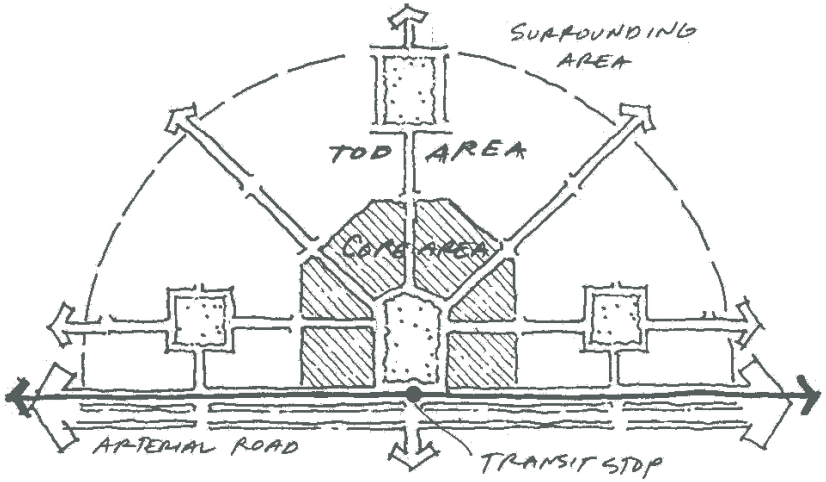
ALL ABOARD? TRANSIT ORIENTED DEVELOPMENT OPPORTUNITIES AROUND SUBURBAN COMMUTER RAIL STATIONS



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All Aboard? Transit Oriented Development Opportunities Around Suburban Commuter Rail Stations

by

DARREN A. ENNS B.A. (Geography), The University of British Columbia, 1999

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We accept this project as conforming
to the required standard

.....

.....

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To my best friend Sandy, thank you for now and forever.

-Darren

EXECUTIVE SUMMARY

INTRODUCTION

This report provides suburban communities which are adopting commuter rail technology with recommendations on how to maximize the potential for station area benefit. These recommendations were developed from a rigorous assessment of case studies, which used metrics based on Transit Oriented Development (TOD) to gauge the potential for station area development.

APPROACH

The project overview is as follows:

1. Start with providing an overview of Transit Oriented Development, its history and relevance to commuter rail;
2. Examine the existing body of research around suburban station area development, Transit Oriented Development and commuter rail;
3. Develop a methodology and a set of metrics to examine different case studies;
4. Analyze the selected case studies using a defined and replicable set of methods;
5. Determine the lessons learned from the case studies;
6. Compile a set of recommendations for communities adopting commuter rail.

The project selected case studies were in Seattle and Vancouver, with a total of six station areas examined; two in industrial suburbs, two in residential suburbs, and two in exurban locations. This matched pair approach was used to determine if there were any similar lessons to be learned from like cities in different regions. The sampling methodology within each case study looked at station area land use, pedestrian environments, commercial activity, employment activity, and residential activity. The methodology also controlled for commuter rail technology and community type to ensure that similar communities served by similar rail systems were used as case studies.

RESULTS

The station area measures were analyzed, and the findings are synthesized under the *Analysis Summary* tab. Through analysis of the case study station areas, a list of recommendations was drawn up with each recommendation pertaining to a particular metric which was measured for (Figure E.1).

Fig. E1 - Recommendations Summary

TOD Attribute	Recommendation
Maximizing TOD Potential	1.Barriers to pedestrian movement around stations should be modified or removed, through both micro and macro level alterations 2. Station alignment decisions should take into account the level of street network connectivity around potential station sites
Station Area Land Use	3. Stations should continue to locate within mixed-use areas, which contain residences, workplaces and shopping opportunities 4. Managing parking is crucial. Large surface parking lots create poor pedestrian environments and reduce the visibility of retailers 5. Extending retail along linear axes maximizes its integration with surrounding residential uses, and should be encouraged
Commercial Choice and Typology	6. A greater proportion of 'daily' retail uses should be encouraged by increasing local residential and employment densities (i.e. the drivers behind local commercial services)
Housing Choice and Density	7. Proactive upzoning of residential parcels around stations is a simple approach to densification which can result in redevelopment of lower density neighbourhoods, and subsequently increased property values for existing residents 8. Housing choice may be increased through a flexible approach towards zoning (such as comprehensive zoning areas) as well as encouraging adaptation and densification of existing dwellings
Employers and Employment Density	9. Incentive based programs and policies should be implemented in order to attract employment generating uses to station areas
Pedestrian Realm; Quality	10. Locating stations next to existing pedestrian oriented areas creates a situation where local businesses act as stewards of the pedestrian environment, ensuring there is a high level of pedestrian quality

CONCLUSION

This report provides a set of recommendations which will assist local communities who are looking to maximize the potential of new commuter rail station areas. It also analyzes the shortcomings of existing stations, offering communities already serviced by commuter rail an assessment tool for their station areas. The next steps for this area of research include looking at implementation strategy for communities, specifically an economic approach to station area redevelopment.

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Chapter 5: Lessons and Recommendations

CHAPTER 1: PROJECT STATEMENT

The goal of this report is to provide suburban communities which are adopting commuter rail technology with recommendations on how to maximize the potential for station area benefits, using Transit Oriented Development as a yardstick of success. Transit Oriented Development is a theory developed in the United States intended to encourage urban development around transit nodes.

In order to achieve this goal, the project will:

1. Give an overview of Transit Oriented Development, its history and relevance to Commuter Rail;
2. Examine the existing body of research around suburban station area development, Transit Oriented Development and commuter rail;
3. Develop a methodology and a set of metrics to examine different case studies;
4. Analyze the selected case studies using a defined and replicable set of methods;
5. Determine the lessons learned from the case studies;
6. Compile a set recommendations for communities adopting commuter rail.

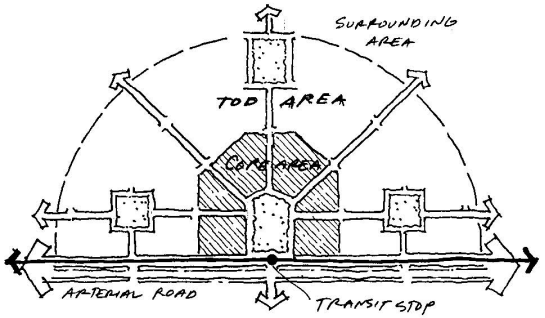
This is a temporally relevant topic, as North America is currently engaged in an intensive investment in rail technology which has left many cities coping with the land use implications of adopting rail technology.

Past research in this field has focused either on technologies other than commuter rail (such as light rail systems), or on urban station areas, thereby neglecting effects on suburban environments. This project fills a void by using an often ignored technology in commuter rail, and looking at its effects in suburban settings.

The approach taken here is to compare existing suburban station area development in Seattle and Vancouver, to determine if there are any similar lessons to be learned from like cities in different regions. Technology type and community type are controlled for through a rigorous evaluation system so that similar case studies are selected in each region. The measures of station area development used are derived out of the principles of TOD, a theory which has been applied in projects throughout the world. TOD theory is based on the idea that communities can alleviate transportation problems and increase transit usage while creating a sense of place through the development of mixed-use, walkable urban centres focused around a mass transit node.

The predicted outcome is that due to the relatively low level of service provided by commuter rail, the best opportunities for a TOD development approach lie in stations which are within or adjacent to existing urban cores. The locations which will have the most difficult time developing according to TOD principles will be stations located in areas without an existing development node nearby, such as park and ride stations in industrial areas.

Fig. 1.1 An explanatory diagram from Peter Calthorpe's "The Next American Metropolis", which graphically describes the theory of Transit Oriented Development



TEMPORALITY: COMMUTER RAIL TODAY

Rail transportation is enjoying a renaissance of sorts in North America, as major urban rail projects are asked to solve a plethora of problems facing American and Canadian cities. While the overwhelming majority of transportation investments in North America are still allocated towards automobile infrastructure[1], there has been an increasing trend towards investing in public rail transportation[2].

The Federal Transit Authority in the United States is currently funding 25 rail projects with another 52 waiting for engineering approvals, and an additional 142 in the preliminary study stage[3]. High profile rail projects have emerged in Minneapolis, Los Angeles, and Houston, with others located everywhere from Alaska to Alabama.

Proponents of rail transit point to its direct benefits, such as the ability to reduce traffic congestion, mitigate air pollution, and provide a better quality commute. There is also the argument that it creates beneficial side effects as well. For example, supporters suggest that rail transit is a more economical transportation investment than automobile infrastructure, that it can create better urban environments by allocating less land to the automobile, that it can create a node for development, and that it can act as a catalyst for station area economic development.

Both proponents and detractors agree that rail technologies have implications for station area development, some positive and some negative.

One technology whose land use implications have not been thoroughly explored is that of commuter rail.

One type of rail technology seeing an increase in use throughout the United States and Canada is commuter rail. Both proponents and detractors of this technology agree that there are land use benefits and opportunities associated with the introduction of this technology, specifically around station areas.

While commuter rail transportation does not enjoy the same level of government spending as the automobile, consumer demand is nevertheless driving a surge in rail ridership. In 2000, U.S. commuter rail systems carried the most passengers since 1980, when ridership was first recorded. In Canada, commuter rail traffic increased 33% between 1994 and 2001, and now carries over 46 million people per year. Toronto's commuter rail network, the GO Train, is the 5th busiest public transit system in North America[4].

While commuter rail transportation is seen as an alternative to the automobile for riders, it is viewed by policy makers as having many of the same benefits as other rail technologies. It is purported to be a method to reduce traffic congestion, lower transportation costs, increase air quality, and reduce energy use.

It is also purported to be a catalyst for development, particularly around stations, and it is this claim which requires investigation.

[1] Of the 38 billion dollars allocated in the 2005 US DOT budget towards "improvements in transportation mobility", 26 billion was allocated to highway improvements, while 8 billion was put towards transit (of which 1 billion was allocated to improving intercity rail services).
[2] Between 1995 and 1996 alone, rail transit track was extended by over 9% in the United States http://www.bts.gov/publications/north_american_transportation_in_figures/html/table_11_1.html
[3] Federal Transit Authority http://www.fta.dot.gov
[4] http://www.cutaactu.on.ca/

Commuter Rail Ridership 1994 - 2001
Toronto, Ottawa and Vancouver

Table 1.1

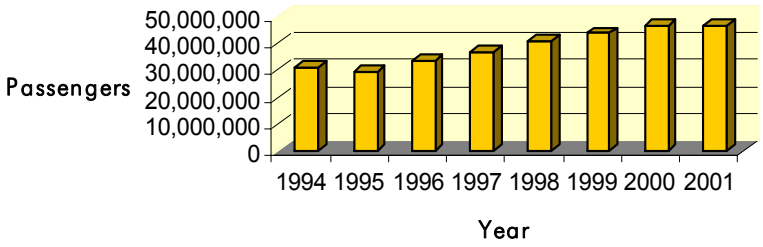


Figure 1.2 Commuter Rail, Vancouver

Figure1.3 Heavy Rail, San Fransisco

Figure 1.4 Light Rail, Salt Lake City

Figure 1.5 Monorail, Japan

WHY COMMUTER RAIL?

Table 1.2 LRT vs. Commuter Rail; Urban Form Implications

	Rapid Transit	**Commuter Rail**
Power Source	At Grade	Above Grade, or Internal
Urban form outcome	At grade power systems require segregated ROW's, usually elevated or tunneled	Due to high travel speeds, fencing is sometimes a requirement along ROW's
Service Headways	Max. 2 minutes	Max. 15 minutes, only operate during morning and afternoon peaks hours
Urban form outcome	High frequencies mitigate peaks in ridership patterns, impacting circulation patterns around stations	Low frequencies and high peak volumes create dead environments before, between and after peak periods
Station Frequency	Min. 2 km.'s apart (1.4 minutes travel time apart)	Min. 9 km.'s apart (8.5 minutes travel time apart)
Urban form outcome	Multiple station locations may reinforce linear growth patterns along service route	Infrequent stations create more opportunities for nodal development, and defined centres
Station Types	Pedestrian oriented, can also be transit hubs, kiss and rides or park and rides	Primarily commuter orientated, usually kiss and ride or park and ride
Urban form outcome	Footprints are usually smaller, and may not require any at grade presence	Footprints are usually large due to parking requirements, which may be mitigated through structured parking
Surrounding Environments	High to medium density	Medium to low density
Urban form outcome	These systems are often located within developed areas, dictating more redevelopment rather than greenfield development	Often located in suburban centres, there are usually more opportunities for station area development due to low density attributes of previous development

Commuter rail has unique impacts on the urban environment which are attributable to it being a unique technology. Some of the unique impacts of commuter rail on station area urban form are explored in Table 1.2.

For example, LRT systems are generally electric powered, which may or may not share a Right of Way with vehicles, they operate on fixed rails with a high station frequency, and generally carry a 'light' passenger load. Heavy Rail uses segregated ROW's, has the ability to carry large passenger volumes, and is characterized by high speeds. These systems have a lower station frequency, and will often use a 'Third Rail' power source, which is located at-grade. commuter rail, also called 'suburban rail', is typified by service to / from a central city, has a repeat customer base, and is diurnal in nature with inbound service in the a.m. peak, and outbound in the p.m. peak.

Commuter rail is often used in conjunction with Light Rail and other transportation systems as a technology which may support development which is focused around a transit node, known as Transit Oriented Development, or TOD.

> *"A Transit-Oriented Development or TOD is a mixed-use community within an average one-fourth-mile walking distance of a transit stop and core commercial area. The design, configuration, and mix of uses emphasize a pedestrian-oriented environment and reinforce the use of public transportation. TODs mix residential, retail, office, open space, and public uses within comfortable walking distance, making it convenient for residents and employees to travel by transit, bicycle or foot, as well as by car."*
>
> -Peter Calthorpe

While Light Rail and other technologies have been proven as successful foci for Transit Oriented Development, it is unclear whether or not Commuter Rail can serve this purpose as well. This uncertainty is evident in current transit impact analysis, which is ambiguous regarding commuter rail's ability to act as a mechanism for Transit Oriented Development[1].

1. For example, TransLink's Northeast Sector project acknowledges challenges in TOD development around commuter rail, but at the same time purports that it can still be accomplished if 'sensitive design' is undertaken.

WHAT IS TRANSIT ORIENTED DEVELOPMENT?

There are numerous definitions of Transit Oriented Development provided by academics, transit service providers, non-governmental organizations and local municipalities. While all tend to have the same basic tenets, some definitions tend to place more importance on certain aspects than others. Perhaps the most well known TOD definitions are those provided by Calthorpe and Associates, and their founder Peter Calthorpe (See Table 1.3). Calthorpe's approach reflects his focus on building a workable urban form as the primary goal. Robert Cervero's definitions tend to focus on the importance of transit and transportation as a primary focus. This may reflect the researcher's backgrounds, with Calthorpe as the architect and Cervero as the transportation engineer.

The key principles of Transit Oriented Development are designed to maximize the number of residents and workers within walking distance of a transit station. The potential of a Transit Oriented Development is maximized when land uses surrounding the transit station are designated medium to high density. Peter Calthorpe's definitions of Transit Oriented Development have placed desirable densities close to the station as high as 125 to 190 units per acre (UPA).

Another principle of Transit Oriented Development is land use mix. A diverse range of land uses including retailing, professional services, and housing characterize the high intensity land uses around the neighbourhood and town centres. The centre of the TOD is the transit station, around which is meant to be the largest level of activity.

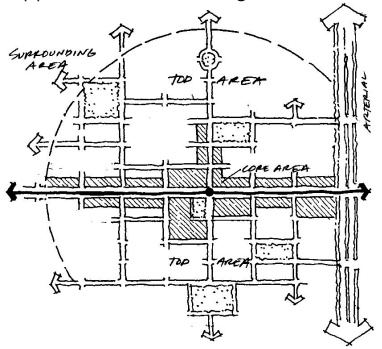
Moderate intensity uses such as singly family residential, light industry and parks are meant to be located further away from the TOD core. While these areas provide an additional ridership base to support transit, they ideally access the station by walking, cycling or using local transit.

The size of a TOD is predicated on comfortable walking distances of five and ten minutes. This creates a particularly nodal pattern of development, with intensity of development declining in a radial pattern away from the transit node. TOD principles rely heavily on walking as a transportation mode in the station area. TOD theory espouses that walking will become a viable mode of transportation when the streetscape makes pedestrian travel pleasant and enjoyable, and when there are a range of destinations within a comfortable distance.

Table 1.3 Calthorpe and Associates TOD Criteria

Locational and Spatial Criteria	
1.	The TOD site must be located either on an express transit system, with service on 10- to 15-minute headways, or on a feeder bus line network within 10 minutes transit travel time from the express transit system.
2.	The TOD site must be located within an Urban Growth Boundary or Urban Policy Area.
3.	TOD concepts can be applied to infill and redevelopment sites located in urbanized areas with existing uses.
4.	TOD concepts can be applied to existing retail, office, and industrial sites by adding mixed-uses with structured parking on existing surface parking lots.
5.	The TOD must not contain land further than 2,000 feet from a transit stop. The Secondary Area may contain land no further than one mile from the stop.
6.	TOD concepts can be applied to infill and redevelopment sites located in urbanized areas with existing uses.

Figure 1.6 The concept of TOD applied in older existing communities



CHAPTER 2: EXISTING RESEARCH

The existing research in the field of Commuter Rail as a TOD node is scarce. It is best to think about the research question (and therefore the literature analysis) as containing three parts.

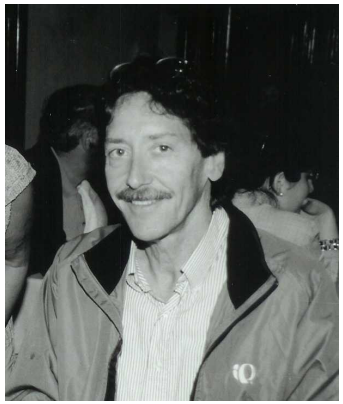
The first is the issue of Transit Oriented Development: What is it, where did it come from, and what are its critiques? There is an abundance of literature regarding TOD, however, the literature often isn't written with Commuter Rail as a focus, which is an obvious weakness. The authors cited here are those which have had a profound impact on TOD, or are authors who have a relationship between TOD and commuter rail.

The second area of literature is that pertaining to the use of Commuter Rail as the technology of choice for a TOD. This body of literature is quite limited, but very helpful for this project.

The third is station area analysis in suburban settings.

The literature analysis is important for this project, as it not only establishes what is already known, it analyzes how this existing literature relates to this project. In this chapter, this is accomplished through the use of 'Relevance Statements', found at the end of every article summary. Understanding the relationship between theory and practice is essential for any planner, and this literature analysis examines the theories which are guiding researchers in this field.

Fig. 2.1 The best known literature around TOD eminated from architect Peter Calthorpe (Top) and transportation planner Robert Cervero (Bottom)



TRANSIT ORIENTED DEVELOPMENT LITERATURE

There is a large body of existing research which examines station area development around transit nodes. The problem is that very little of this research address commuter rail stations. As we have seen, different technologies have different station area effects. For this reason these technologies need to be examined independently. Unfortunately, lessons learned from one other rail technologies have been applied to Commuter Rail without the necessary scrutiny.

The Next American Metropolis; Ecology, Community and the American Dream, Calthorpe, Peter, 1993

Regarded by many as the 'Father of TOD', Calthorpe's book represented one of the first collections of TOD literature in a single publication. While the 'smart growth' and 'new urbanist' camps were the foundation for Calthorpe, this book began to address issues on a regional scale. Criticized by some for dealing with abstractions rather than design, Calthorpe separates *The Next American Metropolis* into distinct chunks which deal with the case for TOD, history of TOD, design guidelines for constructing TOD, and example projects of TOD.

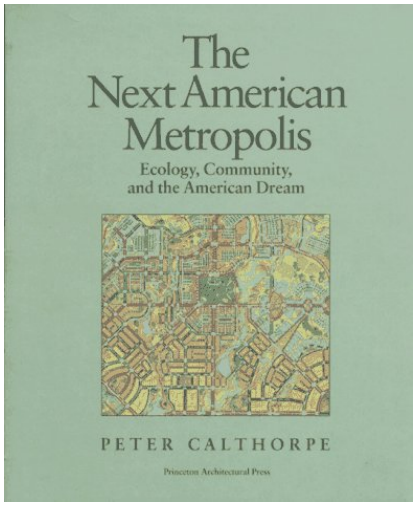
Calthorpe was not rejecting the car with his book, but rather suggesting that the automobile should be balanced with other transportation uses in a city. Nevertheless, critics of new urbanism were quick to apply their same arguments against TOD, that it is elite driven, out of touch with the realities of growth today, and an assault on the independence of suburbanites.

> *The future of transportation use will largely remain with highways and automobiles, but we will make better use of the existing network by upgrading our aging infrastructure and retrofitting roads for high-occupancy lanes or toll lanes. New technology will allow us to eliminate many toll plazas.*
>
> Floyd Lapp, FAICP

Criticisms arose that Calthorpe was too short-sighted, and reliant on a single solution. Andres Duany and Calthorpe engaged in a debate over urban core street networks in Planning magazine for example, with Duany suggesting that Calthorpe's outlook was too regional and sacrificing local neighbourhoods on the alter or regional mobility (The argument was over Calthorpe's advocacy for a one-way street system in urban cores), with Calthorpe responding that his 'urban network' was context sensitive, and could adapt to meet local needs.

Nevertheless, this book secured Calthorpe's preeminence in the field of TOD, and despite being passed over on the Stapleton airport project in Denver, Calthorpe and Associates have secured numerous commissions throughout the world based on their work in the field of TOD.

Relevance: Calthorpe's strict guidelines serve as the template for many TOD definitions. His definition of the ¼ mile and ½ mile station planning areas are well known and generally accepted templates, and are used in this study as a framework for assessment. One of the primary problem with Calthorpe's guidelines is that they are not easily molded to local conditions. When applied to a typical suburban Commuter Rail station area, it is likely that few will ever measure up to Calthorpe's guidelines. For this reason, it is important to focus on Calthorpe's general principles of walkability, density and mix, and not get caught up in his regimented quantitative metrics.



Transit Villages in the 21st Century, Cervero, Robert and Bernick, Michael, 1996.

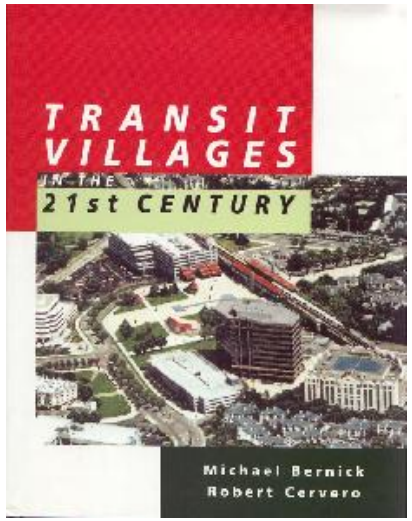
Coming on the heels of Calthorpe's book, these two authors explored the application of TOD in case studies around the world. Advocating an economically feasible, pedestrian friendly development program, this book also starts by looking back at transit villages of the past as justification for a return to this form of living.

The primary difference between Calthorpe's TOD's, new urbanist communities and the Transit Villages, is that Cervero and Bernick believe that the transit station should be the focal point of the community. This differs from new urbanism which advocates more civic uses spread throughout the site to create hierarchical nodes, as well as TODs which typically had the transit node on one side of the development. The argument for this is that transit stations are often not just transportation entities, but economic and social hubs as well. Many of the arguments for Transit Villages are based around solving congestion rather than place-making, perhaps reflecting the author's background as a somewhat classical transportation planner.

Taking a metropolitan scale approach, Cervero draws on case studies from Scandinavia, Japan and North America to illustrate what he considers transit villages. The case studies addressing Commuter Rail are from Denmark, Sweden and New York. The applicability of European case studies is always a cause for suspicion in North America, and even New York must rank as *continental* to most Vancouverites, however there are some transferable lessons from Cervero's case studies.

Firstly, infill TODs in suburbia will often be viewed by residents as anathema to suburban living. Most suburbanites accept that they should have to drive to take transit, just as they have to drive for other functions. Second, park and rides are not only disincentives for developing close to stations, they are often eagerly protected by transit agencies fearing loss of ridership. This raises the issue of parking as an essential design factor, which other authors also address. Third, Cervero is a staunch advocate of financial feasibility for TOD projects. He supports public private partnership whenever possible, and gives several salient examples of financing structures for TOD. This again reveals the authors analytical approach to the many problems which TOD attempts to solve, something which works both for and against him.

Relevance: Cervero's case studies are selective, non-contextual, and are 'good examples'. His focus on the analytical and traffic congestion aspects of TOD is something missing from Calthorpe's work, as is his attention to the financial aspects of TOD. As a transportation planner, Cervero's interest and approach is from the transit side, compared to Calthorpe, who approaches TOD from the design perspective. This juxtaposition is indicative of the struggle between land use planning and transportation provision which occurs in may station areas, including those in the Seattle and Vancouver case studies this paper examines.



The Land-Use Impacts of Urban Rail Transit Systems, Huang, Herman in Journal of Planning Literature, 1996.

The Seattle Sounder Commuter Rail Project references this paper by Herman Huang, to justify its claim that commuter rail will instigate office and other employment uses around stations. Huang's paper investigates the impacts of urban rail transit on real estate development. While relying on several case studies throughout North America, Mr. Huang's examples are Heavy Rail and Light Rail systems, and do not take into account the unique challenges facing real estate development around commuter rail stations. For this reason, it seems to be an inappropriate source to use as justification for a Commuter Rail project.

There are some aspects of Huang's research which arise in other studies. One is that land use changes around stations may not be directly linked to the station presence, but rather extraneous factors (Cervero and Duncan's paper referenced in this chapter accounts for this by using a hedonic model which isolates out the effects of a number of variables). The second is that there is a lag between system inception and station area development, a phenomenon suggested earlier by Moon (1990).

Perhaps the author's most important point is that in order for growth to occur around transit stations, there is a need for healthy market conditions, and favorable regulatory environments as necessary ingredients to spur station area development. This point is certainly one which can hold true for all station areas, not just Heavy and Light Rail.

Relevance: This paper, while probably not an appropriate reference for a commuter rail project, suggests that TOD creation requires positive market *and* regulatory environments to occur. This lesson however, is vague enough that it can be applied to all developments. The use of Huang's paper as a justification for imminent station area development around Seattle commuter rail stations may not have been appropriate, given his use of Heavy and Light Rail systems as case studies. However, many of his arguments, such as the need for an existing healthy real estate market, are applicable for most TOD situations.

CONCLUSION: Transit Oriented Development Literature

Literature pertaining to TOD is quite extensive, so this section examined those authors which have been either a) instrumental in the growth of TOD as planning theory, or b) have been used as a link between TOD and commuter rail.

Peter Calthorpe's *The Next American Metropolis* is widely regarded as a seminal piece of literature in TOD history. His many plans and design criteria established quantifiable measures of what TOD was. This reliance on standards is also a shortcoming, preventing his ideas from adapting to local conditions. With regards to TOD around commuter rail station areas, which are often in the lowest density areas of an urban region, a TOD developed using Calthorpe's standards may not be as appropriate as in a more dense urban environment (i.e. an inner suburb).

Robert Cervero and *Transit Villages in the 21st Century,* approaches the question of TOD from a transportation angle. Using positive exemplars from a number of transportation systems, Cervero makes the case for TOD as an answer to suburban transportation woes first, and suburban place making and urban development comes second. This approach is indicative (not surprisingly) of many transportation service providers, who are more interested in the 'T' than the 'OD'. Understanding this approach is crucial for the case studies in this report, which also involve partnerships between local communities interested in development opportunities, and transportation service providers, who are responsible for moving people.

Herman Huang's paper broaches the idea that for TOD to occur, there must be an accommodating regulatory framework, as well as a healthy development market. This coincides with Cervero's belief that the private sector is an essential partner for any successful TOD. Huang also raises the issue of 'lag time', the idea that there will be a temporal lag between transit service inception, and station area development. This is an interesting idea for the case studies examined in this report, given that the Vancouver example is an older system than the Seattle one, which may provide confirmation of Huang's theory.

Cervero and Huang's research was based on light and heavy rail systems, while Calthorpe is less specific about the transportation system. There is however, a body of research which focuses in on TOD and Commuter Rail.

COMMUTER RAIL LITERATURE

The existing literature pertaining to commuter rail station areas focuses in on the economic impacts. This largely is driven by the need for transportation service providers to prove to communities (often in U.S. courtrooms) that commuter rail service will not deflate property values. The economic impact is important for this project, as it may lend additional guidance to station location recommendations in the conclusion.

Transit's Value-Added: Effects of Light and Commuter Rail Services on Commercial Land Values, Cervero, Robert and Duncan, Michael, 2001.

Cervero and Duncan (2002) looked at the effects of proximity to Light and Commuter Rail stations on Commercial Retail and Office property land values in the Bay area. This study was sponsored by the Urban Land Institute and the National Association of Realtors. The authors also looked at land capitalization around Interstate exchanges as a third comparative, to determine if vehicle infrastructure would have the same impacts on land prices as Light and Commuter Rail stations. This was seen as a contrast to the existing research in the commercial field which focused on rental (not sale) rates, which was argued to be a less reliable measure of value, due to the hidden benefits involved in tenant incentives.

The hypothesis was that since Commuter Rail offers less mobility than heavy rail systems, the capitalization effects should also be more limited, and in fact lie somewhere between the values found for heavy and light rail stations. The authors used a comparative analysis, looking at values near Light Rail and Commuter Rail stations, as well as Freeway interchanges. Their findings were that the most significant value accruals were within ¼ mile of commuter rail station locations, and that the greatest increase in land values was in existing business districts located near commuter rail stops. Their findings were as follows:

Capitalization of Commercial Land Values Within Walking Distance of an LRT Station:	23%
Capitalization of Commercial Land Values in an Existing Business District Within ¼ Mile of a Commuter Rail Station:	120%

This study contrasted with many other previous studies, in that it suggested that significant capitalization effects could be realized from locating close to an LRT or commuter rail stop.

Relevance: This article indicates that there should be a large value accrual attributed to commercial parcels near the stations, *and* within existing business districts. Unfortunately, this purported value increase would be difficult to determine in the Seattle and Vancouver Case Studies for two reasons. One is that the Vancouver and Seattle systems have been around for too short a time to realize a significant number of sales transactions, which would be the primary basis for an analysis. Two, gaining property values from assessment data (another way of obtaining property values) would be impractical given the disparate nature of Washington State's property assessment methodology.

Impacts of Commuter Rail Service as Reflected in Single-Family Residential Property Values, Armstrong, Robert in Transportation Research Record, 1994.

Armstrong (1994) examined the capitalization effects of Commuter Rail, using single family housing in Boston as a primary indicator. His analysis revealed a 'bonus' of 7% for locating housing proximate to stations. It also looked at the effects of Commuter Rail routes, as well as stations, with the assumption that there would be a detrimental effect on values along routes (due to noise, air pollution, etc), versus a positive valuation around stations. Armstrong's analysis did not look at multi-family housing or office and retail uses, all of which are important ingredients in a TOD.

An interesting part of Armstrong's study was that he also examined the effects of Commuter Rail routes, and not just stations. His hypothesis was that property values between stations would be decreased due to noise and pollution from trains. Unfortunately, the outcomes from this portion of his study was inconclusive, as he was unable to disassociate the negative effects of freight trains from commuter trains on the shared rail system he was looking at.

Relevance: Armstrong's approach of examining stations *and* track routes is a good lesson for holistic research design. His findings regarding property values indicates that suburbanites who preserve their single family housing types near stations can have their cake and eat it too, in that they get the 'benefits' of single family living, the accessibility of Commuter Rail, and a value increase to their properties.

Armstrong's research revealed that it is difficult to isolate out negative effects produce by commuter rail from those produced by freight rail

Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects, Transit Cooperative Research Program, Federal Transit Administration, 2004

This massive 600 page report by a group of researchers led by Cervero and the University of California (Berkeley) also included Parsons Brinkerhoff (Portland Office), Bay Area Economics (San Francisco) and the Urban Land Institute. Its goal is to provide a "comprehensive assessment of the state of the practice and the benefits of transit-oriented development (TOD) and joint development throughout the United States". This report is helpful for this project in that it explores Commuter Rail TOD's as an entity unto themselves, recognizing the disconnect which exists based on transportation technologies. It does so using case studies in the Chicago area, located along the METRA rail system.

The METRA system serves ten counties and three states, and has been operating in one form or another since 1856. It was the first service to introduce bi-level passenger cars (1950), and has been operated under a regional umbrella structure (the Regional Transportation Authority) since 1974. Subsequently, the communities it services were often real-estate ventures led by rail companies. The three case studies explored in this report are all communities incorporated in the 1880's, which have had their downtowns experience decay during the 1960's and 1970's. Therefore, the TOD efforts here have focused on reinvestment and refurbishment of a concept that once existed, while the Seattle and Vancouver case studies have not had continuous rail service for the past 125 years.

The lessons for successful Commuter Rail TOD's in suburban Chicago from this report were:

Sensitive station design. Refurbish existing stations, or locate new ones near downtowns. Parking lot parcels should be fragmented, with station area parcels kept small to help instigate private investment;

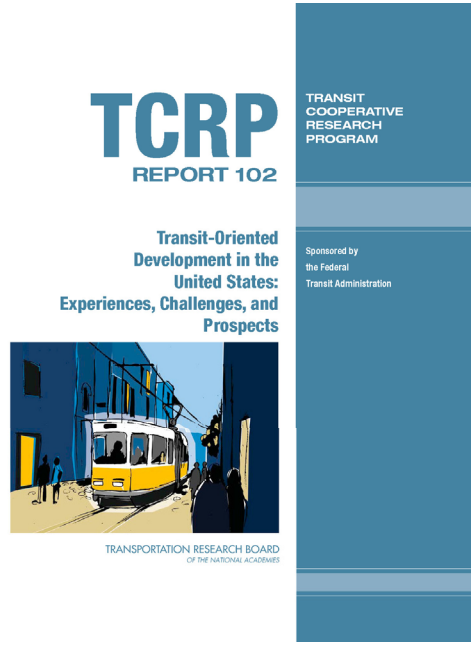
Take your time. Returns on TOD plans are typically in the scale of 15 to 20 years;

Leadership. Essential to the Chicago case studies was the presence of a local champion throughout the plan period;

Parking Management. Good parking facilities are required for these suburban TOD's to succeed. Whenever possible, shared parking facilities should be built;

Supportive Real Estate Market. Bad traffic congestion and a shift in demographics helped provided the impetus for a shift in market demand towards higher density living.

Relevance: This report offered some insight into TOD and Commuter Rail, with a depth which is rarely found in the TOD literature. The Chicago area case studies used are not great for newer Commuter Rail systems, given that they are all located in cities with a long history of commuter rail, and therefore have a better baseline to build from. Therefore, the lessons offered are more geared towards redevelopment, rather than new development. Where this lesson might be best applied in the Seattle and Vancouver case studies is around commuter rail stations which have a high degree of proximity to an existing, older downtown, such as Port Moody or Puyallup.



SUBURBAN STATION AREA LITERATURE

Land use around suburban transit stations, Moon, Henry in Transportation, 1990.

Henry Moon, a transportation planning expert from Ohio, wrote this piece with the goal of assessing the land use impacts of suburban rail stations. He used a case study approach, documenting land use change around 20 suburban stations located along the METRO rail system in Washington, D.C. and the BART system in the San Francisco area. Moon's assessment area was a circle with a 1/3 mile crow-fly radius around the transit node (irrespective of actual network connectivity on the ground)

Findings from this study were somewhat obscured by the number of case studies, which was large enough to obfuscate any identifiable trends. However, there were some salient lessons from this research. First, that the nature of land uses found around station areas varied with proximity to the CBD. While the patterning of this variation was inconclusive, it is an important recognition of the role of proximity in dictating land uses. Second, that the age of the system had a corollary effect on land vacancy around stations. The BART stations, which had been operating since 1972, had much less vacant land surrounding them than the METRO stations, a system which had been around since 1976. The author attributed the reduced development around younger stations as a maturation effect, suggesting that there may be a certain lag time involved for station area development.

This study did indicate that the most common uses found around suburban transit stations were residential and commercial developments, in addition to the transportation service itself.

Relevance: Moon's discussions around lag time for station area development are important for the two systems studied in this report, given the five year separation in system ages between Seattle and Vancouver. The idea that land use composition varies with proximity to the CBD could also be compared against this studies findings, give that the case studies selected within Seattle and Vancouver represent inner, middle and outer suburbs.

CHAPTER 3: METHODOLOGY

The methodology employed in this study will be a comparative case study analysis looking at similar suburban cities who had adopted commuter rail, in order to determine if any common lessons could be learned from multiple environments.

The independent variables which were controlled for were rail technology and community type. Controlling for community type was accomplished through a 'community profiling' process, which is explained in this chapter.

The dependant variable being measured was the commuter rail station areas. The methods for assessing station areas was developed by looking at the components of various Transit Oriented Development definitions. Selected station areas were then compared against their case study partners to see if similar lessons emerged.

The first half of this chapter addresses why the Seattle and Vancouver Regions were chosen, and how the potential case studies selected were determined. The second half addresses the methodology used to assess the station areas through the lens of Transit Oriented Development. The chapter concludes with a look at the data assessment process: how are the results to be analyzed, and how will lessons and recommendations be distilled?

APPROACH

One way to examine the question of Commuter Rail's ability to act as a TOD node, is by using a case study approach. This approach would look at communities where Commuter Rail has been introduced, analyze its integration into the community, as well as its subsequent effects on Land Use.

This case study approach takes the form of a 'matched pair' analysis, where similar communities located in different regions would be compared against each other.

By using a 'matched pair' approach versus looking at a single case study, it would be possible to determine if there are any characteristics which can be generalized with regards to suburban station area development. Stand alone case studies may yield results which are not applicable outside their specific environments.

In order to make this approach successful, the case study approach would have to control for similar regions, similar city types, and similar Commuter Rail technology.

The similarity in regions and cities would be necessary because the research would want to ensure that the environments being examined were products of comparable regulations, populations, and attitudes towards land use development. Controlling for rail technology type would ensure that the station area development was not impacted by inherent aspects of one type of technology, that were not present in another. For example, it would be misleading to compare station area pedestrian environments between a system with an at-grade power source vs. one with an internal power source. Comparing a system which electrocutes a pedestrian who crosses it, versus one which does not, is an apples and oranges type of analysis.

Another constraint limiting case study selection is relevance. Given the trends towards rail investment in North America, it would be beneficial to use case studies which have the most pertinence to Canadian and American cities. While there are many examples to be accessed in Europe, Asia, and Australia, questions arise over the transferability of these lessons to North America, given the differing legislative environments, public attitudes towards public transit, and transportation history of these places.

Therefore it was determined that the use of North American examples may be best suited for case study selection.

"No problem can stand the assault of sustained thinking"
-Voltaire

CASE STUDY SELECTION: REGIONS

The role of Commuter Rail in North America varies greatly across the continent. Typically, east coast cities have a longer history of commuter rail than their west coast counterparts. Cities such as New York have had outstanding service for over a century. While Commuter Rail's impact on land use on the eastern seaboard is well documented[1], its role in influencing land use change on the younger, suburban west coast is not as well researched. Canadian cities, such as Toronto with the GO Trains, have relied on this technology for at least 35 years.

Conversely, west coast cities have made these investments more recently. In the United States, this has largely been due to a later age of development for these cities, which coincided with massive automobile infrastructure investment, notably the Eisenhower Interstate project. The impact on land use in these regions is that the urban form is more suburban, with lower densities, and reliant on the automobile as the primary modal choice. Therefore, the role of Commuter Rail as a catalyst for land use change in the modern day west coast city would be very different than that of a similar technology in a New York commuter town in the 1800's.

Two west coast regions which have chosen Commuter Rail systems in the last decade are Seattle and Vancouver.

As outlined, controlling for various parameters (Commuter Rail technology, Civic similarity) is integral to this type of research. These regions have a number of attributes which make for favorable comparisons.

Top. Toronto "GO Train"
Centre. New York suburban Service
Bottom. Chicago elevated train

1. *Urban Traffic, A Function of Land Use* (Mitchell and Rapkin, Columbia University Press, 1954) was one of the first studies urging a comprehensive approach to transportation modeling; One which included examining social factors in transportation analysis.

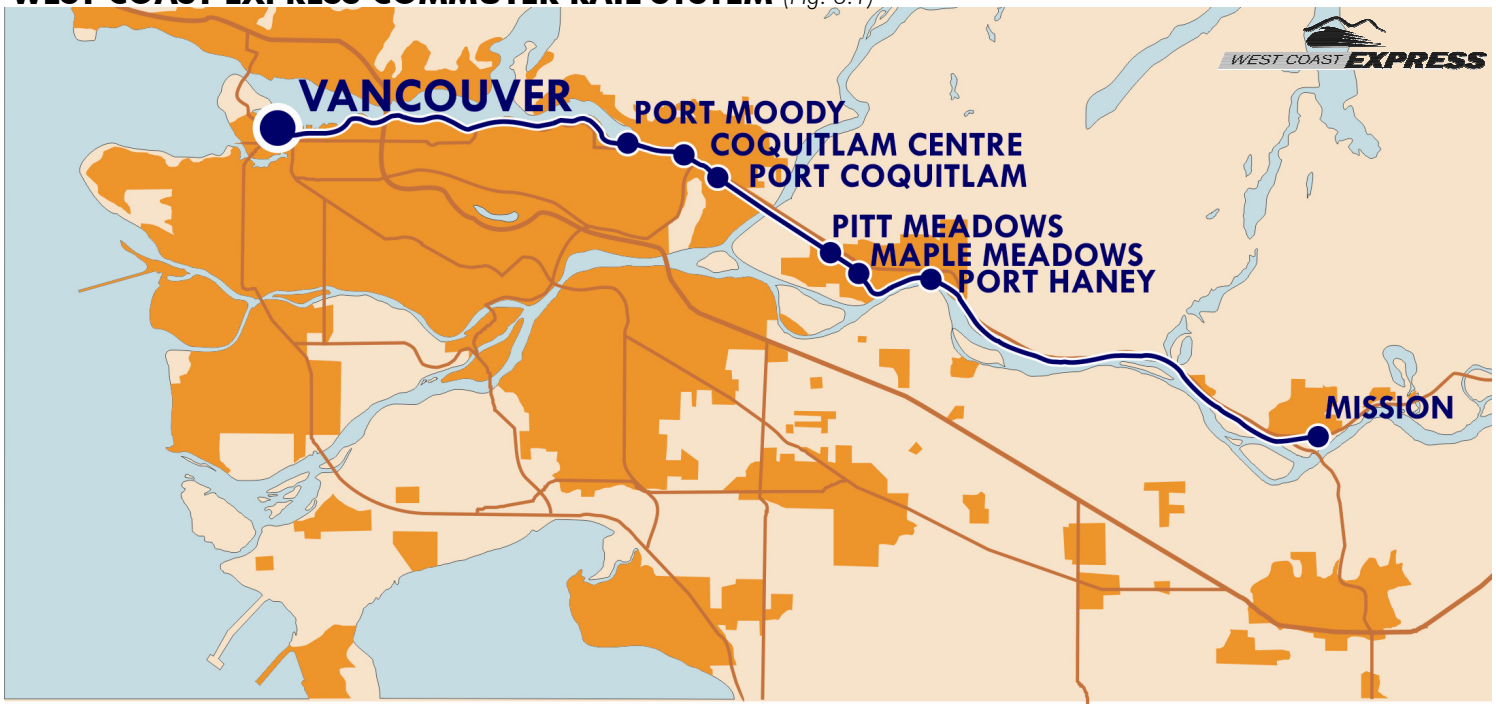
CASE STUDY SELECTION: REGIONS

Both the Seattle and Vancouver systems service a variety of suburban cities, located anywhere from 17 to 70 kilometres from the CBD. Both regions have adopted identical technologies , which rely on the same diesel locomotives (manufactured in the USA) to pull the same passenger coaches (manufactured in Canada). They are both relatively new systems, although Seattle's service is not as mature as Vancouver's which m ay lead to lower ridership numbers.

As Table 3.1 illustrates, the two systems match up very well in terms of route length, cities served, travel time and station types.

Both services are marketed as 'premium services', and boast amenities such as work stations, air conditioning, and in-train cappuccino services. West Coast Express even employs some of its passengers by having them work as coffee servers, and sometimes offer language courses on the train.

WEST COAST EXPRESS COMMUTER RAIL SYSTEM *(Fig. 3.1)*



3.1 (Top) Vancouver — West Coast Express

3.2 (Bottom) Seattle — Seattle Sounder

Table 3.1 Seattle and Vancouver—Systems Overview

	Seattle	Vancouver
Number of Stations	6 Southbound 3 Northbound	8 Eastbound
Total Track	63 km. Southbound (39 miles) 61 km. Northbound (38 miles)	68 km. Eastbound (42 miles)
Total Travel Time	60 min.	73 min.
Daily Ridership	3102	7700
Service Delivery Cost	$19.98 / Passenger	$9.92 / Passenger
Funding Sources	Regional Taxes, Borrowing, Federal Grants, Fares	Fares, Fuel and Parking Taxes, Property Taxes
Station Types	Park and Rides, Kiss and Rides, Transit Exchanges	Park and Rides, Kiss and Rides, Transit Exchanges
Service Inception Date	September 17, 2000	November 1, 1995

SEATTLE SOUNDER COMMUTER RAIL SYSTEM *(Fig. 3.2)*

CASE STUDY SELECTION: REGIONS

In addition to the similarities in technology, these regions exhibit other attributes which make them very comparable, notably their histories and roles as asia-pacific export hubs.

Table 3.2 Seattle and Vancouver Regional Comparison

	SEATTLE	VANCOUVER
Regional Population	3,387,198	2,126,806
Land Area	17,807 sq. km.	12,802 sq. km.
City Age	135	118
City Origins	West coast railway terminus, commodities port, fishing industry support centre, airplane manufacturing, military centre	West coast railway terminus, commodities port, gold rush distribution centre, timber harvesting and processing
Commercial Strengths	Resource extraction headquarters in the past, now high tech oriented	Resource extraction headquarters in the past, becoming high tech oriented
National Role	West coast secondary city	West coast primary city
International Role	North American / Pacific gateway	North American / Pacific gateway
Regional Role	Commercial and transportation core	Commercial and transportation core
Cultural Origins	Convergence of European settlers and Asian immigrants	Convergence of European settlers and Asian immigrants

Seattle

Figure 3.3 (Top) International District

Figure 3.4 (Centre) Pike Place Public Market

Figure 3.5 (Bottom) Waterfront

Vancouver

Figure 3.6 (Top) Chinatown

Figure 3.7 (Centre) Granville Island Public Market

Figure 3.8 (Bottom) Waterfront

REGIONAL COMPARABILITY ISSUES

There are comparability problems between the two regions in several areas which pertain to this project.

First, the Seattle region is characterized by a dual core with Tacoma creating a growth pole at the southern end of Puget Sound. This 'dual primacy' has resulted in growth patterns between the two cities being influenced in two directions (North and South), as opposed to one direction in Vancouver (East).

Second, the history of railroad development in the United States has meant that there is much more railway track[1] per land area, which has significant impacts for modern commuter rail service providers.

In the past, small towns in the US would have been served by several railroads, all with their own unique right of ways and alignments. The result of this locational diversity, is that today there are often several route alignment options for commuter rail, and subsequently several station location options, including a greater opportunity to locate stations close to an existing town centre. This is to be compared against the Canadian model where only two national rail companies were ever present, which predominantly served the agriculture and industrial areas of a city. This is manifested in the commuter rail systems being examined in this report, where Seattle Sounder stations are located closer to existing town centres than the Vancouver stations. Disregarding Tukwila, the Seattle stations are typically 350 metres from the town centre, while the Vancouver station's average proximity is 900 metres.

Third, Seattle has developed an extensive freeway system which serves a larger population and a larger area than that of Vancouver. This investment in automobile infrastructure has a direct impact on commuter rail viability, as well as on suburban form which is generally more auto-oriented.

Another difference is that Canada has a long history of relying on government to provide public services (top down), where as the United States typically looks to the government as a service provider as the last resort (bottom up). This situation is manifested when investments in public services (such as transit) are necessary. The Canadian norm is for governments to authorize spending and be held accountable at election time. The Washington state model for example, relies on onerous referenda which are often highly politicized events, and often ill-attended.

Finally, (and somewhat ironically after the last point), Seattle has a much higher number of regulatory agencies involved in transportation and land use than Vancouver. Seattle has over 5 different agencies providing transit services, 5 different regional governments, and twice as many municipalities per capita than Vancouver[2].

There are comparability issues with all case study research programs. What must be remembered is that much of the existing research in this field has been making much more tenuous comparisons than the one presented here. These two cities are remarkably similar in history, are service by nearly identical commuter rail systems, and are in the end more similar than either would like to admit. While there are comparability issues, they will have a minimal effect on this study.

Figure 3.9 National Highway System — Seattle

Figure 3.10 National Highway System — Vancouver

1. There are over 280,000 kilometres of rail in the United States, compared with 77,000 kilometres in Canada
2. The Puget Sound region has 1 municipality for every 45,160 people, while the Vancouver area has 1 municipality for every 96,636 people

CASE STUDY SELECTION: CITIES

Having determined the two regions to be compared, there was a need to determine which communities served by commuter rail should be examined. The most probable for case study selection are those directly serviced by commuter rail. Therefore the choices are somewhat limited.

It was determined early on that the suburban stations would be the focus of this study, as it seems to be an area which is often neglected in station area development research. In addition, my research interests lie in the impact of transportation technology in suburban environments, where I feel the need for transportation solutions is greatest and where the greatest opportunities for change lie.

The potential for place making in suburban environments may also differ between Seattle and Vancouver, due to the historical location of railways. Whereas railways (and subsequently commuter rail) in Seattle is typically located close to suburban centres, in the Vancouver region suburban railways typically service industrial areas, and attempt to avoid urban centres wherever possible. These locational phenomena are largely a reflection of the historic function of railway infrastructure in their respective countries. This proximity problem must surely have significant implications for station area development.

Time and cost did not permit examination of all the station environments in Seattle and Vancouver. Also, this might not have been the most appropriate approach as there would surely be cases where cities in one region might not have a comparative match in the other region, and thus the lessons learned could not be checked.

It became clear that a minimum number of case studies were necessary to make the 'matched pair' approach significant. With eight potential case study locations in Vancouver, and seven in Seattle, it was determined that looking at three locations in each region would be an appropriate minimum.

As mentioned, there is no desire to examine CBD station areas, so the stations in Seattle and Vancouver were deemed ineligible early on.

Given the dual primacy nature of the Seattle region, highlighted in the previous section, it was determined that Tacoma could not accurately be classified as a suburban centre, and was therefore eliminated. To classify western Washington's 2nd largest city, and a recognizable core unto itself, as a suburban centre would be incorrect and not help in achieving the goals of this project.

After eliminating Seattle, Tacoma and Vancouver, there are seven potential Vancouver area cases remaining, and five Seattle area candidates. Therefore, a process was needed to determine how six station areas would be selected as case studies. This process which would require a thorough analysis of each potential site.

Thus, the task of creating 'Community Profiles' commenced.

Variables Used in Community Profiling

Environment

- LandUse Composition (In order)
- Driving Distance to Core in km.'s
- Driving Time to Core in minutes
- Primary Landuse
- Peak Res. Bldg. Decades
- Area (sq. km.'s)
- Pop. Density (pop / hectare)
- Commuter Rail Distance to Core (CBD) in km's
- Commuter Rail Travel Time to Core (CBD) in minutes
- Commuter Rail Facility Charactersitics
  - Facility Size / Cost?
  - Facility Parking
  - Parking Type
  - Station Proximity (Observation)
  - Station Proximity to municipal core (Km.)

Economic

- Median HH Income (CDN)
  - % Difference between local and state / provincial median HH Income
  - % Difference between local and regional PSRC and GVRD) median HH Income
- Primary Employment Sectors
- # of Business
  - # of People Per Business
  - # of Households Per Business

Social

- Population
- Civic Identifiers
- Avg. Household Size
- Median age of population
- # of Households
- City Age (Incorporation Date)
- Regional Government

CASE STUDY SELECTION: COMMUNITY PROFILING

As the research was looking to compare like cities in different regions, there needed to be a set of controls established to ensure that similar communities were selected.

To determine what makes a community, and therefore enable us to compare one city against others, a list of variables was created which captured the numerous aspects with which a city can identify itself. These variables had to be as catholic as possible in order to represent the number of ways in which a city can be identified.

For example, some cities are defined by their primary employers, such as Redmond, WA being linked with Microsoft. Others are identified with transportation entities, such as SeaTac, WA or Port Moody, B.C.. Another example may be community identities based on natural features such as Delta, B.C., and another still could be historic settlement patterns (Ft. Langley, B.C.). The reality is that the identity of cities is often linked to more than just one of these potential aspects, and more than likely a combination of many.

The list of variables compiled was meant to triangulate across the spectrum of civic identifiers, using the
main tenets of sustainability (Economy, Society, Environment) as a guide.

The variables used would have to be relevant to every potential case study, so that similar data could be collected for each potential case study. The variables would have to examine issues relating to transportation and land use, as these were the guiding tenets of this research. And the list would have to address the breadth of ways in which a city can be identified.

While the complete list of variables was quite comprehensive, those variables which were deemed likely to be used to define community identity were weighted more heavily than others.

Once data collection for these variables was complete, and a determination was made about the hierarchy of these variables, cities were compared against each other to see where similar characteristics occurred.

The city profiling exercise results are synthesized on the following pages. This illustrative display of the findings highlights many of the similarities which exist across the two case study regions.

CASE STUDY SELECTION: COMMUNITY PROFILING RESULTS

VANCOUVER

As Canada's 3rd largest city, over half a million people call Vancouver home. The city's CBD is home to a number of mining and forestry head offices, as well as the largest shipping port on the west coast.

Port Moody

Port Moody is located 27 km.'s from Vancouver along Burrard Inlet. A town of only 24,000 people, Port Moody was founded as the original terminus for the railroad, and is still home to a number of shipping industries.

Coquitlam

With a population on 113,000 Coquitlam is one of the the region's largest suburban centres. An old agricultural city with a strong Quebecois heritage, Coquitlam is the largest of the Tri-Cities (Port Moody and Port Coquitlam being the others).

Port Coquitlam

Port Coquitlam, on the Fraser River, is 31 km.'s from Vancouver, and home to 52,000 residents. Founded as a port, single family residential is now the dominant land use. The city has always had a strong connection with the railroad, and is still home to major rail infrastructure.

SEATTLE

The 'Emerald City', home to 560,000 of the region's 3.4 million people, is the largest city in the Pacific Northwest. Once a resource town, it's no known for its high-tech industries.

Tukwila

A major commercial and industrial centre, Tukwila is situated 17 km.'s south of the CBD, and is home to port industries, manufacturing, and distribution centres. It has more businesses per capita than any other city in the area.

Kent

An old agricultural centre, Kent is home to 84,000 inhabitants, and also has a strong industrial and commercial sector. While Single Family Residential is Kent's primary land use, good proximity to the Interstate system makes it an attractive location for logistics and distribution companies.

Auburn

Auburn is a 40 minute commute to Seattle, and is another city with its roots in agriculture. With an average household size of 2.7, and a large amount of park and open space, this predominantly residential community has attracted many families.

Pitt Meadows

Pitt Meadows is an agricultural centre of 15,000 people, located 38 km.'s from Vancouver. It is situated at the confluence of the Fraser and Pitt Rivers, and a large portion of the city is on reclaimed land.

Maple Meadows

Maple Meadows is located 2 km.'s from Pitt Meadows station, on the border of Pitt Meadows and Maple Ridge.

Port Haney

Located in Maple Ridge, Haney is the city's original downtown. The "Horse Capital of B.C.", Maple Ridge is a rural community of 64,000 people located on the north shore of the Fraser River. The municipality's northern reaches are home to Golden Ears provincial park.

Mission

Settled by a religious order in the late 19th century, Mission is an agricultural and forestry home. A 70 km. drive from Vancouver, Mission is in the Fraser Valley Regional District, and is a local service centre for the northern Fraser Valley.

Sumner

Sumner is a small city of 8,000 sharing the same agricultural history as its neighbours. Located 55 km.'s south of Seattle in Pierce County, the city was named by drawing a paper from a hat.

Puyallup

Home to the Western Washington State Fair, Puyallup and its 36,000 residents are the agricultural capital of the region. Puyallup has the highest average household income of any of the cities serviced by the Sounder. "Puyallup" means generous people.

Tacoma

Tacoma is the second largest city in the region, with 200,000 people, and is located 53 km.'s from Seattle on the I-5 corridor. It is a major shipping hub, and home to many institutional uses, including several hospitals, and McChord Air Force Base.

COMMUNITY PROFILING: MATCHED PAIR RESULTS

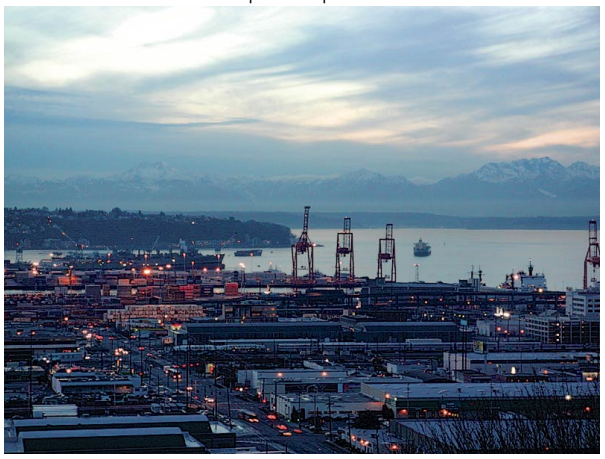
Through this profiling of communities, three sets of cities emerged as the best matched pairs. These two pages contain summaries explaining the rationale for forming these pairs. Using these matched pairs we are able to determine whether or not these similar cities, located in different regions, have experienced similar station area development patterns. Tukwila and Port Moody are inner suburbs with active industrial sectors. Auburn and Coquitlam are middle suburbs, comprised primarily of family oriented residential areas. Mission and Puyallup are historic exurban town centres which retain strong agricultural identities.

MATCHED PAIR 1: PORT MOODY AND TUKWILA

Community	Primary Land Uses	Regional Role	Rail Distance to CBD	Rail Travel Time to CBD	Car Travel Time to CBD	Station Type	Parking Stalls	Station Distance to Suburban Town Centre	City Population	Population Density	Civic Identity	Average Household Size	Number of Households	Median Household Income (Cdn. $)	Population per Business License
Port Moody	1. Parks + Open Space 2. SF Residential 3. Industrial	Inner Suburb	22 km. (14 miles)	25 min.	34 min.	Park and Ride (Surface Parking)	269	2 km. (1.2 miles)	23,816	9.3 / ha	1. Port Industries 2. Railway Terminus	2.79	8,535	$64,932	20.62
Tukwila	1. SF Residential 2. Industrial 3. Commercial	Inner Suburb	17 km. (11 miles)	20 min.	17 min.	Park and Ride (Surface Parking)	250	2 km. (1.2 miles)	17,230	7.7 / ha	1. Commerce 2. Transportation Hub	2.4	7,186	$53,683	8.62

Tukwila and Port Moody represent inner suburbs which have a strong industrial component. The large amount of Park and Open Space in Port Moody can be attributed to a large, undeveloped urban reserve and is not necessarily indicative of a low density community. Both communities have similar rail proximity to the CBD, although the road network in Tukwila includes two interstates which greatly decreases car travel time. Station types are similar, although the Port Moody station is closer to Port Moody's town centre. Both cities also have similar historic backgrounds based on transportation and shipping. Port Moody and Tukwila still retain deepwater port facilities which are actively used. One area of discrepancy between these two case studies is in the area of housing. Tukwila is a lower income community with a lower percentage of housing stock occupied by families. Port Moody on the other hand has a quite large average household size, indicating it is a popular location for families. Tukwila is also much more commercially oriented, with a very high amount of business activity per capita, illustrated by its population per business license ratio and its civic identity.

Figure 3.11 Both Tukwila and Port Moody are home to deepwater ports and related industries



MATCHED PAIR 2: COQUITLAM AND AUBURN

Auburn and Coquitlam are single family residential suburbs with a large number of families. They both have an average degree of proximity to the CBD by both vehicle and commuter rail. Given Coquitlam's large area, some areas of the city would more likely be classified as inner suburbs vs. middle suburbs. The difference in station types are an interesting but not crucial difference. The population difference is large, but is to be expected given the high municipal fragmentation found in the Seattle area. The population of the station's service areas are probably quite similar, given the similar parking numbers at both stations. Household level attributes match up very well, as do the ratios between commercial and residential activity. Neither of these communities are dominated by business uses, a fact Coquitlam has attempted to address by drafting policy which attracts employers.

Community	Primary Land Uses	Regional Role	Rail Distance to CBD	Rail Travel Time to CBD	Car Travel Time to CBD	Station Type	Parking Stalls	Station Distance to Suburban Town Centre	City Population	Population Density	Civic Identity	Average Household Size	Number of Households	Median Household Income (Cdn. $)	Population per Business License
Coquitlam	1. Parks + Open Space 2. SF Residential 3. Undeveloped	Inner / Middle Suburb	25 km. (16 miles)	30 min.	35 min.	Park and Ride (Surface Parking)	550	.4 km. (.25 miles)	112,890	9.3 / ha	1. Agriculture 2. French History 3. River	2.80	40,220	$52,657	21.2
Auburn	1. SF Residential 2. Parks + Open Space 3. Industrial	Middle Suburb	35 km. (22 miles)	34 min.	41 min.	Park and Ride (Parkade)	603	.3 km. (.2 miles)	45,355	1.7 / ha	1. Agriculture 2. Railways	2.82	16,108	$51,692	17.4

Figure 3.12 Auburn's town centre includes a public plaza decorated with large pieces of art...

...while Coquitlam's does not. *(Figure 3.13)*

MATCHED PAIR 3: MISSION AND PUYALLUP

Community	Primary Land Uses	Regional Role	Rail Distance to CBD	Rail Travel Time to CBD	Car Travel Time to CBD	Station Type	Parking Stalls	Station Distance to Suburban Town Centre	City Population	Population Density	Civic Identity	Average Household Size	Number of Households	Median Household Income (Cdn. $)	Population per Business License
Mission	1. Parks + Open Space 2. SF Residential 3. Agriculture	Exurban	68 km. (42 miles)	73 min.	80 min.	Park and Ride (Surface Parking)	220	.2 km. (.1 miles)	31,272	1.4 / ha	1. Agriculture 2. Forestry	2.92	10,705	$49,900	21.76
Puyallup	1. Parks + Open Space 2. SF Residential 3. Agriculture	Exurban	57 km. (35 miles)	47 min.	53 min.	Park and Ride (Surface Parking)	300	.27 km. (.17 miles)	35,690	11 / ha	1. Agriculture	2.76	12,870	$62,300	16.13

Puyallup and Mission represent peripheral suburbs which still maintain their links to primary industry. Mission is still a hub for forestry and farming, while Puyallup is renowned for its state agricultural fair. These communities have similar proximities to the CBD via commuter rail, but not by vehicle as Puyallup has easy access to the I-5 corridor which reduces comparative travel times. Both communities have park and ride commuter rail stations with surface parking lots, and the stations are both located close to the suburban downtowns. Many other attributes are extremely similar as well. These include population, households and household sizes. Both communities are popular with families, with some of the largest household sizes of all the case studies. The difference in income levels is unfortunate, and could impact ridership numbers.

STATION AREA ASSESSMENT

With the case study cities selected, the next step is to determine how to assess the effectiveness of commuter rail station areas in developing according to the principles of Transit Oriented Development. To assess this question, we need to return to what the primary elements of a TOD are, determine what measures are most appropriate to assess the presence of these elements within the case study cities, and figure out what the best approach to conducting field work would be.

In order to guide the production of a measurement system, a list of sampling principles was identified. The goal of these principles was to provide a framework for developing measures. The sampling principles were as follows:

1. **Consistent Methodology** In order to reduce variability of results, it was preferable that the measurement standards used to analyze these criteria would be constant across all case studies.
2. **Replicable Process** Whatever measurements were used would have to be replicable across all case studies. That means that the measures used would have to be applicable to all case study environments for purposes of validity.
3. **Logistically efficient** With restrictions placed on the researcher in terms of time and budget, fieldwork for each case study must not exceed the budget for the research.

Looking at the various definitions for TOD (Appendix 1), it is evident that all station areas should contain a set of fundamental elements in order to be considered TOD:

1. The presence of a **transit stop**, preferably on an inter-community mass transit system,
2. A **mix** of **land uses** within **walking distance** of the transit stop, including **residential**, **retail** and **employment** uses, and
3. A **pedestrian friendly** environment, including **small blocks** and pedestrian necessities such as **sidewalks** and **seating**.

The highlighted aspects of point 2 and 3 comprise the dependent variables which require measurement.

Since the presence of a transit stop was an independent variable which was controlled for already, we know that every case study has a station. All case studies would have a commuter rail node which would serve as the spatial focus for this research investigation.

Figure 3.14 Fieldwork would be needed to measure the attributes of the case study stations areas

STUDY AREA: DEFINING SPATIAL EXTENT

Many TOD definitions state that the maximum area of a TOD must be within walking distance of the transit stop. Determining what 'walking distance' is would provide us with the spatial extent of the study area. The problem of course is that people's walking ability is extremely varied. For example, a study completed in 1996 showed that older adults averaged a walking speed of 4.11 feet / second (.23 of a mile in five minutes), compared to younger adults who averaged 4.95 feet / second (.28 of a mile in five minutes).

Some TOD definitions attach absolute numbers to the idea of 'walking distance'. One is Peter Calthorpe's definition, which ascribes that the primary area of development should be no more than a five minute walk from a transit station and the secondary area no more than a ten minute walk. He suggests that a five minute walk is an approximate distance of a quarter of a mile (1320 feet), while a ten minute walk is a distance of a half a mile (2640 feet).

Calthorpe's definition coincides well with American's daily walking trends. In 1995, the National Personal Travel Survey (NPTS) determined that the average walking trip in the United States was .52 of a mile (2745 feet), just over the ten minute walk that Calthorpe used to define the maximum extent of a TOD. The same survey noted the majority of walking trips (74%) were under the .52 mile average. This reflects that most people in the survey could comfortably walk the ½ mile maximum prescribed by Calthorpe.

Given the congruence between what people are actually walking (average walking trip distances in the NPTS) and existing TOD definitions of walking distances, it was determined that the ¼ mile and ½ mile limits developed by Peter Calthorpe would be an appropriate measure to utilize in this study.

Measure: This study will assume the 'walking distance' definition set out by Peter Calthorpe of 1/4 and 1/2 mile distances, as these are lengths which constitute a walkable distance as illustrated by the NPTS.

Figure 3.15 The spatial extent of a TOD must be a walkable distance.

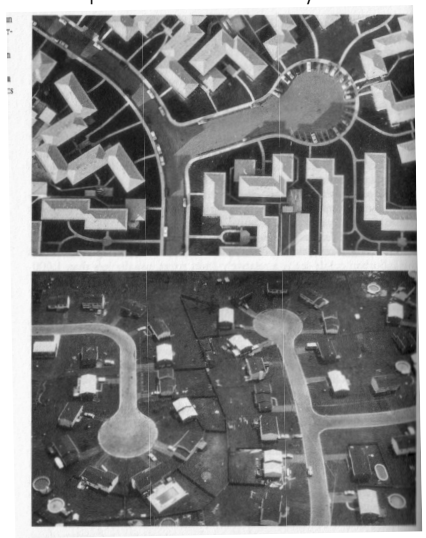
STUDY AREA: DEFINING SPATIAL EXTENT

The spatial extent of a TOD is now determined, and therefore the study area. However the ¼ mile and ½ mile study areas are in reality only theoretical maximums as they are 'crow fly' distances and not distance that can be traveled on the ground, or 'network' distances. This is because street networks can never stretch out for equal lengths in all directions.

One field of research which looks at this difference is found in the literature around 'ped-sheds', short form for 'pedestrian walk sheds'. Pedestrian walk sheds show the actual walking distance from a point, using pedestrian networks found on the ground. To create a walk shed, pedestrian routes are mapped out from a central point (in this case a commuter rail station) to a finite distance (i.e. ¼ and ½ mile distances). The area within these distances is the pedestrian walk shed. Street networks which have good connectivity (i.e. pedestrian friendly grids) will therefore have the largest walk sheds, while street networks with poor connectivity (i.e. cul-de-sac streets, or circuitous networks) will have smaller walk sheds.

The question for this study then becomes do we look at ¼ mile 'crow-fly' distances, or 'network' distances? The answer is both. The reason for studying both is that the crow-fly distances represent a theoretical maximum for a TOD to fill. The network distance on the other hand, shows how the built form has actually developed. Therefore, the larger the area accessible by the 'network' distance, the more connectivity available to the pedestrian, and the more successful the station area has been at adhering to the principles of TOD.

Figure 3.16 Disconnected streets reduce pedestrian connectivity



Measure: This study will create study areas based on a ¼ mile and ½ mile walking distance from the transit node. The study areas will look at both crow-fly distance and network distance, in order to determine how much of the potential TOD area is actually being utilized.

LAND USE INVENTORY

While there are many methodologies available to measuring land use mix, the first step was to conduct a basic inventory, which would provide an 'n' value. An inventory of land use at the sub-parcel level is one of the highest resolutions of data collection available for planning studies, and was the starting point for measuring mix.

There are many methods available for inventorying land use.

Zoning maps can be used, but they reflect desired land use as opposed to actual land use. For example, an area zoned for commercial uses may allow everything from a law office to a coffee shop. Also, zoning designations may not take into account uses which are legal, non-conforming uses (i.e. uses which do not conform to the zoning bylaw, but have been 'grandfathered' in). Zoning also doesn't take into account those activities which are not legal, such as sidewalk flea markets, or unlicensed street vendors.

Another option is using tax assessment data. This type of data usually contains business name and type for commercial activity, as well as a measure of spatial extent (i.e. square feet). There are problems associated with this type of data as well. Assessment data is usually updated once a year at most so some data may be out of date. Another problem is that different assessment jurisdictions employ different assessment techniques which could lead to incomparable data. For this study, this point is exacerbated by the fact that Seattle local government's each have their own independent, elected assessors, while in British Columbia there is only one provincial assessment body, which is independent of state control. Finally assessment data can be very limited in terms of access, as there are often concerns around use of property owner's information, especially with regards to privacy.

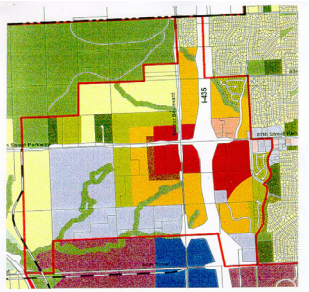
A third option is an observed inventory. This would involve a researcher going into the field and recording land uses at an appropriate level. This creates an inventory which is at a resolution (i.e. parcel, sub-parcel) most appropriate for the researcher, and also results in data which is temporally current. The drawbacks are that it is possible that some land uses may be unattainable, due to issues such as being within private buildings, or been non-visible from the researchers vantage. A personal inventory is also a time consuming method, especially given a large study area.

The observed inventory process' benefits (temporal relevance, perceived accuracy, relevant resolution) far outweigh its drawbacks. While time-consuming, it is also cost-effective, given the excess of spare time a graduate student possesses.

In preparation for the land use mapping aspect of the case study assessment, air photos and cadastral base maps were acquired from case study municipalities to be used as base maps.

Measure: This study will make a first-hand inventory of land use in the study areas, in order to assess the presence of 'essential' TOD uses such as retail, residential, and employment centres.

Figure 3.17 Land use maps are one way of displaying measured land use



LAND USE MIX

While the inventory of land uses would give us a total number of land uses, a measure of land use mix needs to be determined. The requirement for a mix of land uses in a TOD is focused on the three primary elements of residential, retail and employment centres. The mix of land uses is important to ensure a high level of activity, and to provide retail and employment opportunities to residents.

A mix of residential uses is important, as it ensures that there is a wide diversity of housing types, which can subsequently attract a diverse population. This diversity of housing also allows people living in a neighbourhood to upsize or downsize their living situation based on their changing lifestyle (i.e. the idea of aging in place). There is also an economic argument for diversity of housing types. By providing a range of housing product, a developer can ensure that there is a measure of resiliency built into projects.

A retail presence also lends to the idea of constant activity in an urban centre. Retail is also important for local residents, as it means that their daily shopping needs can be met within a walkable distance. This cuts down on vehicle miles traveled, and if designed with street orientation in mind can animate the streetscape with shoppers. Retail is also a use which contributes to the employment base of a TOD.

Employment is a required component of any Transit Oriented Development. The need for employment centres does not preclude non-office employment, such as light industrial uses or institutional uses. A measure of employment will also be necessary within the study areas.

Measuring mix is a difficult prospect however. Is the number of unique uses most important? The amount of activity generated by each use? There is no one method to define 'mixed use', and certainly some station areas may have a successful mixture of uses which would be failures in other situations. This difficulty should not preclude us from examining the mix of land uses. The difficulty in assessing this issue lends to a flexible approach, such as a qualitative narrative which describes the mixture of uses, and how they contribute, or take away from, the station area environment. This qualitative narrative can build upon and explain the land use data collected during the inventory process.

For this project, the land use mix aspect of TOD will be examined through a qualitative narrative, examining the various uses present, and their positive or negative contribution to the TOD.

Measure: This study will present a qualitative assessment of land uses within the study area, based on observed land use mix.

Figure 3.18 The mix of land uses must include residential, retail and employment centres.

RESIDENTIAL TYPOLOGIES

A diversity of residential housing types are an essential element of a TOD core area. A range of types ensures a range of residents, allows people to upsize and downsize within their neighbourhoods, and provides a measure of economic resiliency by ensuring product options for residents.

There are two aspects of residential uses which are important for TOD core areas, and will therefore be measured. The first is housing type, and the second is density.

Residential housing type can be classified as either multi-family or single family. Single family housing is a housing structure designed and used by one group of related individuals. Multi-family housing refers to any housing development where more than one housing unit exists within a single structure. This could include everything from the smallest duplexes and triplexes, all the way to high rise apartment buildings. It would also include more ambiguous definitions, such as secondary suites located within homes.

TOD principles emphasize locating higher density residential uses close to the transit node. In terms of housing typology, this usually means that multi-family housing should be located close to the transit node, with single family housing found further away from the station (if at all). This distribution is not always the case though. Conceivably, a multi-family development could have lower densities than a single family community. Therefore a measure of units within each housing type is needed.

This study will identify the various housing types in each study area, and compare them against their case study counterpart. In order to ensure comparability, a ratio will be used comparing the number of single family units against the number of multi-family units. Because of the numerous types of multi-family housing, a description of the housing type will be included as a clarifying addendum.

Measure: This study will inventory housing types within the study area, as the first step in determining whether or not density is concentrated in station areas. The inventory of housing types will be supplemented with a qualitative description of multi-family buildings, which will clarify the housing distribution pattern.

Figures 3.19, 3.20 and 3.21
Housing types include Single Family, Duplex, and Apartments

RESIDENTIAL DENSITIES

Measuring housing density is far from a clear process. There are several density measurement options available for use, but I will discuss those best suited for neighbourhood analysis. Those are Net Residential Parcel Density, Net Residential Density, and Gross Residential Density. The following is an explanation of these various measures:

Net Parcel Density

This is a measure of dwelling units per area (usually per acre), which uses the parcel edge as its boundary. This measure does not include public right-of-ways, such as streets or public infrastructure associated with residential uses, such as playgrounds. Additionally, this measure examines only those parcels which are residential or mixed-use. Because of the limited spatial definition of this measure, it typically returns higher density measures than the other methods examined here. This method requires a high degree of knowledge about the neighbourhood, especially location of parcel boundaries.

Net Residential Density

Again, this is a measure of dwelling units per area, which looks only at residential portions of a neighbourhood or city. The spatial edge used in this measure is the centre-line of adjacent streets, rather than the parcel line. This measure returns lower density measures than *Net Parcel Density*, as it incorporates uninhabited (hopefully) streets. This method requires a fair degree of data processing, as the researcher constantly needs to define the spatial extents of residential areas.

Gross Residential Density

This is the easiest and most rudimentary measure of density. It is the measure of dwelling units over an area, and includes all land uses (residential or other), as well as all public right of ways. It requires a well defined spatial extent, and if it's being used to compare different locations, the spatial extents should be constant across all examples. This is the easiest and quickest method to measure density.

This study will use both gross residential density as well as net parcel density. By using both methods, a more clear picture of the housing inventory can be constructed. For example, communities with low gross densities but high net densities reflects a situation where units are probably concentrated in very dense housing types, but is a low amount of total housing. This is an example of how comparing between two measures can better inform us about the nature of the housing stock in these case studies.

Measure: This study will look at the gross and net densities of housing in the study areas, in order to see if higher density uses are located closer to station areas.

Figure 3.22 Apartments usually produce the highest densities of any housing type

COMMERCIAL CHOICE AND TYPOLOGY

Goods and service providers in the study area are important for many reasons. Not only do they provide shopping opportunities for commuters, they are also employment generators, and if properly configured can animate streetscapes with pedestrian traffic.

There are many forms which commercial services can assume, with corresponding impacts on density and mix. Farmers markets, high-streets, shopping malls and big boxes are all examples of retail typologies in use in North America today. Each of these typologies offers a unique set of positive and negative aspects, which will be briefly assessed here within the framework of Transit Oriented Development. As noted, the *mix* of land uses is an important element of Transit Oriented Developments. TOD principles state that there should be a degree of variety within a station area, which includes various goods and service providers, as well as choices for the shopper.

With regards to mix, smaller stores will translate into a higher mix value, because many larger stores offer a variety of products within them. Stores which have larger floorplates, such as big box stores, will limit retail variability within the case study because of their large sizes which simply limits the amount of land available for other uses. This is exacerbated by the traditional need for large surface parking lots and other vehicle infrastructure (i.e. access roads) around these stores. Shopping malls (which *can* offer a high mix of uses within their facilities), also require large parking areas to service their customers, and while achieving a higher measure of retail choice than large format retailers, do not come close to offering the variety of street-front retail. Street-front retail is that which fronts directly onto the sidewalk, with parking facilities located on-street, and service facilities in a rear lane.

While a mix of retail uses is important, it is also crucial that the available retail includes tenants which are used on a daily or highly frequent basis. These are usually Food Store Type Merchandisers (FSTM) and Service Commercial uses, which includes grocery stores, produce shops, or coffee outlets. Examples of less frequently visited retail are Department Store Merchandisers (DSTM) and Automotive Retailers. While the type of retail a TOD should have is not specified in most definitions, retail uses which are used on a daily basis generate many of the positive externalities sought after by TOD proponents. Daily retail uses generate more trips than other retail types, and by keeping them close to transit and residential uses, the opportunity for people to walk to retail uses will increase. This will generate pedestrian activity on the street, while mitigating against superfluous automobile trips, both goals of the TOD.

This study will assess the amount of commercial choice in the case study areas (discrete commercial entities) as well as the nature of the retail (daily retail vs. infrequent retail) in the study areas. The former will provide a measure of consumer choice within the case studies, while the latter will permit a qualitative analysis of how the retail activity is contributing to the TOD principles of the study area.

Measure: This study will look at the type, choice, and amount of retail in each study area, to determine how retail activity is contributing to the station area.

Figure 3.23 High frequency uses such as grocers are desirable in TOD areas

EMPLOYMENT CENTRES

Employment centres are another measurable element of a Transit Oriented Development. Places of employment offer retailers an increased customer base and these same people are a potential transit ridership base. As opposed to retail, employment centres are generally not an active part of the public realm as they do not require a ground-floor presence to attract customers. Employment centres can take many forms, from office buildings to industrial uses to institutional sites. Employment amounts can be measured in a number of ways.

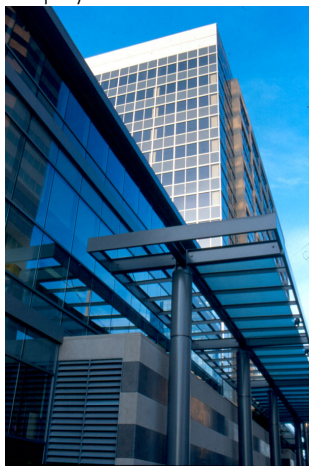
One measure is employment density. This looks at the total number of employees per land unit and can be measured per acre or square foot. Per square foot measurements are more useful at the site level, while per acre measurements allow planners to understand the impacts which certain businesses will have on a neighbourhood scale. For example, a regional retail use may employ around 15 people per acre, while a high-rise office employs 115 people per acre. To determine these numbers for each discrete employment use, one needs to know the total land area dedicated to employment uses, as well as the number of employees on-site. This is very time-intensive when faced with a large study area, and not feasible for this project.

Another method is extrapolating this data using the largest employers in the area. This is not as rigid as the first method, but does provide an insight into the local employment picture. For example, two of the largest discrete land uses in Tacoma are hospitals, therefore it is reasonable to assume that hospitals and health-care are prominent employers in the Tacoma area. This is a much easier methodology, and is fairly quick to accomplish in the study areas, given their relatively small land areas (500 acres). There are problems with such a methodology. For example, the five largest employers may not be indicative of the entire case study. If there are quite a few smaller employers, they will be overshadowed by a few large employers. This however, can be accounted for using a flexible assessment methodology, such as a qualitative discussion regarding employment in the station areas.

This study will look at the five largest employers within each case study area, and calculate an employment density for them, and use this number as a reflection of the employment density picture for the entire case study. Where needed, this will be supplemented by a qualitative discussion about additional employment centres which may be important to the station area, but are not accounted for.

Measure: This study will look at the employment densities of the largest employers in each study area, and use this measure as a comparative analysis of the employment picture in each case study.

Figure 3.24 Office uses tend to generate high employment densities



PEDESTRIAN FRIENDLY ENVIRONMENTS

Pedestrian friendly environments can be measured through a variety of methods, both qualitative and quantitative. This study will look at the quality of the pedestrian realm, the pedestrian connectivity of the block system, and the amount and quality of sidewalks and seating.

This study will conduct several assessments of the pedestrian realm, beginning with a descriptive assessment which will use street sections as explanatory diagrams. This qualitative narrative will discuss the pedestrian realm from the researcher's perspective, focusing on those attributes which are important to a TOD.

The assessment will also speak to the observed nature of pedestrian activity. The observations of pedestrian use could be accomplished qualitatively through a level of service type analysis. For example, a measure might be number of people per metre per hour. The reasoning behind this measure is that if a pedestrian realm is under-designed, sidewalk's and pedestrian areas should experience crowding, or pedestrians will seek alternative routing (i.e. through parking lots). For this sort of analysis to be representative of the entire case study area, peak period measurements will be used at fixed locations on the sites, the result of which would be a number which should be indicative of the quality of pedestrian realm. Pedestrian volumes can be normalized to the hour to assist in comparability. This may need to be supported with a narrative describing pedestrian use patterns where necessary.

The measurement of small blocks will be done through a measure of pedestrian connectivity, looking at the amount of intersections within the study area. The idea behind measuring intersection density is that whenever there is an intersection, there is the opportunity for a pedestrian to make a choice about their trip. Increased options for pedestrians means a more convenient trip, and therefore a better pedestrian environment.

Measure: This study will measure the quality of the pedestrian realm using a narrative supplemented by street sections, while the pedestrian connectivity of the block system will be explored through a measure of intersection density within the station areas.

Figure 3.25 Pedestrian friendly environments help to encourage people to walk

CASE STUDY METHODS SUMMARY

The following table summarizes the ten aspects of the station area environment to be measured:

TOD Aspect to be Measured	Sampling Method	Qualitative or Quantitative	Purpose
Study Area	400 and 800 metre buffers from station areas	Quantitative	Defines the study area of each case study. This will be supplemented with a look at the actual walkable area (the pedestrian walkshed) around the station versus the potential walkable area.
Land Use	Observed Inventory (Land Uses)	Quantitative	The resulting land use map will show what land uses are present, and how they are spatially distributed within the study area.
Land Use Mix	Qualitative Narrative	Qualitative	The measure of mix will be a qualitative assessment, discussing how the mix of land uses contributes to the study area acting as a TOD.
Housing Types	Observed Inventory (SF, MF, etc..)	Quantitative + Qualitative	The final measure will be a ratio between single family and multi family housing units, which will provide an insight into the range of housing types present in each study area.
Housing Density	Gross Density Measure (Units per acre)	Quantitative	This simple measure will provide the number of units per land area in each study area.
Retail Uses	Retail Type (Day to day, intermittent, etc.)	Qualitative	This will assess the retail uses present, and whether or not they have a positive impact on the study area.
Retail Uses	Retail Amount + Choice (Sq. Ft. + # of discrete retail uses)	Quantitative	This will be a measure of total retail floorspace, which can be used as a comparative against other case studies.
Employment Centres	List of Five Largest Employers	Quantitative + Qualitative	Listing the five largest employers will provide a look at the overall employment picture for the entire case study area.
Pedestrian Friendly Environments	Pedestrian Realm Quality Assessment	Qualitative	The assessment of the pedestrian realm will focus on the quality of the pedestrian experience, and how much the pedestrian realm is utilized.
Pedestrian Friendly Environments	Intersection Density and Pedestrian Usage	Quantitative + Qualitative	This will provide a measure of pedestrian connectivity within each case study area.

ANALYZING FINDINGS

The use of quantitative assessment methods lends itself well to producing some type of mathematical result or ranking of each case study. One could certainly take the results of the quantitative analysis, weight the results according to some set of criteria, and come up with a ranking system of which case studies come closest to being a TOD. However, this sort of 'plan by numbers' methodology often does no tell the whole story, and is difficult to turn into action. Since the goal of this project is to produce a set of guidelines on station area development, a number isn't very useful. Rather, a combination of qualitative and quantitative methods is the preferred route.

The goal of the assessment is to offer insights into the lessons learned from each set of case studies. The best way to do this is to explore each set of case studies individually, using both the qualitative and quantitative results of the sampling to explain the lessons which these cases have to offer. By themselves, each approach has obvious shortcomings. Qualitative assessments can be time intensive, explicitly inject the bias of the researcher, and are often viewed as 'unscientific'. Quantitative assessments cannot easily adapt to unique case study situations, are implicitly biased, produce an often non-significant number as an output, and can be viewed as overly rigid. However when working in conjunction with one another the assessment can benefit from the comparability of quantitative analysis, and the flexibility of a qualitative discussion. This combination of methodologies strengthens the overall assessment process, and hopefully results in a stronger end product.

An example of how this would work is in describing the case study area. The pedestrian walk shed area can be measured using quantitative methodology, and compared against the other case studies in a consistent manner. This spatial measurement can then be supplemented by a qualitative discussion around area characteristics, and what it means for the TOD potential of this site.

At the conclusion of assessing each set of case study pairs, a list of primary lessons will be produced discussing what each matched pair has taught us. These will subsequently lead to a list of recommendations which will contain a summary of the lessons learned, and how communities might use this information to implement TOD goals around commuter rail stations.

CHAPTER 4: ANALYSIS

The Analysis section achieves two goals; the first is to synthesize the findings of the fieldwork in one place, while the second is to relate those findings to Transit Oriented Development (TOD).

This is accomplished on a case-by-case basis, starting with Port Moody and Tukwila, then moving on to Coquitlam and Auburn, and concluding with Mission and Puyallup. Presenting the data in this 'matched' format enables the reader to quickly draw comparisons between the similar city types, an approach which also includes a summary table at the end of the chapter.

Within each case study, the analysis is structured according to the ten methodologies used at each site, found in the table on page 3.25. Each method is briefly summarized, the findings are discussed, and the relevance to Transit Oriented Development is explored. A complete catalogue of all collected data is found in the appendices.

The first two case studies represent inner suburbs, which have a significant industrial base. Port Moody and Tukwila both have deepwater ports, and Tukwila is well known as a regional transportation and commerce hub, being home to port infrastructure as well as airports and highways. The second set of case studies, Coquitlam and Auburn, represent middle-ring suburbs which are largely family communities. These case studies are both old agricultural communities which have matured into residential suburbs, with average household sizes approaching three people per household. The final two case studies are Puyallup and Mission. These are exurban communities which have been on the periphery of urban areas, and are now becoming incorporated into their larger metropolitan areas as growth continues outwards. Traditionally agriculture and resource towns, these final two case studies have historic downtown areas established in the early parts of the 20th century.

CASE STUDY PAIR: PORT MOODY AND TUKWILA

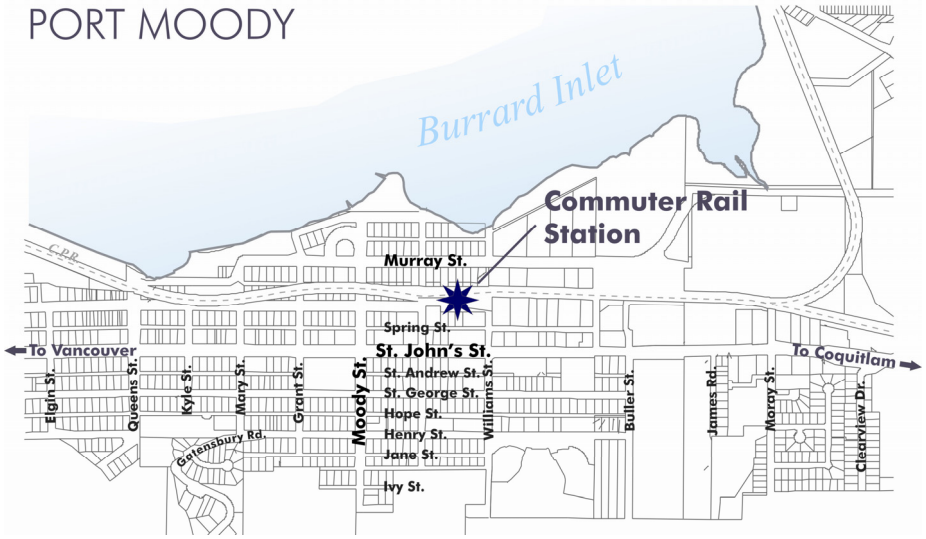
This first case study pair represent inner suburbs which contain strong industrial sectors and have the closest commuter rail stations to the CBD.

CASE STUDY 1: PORT MOODY

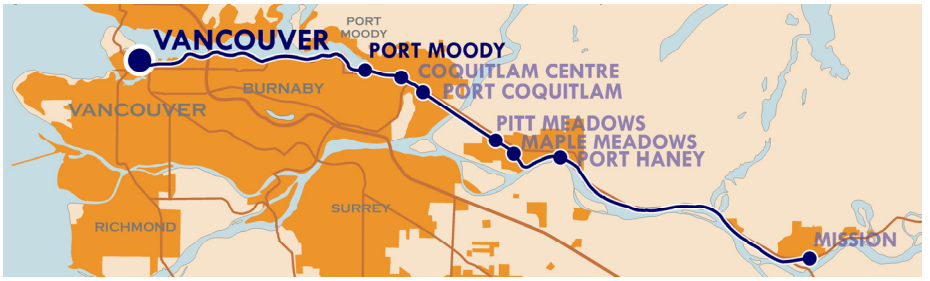
INTRODUCTION

The city of Port Moody is an inner suburb of 24,000 people with an active industrial base which includes a deepwater port, a bulk terminal facility, and a sawmill. Located at the eastern end of Burrard Inlet, Port Moody was founded as a maritime commerce hub, and today retains many maritime related industries. Both Port Moody and its Seattle case study partner Tukwila, are the closest stops to the CBD on their respective Commuter Rail systems. Port Moody is 25 minutes by train, and 22 kilometres from downtown Vancouver. With an average household size of 2.8, the city is home to many families. Port Moody's commuter rail station is located one block off of St. John's Street, an east-west arterial which runs parallel to the rail line and is home to Port Moody's primary retail centre and its historic downtown.

4.1 Port Moody's many "St." streets aren't named after saints, but are rather due to a typographical error which placed the 'St.' abbreviation before rather than after the street name



(L-R) 4.2 Port Moody's historic rail station *4.3* West Coast Express Station *4.4* The Sonrisa project on St. John's Street



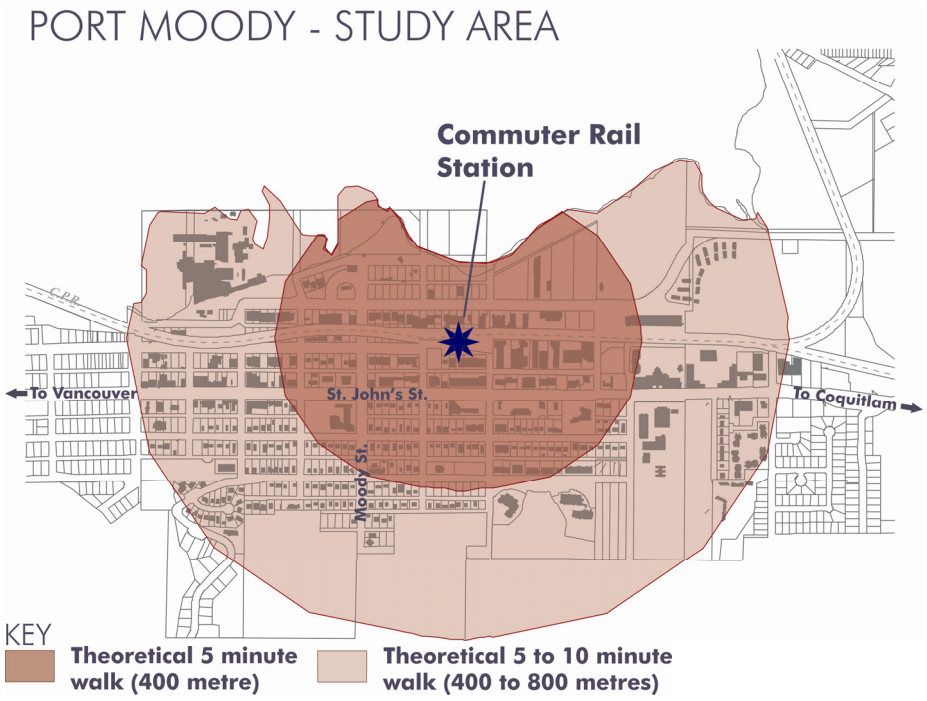
CASE STUDY AREA

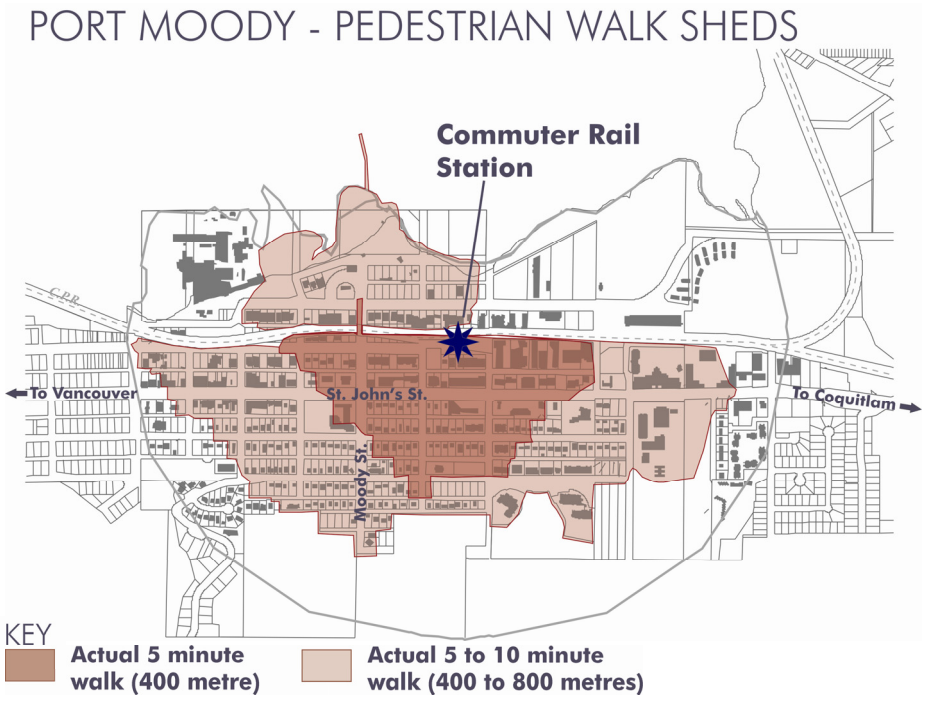
This study area represents the theoretical catchment area of a Transit Oriented Development (TOD), which at its maximum should be a ten minute walk from the transit station. The study area was determined by drawing 400 metre (1/4 mile) and 800 metre (1/2 mile) rings around the Commuter Rail station, which represent five and ten minute walks respectively. The station is defined as the physical extent of the station building, rather than the property line. When these five and ten minute walk 'rings' overlap water bodies, the water areas are not considered part of the research area and are netted out.

In the case of Port Moody, the potential area which could be reached by a five minute walk contains 144 acres of land, while the potential area which could be reached by a five to ten minute walk contains 280 acres of land, for a total study area of 424 acres (139 acres of the study area are in Burrard Inlet, and are excluded).

However, these areas are arrived at based on a 'crow-fly' distance, and not an actual walking distance, which would rely on pedestrian networks such as sidewalks and paths. As mentioned in the methodology section, this study would also examine the actual area reachable in a five and ten minute walk from the station. This was done by analyzing pedestrian networks, and determining which parcels could actually be reached by walking 400 meters from the station. In Port Moody's case, a five minute walk allows the pedestrian to access 56 acres of land, while a 5 to 10 minute walk allows access to an additional 140 acres of land. This means the actual area accessible through a ten minute walk is 196 acres; Or out of a potential area reachable of 424 acres, only 46% can actually be reached by a ten minute walk.

The primary barrier to pedestrian accessibility is the railroad tracks which the West Coast Express commuter rail service uses. There is only one pedestrian crossing of these tracks within the study area, which limits accessibility to the land on the north side of the railroad. For example, to reach a parcel located 16 metres away from the station on the opposite side of the railway tracks, requires a 470 metre walk. This lack of connectivity does not conform to TOD principles, as it literally cuts off potential transit users from transit facilities and in this case retail activity as well. Maximizing pedestrian connectivity in station areas is essential to attracting customers who might walk to transit.





LAND USE

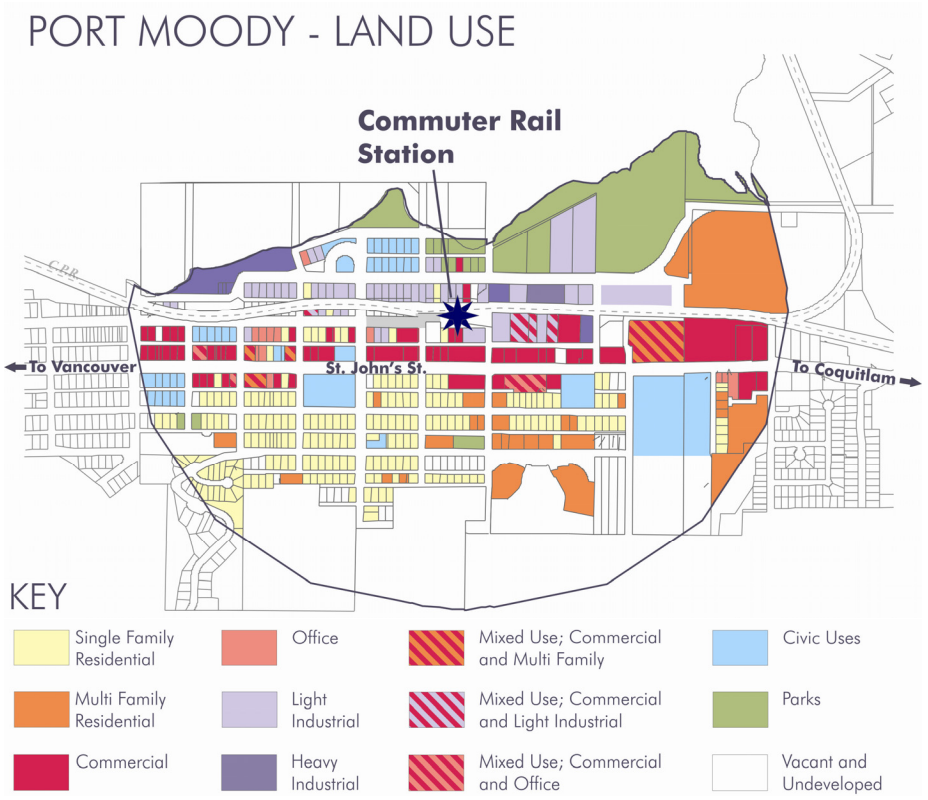
The land uses in the Port Moody case study are easily defined by transportation routes. Industrial uses are north of the railroad near the water, commercial activity is on St. John's Street, and residential uses are located south of St. John's Street.

Industrial uses in the study area are predominantly small scale light industries, with the one exception being the Flavelle Sawmill Company, which occupies 28 acres of land in the northwest portion of the case study. The industrial uses have a large proportion of marine service and repair companies, reflecting Port Moody's past and present role as a maritime community. Retail and commercial uses are focused along St. John's Street, which is also known as the Barnet Highway, Highway 7a and (incorrectly) the Lougheed Highway. This is a six lane thoroughfare which connects the tri-cities to Burnaby and Vancouver, and experiences large traffic flows in the morning and evening peak periods. A significant portion of the street level commercial activity is auto related, including car and motorcycle dealerships, auto repair facilities, and service stations. Office uses in the case study are all local serving, and are located in storefronts, or above retail establishments. Office uses are dominated by financial service providers, law offices, and accountants. St. John's Street is also home to two school sites and other civic uses such as an art gallery and a police station. The residential area begins one block away from St. John's Street, with the bulk of the multi-family development located in the southeast of the study area. The concentration of multi-family development in the southeast is in the form of three story apartment buildings, where as multi-family development located elsewhere is primarily smaller scale, in the form of duplexes and triplexes. There are also a few mixed-use buildings located on St. John's Street, which have been recently constructed.

LAND USE MIX

One of the case study's greatest assets is the linear nature of the community, reflected in the retail presence along St. John's street. Over 90% of housing units in the study area are within 400 metres of St. John's Street, which ensures all residents have fairly easy access to retail services. Unfortunately, the retail environment of St. John's Street is dominated by auto-oriented developments, with building forms that offer little interest to the pedestrian environment and tenants which do note generate local trips. St. John's Street is also an extremely busy street, with over 28,000 vehicles a day traveling on it. The poor pedestrian environment on St. John's and the lack of local serving retail diminishes the benefits of having residential in close proximity to retail.

The industrial uses in Port Moody are an important employment base for the community, as well as a tax base for the municipal government. The separation of industrial uses by the railroad isolates many of the negative externalities associated with these uses, such as truck traffic and noise. Where industrial uses are in close proximity to retail uses, such as in some areas along St. John's Street, there is a noticeable effect with trucks blocking sidewalks, industrial use spilling out into alleys, and generally poor street maintenance and upkeep. The downside of concentrating industrial uses along the waterfront lies in their ability to act as a barrier to public access. Residents may be much more apt to visit a waterfront if they were shielded from the negative effects of industry, and if they had more access to the waterfront.



	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	20	*17.7%*	15	*25.9%*	35	*20.5%*
Periodic Uses	93	*82.3%*	43	*74.1%*	136	*79.5%*

According to TOD principles, commercial uses should be concentrated in the area closest to the station area. Commercial uses in the Port Moody case study comply with this principle, and as mentioned are focused along St. John's Street. There are a total of 171 goods and service providers in the study area, and two out of three of those are within 400 metres (1/4 mile) of the commuter rail station. This concentration of retail appears to be very encouraging for Transit Oriented Development. However, when the type of retail is examined more closely, it is revealed that few of the tenants contribute to Transit Oriented Development.

The majority of the retail is not of the type which generates frequent trips (such as grocers, cleaners, produce stores, etc.). Only one in five commercial uses in the case study are high frequency uses. The remainder are low frequency uses including car dealers, automobile repair facilities, or tattoo parlors. In fact 16% of tenants exist solely to service automobiles, such as gas stations, auto repair facilities and car washes. These lower frequency uses also tend to be more auto-oriented in nature, as they don't attract pedestrian walk-by traffic. While a pedestrian might stop by a grocery store for some milk, it is unlikely that they would stop in at a tattoo parlor for a quick inking. These low frequency uses also tend to function primarily in the daytime. This means that once these shops close down, the area becomes deserted with the lone produce or convenience store sandwiched between four closed auto-body shops. This does not lend to an active round-the-clock environment for the pedestrian traffic which Transit Oriented Development is meant to generate in its retail core.

Figure 4.5 Much of the commercial activity on St. John's Street is auto-oriented

HOUSING CHOICE

Housing in the Port Moody case study offers a moderate level of choice, with 74% of housing units in the multi-family category, while the remaining units are single family (detached) houses.

The multi-family sector is dominated by apartment homes, while there is also a smattering of duplex and triplex units. Having such a limited range of multi-family product diminishes some of the benefits that multi-family housing produces. There are not as many options for young families, who will often look for ground oriented product. Additionally, the lack of first floor activity in apartment blocks takes away from the quality of the streetscape. Also, the spatial distribution of multi-family residential is also a drawback. The majority of multi-family units are in the southeast and northeast of the case study, outside the five minute walk 'ring' from the commuter rail station. These units are also several blocks from the retail area of St. John's Street. This removal of people (and subsequently street life) from the retail area runs counter to the ideals of Transit Oriented Development, which stresses the need for higher density development close to shopping and transportation.

The outlook for housing choice in the case study area remains positive. The Sonrisa development, a mixed-use project on St. John's Street, has introduced 250 housing units, while the Klahanie and Indigo projects on Murray Street (currently cut off from downtown) will eventually contribute an additional 477 units in the case study area.

	Units	% of Total
Single Family	193	19.5%
Multi-Family	799	80.5%
Duplex	*20*	*(2.0%)*
Quadplex	*4*	*(0.4%)*
Party Wall Townhouses	*121*	*(12.2%)*
Apartments	*654*	*(65.9%)*

HOUSING DENSITY

The overall gross densities for the study area remain low, with an average of 2.3 units per acre (UPA) in the entire study area. For some context, the residential areas of Dunbar in Vancouver and Queen Anne in Seattle have between 4.5 and 5.5 gross UPA. This low number can be largely attributable to the industrial base of the case study, which contains almost no housing units. This is confirmed when these gross density numbers are compared to net parcel densities, which reflects the number of units located within residential parcels, rather than within the entire case study. These numbers are significantly higher, and reflect more accurately the high number of multi-family units in the case study area. A positive note is that densities increase towards the commuter rail station area, a key principle of Transit Oriented Development.

Comparing the gross and net densities may reflect on an opportunity for infill and redevelopment in the Port Moody case study, with much of the case study area occupied by non-residential uses, including vacant parcels.

Gross Unit Densities*

5 minute walk 'ring'	
Total Units	373
Acres	143.8
UPA	2.6

10 minute walk 'ring'	
Total Units	619
Acres	279.6
UPA	2.2

Total Study Area	
Total Units	992
Acres	423.4
UPA	2.3

Net Unit Densities*

5 minute walk 'ring'	
Total Units	373
Acres	20.31
UPA	18.4

10 minute walk 'ring'	
Total Units	619
Acres	58.46
UPA	10.6

Total Study Area	
Total Units	992
Acres	78.77
UPA	12.6

*Gross unit densities are housing units per total acreage
Net unit densities are units per residential parcel acre

EMPLOYMENT DENSITY

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Flavelle Sawmill	60	33.11	1.81
Port Moody Middle School	70	11.01	6.36
Moody Elementary	35	3.81	9.19
Port Moody Police Station	24	2.09	11.48
Crestwood International Industries	8	0.61	13.11
McDonalds	8	0.42	19.05

Employment centres, and more specifically employment densities, are important to Transit Oriented Development, as they represent potential destinations for transit riders. Areas with a high number of employees per acre are more attractive to service by transit versus those which have low employment densities. Given the large industrial base of this case study, it might be expected that there would be a few large employers accounting for most of the jobs in the study area.

This is not the case, as there is only one large employer, the Flavelle Sawmill, located in the northwest of the study area which employs over 100 people. Heavy industrial uses such as sawmills tend to have low employment densities because of the large site sizes required for product production and storage. The bulk of employment in the case study is in small light industrial shops, public sector institutions, and small commercial businesses.

The light industrial uses tend to have higher employment densities than heavy industry, but employ fewer people per acre than other uses, such as office or retail. In turn, these low employment density uses are difficult to serve by a single transit node, as employees are spread out over large areas. The largest public sector employers in the case study include two schools and a police station. The schools employ a large number of people but also occupy large sites, which reduces employment densities. The police station has the type of employment densities associated with a small office, but again its large site area (due to a high number of on-site parking stalls) decreases employment density. The retail employers along St. John's street have some of the highest employment densities, especially the fast food restaurants. McDonalds for example employs 20 people per acre, ten times that of the sawmill.

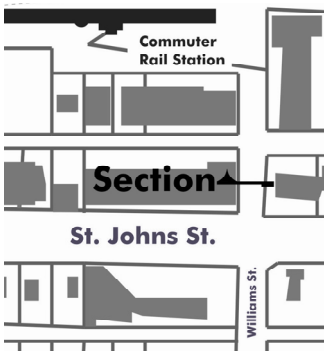
These employment densities don't come close to comparing with high density office numbers, which can generate 100+ employees per acre. The low employment densities don't create a large pool of potential transit commuters, and makes transit service delivery difficult. Where employment densities are high, such as in CBD's, transit can service many employers in a small area.

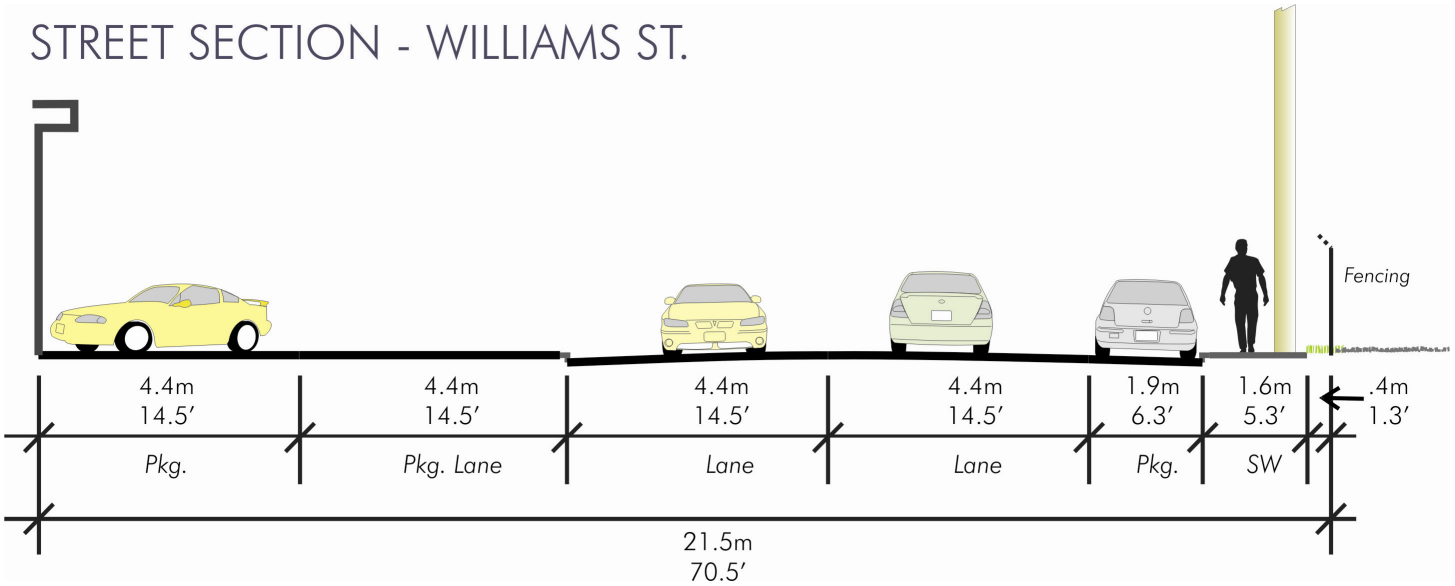
Figure 4.6 Port Moody's industrial uses tend not to have high employment densities

Station area environments must provide amenities for pedestrians, which are in fact better defined as necessities. Just as automobiles demand separation from other uses and parking when they need to stop, pedestrians require well defined boundaries and a place to rest when they are tired. The pedestrian environment of the Port Moody station area could be characterized as utilitarian at best. It has an inconsistent nature, with sidewalks terminating mid-block, offers little or no separation from vehicle traffic, and is often cluttered with obstacles and barriers.

The street section below is the primary access point to the commuter rail station, which is 150 metres (500 feet) from St. John's Street. It is a good example of a typical street in the station area. There is a sidewalk on only one side of the street, which is occupied by telephone poles, and bordered by a grass strip which hosts a chain link fence. The sidewalk is bordered on the other side by on-street parking, which is rarely utilized due to the abundance of on-site parking at most stores. The travel lanes are both 4.4 metres (~15') wide, designed to accommodate bus traffic to and from the station. These two traffic lanes could accommodate six average sedans side by side. The overly wide lane widths on station access streets are common in the Vancouver area examples, most likely due to the need to accommodate busses with their 2.6 metre (8' 6") widths. However, ensuring busses have generous lane widths should not be the primary design criteria for the public realm. The west side of the street is occupied by a curb which separates the public street from a private parking lot. This lot is angle parked, with a travel lane behind it. Finally, the parking lot edge is bounded by a one-storey masonry wall, home to an auto-body repair shop. The shop uses its on-site parking to store vehicles under repair, further adding to the unkempt nature of this area.

SECTION LOCATION





PEDESTRIAN CHOICE

	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	13	20	38
4-way Intersections	18	14	41
Connectivity Measure	*111*	*116*	*278*
Land Area	*143.8*	*279.59*	471.24
Pedestrian Choices Per Acre	0.77	0.41	0.59

Pedestrian environments should not only offer the necessities of sidewalks and protection from cars, they should also offer the pedestrian with choices. Having multiple pedestrian options is important, as it can create a higher level of accessibility for the pedestrian, and create a larger catchment area of potential pedestrians.

Measuring choice in the case study was done by counting the pedestrian intersections in the case study, including lanes, pathways and pedestrian overpasses, then multiplying these intersections by the number of choices present. For example, a 3-way intersection has 3 potential choices for a pedestrian, while a 4-way intersection has 4. This was then factored into the land area available to come up with a measure of connectivity, pedestrian choices per acre.

Overall, the Port Moody case study had 0.54 choices per acre for pedestrians, although the five minute walk 'ring' had much more choice than the five to ten minute walk 'ring'. The inner ring's 0.78 choices per acre is a reflection of its finer block pattern, which fades away as one moves further away from the commuter rail station, dropping the pedestrian choices down to 0.41 choices per acre in the five to ten minute walk ring.

To put these numbers in context, one could look at downtown Portland (2.3 choices per acre), the Las Ramblas neighbourhood of Barcelona (3.03 connections per acre) or Nihonbashi in Tokyo (5.3+ connections per acre)[1].

PEDESTRIAN USE

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	1.6	24
P.M.Count	1.6	6

Given the low level of pedestrian quality, and the comparative lack of pedestrian choice, it's probably not surprising that pedestrian usage is also low. Pedestrian counts were taken in the station area in the a.m. prior to a train departure, and in the p.m. after commuter trains arrived. Since the Port Moody station has only two pedestrian exits, the sample was taken at the exit which best connected commuters to the majority of residential units.

The pedestrian counts for Port Moody are especially pertinent for commuter rail, as the sample location serves only the rail station. Therefore all pedestrians counted are either walking to or from the rail station. While this sample location may not capture the true volume of traffic in the entire study area, it accurately portrays that traffic which is attributable to the commuter rail service. The low pedestrian volumes are a stark portrayal of how auto-oriented this commuter rail station actually is.

[1] Jacobs, Allan B. *Great Streets* MIT Press, 1995

Port Moody's station area has achieved some successful steps towards meeting the definition of Transit Oriented Development, but there remains opportunities for improvement in a number of areas.

The potential TOD area is underutilized, particularly because of a lack of connectivity across the railroad tracks. While this lack of connectivity is tempered by the lack of residential and retail activity on the north side of the railroad, recent residential developments in this area demand increased pedestrian connectivity to the retail uses present on St. John's Street.

Land uses in the study area consist of a good mix of residential and retail uses in addition to the employment generating light industrial areas. Unfortunately, the mix of land uses is not manifested in a manner which contributes to Transit Oriented Development. Much of the commercial activity is not pedestrian friendly, with large setbacks occupied by off-street parking. Also, most of the tenants are periodic uses rather than more frequent uses, subsequently generating a low level of pedestrian activity. Many of these tenants are related to the automobile, such as muffler shops, auto body repair facilities and gas stations. These uses all demand a high level of vehicle access, further intruding automobile traffic into the pedestrian realm. In the future, mixed use residential / commercial developments along St. John's Street , such as the recent Sonrisa project, may represent a shift in this retail structure, bringing pedestrian-friendly retail to St. John's Street, and subsequently transforming this automobile arterial into a retail high street.

Housing choice in the case study appears to be good, with a large portion of housing stock in the multi-family class, which provides many more choices than single family product does. Unfortunately the multi-family stock is dominated by apartment style units. For a city with a large family component it may be preferable to offer a higher degree of ground oriented product which might appeal to families, such as townhouses, rowhouses, or similar housing types. Also, most of the higher density housing types are situated further away from the station and the primary retail area. This is counterproductive to creating the animated civic cores which Transit Oriented Development demands, and decreases the chance that residents will walk to retail sites.

While housing choice is satisfactory, densities in the case study are low. Gross densities for the case study are 2.3 units per acre. This is mainly due to the large amount of underdeveloped land within the case study area. Much of the case study is occupied by low density industrial and retail developments, which contribute to lowering the overall density measures. The residential areas that *have* been developed reflect a fairly high density for suburban settings at 15 net units per acre, which shows a willingness to accept higher densities in the case study area. This bodes well for future developments, and indeed when looking at recent projects in the area (the afore mentioned Sonrisa project has a net unit density of 66 UPA), it seems that the trend towards higher density projects should continue.

The ability for local employers to support transit is not good. Employment densities in the area are fairly low, with many employees in the case study concentrated in industrial areas which are difficult to access from the rail station. There isn't a single large employment centre (such as a regional office development) within the case study, and the outlook for such a development does not appear positive. For the foreseeable future, the Port Moody case study does not appear destined to be a large employment centre.

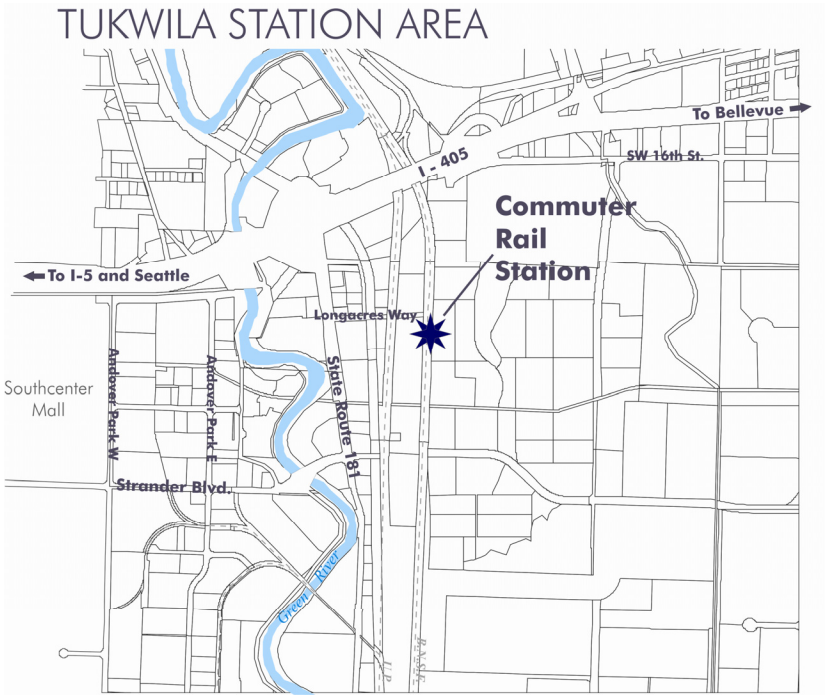
The pedestrian realm is initially compromised by a lack of connectivity, and its appeal is further denigrated by a low quality pedestrian environment. Streets in the station area often fail to shield the pedestrian from arterial traffic, sometimes don't offer sidewalks, and have no amenities that might be expected in a retail area such as seating or street trees. Not surprisingly, pedestrian usage is extremely low. Pedestrian usage of the main access street to the commuter rail station are less than 0.5 people per minute, or one person every two minutes. This does not reflect the desired degree of pedestrian animation which Transit Oriented Development looks for.

The level of success Port Moody has enjoyed as a Transit Oriented Development may be better put in context when compared against its case study partner of Tukwila, an industrial-based suburb with its own set of problems.

CASE STUDY 2: TUKWILA

INTRODUCTION

Tukwila, an inner suburb of 17,000 people, is home to a large number of industrial and transport related companies. Tukwila is just south of Seattle, and its Duwamish River was an early maritime commerce route in the region and today remains an active deepwater port. Tukwila is the closest stop to the CBD on the Seattle Sounder commuter rail system, only 25 minutes by train from Union Station. While Tukwila is well known for its myriad commercial uses, it lacks an identifiable core or civic centre. Its residential base is also small when compared to the wealth of commercial activity which occurs in the city. It does have an active retail base, including a large node located at the Southcenter Mall, approximately one mile west of the commuter rail station.

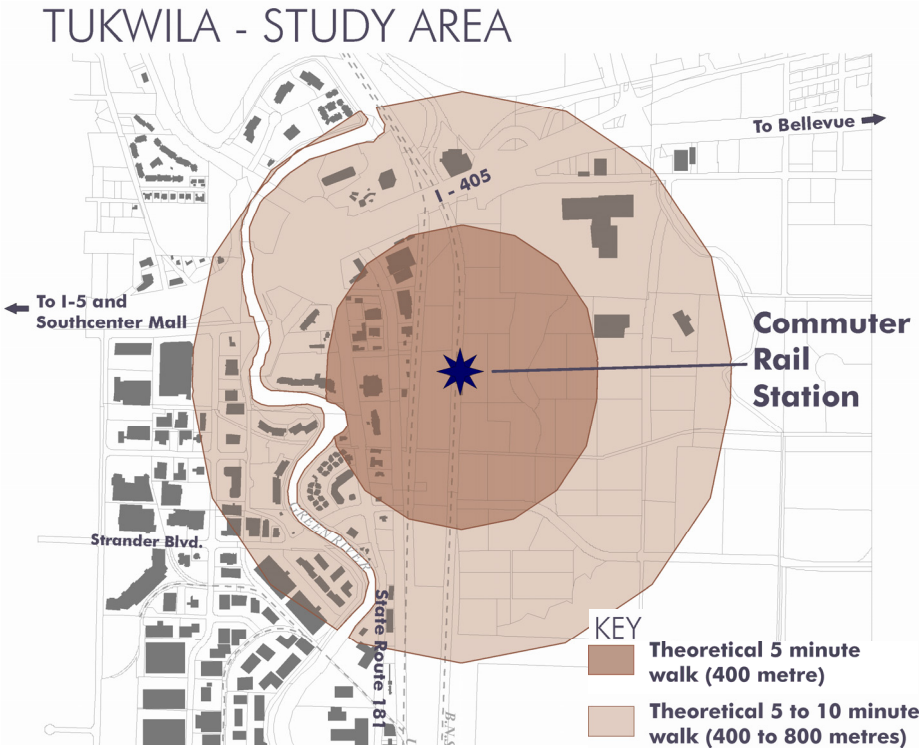


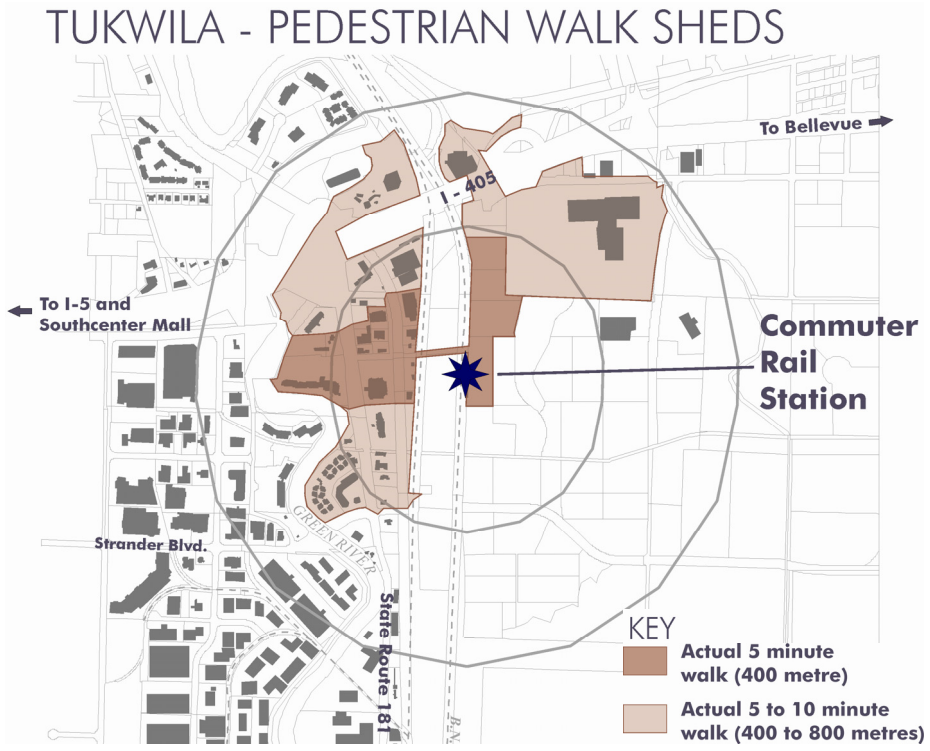
(Top to Bottom) Figure 4.7 Tukwila Sounder Station
Figure 4.8 State Route 181

Tukwila's station area is on a floodplain of the Green River, close to the interchange of I-405 and State Route 181. The station itself is a park and ride facility with a large surface parking lot. The rail line marks the division between the cities of Tukwila and Renton, meaning the parking lot and half of the station are in another city, a quirky situation which nevertheless presents significant problems. The potential area which could be reached by a five minute walk contains 144 acres of land, while the potential area which could be reached by a five to ten minute walk contains 369 acres of land, for a total study area of 513 acres.

These 'crow-fly' distances, don't illustrate the actual level of pedestrian connectivity in the Tukwila station area. From the Tukwila station, a five minute walk accesses 38 acres of land, while a ten minute walk allows access to an additional 104 acres of land. The actual pedestrian walk shed accessible through a ten minute walk is 142 acres. So out of a potential area reachable in a ten minute walk of 513 acres, only 142 acres, or 28% can actually be accessed.

There are a number of reasons for this tremendous lack of pedestrian connectivity. The first is the low density of the street network in the area. The primary street is State Route 181 (a.k.a. West Valley Highway), which has a limited network of streets feeding into it. The access road to the station, which was initially a dead-end, has only recently been connected to the office uses northeast of the station. Another barrier to connectivity is the I-405, which is an elevated freeway built upon earthen berms and supported by pilings around overpasses. The berms present a physical barrier to pedestrian movement, while unfriendly environments exist underneath the overpasses. The third barrier to pedestrian movement is the Green River. With only one crossing at Strander Boulevard, the Green River bisects the case study area, and prohibits movement between the station area and the destination retail node at Southcenter Mall, located one mile to the west.





LAND USE

The land uses in the Tukwila station area are a microcosm of the city as a whole. Commercial uses dominate the landscape, their locational attributes determined largely by transportation routes, while residential uses are almost non-existent.

Commercial activity in the station area is dominated by the hotel industry. With good connectivity to the Interstate system, and relatively close proximity to Sea-Tac Airport, hotels catering to the business traveler surround the station. No less than seven national hotel chains are located within the study area, with all of them on State Route 181. Boeing's nearby offices also serve as a training centre for airline staff, furthering the demand for hotel space. West of the Green River, along Strander Boulevard, there is a number of industrial / business parks. These uses include small offices such as local newspapers and freight forwarders, as well as larger tenants such as distribution and logistics centres. The latter tenants again have located here because of good connections to transportation systems. A major office use in the study area exists in the eastern portion, where Boeing's commercial aircraft division is located on the now defunct Longacre's horse racing site. This is a large office complex which is an important employer in the case study. Retail activity gains intensity as one moves west, towards the shopping centre. Retailers located along State Route 181 are limited to fast-food restaurants and other convenience type activity, while there are more medium-format retailers located west of the Green River, such as electronics goods stores and home improvement warehouses. The smaller scale retailers which are present within the case study are housed within a few strip mall developments.

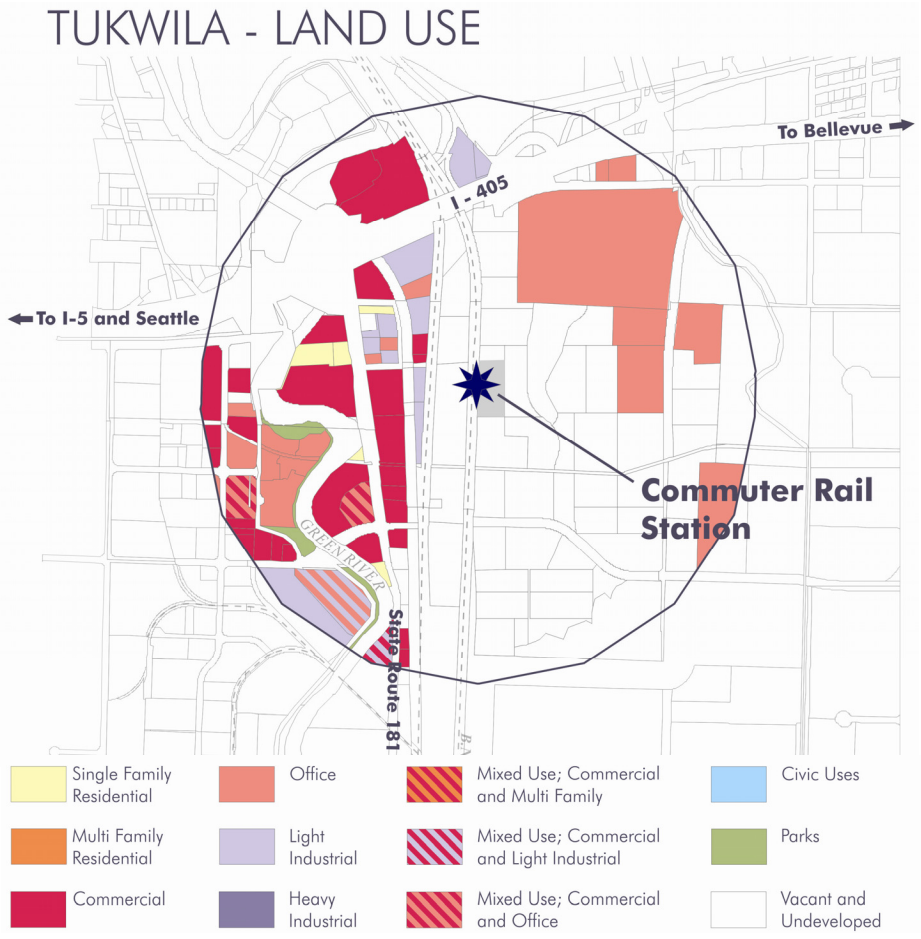
Perhaps the most important land use is the vacant land occupying a vast portion of the case study area. As mentioned, this is the site of the old Longacre's horse racing track, now partially used by the Boeing Corporation. The large areas of the backstretch and infield remain largely vacant however, and represent a glaring void in the development of the Tukwila station area.

LAND USE MIX

The mix of land uses in this case study is limited. Commercial and office uses dominate, and there is a small light industrial presence, while residential parcels can be counted on one hand. While this mix does offer some benefits (i.e. many local employers), it does not adhere to TOD principles in the station area.

The commercial activity along State Route 181 is dominated by the hotel industry, which does little to attract local or regional residents. On the west side of the Green River the commercial activity is primarily in the form of retailers, although with no residents with walking distance, it is a forgone conclusion that these uses are not pedestrian oriented.

The light industrial uses in the case study are located close to rail and highway infrastructure. The light industrial activity in the southwest increases as one leaves the case study area, as indicated by the density of railroads. The pocket of light industry near the commuter rail station includes rubber goods manufacturing, auto fleet services and boat manufacturers.



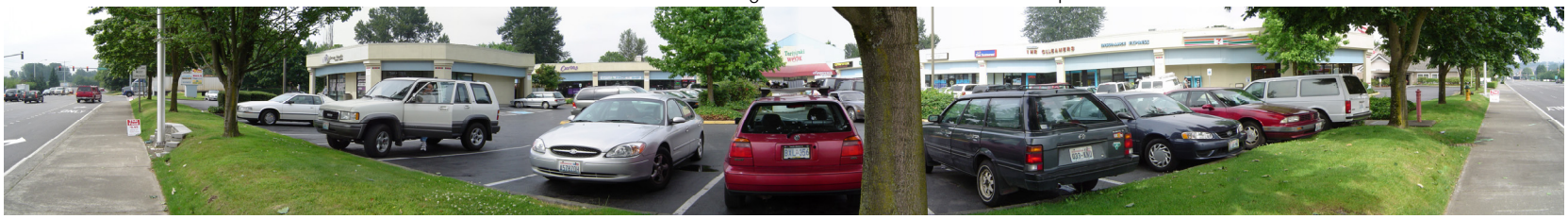
Commercial uses are not very high in number, and they are not arranged in accordance with TOD principles. In the entire case study, there are only 50 unique goods and services providers, less than one for every ten acres. This limited commercial presence is a troubling situation for Transit Oriented Development in this case study.

The commercial activity which is present in the station area is primarily tourist related, with some restaurant and convenience stores. Most of the retail activity is to the west of the case study towards the Southcenter Mall. This is confirmed by looking at the distribution of commercial activity within the five and ten minute walk circles. Within the inner circle, there are only 20 goods and service providers, compared to 50 in the outer ring, illustrating the low level of commercial activity around the station area.

The commercial activity which is present is low frequency in nature, with almost 87% of uses classified as periodic. Those that are daily in nature are dominated by fast food restaurants and convenience stores. These retail typologies are typically not successful at contributing to high quality urban environments. The structure of most daily retail is limited to strip mall developments, or stand alone fast food establishments catering to passing automobile traffic. While this may contribute to increased activity in the TOD area, the type of activity is completely auto dependent.

	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	10	*50.0%*	4	*13.3%*	14	*28.0%*
Periodic Uses	10	*50.0%*	26	*86.7%*	36	*72.0%*

Figure 4.9 Tukwila station area strip mall located at Strander Blvd. and State Route 181



HOUSING CHOICE

	Units	% of Total
Single Family	4	100.00%
Multi-Family	0	0.00%

Housing in the Tukwila case study is practically non-existent, with only four single family homes. Three residential parcels are located along the Green River, while one is on the edge of a light industrial area. While these four homes may be happy with their incredible level of transit service per capita, this lack of housing is not in accordance with TOD principles, and a matter which needs to be addressed should Tukwila pursue a complete Transit Oriented Development plan in the station area.

Tukwila has many constraints to residential development as a community, including its large industrial land base, and the high number of freeway corridors which bisect it. This case study is representative of this, as it is home to two major railways, an elevated Interstate and a busy State Route. While parcels along the idyllic Green River could offer an excellent opportunity for residential infill, it would seem that local market conditions have a predilection towards commercial tenants rather than residential uses.

Gross Unit Densities*

5 minute walk 'ring'

Total Units	4
Acres	143.50
UPA	0.028

10 minute walk 'ring'

Total Units	0
Acres	369.12
UPA	0

Total Study Area

Total Units	4
Acres	496.58
UPA	0.008

HOUSING DENSITY

Needless to say, residential densities hardly even register, with an overall gross UPA of 0.008, or one home for every 125 acres.

With a high amount of land dedicated to commercial uses, there might exist an opportunity for the Tukwila station area to act as a transit destination by fulfilling a role as an employment centre. This is currently a limited possibility, given the low employment densities of most commercial operations in the area.

One positive exception is Boeing's Commercial Airplane division, a large office complex located east of the station. This 865,000 sq. ft. office complex employs over 1,350 people, an anomaly in an area where employment densities are generally low due to large site areas and low intensity uses. Until recently, this office complex was not connected to the station area, making it a physical impossibility to walk to this use from the commuter rail station. A new street however provides employees with a much better level of connectivity to the station and is a welcome structural change in the area road network. Additional eastward connections such as the extension of Strander Boulevard are undoubtedly hampered by having multiple jurisdictions governing the two halves of the station area.

The hotel industries are typically low density employment uses, with between two to four employees per acre. This is primarily due to large site areas, which accommodate surface parking for guests. The low employment densities of the hotels are exacerbated by small building typologies, with the hotels present favoring smaller buildings, and some even utilizing semi-detached suite typologies.

Commercial activities on the opposite side of the Green River achieve higher employment densities, due to the more frequent nature of the retail, and subsequently a higher number of daily customers and therefore employees. This is demonstrated by the numbers from Kinko's and Lowe's Home Improvement. However, when put in context of the numbers from the Boeing site it is evident that these activities are not coming close to achieving the necessary employment densities required to make Transit Oriented Development a success.

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Comfort Suites	12	6.25	1.92
Porter Seal	3	1.51	1.99
Courtyard by Marriot	6	2.90	2.07
Best Western (Southcenter)	20	6.03	3.32
Lowes Home Improvement	75	9.16	8.19
Kinkos Regional Sales Office	13	1.12	11.61
Boeing Commercial Aircraft	1360	48.29	28.16

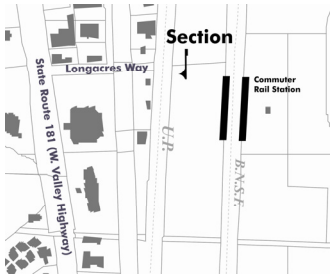
Figure 4.10 Vacant office stock in the study area, located west of the Green River

PEDESTRIAN QUALITY

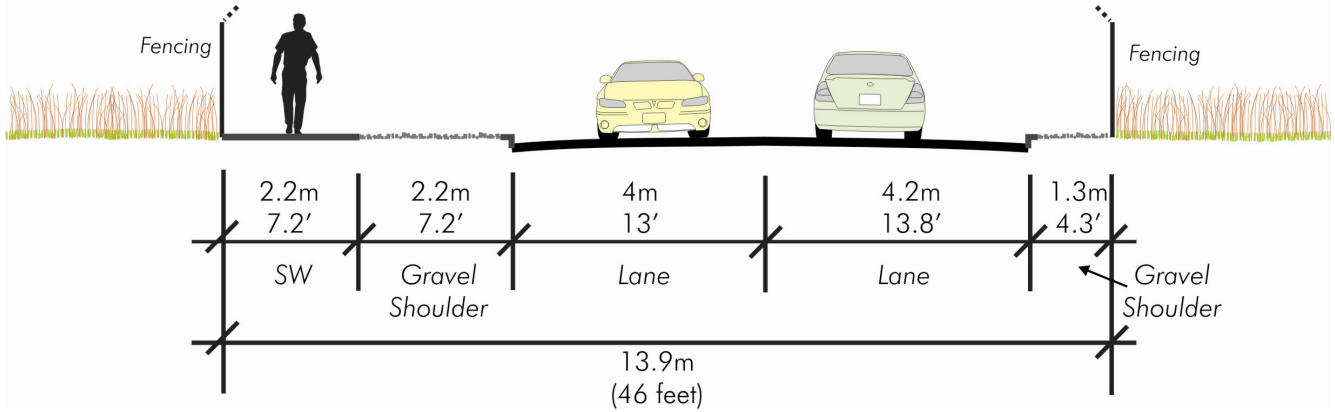
The pedestrian environment around the Tukwila station is an unconnected network of industrial streets. It is a bleak and barren pedestrian landscape dominated by exposed sidewalks, fast moving vehicular traffic, and chain link fencing.

The street section is taken along Longacres Way, the primary access point to the commuter rail station, approximately 240 metres (840 feet) from State Route 181. As mentioned, this used to be the only access to the community prior to the construction of a northeast connector to the Boeing facilities. The section area is flanked by vacant fields, guarded by chain link fencing. To access the station, one must pass under two railroad bridges, and the section is taken at a point between these two bridges. Large gravel buffers give way to parking pullouts, which are reserved as holding bays for busses. Given the single use at the end of the street, traffic volumes are generally very low, with the occasional bus accessing the bus loop located within the station parking lot.

SECTION LOCATION



STREET SECTION - LONGACRES WAY



PEDESTRIAN CHOICE

The Tukwila case study has 0.14 choices per acre for pedestrians, with connectivity consistently low across the entire case study area. The low number of choices per acre is indicative of the low density street network and high number of barriers to connectivity. The Tukwila case study has the lowest level of pedestrian connectivity of all of the case studies examined by a large margin. This is reflected in the small pedestrian walk sheds around the station area.

	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	6	11	17
4-way Intersections	1	4	5
Connectivity Measure	*22*	*49*	*71*
Land Area	*143.5*	*369.12*	512.62
Pedestrian Choices Per Acre	0.15	0.13	0.14

PEDESTRIAN USE

Given the lack of a local population, absence of local-serving retail, low pedestrian quality, and lack of a developed pedestrian network, it's probably not surprising that use is minimal.

The pedestrian counts for Tukwila were taken at the same location as the section. Pedestrian use is almost non-existent, which is not something that should be too surprising. Many bus services along State Route 181 pick up passengers in the park and ride facility, negating any need to walk to or from the station site.

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	2.2	6
P.M.Count	2.2	6

(Left to Right) Figures 4.11, 4.12 and 4.13 Longacres Way - Station entrance street looking east, south and west

Tukwila's station area has some significant obstacles prohibiting it from being considered a Transit Oriented Development and any changes will require a long-term approach. Tukwila represents an example of the difficulties which face suburban communities attempting to adopt Transit Oriented Development, particularly those communities which lack an existing town centre or development node.

The potential TOD area is not only underutilized, it is split between two municipal jurisdictions creating administrative barriers to development of the station area. The lack of pedestrian connectivity arises from a number of factors including massive transportation infrastructure, such as railroads and highways, and an underdeveloped local street network. Additionally, the Green River represents a physical barrier which separates the station area from the retail activity to the west. One positive note is that recent street construction in the northeast has opened up large employment areas to pedestrian traffic, especially from the commuter rail station. This trend seems destined to continue, with discussions underway on extending Strander Boulevard across the railroad tracks, which will help increase pedestrian connectivity.

Developed land in the study area is dominated by commercial and light industrial uses. The commercial activities near the station are mainly hotel uses, while those further to the west are larger retailers. Only a few commercial uses are local serving, and those that are depend on customers accessing their services by automobile. One of the most dominant land uses in the study area is the vacant and undeveloped parcels of the old Longacres racetrack. This underdeveloped area represents an excellent future opportunity for intensification, but is currently a void in the station area landscape. The glaring lack of residential uses is another missing aspect of Transit Oriented Development.

Housing choice and density in the case study is non-existent, with the entire housing stock consisting of four single family homes. Housing, which can drive retail and local office activity, is a fundamental attribute of Transit Oriented Development. Unfortunately, with a low population and lack of a civic core, the Tukwila example is handicapped in this area from the start. Without a local population to utilize the service, the station is dependent on vehicle commuters, or alternatively becoming an employment destination of its own.

The ability for the station area to act as an employment node is uncertain. Most employers in the area have extremely low employment densities, with the lowest belonging to the hotel uses which surround the station. An exception is the Boeing office complex, home to over 1,300 employees at significant employment densities. With the impending construction of a 8,800 square metre (94,000 sq. ft.) Federal Reserve office just south of the Boeing facility, employment densities may soon become high enough that the station could develop into a role as a destination for, rather than a source of, commuter traffic.

The pedestrian realm is extremely compromised by low connectivity, and the low quality pedestrian environment is comparable to an industrial park, not the vibrant commercial areas which are meant to exist in Transit Oriented Developments. The few streets which do exist in the station area have to circumvent massive freeway and railway infrastructure, often subjecting the pedestrian to unsavory experiences. When the pedestrian emerges from a world of railway bridges and freeway underpasses, they find themselves on an exposed arterial with none of the amenities that are necessary in a pedestrian environment. There is little on-street parking, or other buffers from traffic, and large building setbacks strand the pedestrian in a hostile no-man's land. Pedestrian use of the area is almost non-existent, with no homes to walk from and no retail to walk to.

Tukwila's current failure as a Transit Oriented Development should be seen within a long term context of opportunity. Beneath the vacant tracts of land and poor pedestrian environment, there lies a strategic opportunity to develop this site according to TOD principles, or at least as a transit commuter destination.

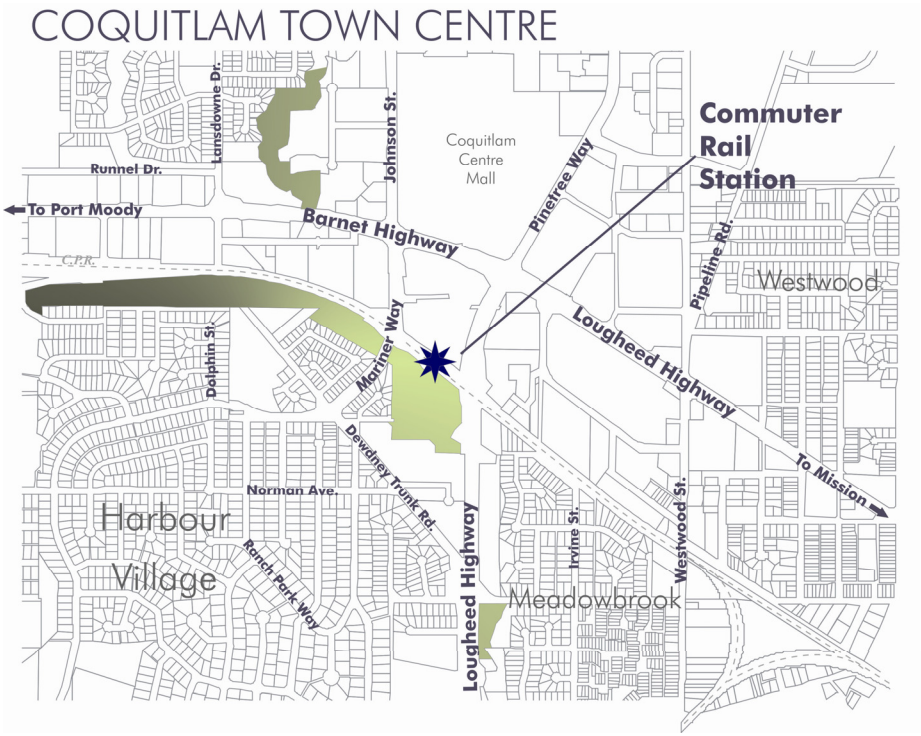
CASE STUDY PAIR: COQUITLAM AND AUBURN

The second case study pair represents primarily residential suburbs which are located midway along the commuter rail route.

CASE STUDY 3: COQUITLAM

INTRODUCTION

Coquitlam is a large residential suburb of 113,000 people and is a popular choice for families looking for more affordable housing options than are present in Vancouver proper. The city has a long history as an agricultural center and a sawmill site, and is home to a small French-Canadian population. The Coquitlam commuter rail station is a 30 minute trip to the CBD, and it is located adjacent to Coquitlam's primary retail area. This retail area is designated as a major town centre in the regional growth strategy, and is currently home to Coquitlam Centre Mall, a destination shopping facility.



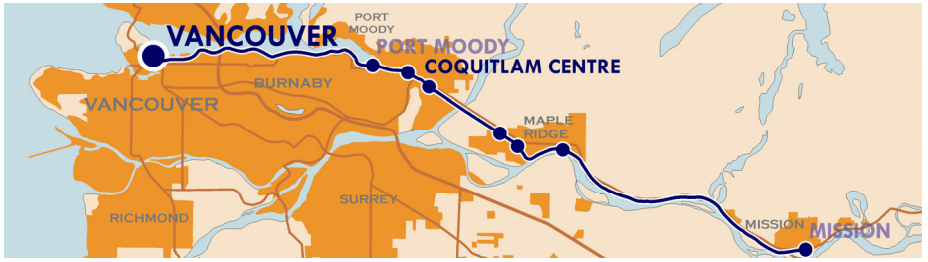


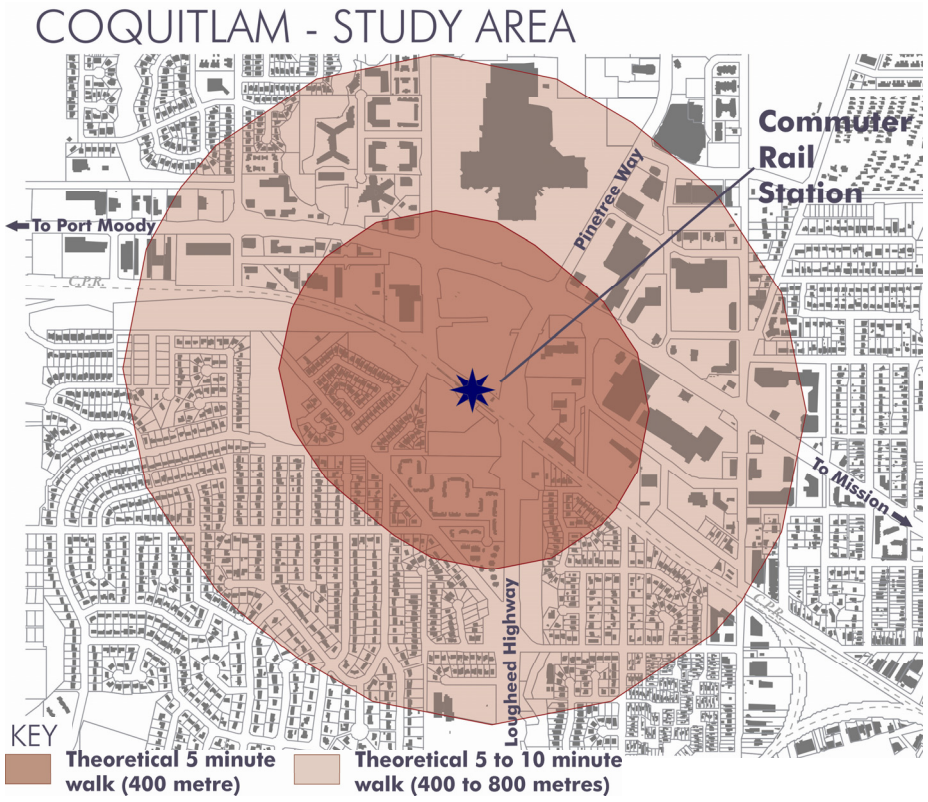
Figure 4.14 Coquitlam Station

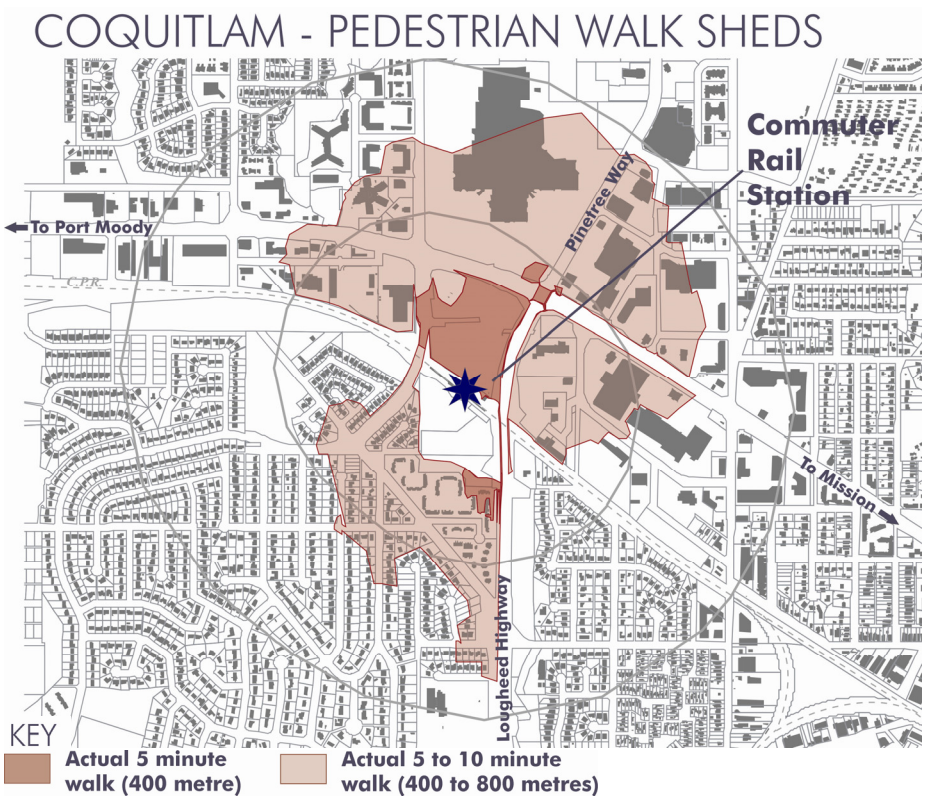
Figure 4.15 Coquitlam Station Entrance Feature

Coquitlam's station is located at the interchange of the Lougheed and Barnet Highways, major highways connecting the eastern suburbs with the remainder of the lower mainland. These highways see heavy traffic volumes throughout the day and often suffer from severe congestion. The station itself is a park and ride facility with a large surface parking lot and a major bus exchange. The railroad divides the retail area from the residential neighbourhoods of Harbour Village to the southwest and Meadowbrook to the southeast. The potential area which could be reached by a five minute walk contains 159 acres of land, while the potential area which could be reached by a five to ten minute walk contains 402 acres of land, for a total study area of 561 acres.

The Coquitlam station area is yet another example of poor station area pedestrian connectivity. From the Coquitlam station, a five minute walk accesses a mere 17 acres of land, while a five to ten minute walk allows access to an additional 168 acres of land. Therefore, the actual area which is reachable in a ten minute walk is only 185 acres out of a potential 561 acres, or 33% of the potential TOD area.

The reason that a five minute walk can access only a small area, while a five to ten minute walk can access a reasonably large area is quite simple. Connectivity is excessively low around the station area, while it improves somewhat further away. The lack of connectivity can be attributed to a number of factors, many of them recurring from the Tukwila case study. Firstly, the railroad tracks present a barrier to movement, and are only crossable in two locations; one along Mariner Way and the other along Lougheed Highway. The Mariner Way crossing is an elevated overpass accessed by a lengthy ramp, the latter exaggerating the walking distance across the railroad tracks. Another barrier to pedestrian connectivity is the presence of highways, which prohibit movement across them. The Lougheed and Barnet highways are not on the same scale as the Seattle area Interstates, but their four to six lane widths, concrete medians and fencing ensure that pedestrians can only cross the street at specified points. Pedestrian movement is subsequently limited to major intersections, such as those at Pinetree and on Johnson Street.





LAND USE

The land uses in the Coquitlam case study are delineated by the railroads and highways running through the site. Commercial uses, anchored by the Coquitlam Centre Mall, are arranged north of the railroad along the Lougheed Highway corridor. Further north, away from the Lougheed Highway, retail gives way to residential uses consisting mainly of multi-family units. South of the railroad is almost exclusively residential, and more particularly almost entirely single family residential.

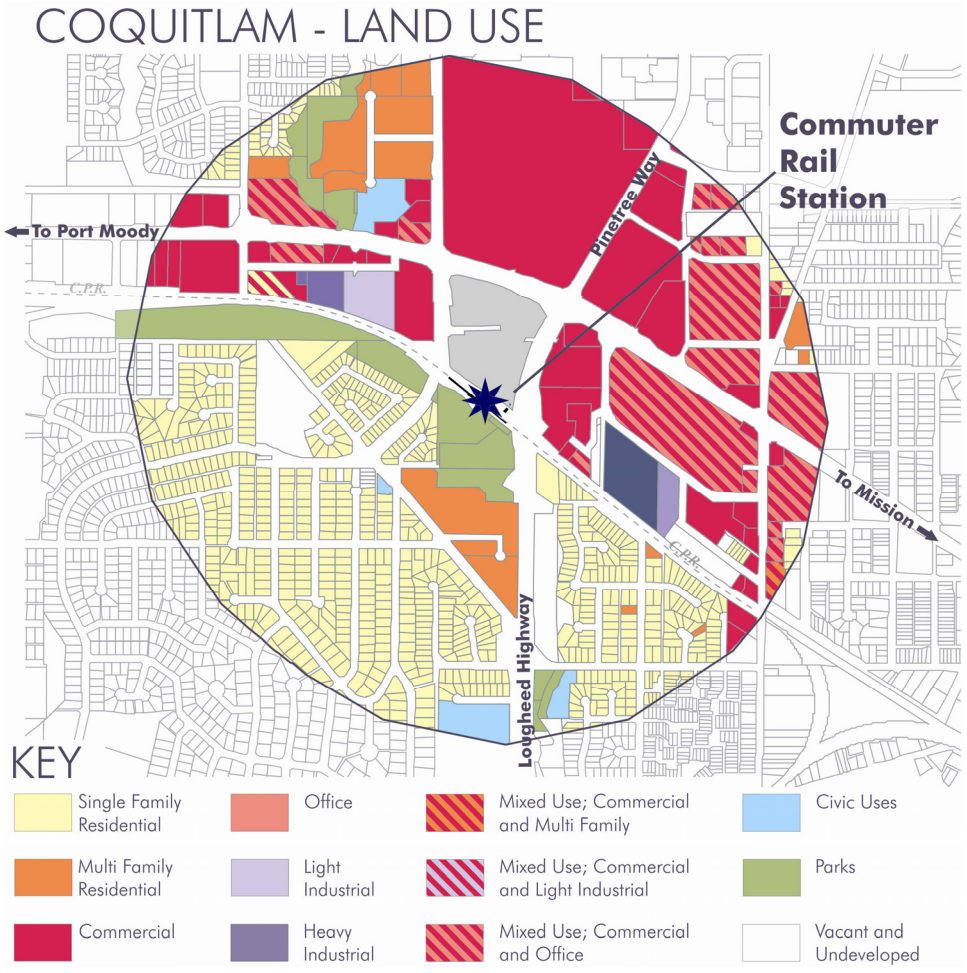
Coquitlam Centre Mall, with108,000 square metres (~1.2 million sq. ft.) of floorspace, is the largest of several retail centres located along the Lougheed Highway. Others include Pinetree Village and Westwood Mall which include large grocery stores as well as smaller retailers, and are located just east of Coquitlam Centre. Many of the smaller retail developments also incorporate office uses, although there are no exclusive office developments in the case study. Much of the office space is of lower quality, and typically house local serving tenants, rather than large regional or larger scale office tenants.

There is a very limited amount of industrial activity in the area, and it is limited to locations along the railroad. There is no single large industrial use, but rather a number of smaller operations including auto wreckers and poultry processors. This limited industrial presence is in line with Coquitlam as a whole, which has a very limited industrial base compared to other local municipalities. The two primary residential neighbourhoods in the case study are quite distinct from one another. Residential activity in the mall area is almost exclusively multi-family residential, consisting primarily of apartments as well as some townhouses. South of the railroad the limited amount of multi-family housing is in the form of lower density townhouse developments. Civic and institutional uses within the case study area include a long-term care facility, church, and elementary school.

LAND USE MIX

The Coquitlam case study exhibits a good mix of land uses which contribute to Transit Oriented Development. Not only are there retail and housing opportunities, there are also employment centres, primarily in the form of local serving offices but also in the limited light industrial base. Unfortunately, with little integration of uses and limited connectivity between different uses, the benefits of a mix of land uses are largely wasted.

The retail activity in the mall area has a mix of local serving and regional retailers, but is auto oriented in nature and contributes little to the public streetscape. The mall, even though it is one of the region's largest, has a Floor Space Ratio of 0.5, which is an indication of the 48 acres of parking that surround it, creating an oasis of retail in a desert of asphalt. Multi-family housing is concentrated near the retail node, making shopping an easier task for the seniors and families which occupy many of the units. However, the opportunity to combine this synergy with the station environment is lost due to the poor connections between the commuter rail station and surrounding uses.



	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	10	*50.0%*	117	*25.7%*	127	*26.7%*
Periodic Uses	10	*50.0%*	338	*74.3%*	348	*73.3%*

The Coquitlam case study has a large number of retailers within the case study area, although this promising situation does little to contribute to Transit Oriented Development in the case study as much of the retail uses are 'periodic' in nature, and most are located far away from the public realm.

Commercial uses in the Coquitlam case study are almost absent from the immediate station area, as they are concentrated in retail areas in the five to ten minute walk ring. There are a total of 475 goods and service providers in the study area, and 195 (41%) of those are located within the Coquitlam Town Centre mall. Most of these are destination type uses, including shoe stores, clothing stores and department stores. However, in addition to the numerous 'periodic' retailers located within the mall, one quarter of all 'daily' retail uses are also located there. This internalization of retail activity is not in line with TOD principles as it takes activity off the street and places it within private facilities, a transition which should raise significant questions about the privatization of public space.

In addition to the mall, there are also at least six large grocery stores in the study area, with several serving as anchors for smaller retailers such as florists, coffee shops and delis. Grocery stores represent a coveted type of retail use for a Transit Oriented Development, as they create a large number of trips, and therefore activity. Unfortunately, most case study residents in Coquitlam cannot walk to these uses, and instead rely on automobile trips to access food stores. This does not conform with the principles of TOD, as the large amount of parking needed for these cars creates large surface parking lots, and the high volume of automobile traffic takes away from the quality of the pedestrian realm..

Figure 4.16 Coquitlam Centre Mall's Winter 2004 advertising campaign

HOUSING CHOICE

Housing in the Coquitlam case study is in two distinct precincts, with each having its own dominant housing typology.

The areas located in the south half of the case study are almost exclusively single family, although they do contain a smattering of duplexes. The one multi-family component of this southern residential area consists of side-by-side and stacked townhouses, both of which have relatively low densities. The Coquitlam case study is a good example of the appeal of ground oriented product for families. The afore mentioned townhouses are popular with young families, being well protected from arterial traffic as well as having direct adjacency to a small linear park to the north.

Meanwhile, the housing area in the north half of the case study is primarily apartments and attracts more seniors and singles than families. Besides one senior's housing complex in this area, there are also several three to four storey apartment buildings. This is a good example of how mixing housing types, especially within the multi-family sector, can create communities with a diverse social structure.

	Units	% of Total
Single Family	704	47.2%
Multi-Family	788	52.8%
Duplex	*8*	*(0.6%)*
Party Wall Townhouses	*153*	*(10.2%)*
Stacked Townhouses	*66*	*(4.4%)*
Apartments	*561*	*(37.6%)*

HOUSING DENSITY

Housing densities in the study area remain low at 2.7 gross UPA, despite the relatively good range of multi-family housing types and high number of total units. The low gross UPA numbers are primarily due to large portions of the case study dedicated to commercial uses.

When these areas are netted out and parcel level densities examined, the UPA numbers rise, but not nearly as much as in the Port Moody case study. This reflects the low density nature of residential areas, especially the single family areas, which are typically comprised of 770 square metre (8,300 sq. ft.) lots, translating into a net parcel density of around 5 units per acre.

Gross Unit Densities*

5 minute walk 'ring'	
Total Units	255
Acres	159.3
UPA	1.6

10 minute walk 'ring'	
Total Units	1237
Acres	402.2
UPA	3.1

Total Study Area	
Total Units	1492
Acres	561.6
UPA	2.7

Net Unit Densities*

5 minute walk 'ring'	
Total Units	255
Acres	54.4
UPA	4.7

10 minute walk 'ring'	
Total Units	1237
Acres	154.5
UPA	8.0

Total Study Area	
Total Units	1492
Acres	208.93
UPA	7.1

*Gross unit densities are housing units per total acreage
Net unit densities are units per residential parcel acre

EMPLOYMENT DENSITY

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Rona	45	4.46	10.09
Superstore	100	8.80	11.36
Safeway	40	3.40	11.76
Dufferin Long Term Care Facility	40	3.22	12.42
The Bay	75	5.33	14.07
Save on Foods	100	6.80	14.71
Future Shop	100	1.68	59.68

There is no single large employer in the case study area. While Coquitlam Centre Mall employs over 2,700 people in total, it is reasonable to assume that these employees are dispersed amongst the mall's 200+ tenants, and that at most only half of this number may be present at the mall site at any given time.

The retail activities which dominate this case study do achieve fairly high employment densities, especially when compared to the industrial uses seen in the two earlier case studies. Future Shop, with its 60 employees per acre, has particularly high numbers, which when combined with a sales force working on commission ensures that their customers always have a store associate close at hand. The grocery stores with between 10 and 15 employees per acre are also important employers, especially given the high number of grocery stores and their typically large sizes.

The lack of office uses limits the role of the Coquitlam case study as an employment destination. The low employment densities in this case study are not surprising, as Coquitlam has made headlines recently by changing land use policies to attract employers to their town centre, including residential density bonuses.

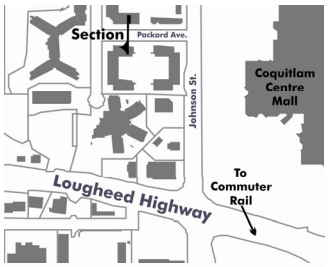
Figure 4.17 Coquitlam's retail area is not a high-density employment centre

PEDESTRIAN QUALITY

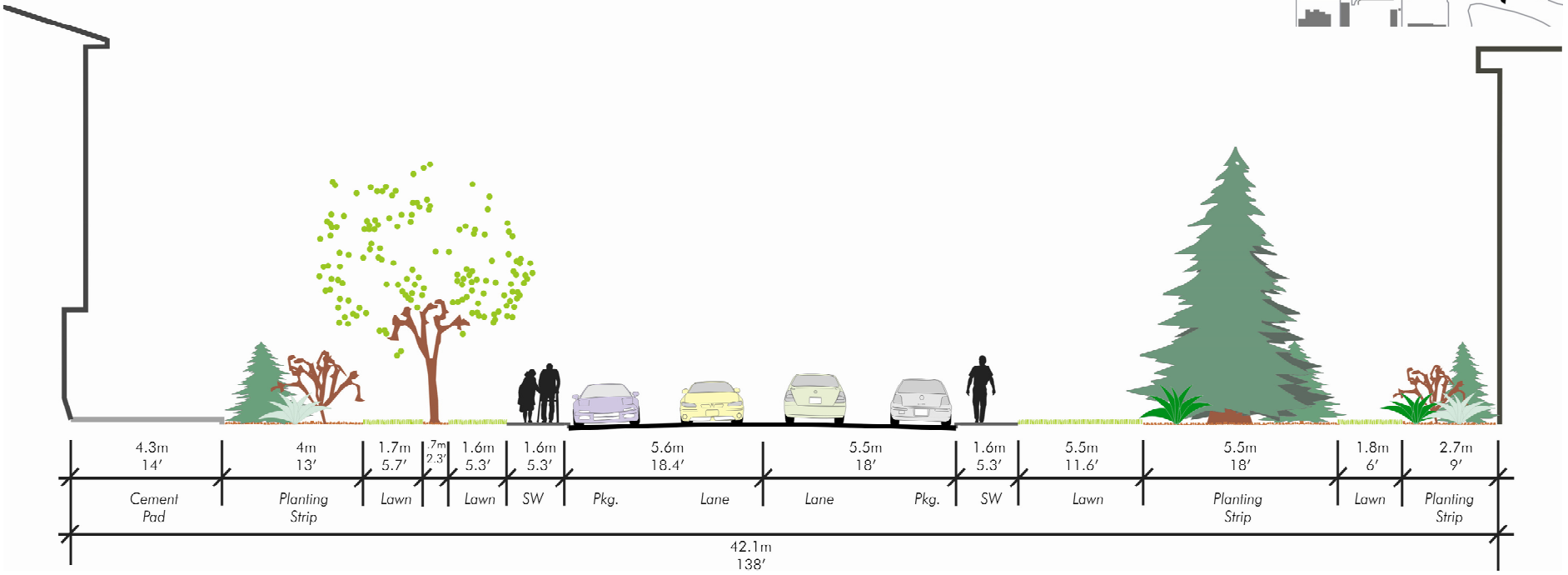
The pedestrian environment around the Coquitlam station is of low quality, with a coarse grained street network (so called 'superblocks') in the mall area, and low amenity streetscapes in residential areas.

The street section is taken along Packard Avenue, a street which connects the primary retail areas with a large multi-family area (While most of the other case studies have street sections taken adjacent to the station, there is no single street leading into the Coquitlam station; access to the station is through a large park and ride parking lot, leaving pedestrians to slither in between parked cars like a salmon writhing up a river). Packard Avenue is an interesting example of how privatization of public space can take away from the pedestrian experience. The 42 metres (140 ft.) between building walls contain a vast hodgepodge of travel lanes and private landscaping. In an area with many seniors, the sidewalk is barely wide enough to fit two people comfortably, and the trees which are present do not act as a buffer between the pedestrian and traffic. Additionally, the landscaping is arranged in an unsettling mish-mash, with deciduous facing coniferous, shrubs behind trees, and large setbacks, all of which takes away from the building's efforts to frame the street. On-street parking is well used on this street and works well as a buffer. Additionally, it is a positive note that the sidewalks are double-loaded, rather than being present on one side of the street only.

SECTION LOCATION



STREET SECTION - PACKARD AVE.



	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	16	48	64
4-way Intersections	4	16	20
Connectivity Measure	*64*	*208*	*272*
Land Area	*159.34*	*402.23*	561.57
Pedestrian Choices Per Acre	0.40	0.52	0.48

PEDESTRIAN CHOICE

Coquitlam has a mediocre level of connectivity, with 0.5 choices per acre for pedestrians. This may seem like a high number, given the small pedestrian walksheds, and the use of a 'superblock' model in the mall area. In fact, the connectivity is lowest in the area closest to the station, with the five minute walk ring having a connectivity measure of 0.4. This low level of connectivity immediately surrounding the station area is the main reason for the small pedestrian walksheds.

The 0.52 choices per acre in the outer ring is a mediocre level of connectivity, and is enhanced by the use of lanes within the single family areas. Lanes greatly increase the potential routes available to pedestrians, and contribute to the overall walkability of a neighbourhood. The use of lanes is surprising in a neighbourhood of this vintage (1960's – 1970's), given the preference for cul-de-sacs and curvilinear streets. Where cul-de-sacs are employed in this case study, there is often a pedestrian connection through to adjoining streets which helps to increase pedestrian connectivity.

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	1.8	12
P.M.Count	1.8	126

PEDESTRIAN USE

Once again, this case study exhibits a low quality pedestrian environment, with limited pedestrian connectivity. The pedestrian usage was again low, but not as low as in other case studies. Measuring at the primary intersection of Pinetree and Lougheed Highway, morning pedestrian counts exhibited no significant use, while the p.m. peak had 21 people over a ten minute period. The majority of these were shoppers from the mall accessing the bus loop, which is located across Lougheed Highway next to the rail station. It is somewhat ironic that this case study has the highest pedestrian usage numbers, despite pedestrians having to contend with zero buffering from highway traffic, excessively long signal cycles, and a low quality pedestrian environment. High use pedestrian environments should be high quality environments, a criteria not just of Transit Oriented Development but a fundamental aspect of good urban design.

Coquitlam's commuter rail station area has several of the necessary land use components of Transit Oriented Development, but the lack of residential density and pedestrian connectivity minimizes the benefits which could be produced.

A large portion of the potential TOD area is not being realized, particularly because of a lack of connectivity in the station area. The primary obstacles to pedestrian connectivity in the station areas are the railroad and the highway system. This lack of connectivity separates residential areas from both the transit facility and retail activities, both of which are on the north side of the railroad. The location of most of the multi-family housing adjacent to the retail core somewhat reduces the importance of the poor connections around the station area.

Land uses in the study area have all the necessary components of Transit Oriented Development. However, the massive commercial presence is primarily of 'periodic' type uses, highlighted by the Coquitlam Centre Mall. The internalized commercial activity of the mall takes away from the pedestrian environment by creating large setbacks from the street for surface parking and effectively privatizes the public realm by moving storefronts inside. The mall also contains a large number of 'daily' type uses which if located on-street, could animate the public realm with pedestrian traffic. With regards to the remaining commercial developments, they consist primarily of 'periodic' uses which are designed in a manner focused on accommodating large automobile volumes. This translates into a low quality pedestrian experience, and high number of vehicle trips.

Housing choice in the case study is reasonably good, although it tends to be segregated based on density. Most of the multi-family units are apartment units, which are located close to the retail area around Coquitlam Centre Mall while lower density townhouse and duplex typologies are concentrated in areas south of the railroad tracks. There is little integration of multi-family and single family areas. Also, most of the higher density housing types are situated further away from the station and the primary retail area. This is counterproductive to creating the animated civic cores which Transit Oriented Development demands, and decreases the chance that residents will walk to retail sites.

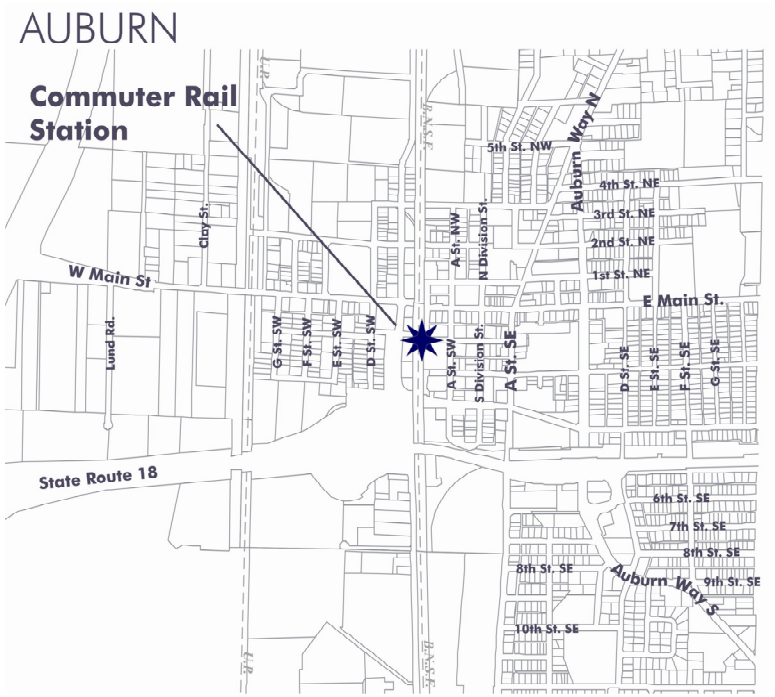
While housing choice is satisfactory, densities in the case study remain low. Gross densities for the case study are 2.7 units per acre. This is mainly due to the large amount of surface parking and other underdeveloped land within the town centre area. In existing residential areas, development has been at a very low density (as illustrated by the net density measures), at approximately 7 UPA. This is not an encouraging sign, as it illustrates that there is not a good precedent for higher densities within the case study area. The outlook for increased densities in the Coquitlam Centre case study is tempered by the planned Burke Mountain development, a mixed-use project of approximately 7,600 units (representing ~18-22 years of absorption at 2004 rates). Any multi-family projects in Coquitlam Centre will be competing with Burke Mountain for market share.

The ability for transit to serve local employers is not good. Employment densities are more promising than the first two case studies with a large amount of employees in the case study concentrated in a single retail mall. However, the employment densities of most retailers is still much smaller than office uses, and traditional commuter rail may be unable to cope with the largely part-time working hours of retail employees.

The pedestrian realm is extremely poorly connected in the station area, and is lacking in quality in the retail core. Massive setbacks around shopping centres and high volume arterials create an exposed pedestrian realm which borders on dangerous at times. Sidewalks have no buffering from passing vehicles, and pedestrian amenities such as seating, are largely left up to private establishments located around the mall. This low quality pedestrian environment is surprising, given that pedestrian usage is at good levels, especially to and from the bus loop located within the commuter rail station facility. With a new rapid transit link expected at this site by 2010, it would be hoped that the pedestrian realm's quality will reflect this site's importance as a budding transit hub.

Coquitlam Centre's future as a Transit Oriented Development will require adapting its street network to meet the basic principles of pedestrian connectivity and pedestrian quality. Retail uses next to a station aren't arranged according to TOD principles if you can't walk to them. Coquitlam's approach to creating downtown vitality is a marked difference from its partner in the Seattle area, Auburn.

Top. 4.18 Vacant industrial land
Middle. 4.19 Downtown retail area
Bottom. 4.20 Station area public art



CASE STUDY 4: AUBURN

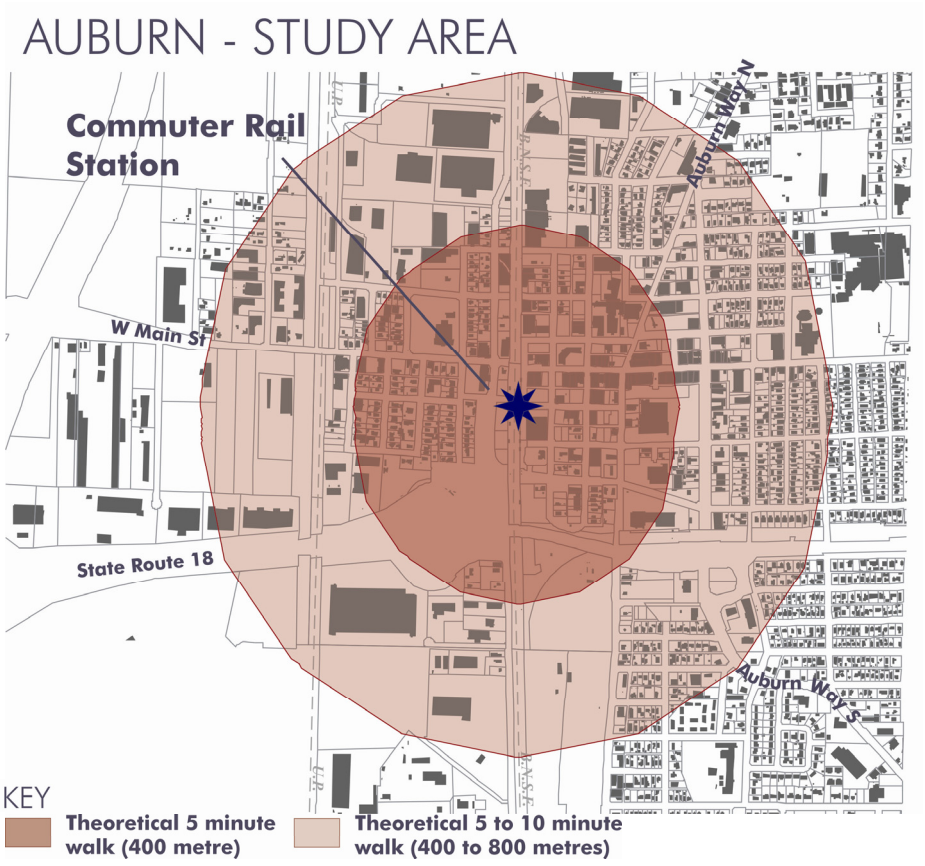
INTRODUCTION

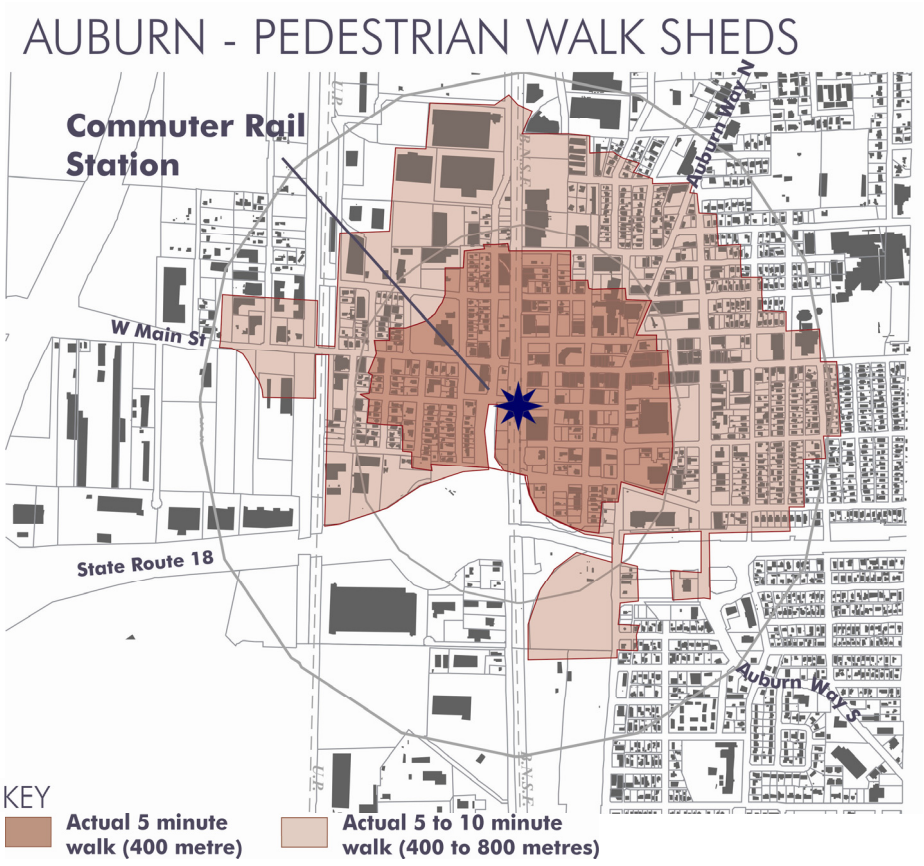
The city of Auburn is located 35 kilometres from Seattle, and has a population of approximately 45,000 people. The city lies in a fertile valley, which provided the agricultural base from which it grew. While the city started as a farming community, it is now home to a large residential population as well as a strong industrial base. Auburn is a 34 minute train ride from Seattle, or a 30 - 40 minute drive. The Auburn station is located adjacent to the community's historic downtown, and its mixed-use parking structure also contains a pedestrian overpass across the tracks.

For the Auburn case study, the potential TOD area represented by a 'crow-fly' 5 minute walk contains 164 acres of land, while the potential area which could be reached by a 5 to 10 minute walk contains 405 acres of land, for a total study area of 569 acres.

The pedestrian walk-shed however, or the area which is *actually* accessible by a 5 minute walk is 97 acres, while a 5 to 10 minute walk accesses an additional 205 acres of land. This totals to an actual 10 minute walk area of 302 acres, or a TOD 'efficiency rating' of 53%. Given the Auburn downtown area's relatively high density street network and the station facility's connection over the railroad tracks this number seems surprisingly low, although upon closer examination the barriers to pedestrian movement are familiar ones.

The walk shed map for Auburn illustrates the importance of pedestrian connectivity towards maximizing a TOD's potential. In the residential northeast, where a fine grained street network maximizes connectivity, the actual 10 minute walk distance comes very close to reaching the theoretical 10 minute walk distance. In the industrial northwest, where the street network is not as fine grained, pedestrian movement becomes more constrained. Finally, to the south of the station, pedestrian connections are destroyed by the ubiquitous elevated freeway, in this case State Route 18. The saving grace in the Auburn case study is that much of the land on the south side of the freeway is either undeveloped or of a low density nature, neither of which contribute to a Transit Oriented Development environment.





LAND USE

There are a number of land uses in the Auburn case study which contribute towards the ideals of Transit Oriented Development, including a number of commercial uses within close proximity to the station area. In fact, the Auburn case study represents the best arrangement of land uses for a Transit Oriented Development of any of the communities studied in this project due to a number of pre-existing conditions.

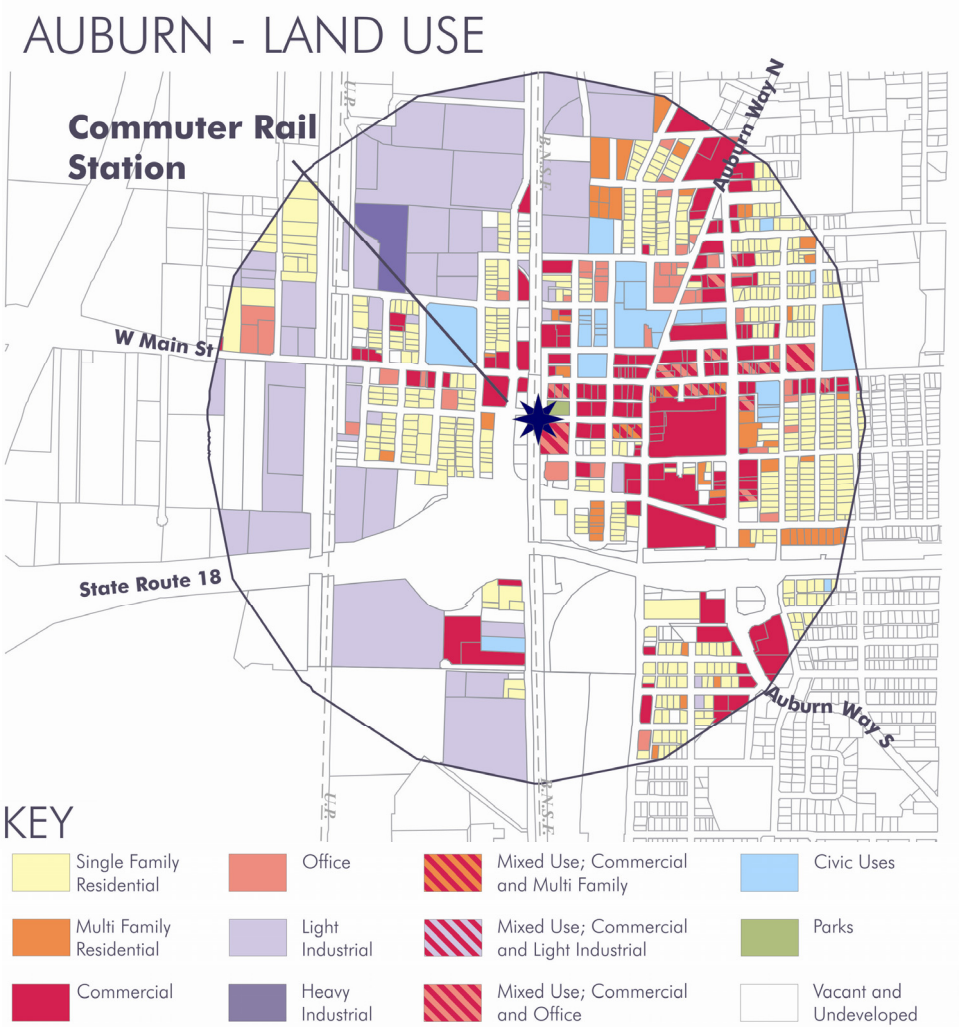
Auburn's downtown area is home to a large amount of commercial activity and remains the primary retail node in the immediate area. This keeps shoppers coming into the area, and contributes to a very active downtown core. A good example of retail activity triggering pedestrian activity is the Auburn Safeway, a 5,100 square metre (~55,000 sq. ft.) store which generates a high number of customer trips. Thanks to good connectivity with an adjacent retail high street, many of the Safeway customers stay in the downtown area to shop at smaller retailers, visit local café's, or conduct business.

Industrial uses in the Auburn case study are concentrated to the north, especially in the area between the Union Pacific and Burlington Northern – Santa Fe railroad tracks. The industrial tenants range from smaller manufacturing sites to large distribution centres and include large national companies such as U.S. Gypsum. While the locational decisions of these industries are not based on TOD theory, there are many positives which come out of this situation. The interstitial space between two closely bunched transportation corridors (especially railways) is all too often a void. The Tukwila case study for example, has absolutely no development in a very similar area. In the Auburn situation, the industrial uses have achieved a location which benefits them, while the city has avoided the presence of a land use 'vacuum' in their downtown.

The main residential area in the case study is east of the retail area, and is primarily single family. Multi-family housing in the station area is scattered throughout, and there is no significant residential density cluster to speak of.

LAND USE MIX

The largest omissions in this case study's land uses are residential uses. With such a large amount of commercial activity and highly walkable downtown, it is disappointing that there is no significant residential presence in the Auburn core. Not only is there a large amount of retail, the downtown environment is for the most part a high amenity environment with a good level of civic investment in the public realm including planting, lighting, and a number of well maintained civic plazas. Unfortunately, with no local residential base to utilize this environment, the investment is somewhat wasted at the end of every business day when the downtown becomes dormant.



Of the total 264 total goods and service providers in this case study, 60% are located within the 5 to 10 minute walk ring. This runs counter to TOD theory which would like to see retail activity concentrated around the station area. The good news is that the commercial uses within the immediate station area are more likely to be 'daily' type uses rather than 'periodic' uses, the latter tending to locate further away from the station. The location of 'periodic' uses in this case study is based on their tendency to congregate along arterials, specifically Auburn Way, the city's primary north-south arterial. 'Daily' retail on the other hand has more diverse locational attributes and does not always demand high exposure locations. One of the major reasons that Auburn's 'periodic' uses congregate on Auburn Way is that a good number of them are auto-oriented businesses such as car washes, car dealers, and fast-food restaurants, and therefore want to locate in convenient locations for their customers.

Almost one in three commercial uses in the Auburn case study are 'daily' uses. As mentioned, they are in various locations throughout the case study. One reason for the high number of 'daily' uses (relative to the other case studies), is the nature of Auburn's downtown parcelization. The downtown area includes small, medium and large parcels, all within a fine-grained street structure. This variety of parcels and subsequently buildings, encourages commercial activity from all sizes of entrepreneurs, including smaller ones who may lack the resources to rent large amounts of floorspace or purchase large parcels. This commercial diversity also allows for larger businesses such as the Auburn Safeway to function, while also acting as a magnet for activity.

	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	36	33.3%	38	24.4%	74	28.0%
Periodic Uses	72	66.7%	118	75.6%	190	72.0%

Figure 4.21 Auburn's W. Main Street

HOUSING CHOICE

	Units	% of Total
Single Family	454	52.5%
Multi-Family	411	47.5%
Duplex	*28*	*(3.2%)*
Triplex	*12*	*(1.4%)*
Townhouses	*22*	*(2.5%)*
Apartments	*349*	*(40.3%)*

There are 454 single family homes in the case study, as well as 411 multi-family dwellings, the latter being primarily apartments. Unfortunately, the multi-family product in this case study is not arranged in a TOD-complimentary fashion, but rather is in clusters located throughout the study area.

TOD principles would have multi-family housing located adjacent to commercial areas, and concentrated near the station area. By locating next to commercial uses, multi-family housing can act as a buffer between larger scale commercial buildings and single family residential areas. When located close to a transit station, it creates a large potential transit ridership base for commuter rail service. A concentration of residential density can also animate the environment with pedestrian traffic, as opposed to dispersing multi-family housing, which subsequently abandons this opportunity. This is what has happened in the Auburn case study, where apartment buildings are peppered throughout the study area. There are some mixed use units in the historic downtown area but little of this is new construction.

With regards to the smaller scale multi-family, 18 of the 28 duplex units are located adjacent to one another in the southeast of the case study, rather than being integrated into single family areas. This obviously reduces the locational choices of duplex residents. Single family units are primarily on small lots, with house construction dating mainly from pre-war to the 1950's and 1960's. Most single family residential areas are also accessible by lanes, increasing pedestrian connectivity within these areas.

HOUSING DENSITY

Gross Unit Densities*

5 minute walk 'ring'

Total Units	308
Acres	164.04
UPA	1.88

10 minute walk 'ring'

Total Units	557
Acres	404.73
UPA	1.38

Total Study Area

Total Units	865
Acres	568.77
UPA	1.52

Net Unit Densities*

5 minute walk 'ring'

Total Units	308
Acres	25.15
UPA	12.2

10 minute walk 'ring'

Total Units	557
Acres	64.55
UPA	8.6

Total Study Area

Total Units	865
Acres	89.7
UPA	9.6

*Gross unit densities are housing units per total acreage
Net unit densities are units per residential parcel acre

The overall densities for the Auburn case study are low, with a gross UPA of 1.52. This low level of density is a reflection of the high amount of non-residential land, and where there are residential uses, a large degree of single family housing. The low intensity of residential activity is confirmed by the net residential density measure, which reflects a UPA of below 10 for the entire case study. It should be remembered that the net parcel density measure employed here returns the highest density figures of any density methodology, so the 9.6 UPA number can be considered as the highest figure of density measurable in this case study.

A positive note is that densities decline further away from the commuter rail station area, a key principle of Transit Oriented Development.

EMPLOYMENT DENSITY

The Auburn case study has three sectors in which it generates a large amount of employment; industrial uses, commercial uses and institutional uses.

The industrial employers in Auburn tend to have lower employment densities, as expected. However, they do take up a large portion of the case study, and therefore cannot be ignored. U.S. Gypsum, a wallboard manufacturer, is perhaps one of the largest industrial employers with 50 staff on hand during peak periods. However, this is over a large site area containing a large manufacturing building and expansive paved areas used for shipping purposes. The commercial uses in the study area have higher employment densities, as evidenced by the 13 employees per acre of the Auburn Safeway (or at the building level, 1500 sq. ft. / employee). These higher densities are promising, given the large amount of retail activity in the Auburn case study. The most important employer in the case study is by far the Auburn Regional Medical Center. Not only does this hospital complex employ a large number of people, it also has a high employment density. This is an extremely important combination as it is these high density employment centres which can make transit service a feasible commute option.

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Norplex Plastics	6	6.76	0.89
U.S. Gypsum	50	7.70	6.49
West Auburn High School	33	4.77	6.92
Washington Elementary School	50	4.34	11.52
Safeway	45	3.48	12.93
Auburn Regional Medical Center	391	7.26	53.86
Post Office	105	1.81	58.01

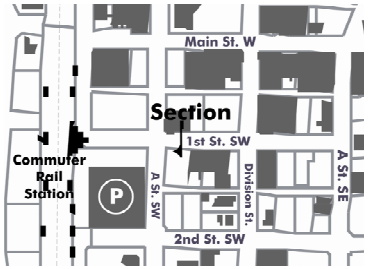
Figure 4.22 Auburn's Regional Medical Center is a major employer within the case study

PEDESTRIAN QUALITY

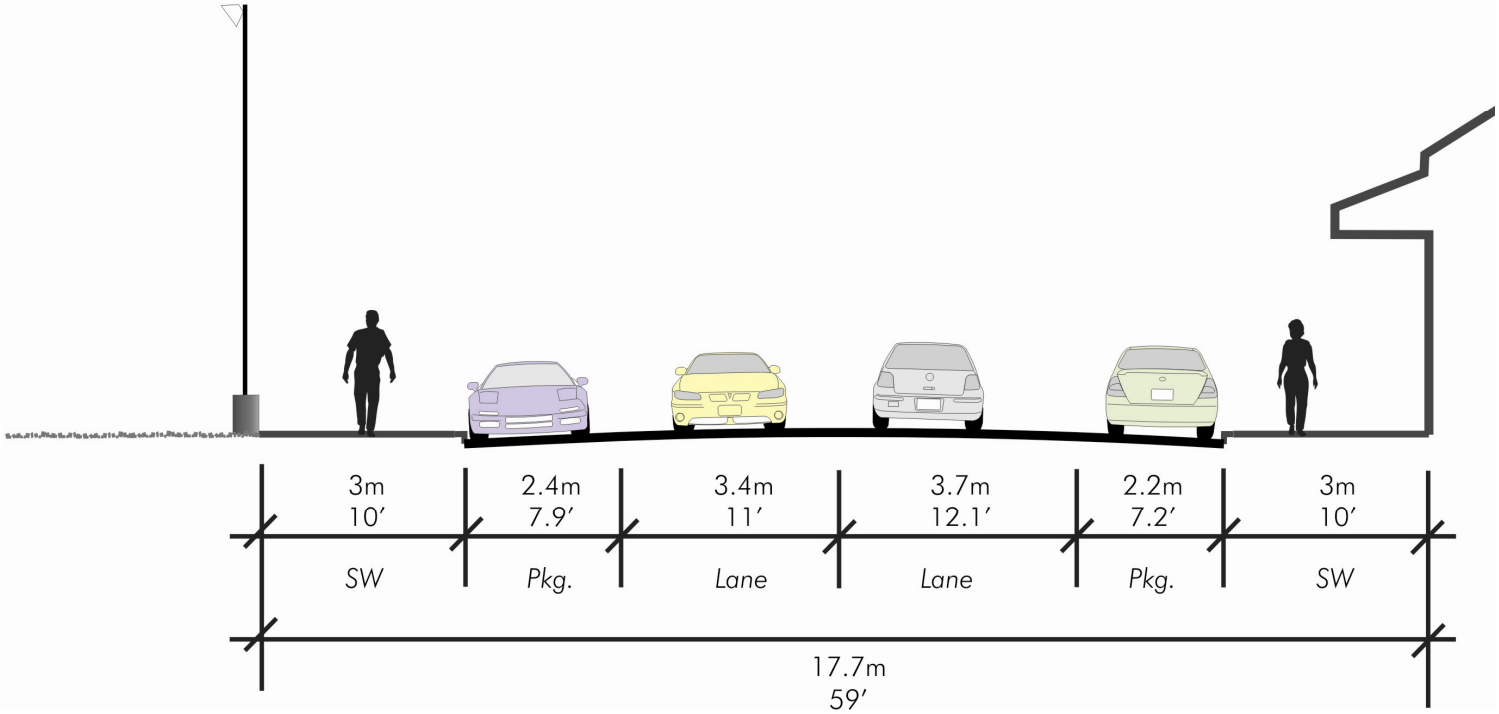
The pedestrian quality of Auburn's station area is extremely varied. It has high quality streetscaping in the commercial and civic areas as well as single family areas, but is in poor shape in industrial sectors and multi-family areas.

The street section location is the primary access street to the commuter rail station, and also serves as an indirect connection with the retail areas along Auburn Way. The street is flanked on the south side by a gravel parking lot, and on the north by a restaurant. This short street of 250 metres (820 feet) terminates to the west with a public plaza and the clock tower of the commuter rail station building. The street makes use of on-street parking as a buffer for pedestrians as well as pedestrian bulges at the intersection of A St. SW and 1st St. SW. The travel lanes are both ~3.5 metres (~11'6") wide, and not terribly over-designed when compared to some of the other case studies in this project, even though this street does accommodate a high volume of bus traffic. One interesting note is that the use of concrete for many of the streets in this case study (as opposed to the asphalt used in the other case studies) detracts from pedestrian quality through a marked increased in noise and vibrations. The north side of the street offers pedestrians shelter under fabric awnings, while the south side of the street is bordered by a gravel parking lot, containing vehicles in various states of repair.

SECTION LOCATION



STREET SECTION - 1st STREET SW



PEDESTRIAN CHOICE

Auburn has a good level of choice for pedestrians compared to the other case studies. This is evident by the large extent of its walkshed, especially in the north-east. The Auburn case study has a particularly good amount of pedestrian choice in the commuter rail station area, a requirement of Transit Oriented Development. This is due to the fine grained street network, use of lanes and alleys, and even mid-block pedestrian connections. Pedestrian choice declines as one moves farther away from the station area, particularly because of the coarse street network in the industrial areas, as well as the barriers presented by the elevated freeway which has only two pedestrian underpasses in the case study area. If Auburn's fine-grained street network had been able to expand uninterrupted to the south, the level of pedestrian choice would undoubtedly be the best of all case studies examined. Unfortunately, this is another example of large transportation infrastructure reducing pedestrian connectivity.

	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	26	49	75
4-way Intersections	28	42	70
Connectivity Measure	*190*	*315*	*505*
Land Area	*164*	*404.73*	568.73
Pedestrian Choices Per Acre	1.16	0.78	0.89

PEDESTRIAN USE

The Auburn station area has a non-existent amount of pedestrian use, not because of a poor pedestrian environment, but rather due to the lack of residential in the case study. While there are a number of people accessing the Seattle Sounder at this station, they are almost exclusively using the park and ride lot. This creates an unfortunate situation with a good quality pedestrian realm is being underutilized. The sample was taken at the same point as the street section before one of the a.m. trains departed, and in the evening after one of the return trains arrived.

This absent pedestrian usage is unfortunate, and it would be hoped that in the future Auburn's residential base will increase to a level which rewards the City's high level of investment in the pedestrian realm.

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	1.8	0
P.M.Count	1.8	0

Figure 4.23 Auburn's streets offer high quality public amenities, including planting, lighting, and textured pavement.

Auburn's station area is well on its way to meeting the definition of a Transit Oriented Development, and with an increased residential presence in this community, could be amongst one of the better examples studied in this project.

Auburn currently utilizes close to half of its potential TOD area, hampered by particularly poor connectivity across State Route 18. Fortunately, there is very little residential and retail activity south of the highway, so the lack of connectivity across it is not as crucial as it could be. However this lack of connectivity does segregate retail and residential uses which exist in the southeast from the rest of the case study area, a common and unfortunate side-effect of freeway infrastructure.

Land uses in the Auburn case study area of an excellent mix of residential and retail uses distributed in a manner which contributes to Transit Oriented Development. Not only is much of the commercial activity pedestrian friendly, it is concentrated within a five minute walk of the station area. Also, a strong diversity of tenants includes both 'periodic' and 'daily' uses rather than one or the other. While many of the 'periodic' tenants are dependant upon automobile traffic, they are concentrated along a major arterial rather than in downtown pedestrian environments. Industrial uses are sandwiched between rail corridors, a location which is all to often a development void in communities. This provides an employment base for this case study while not detracting from the pedestrian experience.

Housing choice in the case study remains somewhat limited, with less than 1,000 total units split between single family residential and apartments. There are less than 70 multi-family units of other typologies, which reduces the appeal to families and other tenants who might favour ground-oriented product over traditional apartments. The low level of housing choice is exacerbated by the low overall densities, which have a major impact on Auburn's success as a Transit Oriented Development.

The lack of housing density is an impediment to Auburn's station area meeting the principles of Transit Oriented Development. Gross densities for the case study are 1.5 units per acre, half that of most of the other case studies. This is caused by a lack of multi-family developments in the case study area, as well as a significant amount of underdeveloped and industrial land. In built-out residential areas, parcel level densities are much better, with a parcel density of 12 UPA in the station area dropping down to 8.6 UPA in the outer portions of the case study. The reason for the higher parcel densities, especially when there is so little multi-family development, lies in the small lot single family areas which generally have lot sizes of 540 square metres (5,800 sq. ft. or 45' x 132'). The difference in gross and net UPA's tells us that there isn't a significant residential population in this case study, but where people *are* living they are willing to live in higher density environments (or at least higher density according to suburban standards).

The ability for local employers to support transit is varied. We have seen in other case studies how light industrial uses have trouble generating high enough employment densities to warrant transit. This holds true in Auburn as well where industrial tenants employ less than 10 employees per acre. However Auburn is in the enviable position of having a large, high-density employer in the Regional Medical Center. With many spin-off employers (i.e. clinics, doctors offices) associated with it, the hospital may play a role as an employment 'anchor' much the same way as a grocery store supports adjacent retail.

The pedestrian realm in the Auburn case study is of high quality in the key commercial areas around the station, but is left lacking in the small but important multi-family areas. Industrial areas have the same sub-standard streets as found in similar precincts in the other case studies. Streets in the station area have been improved through the use of lighting and planting as well as the use of textured materials in some commercial areas. Well-used on-street parking acts as an important buffer for pedestrians and there is a good deal of pedestrian amenities including seating and an excellent public art program. Taking away from this encouraging example of a high quality pedestrian realm is its underutilization. Pedestrian usage in the case study remains low, especially in the station area. The park and ride aspect of the station facility does not inject any pedestrian animation into the streetscape and with a limited local residential base there are not many locals on the streets after closing time.

Auburn meets many of the criteria of Transit Oriented Development, notably land use mix and arrangement, pedestrian quality, and high density employers. However, its lack of a station area residential population means that much of the city's investment in the urban public realm is sacrificed.

CASE STUDY PAIR: MISSION AND PUYALLUP

These case studies represent peripheral communities which are on the edge of their respective metropolitan regions and have strong ties to primary industry.

CASE STUDY 5: MISSION

INTRODUCTION

Mission is located 68 kilometres (42 miles) from downtown Vancouver, and is over an hour's drive during peak periods. Mission is an old agricultural and forestry community whose residential base has swelled to approximately 31,000 people including many families and retirees. The city still has a large number of people employed in resource sectors but is becoming increasingly popular as a residential choice for families, many of whom commute to the inner suburbs and CBD. Mission lies in on the north shore of the Fraser River, which is home to several sawmills within the City limits. The Mission commuter rail station is on North Railway Avenue which is half of a one-way couplet, the other being Mission's historic retail high street, 1st Avenue.

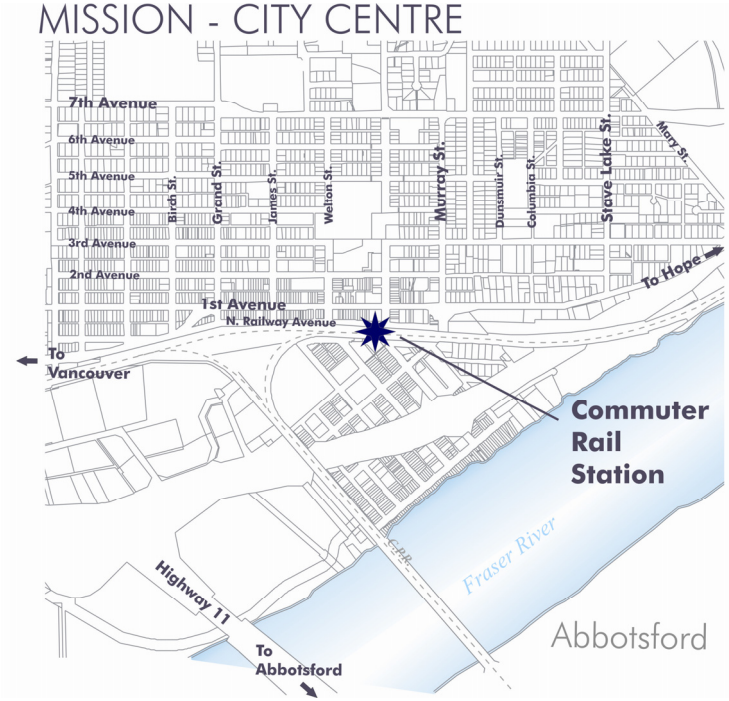


Figure 4.24 Mission's Commuter Rail Station

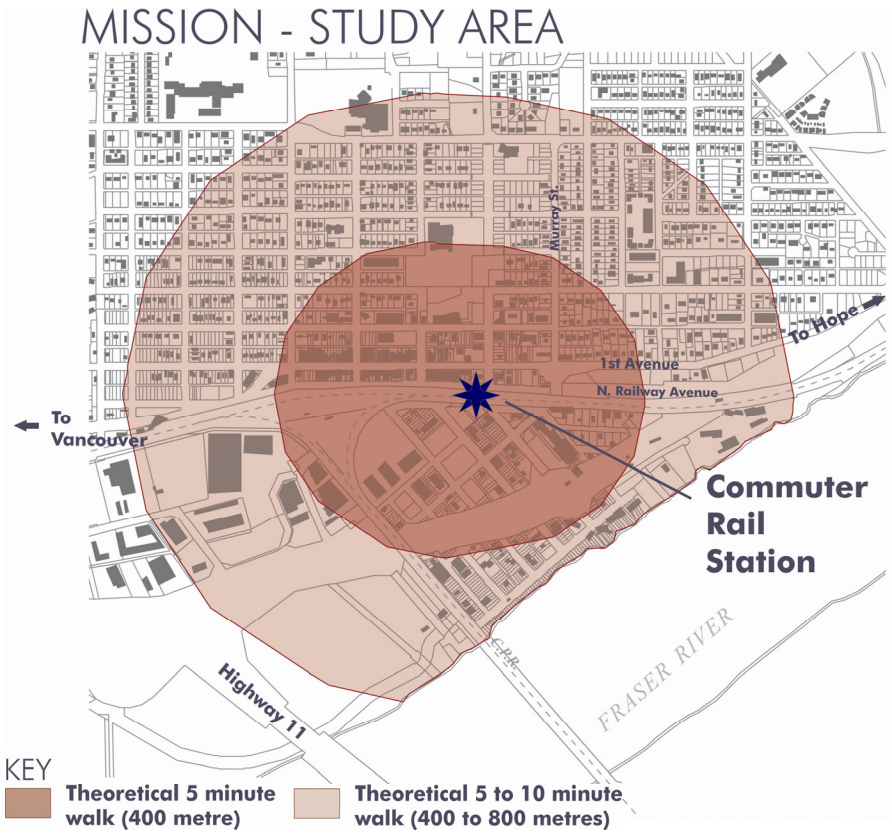
Figure 4.25 Mission's N. Railway Ave

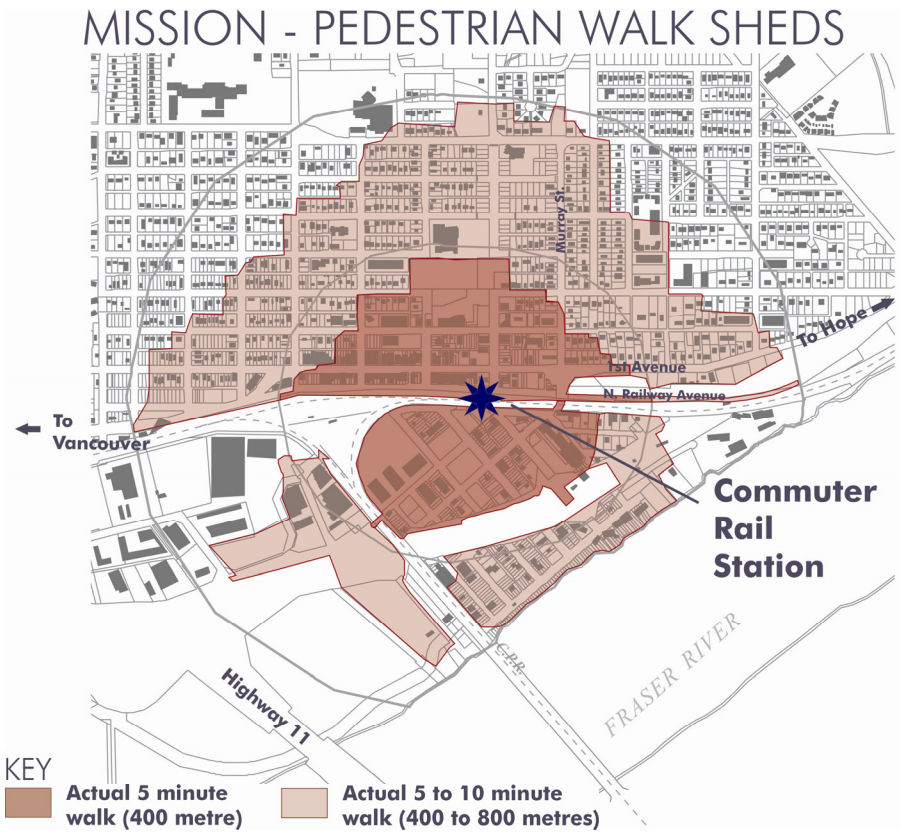
CASE STUDY AREA

The study area of 800 metres (1/2 mile) around the commuter rail station encompasses a portion of the Fraser River, which was not included in the study. In Mission's study area the first ring of 400 metres (1/4 mile) encompasses 162 acres, while the potential area which could be reached by a five to ten minute walk contains 338 acres of land, for a total study area of 500 acres.

These 'crow-fly' distances are not an indication of the actual area accessible by five and ten minute walks. The actual area accessible by a five minute walk from the Mission station is 93 acres, while a five to ten minute walk accesses an additional 209 acres, for a total pedestrian walk shed area of 302 acres. Therefore, the actual area accessible through a ten minute walk encompasses 60% of the potentially accessible area. This represents a very good TOD 'efficiency rating' compared to the other case studies.

Freeways have provided the major barrier to pedestrian mobility in other case studies. Mission however, does a good job of integrating one of its freeways (The Lougheed Highway) into their existing street system. This is done through the use of a one way couplet in their downtown, which while encouraging fast moving traffic in the downtown, avoids the massive impacts which elevated freeways produce in urban areas. Another potential barrier to pedestrian movement is the railroad. Pedestrian accessibility across the railroad tracks in Mission is overcome at two points. Firstly at the station itself through the use of a pedestrian overpass, and secondly at Murray Street via a vehicular overpass. However, in the southwest of the case study, where industrial uses dominate the landscape, railroad infrastructure creates more barriers to pedestrian accessibility, barriers which are not overcome as effectively as in the immediate station area.





LAND USE

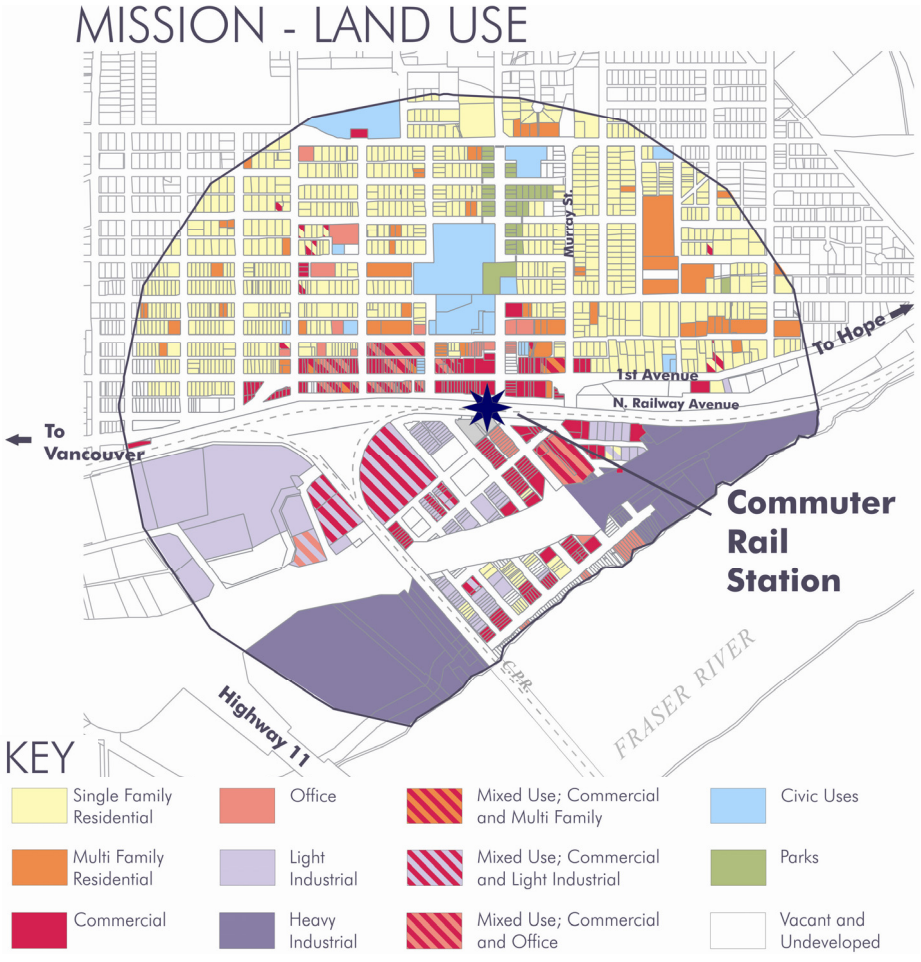
Major land uses in the Mission case study are separated by the railway. The railway is at the base of a large hill made up of residential and commercial uses while on the flats between the railway and the river industrial uses dominate. This is not dissimilar from the Port Moody case study, which has roughly the same distribution of land uses and topography.

Mission's industrial tenants represent its historical role as a forestry commerce centre. The study area has two heavy industrial uses, consisting of a sawmill and a log sorting yard, both of which extend their operations into the Fraser River. Light industrial uses (which are not normally reliant on the river), are situated closer to the railroad. These smaller industrial uses are sometimes combined with small retail operations. For example, a small engine repair shop might also have a power tool rental centre, or a drywall distributor may also sell hardware. Retail and commercial uses in the study area are focused along 1st Avenue, a one-way street running east-west which is also Mission's historic commercial district. About one in three of these uses is local serving, including a number of cafés and restaurants. This commercial high street has some mixed use developments including local serving offices, and a limited amount of multi-family residential. There are however no large retailers in the downtown or recently established retail. The most important retail activity for downtown Mission is not on 1st Avenue, but rather 1.5 kilometres (1 mile) to the west at the Junction Centre, a 23,000+ square metre (250,000+ square feet) facility, euphemistically labeled an 'unenclosed shopping centre' by its owner RioCan REIT. This strip mall development and adjacent satellite projects have greatly reduced the importance of 1st Avenue and other existing retail areas. The residential area of Mission begins one block north of 1st Avenue, and continues north throughout the case study. Multi-family uses are located in the 1st Avenue area, as well as in the southeast of the study area. These two multi-family areas are mainly apartment buildings and townhouses, as well as a few senior's facilities. The multi-family developments scattered throughout the single family areas are mainly in the form of duplexes and triplexes.

LAND USE MIX

The mix of multi-family development and commercial activity in the 1st Avenue area is very much in keeping with TOD principles. Not only do these developments bring more people to the downtown area and keep it an active and vibrant area, they also create a buffer between single family housing and busy commercial areas. Unfortunately the large multi-family component to the southeast is somewhat separated from the retail core, and would be better sited closer to the downtown core. With the 1st Avenue commercial core under continued assault from peripheral retail developments, any additional population in the downtown core is desirable.

The industrial base of Mission is an important employment base for the community, as well as a source of employment and tax revenue for the city. The separation of industrial and residential uses is accomplished by the railroad, which isolates many of the negative externalities associated with industrial uses such as truck traffic and noise. Mission does a good job of keeping industrial uses out of retail areas, while ensuring that retail uses *are* present in industrial areas. The latter is important, as it ensures that industrial employees have access to local serving retail such as restaurants, while also encouraging industrial-oriented retail.



	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	39	*29.3%*	7	*25.9%*	46	*28.8%*
Periodic Uses	94	*70.7%*	20	*74.1%*	114	*71.3%*

Commercial uses in the Mission station area comply with the principle that there should be a concentration of commercial uses within a five minute walk of the station area. Eight out of ten commercial uses in the Mission case study are located within the afore mentioned five minute walk, with the remaining commercial activity found primarily in the waterfront area, catering to marine and industrial customers. While this distribution of commercial activity appears to be very encouraging for Transit Oriented Development, it is recent retail projects located outside of the case study, particularly at "The Junction" shopping centre, which have the most importance for Transit Oriented Development in Mission.

While the downtown Mission houses most of the case study's retail, it is not a high quality retail environment. There are few new retail businesses, no large anchor stores, and a high number of vacancies. While the decline in Mission's downtown commercial core is due to a number of factors, competition from peripheral retail centres is undoubtedly a key. At 23,000+ square metres (250,000+ square feet), "The Junction" shopping centre represents *at least* the equivalent of half of downtown Mission's total retail space. Add to this a ~9,300 square metre (~100,000 square feet) Canadian Superstore further west, and its easy to see people aren't shopping in downtown Mission anymore. As more and more retailers locate in peripheral Mission, the prospect for adhering to TOD principles in downtown Mission gets smaller and smaller. Any one of the several anchor stores in these peripheral developments could have provided a crucial influx of shoppers to the downtown core. Instead, peripheral developments, both residential and retail, are slowly transforming Mission's historic downtown into a vacuum.

HOUSING CHOICE

Housing in the Mission case study offers a moderate number of choices, with 48% of the total housing unit count in the multi-family category, while the remaining units are single family homes.

Multi-family housing is predominantly apartment housing, although there are also a number of duplexes in the study area. Fortunately most of the apartment housing is located close to, if not adjacent to, the retail core. While most of these units are of an older vintage, there is a limited amount of newer development, including a mixed apartment / townhouse project. Having a supply of apartment stock is especially important in family oriented cities such as Mission, where alternatives to single family housing are rare. The spatial distribution of the other multi-family units, which are mainly duplexes, follows no definite pattern. They are scattered throughout single family areas, with some located mid-block, others on corner lots, some clustered and some not.

The most important prospect for housing choice in the Mission case study is not actually in the case study, but west of downtown Mission. 'The GenStar Development' as it is colloquially named after the development company, is an 11,000 unit project located 6 kilometres west of downtown Mission. As this project represents over 70 years of absorption at 1990—2000 absorption rates, residential projects in downtown Mission will be hampered with having to take market share away from GenStar's greenfield site.

	Units	% of Total
Single Family	627	51.56%
Multi-Family	589	48.44%
Duplex	*50*	*(4.1%)*
Quadplex	*8*	*(0.7%)*
Townhouses	*28*	*(2.3%)*
Apartments	*503*	*(41.4%)*

HOUSING DENSITY

The gross densities for the Mission case study are 2.43 units per acre (UPA), with higher gross densities located in the 5 to 10 minute walk 'ring'. This distribution of density reflects the location of many apartment units in the outer 'ring' in the southeast of the case study. The low densities in the inner 'ring' can be attributable to the large amount of industrial and commercial uses in the station area, particularly south of the railroad. These commercial and industrial areas contain very few housing units, thereby reducing gross densities.

When looking at net densities, the housing picture is further clarified. Net parcel densities reflect that while there are fewer housing units close to the station area, the units that are present are built at 1.5 times the density of those in the outer ring. This is a promising note, as it indicates that there is acceptance of higher density housing forms within the immediate station area. However, for TOD principles to be adhered to, the absolute number of units must be increased in the immediate station area.

Gross Unit Densities*

5 minute walk 'ring'	
Total Units	305
Acres	162.3
UPA	1.9

10 minute walk 'ring'	
Total Units	911
Acres	337.4
UPA	2.7

Total Study Area	
Total Units	1216
Acres	499.7
UPA	2.4

Net Unit Densities*

5 minute walk 'ring'	
Total Units	305
Acres	24.37
UPA	12.5

10 minute walk 'ring'	
Total Units	911
Acres	109.57
UPA	8.3

Total Study Area	
Total Units	1216
Acres	133.94
UPA	9.1

*Gross unit densities are housing units per total acreage
Net unit densities are units per residential parcel acre

EMPLOYMENT DENSITY

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Meeker Log Sort	8	43.54	0.2
Leisure Centre	14	11.74	1.2
VIP Soaps	35	11.00	3.2
Mission Central Elementary	34	7.54	4.5
Liquidation World	10	1.45	6.9
Clarke Group Sawmill	175	21.09	8.3
Fields Department Store	4	0.25	16.0
Tim Hortons	8	0.45	17.8
Bellevue Hotel	20	0.29	69.0

Mission is an unlikely candidate as an employment centre TOD, as overall employment densities are currently low and not likely to increase in the future. The largest employer in the Mission case study is the Clarke Group Sawmill which has approximately 175 people on-site at peak period. However, this heavy industrial use has a low employment density of 8.3 people per acre because of its large site size. The Meeker log sorting operation has an even lower employment density due to a large site size coupled with a non-labour intensive operation.

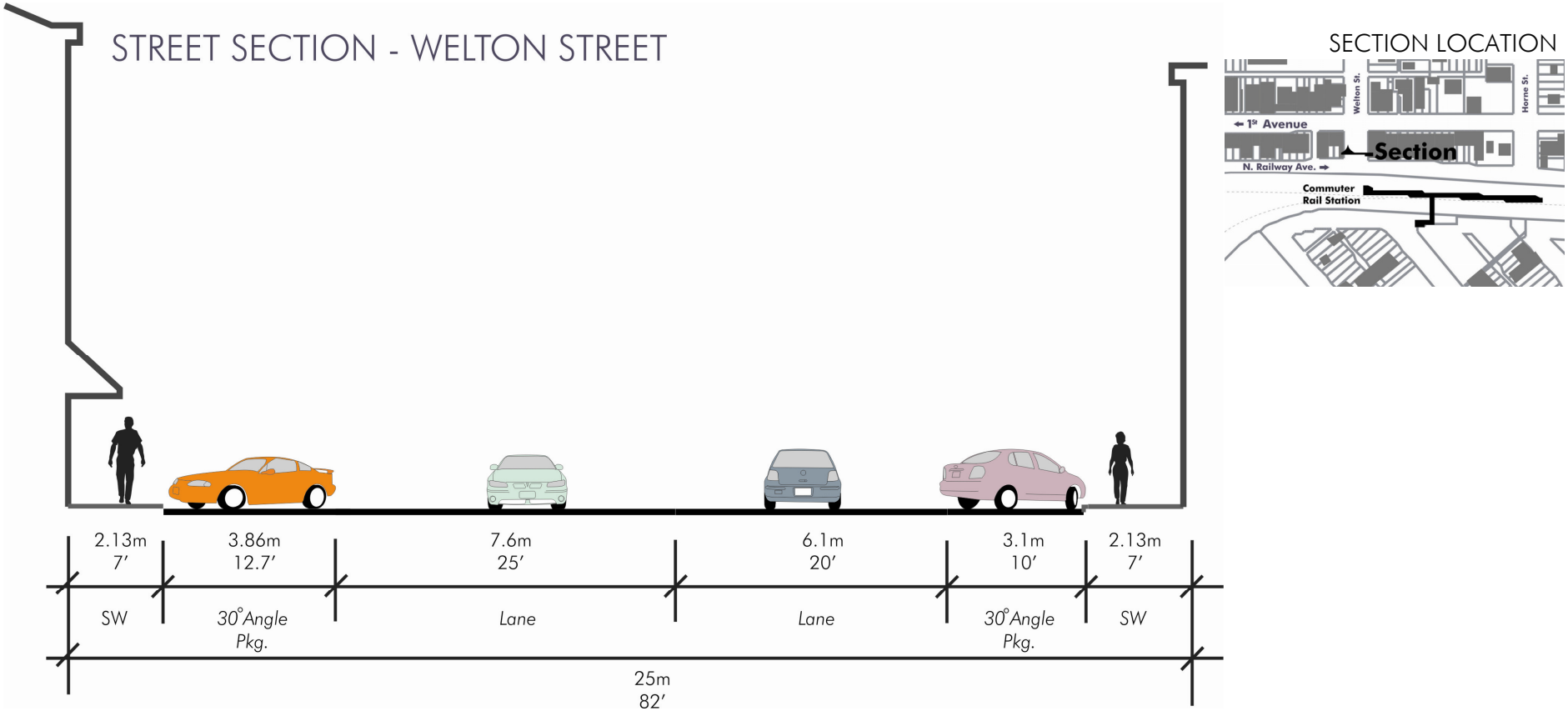
The light industrial uses in the case study tend to have higher employment densities than heavy industry, but still employ very few people per acre. VIP Soaps, a detergent manufacturer, employs a mere 3.2 people per acre. Civic and institutional employers such as Mission Central Elementary and the Leisure Centre employ between 1 and 5 people per acre, which is again not very high. Department store retailers such as Fields and Liquidation World have moderate employment densities, but their low number of total employees make them unimportant as employment generators. At the other end of the spectrum, the Bellevue Hotel represents a relatively dense employer, with 69 employees per acre. While this number is a statistical outlier, it *is* credible given the Hotel's multiple activities, including a restaurant, liquor store, and the roughest bar this side of Whonnock.

The employment densities in Mission are quite low, and with a lack of large office employers or other high density employers, this seems unlikely to change. While there may be potential for more jobs in Mission's industrial area, they would not likely be at employment densities which could support transit service.

PEDESTRIAN QUALITY

The pedestrian environment around the Mission station area consists of industrial streetscapes to the south of the station area, with more pedestrian-friendly streets in the commercial areas around 1st Avenue. The station area pedestrian environment is somewhat diminished by the fast-moving traffic on N. Railway Avenue which runs parallel to the station.

The street section is along Welton Street, a street connecting the 1st Avenue retail area and the Commuter Rail station. While Welton Street is a minor street in Mission's downtown, it is still a good example of the numerous streets (Horne St., James St., Grant St.) which connect residential and commercial areas with the commuter rail station. Perhaps the most remarkable aspect of these streets are their massive overdesign. While the street does see bus traffic, 25 foot travel lanes are wide enough to accommodate three busses, not just one. Overly wide street widths are also present on N. Railway Avenue, which contribute to higher vehicle travel speeds, as does the single-loaded nature of N. Railway. This overdesign is exaggerated by the low overall pedestrian usage of the downtown which creates the perception that the streets are bigger than they really are. Shelter for pedestrians is limited, with the occasional awning, while buffering from passing traffic is quite good due to the angle parking, which provides a 3.8 metre (12 foot) separation between pedestrians and passing vehicles.



	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	17	46	63
4-way Intersections	22	34	56
Connectivity Measure	*139*	*274*	*413*
Land Area	*162.28*	*337.38*	499.66
Pedestrian Choices Per Acre	0.86	0.81	0.83

PEDESTRIAN CHOICE

Pedestrians in the Mission case study had 0.83 choices per acre, with pedestrian choice slightly higher in the five minute walk 'ring'. This number is amongst the highest of all the case studies examined, but is still very low for a Transit Oriented Development. The comparatively high measure of pedestrian choice is due mainly to the fine grained street network in the commercial and residential areas which contain small blocks, and a high number of intersections. Another factor which increases pedestrian choice in the Mission case study is the inconsistent use of lanes and alleys. Where they are present, they offer pedestrians an increased number of options when walking.

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	2.13	12
P.M.Count	2.13	126

PEDESTRIAN USE

With a moderate quality pedestrian environment and relatively low density residential component, pedestrian usage may be expected to be low. It is low in absolute numbers, although when compared to the other case studies it is among the best. The pedestrian use sample was taken at the same location as the street section along Welton Street. While the pedestrians in the morning are exclusively commuter rail users, most of the afternoon pedestrians are retail users including a large number of children accessing a martial arts school on N. Railway Avenue. Very few of the commuter rail users walk up Welton to the retail area on 1st Avenue. What is interesting is that Welton Street turns into an informal kiss-and-ride parking lot prior to the train's arrival, as does N. Railway Avenue. Coupled with the fast moving traffic on N. Railway, this creates a dangerous situation, with pedestrians running across the busy N. Railway to get picked up.

Mission station's location adjacent to its historic downtown has endowed this case study with many of the basic attributes of Transit Oriented Development. However Mission's future success as a Transit Oriented Development is becoming more and more limited by peripheral residential and retail developments which remove daily activity from a promising downtown core.

The potential area for Transit Oriented Development is minimally hampered by a lack of connectivity across the railroad tracks, although Mission still is one of the best case studies in terms of utilizing its potential TOD area. By having a fine grained street network which accesses over 60% of its theoretical potential, Mission's station area allows transit users easy access to the retail core as well as single family and multi-family residential areas. While this lack of connectivity is greatest directly south of the station area, this precinct consists primarily of industrial and underdeveloped properties which are not essential elements of Transit Oriented Development.

Land uses in the study area consist of a good mix of residential and retail uses in addition to the employment generating light industrial areas. Commercial activity is in the form of a retail high street along 1st Avenue which offers both 'daily' and 'periodic' uses. This retail activity is threatened by peripheral shopping centres, an example being "The Junction" shopping centre, which has a retail floorspace equivalent to half of downtown Mission. The current linear alignment of the retail core provides many urban design benefits, including acting as a buffer between the industrial areas and residential uses, the latter primarily located north of 1st Avenue. Most of the residential areas in this case study have decent proximity to both the station and the retail core. However, the low overall densities in the case study reflect the need for additional housing units in the downtown area, a prospect which is limited by large-scale peripheral developments.

Housing densities in the case study are low at 2.4 gross UPA, despite relatively small lot single family sizes and a moderate amount of apartment units. With residential density driving the need for local retail, additional units in the study area would go a long way towards propping up downtown Mission retail activity. With much of the case study allocated to industrial uses, it might be expected that gross densities would be low. Net parcel densities of 9 UPA reflect the dominance of medium sized single family lots of 700 square metres (7,500 sq. ft.), versus higher density housing forms. Any multi-family product introduced into the downtown area will have to compete with the GenStar project, which represents over 80 years of multi-family supply at average 1990 absorption rates.

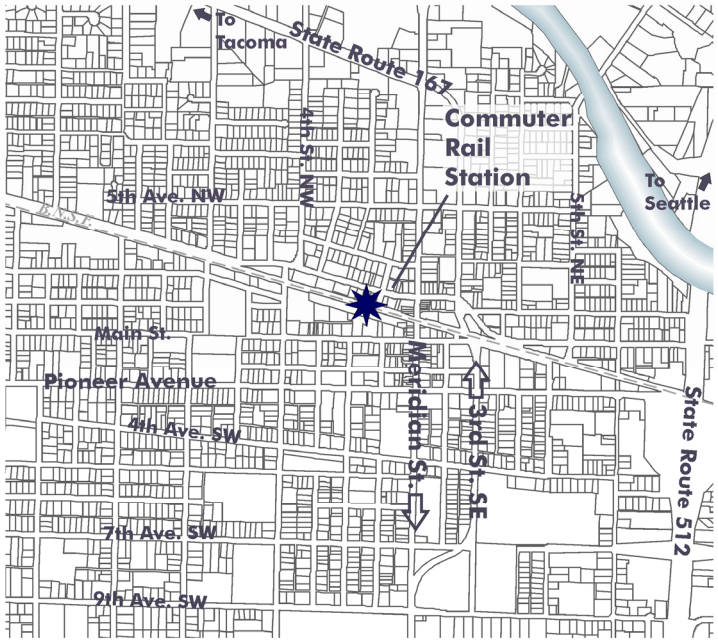
Mission's ability to act as an employment hub serviceable by transit is minimal give its large industrial base. These industrial uses have very low employment densities, while the declining retail core does not have a promising future as an employment node. The high employment densities found at the Bellevue Hotel are largely an anomaly in the decaying urban core. When combining these factors with Mission's position at the end of the existing transit service route, Mission has limited prospects for high density employment.

The pedestrian realm in Mission holds a high degree of promise, with good pedestrian connectivity and choice coupled with decent quality streetscaping. The retail high street of 1st Avenue in particular is a well designed pedestrian environment with on-street parking acting as a buffer for pedestrians and a strong street-wall framing the sidewalk area. The use of a one-way couplet to route highway traffic through the downtown ensures a high level of vehicular activity, although this traffic is slowed on 1st Avenue by pedestrians and on-street parking. On. N Railway Avenue however, which the rail station fronts onto, wide lane widths and a single-loaded street-wall contribute to excessively fast vehicle speeds.

The Mission case study's ability to function as a Transit Oriented Development is largely limited by peripheral developments which are removing residents and shoppers from the station area, which is also Mission's historic downtown. While there may exist alternative retail opportunities for 1st Avenue, its future as Mission's primary daily shopping centre looks poor. The outflow of retailers and people to alternative locations places Mission's path to becoming a Transit Oriented Development in reverse. Looking at its case study partner of Puyallup, one can see both similarities and differences in how exurban communities have used transit integration as a method with which to deal with rapid growth.

Top to Bottom
4.26 Main St. W in station area
4.27 Puyallup commuter rail station
4.28 Downtown retail district / Meridian St.

PUYALLUP



CASE STUDY 6: PUYALLUP

INTRODUCTION

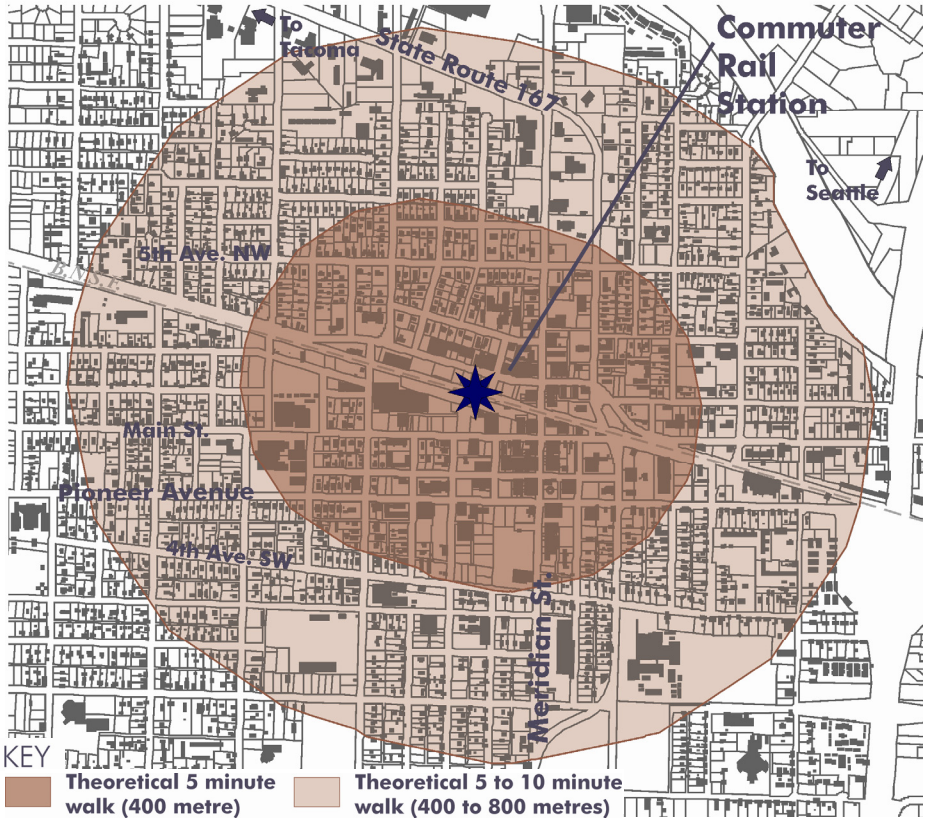
The city of Puyallup was founded as an agricultural centre and still retains its agricultural identity to the present day. Located near the south end of Puget Sound, the community is well known for its annual state fair which draws thousands of visitors to the state fairgrounds, located just past the southern edge of the case study area. Puyallup's current 36,000 residents are more likely to be commuters rather than farmers however, and the city's large household size reflects its appeal to families.

Puyallup's commuter rail station is located close to the primary downtown intersection of Meridian St. and Main St., the former being Puyallup's primary commercial high street. Meridian St. is a partner with 3rd Street SE in a one-way couplet road system which runs through the downtown core, with more auto-oriented commercial activity located along 3rd Street SW, and a more walkable environment on Meridian Street.

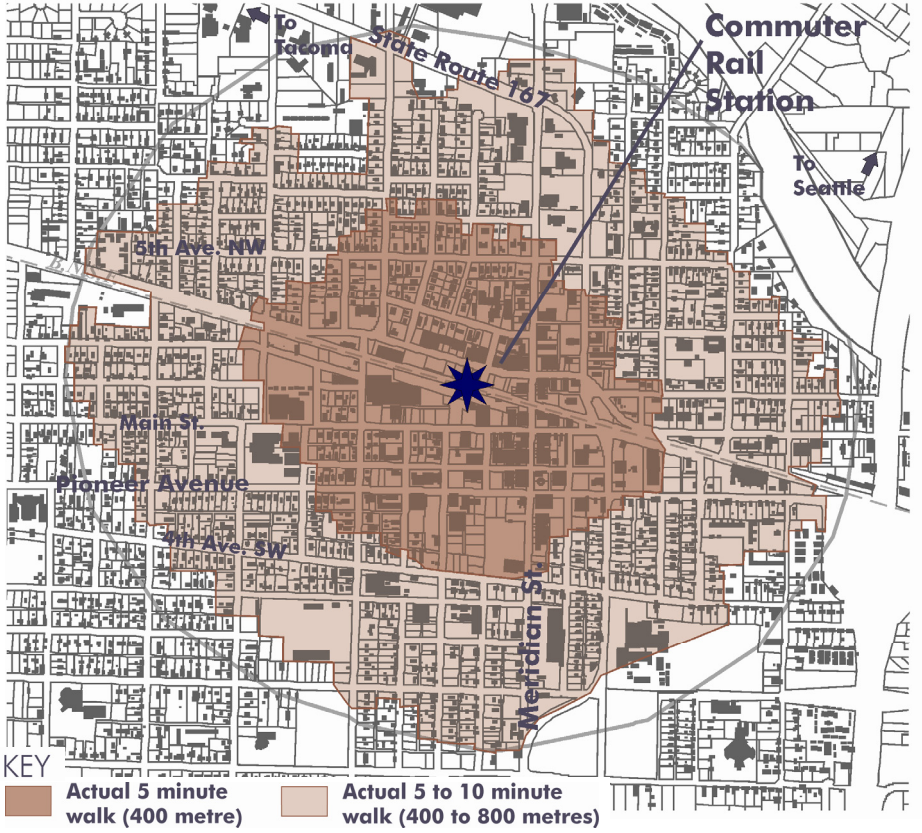
The Puyallup station exists within a well-connected network of local and arterial streets. A 'crow-fly' distance of 400 metres (1/4 mile) provide access to a potential of 185 acres of land, while a 'crow-fly' distance of 400 to 800 metres (1/4 mile to 1/2 mile) provides access to a potential area of 419 acres. This adds up to a total study area of 604 acres, which is net of a small area containing the Puyallup River.

The actual area which can be accessed by a five minute walk is 148 acres, while a five to ten minute walk accesses 326 acres, for a total ten minute pedestrian walk shed of 474 acres. This means that this case study is utilizing 78% of its potential TOD area, which is the best any of the case studies examined in this report. Whereas the railroad itself has been the primary barrier to pedestrian accessibility in other case studies, Puyallup does not experience this problem. With a crossing every 260 metres (850 feet) on average within the study area, connectivity across the railroad is extremely good. The main reason for Puyallup's high level of pedestrian connectivity is its use of a fine-grained grid system which enables pedestrians an excellent amount of choices in their trips. Where the grid becomes discontinuous (such as in the northwest area), the ability to allow pedestrian movement becomes more limited. Not surprisingly, the level of connectivity in Puyallup corresponds well with the age of development with pre-war and 1950's neighbourhoods exhibiting higher levels of connectivity than 1960's—1980's neighbourhoods. Highways such as State Route 167, another major obstacle to pedestrian movement, are adapted to the downtown environment through the use of a one-way couplet system. While this does create higher vehicle speeds in the commercial core, it is much better for pedestrian connectivity than an elevated freeway system.

PUYALLUP - STUDY AREA



PUYALLUP - PEDESTRIAN WALK SHEDS



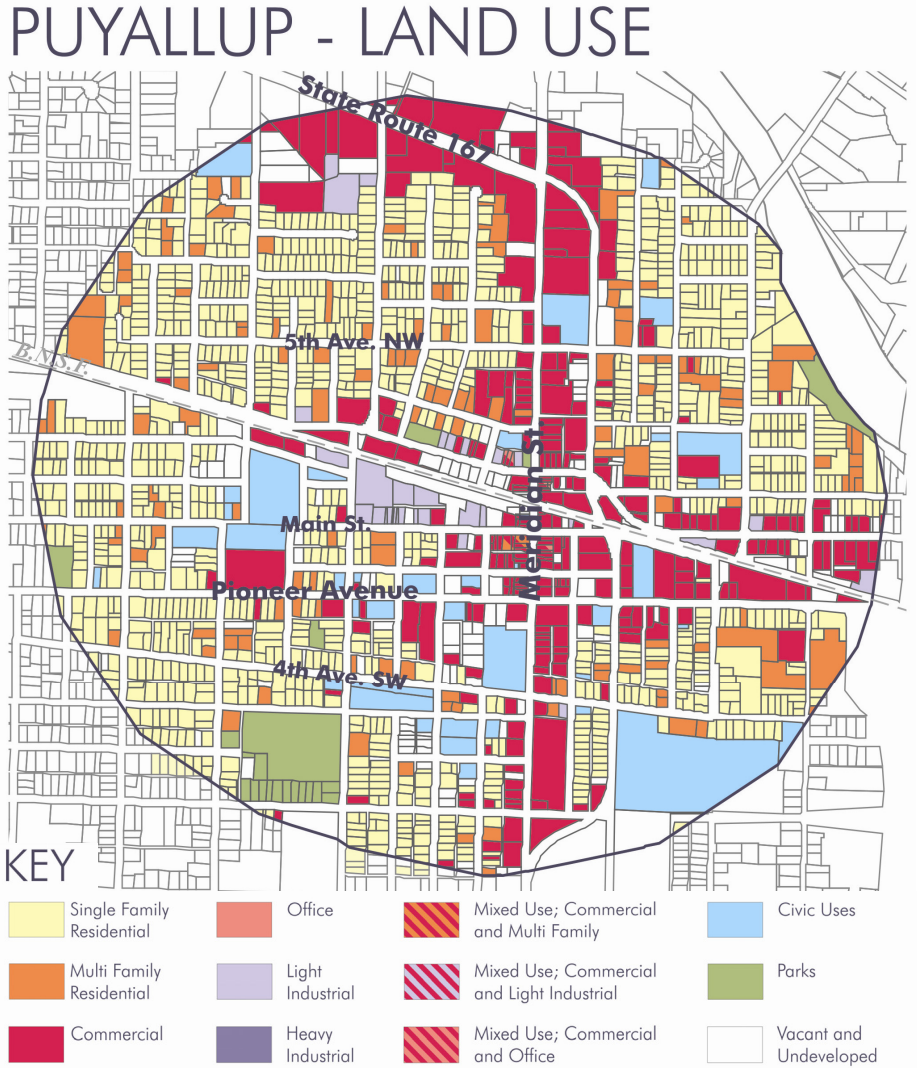
LAND USE

The land uses in Puyallup are focused on the primary arterials, specifically Meridian Street which serves as a structural spine for the community. Commercial uses congregate around Meridian Street, while multi-family and single family residential uses are concentrated in surrounding neighbourhoods.

Retail and commercial uses in the Puyallup case study are focused along Meridian Street, and continue to the north along State Route 167, which leads to Tacoma. Retail activity along Meridian Street is dominated by small storefronts (including many 'daily' type retailers) many of which are in historic buildings, while the retail uses along State Route 167 are dominated by car dealers and other auto-oriented tenants. While Meridian Street is a busy vehicle thoroughfare, on-street parking and pedestrian amenities ensure that it is still a pleasant pedestrian environment in line with TOD principles. This quality does not extend to the more auto-oriented areas, where large building setbacks and exposed sidewalks create unpleasant pedestrian situations. The multi-family areas of the case study are located throughout the case study, with a number of duplex, triplex and fourplex units integrated into single family neighbourhoods. The triplexes and fourplexes are often located on street corners, distributing their building mass along two axes. Apartment uses have no particular geographic concentration, although most are within 400 metres (1/4 mile) of the commercial activity along Meridian Street. While not strictly in line with TOD principles, this distribution of housing density minimizes reliance on the automobile for everyday retail trips. Civic uses within the case study are not located along high value arterials, but are found either just off of the commercial strip. These civic uses include a library, schools, a stadium, and a police station. The Puyallup case study's industrial base is very small, with a concentration located along the railway corridor along Main Street. The industrial uses do not extend on to Meridian Street, as they are buffered by a single commercial building which fronts onto the high street.

LAND USE MIX

The mix of land uses within the Puyallup case study contributes positively towards meeting the principles of Transit Oriented Development. Of particular note is the integration of residential and commercial uses. The grid street network allows for a gradient of uses between the primary commercial street and single family residential neighbourhoods, by using civic and multi-family developments as a buffer. Multi-family units are integrated very effectively into single family neighbourhoods, primarily through the use of effective scale. The mix of duplexes, triplexes and fourplexes means an increased amount of housing choice for tenants, within a housing type that is more appropriate for the local neighbourhood than an apartment block.



TOD principles encourage commercial uses to be concentrated close to the station area, especially those which are local serving. Commercial uses in the Puyallup case study comply with the first part of this principle, as approximately 6 out of 10 retailers are located within a five minute walk of the station. There are a total of 257 independent goods and service providers in the study area, primarily located along the Meridian Street corridor. However when the type of retail is examined more closely, we see that the majority of commercial tenants are low-frequency uses which contribute less to Transit Oriented Development than more high-frequency tenants.

The majority of the retail in the Puyallup case study is of the 'periodic' type, which generates a low frequency of trips. Some examples of these retailers in this case study include car dealers and auto repair facilities. Only one in five commercial uses in the case study are high frequency uses. 'Daily' uses within the case study include a Safeway grocery store, banks, and several convenience stores. One interesting aspect of Meridian Street's retail is the wealth of antique type stores, which most likely have a sub-regional customer base. When coupled with the downtown's historic appearance, it could be suggested that the retail nature of Meridian Street is becoming a caricature of itself, attracting people to buy antique goods in an authentically antique environment rather than using Meridian Street as a functioning 'daily' retail node.

The total number of uses in the Puyallup case study is higher than that of its counterpart Mission, which may reflect the more positive nature of Puyallup's retail core. However, Puyallup is in a similar situation as Mission having recently seen a large amount of large format retail locate outside the downtown core. While this has not affected Puyallup's downtown to the same extent as its case study partner, it is not an encouraging sign for Meridian Street retailers.

	Uses in the 5 minute walk 'ring'	(%)	Uses in the 10 minute walk 'ring'	(%)	Total	(%)
Daily Uses	32	*21.9%*	24	*21.6%*	56	*21.8%*
Periodic Uses	114	*78.1%*	87	*78.4%*	201	*78.2%*

Puyallup's Meridian Street

HOUSING CHOICE

Housing in the Puyallup case study offers a fairly good level of choice, with one out of three housing units in the multi-family category while the remaining units are single family (detached) homes.

Within the multi-family sector there is a decent mix of unit types, thanks largely to the use of smaller multi-family housing types within the single family areas such as duplexes and triplexes. Not only does this smaller product type appeal to families in this case study, ground-oriented product such the triplexes are also attractive housing options for seniors. With many of these units assuming a 'rancher' housing style, they offer a high degree of mobility within the unit as well as a small yard. Integrating these units into single family areas ensures that there are no senior's 'ghettoes' created, an all too common practice in suburban communities.

The outlook for housing choice in the case study area remains uncertain. There is a limited amount of new development within the study area, especially close to Meridian Street. New multi-family projects are located northeast of the case study, as well as south of the case study area along Meridian Street. These projects are significantly removed from the downtown core, and are outside a ten minute walk from both the station and retail areas.

	Units	% of Total
Single Family	1062	67.47%
Multi-Family	512	32.53%
Duplex	*84*	*(5.3%)*
Triplex + Fourplex	*47*	*(3.0%)*
Townhouses	*96*	*(6.1%)*
Apartments	*285*	*(18.1%)*

HOUSING DENSITY

Overall gross densities for the study area remain low, with an average of 2.6 gross units per acre (UPA) in the entire study area. This low number can be attributable to the fact that single family units are the dominant housing typology, coupled with a large land base dedicated solely to commercial activities. Looking at the net parcel density figures confirms this. The net densities tell us that even when we look solely at residential parcels, we see that they are developed at lower densities, reflecting the dominance of single family housing types. A positive note is that the net densities decline away from the commuter rail station area, due to the presence of apartment uses near the commercial core.

Gross Unit Densities*

5 minute walk 'ring'	
Total Units	386
Acres	185.0
UPA	2.09

10 minute walk 'ring'	
Total Units	1188
Acres	419.0
UPA	2.84

Total Study Area	
Total Units	1574
Acres	604.0
UPA	2.61

Net Unit Densities*

5 minute walk 'ring'	
Total Units	386
Acres	51.7
UPA	7.5

10 minute walk 'ring'	
Total Units	1188
Acres	188.9
UPA	6.3

Total Study Area	
Total Units	1574
Acres	240.7
UPA	6.5

*Gross unit densities are housing units per total acreage
Net unit densities are units per residential parcel acre

With Puyallup's large and diverse commercial core, there is little likelihood that one employer would account for a large proportion of all jobs within the case study. Rather the concentration of employment is spread across many smaller business, many in the retail sector.

There are few light industrial uses in the case study, and where they are present they employ a low number of people per acre, making them an insignificant factor as an employment base. Vancouver Door for example has under 10 employees per acre. Public sector institutions, such as the Puyallup Public Library or the large public high school have a moderate ability to act as employment centres, although there numbers are still below those associated with regional office uses. The data for the Puyallup police station reflects a time when most staff are on-site, an event which it may be safe to assume occurs periodically at best, give the nature of the employee's tasks.

The auto-oriented commercial activity in the north end of the case study has moderate density levels, with car dealerships showing up at about 14 employees per acre. This peak employment figure represents a Saturday sales day, when all sales staff are present on the lot. As might be expected a car dealer's employment density is largely affected by the retailer's decision to use indoor or outdoor sales facilities. Retail activity elsewhere in the study area has comparable employment densities to the other case studies, between 10 and 20 employees per acre, as confirmed by the numbers from the Puyallup Safeway. While retail is an important land use in this case study, it is obvious from these figures that it is not large enough to support a role for Puyallup as a Transit Oriented employment centre.

With Puyallup's overall low employment densities and lack of large employers in their central business area, it seems unlikely that these land uses can support transit service as a commuting option.

Employer	Employees (Peak)	Area (Acres)	Employees per Acre
Public Library	12	3.06	3.92
Kalles Junior High	80	15.73	5.09
Vancouver Door	30	3.12	9.62
Puyallup KIA	25	2.12	11.79
Puyallup Senior High	140	10.02	13.97
Safeway	30	1.88	15.96
Police Station	40	0.59	67.80

Puyallup's police department is a major employer downtown, and has one of the younger forces in the state.

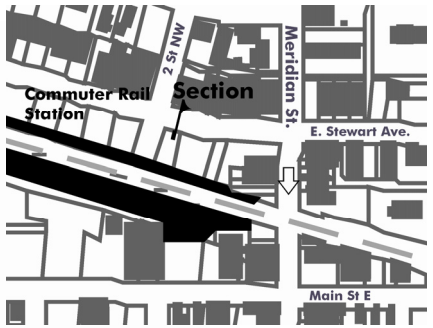
PEDESTRIAN QUALITY

The pedestrian environment of the Puyallup station area consists primarily of well maintained commercial streets, which create pleasant pedestrian experiences throughout. It has a consistent nature throughout the downtown, provides good separation from vehicle traffic, while buildings frame the streetscape in a consistent and well thought out manner.

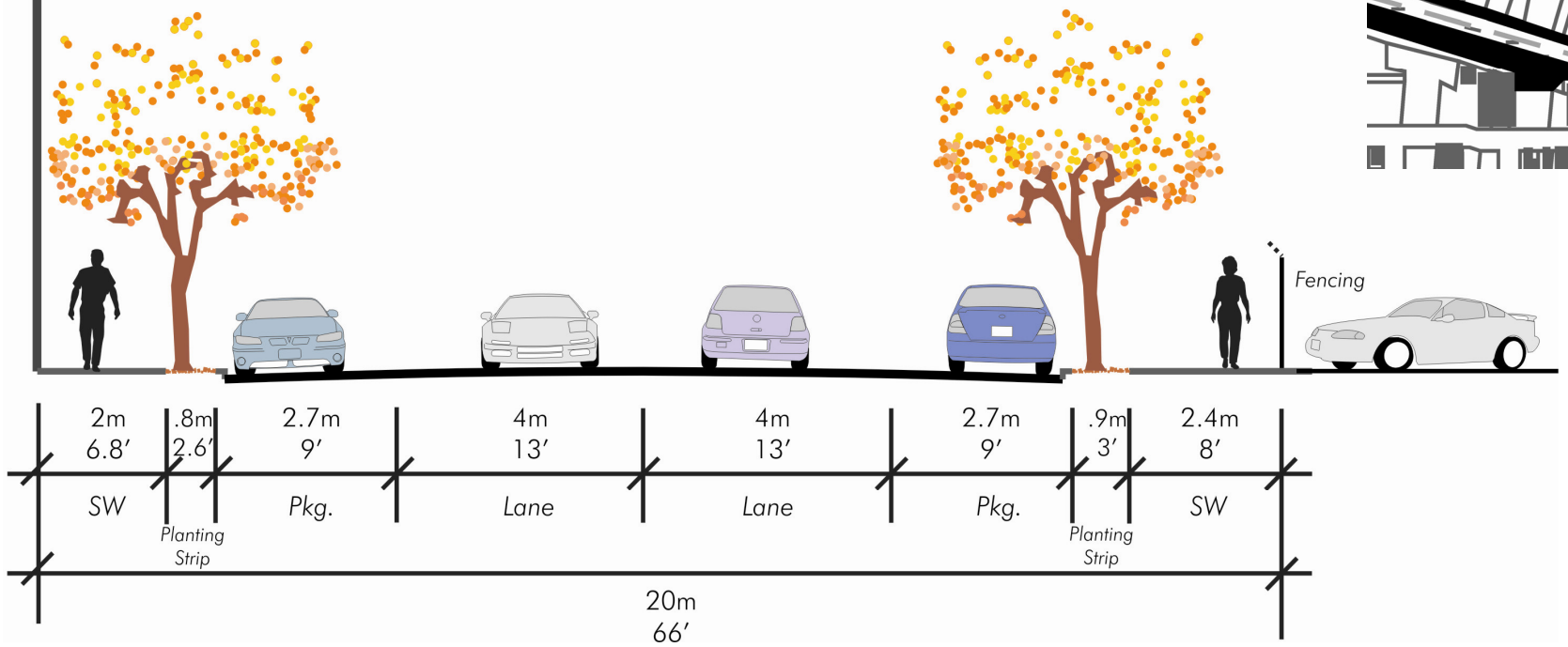
The street section location is on W. Stewart Avenue, which the station is accessed from, less than one block from the commercial hub of Meridian Street. It is a good example of commercial streets in the station area. There are sidewalks on both sides of the street, both of which are separated from traffic flow by street trees and on-street parking. This combination of vegetation and parking is well maintained, and when combined with a strong façade creates a very comfortable walking experience. On the south side of the street, the sidewalk is bordered by a chain link fence separating the pedestrian from a parking lot.

The travel lanes are both 4 metres (13 feet) wide, which more than accommodate station area bus traffic, but not overdesigned to the degree found in the other case studies. The on-street parking is limited to customers of local stores, rather than commuter rail users who park in a separate lot. This reduces the potential for conflict with local businesses, many of whom are concerned about losing parking to transit users.

SECTION LOCATION



STREET SECTION - W. STEWART AVENUE



PEDESTRIAN CHOICE

Puyallup has the best level of pedestrian choice of any of case studies examined in this project. The fact that Puyallup's pedestrian walk shed is nearly as large as its theoretical maximum size is evidence of this good level of connectivity.

Puyallup's highest level of pedestrian choice is in the commuter rail station area, which is consistent with the principles of Transit Oriented Development. This is due to a very fine grained street network, the use of lanes and alleys, and small overall block sizes. There are also no large institutions or other large buildings which break up the pedestrian network. Pedestrian choice declines as one moves farther away from the station area, but remains high overall. This is again due to the use of a grid pattern throughout the case study area. In the rare neighbourhood where cul-de-sacs and dead ends are used (i.e. in some parts of the northwest), pedestrian choice decreases due to the barriers that these street types present.

	5 minute walk 'ring'	10 minute walk 'ring'	Total Case Study
3-way Intersections	71	102	173
4-way Intersections	44	58	102
Connectivity Measure	*389*	*538*	*927*
Land Area	*185.01*	*419.02*	604.03
Pedestrian Choices Per Acre	2.10	1.28	1.53

PEDESTRIAN USE

The pedestrian use sample taken at the Puyallup station area reveals an extremely low number of pedestrians utilizing a high quality pedestrian environment. While there are a number of people accessing the Seattle Sounder at this station, they are almost exclusively using the park and ride lot rather than walking to the station from their residences. This creates a situation similar to that of the Auburn case study where a high quality pedestrian realm is being underutilized. As with the other case studies, samples were taken at the same point as the street section before one of the a.m. trains departed, and in the evening after one of the return trains arrived.

The low pedestrian use is unfortunate, and while this sample is not a comprehensive measure of pedestrian usage, it does not support the idea that commuter rail can animate suburban centres with pedestrian traffic.

	Effective Sidewalk Width (m.)	People per Hour
A.M. Count	4.4	0
P.M.Count	4.4	6

Puyallup's station area has nearly all of the attributes expected of a Transit Oriented Development, with a good quality pedestrian environment, effective mix of land uses, and a large residential component within a ten minute walk of the commuter rail station.

Puyallup utilizes nearly 80% of its potential TOD area, which may be as close as is physically possible in a gridded street network. The breadth of this connectivity is largely due to the lack of freeway infrastructure in the downtown, coupled with good connectivity across the railroad tracks in the case study area. Where blocks become bigger, such as in the north of the case study around the car dealerships, the walkable area becomes reduced.

Land uses in the Puyallup case study represent an excellent mix of residential and commercial uses, distributed in a manner which contributes to Transit Oriented Development. A large portion of the retail activity is located along the Meridian Street corridor, a highly walkable street which is easily accessed from adjoining residential neighbourhoods. A good diversity of tenants includes both 'periodic' and 'daily' uses, although the 'periodic' uses do account for almost three out of four commercial tenants. The 'periodic' tenants which are present are more likely to be reliant on vehicle traffic, and as such they are concentrated on more automobile-friendly streets rather than in the highly walkable downtown area. The industrial uses which are present in the case study are shielded from the downtown retail area, mitigating the negative effects associated with industrial uses within retail environments (as seen in Port Moody).

Housing choice in the case study remains promising, with over 1,600 total units divide between single family units and several different multi-family typologies, the latter accounting for two out of every three housing units. The multi-family units consist of a variety of typologies, including good variety within the ground-oriented realm such as duplexes and triplexes. In fact, over half of the multi-family units are non-apartment housing types, which increases appeal to families and seniors who might favour ground-oriented product over traditional apartments.

Housing density in the Puyallup case study is in generally good shape compared to the other case studies. Gross densities for the case study are 2.6 units per acre, the highest of all the case studies. This is due to a small parcel size within the single family areas as well as a relatively high number of multi-family housing units. Another contributing factor to high housing densities is the lack of non-residential land uses within the case study, which drives the gross density measures up. Comparing the gross densities with the net densities we see that residential units are of a higher density closer to the station area, in accordance with TOD principles. Overall net densities of 6.5 UPA illustrate the predominance of smaller lot single family development, which average around 6.6 UPA in net density.

The ability for local employers to support transit is not good. The employment base in Puyallup is concentrated in small retailers, which do not have employment densities supportable by transit. There is also no industrial base, a land use which acts as an employment generator in other case studies. Office uses are local serving, such as law offices, accountants, etc… Again, these uses do not generate large employment densities. Unlike in other case studies there is not a large institutional or public sector use to generate employment, although the 140 employees of Puyallup Senior High School are arguably an exception. However, there are no other employers as large as the High School, and the outlook for a large regional employment centre locating within this highly developed urban centre seems unlikely.

The pedestrian realm in the Puyallup case study is of high quality in station area, particularly in the commercial areas, but its underutilization by commuter rail traffic is a troubling problem which comes up yet again. Streets in the station area provide good protection for pedestrians from heavy vehicle and bus traffic. This is achieved primarily through the use of street trees and on-street parking. A high number of crosswalks and other pedestrian amenities turn the busy Meridian Street into a pleasant downtown high street, although this peters out towards the north end of this street. The park and ride aspect of the station facility detracts from the pedestrian environment by injecting very few pedestrians into the streetscape, while at the same time acting as a large generator for vehicle traffic.

Puyallup is a good example of a well-established community doing a good job of accommodating commuter rail according to many of the criterion of Transit Oriented Development. Of particular note is its excellent station area pedestrian environment and mix of land uses within close proximity to the station. Puyallup has a promising future as a Transit Oriented Development, as long as it can keep property investment concentrated in its downtown core.

CHAPTER 5: LESSONS AND RECOMMENDATIONS

The case study analysis has produced a number of issues for consideration. Some of these issues are specific to a single case study pairing, while others extend across all case studies. Distilling a list of recommendations from these lessons will help serve as a guide for future commuter rail projects, particularly those looking to maximize the potential benefits for station areas in suburban communities. The recommendations are listed in the same order as is used in the case study analysis.

This will start with looking at TOD potential in these case studies, and how future communities might take the fullest advantage of a station area's potential when selecting station sites. The next aspect of Transit Oriented is land use and land use mix. Many of the station areas had land use mixes which appeared to help contribute to Transit Oriented Development, but in fact were not as positive as first thought. Recommendations for this section might entail how to identify neighbourhoods which can contribute to achieving, rather than detract from Transit Oriented Development. Commercial choice and type are measurable aspects of Transit Oriented Development which have been constant across all case studies. While the measured ratios between 'daily' and 'periodic' commercial uses are not as high as TOD principles would dictate, there are a limited range of options available to change this situation. With respect to housing choice and density, there are a number of lessons from the case studies. This ranges from the relevance of having no housing in a station area (Tukwila) to having restricted housing choice in a station area (Port Moody). The examination of employment densities in this report offers some clues toward how a transit oriented employment centre might best be identified and capitalized on. Finally, a look at the joint issues of pedestrian quality and choice, and how all the variables studied can influence pedestrian usage.

MAXIMIZING POTENTIAL TOD AREA

Primary Findings:

a. Transportation routes, including the railways which provide commuter rail service, are often barriers to pedestrian movement in station areas;
b. Peripheral communities (those furthest from the CBD) did the best job of creating large pedestrian walk-sheds around their station areas;
c. Stations which were situated within established, well-connected street networks had the best chance of realizing their full TOD potential.

RECOMMENDATIONS:

1. **Barriers to pedestrian movement around stations should be modified or removed, through both micro and macro level alterations;**

2. **Station alignment decisions should take into account the level of street network connectivity around potential station sites.**

Recommendation 1: Barriers to pedestrian movement around stations should be modified or removed, through both micro and macro level alterations.

TOD potential areas around the station were determined using a 'crow-fly' buffer of 800 metres, or ½ mile, which is meant to represent a ten minute walk. However, the actual ten minute walking area was also determined, and compared against the 'crow-fly' buffer in order to determine how much of the potential TOD area was actually accessible from the station. The results ranged from a low of 28% of potential in Tukwila to a high of 78% in Puyallup. The industrial case studies faired quite poorly in this analysis, ranking 4th and 6th out of all 6 case studies. The suburban residential communities had a range of 33% in Coquitlam to 53% in Auburn, while the exurban communities of Mission and Puyallup scored the highest, realizing between 60% and 78% of their TOD potential. The ability of these communities to realize their TOD potential was largely a function of how they dealt with barriers in the community (i.e. freeways and railways), and how they designed their street system. Communities which exhibited a high degree of pedestrian choice in their street networks were the same communities which took best advantage of their TOD areas, subsequently creating large pedestrian walk sheds. Some communities, such as Auburn, had a relatively high amount of pedestrian choice in their street system, but the street network was bisected by freeways which lowered the TOD potential measure.

The recommendation is to remove or modify barriers to transportation in order to better facilitate pedestrian circulation. Many of the barriers mentioned, such as railways and freeways, can be treated through micro-improvements and / or macro-improvements.

Micro-improvements are those localized design measures which would improve pedestrian circulation. These might take the form of pedestrian overpasses, or small stiles to allow people to cross a raised railroad bed, or installing signalized pedestrian crosswalks across busy streets. These need not be massive capital investments, as illustrated by Figure 5.1, a wooden stile over the Arbutus rail corridor in Vancouver.

Macro level improvements would address structural change in the pedestrian network, specifically across major barriers. Some examples might be a strategic plan for the redevelopment of the street network in the station area, something which might take 30 years. Another example of a macro level alteration could be the eventual elimination of freeway infrastructure from suburban city centres. Again this is a long term goal which would contribute to improving pedestrian connectivity in station areas.

Figure 5.1 A wooden stile over the Arbutus railroad corridor in Vancouver, B.C.

Recommendation 2: Station alignment decisions should take into account the level of street network connectivity around potential station sites.

The positive effects which stations can have on their surrounding environments can only occur if stations are connected with those environments. The comparison of TOD potential and pedestrian choice (Figure 5.2) illustrates the importance of having a well connected street network in the station area. When examining alignment and siting options of future stations, it would be advisable to take advantage of areas where there is either an existing fine-grained street network, or the potential for such a network to be constructed.

This would require potential station area assessments to look at localized pedestrian circulation networks, with the goal of capitalizing on existing well connected networks. Potential station areas which have been built-out using a disconnected street network are probably the most difficult to change or adapt, and are therefore unappealing as station locations. Underdeveloped station areas which have large amounts of vacant or easily redeveloped land (i.e. parking lots), may represent the best 'opportunity' locations for retrofitting existing station areas, should they require an increased level of pedestrian connectivity.

LAND USE

Primary Findings:

a. Station area land uses all contained the necessary land use components of TOD, except in Tukwila which lacked a residential component;
b. Surface parking and other uses which create large building setbacks restrict the integration and mixing of land uses;
c. Linear retail zones are extremely effective at maximizing residential integration with retail areas;
d. Employment generating uses are underrepresented in all case studies, save for Tukwila.

RECOMMENDATIONS:

3. **Stations should continue to locate within mixed-use areas which contain residences, workplaces and shopping opportunities;**

4. **Managing parking is crucial. Large surface parking lots create poor pedestrian environments and reduce the accessibility and visibility of retailers;**

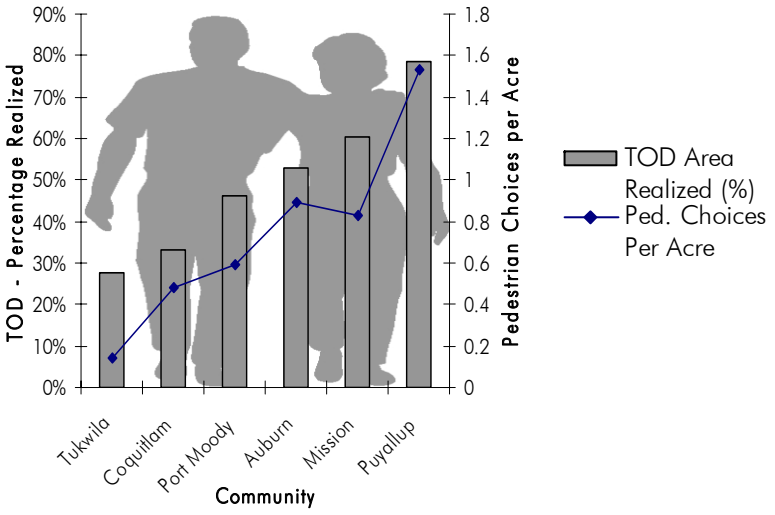
5. **Extending retail along linear axes maximizes its integration with surrounding residential uses, and should be encouraged.**

Recommendation 3: Stations should continue to locate within mixed-use areas which contain residences, workplaces and shopping opportunities.

All the stations in these case studies, except for Tukwila, were situated within mixed-use neighbourhoods which were comprised of residential uses, workplaces, and retailers. The presence of these basic land uses is essential to meeting the requirements of Transit Oriented Development. Whenever possible, future station locations should look for potential sites which have these land uses in substantial quantities within a walkable ten-minute distance.

This is an especially poignant recommendation for commuter rail, as it often operates on right-of-ways which service industrial areas, making industrial area stations an easy and inexpensive option for transit service providers. This should be avoided, as we have seen that most industrial areas lack many of the attributes which make for an active station area, including significant employment centres.

Figure 5.2 Pedestrian Choice per Acre vs. Actual TOD area



Recommendation 4: Managing parking is crucial. Large surface parking lots create poor pedestrian environments and reduce the accessibility and visibility of retailers.

Coquitlam stands out as an example of a station environment which possesses all of the necessary land use components, but renders the benefits of land use mix impotent by separating them with surface parking. A busy retail node (Coquitlam Centre Mall) is cut off from the station and adjacent residential areas by a tremendous lack of pedestrian connectivity. This is exacerbated by the creation of an unpleasant pedestrian environment around the station, and the commitment of 20% of the case study area to surface parking. These problems are compounded by the commercial form of the traditional shopping mall, which further separates residents from retail through both physical design (i.e. the internalization of retail) and administration (i.e. the privatization of the public realm). Coquitlam teaches a powerful lesson about integration of land uses, and how a community can possess all of the necessary land use components of Transit Oriented Development, yet fall well short of arranging them in a manner conducive to fostering TOD principles. Other case studies have not only incorporated all the necessary components of TOD, but have done so in a manner which integrates them with adjacent uses. Coquitlam's case study partner of Auburn not only has a range of retail activity, it is also easily accessible from neighbouring residential neighbourhoods. This is partly because of Auburn's use of structured parking in the station area as opposed to surface parking. The structured parking in Auburn mitigates the negative effects which surface parking produces in Coquitlam (i.e. large setbacks, inhospitable pedestrian environment). The need to manage station area parking is confirmed by other agencies with experience in commuter rail station area development. METRA, Chicago's commuter rail service provider, lists parking as the number one challenge to fostering Transit Oriented Development around commuter rail stations (METRA, 1991).

Managing parking can be accomplished in a number of ways. The first would be structured parking, such as in the Auburn case study, as well as in other Sounder stations such as Kent and Tacoma. Structured parking costs can be mitigated through sharing the facility with local retailers, or by integrating income producing facilities. The Seattle area stations all have retail uses located on the ground plane, a design which makes for a pleasant and interesting streetscape, while returning steady revenue for the facility owner. If surface parking is desired, then breaking up the footprint of the parking lot is helpful, as it avoids creating vast oceans of parking lots and may assist in making the lots more usable for adjacent businesses and uses. An example of this might be a commuter rail parking lot located adjacent to a theatre. The lot is used by commuters during the day, and theatergoers in the evening. This sharing of parking also helps in keeping the station area animated throughout the day the night. A third strategy is to eliminate parking at these stations, creating kiss and ride facilities, or stations which rely solely on bus feeder routes to get commuters to the rail station. This approach relies on a well established feeder bus system, and surrounding residential densities which can support such a bus system.

Figure 5.3 Auburn Station's Parkade

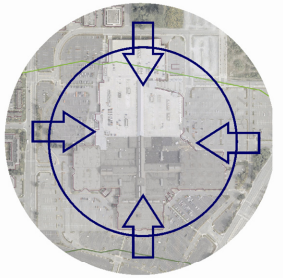
Figure 5.4 Coquitlam's Surface Parking

Figure 5.5 A Kiss-and-Ride

Recommendation 5: Extending retail along linear axes maximizes its integration with surrounding residential uses, and should be encouraged.

The integration of retail uses with surrounding communities is best achieved through a linear format, a lesson planners can take from geometry. A retail base of 100,000 square feet, when arranged in a nodal format has a circumference, or an interaction with the surrounding community, of 1,124 feet in length. That same 100,000 square foot retail base, when configured in a 100' x 1000' rectangle has a circumference of 2,200 feet. That means the latter, linear form of retail has almost twice the level of interaction with surrounding uses. The configuration of retail along linear high-streets should be the preferred configuration of retail in station areas, as it maximizes the interaction with adjacent residential areas, and creates lively public shopping streets as opposed to private shopping malls.

Figure 5.6 Equal sized areas of retail land use have vastly different levels of interaction with their surrounding neighbourhoods. The Puyallup retail street on the bottom has twice the linear circumference of the Coquitlam mall on the top, and therefore twice the level of interaction.



COMMERCIAL CHOICE AND TYPOLOGY

Primary Findings:

a. Commercial choice was constant across all case studies, with between 20% to 30% of activity of the 'daily' type, and the remainder of a more infrequent nature.

RECOMMENDATION:

6. **A greater proportion of 'daily' retail uses should be encouraged by increasing local residential and employment densities (i.e. the drivers behind those 'daily' services).**

The measure of commercial choice was one category which produced near homogenous results across all case studies. As a percentage of all goods and services, 'daily' uses made up between 20% to 30% of the total, with a low of 22% in Puyallup and a high of 29% in Mission. This constant result was doubly impressive given the diversity in retail form seen across the case studies.

The concentration of 'daily' type uses advocated by TOD principles reflects the desire to create vibrant commercial centres which attract people to visit on a frequent basis. Retail uses which are 'periodic' in nature generally won't generate as many trips, and therefore won't generate the vibrancy associated with 'daily' uses. Because retail quantity and type are directly linked to population, the low concentration of 'daily' uses within all of the case studies can largely be viewed as a function of low residential densities. A larger population base would create an impetus for additional retail uses, especially 'daily' retail.

The recommendation here is to encourage the driving factors which create and support retail activity, as opposed to forcing high-frequency retail uses into station areas. While there are a number of proactive solutions that could be taken to confront this problem (i.e. stricter zoning controls on land which encourage high frequency land uses), these are politically unpalatable and likely to send a negative message to the development community. Encouraging the creation of a local population base will drive the demand for more retail activity, particularly local-serving retail such as grocery stores and coffee shops, which also tend to be high-frequency uses.

HOUSING CHOICE AND DENSITY

Primary Findings:

a. Residential densities are low in all case studies, well below the prescribed minimums of TOD definitions;
b. Housing choice is limited within these case studies, and is dominated by single family housing stock.

RECOMMENDATIONS:

7. **Proactive upzoning of residential parcels around stations is a simple approach to densification which can result in redevelopment of lower density neighbourhoods, and subsequently increased property values for existing residents;**

8. **Housing choice may be increased through a flexible approach towards zoning (such as comprehensive zoning areas) as well as encouraging adaptation and densification of existing dwellings.**

Figure 5.7 This quad-plex is an unassuming approach to suburban densification

Recommendation 7: Proactive upzoning of residential parcels around stations is a simple approach to densification which can result in redevelopment of lower density neighbourhoods, and subsequently increased property values for existing residents

TOD principles advocate a range of housing types, with the highest densities located closest to the station area. Some TOD definitions set fixed targets for densities, such as Calthorpe and Associates, who advocate net densities within regional TODs (i.e. TOD's which are focused around a regional transportation link) which are a minimum of 12 net UPA, and an average 15 net UPA. Of all the case studies examined here, Port Moody's net UPA measure of 12.8 is the only community which meets these rigorous standards. The need for density is crucial to TOD succeeding. Not only does it reduce reliance on the automobile by locating more people close to transit, it can also be an indirect driver for many other aspects of TOD, such as retail activity and pedestrian usage. All of the case studies would benefit by increasing density within their station areas, especially those which are seeking a more animated and lively station area. Since commuter rail is a technology which introduces a small number of people to the station area twice a day, its ability to trigger retail activity and pedestrian usage is small. A large local residential base would be the better driving force to create retail and pedestrian activity.

A simple method to encourage the market to redevelop low density residential areas around stations would be to proactively upzone (increase allowable densities) around the station areas. This would remove a large regulatory hurdle for developers looking to construct higher density housing typologies while increasing the equity that current landowners have invested in their property. This recommendation only works if the municipality also maintains a resistance to developing peripheral greenfield sites which may unduly infringe on the market share of station area projects. While this 'guiding hand' approach to local real estate markets may be politically difficult, it can succeed with a strong amount of political will and leadership.

Recommendation 8: Housing choice may be increased through a flexible approach towards zoning (such as comprehensive zoning areas) as well as encouraging adaptation and densification of existing dwellings

Housing choice is integral to creating a diverse community, as a wide range of housing products have the potential to house a wider range of tenant types. Case studies which have offered the best amount of housing choice are not necessarily those which offer the greatest amount of multi-family housing. The case studies by and large have a limited degree of housing choice, with most based around single family and apartment housing. The concentration of multi-family stock is most troubling, as multi-family housing can offer a wide range of unit types other than apartments. These other multi-family housing types are at densities which are almost always higher than single family housing. Examples of these housing types include row-houses, town-houses, secondary suites, and coach-houses. In case studies where there is a good range of housing types, especially types which are ground-oriented, there is a much greater number of families using multi-family housing. This leads to the conclusion that it is not only important for station areas to provide a larger proportion of housing in the multi-family category, but to encourage a range of multi-family housing types, including those which are ground-oriented in nature.

Typical residential zoning designations usually allow for only a limited range of housing types within them. For example, it is rare to find a single family residential zone definition that also permits duplexes or triplexes. Allowing a wider range of housing types within a zoning classification might help in fostering diversity in housing stock. Allowing greater flexibility in the housing types allowed would also create more market interest, as developers who purchase these properties would then have a greater degree of flexibility allowing them to better respond to fluctuating market conditions.

Increasing the amount of housing choice could also be done through more small scale changes to regulatory policy. For example, allowing people to construct secondary suites within their single family homes would create the potential to double existing densities while returning more value to existing residents. This would create a pool of housing which would be well suited for the first time renter, or older people looking to downsize to a smaller housing unit.

EMPLOYERS AND EMPLOYMENT DENSITY

Primary Findings:

a. All case studies lacked significant employment bases, with only one (Tukwila) having a strong outlook as an employment base.

RECOMMENDATION:

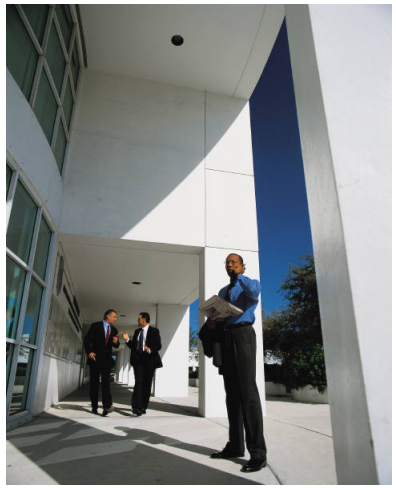
9. Incentive based programs and policies should be implemented in order to attract employment generating uses to station areas.

All the case studies lack significant employment bases, and with the exception of Tukwila, have no strong prospects for attracting large employers to the station areas. Most employment in the case studies is found in the retail sector or in light industrial operations, neither of which produce large employment densities.

The opportunity for creating additional employment bases is exacerbated by larger scale regional trends towards the exuburbanization of the office market, especially in the field of low-cost suburban business parks, which tend to locate on the periphery of suburban cities. Office uses are important because they represent high density employment nodes. Suburban business parks are crucial, because they are usually located in industrial areas rather than suburban downtowns, and remove employment uses from both the CBD and suburban town centres. Tukwila may actually be in a position to capitalize on this trend. As a suburban community with a large stock of inexpensive industrial land, it is an attractive market for office tenants looking to relocate out of the CBD and into the suburbs. While this type of move usually is a headache for transit providers (a more dispersed employment base is harder to serve with transit), the Tukwila case study has the unique attribute of a fixed transit system. The literature on Transit Oriented Development has often pointed to the necessary synergy between a conducive market and the policy environment for creating Transit Oriented Development, and should not be ignored in this study area.

For the other suburban centres, attracting employment uses such as regional offices, is a harder task. These station areas should focus on creating land use regulations which create barriers to peripheral office development, while offering incentive schemes to locate in town centre areas. Incentive based programs could take the form of FSR exemptions for employment creating uses, or bonuses for developers who attract employment generating uses. Coquitlam, a case study which has almost all of its employment uses concentrated in retail activity, has already taken such an approach by rewarding developers with residential density bonuses if they can attract employment generating tenants to their town centre. While it is too early to tell if Coquitlam's approach will be successful, it is encouraging that local governments are recognizing the need to be proactive in creating market conditions as opposed to responding to market forces.

Figure 5.8 Incentive based approaches to attracting employers are preferable to regulating



Primary Findings:

a. Stations located adjacent to pedestrian oriented retail areas have the highest quality streetscapes;
b. Stations located within auto-oriented commercial areas or industrial areas have low quality pedestrian environments.

RECOMMENDATION:

10. **Locating stations next to existing pedestrian oriented areas creates a situation where local businesses act as stewards of the pedestrian environment, ensuring there is a high level of pedestrian quality.**

The three aspects of pedestrian realm quality, choice and use are key to meeting TOD principles of pedestrianism. A high quality pedestrian realm increases the likelihood that pedestrians will feel comfortable in this environment. A large degree of pedestrian choice means that people will be able to access to the transit node, as well as other key uses within their community, in an easy and efficient manner. A large amount of pedestrian usage animates the streetscape and creates many positive side effects.

The station areas which exhibited the highest quality pedestrian areas were those adjacent to retail and commercial districts. Puyallup, Mission and Auburn all had good quality pedestrian environments, which were probably more related to the presence of local businesses rather than the station itself. Where local business are reliant on street exposure, as well as walk-by traffic, they are more likely to have a keen interest in maintaining the quality of the street environment, specifically the pedestrian realm.

An anomaly in this is the Coquitlam case study. With the largest amount of commercial and retail activity of any case study within walking distance of the station area it might be expected that Coquitlam would exhibit one of the highest quality pedestrian environments. This is not the case however due to the form the retail assumes. The mall environment places emphasis on the quality of indoor spaces, while its outdoor realm is focused on efficient parking systems for vehicles. This creates a low quality pedestrian realm which is ironically, the most used of any case study.

In station areas which are adjacent to, or surrounded by business and commercial activity which are less reliant on pedestrians, the quality of the streetscape deteriorates. The best examples of this are in Tukwila and Port Moody. In Tukwila, the hotel uses which surround the station area have no reason to be concerned about the condition of local sidewalks. Their guests are unlikely to walk to the hotel, and once there guests have nothing to walk to. Port Moody's station, with its good proximity to the retail corridor along St. John's Street, should have a high quality pedestrian realm. However, since most of the retail activity in the station area is auto-related, there is little impetus to upgrade the street environment. Port Moody's pedestrian realm ends up assuming many of the characteristics of an industrial area, rather than a commercial node.

Figure 5.9 High quality streetscapes such as this one in Auburn are thanks in part to the presence of local businesses who desire a high quality environment for their customers.

THE PEDESTRIAN REALM; CHOICE

Primary Findings:

1. Pedestrian networks are difficult to retrofit in built-out communities;
2. Stations which have been located adjacent to 'traditional' town centres exhibit the highest degree of pedestrian choice;
3. Underdeveloped station areas represent an excellent opportunity for *creating* a street network with a high degree of pedestrian choice.

RECOMMENDATION:

11. Station alignment decisions should take into account the level of street network connectivity around potential station sites (Same as Recommendation 2).

Providing pedestrians with options during their trip increases the convenience and the appeal of walking as a mode choice. The level of pedestrian connectivity is largely a function of street network design, which is often related to the age of the community. Communities constructed during periods when the automobile was less important for travel (i.e. pre-war) tend to have higher degrees of pedestrian connectivity than those constructed in more recent years. This holds true within the case study communities.

The station areas of Auburn, Puyallup and Mission are all adjacent to the original townsites of these communities, which used fine-grained street patterns and which had a high degree of pedestrian connectivity. Port Moody is one of the older case studies as well, however its attempt to rationalize its at-grade railroad crossings through a single overpass has greatly reduced pedestrian connectivity, particularly to the waterfront. This is the primary reason why Port Moody's pedestrian connectivity is below that of Auburn, Puyallup and Mission.

The Coquitlam station area is a much younger area, developed primarily in the 1970's and 1980's. The station area has a very low level of pedestrian choice, reflecting its regional shopping role, and subsequent need to accommodate vehicles through surface parking lots. Its level of connectivity would be much lower were it not for the use of alleys and lanes in the single family residential areas.

Tukwila's station area, with a stunted street network, has an extremely low level of pedestrian choice. Its large parcels and undeveloped street system limit pedestrian choice to a few major arterials. The positive aspect of this situation is that the Tukwila station area is a veritable blank canvas, with an excellent opportunity to create a rich pedestrian environment as there is only a minimal amount of existing development.

Primary Findings:

1. Pedestrian realm usage was very low in all case studies, pointing towards commuter rail users being unlikely to walk to or from the station area;
2. The study did not reveal an expected link between pedestrian realm usage and pedestrian realm quality or choice, although this may be due to a limited sampling methodology.

RECOMMENDATION:

None.

There were extremely low pedestrian usage numbers in all case studies, including some with no measurable use at all. It would be hoped that pedestrian environments which have a high degree of pedestrian choice and are of a high quality would also be high use. The data collected in this study does not indicate that this is the case. A linkage between pedestrian quality and pedestrian usage did not emerge, with poor quality station areas (i.e. Coquitlam) having the highest amount of usage. A relationship which might have more pertinence is that between pedestrian usage and density. Station areas with higher residential densities would be expected to exhibit a higher degree of pedestrian usage. Again, this does not pan out, with no real link showing up between density and pedestrianism. While this link isn't established in this project, it can be assumed that this is probably due to the combination of low residential densities, and an overly small sample size for pedestrian usage.

However, the sample size for the pedestrian usage measure was very focused in scope. The sampling locations, and methodology of measuring pedestrian flow before commuter trains departed in the morning, and after they arrived in the afternoon, was intended to focus on the pedestrian volumes created by the transit node. Isolating out non-commuter rail pedestrian traffic (i.e. midday pedestrian usage) may produce deflated numbers, and give a misleading representation of overall pedestrian use in these case studies, however it accurately shows the minimal impact commuter rail has on the pedestrian network in these communities.

There is no recommendation for pedestrian usage, as increased pedestrian usage is something which will emerge when station areas adopt the other recommendations listed in this section. With a large local population, well connected pedestrian network, an easily accessible local retail base, and a high quality streetscape, pedestrian usage will act as an emergent property of a station area which is planned according to the principles of Transit Oriented Development.

Figure 5.10 Increased pedestrian usage will emerge from bringing together all the necessary components of a TOD in station areas.

RECOMMENDATIONS SUMMARY

TOD Attribute	Key Findings	Recommendation
Maximizing TOD Potential	a. Transportation routes, including the railways which provide commuter rail service, are often barriers to pedestrian movement in station areas. b. Peripheral communities (those furthest from the CBD) did the best job of creating large pedestrian walk-sheds around their station areas c. Stations which were situated within established, well-connected street networks had the best chance of realizing their full TOD potential	1.Barriers to pedestrian movement around stations should be modified or removed, through both micro and macro level alterations 2. Station alignment decisions should take into account the level of street network connectivity around potential station sites
Station Area Land Use	a. Station area land uses all contained the necessary land use components of TOD, except in Tukwila which lacks a residential component b. Surface parking and other uses which create large building setbacks restrict the integration and mixing of land uses c. Linear retail zones are extremely effective at maximizing residential proximity to retail areas d. Employment generating uses are absent in all case studies, save for Tukwila.	3. Stations should continue to locate within mixed-use areas, which contain residences, workplaces and shopping opportunities 4. Managing parking is crucial. Large surface parking lots create poor pedestrian environments and reduce the visibility of retailers 5. Extending retail along linear axes maximizes its integration with surrounding residential uses, and should be encouraged
Commercial Choice and Typology	a. Commercial choice was constant across all case studies, with between 20% to 30% of activity of the 'daily' type, and the remainder of a more infrequent nature.	6. A greater proportion of 'daily' retail uses should be encouraged by increasing local residential and employment densities (i.e. the drivers behind local commercial services)
Housing Choice and Density	a. Residential densities are low in all case studies, well below the prescribed minimums of the most well-known TOD definitions b. Housing choice is limited within these case studies, and is dominated by single family housing stock	7. Proactive upzoning of residential parcels around stations is a simple approach to densification which can result in redevelopment of lower density neighbourhoods, and subsequently increased property values for existing residents 8. Housing choice may be increased through a flexible approach towards zoning (such as comprehensive zoning areas) as well as encouraging adaptation and densification of existing dwellings
Employers and Employment Density	a. All case studies lacked significant employment bases, with only one (Tukwila) having a strong outlook as an employment base	9. Incentive based programs and policies should be implemented in order to attract employment generating uses to station areas
Pedestrian Realm; Quality	a. Stations located adjacent to pedestrian oriented retail areas have the highest quality streetscapes b. Stations located within auto-oriented commercial areas or industrial areas have low quality pedestrian environments	10. Locating stations next to existing pedestrian oriented areas creates a situation where local businesses act as stewards of the pedestrian environment, ensuring there is a high level of pedestrian quality

CONCLUSION

The goal of this report was to provide suburban communities which are adopting Commuter Rail technology with recommendations on how to maximize the potential station area benefits. This goal has largely been met through the list of recommendations which the report contains. These recommendations are the result of a rigorous methodological approach which was by and large successful, although there is room for improvement. There are also some areas which require further investigation, particularly pertaining to the economic side of implementation strategies. While the report provides a good guide for cities who will adopt commuter rail in the future, the recommendations leave both the reader and researcher wondering how the case study communities in this report can improve their current situations. While this report did not investigate this issue, it does not mean it is insignificant, and it is certainly an area where future research may be needed.

The methodological approach could have been improved in a number of ways. Firstly, the strengths of the comparative case study approach are reduced when only one pair of case studies is used. Had the sample size been increased to three or four case studies (i.e. four industrial suburbs, four exurban cities, etc…) the comparative nature of the case studies might have been stronger. Second, some of the sampling measures could have been more in-depth. The measurement of employment densities for example would have been better had there been a total employment figure for the entire case study area. This could have been achieved either through data collection, or by extrapolating out from the representative numbers presented in this report. Another method which was less than perfect was that of pedestrian usage. The two ten minute sample periods did not represent the complete picture of pedestrian activity in these station areas. While it did for the most part accurately portray the pedestrian usage attributable to commuter rail, it did not address pedestrian usage throughout the majority of the day.

The recommendations failed to look at economic implementation strategies, instead focusing on policy and physical design measures which might be taken. Understanding how market forces can be a positive contributor to station area development is essential in order to affect positive station area change. Applying the economic research and models already done on station areas to the case studies in this report would have presented an interesting lesson on the economic benefits of station area development, and would make this report more useful for the development community and regulators alike.

An excellent opportunity for future research would be a project addressing the adaptation of existing station areas to meet the principles of Transit Oriented Development. Each one of these case study cities could transform the station areas according to TOD principles. Some of the case studies would have a more difficult path than others, but this report shows that each one has positive attributes which they could build on. A future project looking at the redevelopment of these sites would provide a strategic goal for these communities to pursue, based on this report's thorough analysis of existing conditions.

Figure 5.11 This study has scratched the surface of commuter rail station area development issues, and is a good starting point for further research in the field.

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APPENDIX 1: TOD DEFINITIONS

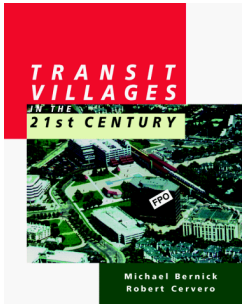
This Appendix is a reference tool which illustrates the different manners in which Transit Oriented Development (TOD) is defined and applied by various researchers, planners and government agencies.

The Transit Village; Michael Bernick and Robert Cervero

Introduced in 1996 through their book "Transit Villages in the 21st Century", these researchers advocate building communities which practice 'Transit Supportive Design'. The goals of their proposal are to create communities which are focused around a central transit node, with a core that extends out approximately 1/4 mile from the station. This focus around a station is not intended as just physical design. It is meant to create social and economic benefits as well. The intention is that these walking communities will bring people together, and creating a sense of belonging and attachment through an attractive built environment and civic core. Economically, these urban environments are intended to be economically viable and financially self sustaining. The introduction of high amenity station areas should produce economic benefits, while access to transportation should have a positive effect on property values and commercial rents. Another area for economic opportunity is in run-down areas, where the creation of a high quality public realm will attract private investors to the area.

The hallmarks of a transit village are:

1. Enhanced Mobility and Environment
   Increased transit ridership as a result of congregating housing, jobs and shops in a single place. An increase in transit means less traffic congestion, especially along corridors served by rail, as well as better air quality, due to less car trips.
2. Pedestrian Friendliness
   Mixes of land uses can encourage walking, especially when the pedestrian environment is enhanced by removing surface parking lots, high amenity streetscapes, and reduced building setbacks.
3. Alternative suburban living and working environments
   Transit villages don't endanger the suburbia, but rather offer suburbanites the ability to work, live and shop in their communities. If anything, they relieve the pressure on existing suburban communities, by offering an outlet for development pressure.
4. Neighbourhood revitalization
   The transit village offers a new approach to stimulating economic growth in inner-city neighbourhoods already served by rail. This is a break from earlier large scale redevelopment initiatives, as it focuses public and private investment in a small area around the station area.
5. Public Safety
   By incorporating a strong residential presence around transit stations, security is enhance by encouraging eyes on the street. Station areas which are vacated in the evenings and on weekends are perceived as unsafe places.
6. Public Celebration
   Public plazas around transit stations provide a place for community gathering, such as occurs in Europe. Residents are drawn to the area by its vibrancy, and vendors are attracted to the heavy walk-by traffic.



Transit Oriented Development (TOD); Calthorpe and Associates

Largely viewed as the father of TOD, Peter Calthorpe's "The Next American Metropolis" of 1993 advocated a fundamental change in the patterns of community building to respond to the growth crisis in US cities. Calthorpe was a founder of the Congress for New Urbanism, and many of his TOD designs reflect new urbanist leanings. The book presents 24 of Calthorpe's regional urban plans, in which towns are organized so that residents can be less dependent upon their cars and can walk, bike, or take public transportation between work, school, home, and shopping.

The primary tenets of Calthorpe's model is a Greenfield, suburban development served by a transit station connecting the community to a larger metropolitan core. He prescribes an urban form which concentrates growth within 1/4 mile of the station area (equivalent to a 5 minute walk), with a secondary area containing lower density development.

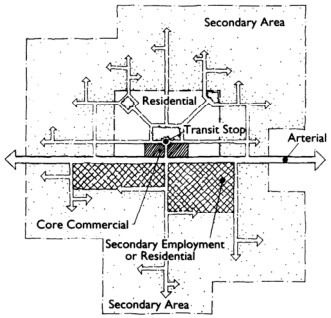
Calthorpe's book and other articles spell out a well defined set of metrics for what is considered TOD development. These are grouped into 'Location Criteria' which pertains to the station location, and 'Site Criteria' which discusses the attributes of the surrounding area.

Location Criteria

1. The TOD site must be located either on an express transit system, with service on 10- to 15-minute headways, or on a feeder bus line network within 10 minutes transit travel time from the express transit system.
2. The TOD site must be located within an Urban Growth Boundary or Urban Policy Area, with growth areas served by an express transit system or within 10 minutes transit travel time along a feeder bus line. TODs in urban growth areas may be surrounded by Secondary Areas.
3. TOD concepts can be applied to infill and redevelopment sites located in urbanized areas with existing uses.
4. TOD concepts can be applied to existing retail, office, and industrial sites by adding mixed-uses with structured parking on existing surface parking lots.

Site Criteria

1. In Urban Growth Areas, TOD sites must be at least 40 acres and no more than 160 acres in size.
2. Infill and redevelopment sites must be at least 20 acres and no more than 160 acres in size. Sites with the minimum acreage must be at least 80% vacant or developable.
3. The TOD must not contain land further than 2,000 feet from a transit stop. The Secondary Area may contain land no further than one mile from the stop.
4. Regardless of the number of property owners, the TOD application must consist of a comprehensive TOD Development Plan or



Planning for Transit-Friendly Land Use; New Jersey Transit

New Jersey Transit's approach represents the view of the service provider in transit oriented development.

Seeking to encourage land use that is compatible with and supportive of transit, New Jersey Transit prepared a handbook to communicate techniques that communities could draw on as they plan residential and commercial development and redevelopment. Developed in conjunction with Skidmore Owings and Merrill and others, this handbook drew on many of the lessons introduced by Calthorpe and others. Published in 1994, the book was intended as a toolkit for New Jersey communities, many of which are commuter suburbs of New York city.

This document represents one of the first recognitions of cycling as an important modal choice in station areas, perhaps as a method of incorporating transit stations into already existing lower density communities.

The primary tenets of this handbook are:

1. A transit station or stop that is a visible point of identity for the neighborhood, district, or community it serves
2. Access to the transit station or stop that is along clear, direct, and convenient routes
3. Continuous and safe sidewalks and pathways that make pedestrian access easy
4. Bike paths and storage locations that encourage bicycle access
5. Safe and comfortable places to wait and to meet others
6. Major points of origin or destination for transit riders that are in easy and interesting walking distance of the transit station or stop
7. A mix of land uses, including retail, housing, and/or offices and other employment centers and perhaps also such special uses as governmental offices, schools and health care facilities, or tourist or recreation locations

These points are predictably ambiguous, as opposed to the absolute metrics prescribed by Calthorpe's TOD definitions. This is of benefit when existing communities in place, and malleability is required in implementing urban change. Additionally, New Jersey transit's policies are responsible at the statewide level, where as Calthorpe's were developed as a project scale set of guidelines.

IBI Group; Urban Land Consultants (Vancouver, B.C.)

The IBI group is a consultant engaged in TOD projects in Canada and throughout the world.

IBI's view of TOD is that of 'Integrated Community Design', design which integrates transportation and land use planning, as well as other elements such as market demands, environmental constraints, architecture, urban design, and community input into a seamless planning process.

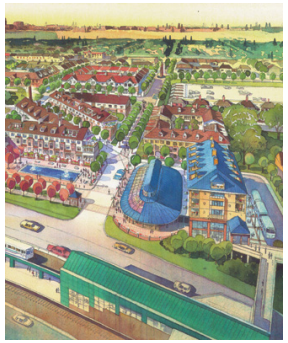
IBI also sees TOD as an opportunity for interdisciplinary convergence between the traditional disciplines involved in transportation and urban planning. This process focused approach seems likely to yield positive external benefits, such as increased communication and understanding between the engineering and design schools of planning.

The primary principles of TOD according to IBI are:

1. Interconnected Streets
2. Compact Development
3. Mixed Land Uses
4. Pedestrian Friendliness
5. Natural Open Space
6. Public Realm
7. Commercial Centre

IBI's secondary principles of TOD are:

1. Smaller City Blocks
2. Mixed-Use building types
3. Architectural variety
4. Narrow and Calmed Streets
5. Street Facing Buildings
6. Relaxed Parking Standards
7. Bicycle Friendly Streets
8. Market Acceptance
9. Sustainability



AGENCY DEFINITIONS

Miscellaneous definitions from other agencies are listed here.

Transit Agency	Definition
ATLANTA: Metropolitan Atlanta Rapid Transit Authority (MARTA)	Broad concept that includes any development that benefits from its proximity to a transit facility and that generates significant transit ridership.
ASPEN: Roaring Fork Transportation Authority, Colorado	Land development pattern that provides a high level of mobility and accessibility by supporting travel by walking, bicycling, and public transit.
BALTIMORE: Maryland Transit Administration	A relatively high-density place with a mixture of residential, employment, shopping, and civic uses located within an easy walk of a bus or rail transit center. The development design gives preference to the pedestrian and bicyclist.
CHARLOTTE: Charlotte Area Transit System	High-quality urban environments that are carefully planned and designed to attract and retain ridership. Typically, TODs provide for a pedestrian-friendly environment.
NEW JERSEY: New Jersey Transit Corporation (NJ TRANSIT)	An environment around a transit stop or station that supports pedestrian and transit use, created by providing a mix of land uses in a safe, clean, vibrant, and active place.
CHICAGO: Regional Transportation Authority of Northeast Illinois (RTA)	Development influenced by and oriented to transit service that takes advantage of the market created by transit patrons.
ORLANDO: Central Florida Regional Transportation Authority (LYNX)	A sustainable, economically viable, livable community with a balanced transportation system where walking, biking, and transit are as valued as the automobile.
SALT LAKE CITY: Utah Transit Authority (UTA)	Projects that enhance transit use, improve the quality of service provided to Authority riders, or generate revenue for the purpose of supporting public transit.
SAN FRANCISCO: Bay Area Rapid Transit Authority (BART)	Moderate- to higher-density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment, and shopping opportunities designed for pedestrians without excluding the automobile. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use.
WASHINGTON, D.C.: Washington Metropolitan Area Transit Authority (WMATA)	Projects near transit stops which incorporate the following smart-growth principles: reduce automobile dependence; encourage high shares of pedestrian and bicycle access trips to transit; help to foster safe station environments; enhance physical connections to transit stations from surrounding areas; and provide a vibrant mix of land-use activities

APPENDIX 2: COLLECTED LAND USE DATA FROM CASE STUDIES

PORT MOODY CASE STUDY; GOODS AND SERVICES CHARACTERISITCS

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Accountant	400		✓
Accountant	400		✓
Antique Store	400		✓
Arcade	400		✓
Art Gallery	400		✓
Art Gallery	400		✓
Art Store	400		✓
Auto Glass Repair	400		✓
Auto Parts Sales	400		✓
Auto Parts Sales	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Bedwares	400		✓
Bicycle Retailer	400		✓
Brake Repair	400		✓
Café	400	✓	
Café	400	✓	
Car Dealer	400		✓
Car Dealer	400		✓
Car Wash	400		✓
Caterer	400		✓
Cheque Cashing	400		✓
Chiropractor	400		✓
Chiropractor	400		✓
Clothing Manufacturer	400		✓
Convenience Store	400	✓	
Copy Store	400		✓
Craft Store	400		✓
Dance School	400		✓
Dance School	400		✓
Deli	400	✓	
Deli	400	✓	
Donut Shop	400		✓
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Fieldhouse	400		✓
Financial Services	400		✓
Fireplace Store	400		✓
Florist	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Furniture Refinishing	400		✓
Furniture Store	400		✓
Furniture Store	400		✓
Garden Furniture Retailer	400		✓
Gas Station	400	✓	
Gas Station	400	✓	
Gas Station	400	✓	
Gym	400	✓	
Gym	400	✓	
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Housewares Store	400		✓
Insurance Sales	400		✓
Insurance Sales	400		✓
Laundromat	400	✓	
Liquor Store	400	✓	
Locksmith	400		✓
Lumber Supply Store	400		✓
Marine Repair	400		✓
Marine Repair	400		✓
Martial Arts Academy	400		✓
Martial Arts Academy	400		✓
Mattress Store	400		✓
Medical Lab	400		✓
Motorsports Dealer	400		✓
Motorsports Dealer	400		✓
Muffler Repair	400		✓
Museum	400		✓
Office Supply Store	400		✓
Oil and Lube	400		✓
Party Supplies Store	400		✓
Pet Groomer	400		✓
Pet Groomer	400		✓
Pet Store	400		✓
Pet Training	400		✓
Physiotherapist	400		✓
Physiotherapist	400		✓
Pizza Delivery	400	✓	
Pizza Delivery	400	✓	
Pizza Delivery	400	✓	
Pool	400		✓
Restaurant	400	✓	
Restaurant	400	✓	
Safety Equipment Dealer	400		✓
Safety Equipment Dealer	400		✓
Sailing Club	400		✓
Scrap Metal	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Sign Maker	400		✓
Sporting Goods	400		✓
Sporting Goods Manufacture	400		✓
Sports Memoribilia Dealer	400		✓
Sports Training	400		✓
Steel Fabricator	400		✓
Steel Fabricator	400		✓
Steel Fabricator	400		✓
Toner Supply Store	400		✓
Tool Rental	400		✓
U Brew	400		✓
Used Appliance Sales	400		✓
Vacuum Retailer	400		✓
Vetrinarian	400		✓
Accountant	800		✓
Antique Store	800		✓
Bank	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Chiropractor	800		✓
Church	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Computer Store	800		✓
Consignment Store	800		✓
Day Spa	800		✓
Deli	800	✓	
Dentist	800		✓
Dentist	800		✓
Doctor	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Drycleaner	800	✓	
Fast Food Restaurant	800	✓	
Financial Services	800		✓
Florist	800		✓
Gift Store	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hobby Store	800		✓
Housewares	800		✓
Law Office	800		✓
Legion	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Martial Arts Academy	800		✓
Martial Arts Academy	800		✓
Massage Therapy Clinic	800		✓
Motorsports Dealer	800		✓
Office Supply Store	800		✓
Pet Groomer	800		✓
Post Office	800	✓	
Printer	800		✓
Pub	800	✓	
Realty Office	800		✓
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Shoe Repair	800		✓
Sporting Goods	800		✓
Tanning Salon	800		✓
Tattoo Parlour	800		✓
Tire Store	800		✓
Toy Store	800		✓
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Bank	400	✓	
Cheque Cashing	400		√
Chiropractor	400		√
Convenience Store	400		√
Dentist	400		√
Dentist	400		√
Drycleaner	400		√
Electronics Store	400		√
Esthetician	400		✓
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Gas Station	400	✓	
Hair Salon	400		✓
Hotel	400		✓
Hotel	400		✓
Hotel	400		✓
Hotel	400		✓
Hotel	400		✓
Hotel	400		✓
Insurance Sales	400		✓
Limousine Service	400		✓
Military Recruitment	400		✓
Pub	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Shipping Supply Store	400		✓
Sign Maker	400		✓
Welding Supply Store	400		✓
Amusement Park	800		✓
Appliance Store	800		✓
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Building Supply Store	800		✓
Building Supply Store	800		✓
Car Dealer	800		✓
Craft Store	800		✓
Electronics Store	800		✓
Electronics Store	800		✓
Engraving Store	800		✓
Equipment Rental	800		✓
Financial Services	800		✓
Furniture Rental	800		✓
Furniture Store	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Grocery Wholesaler	800		✓
Hair Salon	800		✓
Health Products Store	800		✓
Hotel	800		✓
Medical Lab	800		✓
Office Supply Store	800		✓
Office Supply Store	800		✓
Paint Store	800		✓
Physiotherapist	800		✓
Printer	800		✓
Printer	800		✓
Sign Maker	800		✓
Trailer Rental	800		✓
Trophy Store	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Auto Body Repair	400		✓
Bank	400	✓	
Bookstore	400		✓
Café	400	✓	
Car Dealer	400		✓
Clothing Store	400		✓
Dentist	400		✓
Fast Food Restaurant	400	✓	
Flooring Supply	400		✓
Grocery Store	400	✓	
Lumber Yard	400		✓
Optometry Clinic	400		✓
Pub	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Tanning Salon	400		✓
Toner Supply Store	400		✓
Yoga Studio	400	✓	
Accountant	800		✓
Accountant	800		✓
Adult Video Store	800		✓
Art School	800		✓
Art Store	800		✓
Art Store	800		✓
Auto Body Repair	800		✓
Auto Body Repair	800		✓
Auto Parts Sales	800		✓
Auto Parts Sales	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Bakery	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bookstore	800		✓
Bookstore	800		✓
Brake Repair	800		✓
Brake Repair	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Butcher	800	✓	
Butcher	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Café	800	✓	
Candy Store	800		✓
Candy Store	800		✓
Car Dealer	800		✓
Car Rental	800		✓
Car Rental	800		✓
Career Counselling	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Cellular Phone Store	800		✓
Chiropractor	800		✓
Chiropractor	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
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Clothing Store	800		✓
Clothing Store	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
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Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Computer Repair	800		✓
Computer Repair	800		✓
Computer Repair	800		✓
Convenience Store	800	✓	
Cosmetics Store	800		✓
Cosmetics Store	800		✓
Cosmetics Store	800		✓
Cosmetics Store	800		✓
Cosmetics Store	800		✓
Counselling Service	800		✓
Counselling Service	800		✓
Craft Store	800		✓
Craft Store	800		✓
Day Spa	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Day Spa	800		✓
Day Spa	800		✓
Day Spa	800		✓
Day Spa	800		✓
Day Spa	800		✓
Deli	800	✓	
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Denturist	800		✓
Department Store	800		✓
Department Store	800		✓
Department Store	800		✓
Department Store	800		✓
Diet Service	800		✓
Diet Service	800		✓
Diet Service	800		✓
Diet Service	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Drugstore	800		✓
Drugstore	800		✓
Drycleaner	800	✓	
Drycleaner	800	✓	
Drycleaner	800	✓	
Drycleaner	800	✓	
Electronics Store	800		✓
Electronics Store	800		✓
Electronics Store	800		✓
Electronics Store	800		✓
Engraving Store	800		✓
Entertainment Ticket Sales	800		✓
Esthetician	800		✓
Esthetician	800		✓
Esthetician	800		✓
Eyewear Store	800		✓
Eyewear Store	800		✓
Eyewear Store	800		✓
Eyewear Store	800		✓
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Financial Services	800		✓
Financial Services	800		✓
Financial Services	800		✓
Financial Services	800		✓
Fitness Equipment	800		✓
Florist	800		✓
Florist	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Foreign Exchange	800		✓
Framing Store	800		✓
Framing Store	800		✓
Framing Store	800		✓
Furniture Store	800		✓
Furniture Store	800		✓
Furniture Store	800		✓
Gas Station	800	✓	
Gas Station	800	✓	
Gas Station	800	✓	
Gas Station	800	✓	
Gift Store	800		✓
Gift Store	800		✓
Greeting Card Store	800		✓
Greeting Card Store	800		✓
Grocery Store	800	✓	
Grocery Store	800	✓	
Grocery Store	800	✓	
Gym	800	✓	
Gym	800	✓	
Gym	800	✓	
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hairdressing School	800		✓
Home Brewing Supplies	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Housewares	800		✓
Insurance Sales	800		✓
Insurance Sales	800		✓
Insurance Sales	800		✓
Insurance Sales	800		✓
Insurance Sales	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Jewerelly Store	800		✓
Karaoke Bar	800		✓
Laundromat	800	✓	
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Light Industrial	800		✓
Liquor Store	800	✓	
Liquor Store	800	✓	
Lottery Sales	800	✓	
Lottery Sales	800	✓	
Martial Arts Academy	800		✓
Massage Therapy Clinic	800		✓
Massage Therapy Clinic	800		✓
Medical Lab	800		✓
Medical Lab	800		✓
Medical Lab	800		✓
Medical Product Store	800		✓
Music School	800		✓
Music Store	800		✓
Newstand	800	✓	
Newstand	800	✓	
Newstand	800	✓	
Notary Public	800		✓
Notary Public	800		✓
Office Supply Store	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Oil and Lube	800		✓
Optometry Clinic	800		✓
Optometry Clinic	800		✓
Optometry Clinic	800		✓
Optometry Clinic	800		✓
Optometry Clinic	800		✓
Paint Store	800		✓
Paint Store	800		✓
Paint Store	800		✓
Pet Groomer	800		✓
Pet Store	800		✓
Pharmacy	800		✓
Photo Store	800		✓
Photo Store	800		✓
Physiotherapist	800		✓
Physiotherapist	800		✓
Pizza Delivery	800	✓	
Pizza Delivery	800	✓	
Pizza Delivery	800	✓	
Post Office	800	✓	
Printer	800		✓
Produce Store	800	✓	
Produce Store	800	✓	
Produce Store	800	✓	
Produce Store	800	✓	
Realty Office	800		✓
Realty Office	800		✓
Realty Office	800		✓
Recruitment Services	800		✓
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Seafood Store	800	✓	
Shipping Supply Store	800		✓
Shoe Repair	800		✓
Shoe Repair	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Sign Maker	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Sporting Goods	800		✓
Tailor	800		✓
Tailor	800		✓
Tanning Salon	800		✓
Tea Store	800		✓
Television Repair	800		✓
Tire Store	800		✓
Tire Store	800		✓
Toner Supply Store	800		✓
Toy Store	800		✓
Travel Agency	800		✓
Travel Agency	800		✓
Travel Agency	800		✓
Travel Agency	800		✓
Travel Agency	800		✓
Travel Agency	800		✓
Tutoring Service	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tutoring Service	800	✓	
Tuxedo Rental	800		✓
Vacuum Retailer	800		✓
Vetrinarian	800		✓
Vetrinarian	800		✓
Video Rental	800	✓	
Video Rental	800	✓	
Video Rental	800	✓	
Video Rental	800	✓	
Vitamin Store	800		✓
Vitamin Store	800		✓
Vitamin Store	800		✓
Vitamin Store	800		✓
Vitamin Store	800		✓
Vitamin Store	800		✓
Vocational Training	800		✓
Vocational Training	800		✓
Vocational Training	800		✓
Yoga Studio	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Accountant	400		✓
Antique Store	400		✓
Antique Store	400		✓
Auto Parts	400		✓
Auto Parts	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bookstore	400		✓
Building Supply Store	400		✓
Bulk Fuel Sales	400		✓
Bulk Fuel Sales	400		✓
Café	400	✓	
Café	400	✓	
Café	400	✓	
Café	400	✓	
Café	400	✓	
Child Care Centre	400		✓
Coffee Shop	400	✓	
Coffee Shop	400	✓	
Coin Shop	400		✓
Computer Repair	400		✓
Consignment Goods	400		✓
Convenience Store	400	✓	
Convenience Store	400	✓	
Convenience Store	400	✓	
Counselling Service	400		✓
Dance School	400		✓
Deli	400	✓	
Dentist	400		✓
Dentist	400		✓
Denturist	400		✓
Doctor	400		✓
Esthetician	400		✓
Esthetician	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Eyeware Store	400		✓
Farm Equipment Retailer	400		✓
Farm Supply Store	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Frame Store	400		✓
Furniture Store	400		✓
Gas Station	400	✓	
Gift Store	400		✓
Gift Store	400		✓
Gift Store	400		✓
Grocery Store	400	✓	
Hair Salon	400		✓
Hardware Store	400		✓
Hobby Store	400		✓
Hospital	400		✓
Housewares	400		✓
Internet Café	400	✓	
Irrigation Retailer	400		✓
Jewellery Store	400		✓
Juice Bar	400	✓	
Law Office	400		✓
Law Office	400		✓
Locksmith	400		✓
Massage Therapy	400		✓
Medical Clinic	400		✓
Medical Clinic	400		✓
Medical Clinic	400		✓
Medical Clinic	400		✓
Musical Instrument Store	400		✓
Notary Public	400		✓
Optometrist	400		✓
Pawnshop	400		✓
Pet Store	400		✓
Photo Store	400		✓
Photo Store	400		✓
Plumber	400		✓
Post Office	400	✓	
Post Office	400	✓	
Printer	400		✓
Printer	400		✓
Pub	400	✓	
Pub	400	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Pub	400	✓	
Pub	400	✓	
Pub	400	✓	
Pub	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Senior High School	400	✓	
Tailor	400		✓
Theatre	400		✓
Toy Store	400		✓
Upholsterer	400		✓
Vacuum Store	400		✓
Vocational Training	400		✓
Welding Supply Store	400		✓
Window Glass Store	400		✓
Accountant	800		✓
Appliance Rental	800		✓
Auto Parts	800		✓
Auto Parts	800		✓
Auto Parts	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Auto Repair	800		✓
Bank	800	✓	
Bank	800	✓	
Bank	800	✓	
Bookstore	800		✓
Bookstore	800		✓
Bookstore	800		✓
Café	800	✓	
Café	800	✓	
Café	800	✓	
Car Dealer	800		✓
Car Dealer	800		✓
Car Wash	800		✓
Car Wash	800		✓
Ceramic Goods	800		✓
Cheque Cashing	800		✓
Chiropractor	800		✓
Church	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Clothing Store	800		✓
Clothing Store	800		✓
Cobbler	800		✓
Coffee Shop	800	✓	
Coffee Shop	800	✓	
Coffee Shop	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Counselling Service	800		✓
Dairy Processing	800		✓
Dance School	800		✓
Deli	800	✓	
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Denturist	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Dollar Store	800		✓
Donut Shop	800	✓	
Drycleaner	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Drycleaner	800	✓	
Drycleaner	800	✓	
Embroidery Store	800		✓
Esthetician	800		✓
Eyeware Store	800		✓
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Financial Services	800		✓
Financial Services	800		✓
Florist	800		✓
Florist	800		✓
Funeral Home	800		✓
Gas Station	800	✓	
Gas Station	800	✓	
Gas Station	800	✓	
Gas Station	800	✓	
Gift Store	800		✓
Gift Store	800		✓
Gym	800		✓
Gym	800		✓
Gypsum Plant	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hotel	800		✓
Housewares	800		✓
Insurance Sales	800		✓
Insurance Sales	800		✓
Internet Café	800	✓	
Jewellery Store	800		✓
Labour Service	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓
Law Office	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Legion	800		✓
Lighting Store	800		✓
Martial Arts Academy	800		✓
Medical Clinic	800		✓
Medical Clinic	800		✓
Office Products	800		✓
Paint Store	800		✓
Photo Store	800		✓
Physiotherapist	800		✓
Physiotherapist	800		✓
Physiotherapist	800		✓
Pizza Delivery	800		✓
Printer	800		✓
Pub	800	✓	
Realty Office	800		✓
Realty Office	800		✓
Realty Office	800		✓
Rental Hall	800		✓
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Sewing Store	800		✓
Shoe Store	800		✓
Shoe Store	800		✓
Stove Sales	800		✓
Tailor	800		✓
Television Repair	800		✓
Tire Sales	800		✓
Tire Sales	800		✓
Tobbacoist	800		✓
Vocational Training	800		✓
Yoga Studio	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Antique Store	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Billiards Hall	400		✓
Bookstore	400		✓
Bowling Alley	400		✓
Butcher	400	✓	
Butcher	400	✓	
Café	400	✓	
Café	400	✓	
Café	400	✓	
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Ceramics Store	400		✓
Cheque Cashing	400		✓
Clothing Store	400		✓
Clothing Store	400		✓
Clothing Store	400		✓
Consignment Store	400		✓
Consignment Store	400		✓
Consignment Store	400		✓
Convenience Store	400	✓	
Convenience Store	400	✓	
Convenience Store	400	✓	
Convenience Store	400	✓	
Craft Store	400		✓
Craft Store	400		✓
Dance School	400		✓
Dance School	400		✓
Day Spa	400		✓
Dentist	400		✓
Dentist	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Dentist	400		✓
Department Store	400		✓
Department Store	400		✓
Dollar Store	400		✓
Dollar Store	400		✓
Drycleaner	400	✓	
Electronics Repair	400		✓
Esthetician	400		✓
Eyeware Store	400		✓
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Fireplace Store	400	✓	
Flooring Supply	400		✓
Florist	400		✓
Frame Store	400		✓
Frame Store	400		✓
Fuel Wholesaler	400	✓	
Funeral Home	400		✓
Gas Station	400	✓	
Gift Store	400		✓
Gift Store	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hardware Store	400		✓
Hotel	400		✓
Hydroponics Supply	400		✓
Insurance Sales	400		✓
Janitorial Supply	400		✓
Jewellery Store	400		✓
Landscape Supply	400		✓
Laundromat	400	✓	
Law Office	400		✓
Lingerie Store	400		✓
Liquor Store	400	✓	
Liquor Store	400	✓	
Lumber Supply Store	400		✓
Martial Arts Academy	400		✓
Motorsports Dealer	400		✓
Motorsports Dealer	400		✓
Motorsports Dealer	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Music School	400		✓
Notary Public	400		✓
Optometrist	400		✓
Pawnshop	400		✓
Pawnshop	400		✓
Pawnshop	400		✓
Pawnshop	400		✓
Pet Groomer	400		✓
Pizza Delivery	400	✓	
Pizza Delivery	400	✓	
Pizza Delivery	400	✓	
Post Office	400	✓	
Printer	400		✓
Printer	400		✓
Pub	400	✓	
Pub	400	✓	
Realty Office	400		✓
Realty Office	400		✓
Realty Office	400		✓
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Shoe Repair	400		✓
Shoe Repair	400		✓
Sporting Goods	400		✓
Sporting Goods	400		✓
Sporting Goods	400		✓
Tanning Salon	400		✓
Tattoo Parlour	400		✓
Tire Store	400		✓
Tire Store	400		✓
Tool Sales	400		✓
Vacuum Retailer	400		✓
Vetrinarian	400		✓
Vitamin Store	400		✓
Auto Repair	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Auto Repair	800		✓
Auto Repair	800		✓
Bakery	800	✓	
Bed and Breakfast	800		✓
Café	800	✓	
Chiropractor	800		✓
Convenience Store	800	✓	
Esthetician	800		✓
Fireplace Store	800	✓	
Grocery Store	800	✓	
Gym	800	✓	
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hydroponics Supply	800		✓
Marine Gas Station	800		✓
Marine Hardware	800		✓
Mattress Store	800		✓
Pet Food Store	800		✓
Photo Developing	800		✓
Pizza Delivery	800	✓	
Printer	800		✓
Realty Office	800		✓
Tanning Salon	800		✓
Upholstery Service	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Accountant	400		✓
Accountant	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Antique Store	400		✓
Auto Parts	400		✓
Auto Parts	400		✓
Auto Parts	400		✓
Auto Parts	400		✓
Auto Parts	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Auto Repair	400		✓
Bakery	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bank	400	✓	
Bookstore	400		✓
Bulk Fuel Sales	400		✓
Café	400	✓	
Café	400	✓	
Café	400	✓	
Café	400	✓	
Candy Store	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Car Dealer	400		✓
Catering Service	400		✓
Catering Service	400		✓
Cheque Cashing	400		✓
Church	400		✓
Church	400		✓
Church	400		✓
Church	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Church	400		✓
Church	400		✓
Clothing Store	400		✓
Cobbler	400		✓
Coffee Shop	400	✓	
Coffee Shop	400	✓	
Computer Repair	400		✓
Consignment Goods	400		✓
Consignment Goods	400		✓
Convenience Store	400	✓	
Convenience Store	400	✓	
Convenience Store	400	✓	
Convenience Store	400	✓	
Counselling Service	400		✓
Counselling Service	400		✓
Craft Store	400		✓
Dance School	400		✓
Day Spa	400		✓
Dentist	400		✓
Dentist	400		✓
Dentist	400		✓
Doctor	400		✓
Donut Shop	400	✓	
Esthetician	400		✓
Esthetician	400		✓
Eyeware Store	400		✓
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Fast Food Restaurant	400	✓	
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Financial Services	400		✓
Flooring Store	400		✓
Florist	400		✓
Frame Store	400		✓
Funeral Home	400		✓
Funeral Home	400		✓
Gas Station	400	✓	
Gift Store	400		✓
Gift Store	400		✓
Glass Store	400		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Gym	400	✓	
Gym	400	✓	
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Hair Salon	400		✓
Harp Store	400		✓
Hobby Store	400		✓
Hotel	400		✓
Insurance Sales	400		✓
Jewellery Store	400		✓
Jewellery Store	400		✓
Law Office	400		✓
Law Office	400		✓
Law Office	400		✓
Law Office	400		✓
Law Office	400		✓
Legion	400		✓
Library	400		✓
Locksmith	400		✓
Martial Arts Academy	400		✓
Massage Therapy	400		✓
Medical Equipment Sales	400		✓
Motorsports Dealer	400		✓
Musical Instrument Store	400		✓
Musical Instrument Store	400		✓
Pawnshop	400		✓
Pet Store	400		✓
Photography Studio	400		✓
Post Office	400	✓	
Printer	400		✓
Printer	400		✓
Pub	400		✓
Public Washrooms	400		✓
Realty Office	400		✓
Realty Office	400		✓
Realty Office	400		✓
Realty Office	400		✓
Realty Office	400		✓
Rental Hall	400		✓
Rental Hall	400		✓
Restaurant	400	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Restaurant	400	✓	
Second Hand Store	400		✓
Sporting Goods	400		✓
Theatre	400		✓
Tire Sales	400		✓
Vacuum Store	400		✓
Yoga Studio	400	✓	
Antique Store	800		✓
Auto Parts	800		✓
Auto Parts	800		✓
Auto Repair	800		✓
Building Supply Store	800		✓
Café	800	✓	
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Dealer	800		✓
Car Wash	800		✓
Car Wash	800		✓
Chiropractor	800		✓
Chiropractor	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓
Church	800		✓

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Church	800		✓
Church Community Centre	800		✓
Coffee Shop	800	✓	
Coffee Shop	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Convenience Store	800	✓	
Counselling Service	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Dentist	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Doctor	800		✓
Dollar Store	800		✓
Driving School	800		✓
Drycleaner	800	✓	
Drycleaner	800	✓	
Drycleaner	800	✓	
Electronics Store	800		✓
Embroidery Store	800		✓
Equipment Rental	800		✓
Esthetician	800		✓
Fast Food Restaurant	800	✓	
Fast Food Restaurant	800	✓	
Financial Services	800		✓
Financial Services	800		✓
Financial Services	800		✓
Flooring Store	800		✓
Flooring Store	800		✓
Florist	800		✓
Florist	800		✓
Gas Station	800	✓	
Gas Station	800	✓	

Goods and / or Services Type	5 minute walk ring or 10 minute walk ring	Daily Use	Periodic Use
Gas Station	800	✓	
Gas Station	800	✓	
Gas Station	800	✓	
Grocery Store	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Hair Salon	800		✓
Heating Supply Store	800		✓
Insurance Sales	800		✓
Liquor Store	800		✓
Medical Clinic	800		✓
Medical Clinic	800		✓
Medical Equipment Sales	800		✓
Moving Company	800		✓
Museum	800		✓
Music School	800		✓
Office Equipment	800		✓
Optometrist	800		✓
Pharmacy	800		✓
Pizza Delivery	800	✓	
Printer	800		✓
Realty Office	800		✓
Realty Office	800		✓
Rental Hall	800		✓
Restaurant	800	✓	
Restaurant	800	✓	
Restaurant	800	✓	
Shoe Store	800		✓
Sporting Goods	800		✓
Tanning Salon	800		✓
Tutoring Service	800		✓
Video Rental	800	✓	

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