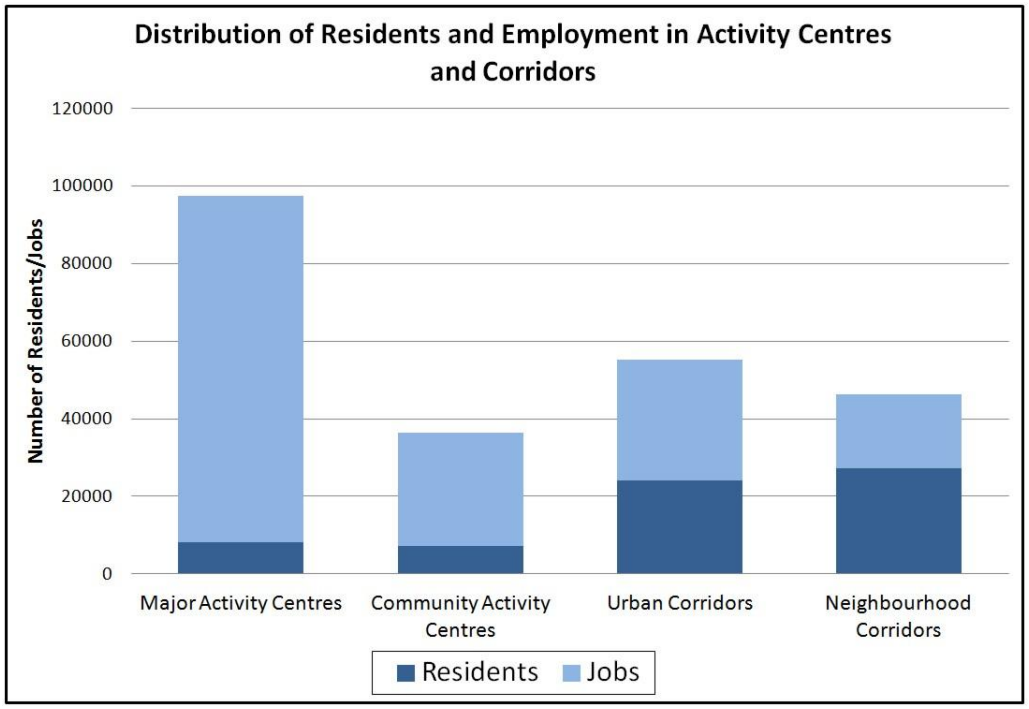


Figure 16 - (City of Calgary Land Use Planning & Policy, 2010)

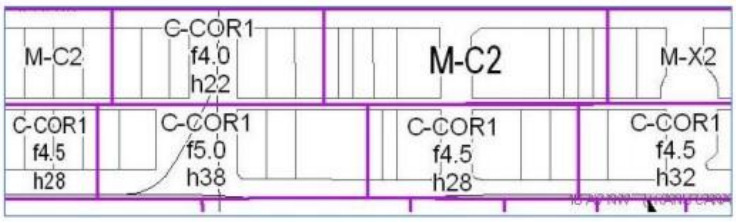


Land Use Bylaw 1P2007

With the CTP and MDP providing broad statutory guidance, the City also needed a land use bylaw that could enforce these objectives at the site plan level. The 1980 Land Use Bylaw (2P80) "had grown increasingly inadequate to respond to new development trends and changes in City Council policy" (Medeiros, 2011, 4). This was evidenced by the City's increasing reliance on its flexible Direct Control districts: between 1996-2000 "City Council approved 454 direct control district redesignations versus 191 conventional district redesignations" (Medeiros, 2011, 4). Administration prepared a new land use bylaw – 1P2007 – that was approved by Council and came into force on June 1, 2008 (City of Calgary, 2007a, 2007b). The bylaw introduced several new zoning concepts in Calgary: modifiers for conventional districts, minimum densities, regulating use areas within developments, expanded design standards, and new parking standards. The aims of these additions were to reflect "contemporary planning theory by providing a tool to implement fine-grained land use policy in response to the rapid growth in Calgary since 1980" (Medeiros, 2011, 1).

Adding modifiers to conventional districts introduced more flexibility in achieving the land use aims for a particular area. Three modifiers could be applied: ***f*** denoting Floor-Area-Ratio (a measure of density), ***h*** which established a maximum building height in metres, and ***d*** which would be used in residential districts to establish a maximum density in terms of units per hectare. Minimum densities were also established, although these are common to all parcels of a given district. For example, M-1 districts which are intended to provide multi-residential housing at medium density in new suburban areas are required to provide a minimum density of 50 units per hectare (City of Calgary, 2007, §620(1)).

Figure 17 - Example of District Modifiers (Medeiros, 2011, 6)



The new bylaw also regulated the size of individual uses and their location within a site. This came from a growing awareness that "the scale of a use is often more important than the use itself" (Medeiros, 2011, 7). To address this, planners used the concept of a 'use area' which encompassed the building area devoted to an individual commercial unit. These use areas were then regulated to ensure that the scale of activity was consistent with the planned character of the area. This tool was primarily applied to at-grade commercial to support a pedestrian-friendly environment. For example, the C-COR1 district which was used primarily for 'main street' commercial typologies, restricted the use area on the ground floor to a maximum of 465m^2, except supermarkets which could achieve a use area up to 1,400m^2 (City of Calgary, 2007a, §785). By contrast, C-COR2 which reflects a higher scale of activity permitted use areas up to 930m^2, with supermarkets allowed up to 2,500m^2 (City of Calgary, 2007a, §803).

The new land use bylaw also considered the distribution of uses within a building (or vertical mixing). Influenced by form-based codes, planners recognized that certain "uses such as 'offices' tend not to create interest for pedestrians and may not positively contribute to streetscape activity. In those districts

in which the activity at the street level is important LUB 1P2007 prohibits certain uses from locating on the ground floor" (Medeiros, 2011, 8). Furthermore, the City could also mandate mixed-uses within new developments. The M-X1 district required a minimum of 300m^2 of commercial area located on the level closest to grade and a maximum use area (single space) of 300m^2 (City of Calgary, 2007a, §677).

The bylaw also expanded the standards that were expected of new development with respect to siting and orientation on a parcel. Development could be required to provide a maximum setback from the property line, achieve a minimum frontage on a commercial street, and provide the primary entrance on that street. Once again using C-COR1 as an example, the building was not permitted to be setback more than 3m from the property line, parking uses were not permitted between the street and building, and the design should occupy a minimum of 80% of the frontage of the commercial street it faces (City of Calgary, 2007a, §782-§783).

Lastly, the new land use bylaw also addressed concerns over suitable parking requirements, particularly site provision (see also **Section 4.44**). Reduced parking supply was allowable under certain circumstances, including: a transportation demand management strategy approved by the City, shared parking for commercial uses in shopping centres, providing bike lockers and showers, locating within the inner city, and proximity to LRT or frequent bus service (City of Calgary, 2007a, §124(2); Medeiros, 2011). In most districts the reductions that were allowed by proximity to transit service would be 10% for parcels within 400m of an existing or approved LRT station, and 5% for parcels within 150m of frequent bus service (City of Calgary, 2007a). Lastly, where excessive parking was to be provided, the City could mandate it be structured or underground: in the C-COR1 district providing more than 6 stalls per 100m^2 gross area this requirement would be triggered.

The new land use bylaw has proven to be an effective tool in regulating new development for much of the city. Notable examples are two projects built using C-COR1 districts on traditional commercial streets: Atlantic Avenue Art Block in the Inglewood community and Hanson Square in the Beltline (**Figure 18**). Both were built to four storeys, containing offices and small ground floor retail units. Parking in both projects is located underground or behind the buildings.

Figure 18 - Atlantic Avenue Art Block (Top) and Hanson Square (Bottom) (Source: Google Maps)

However, the 1P2007 bylaw has not been sufficient in addressing the zoning challenges at TOD sites (see Chapter 4). The City has continued to make heavy use of the DC district in these areas, principally for the purpose of requiring minimum densities and including density incentives for certain amenities or the inclusion of residential components. Furthermore, the parking policies are a positive first step but the relatively modest reductions available and continued limitation of the cash-in-lieu policy to central areas will ensure that parking provision remains a considerable and costly element of new developments.

Summary

This era saw a major leap forward for Calgary in land use planning. Economic conditions created a market for multi-residential housing, especially in the developed area of the city. But this was in many ways facilitated by a City administration that was increasingly willing to support and facilitate this growth. Motivated by a reduce infrastructure expenditures and maximizing current assets, planning efforts shifted away from new suburban growth and towards intensification. This motivation also fed into a desire to reduce automobile use and encourage transit and active modes instead.

The transportation-land use connection also became strengthened by the integrated planning approach used in the CTP and MDP. Previous plans, even the progressive GoPlan, had tied transportation

decisions to land use trends. Now, the City's plans reflect a more active approach to shaping land use through transportation investments. The proposed Primary Transit Network will offer improved accessibility between key activity nodes, and the City believes that this benefit will stimulate land use changes as congestion grows on roadways.

As to why efforts to create policies for intensification were more successful in this era than in previous ones is largely because public perceptions had changed. Through imagineCALGARY and Plan It, Calgarians responded that they were now more open to density, and wanted better transit service throughout the city and not just to downtown. The framework created by Activity Centres and Corridors will be key to maintaining this support, especially in communicating the level of intensity that will be expected and how these nodes will integrate into surrounding communities.

The 14 years since the GoPlan was approved were transformative for land use policy in Calgary. Where once residential growth was to be overwhelmingly suburban, and employment focused into two "mini-downtowns" on the urban periphery linked by a ring road freeway, planners now envisioned clusters of density in the existing area of the city which are linked instead by transit.

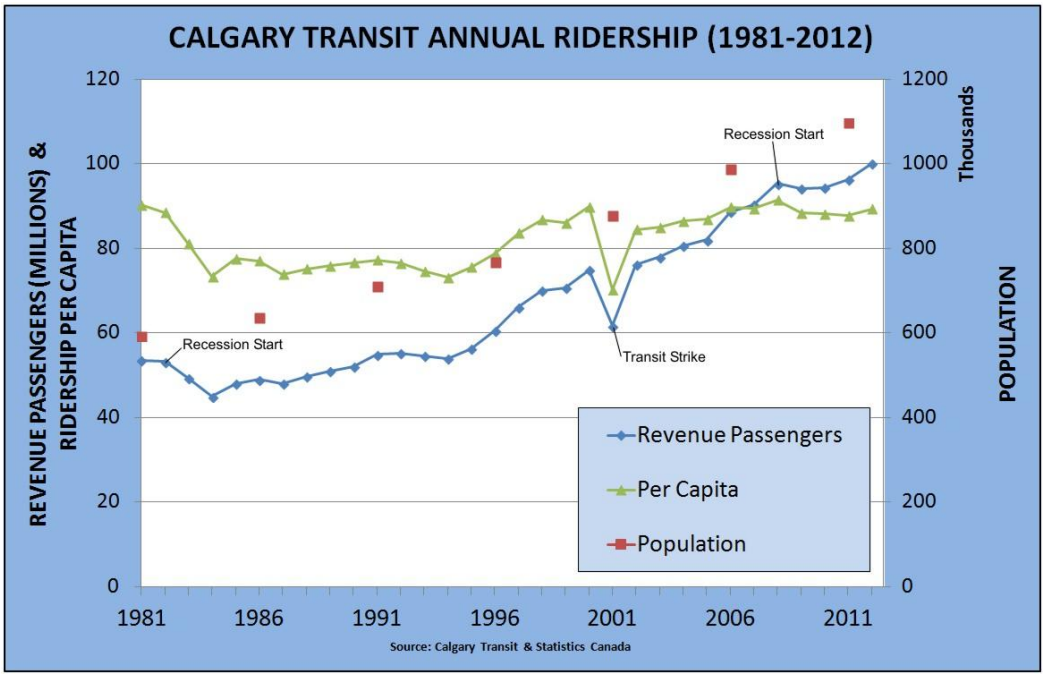
4.43 Transit Planning and Service

The 2000s saw a resurgence in both ridership and construction for Calgary's transit system. All three existing LRT lines were extended to the edge of the city, and the long awaited West LRT line was built, opening in 2012. From 2000-2012 the total length of LRT track in Calgary grew from 32.7km to 56km and the number of stations increased from 33 to 44 (City of Calgary Land Use Planning & Policy, 2004a; City of Calgary, 2012). Service improvements were also made, with transit hours per capita increasing to their highest levels since LRT service was first introduced.

Ridership also increased dramatically during this era. While the city's population grew 28% from 1996-2006, transit ridership grew 46% over the same period (Calgary Transit, 2013a). Ridership gains on the LRT system were even more significant as average weekday volumes rose by 111% from 1995-2005

to 220,000 daily riders, carrying nearly half of all transit riders in the city every weekday (Calgary Transit, 2005; McKendrick, et al., 2005). This level of growth was creating capacity concerns, while worsening traffic congestion in high growth corridors to the north and south-east created a need to plan for two more LRT lines.

Figure 19 - (Adapted from Calgary Transit, 2013a)



Transit planning also evolved during this era, with increasing emphasis on providing a competitive travel alternative not only to downtown but throughout the city. Planners introduced a Primary Transit Network in 2009, which would provide improved service linking activity centres targeted for intensification. In 2012, the City approved RouteAhead, a comprehensive transit capital plan to implement the Primary Transit Network over the next 30 years.

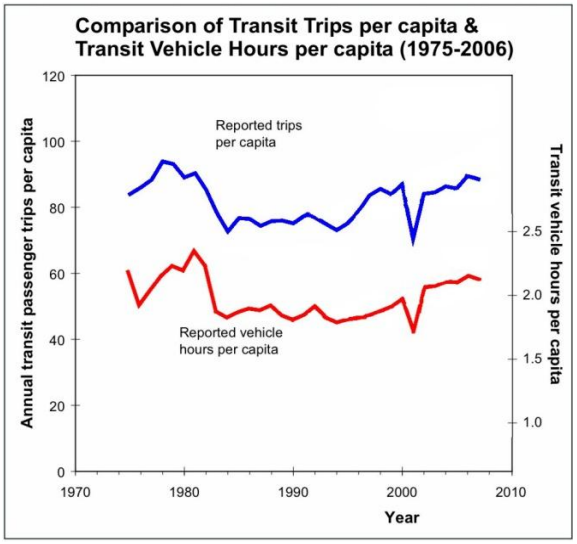
Positive transit trends that started in the mid-1990s continued into the 2000s. Ridership was increasing faster than population growth, and new service hours were being added every year. Although a transit strike in 2001 slowed the ridership growth rate, by 2012 Calgary Transit achieved a milestone, carrying over 100 million riders for the first time (City of Calgary, 2012). Downtown continued to be the

primary driver of ridership gains, but transit was also increasingly carrying riders to destinations outside of the core. During peak hours, one quarter of all LRT trips were travelling away from downtown, "many towards jobs in the northeast and southeast or classes at post secondary schools in the northwest" (McKendrick, et al., 2005, 7). This diversity of travel improved citywide transit commute mode share, increasing from 13.6% to 16.8% from 1996-2006 (City of Calgary Transportation Planning, 2008c).

The implementation of transit passes at the Southern Alberta Institute of Technology (SAIT) and University of Calgary in 2001-02 was also a significant factor in attracting these trips. In the three years following the introduction of a student pass at SAIT, ridership at the LRT station on campus increased by 38%, and the transit mode split improved from 37% to 48% (City of Calgary Land Use Planning & Policy, 2004a). The program also had a significant impact on parking demand at the school: "We [SAIT] had a two year wait for parking passes and now, six months later, there is no wait" (McNally, 2002). Although the result of a transit incentive program, this outcome nonetheless provides a marked contrast to IBI's assertion during the South LRT Land Use Study that parking demand would not be significantly affected by the presence of LRT (IBI Group, 1978). This raises the possibility that similar programs could be impactful on travel behaviour if adopted by respective employers or developers.

Calgarians were also riding transit more often. At 88.2 trips per capita, the average number of transit trips per Calgarian in 2011 was nearly the same level as in 1981 when the LRT system first opened (City of Calgary Transportation Planning, 2008a). This trend was in no small part due to a significant increase in service hours (**Figure 20**). Service hours per capita had been steadily rising since the mid-1990s and by 2011 Calgary Transit operated 2.43 hours of service

Figure 20 - (City of Calgary Transportation Planning, 2008a, 2-3)



per person, also the highest since the introduction of the LRT (Calgary Transit, n.d.; City of Calgary Transportation Planning, 2008a).

Downtown continued to play a key role in generating new transit trips as employment growth resumed (**Table 8**). Transit mode share also increased, rising from 32% in 1996 to 45% in 2006, while the proportion of auto drivers fell from 49% to 37% over the same period (City of Calgary Transportation Planning, 2010). Transit mode share grew so quickly that the 50% GoPlan mode share target was indeed reached more than a decade before projections: in 2012, the City announced that "for the first time in Calgary's history, half of all trips to the downtown [during the AM peak hour] were by public transit" (Gandia, 2012).

There was also evidence that the policies encouraging residential growth in Centre City were having their intended effect. The population of downtown increased by 46% during the 2000s, and the number of trips by active modes more than doubled. Investments in infrastructure have shifted accordingly. In 2012 the City opened a new pedestrian bridge over the Bow River, the Peace Bridge, which has already exceeded expectations with 6,000 daily users (Calgary City News Blog, 2012), and in 2013 a separated bike lane was introduced connecting the Peace Bridge to the Stephen Avenue pedestrian mall via 7th Street W.

Table 8 - (City of Calgary Transportation Department, 2011, 6-2)

Table: Downtown Travel Changes – 1999 to 2009

Method of Travel	Number of Trips, AM Peak Period (2hr)		Change
	1999	2009	
Walk	6 700	15 000	123%
Cycle	1 700	2 300	35%
Transit	36 500	65 500	79%
Auto Driver	55 000	69 500	26%
Auto Passenger	11 300	12 600	11%
Auto Total	66 300	82 100	24%
Employment	102 100	130 000	27%
Population	10 600	15 500	46%

New and Future Investments in Calgary's LRT Network

Population, employment and transit ridership growth were all exceeding projections. This created a need to accelerate planning for the next generation of transit infrastructure. Transit was rapidly approaching capacity in downtown (**see section 4.41**), and significant population growth was expected in areas not served by LRT, especially the south-east and north-central corridors. Currently only served by conventional bus routes, these corridors were expected to add over 200,000 new residents and 50,000 jobs by 2015 (**Table 9**). To accommodate this growth on the transportation network, three new LRT lines would be required over the next 25 years.

Table 9 - (City of Calgary Transportation Department, 2007, 5)

Table: LRT Corridors - Current and Future Population and Employment Projections

	South	NW	NE	West	SE	NC
Current						
Population	202,200	159,300	164,900	**84,300**	65,100	57,900
Employment	93,000	45,600	68,600	**18,000**	48,700	5,600
2015						
Population	247,000	170,000	191,000	**118,300**	135,000	170,000
Employment	121,000	54,000	95,000	**21,700**	85,000	16,000

Not served by LRT

The 2006 Downtown LRT Feasibility Study marked the return to planning for the West LRT line. The Study noted of the three new proposed lines, the West LRT should be the next logical step in transit expansion as it was "the easiest line to implement since it will function as an operational extension of the Northeast LRT and requires no new infrastructure in the downtown to support it" (Clifton ND Lea, 2006, 5). Furthermore, the West LRT corridor had the highest population not yet served by an LRT line. Council proceeded by directing staff to update the relevant planning for this corridor in 2006. With Provincial funding forthcoming, on November 6, 2007 Council approved the West LRT as the next LRT line to be constructed (City of Calgary Transportation Department, 2007). At nearly 8 kilometres long, the line was initially budgeted at a cost of $600 million (Calgary Transit & Clifton ND Lea, 2006).

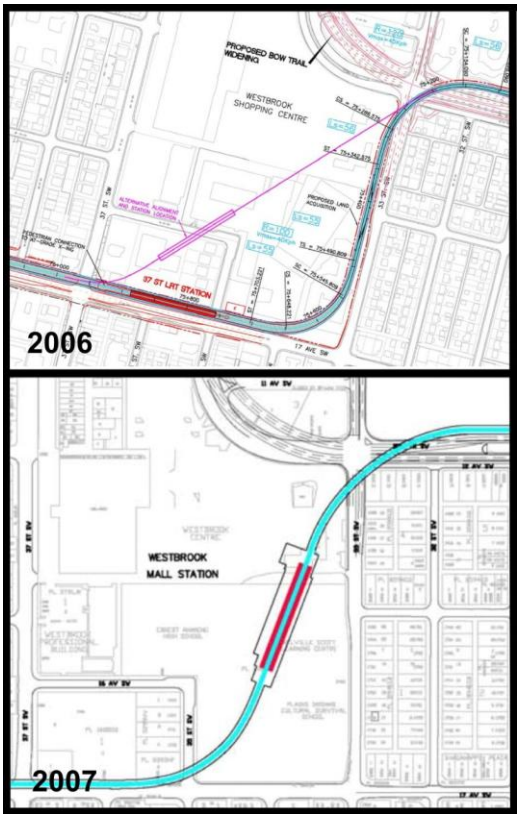
While considerable planning work had been dedicated to studying the new line in the 1980s, there was a need to review these decisions to reflect the changes that had occurred in the two decades since. The general alignment, using Bow Trail and 17th Avenue SW to a terminus at 69th street, remained unchanged. Yet there remained considerable indecisiveness over specific aspects of the alignment, such as station siting and placing track in medians or adjacent to roadways. Several of these aspects changed repeatedly during the planning process. However, each report was consistent in noting the importance that the decisions reflect land use objectives, specifically improving the pedestrian environment and future potential for TOD (Calgary Transit & Clifton ND Lea, 2006; City of Calgary Transportation Department, 2007; Stantec & SNC Lavalin, 2007). The West LRT Land Use Study, being conducted concurrently with technical design, also influenced decision making for the physical design of the line.

The design for two stations in particular demonstrates the turbulence of designing the LRT line: 69th Street and Westbrook. 69th Street Station underwent perhaps the most significant design change of all stations along the West LRT (**Figure 21**). Originally proposed as an at-grade station north of 17th Avenue with grade separated pedestrian connections to the bus terminal and park-and-ride south of the road, two significant changes were made to improve the connection with land use objectives. First, the station was relocated to the south-west "to provide accessibility to the educational campus that is being developed in this area" (City of Calgary Transportation Department, 2007, 15). With a new high school to replace one being demolished for the West LRT at Westbrook, in addition to a private school and a university college, some 4,000 students, faculty and staff would locate on this campus over an area of 7.5 hectares (City of Calgary Transportation Department, 2007). The second decision was to construct the station directly under the cross-street, allowing one station head to connect to the educational campus, while the other provided direct access to the bus loop on the east side of the roadway.

Figure 21 - Changing Design at 69th Street LRT Station
(Calgary Transit & Clifton ND Lea, 2006, 18; City of Calgary Transportation Department, 2007, VII; Pootmans, 2013)

At Westbrook Station, there was little doubt over the commitment to support a future TOD on the site: "There is a significant opportunity to capitalize on a transit-oriented development at Westbrook Mall Station. Selecting an LRT alignment that maximizes the greatest redevelopment potential in this area is an important consideration" (Stantec & SNC Lavalin, 2007, 3.8). Instead, the debate was over which alignment would be best in facilitating these aims. Plans approved during the 1980s favoured either an elevated or below-grade structure, but left the final decision to be made in the future. In 2006, based off feedback from the owners of the mall property and Calgary Board of Education, reports

Figure 22 – Changing Design at Westbrook LRT Station (Calgary Transit & Clifton ND Lea, 2006, 10; City of Calgary Transportation Department, 2007, IV)



initially supported an elevated line connected to surrounding development by elevated walkways, which would be "considerably less expensive than a tunnel and reduces impacts to existing businesses or access to the future development site" (Calgary Transit & Clifton ND Lea, 2006, 9). By 2007, it was decided that the high school onsite would instead be moved to a new location at 69th Street Station, allowing construction of an underground station (City of Calgary Transportation Department, 2007).

On June 9, 2008, Calgary's City Council approved a finalized alignment, allowing construction to begin, targeting completion by 2012 (City of Calgary Land Use Planning & Policy, 2009a). The question remained as to what the expected ridership would be. The western area of the city had grown faster than had been expected during the 1980s: nearly 60% more residents lived within the catchment area in 2005 than had been expected in 1988 (City of Calgary Transportation Department, 2007). Planners now estimated that daily ridership on the West LRT would be 32,000-37,000 when the city population surpassed 1.25 million (Calgary Transit & Clifton ND Lea, 2006). Furthermore, planners also noted the potential ridership impacts of TOD: they felt that through development at Sunalta and Westbrook Stations, and moderate intensification at other stations, 5,000-7,000 additional riders could be realized for a total of up to 44,000 daily riders.

When the West LRT opened in December 2012, ridership exceeded expectations. Calgary Transit had forecast 25,000 riders crossing the downtown screenline daily; preliminary reports indicate a ridership of 28,000 over the same screenline, with "several thousand passengers per day that disembark at various stations along the west line rather than travelling downtown" (Pootmans, 2013). Furthermore, while many of the riders have shifted from buses to the new LRT, Calgary Transit has reported that overall transit patronage within the West LRT service area has increased by "approximately 28 per cent over pre-LRT numbers within the first few months of service" (Pootmans, 2013).

The planning process for Calgary's West LRT showed greater emphasis on land use impacts. But with little existing transportation right-of-way, unlike previous LRT lines, there were many challenges to

overcome in finalizing an alignment. Concerns about sensitive integration into existing communities added complexity to the project, and contributed to rising costs. The decision to depress part of the line along 17th Avenue to address complaints about traffic delay and noise added $85 million to the project alone (Calgary Herald, 2008). Including a new interchange, roadway improvements, and a new high school, the final cost of the project rose to $1.4 billion, more than double initial estimates. This tension between maximizing redevelopment and ridership potential against cost concerns is an issue that the City is confronting again as it plans for the North Central LRT.

The planning process for the proposed North Central LRT (NCLRT) line provides significant insight into the City's philosophy for transit. There are numerous tradeoffs that need to be made in designing the line, but one in particular has direct relevance to a theme in this research: is the intent behind rapid transit to facilitate suburban commutes to downtown and thus support suburban expansion, or is it to provide mobility options for all trips and to stimulate intensification? As has been discussed, Calgary's first 3 LRT lines took the former approach, while the West LRT has moved towards the latter. In the case of the NCLRT, the City is facing a similar choice, and the decisions which will eventually be made will provide strong evidence of the City's commitment to the policies of the 2009 CTP and MDP.

Map 19 - North Central LRT Alignments Under Consideration (Adapted from Presentation Boards at North Central LRT Open Houses June 2013)

Like the West LRT, the right-of-way for a North Central line has only been protected in suburbs developed since the mid-1980s (Clifton ND Lea, 2006). Similarly, the area between the protected right of way and downtown is densely urbanized with major commercial streets, making expanding these

corridors to accommodate rail transit difficult. In 2006, the City initially approved an alignment through the Nose Creek valley along the eastern edge of the service area in order to avoid the built up area (**Map 19**). There were two reasons behind this early decision. Superficially, the City believed that a more central alignment would be unable to realize the preferred LRT operational characteristics, predicated on generating a travel time advantage over autos and thus favouring higher average speeds (Calgary Transit, 2006). But this was a result of the second and more significant reason behind this alignment: the NCLRT was "required to serve future communities north of Stoney Trail" (Clifton ND Lea, 2006, 1).

In 2005, the population of the north central corridor stood at 145,800, 76% of which was in established communities south of Beddington Trail (Calgary Transit, 2006). By 2040, the corridor is expected to be home to 314,000 people. 82% of this growth (138,000 residents) was expected to occur north of the Stoney Trail ring road, although it should be noted that these projections were made under the policies of the suburban focused GoPlan and 1998 MDP.

The Nose Creek alignment is undoubtedly the most desirable choice if the primary purpose is to serve these northern communities, but also has major limitations for transit riders in established communities. The route was cost-effective: the City owned most of the property required, and by utilizing existing infrastructure on the Northeast LRT to enter downtown it could avoid expensive new grade separated connections over the Bow River and within downtown itself. Furthermore, by allowing high operational speeds in the low-cost at-grade alignment, this route provided a 30% travel time improvement over existing bus service from the far north (Calgary Transit, 2006).

The limitations on this corridor were also readily apparent and significant. South of the planned Aurora Business Park, the alignment travelled in a steep valley: this restricts accessibility to adjacent land and limits opportunities for park-and-ride lots and bus terminals. Only two stations south of Beddington Trail were planned to have bus connections to the area. The peripheral location of the line also meant that many riders in established communities would continue to use buses, as "those wishing to travel from the

communities south of Beddington Tr via LRT would have considerable out of the way travel at both ends of the journey" (Calgary Transit, 2006, 25).

In contrast, a more centrally located alignment would provide less utility for residents in new communities but a considerable benefit to established communities, both in terms of improving transit service and in supporting the land use policies in the 2009 CTP and MDP. Existing bus service along Centre Street carried 8.4 million riders in 2006; by 2029 with transitway improvements planners are projecting this to increase to 14 million annual riders (City of Calgary, 2013a). Capacity has already become a concern. Peak hour service to downtown carries 3,700 riders, only 18% less than peak hour LRT ridership on the Northwest and Northeast LRT lines (Calgary Transit, 2006). Furthermore, peak hour ridership demand is expected to increase to 10,000 by 2040. Druh Farrell, a City alderman whose ward includes most of the area south of Beddingon Trail, summarizes: "We've got 1,500 buses going down Centre Street a day, and we're still leaving people at the curb" (Stephenson, 2012).

A central alignment for the NCLRT also creates significant benefits in supporting land use objectives and connectivity to more destinations. The 2009 MDP identified both Centre Street and Edmonton Trail as Urban Corridors, targeted for intensification to 200 people and jobs per hectare. Moreover, half of the employment in the corridor by 2040 is expected to be south of Beddington Trail, with much of the remainder in the planned Aurora Business Park (Calgary Transit, 2006). Finally, a central alignment also permits the NCLRT to be integrated with the Southeast LRT line in downtown, as the latter is planned to terminate in Eau Claire in the northern part of downtown (**Map 19**).

It seems residents have realized the benefits of a central alignment as well, and public opposition to the Nose Creek as mounted. In 2011, the City announced its intention to review the alignment choice and gather public input. It is worth noting that Calgary's comprehensive transit plan approved in early 2012 shows the NCLRT as part of a so called "Green Line" with the Southeast LRT, which will not be possible with the Nose Creek alignment (City of Calgary, 2012).

While planning for the eventual route for the NCLRT continues, this process highlights some of the competing interests which have shaped transit planning in Calgary, even as the city moves to a policy framework that sees transit investment as a means to facilitate land use change. Part of the limitations in planning for these objectives in this corridor is the lack of local area planning. Unlike the West LRT, the North Central corridor has no land use study underway, and only one active Area Redevelopment Plan. As this process moves forward, it will be an interesting test case of the City's newfound commitment to using transit investments to encourage intensification.

Primary Transit Network and RouteAhead

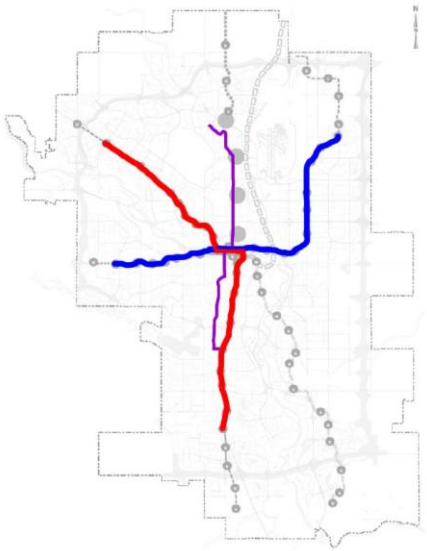
"The most popular and easiest way to get around Calgary today is the car. This is partly because the car is more convenient than transit in many parts of the city. In most communities, transit only runs frequently during rush hour, and the best service leads to downtown" (City of Calgary, 2009c, 12). This assessment clearly outlines the challenge for planners in designing a transit system to fulfill the planning objectives of the CTP and MDP. With a multitude of new activity centres and corridors planned throughout the city, a radial transit network centered on downtown will no longer be sufficient in accommodating travel demand. Planners recommended the creation of a Primary Transit Network (PTN) which included LRT as well as improved bus services (City of Calgary, 2009c; **Map 18, p.127**). The solution was a dichotomous approach to transit service: maintaining and making small improvements to base transit service, but focusing investment on high frequency service between activity centres.

The base transit service would continue to fulfill the role of transit as a public service for those with limited mobility. It would be designed to reach almost all Calgarians within 400m (or a 5 minute walk) from a bus stop, with average peak headways of 15-20 minutes (City of Calgary, 2009d). Most improvements to this service targeted off peak service. While some current routes operate at headways of up to 1 hour during off peak periods, the future minimum headways should be no worse than 30 minutes.

The PTN, on the other hand, is aimed at maximizing ridership and transportation network efficiency between high trip generating nodes. The PTN was operationalized by meeting service standards, not by technology; key measures of success would be a reliable and permanent high frequency service that offered capacity commensurate with demand (City of Calgary, 2009b). The operational standard was to provide service at no worse than 10 minute headways, for 15 hours per day, 7 days per week; service outside of this period would operate at no worse than 30 minute headways. The City felt this standard offered greater competitiveness with the automobile: high frequencies would minimize travel delay associated with wait and transfer times and direct routing between activity centres would reduce in-vehicle times. This type of service would also improve rider experience and accessibility to the system by enabling riders to "make spontaneous trips along the transit corridors without consulting a transit schedule" (City of Calgary, 2009b, 3-12). This would also broaden the market for potential transit riders, "ensuring that all types of trips can be accommodated on the Primary Transit Network – not just work and school commuting" (City of Calgary, 2009b, 3-12).

When the PTN was introduced in 2009, only the LRT lines were close to meeting its service requirements. However, some high ridership corridors, such as Centre Street N, provide this level of service for portions of the day and required minimal investment to achieve full primary transit service. As such, the City has focused on improving these corridors first. Furthermore, "focusing investment in existing high-demand transit corridors will achieve the dual benefit of increasing transit capacity to attract new transit riders and providing incentives for more intensive, mixed-use development" (City of Calgary, 2009b, A-2). By 2012, PTN service was provided on all LRT lines and one bus route (Route 3) which runs parallel to the South LRT and

Map 20 - Primary Transit Network, 2012



into North Central Calgary (City of Calgary, 2012; **Map 20**).

Initial progress could be made on a few existing high ridership corridors at minimal cost, but full build-out the network will require more extensive infrastructure. This was especially true in suburban sections of the network, where transit service requires a greater increase in operational speed to compete with automobiles (City of Calgary, 2009d). The scope of the system was also seen as critical to its success: offering this improved service to more residents with more destinations. In 2009, only 8% of all residents and jobs were within a 10 minute walk of the LRT; by 2076, the City aimed to have 50% of residents and jobs within walking distance of the PTN (City of Calgary, 2009b). To achieve this, the City aimed to intensify a series of Activity Centres and Corridors (**see section 4.42**), but also plan for the expansion of the PTN to bring service to residents. This latter goal was addressed in 2013 with Council approval of RouteAhead, an $11 billion transit capital plan for the next 30 years (City of Calgary, 2012).

RouteAhead was an important step for transit planning in Calgary, as "for the first time in our city's history, we will have a long-term and comprehensive strategy for public transit" (City of Calgary, 2012, 2). Public engagement by the project team found that Calgarians increasingly wanted the type of service that the PTN was to provide: the top two priorities for the public were improved service frequency and network design by connecting people to where they needed to go. Calgary was moving from a uni-centric city focused on downtown to a poly-centric city. Several large employment hubs were beginning to emerge: University Research Park north of the University of Calgary; a medical campus at Foothills Hospital; and Quarry Park, a redeveloped industrial site in the southeast that will eventually employ 15,000 people and include the 75,000m^2 Canadian headquarters of Imperial Oil (CBC News, 2012). Furthermore, "expectations about the role of public transit in our community are changing. Citizens want transit to play a larger role in their lives. They want to easily get around during peak hours as well as other times of the day to meet other daily needs" (City of Calgary, 2012, 18).

In order to meet these new expectations, RouteAhead prioritized service improvements to direct early investments to where the greatest change in travel behaviour could be expected. As such, each of the proposed projects was evaluated on three criteria:

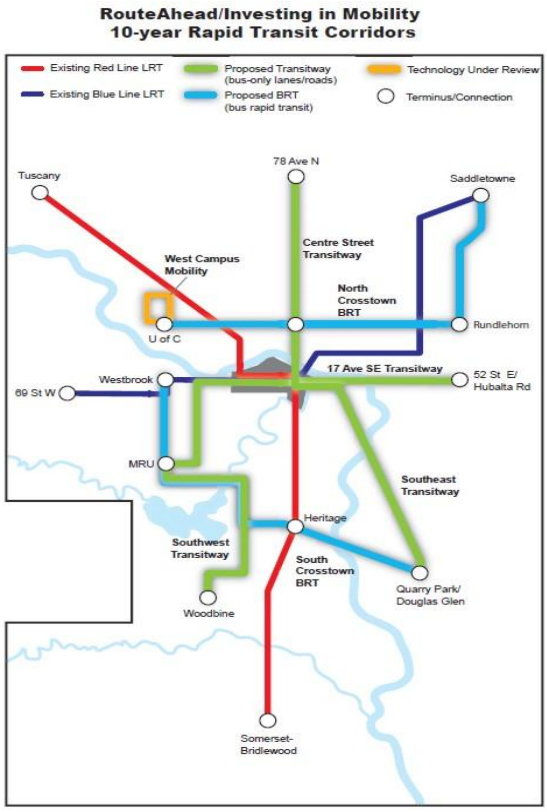
Land Use: This criterion evaluated how each project would support activity centres and corridor typologies with higher scores given for connecting more of these nodes; improving connectivity along the future Primary Transit Network; and the number of residents and jobs forecasted for 2029 that would be served.

Customer Experience: This criterion included consideration of travel time improvements; reducing reliability issues and delays through improved rights-of-way and transit priority measures; and increasing passenger capacity over existing service.

Project Characteristics: The final criterion considered whether a project would serve an existing high ridership corridor and thus support existing travel patterns and reduce congestion concerns; how the project would contribute to lifecycle management (with projects rebuilding existing assets scoring higher than new construction); overall capital costs which favoured lower cost projects that could be integrated into the 10-year capital budget; and the ability of projects to improve mobility for all modes.

Following this evaluation, planners selected projects to be included in the City's 10-year transportation capital budget (**Map 21**). This budget included an estimated $4.5 billion for transportation infrastructure to meet CTP goals, 40-50% of which Council directed to be allocated to transit and improving mobility in activity centres and corridors (City of Calgary, 2012). However, transfers from the provincial and federal governments, providing 65% and 15% of Calgary's transportation capital funding respectively, are expected to decline in coming years (City of Calgary Transportation Department, 2012). As a result planners are expecting a $2 billion shortfall over the life of this budget.

Map 21 (City of Calgary, 2013a, 2)



The North-Central and Southeast LRT corridors will be built first as bus transitways to build ridership and encourage intensification in advance of fixed rail transit, a strategy similar to the Blue Arrow buses of the 1970s. Given the current debate in Calgary over which of these two corridors should be developed into LRT first, it is interesting to review the evaluation of each project (City of Calgary, 2013a). The Centre Street Transitway, in the North-Central corridor, received a high priority for investment. It supported a greater number of future riders (10.5 million annually in 2019, 14 million by 2029), serve the most residents with limited mobility, and have significant opportunities for TOD. By contrast, the southeast transitway served an area with a current annual ridership of 4.7 million. Even with improvements and a 13 minute travel time savings to downtown, annual ridership was expected to grow to only 5.9 million in 2019. With much of the southeast transitway routed through industrial lands, the opportunities for TOD are limited and the cost per rider much higher.

Although it is still much too early to draw conclusions as to the effectiveness of RouteAhead in realizing the City of Calgary's PTN policies, the evaluation of transit projects in the 10 year capital budget does provide one meaningful result. The southeast transitway has received a relatively low score precisely because most of the benefits of this investment would accrue to suburban commuters to downtown. It offered limited redevelopment potential and connectivity to other transit priority areas, and the industrial area would generate few transit trips. That the evaluation framework resulted in such a score is also indicative that the City has largely incorporated its new transit policy into an implementation

strategy. This is supported further by the high scores given to two bus projects, one of which doesn't serve downtown at all. The Southwest Transitway and South Crosstown BRT, connecting planned TODs at Westbrook and Heritage LRT stations, and activity centres at Mount Royal University and Quarry Park, are expected to add nearly 3 million new annual riders by 2019 for a relatively low cost ($60 million, or $3.75 per rider) (City of Calgary, 2013a).

One area that will be important to monitor with respect to implementing RouteAhead is the premise that improved bus service will be successful in stimulating development and land use changes. The type of service that will be offered along PTN routes varies considerably in operational and infrastructure characteristics. Even the use of 'transitway' is quite broad in its application: it could include separate roadways such as Ottawa's BRT system, but could also be dedicated lanes or shoulders on roadways. RouteAhead planners recognized that developers would like a greater sense of permanency like that offered by rail systems, and feel that including more robust infrastructure will not only improve service quality but also TOD opportunities:

> "LRT infrastructure differs from BRT infrastructure in terms of the impression of permanency, or long-range stability. For instance, a concrete guideway, or train tracks signal to developers and investors that the infrastructure will be in place for the long-term. In-street BRT suffers in this regard because the infrastructure is often smaller in scale and not as visible, even if the service is intended to continue for a long time period or be a precursor to future LRT investment. Transitways can have more permanent infrastructure and will inspire more transit-oriented development than in-street BRT." (City of Calgary, 2012, 103).

Summary

The 2000s were a highly prolific era in Calgary in both changing transit trends and transit planning. Ridership continued to grow, despite the effects of the 2001 transit strike and 2008 recession. An extension on the Northeast LRT line and the addition of the West LRT in 2012 helped to continue this

trend: LRT and bus ridership increased by 11% in the first quarter of 2013 over 2012 (APTA, 2013). While transit use is increasing, travel patterns continue to change with a lower emphasis on downtown trips. New significant suburban employment centres are emerging, and the 2009 Calgary Transportation Plan and Municipal Development Plan's emphasis on directing growth to activity centres and corridors meant that the present radial transit system will need to evolve.

Transit planners responded to this challenge by preparing a new direction for Calgary's transit system, the Primary Transit Network, to support a transition into a grid-based network. The increased importance of using transit as a land use tool also affected the physical design of LRT lines. The West LRT was designed to maximize potential redevelopment opportunities, while the ongoing planning process for the North Central LRT indicates a similar shift may be underway on that line. As the new transit planning philosophy continues to move from policy, to implementation strategy, and hopefully into reality, the City appears committed to using transit investments to shape land use outcomes.

4.44 Parking

The parking policies that had been established in downtown over the past three decades had a significant influence on travel behaviour in this era. The growth in the number of long-term stalls in downtown Calgary had slowed, and briefly even decreased during the boom years. This had the expected impact on transit mode share, which increased quickly to achieve the 50% target 12 years ahead of projections. As the number of stalls per employee fell, parking prices in downtown Calgary rose, becoming the second most expensive in North America behind Manhattan (Colliers International, 2012). During this era, planners also corrected policy measures enacted during the 1980s. Moreover, the City also took steps to extend some of the lessons learned in downtown to the suburbs. While these changes are in many ways still nascent, they represent the first steps towards a parking policy that will support the modern land use and transportation planning philosophy in Calgary.

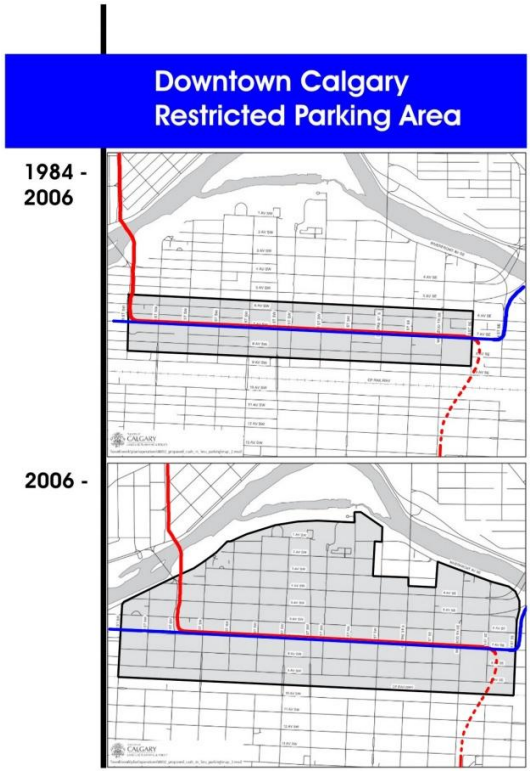
Downtown

The City's goal to restrict long-term parking stalls in order to promote transit mode was highly impactful during this era. Downtown employment grew by 37% between 1996 and 2006, but long-term parking stalls increased by only 4% to 43,000 (City of Calgary Transportation Planning, 2010). The total number of spaces actually declined temporarily as new office tower projects were being constructed during the boom, such that the total number of stalls fell to 42,000 in 2009 (City of Calgary Transportation Department, 2011). The level of parking availability predicted to achieve a 50% transit mode share, 32 stalls per 100 downtown workers, was reached in 2006, and the transit mode share target six years later (City of Calgary Transportation Department, 2011). Efforts have now turned to further reducing the ratio of long term parking spaces to 24 stalls per 100 employees, the level required to achieve a new 60% transit mode share target (City of Calgary Transportation Planning, 2010).

In order to realize this reduction, planners expanded the Restricted Parking Area in downtown subject to cash-in-lieu. The cash-in-lieu parking policy was highly effective in reducing downtown parking supply, but had been limited to only a thin band of downtown adjacent to the LRT lines. These boundaries were a vestige of the original intent to create a linear office core on the LRT lines, and the limited area subject to cash-in-lieu had caused development patterns to shift, "the cumulative affects [sic] of which were a disconnect between the restricted parking and land use density policies. This resulted in an urban form that was not easily served by transit" (City of Calgary Land Use Planning & Policy, 2008a, 2). To rectify this disconnect, in 2006 Council approved an expansion of the Restricted Parking Area, now comprising almost the entire downtown office core north of the CPR tracks (**Map 22**).

The City was also cognizant that the same factors which caused office development to occur outside of the original restricted parking area may cause this to happen again south of the CPR tracks into the Beltline (City of Calgary Transportation Department, 2011). To reduce the risk of such a spillover, an intermediary parking control policy would be introduced for the Downtown Parking Area (**Map 23**). Lands within this boundary but not subject to the Restricted Parking Area could provide no more parking than the base requirement (City of Calgary, 2007b, §1.1(c)). Developers could also opt to have up to 25% of the parking requirement be made in cash-in-lieu. While plans are in place to eventually expand the full restricted parking area southward to 12th Avenue S in accordance with Centre City's policy to extend the office core into the Beltline, "this will only be considered if and when allowable office floor area is increased above the existing 8.0 Floor Area Ratio maximum" (City of Calgary Land Use Planning & Policy, 2007).

Map 22 (City of Calgary Land Use Planning & Policy, 2008a, 13-14)

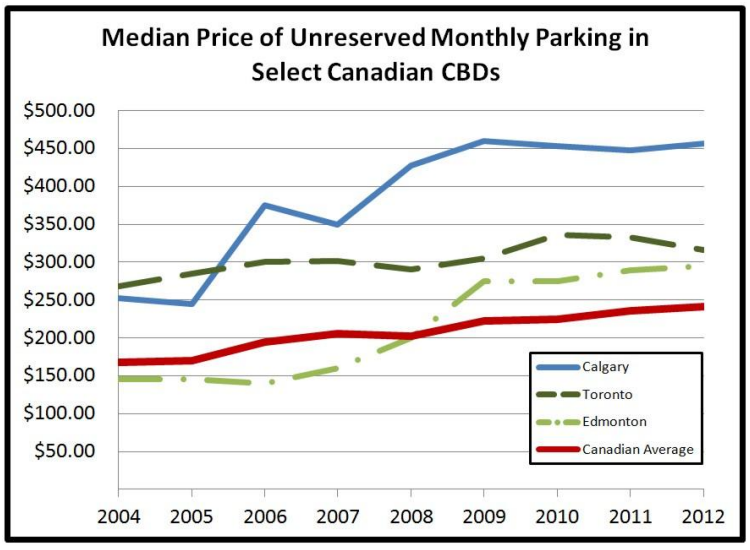


Map 23 - Downtown Parking Area (City of Calgary, 2007b, 39)

Some of the parking policies for downtown also began to be applied to certain districts adjacent to downtown. For nearly 30 years, restaurants, entertainment and cultural uses were encouraged to locate downtown by exempting them from providing parking (City of Calgary Land Use Planning & Policy, 2008a). Now, in the popular retail and entertainment districts along Kensington Road, 17th Avenue S and 4th Street SW, food and drinking establishments and small retail developments are permitted to provide between 50-100% of their parking requirements as cash-in-lieu (City of Calgary, 2007b). In areas of the Beltline, this was extended even further. Any ground floor commercial unit in a C-COR1 district with a use area no greater than 465m^2 would be allowed to provide no parking for that unit if the building contained residential or office uses above grade (City of Calgary, 2007a, §791(3)). Similar reductions were made available for residential units, where minimum requirements could now be as low as 0.5 stalls per unit (City of Calgary, 2007b).

The net impact of these policies, in addition to employment in downtown increasing by one-third during the 2000s, was a dramatic increase in the price of parking. Calgary already had the second highest median price for unreserved monthly parking in Canada in 2004, but this price nearly doubled over the next 5 years (**Figure 23**). By 2012, the median cost for monthly parking was almost 40% ahead of the nearest Canadian city, Montreal ($319/mo), and within North America ranked only behind Midtown and Downtown Manhattan (Colliers International, 2012).

Figure 23 - (Colliers International, 2004, 2005, 2006, 20077, 2009, 2010b, 2012)



Parking in Activity Centres and Corridors

In the 2000s the City began extending the parking policies developed downtown to the rest of the city. With a new focus in the Calgary Transportation Plan and Municipal Development Plan to encourage the use of alternative modes and reduce auto dependency, "continuing these strategies and expanding them to other key locations [...] will continue to shift the focus from providing an abundance of free parking to a more managed approach" (City of Calgary, 2009b, 3-40). Transit was once again the principal factor that enabled this changing approach: "Long-stay parking in Activity Centres and Corridors should be limited where high-quality alternative modes of travel are in place (such as LRT or BRT)" (City of Calgary, 2009b, 3-41).

In addition to its impacts on travel behaviour, parking was not seen as a good use of land within areas targeted for intensification. With land value near LRT stations estimated by planners to be 15-30% higher than comparable parcels, excessive parking would reduce the development potential of these desirable areas (City of Calgary, 2012). Furthermore, although the city sought to intercept commuters that would otherwise complete their trips in personal vehicles through its network of park-and-rides, the ridership potential for the equivalent area would be significantly higher if developed as a TOD; thus, "priority should be given to providing service and facilities that favour access to LRT by feeder bus, walking and cycling" (City of Calgary, 2012, 113). This is a direct contrast to the findings in the literature review, which has a more limited view of TOD ridership potential as a substitute for park-and-ride. However, the land use intensity envisioned in activity centres in Calgary – 150-200 people and jobs per hectare – does exceed the minimum density threshold that Duncan (2010) identified to offset park-and-ride ridership losses.

Many plans during this era have also called for a formal review of suburban parking policy, especially for park-and-ride. While no review has been conducted as of this writing, the City has moved to implement parking reduction strategies through its Land Use Bylaw. The broadest reduction strategy

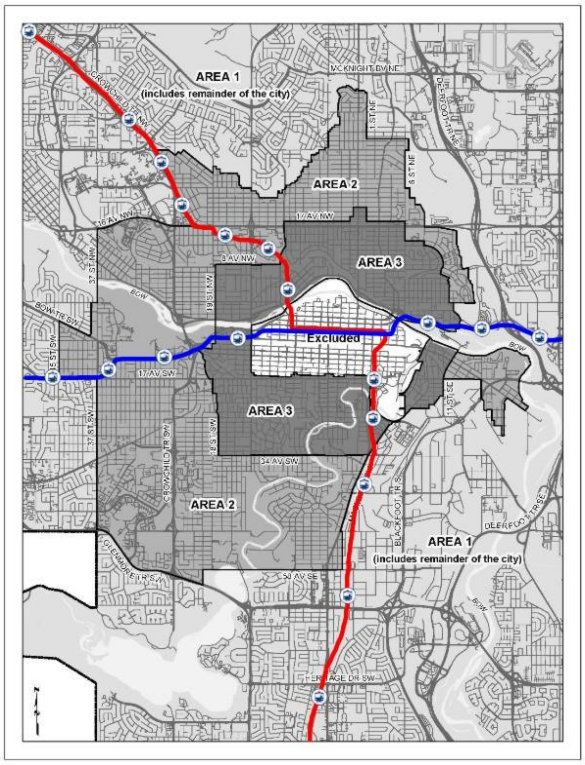
was in permitting most residential and commercial development to reduce minimum parking requirements based on proximity to frequent transit service. Most commercial land use districts allow a reduction in parking requirements of 10% if a parcel is within 400m of an existing or approved LRT station, or 5% if located within 150m of a street with frequent bus service[5] (City of Calgary, 2007a). Another form of reducing parking requirements for commercial uses is sharing parking among commercial retail uses or through mixing them with office and residential uses within a site. Shopping centres which included the "most common commercial uses" are eligible for reductions based on shared parking (Medeiros, 2011, 7). Many districts also allowed minor reductions to parking requirements if dwelling units or office uses existed over ground floor commercial (City of Calgary, 2007a).

However the City did not enact commercial parking maximums outside of downtown. The Land Use Bylaw only addressed excessive parking by requiring it to be structured or placed underground. The amount of parking required to be considered as excessive was considerable: in the C-COR1 district this threshold for commercial and office uses was more than 6 stalls per $100m^2$, up to six times the base requirement in the district (City of Calgary, 2007a, §791-792).

For residential uses, proximity to downtown was used as a basis for permitting reductions (**Map 24**), reflecting the higher quality transit service that generally exists in these areas. Multi-residential developments in Areas 1 or 2 received a 10% reduction in parking requirements within 600m of an LRT station rather than the 400m used for commercial developments (City of Calgary, 2007a, §560). Parking maxima for multi-residential uses were also instituted in these areas, another new policy within Calgary's Land Use Bylaw (Medeiros, 2011). Residential developments with 3 or more units within 600m of an LRT station were permitted a maximum of 1.5 parking stalls per unit in Area 1, and further reduced to 1.25 per unit in Area 2 (City of Calgary, 2007a, §561). Of all suburban parking policy implemented to

[5] Frequent bus service was defined as operating with 20 minute headways between 06:30-18:00 on weekdays, and 30 minute headways for all other periods.

date, these maxima most closely reflect actual behaviour in TODs: several sources in the literature review have identified parking demand in TODs at no greater than 1.2 vehicles per unit.



Map 24 - Residential Parking Areas (City of Calgary, 2007a, 373)

Park-and-Ride

The City's policy for park-and-ride had remained relatively unchanged since the LRT system was first built, and a certain degree of support for maintaining this function remains. As LRT extensions were completed and new BRT routes were put into service, the number of park-and-ride stalls in the system more than doubled during this era to 14,400 stalls at LRT stations and a further 3,000 stalls on the BRT network (City of Calgary, 2012). The utilization of these facilities remains high: 10% of daily transit ridership accesses the system through park-and-ride (City of Calgary, 2012). As this includes ridership on bus routes not served by park-and-ride, a higher proportion of riders boarding LRT and BRT routes from park-and-ride are likely.

However, changing views with respect to transportation objectives and the intensification of activity centres suggests the City is reconsidering how this service should be provided in the future. The role of park-and-ride in intercepting vehicle commuters to mitigate inner city congestion remained for strategic locations, but is not as desirable in areas where growing transit ridership and intensification are a priority: "excessive parking detracts from the goal of maintaining an effective feeder bus service and may limit opportunities for TOD" (City of Calgary, 2009b, 3-40).

While no formal study into park-and-ride policy has been initiated, early signs indicate that the City will pursue a reduction strategy based on distance from the CBD. Planning staff for RouteAhead recommended that a significant reduction in park-and-ride supply be made within established communities (within approximately 10 kilometres of downtown), while higher numbers of stalls should be provided "in outer suburban areas where bus service is limited due to the cost of delivering service" (City of Calgary, 2012, 54). Such a policy seems especially appropriate as new LRT extensions have changed parking demand such that former terminal stations now have excess parking capacity, making these stations suitable candidates for future TODs (City of Calgary, 2012).

One policy change that the city did actively pursue during this era was to implement a parking charge at all park-and-rides. This decision was made to defray maintenance and security costs. The results of this program revealed that extensive parking supply may not be necessary to generate ridership (Calgary Transit, 2011). The initial pricing program implemented in March 2009 was a $3 daily flat fee for all long-term parkers.[6] The immediate effect was that lot usage dropped almost by half, from being over capacity prior to the program, to 56% in September 2009. One year later parking demand returned to 65%. More importantly, feeder bus ridership increased by 22% after the introduction of the parking fee, almost entirely offsetting lost park-and-riders, while LRT ridership at the downtown cordon remained unchanged.

[6] A small portion of short stay stalls remained that allowed users to park up to 4 hours for free.

Public reception of these changes was mixed. A survey in September 2010 found "that 41% of Calgarians support charging for LRT parking," and "most of the remainder feel that parking costs should be supported by either tax payers (23%) or transit fares (23%)" (Calgary Transit, 2011, 10). Nonetheless, increasing public opposition to the charging program caused the flat daily fee to be replaced in April 2011 with a reserved stall program which encompassed only a portion of spaces, charging $70 per month.

While the new reserved parking program is highly subscribed, the majority of parking spaces at LRT stations and BRT stops are once again free. The program had significant net benefits to transit operations and travel behaviour, but public opposition was sufficiently strong to reverse it. Nevertheless, it has provided invaluable real-world experience for planners seeking to implement parking management policies in suburban Calgary: "Charging for parking has proven to be a useful tool for balancing the demand for parking since it places a value on this added level of service and has proven to influence a shift to other modes of access" (Calgary Transit, 2011, 15).

Summary

This era demonstrated a major evolution in planning policy in Calgary. Several lessons which had been learned and proven in downtown were now starting to be extended elsewhere in the city. While some of these policies are still nascent in their application, and others still fall short of an appropriate level of control to meaningfully impact travel behaviour, they still represent a substantive step forward in a city that only twenty years ago was still thoroughly committed to the automobile for suburban mobility.

New bylaws reflected the value of transit by reducing minimum parking requirements, a far cry from what consultants had advised in 1978. To avoid over-providing parking in transit priority areas, planners also instituted parking maxima for residential uses; however, commercial and office uses have yet to include such restrictions outside of the Downtown Parking Area. This will be a major concern as new office development occurs in suburban office nodes like Quarry Park, where despite being identified

as an activity centre to be intensified, future PTN service, and improved site design, the area is becoming characterized by large surface lots.

This era also saw planners increasingly question the appropriateness of park-and-ride facilities. These lots, which had been crucial parking substitutes for downtown restrictions, are now beginning to be viewed as impediments to TOD. Even their function as interceptors of vehicle trips is increasingly suspect as commuters showed a willingness to use feeder buses when parking charges were introduced. Without any formal plans or planning review for suburban parking, it is difficult to hypothesize how this evolution will continue. But, the rhetoric utilized in current plans indicates that parking control may form a larger part of future policy planning in TOD areas:

> "The availability of parking is an important factor in what modes of transportation choose to use. Traditionally, cities have required ample amounts of parking to alleviate parking congestion. However, an abundance of free parking encourages vehicle use, consumes useful land and is expensive to construct and maintain. Solving this problem by providing additional parking further increases parking demand, perpetuating the cycle" (City of Calgary, 2009b, 3-40).

4.45 Summary

The 2000s were transformational period in Calgary, both in market dynamics and in the evolution of planning philosophy. Significant policy changes were made in each of the major themes discussed in this thesis, and progress has been made towards realizing them through implementation strategies. Downtown continues to be the economic heart of the city, but several trends are transforming its role in the city and its transportation network. Outside of downtown, the City has made intensification of the existing area of the city a high priority. With increasing demand for multi-residential housing and suburban office space, land use policy is focused on managing this growth and directing it to key nodes to be served by higher order transit service. Finally, parking policies which contributed heavily to centralizing employment and transit trips in downtown are undergoing their own transition. Much like

transit service, planners are beginning to extend parking control out of downtown in order to influence travel behaviour throughout the city.

Downtown remains the largest activity centre in Calgary. Yet its resurgent employment growth has created severe challenges towards maintaining this growth. Congestion, especially on transit lines, is a growing concern. Reaching the 50% transit mode share target more than a decade ahead of projections is rightfully a success for planners, but the rapid increase in ridership has also meant that transit improvements are being needed sooner than was expected. Similarly, the boom generated major development activity that saw the skyline soar ever higher, but has been accompanied by expensive rents and parking prices. The result is that the costs of being downtown have eroded its competitive advantage. Firms that once looked unfavourably on suburban office space are now moving there.

The City's desire to decentralize employment had nominally existed for decades. Plans approved in this era had finally created a framework for this transition while supporting efficient use of transportation infrastructure. The Centre City Plan has called for a greater residential presence in downtown, to support a more diverse, dynamic and multi-modal core. The 2009 Calgary Transportation Plan and Municipal Development Plan crafted a network of Activity Centres and Corridors into which employment and residential growth will be directed.

Transit planning in this era evolved from a radial network designed to carry suburban commuters to downtown to a more comprehensive mobility solution. Key to this transformation is the greater value that has been placed on the ability of transit investments to shape land use patterns, rather than respond to them. This is demonstrated particularly through projects like the West LRT, Primary Transit Network (PTN), and North Central LRT. The West LRT, while carrying workers into downtown office towers, was designed to maximize the development potential at strategic points, most notably at Westbrook Mall. The PTN aims to extend this concept by connecting major activity centres in a grid of frequent, high capacity service. The implementation of the PTN will also be an important indicator of the level of commitment

the City has for this new vision for transit, especially as it is planned to be completed ahead of the development it is meant to support. Similarly, the decisions to be made for the North Central LRT will demonstrate if the accessibility benefits of transit investments will be used to support suburban expansion or inner city intensification.

Elements of the City's downtown parking policy, long seen as a major factor in increasing transit ridership, are also being extended into the suburbs to support land use and transportation objectives. Parking requirements for new developments have been reduced, especially in proximity to high quality transit service. The City is also showing signs that its current park-and-ride policy could be an obstacle to intensification and encouraging transit use. Rather than a homogenous policy of accommodating a prescribed share of riders, it appears planners have moved to a more dichotomous approach to these facilities: remaining a desirable policy goal in outer suburbs where good transit service is unavailable, but limiting or reducing its provision in areas where transit and redevelopment are priorities.

As planning philosophy continues to evolve in Calgary, it is important to examine the outcomes it has generated on a local planning level. The next chapter contrasts how these trends manifested themselves in LRT station area planning.

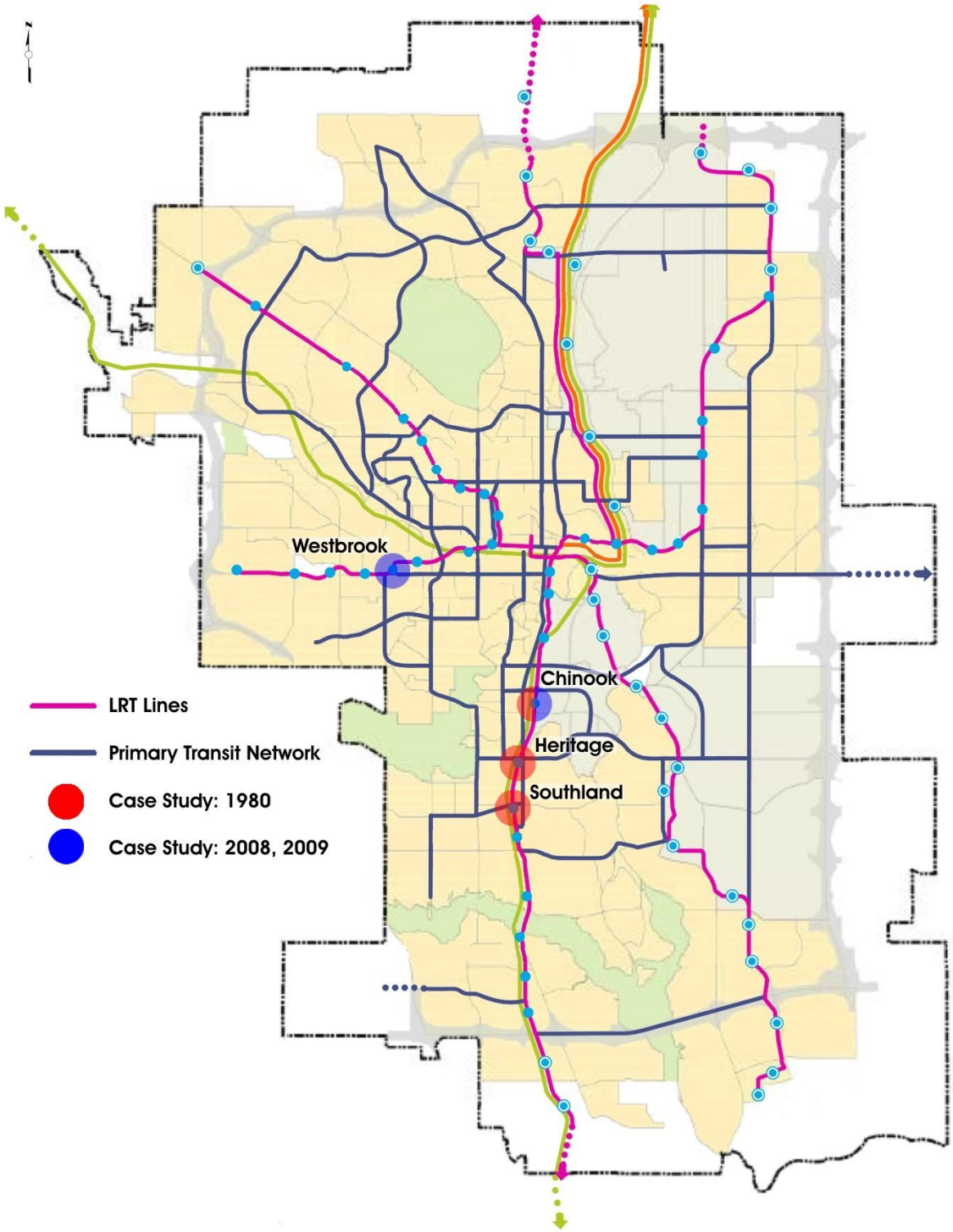
Chapter 5: Case Study: Implementing TOD in Calgary

This chapter compares how City staff implemented the planning philosophies of two eras, focusing on station area plans and zoning at four LRT stations (**Map 25**). There are two principal reasons for examining local area plans such as these: as the accessibility benefit of rail transit is concentrated near the station, development outcomes in these areas more clearly demonstrate the value of this benefit; and, local area plans and zoning contain the highest degree of detail and specificity of a city's policies for a given area and are therefore the most immediate concerns to be satisfied by prospective developers.

The two eras examined in this chapter correspond to Calgary's first and second generation of LRT (and the sections of the same name in Chapter 3). When the South LRT opened in 1981, Station Area Plans (SAPs) were in adopted for each of its 7 stations. Of these, three were selected for inclusion in this case study: Chinook, Southland, and Heritage stations. These were envisioned as the most significantly intensified stations by the South LRT Corridor Land Use Study, yet all had outcomes which fell short of this goal. Examining these outcomes demonstrates how planning objectives interacted with market forces, and the significant impact of Council decision making. Each station reflected a different aspect of these relationships: Chinook, which had the highest development potential but where intensification did not occur; Southland, where market interest existed prior to the LRT but was not subsequently leveraged after its opening; and, Heritage, where city owned property near the station was allowed to be developed in an auto-oriented form.

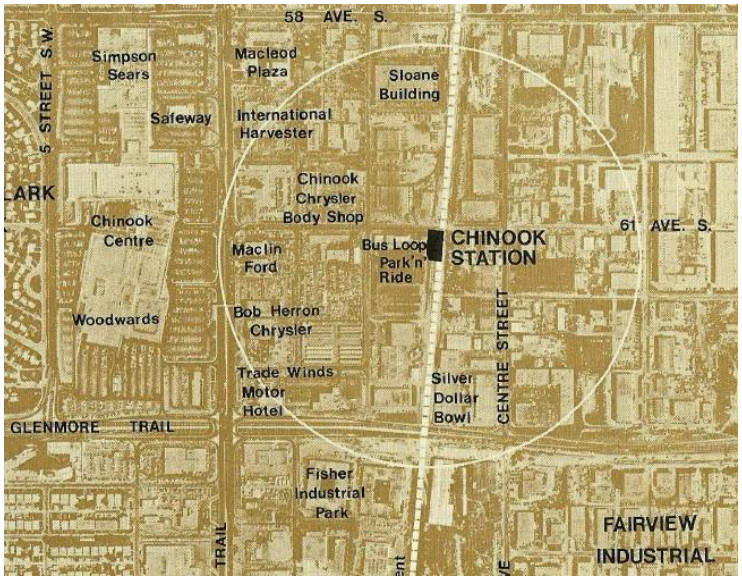
The modern philosophy to station area planning is exemplified by two stations. The first, Westbrook, is on the new West LRT line and demonstrates how conducting land use studies prior to construction improved development opportunities at the station. The second example returns to Chinook to contrast how the City's TOD policies have changed within the same station context. More broadly, both of these stations also that the level of active involvement by the City in facilitating change in these areas has increased significantly, including clearer expectations of development proposals and proactive zoning changes.

Map 25 – TOD Case Studies
(Map Adapted from: City of Calgary Land Use Planning & Policy, 2012, 66)



5.1 Transit-Oriented Development – 1980 – South LRT

The area surrounding the Chinook LRT Station had been a centre of commercial activity in Calgary since 1960 with the opening of Chinook Shopping Centre at the intersection of Macleod Trail and Glenmore Trail. By 1985, the Centre contained 250 stores, with 3,000 employees (Zurowski, 2009). While some office uses exist in the vicinity, the station area was mostly characterized by auto-oriented retail west of the LRT line and light industrial to the east (**Map 26**).



Map 26 - Chinook Station Area (City of Calgary Planning Department, 1980a)

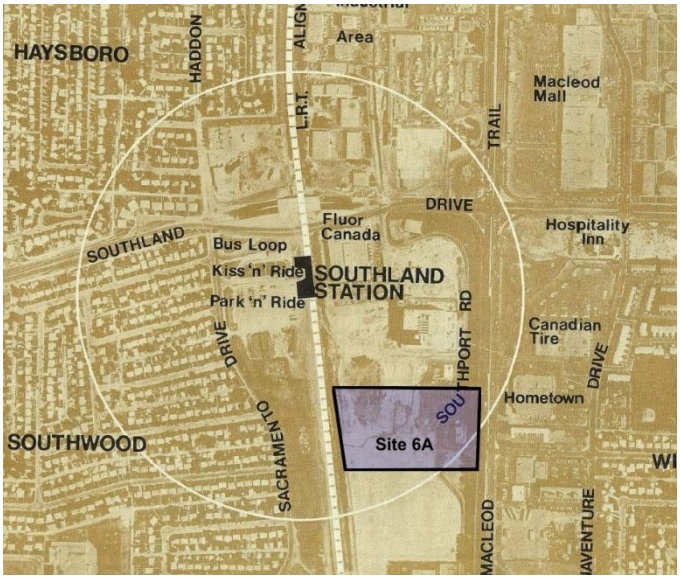
The station area also contained large land parcels for future development. In the market study, Chinook Station was identified "as the only location with the highest potential for a true large-scale mixed use development outside the Core" (Urbanics Consultants, 1979). The Chinook Station Area Plan envisioned a substantive residential component, primarily along 61st Avenue S west of the station area, with intensive office and other employment throughout (City of Calgary Planning Department, 1980a). Much of the industrial character east of the LRT line would be maintained.

There was some nascent market demand for intensification at Chinook. A large mixed use development had been approved in 1978 on Silver Dollar Bowl site, but it became a victim of the recession. However, there were several significant missed opportunities. The clearest example is found in

the lands labelled Maclin Ford, Bob Herron Chrysler and the Trade Winds Motor Hotel in **Map 26**. The Chinook Station Area Plan had called for medium to high density employment with residential bonusing (City of Calgary Planning Department, 1980a). When the site was eventually redeveloped in the mid-1990s, Council permitted a 'big box' format with three large format retailers with considerable parking supply. The zoning history of these parcels is also illuminative. In 1988 a DC zoning application was approved (DC 11Z88) permitting up to 40,000m^2 of gross floor area, including 7,600m^2 of office space. When a new DC application was submitted in 1994 to allow the construction of the retail centre (DC 19Z94), the maximum density was reduced to 24,800m^2 of gross floor area devoted entirely to retail. This was a far cry from the anticipation "that the Chinook Station Area will emerge as the prime site for future development activities, particularly for mixed use projects" (City of Calgary Planning Department, 1981, 85).

Southland Station differed from Chinook in that intensification had already occurred within the station area (**Map 27**). Two large office projects were already built by 1980 east of the LRT line, and the station area included almost 44,000 m^2 of commercial space when the South LRT opened (City of Calgary Planning Department, 1981). Furthermore, Council had also recently approved new zoning north-east of the station to permit a high density development including retail and two apartment towers (City of Calgary Planning Department, 1980b).

Given the existing development trends favouring further intensification, the station area showed great promise in fulfilling the land use goals planners expected. The second phase of Southport Business Park proceeded on schedule, and a third phase was eventually added in the 2000s. The proposed mixed use development northeast of the station was also completed in the 1980s.



Map 27 – Southland Station Area (Adapted from City of Calgary Planning Department, 1980b)

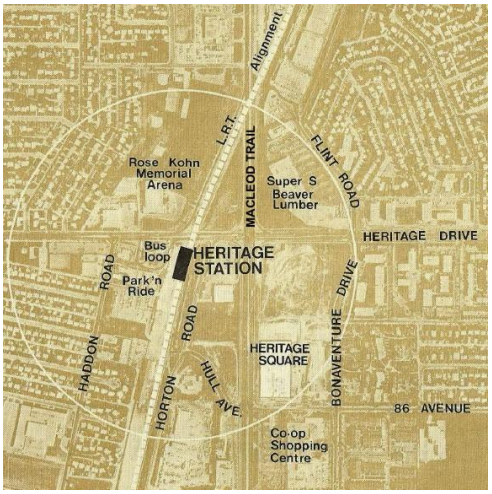
Despite these successes, not all development potential was realized. One example is Site 6A (**Map 27**), intended as high density commercial with a maximum Floor-Area-Ratio of 2.8, and a residential bonusing provision that could see this expanded to FAR 3.5 (City of Calgary Planning Department, 1980b). To reflect this, City Council approved a zoning amendment in 1976 that inserted the provision that "prior to the release of any Development Permit, the developer submit plans to the Calgary Planning Commission demonstrating how future Rapid Transit-oriented uses can be integrated into the development" (City of Calgary Development & Building Approvals, 1976). Once again the opportunity was not realized, and in 1989 the site was developed to accommodate a big box grocery store with half of the site dedicated to parking at grade.

In both Southland and Chinook Stations, the planning objectives in Station Area Plans were subverted by Council decisions to permit developments that were not consistent with the plans or even zoning amendments. A partial explanation for this outcome is that the Station Area Plans were not considered statutory and left considerable discretion to Council decisions. Had these plans carried greater legal force it would have been more difficult to make these decisions. However the more likely reason that such development was permitted was the economic environment in the City. The recession had ended

but was replaced by stagnation. Council made a seemingly pragmatic choice that any development was better than no development. Of course, this ensured that when the market for development recovered in the late 1990s, significant portions prime land near these stations had been recently developed to incompatible uses and were unlikely to be made available within a reasonable time frame.

Even in the case of city-owned land, Council continued to permit development below its highest-potential use. At Heritage Station, located between Chinook and Southland stations, the city owned a large parcel favourably situated on the southeast corner of Macleod Trail and Heritage Drive (**Map 28**). Planners recommended a mixed use development "with a major residential component in combination with commercial office uses," while recognizing "the potential for integration with the Police District C Office to be located on the southwest corner of Bonaventure Drive and Heritage Drive" (City of Calgary Planning Department, 1980c). Instead, in 1986 Council permitted the construction of Heritage Plaza, a strip mall development entirely independent from the Police Station.

Map 28 - Heritage Station Area
(City of Calgary Planning Department, 1980c)



Despite the ambitious land use aims in the South LRT corridor, little development occurred during this era that was supportive of this goal. A monitoring study in 1984 concluded that LRT had stimulated development in station areas, noting that 40 rezoning applications had been made since 1979 in the corridor (City of Calgary Planning & Building Department, 1984). However, of the development proposals that were built, many were decidedly auto-oriented or far enough from the station that this causality should be questioned.

Development pressure to intensify did exist in the Macleod Trail corridor, but as this pressure dissipated with the onset of the recession of the 1980s, City Council demonstrated a willingness to accept more subpar development proposals. These low density proposals removed several highly desirable parcels of land from potential development when market conditions improved. When new development did proceed in all three station areas examined here, it took place on the periphery of the station area, while core areas continued to reflect Council decisions of the 1980s. The unfortunate conclusion to be drawn is that "in most cases, developed land uses are very long term, therefore, the cumulative impact of incremental, poor land use decisions is significant" (Hubbell & Colquhuon, 2006, 12).

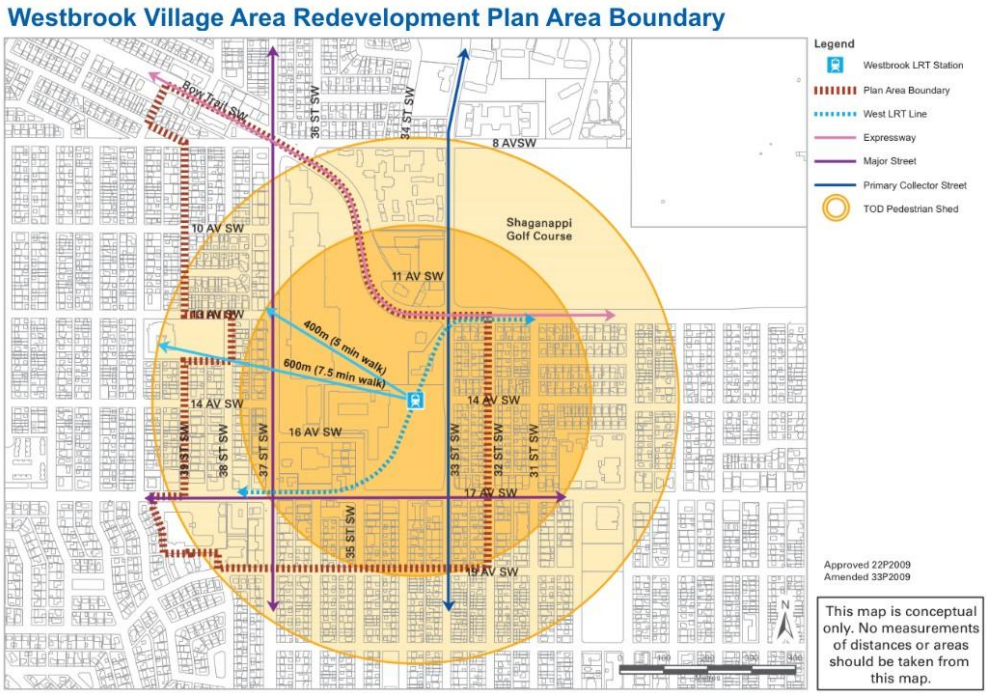
5.2 Transit-Oriented Development – 2009 – Westbrook Station

With a new land use policy focus on intensification in existing areas, the City identified the need for updated station area plans to implement these policies on a local scale. Acknowledging that efforts should be focused on areas that had generated market demand and could yield the greatest development potential, from 2008 to 2011 plans were prepared for 10 LRT stations (City of Calgary Land Use Planning & Policy, 2012). Westbrook Station was seen by planners as the most promising intensification opportunity on the new West LRT.

Westbrook was seen as a highly desirable site for intensification not only for its location and connectivity to other centres but its site characteristics. It was already a major transit hub in west Calgary, with a service catchment population of 36,000 residents, and offered direct transit connections to downtown, the University of Calgary, and Mount Royal University, as well as the potential to attract reverse peak flow from intensifying inner city neighbourhoods such as Garrison Woods (City of Calgary Land Use Planning & Policy, 2009b). By implementing land use policies favouring intensification, the population of the catchment area is expected to increase to 48,000 residents by 2033. Furthermore, increasing employment and commercial activity in the station area, along with moderate intensification at other stations along the line, could increase ridership on the West LRT by 15-38%: "a conservative estimate suggests that an additional 5,000 to 7,000 daily trips on West LRT could be achieved beyond the

ridership estimates [...] as a result of TOD" (Calgary Transit & Clifton ND Lea, 2006, 3). Most of these riders would use Westbrook LRT station: the initial projected daily ridership of 12,000 was expected to increase to 27,000 by 2033 (City of Calgary Land Use Planning & Policy, 2009b).

Map 29 - (City of Calgary Land Use Planning & Policy, 2009b, 6)



Concurrent with the broader West LRT Land Use Study, planning staff prepared the Westbrook Village Area Redevelopment Plan (ARP), enacted three years before the LRT line opened (City of Calgary Land Use Planning & Policy, 2009b). This created "an opportunity to ensure that the design of the line and the station are fully integrated with an appropriate land use and urban design plan for the Plan area as a whole" (City of Calgary Land Use Planning & Policy, 2009b, 5). Approved by Council on June 1, 2009, the Westbrook Village Area Redevelopment Plan's purpose is to "to provide a detailed policy framework for implementation of TOD objectives specific to the Westbrook Village Plan area. A long term vision for the future of Westbrook Village is set out in this Plan but also, more importantly, various implementation actions that will be instrumental in realizing the vision are identified" (City of Calgary Land Use Planning & Policy, 2009b, 3).

The timing of the ARP was prescient. Market interest for multi-residential housing, and high street retail models had begun to increase in the city. Demand also increased for "significant office development in strategic locations outside Downtown that are well served by transit" (City of Calgary Land Use Planning & Policy, 2009b, 11). Westbrook itself was already experiencing development pressure: a 550 unit condominium project had recently begun construction immediately north of the mall, within 400m of the eventual station location.

The site itself also offers several advantages, and challenges, in facilitating redevelopment. Encompassing ~21 hectares and with few but large land parcels, occupied by an aging Westbrook Mall and two schools owned by the Calgary Board of Education. This was seen as an asset to attracting further market interest: the large land parcels mitigated land assembly issues and "facilitate comprehensive planning and investment strategies" (City of Calgary Land Use Planning & Policy, 2009b, 11).

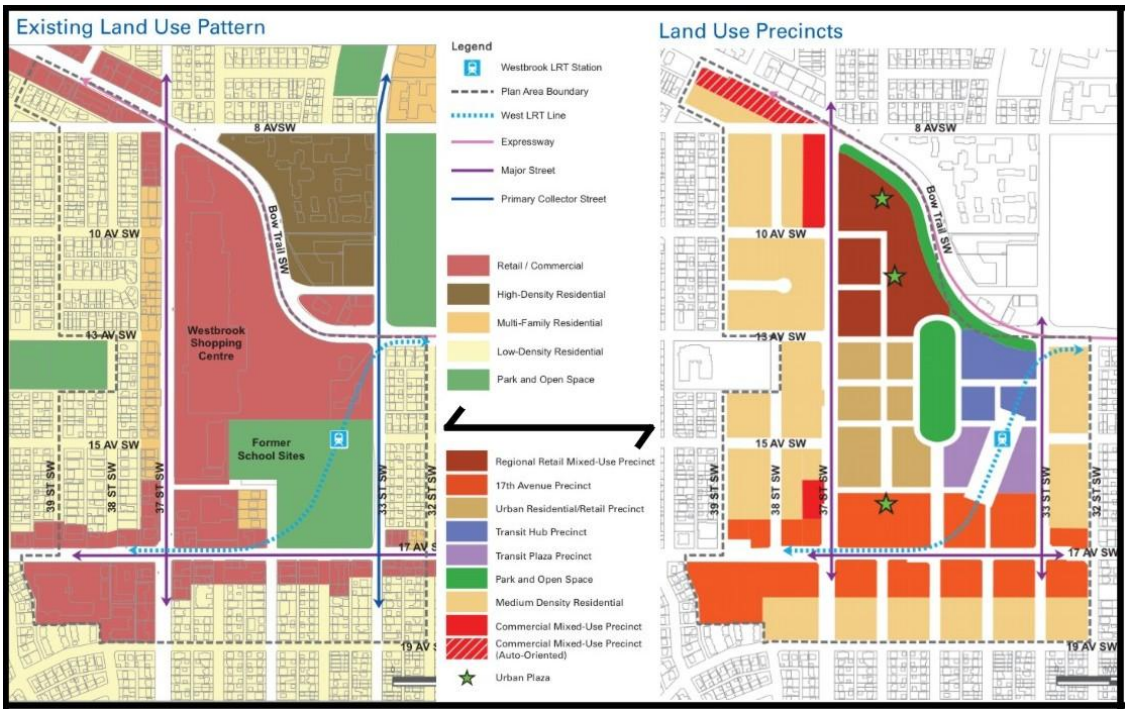
Importantly, the decision to construct the station and line underground at Westbrook resulted in the school sites being purchased by the City. As only a portion of these sites were required for the line and station, there would be 3.6 hectares of surplus land. The City decided to divide this land into 4 new parcels to be sold for Transit-Oriented Development (City of Calgary Office of Land Servicing & Housing, 2012). This is a significant departure from past practice, where the City avoided getting directly involved in the land market in station areas, most notably demurring on the purchase of land in Shawnessy Centre in the 1990s (Hubbell & Colquhuon, 2006). That the City was willing in this case to assemble and hold land for development is an encouraging sign. However, as of this writing the process has only proceeded to a request for proposals. The outcome of this purchase bears monitoring: will the City ensure that transit-supportive development occurs, or will it follow the example of Heritage Station discussed above.

While the site offers many advantages, the study area also has several challenges that needed to be addressed. The large land parcels exist because they support large single-use and low-density

development which include large amounts of surface parking. Auto-oriented uses and built form predominate, with a sparse internal circulatory system of roadways or sidewalks. Quite simply: “the current land use and development pattern within the Plan area boundary is not consistent with TOD aspirations” (City of Calgary Land Use Planning & Policy, 2009b, 9).

To address this, the plan called for the introduction of internal roadways as new development supplanted current uses. Having this proposed network in place would also allow incremental development to occur on the mall parking lot and pad sites before the mall building itself would be repurposed or torn down. The plan also divided the area into land use precincts which direct new development into appropriate areas, and also support Westbrook’s role as a major retail area (**Map 30**). Through these land use precincts, the Westbrook Village ARP also provide more detailed development guidelines regarding desirable land use, density and heights, and mobility.

Map 30 - Existing Land Use and Proposed Land Use Precincts - Westbrook Station
(City of Calgary Land Use Planning & Policy, 2009b, 7, 22)



Land Use: New auto-oriented uses would not be allowed, while stand alone retail and commercial should be discouraged. Development should include a mix of uses horizontally and/or vertically, while residential projects should provide a variety of housing types. Buildings should contain small scale retail uses at grade whose use area should not exceed 1,900m^2, except for supermarkets and pharmacies. Uses at grade which do not generate significant pedestrian volumes would be restricted to a frontage no greater than 12m. In the regional retail precinct, large scale retail as a component of new development would be permitted. This was to support the major retail function of the area and to facilitate redevelopment of the mall, but should be combined with other uses "and incorporated into an urban format building" (City of Calgary Land Use Planning & Policy, 2009b, 29).

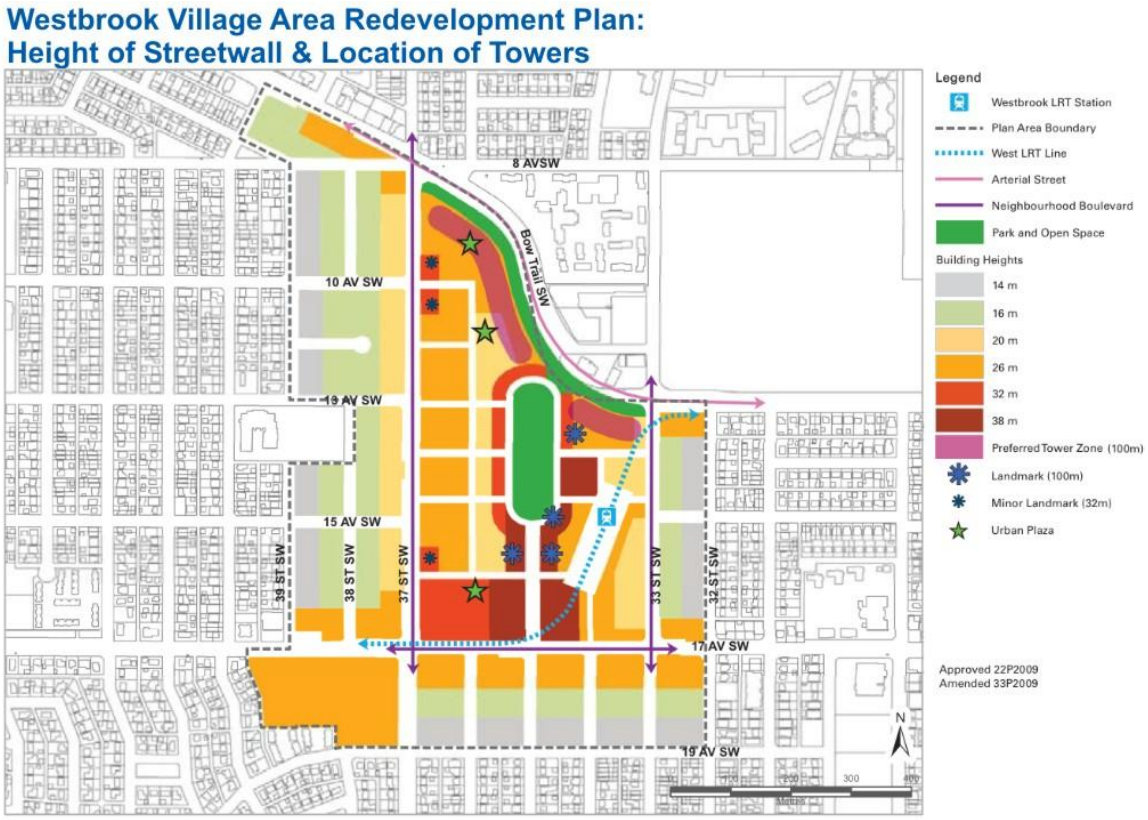
Density & Heights: Density should be focused around the station area proper, tapering downward with distance to integrate into the surrounding communities. Minimum as well as maximum densities are provided for each precinct "in order to ensure that new development will contribute sufficient activity to the area and to ensure that the building mass will be large enough to contribute to an appropriate streetwall" (City of Calgary Land Use Planning & Policy, 2009b, 33). A density bonus system was implemented to encourage provision of desirable public amenities. Building heights will be highest near the station proper and in a 'preferred tower zone' along the northern border of the site. Several sites would permit building heights up to 100m; however most would be restricted to 38m or less, decreasing towards established communities (**Map 31**).

Mobility: "One of the main attractions of the TOD model is the ability to move freely and accomplish everyday tasks without a car. To enable a variety of travel modes, particularly walking and bicycling, the transportation network must ensure these modes are convenient, safe, efficient and pleasant" (City of Calgary Land Use Planning & Policy, 2009b, 59). Development should contribute to this by providing high quality pedestrian and cycling facilities at grade; "grade separated facilities are strongly discouraged as they dilute the potential pedestrian vitality of the area" (City of Calgary Land Use Planning & Policy, 2009b, 59).

While the personal vehicle should still be accommodated for occasional trips, the plan should not over-provide parking as this will "only promote further use of the automobile, diluting the intent of creating a walkable, transit-oriented area" (City of Calgary Land Use Planning & Policy, 2009b, 65). Where parking is provided, it should be located to the rear of the site and accessible via lanes or side streets. Parking between a building and the street will not be permitted.

Reductions in parking requirements should be pursued, through provision of proven Transportation Demand Management policies at the prerogative of the developer. "Parking requirements may be substantially reduced, subject to City approval, by provision of shared parking facilities that serve multiple uses with peak parking demands at different times of the day" (City of Calgary Land Use Planning & Policy, 2009b, 65).

Map 31 - (City of Calgary Land Use Planning & Policy, 2009b, 34)

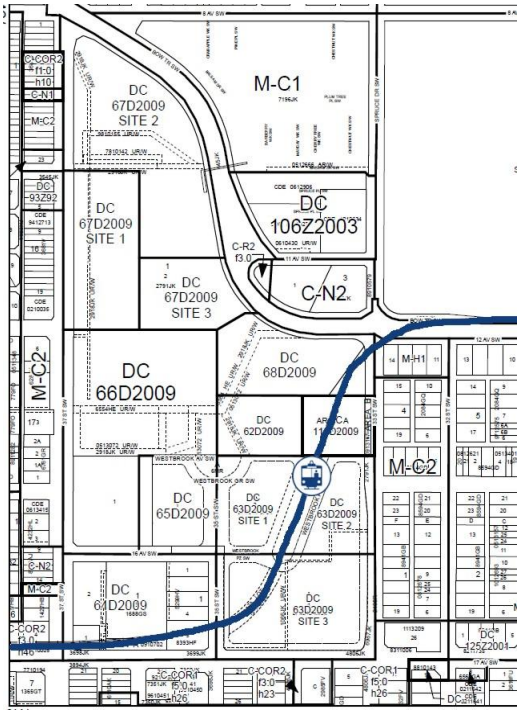


The Westbrook Village ARP also considered was steps the City should take in encouraging development. Infrastructure investment in the area was already considerable. Transportation upgrades in addition to the LRT included bike storage lockers and sheltered passenger waiting areas, and upgraded streetscapes along 17th Avenue S and 37th Street W. The City also contributed more directly to development in the area by construction an office building on the north station head. The building contains 10,000m^2 of gross floor area and will be the new office for Calgary Transit's administration, but also include retail shops and community spaces.

The City also sought to encourage intensification by implementing development levies and a density bonus program to fund future public realm improvements and infrastructure. New internal streets and public spaces would be provided either directly as part of development permit applications or through a development levy for the study area. Density bonuses are offered for publicly available open spaces, affordable housing, or contributing to a Community Investment Fund dedicated to improvements such as acquiring land for public parks and streetscape improvements.

The language of the ARP reflects a much clearer communication of development guidelines than the Station Area Plans approved in the 1980s. Furthermore, the City also did more to establish its role in infrastructure improvements that were necessary in the station area. The Plan banned certain auto-oriented uses outright, and mandated several conditions that were required of proposed developments. More importantly, the City implemented the policies of the ARP directly through rezoning. When the Plan was adopted as bylaw on June 1, 2009, administration also prepared a series of Direct

Map 32 - Westbrook Station Zoning 2009 (City of Calgary, 2013b)



Control (DC) redesignations which were adopted by the end of that month (**Map 32**).

The new Direct Control (DC) districts mandated the inclusion of nearly all land use objectives contained within the ARP. Each district included both the minimum and maximum densities permissible, with no district allowing a Floor Area Ratio (FAR) below 2.0. Auto-oriented uses were removed from the list of allowable uses, though some districts retained them as discretionary uses. Districts 63D2009, 64D2009, and 68D2009 all restricted at-grade use areas to 1,900m^2, except for supermarkets and pharmacies which were permitted up to 5,500m^2. One significant new inclusion in these new districts not discussed in the Westbrook Village ARP was the reduction of parking requirements based on proximity to Westbrook LRT Station. All districts except for 66D2009 and 67D2009 reduced parking requirements by 10% where a portion of the parcel lay within 400m of the LRT station.

Summary

Planning for the West LRT, and Westbrook Station in particular, contained a greater level of detail for how redevelopment should proceed than LRT plans in the 1980s. The City was willing to ask, and require, more from development proposals by implementing appropriate zoning designations. It also shared some of the risk in improving the area: it purchased land, built the City's first underground LRT station, and made further improvements through landscaping and upgrading pedestrian facilities. The underground design also ensured that the land which benefitted most from accessibility to transit remained available for development, unlike the expressway medians on the Northwest and Northeast LRT lines. The first signs of success may be just around the corner: the City is currently in the process of marketing its surplus holdings in the station area, with all three parcels to be available for development by the end of 2013 (City of Calgary Office of Land Servicing & Housing, 2012).

5.3 Transit-Oriented Development – 2008 – Chinook Station

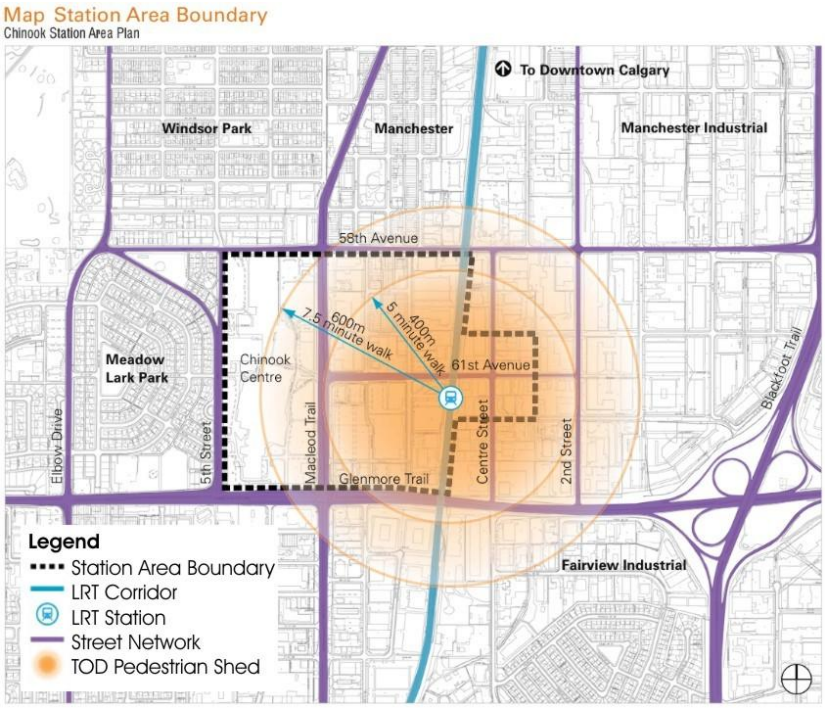
The example offered at Westbrook Station illustrates the implementation of TOD policy in conjunction with planning for rail infrastructure. By contrast, Chinook Station shows how the City undertook TOD planning where LRT already existed, but more importantly a direct comparison of how planning had evolved in Calgary since the original 1980 Chinook Station Area Plan. Westbrook and Chinook LRT Stations also serve as suitable contrasts to each other due to similar characteristics and functions within their respective regions. They are primarily retail-oriented commercial areas anchored by malls. Both are also primary transit hubs for feeder buses serving large catchment areas and are well served by transit connections to other major destinations. While the station areas are bordered by major roadways, they are not major locations for park-and-ride lots.[7] However, where Westbrook's mall is an aging facility with a sub-regional focus, Chinook Centre is one of Calgary's premiere shopping destinations. As many of the land use objectives, including minimum densities, design of and reduction in parking requirements, and control of use size at grade, are similar to those discussed at Westbrook, this section focuses on unique aspects of the Chinook TOD planning area.

The Chinook LRT Station area "has attracted significant development interest, providing the opportunity to test TOD policies and principles on a neighbourhood scale and flagging the need to update existing policy for the area" (City of Calgary Land Use Planning & Policy, 2008c, 5). However, interest that had translated into built projects in the previous three decades was decidedly un-supportive of TOD. Nevertheless, staff felt that "the context for growth and redevelopment has changed significantly since 1981 – creating the market conditions that will allow the transformation of Chinook Station Area into one similar to that imagined in 1981 but with some important modifications" (City of Calgary Land Use Planning & Policy, 2008c, 5). To facilitate this change staff prepared the Chinook Station Area Plan (SAP), approved by Council in June 2008 (City of Calgary Land Use Planning & Policy, 2008c).

[7] Westbrook LRT Station has no park-and-ride spaces, while Chinook has 320.

Like Westbrook LRT Station, staff felt that Chinook was a highly desirable site for TOD: it was centrally located, had a major trip generating land use nearby, and had several large land parcels which were sparsely developed. With an area of 67 hectares, one third occupied by the shopping centre, the station has a large land base for potential redevelopment. Chinook is also a significant concentration of employment in the city: over 17,700 jobs are located within 800m of the LRT station (8,800/km^2), 7,000 of which are within the station area boundary (**Map 33**).

Map 33 – Chinook Station Area Plan: Area Boundary
(City of Calgary Land Use Planning & Policy, 2008c, 6)



With more than 15,000 daily boardings at the LRT station in 2006, Chinook is also the most heavily used station on the South LRT line. Bus routes provided feeder services but also direct connections to Mount Royal University and peak period service to the emerging employment node at Quarry Park. An existing street grid pattern also means fewer new roadways would be necessary to complete a finely grained transportation network supportive of pedestrian activity. Finally, pedestrian volumes were already high on 61st Avenue S (connecting the station to the mall), offering a central axis onto which station area development could focus.

There were also some significant challenges for planners in the Chinook area. Much of the station area is characterized by large single use buildings, poorly oriented to the street and containing large amounts of surface parking. There are also concerns about connectivity within the station area. Macleod Trail is a heavily used arterial street which divides the planning area and has a prohibitive pedestrian environment. One significant obstacle stemmed directly from planning decisions in the 1990s; almost all of the streets necessary to complete the grid-network and support future development are located on the parcel south of 61st Avenue where new large format retail development had been permitted. Lastly, there is no existing residential base within the planning boundary: only 204 residents live within 800m of the station.

The Station Area Boundary itself revealed another challenge that planners faced. The previous 1980 Station Area Plan had encompassed significant portions of land east of the LRT line with the intent of shifting industrial uses into commercial and residential development. By contrast, the 2008 Chinook SAP included a much smaller portion of these lands. The industrial area had been transforming from light industrial into office and retail uses, but in forms not suitable for TOD. As such, planners favoured retaining these lands for labour-intensive light industrial and commercial uses, but with no residential component.

In terms of its future character, the SAP envisioned a primarily office and retail area augmented by residential uses, as Chinook was "one of the prime areas in the city to accommodate a significant number of new jobs" (City of Calgary Land Use Planning & Policy, 2008c, 15). The scale of this development was also significantly higher than what had been planned in the 1980s. The South LRT Land Use Study had called for up to 5,500 new residential units and 170,000m^2 of office and retail space, while a market study concluded that total demand would be one-third of this. The 2008 plan projected fewer residential units (between 1,425-3,650), but office and retail space should expand by 215,000-370,000m^2 (**Table 10**).

Table 10 – Projected Build out at Chinook LRT Station
(City of Calgary Land Use Planning & Policy, 2008c, 75)

Future Projections

TABLE C.1 – BUILDING FLOOR AREA			
	2006 Building Floor Area (sq. m)	Minimum Build-out Building Floor Area (sq. m)	Maximum Build-out Building Floor Area (sq. m)
Residential	0	142,500	365,000
Retail	80,000 *	30,000 **	45,000 **
Office	11,695	185,000	325,000
Sub Total	91,695	357,500	735,000
Chinook Centre Mall	138,000	161,000	161,000 ***
Total	**229,695**	**518,500**	**896,000**

TABLE C.2 – POPULATION					
	2006 Population	Projected Population - Minimum Build-out	Projected Dwelling Units - Minimum Build-out	Projected Population - Maximum Build-out	Projected Dwelling Units - Maximum Build-out
Residents	0	2,850	1,425	7,300	3,650
Employees	2,400	8,000	n/a	14,000	n/a
Sub Total	2,400	10,850	1,425	21,300	3,650
Chinook Centre Mall	4,500	4,900	n/a	4,900	n/a
Total	**6,900**	**15,750**	**1,425**	**26,200**	**3,650**

* Existing retail includes automotive and big box uses
** Assumes redevelopment of all existing retail sites
*** Chinook Centre Mall maybe larger but yet to be determined

Planners felt confident that sufficient market demand would exist for commercial uses to meet this projection over the plan horizon, but the demand for residential is less clear. Although a 202 unit multi-residential project had been built in 2005 just north of the station area, it was constructed as low-income housing operated by the City of Calgary and a non-profit organization (City of Calgary Office of Land Servicing & Housing, n.d.). To encourage market residential development within the Chinook station area, the plan required residential components in some districts and relied on zoning incentives to encourage its provision in others. Each site west of the LRT line would have three maximum densities: a commercial-only maximum, a higher density for projects including a residential component, and finally a bonus density for provision of public amenities. A project would only be able to realize its maximum potential density through providing a significant residential component.

By incentivizing residential components as part of a density bonus program, the 2008 SAP provided a more meaningful way of encouraging its inclusion than its predecessor. The 1980 Chinook SAP also acknowledged that station area characteristics may be prohibitive for residential uses, but only

offered the solution that "comprehensive development on large parcels may be necessary to overcome these negative environmental factors" (City of Calgary Planning Department, 1980a).

The mobility goals in the station area also changed from the 1980 SAP. The focal point for designing the transportation network was now placed on pedestrians: "it is essential to the success of this Plan that each street be redesigned and constructed to support an active pedestrian environment" (City of Calgary Land Use Planning & Policy, 2008c, 15). An enhanced streetscape at grade should be provided to encourage use; grade separated pedestrian walkways would not be permitted in new developments to prevent diluting street activity. When combined with the intensity of development being planned, this would undoubtedly create congestion impacts. Although the function of Macleod Trail as a major vehicle thoroughfare is to be maintained, on local streets planners placed "pedestrian and bicycle priorities first, followed by transit. Some limitations of automobile mobility should be considered" (City of Calgary Land Use Planning & Policy, 2008c, 43).

The centrepiece of this pedestrian-oriented network would be 61st Avenue, which connected the LRT station to the mall, and which would be refashioned as the station area's 'Grand Boulevard.' This boulevard is envisioned to be a multi-modal roadway with infrastructure improvements for pedestrians and cyclists. Design elements are to include wider sidewalks, shade trees, curb extensions at intersections to minimize crossing distances, and separated bike lanes. Development fronting onto the street should facilitate a retail 'high street.' At the mall end of the boulevard, a new pedestrian bridge will span over Macleod Trail to minimize conflicts with vehicular traffic and the more hostile pedestrian environment. This bridge will also connect directly into the mall, offering a weather protected means of access from the LRT station. Implementing the Grand Boulevard and pedestrian bridge is seen as a priority for the City in order to "signal to the private sector the intent to change the character of this area into a pedestrian friendly transit oriented environment" (City of Calgary Land Use Planning & Policy, 2008c, 58). As such, the City plans invest into making these required changes ahead of development, with the possibility of recouping these costs through development levies and density bonuses.

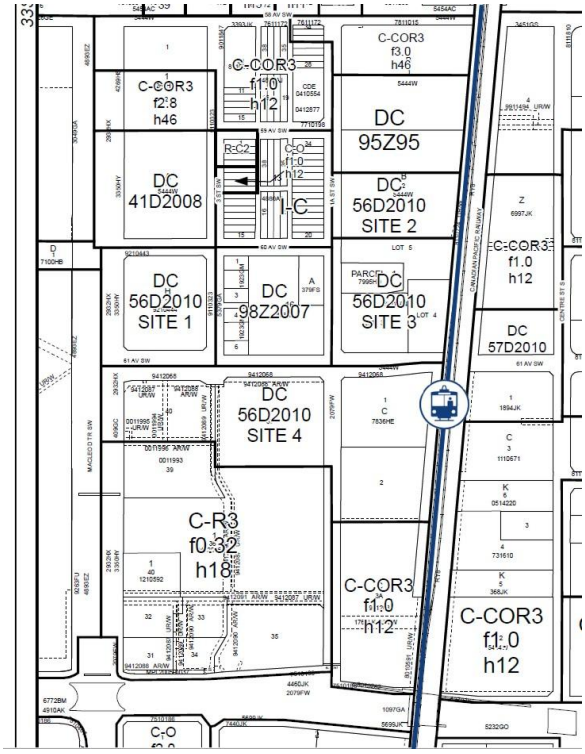
This approach to mobility is almost diametrically opposite to the policies established in 1980. In the earlier SAP, site requirements and the density bonus program almost entirely focused on moving pedestrians into grade separated facilities and internal walkways (City of Calgary Planning Department, 1980a). For example, the proposed density bonus would allow a density bonus of 15 units of area for every 1 provided in an internal mall. Furthermore, in outlining City responsibilities for future infrastructure improvements, the 1980 Plan offered the most detail and commitment in for road widening to accommodate auto traffic. The clear intent was to accommodate vehicle traffic and minimize pedestrian-auto conflicts by removing pedestrians from roads.

Another investment being made by the City in the Chinook area today is improvements to the station itself. Although the main purpose of its current reconstruction is to accommodate 4-car trains (Calgary Transit, 2013b), it affords the opportunity to correct deficiencies in its design: the station was "physically separated from the surrounding area by a large surface parking lot and bus loop. The station itself is single-purpose and does not include usable public spaces. [...] The centre loading platform reduces the potential to connect transit users more conveniently with new development" (City of Calgary Land Use Planning & Policy, 2008c, 7). The station was closed on January 14, 2013 and the building demolished. In its place, the centre-loading design will be retained but access is now provided entirely at grade, and includes upgraded waiting areas at the adjacent bus loop (**Figure 24**).

Figure 24 - Chinook LRT Station - Previous and Future Design (Calgary Transit, 2013b)

Like Westbrook station, the Chinook SAP recommended land use redesignations for parcels within the station area boundary. However, the number of parcels affected in this way is more limited: "land use amendments will be initiated by The City for properties fronting onto 61st Avenue SW" (City of Calgary Land Use Planning & Policy, 2008c, 62). These new Direct Control districts (56D2010 in **Map 34**) reflected the principal design and land use aims of the plan, including: minimum densities, provisions to encourage residential uses, limiting use areas for retail at grade, and parking requirement reductions based on proximity to the LRT station. The changes to zoning in this area also reveal how recent some of the changes to TOD design are from a policy perspective. One of the sites along 61st Ave had been redesignated as recently as 2006 as a Direct Control district which required a development permit applicant to enter into an agreement with the City to provide funds for constructing a grade separated walkway over 61st Avenue.

Map 34 - Chinook Station Zoning (City of Calgary, 2013a)



But the limited scope of this city-initiated rezoning suggests the City has not fully learned from the experience in the 1990s at Chinook. Planners in the 2008 SAP directly mention that the redevelopment of the retail area will likely be realized in the long term, and aimed to ensure that when this development did occur that it would comply with the overall station area vision. Its retail function is to be maintained, but the SAP recommended that new development should "redevelop their stores into two-storey urban formats" (City of Calgary Land Use Planning & Policy, 2008a, 23). Retail units whose use space exceeds 4,500m^2 should be also built with a minimum of two storeys with a minimum height of 13m. Furthermore, any rezoning application would require conformity with the SAP; and yet, the current

zoning in the retail district permits a maximum density of 0.32 FAR, only 0.07 higher than the recommended minimum established in the 2008 plan.

Summary

Planning efforts in the Chinook station area appear to be paying off. Council directed staff to "explore opportunities to expand redevelopment opportunities to lands owned by Chinook Centre, and additional lands to the east," (City of Calgary, 2013c), and in June 2013 the owners of the mall announced intentions to develop the south-east portion of the site as a transit-oriented site. The application, supported by administration, proposes a land use redesignation that would permit up to 210,000m^2 of new use area (greater than that of the existing mall) including new retail spaces, offices, hotel and residential units (Toneguzzi, 2013; Brown & Associates Planning Group, 2013). In order to ensure compatibility with the rest of the station area, the application would also propose an amendment to the Chinook SAP to formally include the site within the station area land use policy boundary (Brown & Associates, 2013).

Changes to station area planning in the Chinook Area in the 2000s demonstrates considerable progress from its 1980 predecessor. The overarching goals of intensification and mixed uses remain, and have even increased in scale. But the City's plan to invest in new infrastructure ahead of development shows a greater commitment to pursuing a true transit- and pedestrian-supportive environment and draw market interest. City staff has also been proactive in zoning changes that reflect this commitment by implementing statutory requirements for minimum densities and including residential components in new development. This has not gone unnoticed by land owners and prospective developers:

> "Chinook Centre has undergone a number of expansions and transformations since its inception. This proposed land use and policy amendment represents the next phase of expansion and allows for mixed-use and transit supportive infill development to complement the existing mall and the Chinook LRT Station." (Brown & Associates Planning Group, 2013, 4)

Chapter 6: Synthesis

The preceding historical narrative has highlighted several important trends in Calgary's planning approach. Some were motivated by market responses to economic conditions, but all were shaped in some way by the planning philosophies of their respective eras. This chapter focuses on these key points in order to summarize the evolution of planning philosophy in Calgary.

The Role of Downtown

Throughout the city's history, downtown has been the dominant centre of economic activity. The municipal government has consistently and actively supported this function through its planning policies. As roadway congestion in the core became a concern, the investment in rapid transit kept the relative costs of commuting to downtown low. This role became more important as public opposition to new roadways increased, allowing increased travel demand to be met without major new road infrastructure (MITL, 2012): since 1991, downtown employment has grown by more than 43,000 – an increase of 50% – without requiring new roads. This low cost of transportation increased the capacity of downtown for new development, and allowed agglomeration benefits to exceed externalities.

However, in the last 10 years conditions appear to be changing. The tremendous growth in new development and activity has contributed to significant congestion on the LRT lines. One response to this has been accelerating plans for transit improvements to increase capacity. The City is currently upgrading its LRT platforms in downtown and on the South LRT to accommodate four-car trains.

A longer term solution to traffic concerns in downtown is by increasing the share of travel by pedestrian and cycling modes. This is to be achieved by encouraging residential population growth within downtown and the surrounding area. Envisioning a more mixed use urban centre, the City expects that downtown will accommodate a lower share of office employment growth in the future. With downtown and the Beltline (collectively Centre City) already intensively developed – 30,000 people and jobs per

square kilometre – planners have set a target of accommodating 30,000 new residents and 66,000 new jobs in the core over the next 25 years.

During the most recent economic boom, the rising costs of locating downtown have lowered its competitive advantage over suburban office space: from 2004-2007 the cost of downtown office space more than doubled, and from 2005-2009 the price of monthly parking increased by 87% to become the second highest in North America. Although the costs of suburban office space also grew during this period they did not do so as quickly; average prices have remained 25-40% less expensive than in downtown.

The net influence of these changing conditions has been an increasing trend toward the decentralization of office firms. The most notable of these occurred in September of 2012 when Imperial Oil announced its plans to move to a suburban activity node, the first major oil company to leave downtown. However, most emerging suburban office nodes – the Macleod Trail corridor, the University of Calgary Research Park, and Quarry Park, among others – are located on current or planned LRT lines and are targeted for further improved transit service through the City's planned Primary Transit Network.

Transit Planning and Service

The primary role of transit through much of the time period examined in this research was to accommodate commuting trips to and from downtown. As such, the transit network was designed to fit this role: feeder buses brought riders to the radial LRT lines, and crosstown trips were not effectively served. As citywide travel demand became increasingly dispersed and less focused on downtown between 1971-1991, Calgary's transit service instead became more reliant on this market: by 1991 nearly half of all transit trips were to or from downtown.

Planning for Calgary's first three LRT lines was done in a very pragmatic way. This reflected the LRT's main purpose of accommodating downtown commuters, but also the high population and employment growth of the late 1970s. These were boom years: from 1976-1981, when all three lines were

planned, Calgary's population grew by more than 25% to almost 600,000 and downtown employment by 58% to 82,300. However, the City's growth strategy had significant implications on how rapid transit was implemented. The focus on suburban expansion meant that LRT service was prioritized to serve these low-density growth areas, effectively reinforcing this development pattern. This is especially true with the decision in the 1970s to construct the Northeast LRT line to serve a new growth corridor rather than the planned North Central line. The alternative, to shape the form of growth by extending service into developed corridors with high transit ridership, was never a serious consideration.

With most residential growth occurring in corridors to be served by these LRT lines, the City opted to reduce costs to maximize system length (MITL, 2012). As a result, the lines were aligned in existing transportation rights-of-way: the South LRT shared a freight rail corridor, while the Northwest and Northeast LRTs utilized expressway and arterial street medians. Stations were simple in design and served as transportation nodes first. Most utilized grade separated pedestrian access and provided extensive surface park-and-ride facilities.

Planning for the West LRT, first started in 1983, utilized a significantly different approach. As the line was not viewed as a construction priority, planners had more time to consider other potential impacts associated with LRT service. The most notable of these was choosing an alignment: lacking an available transportation right-of-way in the inner city, planners were faced with recommending an alignment that met transportation service objectives but which could also support redevelopment and intensification at key sites. When funding became available to build the line in 2007 the City recommitted to this approach, willing to trade off higher costs for a line that integrated more successfully into surrounding communities and would maximize redevelopment potential at Westbrook and Sunalta stations.

There is further evidence that the City is moving away from using transit to support suburban expansion. The 2009 Calgary Transportation Plan proposed a Primary Transit Network which will form a

framework for future transit investments. Although two new radial LRT lines are planned, the focus of this network is to improve mobility between activity centres by transit. Furthermore, the evaluation process used to prioritize improvements has given high scores to projects that improve mobility in the existing area of the city, and comparatively poor scores to projects like the Southeast transitway that support new growth areas only.

A significant test of this new philosophy will be the design of the North Central LRT. The alignment proposed in 2006 was overtly for the purpose of facilitating travel demand from new suburbs north of the ring road freeway into downtown. But residents have pushed back, demanding a line that will provide greater accessibility and mobility for established communities first. Changing the NCLRTs alignment to a more central route also provides greater support to the City's new land use policies.

Land Use Policy

The eras discussed in this thesis demonstrate a slow but progressive evolution of Calgary's planning philosophy towards managing growth and addressing a jobs-housing imbalance. Like many North American cities, most of Calgary's population growth since the Second World War has occurred through suburban expansion. Similarly, this low-density development pattern was sustained by municipal policy and public support. Unlike many cities the City of Calgary actively encouraged, and achieved, a high degree of centralization of employment in downtown. The result, in combination with the concentration of industrial employment east of the Deerfoot Trail freeway, was that by the 1990s there was a severe jobs-housing imbalance which created strain on the transportation network.

The initial response, proposed in the 1995 GoPlan, was motivated by public opposition to intensifying existing communities and a continued reliance on the automobile. New suburban communities were required to provide greater densities and land use mix. More importantly, the city proposed creating employment concentrations on a peripheral ring road freeway to address the jobs-housing imbalance: Garreau's (1991) prototypical "Edge City." While regulations for new suburbs have

largely been effective, the Town Centres concept has not been implemented as intended: the proposed northern Town Centre is still undeveloped, with its southern counterpart is principally a retail-oriented power centre. The appeal, and still relatively low transportation cost, of downtown remained strong.

In the 2000s, the City shifted its focus to the existing area of the city to address growth patterns and the jobs-housing imbalance. This shift was facilitated by two major changes: a new transportation emphasis on transit to provide mobility, and public feedback that showed residents were now much more supportive of intensification. The City established a series of Activity Centres and Corridors to focus intensification into key nodes that could be served by the Primary Transit Network, and to minimize the level of change in other communities. Planners established a target that 50% of all population and employment growth over the next sixty years will occur in the existing area of the city; more than half of this share is expected in Activity Centres and Corridors.

The City's approach to land use planning around LRT stations also underwent a significant change between the 1980s and the present. Of the first three LRT lines, only one – the South LRT – had a comprehensive land use study conducted, and this only after construction on the line had already started. Station Area Plans (SAPs) overestimated market interest and the potential to change land use at some stations. Zoning reflected desired maximums, but included few requirements that needed to be met to ensure development was transit-supportive. The initial SAPs also did little to address the tension between stations as nodes and places. Extensive surface parking occupied large portions of prime real estate adjacent to the stations, and responsibility for infrastructure improvements was placed on potential developers. Perhaps most significantly, when economic conditions soured in the 1980s, the City showed a willingness to accept development proposals in station areas that did not support its land use aims.

By the 2000s, the City took a much more active role in planning for LRT station areas. The West LRT project included a land use study that was concurrent with the design of the line itself, allowing feedback on development potential to influence station and alignment choices. Station area planning was

also more expansive. By 2012, 10 LRT stations had local plans completed or underway. These plans include requirements for minimum densities, incentives for bonus densities and mixed uses, and mechanisms for directing development levies to local improvements. The plans also call for some improvements to local infrastructure to be made ahead of development, seeing the City share some of the financial risk in redeveloping station areas. Lastly, the City has utilized zoning as a tool to implement the SAP policies, proactively rezoning large portions of station areas with Direct Control districts.

Parking

Calgary's approach towards parking management has been dichotomous: highly utilized in downtown but minimally so in the suburbs. This reflects the long standing view that auto use should be restricted in the central area of the city but accommodated elsewhere. However, the strength of this conviction is being eroded as transit is becoming a priority for mobility outside of the core.

In the downtown core, restrictive parking policies have been in place since the 1970s with the explicit aim of reducing auto use and encouraging transit utilization. The two key policies which supported this aim were a stringent parking requirement of 1 stall per 140m^2 of gross office floor area, and the cash-in-lieu program, both introduced in 1972. The former drastically reduced the amount of parking that could be built in downtown, while the latter then permitted up to 20% of the required parking to be built on site. The cash-in-lieu program also created a policy tool whereby the City could delay construction of new spaces to support its transportation objectives. By 1981, the number of stalls per downtown employee decreased by 20%.

The recession in the 1980s led to a weakening of parking management in downtown. With parking now a profitable venture for developers, the city sought to stimulate development by reducing the area subject to cash-in-lieu, while sites remaining within its boundaries were now allowed up to 50% of the required parking to be built on site. Developers responded by building outside of the cash-in-lieu area to provide the maximum amount of parking. Furthermore, lots cleared for development which were left

vacant in the recession were given over to parking uses. This increase in the number of stalls contributed to decreasing transit demand and increasing auto mode share.

In the 1990s and 2000s, the City recommitted itself to reducing parking availability in the core in order to support transit. New development eliminated surface lots on the downtown periphery, but there was also a need to address how much parking these new projects could provide. In 2006, the City adopted a 50% transit mode share target for downtown commuters. To support this, the restricted parking area was expanded to encompass all of downtown: no office project could now provide more than 50% of parking on site. Steps are also taken to begin expanding the parking management policy into the Beltline and commercial districts in the inner city.

In the suburbs, consideration of parking management was largely absent from planning discussions. Consultants for the South LRT Land Use Study noted that parking demand at station area developments would only marginally be reduced by the presence of the LRT, while the SAPs prepared for each of the South LRT's stations made no mention of parking at all. Furthermore, although some reductions in parking supply had been allowed through zoning changes, planners were wary of continuing this program for fear of parking overspill into surrounding communities. Only with the adoption of the 1P2007 Land Use Bylaw were policies introduced to reduce parking supply near transit. Parking maximums for multi-residential housing were enacted based on distance from downtown, and a 10% reduction in minimum parking requirements was available for commercial and residential uses within 400m of an LRT station and 150m of frequent bus service.

Lastly, the City strongly supported providing park-and-ride spaces at LRT stations, establishing a target that 20% of rail riders should access the system by private vehicle. This policy was implemented as a corollary of the restricted parking policy in downtown: park-and-rides were proxies for CBD stalls which intercepted vehicle trips that would otherwise continue into the core. However, there is evidence that these facilities are not necessarily required to attract commuters from their cars. When a new park-

and-ride facility was built at Brentwood LRT Station in the north-west, one-third of its users had previously accessed the line by feeder buses. Similarly, a parking fee program in 2009 resulted in a decrease in parking utilization by one-third, while feeder bus ridership increased by 22% and overall LRT ridership did not change. Planning staff are increasingly cognizant of the challenge that park-and-rides present to redeveloping stations into TODs, consuming both desirable development land and diverting potential riders from using transit to access these areas. While no formal review has been conducted into the City's park-and-ride policy, recent plans suggest one may be coming.

Summary

Ultimately, the evolution of planning in Calgary shows a city faced with the challenge of evolving from a mono-centric auto-dominated city into a poly-centric multi-modal one. Past planning approaches were appropriate for a city with relatively little congestion and where the costs of suburban expansion were manageable. Even as these costs grew, the investment in rapid transit was able to mitigate its impacts. It effectively supported mono-centricity, but also the city's low-density growth pattern. However, as the LRT lines now too become congested alongside roadways, the City is managing a transition to an urban form that will have multiple activity centres and where mobility needs can be provided not by personal vehicle, but by transit.

Chapter 7: Conclusions

The research presented in this thesis leads to several important conclusions in examining the land use impacts of Calgary's LRT system.

Calgary's LRT system did enable two significant land use changes to occur. The most immediately visible is the high degree of office centralization in the city's downtown. Employment in the CBD has grown by almost 100,000 since the need for rapid transit was first identified, and yet has done so with minimal improvements to the roadway network: 43,000 of these new jobs were created in the last 20 years during which no changes have been made to the road network to downtown.

The high degree of intensification in downtown, and indeed motivation to build rapid transit, was the direct result of the City's desire to retain downtown's primacy as the centre of the city economy. In building the LRT network, the City provided a low cost transportation alternative for downtown commuters. Ridership was encouraged both by rapidly extending the LRT lines outward to new communities, but also a downtown parking policy which strongly discouraged auto use. Although land was available for office uses in suburban locations, zoning and other development control resulted in only small concentrations of employment. This centralization was also supported by market forces, wherein the agglomeration benefit of being downtown was far greater than the transportation cost. When conducting the South LRT Corridor Land Use Study, planners found that almost no downtown firm was willing to relocate to the suburbs. However, trends in recent years indicate that the market forces which once promoted centrality are changing. Downtown has become expensive both in land rents and transportation costs, while City land use policy has opened up new suburban lands for office development, many along current and future LRT lines.

The other land use impact is less visible, but no less significant. The planning philosophy applied to the rapid transit system actively supported and reinforced Calgary's low density outward growth. Rapid transit lines were prioritized in corridors that were sparsely developed but expected to grow considerably with new subdivisions. This is particularly exemplified in the decision to build a Northeast LRT line rather than the originally proposed North Central line: the northeast corridor had almost no residential development and was not considered as a growth area when rapid transit was first proposed in 1966. By emphasizing system length and operational speeds, the LRT made downtown highly accessible from even the farthest suburb: there was little incentive to locate closer to downtown.

To maximize system length, the City adopted a low cost approach which accentuated LRT as a transportation facility rather than a tool to shape land use. Alignments were selected in expressway medians and freight corridors, and stations were characterized by large surface parking lots. The provision of park-and-ride facilities in particular supported both downtown centrality and low-density growth. By restricting parking supply downtown, park-and-rides provided a reasonable proxy supply that kept transportation costs low. These facilities also extended the service range of the LRT network, diluting the accessibility benefit of locating near the station, while simultaneously occupying prime developable land near the station where this benefit is highest. As a result, the level of intensification at suburban LRT stations has been relatively modest to date.

The land use shaping potential of LRT has also been influenced by market forces and Council decision making. The opening of Calgary's first three LRT lines coincided with the start of a severe recession. Market interest, which existed at stations such as Southland and Chinook leading into the start of LRT service, evaporated. Given the economic climate, the City then accepted substandard development proposals which failed to capitalize on nearby LRT stations (primarily big box retail with large surface parking lots). Even when presented with the opportunity to purchase and preserve land near future LRT stations for development when market conditions improved, the City elected not to buy land given upfront costs.

In light of these findings, it is not surprising that little change in land use has occurred in LRT station areas outside of downtown. But the evolution of planning philosophy in Calgary gives reason for optimism that a similar path will not be taken in the future. In implementing the 2009 Calgary Transportation Plan and Municipal Development Plan, the City has taken a more active approach to curtailing suburban expansion. Activity centres, and a new Primary Transit Network, provide a framework for intensification and take a more substantive view of transit's land use shaping potential.

On a local area planning level, the City of Calgary's current transportation and land use policies provide appropriate and reasonable direction for transit-oriented development to occur in station areas. New plans for station areas mandate minimum densities, mixed uses, and pedestrian-oriented designs. A key area of opportunity for the City is to more comprehensively implement the parking management policy lessons it learned in downtown. In tandem with the competitive travel alternative offered by LRT, the restrictive parking policy acted as a strong auto-disincentive, so much that half of today's downtown commuters reach work by transit. Although steps have been taken which limit residential parking, and offer reductions to minimum parking requirements, these are still relatively modest in comparison to the current high availability of parking in suburban areas.

Thus I return to the primary research question that inspired this thesis: why has Calgary's investment in its LRT system not produced the expected land use impacts along the network? Within the scope of research presented, the answer is: the combination of transportation policy, land use policy, and market forces, which existed during the design, construction and operation of the first three LRT lines favoured intensification in downtown and dispersion in suburban areas. However, the evolution of planning policy and market forces in the city indicate that this will not be as true in the future. To successfully develop TODs at suburban LRT stations, the City will need to remain committed to the philosophy that has emerged, to constantly improve the policies which support intensification, and take advantages of opportunities to implement TOD.

7.1 Recommendations

In analyzing Calgary's current policy suite, the analysis presented finds them to closely reflect best practices. Yet this research has also identified several opportunities, and challenges, for the City of Calgary to improve the likelihood of realizing Transit Oriented Development. Four of these are of particular importance: Calgary's unique employment characteristics, planning in a boom/bust economy, LRT alignment choice and design, and prioritizing transit investments to stimulate changes in land use and travel behaviour.

The predominant use of Calgary's office space continues to be by firms in the petroleum industry, either directly or indirectly. As has been the historical case in the city, this industry has predilection for locating in the downtown core. Some other major employment sectors, especially transportation and logistics, do not lend themselves to concentrating around transit. Thus the question becomes: by pursuing employment concentrations around LRT stations, what market segment will cluster in these centres?

The 1984 South LRT Corridor Impact Monitoring Study noted that office firms locating in station areas tended to be "engineering firms, traditional suburban office users, [and] junior oil companies that previously had offices in downtown" (City of Calgary Planning & Building Department, 1984, 6). The Study further noted that although proximity to downtown via LRT service was an important factor in selecting these locations, so too was the high availability of parking. If current market trends in downtown continue, it is likely that more of these firms may look to suburban locations.

But if true TOD is a plan objective, including high quality pedestrian environments, reduced auto use, and appropriate built form, then this aforementioned market is not likely to produce these results. Broadly, these firms have left downtown because the benefit of clustering (agglomeration) was lower than the costs of doing so. Station environments that move towards an urban built form and travel pattern may replicate these costs. As a result, the development pattern these firms take may include proximity to LRT and other rapid transit services, but in low-rise office parks with large surface lots. Examples of these are

numerous in Calgary today: Sunpark Plaza near Shawnessy, Franklin Business Park, and even the emerging node at Quarry Park. A fuller realization of TOD employment aspirations is more likely to come from a market that exhibits agglomerative tendencies but for which the value of locating in the petroleum-dominated CBD is not a major priority.

One sector that appears to exhibit positive trends towards clustering is the research and technology sector, primarily around the University of Calgary. With nearby access to two LRT stations, the City should support both the expansion of this sector and in maintaining its proximity to Brentwood and University stations. Beyond this, this thesis recommends that the City of Calgary develop an employment strategy to cultivate growth sectors that are likely to locate in suburban LRT employment nodes in an appropriate built form.

The second major challenge for the City is in planning in a cyclical economy of booms and busts. Historically, the City has underestimated growth trends during boom periods, and overestimated the impacts of recessions. This cycle has also led to impacts on municipal service provision and development patterns, especially in bust periods. Of course, these tendencies are significantly influenced by provincial mandates that preclude running fiscal operating deficits. But when viewed through the lens of decades rather than fiscal years, the overall growth trend is upward.

There are two major implications that stem from this knowledge: having a list of "shovel ready" transportation infrastructure projects that can be quickly commenced with the availability of funding, and supporting plan objectives and development standards regardless of economic climate. The former is largely being incorporated into the City of Calgary's transit strategy, primarily through the framework of RouteAhead, but there is a major opportunity to improve in the latter.

As has been demonstrated in the Chapter 4 case study, the economic recession of the 1980s and relative stagnation in the 1990s led to a significant weakening of land use policy both in downtown and suburban LRT station areas. Furthermore, these decisions left lasting legacies that planners today must

address. In downtown, changes to the restricted parking area and a weakening of the cash-in-lieu program did spur development, but away from the LRT lines and in a manner that encouraged auto use: transit ridership and mode share took more than a decade to recover and the onset of a new boom. The effect in the suburbs was perhaps even more dramatic. Several proposals were made, and approved, at the three case study South LRT stations which produced auto-oriented low-density developments on prime station area land. With the relatively recent construction of these projects, they are unlikely to be redeveloped in the near term. This is especially true at Chinook, where three big box stores occupy nearly a quarter of available station land. Furthermore, these parcels are where nearly all local transportation improvements identified in the 2008 Chinook Station Area Plan are located.

Although it is beyond the scope of this thesis to know with certainty how these specific decisions were made, the impact of the recession and a desire to stimulate any development appear to be strong motivations. These decisions, however, directly contravened the planning policies that were put in place in these stations for a specific purpose: encouraging intensification to maximize utilization of LRT infrastructure and mitigate automobile congestion. Thus, the recommendation is that decision-makers, and planners, should adopt a longer term view of the development potential in station areas, and to be cognizant that any development does not necessarily equate to good development. Quite the opposite, taking short term views towards development has produced long lasting and negative impacts.

In a similar manner, the City should be more willing to take advantage of opportunities to preserve land for future development. A prominent example is the missed opportunity to purchase land in the Shawnessy area in the 1990s and its subsequent development as an almost purely retail oriented power centre. This is being rectified to some degree with recent examples of purchasing and preparing developable land at Westbrook and Sirocco stations on the West LRT. Nevertheless, land acquisition and its release for development should be included in comprehensive planning for LRT projects.

Alignment choices are another factor in which the City has done much to improve over the course of its experience with LRT. Still, the city lacks consistency in its application. Calgary's first three lines were extended in low cost corridors which offered little in terms of supportive land use (South LRT) or developable land in close proximity to the stations (Northwest and Northeast). This served well the transportation role of intercepting vehicle commuters to the core, but has done little to promote walkable and transit-oriented urbanism. As stated by Vuchic (2005) in the literature review, transit service should intersect a community, not operate on its periphery. In planning the West LRT at Westbrook, the City traded off higher costs for a line that is aligned through the centre of the redevelopment site. Another recent example of this concept is the Northeast LRT extension into Saddletowne, where the station is integrated with the commercial centre of that community.

However, the planned North Central LRT line is proposed in a corridor in Nose Creek (**p.144**) that follows the approach utilized by Calgary's earlier LRT lines. In emphasizing operational speed and lower costs, this choice will do little to support the planned Urban Corridors on Centre Street, Edmonton Trail, and 16th Avenue N (Trans-Canada Highway), or to improve service for existing transit users in this corridor living south of Beddington Trail. This research strongly supports the recommendation that a North Central LRT line be aligned instead via Centre Street. This will help relieve current congestion on bus routes entering downtown, and support the land use and transportation policies of the 2009 MDP and CTP.

The final opportunity for the City is perhaps the most difficult from a political perspective, but may have the greatest impacts on development trends and travel behaviour: prioritizing transit network improvements. Current political discourse for transit is focused on whether the North Central or Southeast LRT lines should be extended first, yet the current planning for both of these lines reinforces the conclusions of this thesis: they will offer the greatest benefit to new suburban growth areas and continue to cluster employment in downtown. The North Central line is currently being reviewed, but as recently as 2006 it was stated that its purpose was to serve new growth north of the Stoney Trail ring road (Clifton

ND Lea, 2006). The Southeast LRT line has no such ambiguity: it will traverse low-ridership generating industrial areas to reach developing communities in a suburban growth corridor. In conjunction with the current policy of providing a high availability of park-and-ride, these lines are likely to support continued outward growth in a dispersed pattern.

The research described in the literature review suggests that intensification, and transit use, is more likely to occur at the intersection of transportation networks. Calgary's current system of feeder buses and radial LRT lines means that downtown is one of the few places where higher order transit service intersects. With crosstown transit service still very limited as an alternative to automobiles, suburban LRT stations remain inaccessible to potential non-local transit riders.

To improve the likelihood of TOD in Calgary's LRT station areas, and to support greater growth in the existing area of the city, cross town links in the Primary Transit Network should receive the highest priority for implementation. This assertion is supported by similar conclusions in the City's cost-benefit analysis for transit corridors, in which the Southwest Transitway and South Crosstown BRT scored 2nd and 3rd respectively of 8 proposed transit projects (City of Calgary, 2013a).

Finally, in implementing the 'green line' LRT, rather than building out the North Central or Southeast line to planned termini on the suburban fringe, the City should focus on building the first stages of both proposed projects. This includes constructing the North Central LRT line to 78th Avenue N and a Southeast LRT line to Quarry Park. In doing so, the additional mobility and transit capacity benefits are distributed mainly in the existing part of the city. This will improve the relative desirability of living in the existing area of the city over new growth, but still offer a moderate improvement in service to peripheral communities.

The recommendations contained in this thesis do not require a significant deviation from current City policy towards transit and land use, which is found to closely reflect established best practices. Rather, they seek to strengthen these policies to further their realization. These changes require political

willingness and leadership. But as this historical evolution of planning in Calgary has demonstrated, it can happen and has happened before.

7.2 Future Research

This thesis examined the transportation-land use relationship through the lens of municipal planning. As such, the discussion of factors which influence this relationship emphasize regulatory and development control, while market forces are discussed broadly. This approach gave little voice to the agency of developers themselves. As historian Max Foran (2009, 4-5) wrote of Calgary: "Though there were other participants, the suburbanization process was directed, monitored, and executed through the interplay between Calgary's municipal authorities and the land developers." Accounting for this relationship will help to explain some of the decisions the City made that are questioned in this thesis, including weakening parking policies in downtown in the 1980s, and transit-unsupportive development in station areas.

Another significant research opportunity is in expanding the discussion of park-and-ride policy, specifically in applying quantitative methods. The City of Calgary has maintained a position that these facilities are a desirable element of LRT station design, and that their inclusion generates additional transit ridership. Yet the relationship between parking supply and individual station ridership is not clear in the case of Calgary. A more thorough analysis of park-and-ride's influence on travel behaviour will be crucial as Calgary, and other cities, move forward in planning for TODs.

Finally, this thesis includes the assertion that one obstacle to successfully implementing TODs can be found in choosing low cost alignments through existing transportation rights-of-way, and that alternative alignments which improve redevelopment potential often require a trade-off in the form of higher costs. There is considerable public opposition to the costs of these transit investments in many cities contemplating LRT systems, and research which examines the economic benefits of this trade-off will be beneficial in addressing these concerns.

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Appendix A: (IBI Group, 2009, B-3)

Comparison of Plan It Growth Patterns and Current Calgary Transit Operations			
	Current	Dispersed	Recommended
Transit Mode Split	9%	8%	17.5%
Population	956,000	2,300,000	2,300,000
Transit Service Area	55,000	101,000	76,000
System Annual Operating Hours	2,000,000	5,750,000	8,500,000
Operating Hours Per Capita	2.12	1.6	3.7
Transit Trips Per Capita	91	90	180
LRT			
LRT System Km	45	137	119
Annual LRT Hours	165,000	500,000	440,000
Bus			
Total Bus Route KM	4,900	9,000	6,800
Total Bus Operating Hours	2,100,000	5,500,000	8,000,000
System Costs (in $ millions)			
Annual System Ridership	95,000,000	210,000,000	410,000,000
Annual System Revenue	$135	$250	$500
Total System Costs	$250	$550	$800
Total Operating Costs (millions)	$115	$300	$300

Comparison of Plan It Growth Patterns and Current Calgary Transit Capital Costs			
Costs are in $ millions			
	Dispersed	Recommended	Difference
LRT			
LRT route KM to be added	92	74	18
Additional LRVs	300	240	60
Cost of LRT Line Extensions	$4,600	$3,700	$900
Cost of Additional LRVs	$1,200	$1,000	$200
LRV Maintenance Facilities	$600	$500	$100
Total LRV Infrastructure Cost	$6,400	$5,200	$1,200
Bus			
Cost of Exclusive Busways	$0	$150	-$150
Additional Buses	700	1,600	-900
Cost of Buses	$300	$650	-$350
Additional Bus Mtce Garges	$100	$200	-$100
Total Bus Infrastructure Costs	$400	$1,000	-$600
Total Capital Cost (millions)	$6,800	$6,200	$600