

2015

Moving Towards a Greener Future: An Investigation of How Transit-Oriented Development Has the Potential to Redefine Cities Around Sustainability

Margaret E. Smith
Scripps College

Recommended Citation

Smith, Margaret E., "Moving Towards a Greener Future: An Investigation of How Transit-Oriented Development Has the Potential to Redefine Cities Around Sustainability" (2015). *Scripps Senior Theses*. Paper 534.
http://scholarship.claremont.edu/scripps_theses/534

This Open Access Senior Thesis is brought to you for free and open access by the Scripps Student Scholarship at Scholarship @ Claremont. It has been accepted for inclusion in Scripps Senior Theses by an authorized administrator of Scholarship @ Claremont. For more information, please contact scholarship@cuc.claremont.edu.

**MOVING TOWARDS A GREENER FUTURE
AN INVESTIGATION OF HOW TRANSIT-ORIENTED DEVELOPMENT HAS
THE POTENTIAL TO REDEFINE CITIES AROUND SUSTAINABILITY**

Maggie Smith

In partial fulfillment of a Bachelor of Arts Degree in Environmental Analysis,
2014-15 Academic Year, Scripps College, Claremont, California

Readers:

Professor Lance Neckar
Professor Char Miller
Professor Bruce Coats

TABLE OF CONTENTS

<u>ACKNOWLEDGEMENTS</u>	3
<u>INTRODUCTION: PLANNING FOR THE CITIES OF TOMORROW</u>	4
<u>CHAPTER 1: TRANSIT-ORIENTED DEVELOPMENT</u>	9
HISTORY: FROM THE CITY TO THE SUBURB AND BACK AGAIN	10
PRINCIPLES AND GOALS: SUSTAINABILITY AND LIVABILITY	13
CRITIQUES AND CHALLENGES OF TOD	19
<u>CHAPTER 2: TRANSIT VILLAGES: DESIGNING AROUND MOBILITY</u>	21
<u>CHAPTER 3: RELEASING OURSELVES FROM THE CAR</u>	27
<u>CHAPTER 4: THE EVOLUTION OF TRANSIT ORIENTED DEVELOPMENT</u>	31
EBENEZER HOWARD’S GARDEN CITY: EARLY ORIGINS OF TOD	31
VANCOUVER SKYTRAIN: THE ECONOMICS INCENTIVES OF MASS TRANSIT	33
FRUITVALE VILLAGE: PROMOTING SOCIAL RESILIENCY THROUGH TOD	37
PORTLAND TRANSIT MALL: A MODEL OF SUSTAINABLE TRANSIT TOWN	40
<u>CHAPTER 5: THE EMERALD CITY: SEATTLE’S TRANSIT FUTURE</u>	48
HISTORY OF THE LIGHT RAIL	50
LINK LIGHT RAIL’S SUSTAINABILITY INITIATIVES	52
TRANSIT ORIENTED DEVELOPMENT ALONG THE CENTRAL LINK	55
<u>CHAPTER 6: REDMOND: REDEFINING A SUBURBAN TOWN AROUND SUSTAINABILITY</u>	58
<u>CONCLUSION</u>	74
<u>BIBLIOGRAPHY</u>	76

ACKNOWLEDGEMENTS

Special thank you to all three of my readers for helping me incorporate my design ambitions into a workable thesis; Lance Neckar, for your knowledge, expertise, and willingness discuss my topic with me from the beginning, Char Miller for your extensive feedback and encouragement through the entire writing process, and Bruce Coats, for your helpful comments and suggestions during my research.

Thanks to Joel Pfundt, Scott Koppelman, and Kristen Lohse for helping me through the research, planning, and design portions of my project.

And lastly, thanks friends and family for being so supportive during the entire thesis process, whether reading drafts, reviewing presentations, or simply listening to me talk through ideas out loud.

Introduction: Planning for the Cities of Tomorrow

It's hard to conceptualize that there are over seven billion people on this Earth. Maybe it is easy for you to think about your local city, perhaps 100,000 people, but seven billion? Now, take into account that over half of this population is consolidated in cities. As of 2014, 54% of the world resides in urban areas, and this is projected to grow to 66% by 2050.¹ With literally billions of new urban inhabitants expected in the next 20 years, cities are being pushed to their limits, and new development is taking place at unprecedented speeds. The growth of "megacities," cities with over 10 million inhabitants, is expected to reach 41 by 2030, up from 10 in 1990 and 28 in 2014; and cities like Tokyo, Delhi, and Shanghai are predicted to have populations close to 40 million each by the year 2030.¹ Thus, it is unsurprising that leaders such as John Wilmoth, Director of UN DESA's Population Division, argue that "managing urban areas has become one of the most important development challenges of the 21st century."²

At stake is our very way of life, with escalating demands on our city's most basic resources such as food, water, jobs, housing, and transportation. While transportation may seem a trivial component, it provides insight into patterns of access that shape the flow of urban demands. The systems that structure urban transportation provide a legacy of infrastructure that provide both day-to-day access as well as wider mobility across the variety of modes they support. Cities are where the majority of greenhouse gasses, pollution, and waste are produced, and thus sustainability initiatives must start in these places. While it certainly will be a challenge, the expected urban population growth has

¹ "World's Population Increasingly Urban with More than Half Living in Urban Areas | UN DESA | United Nations Department of Economic and Social Affairs," July 10, 2014, <http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html>.

² Ibid.

given us a chance to reevaluate the way we structure and design cities, to see what has worked well and what could be improved on or changed as we proceed into the 21st century. It's important to remember that cities are not simply a conglomeration of infrastructure; cities are a place full of culture, creativity, life, and people, and should be designed as such. This population trend is going to put new demands on the function of cities, and the development of successful transportation systems will be at the heart of economic, social, and environmental change. As cities become denser, mobility becomes an increasingly integral part of the city and represents an opportunity for targeted sustainable redevelopment. Access-based transportation represents the backbone of cities, and targeting sustainable development around mass transit has the potential to project sustainability onto the city as a whole.

To cite the widely recognized 1987 Brundtland Report, "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*"³ This broad, overarching definition has been stretched and manipulated for years to legitimize various development practices, some with more noble intentions than others. Central to the idea of sustainability is continued environmental, economic, and social progress. Not one of these three "pillars of sustainability" is easy to accomplish, and doing all three together and doing them well requires forward thinking and collaboration across fields. If cities are expected to absorb an increasing proportion of the global population while keeping these three pillars balanced, it is imperative that we start developing strategies now to design the cities of tomorrow.

³ Strategic Imperatives, "Report of the World Commission on Environment and Development: Our Common Future," accessed December 3, 2014, <http://www.ask-force.org/web/Sustainability/Brundtland-Our-Common-Future-1987-2008.pdf>.

One such strategy is that of Transit-Oriented Development (TOD), the practice of consolidating development around mass transit routes. Until very recently, cars have dominated transportation infrastructure and driven development in the United States for years now, and their effects go beyond the obvious issues of pollution. They have completely changed the way cities are laid out. Suburban sprawl has created a host of issues, not only ecological but also social and economic. Political scientist Robert Putnam has argued that changes in urban form, namely the evolution of urban sprawl, is to blame for decline in “social capital.”⁴ He claims that loss of social interaction is due to longer travel times alone in cars, increased segregation, and the lost sense of “boundedness” that encourages social involvement within closely-knit communities⁵. Without social capital, cities cannot thrive and culture starts to disappear.

Now is the time to rethink this trend in urban form and start looking at Transit-Oriented Development. Its fundamental principles, denser communities and decreased car use, have dramatically positive effects on all aspects of sustainability, and the subsequent formation of “transit villages,” mixed-use urban development centered around transit, encourages sustainability simply through its form. As more and more people are moving into urban areas, developing strong mobility systems will become a priority of cities, and presents a major opportunity to update existing cities and suburbs with an emphasis on sustainability.

Urban form can vary dramatically from city to city. After spending a semester in Copenhagen, Denmark, I witnessed what public transportation could offer urbanites when executed to its fullest potential. The compact city shape combined with the metro, trains,

⁴ Jan K. Brueckner and Ann G. Largey, “Social Interaction and Urban Sprawl,” *Journal of Urban Economics* 64, no. 1 (July 2008): 18–34, doi:10.1016/j.jue.2007.08.002.

⁵ *Ibid.*

busses, and bikes all contributed to a mobility system in which a car was completely unnecessary. In some of Copenhagen's densest neighborhoods such as Nørrebro and Vesterbro, car ownership is 14% and 17% respectively, with a citywide average under 30%.⁶ Then I came back to school in Los Angeles and was reminded what a city built around the automobile looks like, huge, sprawling, and polluted. While European cities have the advantage of typically being older and thus more compact, there is no reason why any American town could not be redeveloped around transit; in fact, the benefits of this redevelopment would make it foolish not to change. Seeing these two extremes made me think more about what transit can do for cities when done right, and inspired me to look carefully at how bringing mass transit to a pre-existing town could inspire wide-reaching sustainability and urban livability.

The growing urban population combined with an increased knowledge of how transit informs city shape presents an unprecedented opportunity for sustainable development. Recent historic agreements between nations like the United States and China to tackle climate change prove that we, as a planet, are finally realizing and accepting many of the environmental issues we have caused.⁷ With the rapid growth of our cities, now is the time to figure out how we want our cities to be built, or improved, so that they can succeed in the coming years. In order to do this, we need to rethink the system that shapes our cities, principally transit. Thomas Schröpfer writes, "the mobility system is not only a system of transport; it is the whole understanding of a city and its surroundings. The more we create an integration of functions, the better a city will

⁶ "Copenhagenize.com - Bicycle Culture by Design: Danish 180% Tax on Cars Is Rather Irrelevant," accessed December 3, 2014, <http://www.copenhagenize.com/2012/10/danish-180-tax-on-cars-is-rather.html>.

⁷ "U.S.-China Joint Announcement on Climate Change," *The White House*, November 12, 2014, <http://www.whitehouse.gov/node/307541>.

become.”⁸ Now is a point of convergence for several positive trends including growing transit ridership, increased investment in mass transit, frustration with traffic and urban sprawl, smart growth, and increasing understanding of the benefits of Transit-Oriented Development.⁹ The goal of this project is to assess the ways a carefully executed transit station can promote ecological sustainability while helping to mitigate social and economic issues associated with urban areas such as limited mobility, little green space, and a lack of community. By nudging people into being sustainable by providing convenient access to mass transit, it is hoped they might adopt other sustainable practices. Through the design of a hypothetical transit station for the city of Redmond, Washington, these issues will be teased out in the hopes of assessing how a transit station can go beyond being a necessary piece of public infrastructure and become an active space that can help promote a more sustainable society, adaptability, and resiliency.

⁸ Thomas Schröpfer, *Ecological Urban Architecture* (Basel: Birkhäuser, 2012). 86.

⁹ Hank Dittmar and Gloria Ohland, eds., *The New Transit Town: Best Practices In Transit-Oriented Development*, 3rd edition (Washington, DC: Island Press, 2003).

Chapter 1: Transit-Oriented Development

Transit-Oriented Development (TOD) is the concept of planning dense, walkable neighborhoods around existing or future transit lines, usually within a half-mile radius, or ten-minute walk from the station. This is considered the maximum time and distance a pedestrian would walk before opting for another form of transit.¹⁰ The core idea of TOD is that by concentrating development in areas with strong public transportation, you create “transit villages,” and the need for cars will decrease, leading to a host of environmental, economic, and social benefits. Though its name might not suggest it, Transit-Oriented Development often also emphasizes bicycle and pedestrian infrastructure in their design. Urbanists Hank Dittmar and Gloria Ohland argue that the transit station itself, the very core of these developments, simultaneously acts as a cultural hub as well as “an interchange point servicing a specific function in a regional network.”¹¹ The idea is not just to move people efficiently in and out of these areas, but also to create a space around the transit station that people will enjoy staying in. The developments

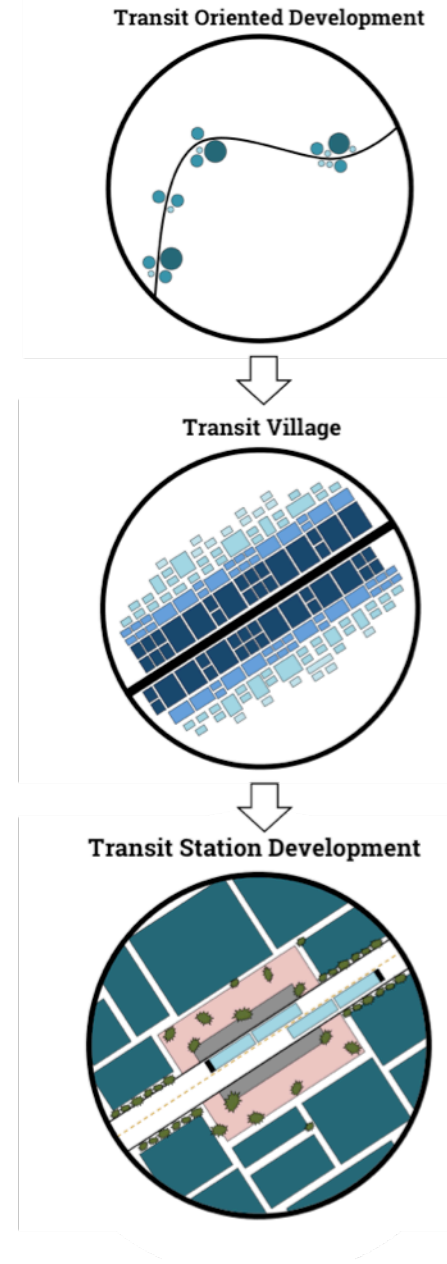


FIGURE 1. A look at TOD on the regional level, the “transit village” neighborhood level, and the local station level.

¹⁰ Ibid.

¹¹ Ibid., 32.

around these stations are designed to benefit not only riders, but also local residents living near these centralized transit stations.

History: From The City To The Suburb And Back Again

The shape of style of TOD in the United States has gone through three distinct iterations over time. These changes reflect changes in priority by the city, its inhabitants, and the modernizing world. From horse-drawn carriages, to the steam engine, to personal vehicles, transit has seen a lot of change over the past centuries, and its important to think about modern day Transit-Oriented Development within the context of its previous forms.

The first form of TOD, popularized in the early 20th century, was essentially development-oriented transit. The 20th century was an age of industry and innovation, and much new development. Anxious to ensure their developments were easily accessible, developers at the time built transit lines, primarily streetcars, to connect their developments to the city. While at first glance this may seem similar to the modern definition of TOD, where development follows mobility systems, development-oriented transit begins with the construction of housing and shops outside the city and later connects them in with transit. This created, as urban historian Sam Bass Warner described quite simply, “a two part city: a city of work separated from a city of homes.”¹² This is, in fact, the opposite of what TOD aims to do. The issue of suburbanization and urban sprawl brings with it a whole host of environmental issues related to increased car travel. Government investment in roads and highways following the invention of the

¹² Ibid., 5.

automobile was the nail in the coffin, and developments began sprawling further and further out from the city center.

The second phase of TOD came out of the post WWII-war years: automobile-oriented development. Automobile use was continuing to grow, and with it grew traffic congestion. This growth was linked closely with the idea of what it meant to be American, to be free, independent, and modern. This era also featured the rise of city bus systems, but seeing as busses could not escape the traffic plaguing personal vehicles, bus ridership was primarily composed of those who couldn't afford a car, and was viewed as a transit mode of last resort. Around this time, we saw the emergence of major urban transit systems, including the well-known Bay Area Rapid Transit (BART) system and the Washington (D.C.) Metropolitan Area Transit Agency (WMATA). While these cities are today lauded today for their sustainable transit systems, it's important to understand the intentions behind them. These systems were built first and foremost to relieve automobile traffic, and were never expected to become a preferred method of transportation, but rather, once again, to be used by the few that couldn't afford to commute to work every day by car. Thus, stations did little to promote new development. In order to fit within the automobile-favored systems, stations were often surrounded by mass parking lots that further isolated them from nearby communities. While it was not the explicit intention, the development of these systems did help cut down a bit on car ownership, but there were still a number of changes that needed to be made before full on TOD could be realized.¹³

Finally, there is modern-day Transit-Oriented Development, building new developments along existing and proposed transit routes. Many developers and

¹³ Ibid.

government agencies have realized the economic value brought by transit, and have thus sought to consolidate new development around new transit lines.¹⁴ Given the cost of building transit systems, government agencies look at development as a way to get back some of that investment. However, this can sometimes overshadow the importance of environmental and social concerns in these spaces. Moving forward, governments must look at how their investments affect all facets of sustainability. While these three types of TOD were presented separately and chronologically based on trends of the time, you can find modern day examples of all three systems or combinations thereof. In fact, many urbanists such as Dena Belzer and Gerald Autler argue that Transit-Related Development might be a more appropriate term for the development we see today, with true Transit-Oriented Development still an unachieved goal for the future.¹⁵ Cities and towns are all unique, dependent on location, population, local economy, etc. It is very difficult to change urban form once it has been set up, and many people will resist change. Yet it is our existing cities that will take on this increasingly urban population, and so perhaps a fifth system must be developed, something along the lines of “Transit-Adapted Development.” Finding ways to transform existing cities and towns into sustainable ones centered on transit will be key for both urban livability and sustainability as our cities continue to grow.

Given the subtle nuances between these different systems of development, they are often grouped under the umbrella of “Transit-Oriented Development,” and as such, this paper will use the term TOD broadly to refer to all transit-related development.

¹⁴ Ibid.

¹⁵ Gerald Autler and Dena Belzer, *Transit Oriented Development: Moving from Rhetoric to Reality* (Center on Urban and Metropolitan Policy, the Brookings Institution, 2002), <http://www.brookings.edu/es/urban/publications/belzertod.pdf>.

Principles and Goals: Sustainability and Livability

Transit-Oriented Development has several different yet related goals. At its core, it aims to reduce car use. This in turn reduces household transportation costs as well as environmental impact. Through the creation of mixed-use neighborhoods, TOD also aims to improve overall quality of life for residents. Rather than centering cities around the car, TOD prioritizes walking and biking by implementing high quality infrastructure to facilitate these different forms of mobility. According to urbanist Peter Calthorpe, there are seven core principles associated with Transit-Oriented Development¹⁶:

1. **Compact growth should be organized on a regional level and be transit supportive.** Scale and urban form are a big factor in the success of TOD, with compact cities being much preferred. If we look for cities that already employ TOD tendencies, we see many European examples that were founded before the car. Here, people had to live closer together because, without automated modes of transportation, there simply wasn't an option to spread out from urban centers. In other cases, such as the city of Groningen, The Netherlands or Copenhagen, Denmark, cities were literally confined by fortresses put up to defend from enemy attack during times of war. These boundaries helped cities focus on compact development, and when bike paths, busses, and subway lines went in later on, they automatically became modernized transit villages. In newer cities, like many in the U.S., which developed after the invention of the car, the urban form requires significant alterations to become transit-supported and sustainable.

¹⁶ Dittmar and Ohland, *The New Transit Town*.

2. **Housing, offices, and “civic uses” should be located within walking distance of transit stops.** The urban forms of many U.S. cities have sprawled such that these three urban components are completely spread out from each other. As mentioned above, the suburbanization of the United States led many Americans out of downtown and into large, single-family houses in the suburban countryside. Part of this had to do with the appeal of living closer to nature, and more recently because it has become so expensive to live in cities. However, owning a car is quite expensive too, and driving back and forth between home and work every day brings with it a number of social and environmental issues. Further, these suburban places that were supposedly “closer to nature” have in fact lost a lot of their green spaces due to sprawl, which means more driving so people can get their nature fix if or when they have time. By combining all three of these components around transit, we eliminate the desire for people to move far away from town clusters, because nature will be incorporated into the urban design by default.

3. **Streets should be bike and pedestrian friendly and connect to local destinations.** TODs go beyond simply providing access to transit by focusing on intermodality. In many American cities, biking and walking have developed more as a form of exercise than as a form of transport. Those who avoid walking and biking cite safety concerns, especially along roads with fast moving cars. TOD invests just as much in creating safe and attractive pedestrian and cycle tracks, which help connect the community. By creating these opportunities for intermodality, people are much more likely to ditch their cars and bike to the grocery store or to work. This goes hand in hand with

the idea of rescaling cities to be more compact. Living a mile or two from work vs. 20 miles makes it much easier to commute via a sustainable mode of transit, such as by bike. One could also look at this in terms of obesity rates. Many blame Americans' sedentary lifestyles for the 34.9% adult obesity rate, and while there are many other factors, daily exercise could have a dramatic effect on improving public health. A study done by Reid Ewing et al. analyzing 448 US counties found a significant negative correlation between minutes walked, BMI, hypertension, and obesity. The study concluded that urban form can indeed have an impact on health, with compact, walkable cities having statistically lower rates of obesity related issues.¹⁷ According to the Center for Disease Control and Prevention, in 2008, the US spent over \$147 billion dollars on obesity related medical issues.¹⁸ This is money that could be better spent, for example, on creating public infrastructure that could encourage healthier lifestyles.

- 4. There should be a mix of housing types, densities, and costs.** Though TOD seeks to capitalize on the environmental benefits that come with high-density, multi-family complexes, its social component involves recognizing that different people have different preferences about where they live. Some may prefer downtown apartments while others may want their own house. By providing a variety of options, TODs can bring more people into the city. Having a mix of housing types encourages diversity

¹⁷ Reid Ewing et al., "Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity," *American Journal of Health Promotion* 18, no. 1 (September 1, 2003): 47–57, doi:10.4278/0890-1171-18.1.47.

¹⁸ "Obesity and Overweight for Professionals: Data and Statistics: Adult Obesity - DNPAO - CDC," *Centers for Disease Control and Prevention*, September 9, 2014, <http://www.cdc.gov/obesity/data/adult.html>.

amongst residents; you might have families with young children, young professionals living alone, or elderly couples all living within close proximity to each other. While these groups tend to congregate in separate areas, there are many social benefits that come from mixing these family-types together. Ensuring there is a diversity of housing costs is also critical to the success of TOD. As we will see later on, one of TOD's greatest criticisms is that it leads to gentrification. By designing with this in mind, TOD planners have become more diligent about including low-income housing and apartments for rent. This socioeconomic diversity comes with social benefits too, which have been written about by several urbanists.¹⁹

- 5. Ecosystem services should be preserved, as well as high-quality open space.** The lack of green spaces in cities has been blamed for a number of urban environmental issues. By paving over vast areas of natural vegetation, we have created acres of impermeable surface that rainwater must travel over before finally being absorbed into the ground or funneled out, unfiltered, into the ocean. During this time, the water picks up harmful pollutants from cars and other human activity, which has significant and detrimental effects on both terrestrial and marine wildlife. The systematic removal of vegetation from urban areas has led to irreparable decreases in plant and animal diversity. By including more vegetation in cities, we decrease the need for pesticides and fertilizers, which often end up polluting storm water runoff. Further, this lack of vegetation means air pollutants, most specifically carbon dioxide, are going unchecked. One tree can absorb up to 48 pounds of carbon dioxide per year,

¹⁹ Kathy Arthurson, "Creating Inclusive Communities through Balancing Social Mix: A Critical Relationship or Tenuous Link?," *Urban Policy and Research* 20, no. 3 (September 1, 2002): 245–61, doi:10.1080/0811114022000005898.

and studies have shown that trees are capable of absorbing a number of other air pollutants such as VOCs.^{20,21} By removing trees from cities, the places with the highest concentrations of pollutants, we are resigning ourselves to the huge number of health issues associated with poor air quality. Lastly, the greening of cities help mitigate urban heat island effect, which causes asphalt-covered city temperatures to rise significantly in the summer, by providing shade and increasing evapotranspiration, which can help lower the city's summertime temperatures and energy use.²² In addition to these more measurable effects, green spaces provide a place for urban residents to take a break from their hectic lives and to relax in nature. As we saw above, this longing for nature is part of what drew many families out into the suburbs, and by preserving these green spaces in cities, we eliminate the need to leave them.

6. Public space should be the central focus of buildings and neighborhoods. So

often in the U.S. cities of today we see a distinct lack of public space.²³ Compounding this problem, we have become so self-sufficient over the past couple of decades that we have forgotten the importance of daily social interaction. Furthermore, humans are inherently people watchers, and creating a central public place allows visitors to partake in this unspoken urban pastime.²⁴ These kinds of spaces can also promote public safety. Urban pioneer, Jane Jacobs, coined the phrase “eyes on the street,”

²⁰ “Tree Facts | American Forests,” *American Forests: Protecting and Restoring Forests*, accessed November 20, 2014, http://www.americanforests.org/discover-forests/tree-facts/#_ftn1.

²¹ Larry O’Hanlon, “Trees Eat Pollution Better Than Expected,” *DNews*, November 27, 2012, <http://news.discovery.com/earth/global-warming/trees-pollutants-voc.htm>.

²² “Heat Island Effect | U.S. EPA,” *U.S. EPA*, July 31, 2014, <http://www.epa.gov/heatisland/>.

²³ Paul M. Sherer, “Why America Needs More City Parks and Open Space,” *The Trust for Public Land*, 2003, http://conservationtools.org/uploaded_files/0000/0046/parks_for_people_Jan2004.pdf.

²⁴ William H. Whyte, *The Social Life of Small Urban Spaces* (Project for Public Spaces Inc, 2001).

saying, “there must be eyes upon the street, eyes belonging to those we might call the natural proprietors of the street. The buildings on a street equipped to handle strangers and to insure the safety of both residents and strangers, must be oriented to the street. They cannot turn their backs or blank sides on it and leave it blind.”²⁵ Better than the most advanced team of police, the public has a way of policing itself without the use of violence, or even words. These public spaces provide a place for you to get to “know your neighbors,” even if all that means is knowing what they look like. This is important for social sustainability. Rather than make homes or offices the center of towns and cities, the prioritization of public space in the center of towns and neighborhoods helps create an important sense of community.

- 7. Existing neighborhoods requiring infill should be redeveloped along transit corridors.** Shifts in the economy can lead to empty pockets in cities where industry or residents used to live. This leads to cities with approximately the same area but decreased density, an unsustainable characteristic. Rather than adding homes to the periphery of neighborhoods, possibly on undeveloped greenfields, concentrating this development closer to downtown, and closer to transit stations means reducing the need for a car. This can also help revitalize towns that are economically struggling by bringing in new development while promoting urban density, and potentially, affordability.

²⁵ Jane Jacobs, *The Death and Life of Great American Cities*, Reissue edition (New York: Vintage, 1992). 35.

Challenges and Critiques of TOD

While Transit-Oriented Development strives to improve the quality of life in cities, it certainly is not without critique and consequence. Some planners have labeled transit villages as “boutique” planning and design—aesthetically pleasing but insignificant in the grand scheme of things.²⁶ They argue that there is no real connection between land use and transportation, and that cities have more important issues to focus their time and money on. However, as we will explore through this paper, transit *is* deeply related to the shape and productivity of cities, and should be closely developed with land use planners to ensure a sustainable urban form.

Another common consequence of TOD is that of gentrification, the process by which a neighborhood is redeveloped and the cost of living is increased, pushing out existing residents who might not be able to afford the new prices. A study by the Brookings Institution took a close look at early gentrification in the United States between the 1970s and 80s, and proposed a set of solutions for promoting equitable development.²⁷ One solution in particular, “location efficient mortgages,” give borrowers a lower mortgage rate if they are purchasing property near transit due to the perceived transportation cost savings. This makes Transit-Oriented Developments more affordable for low-income families and can help combat some of the financial issues associated with gentrification.²⁸

²⁶ Paul M. Sherer, “Why America Needs More City Parks and Open Space,” *The Trust for Public Land*, 2003, http://conservationtools.org/uploaded_files/0000/0046/parks_for_people_Jan2004.pdf.

²⁷ Maureen Kennedy and Paul Leonard, *Dealing with Neighborhood Change: A Primer on Gentrification and Policy Choices* (Brookings Institution Washington, DC, 2001).

²⁸ Patrick C. Doherty and Christopher B. Leinberger, “The Next Real Estate Boom,” *The Brookings Institution*, November 2010, <http://www.brookings.edu/research/articles/2010/11/real-estate-leinberger>.

It is essential to look at this history when planning future TOD projects, to get a sense of the many different types of TOD that can occur. No two TOD projects are exactly alike, and there is no perfect formula for creating a successful, sustainable transit town. There are hundreds of different factors that go into planning a transit station, things like who the users will be, and how development will take shape around it. Future plans need to think more about how transit is related to development, outside the narrow definition. Now more than ever, TOD is transforming the way we look at development. It can bring so much more to a town than simple, easy transportation. It is helping towns grow and become more sustainable in every sense of the world. The key is careful planning to ensure these projects are not just thrown together in the cheapest way possible. By working with citizens, riders, and developers, those planning new transit and surrounding development have the opportunity to completely transform towns, cities, and neighborhoods into centers of sustainability, with the effects extending beyond the literal station area out to the edges of the community.

Chapter 2: Transit Villages: Designing Around Mobility

No other model of urban form better demonstrates the core tenants of sustainability than the “transit village.” Following the development of high quality transportation systems, new development begins to emerge around these transit stations, typically within a quarter mile of its center, an easy 5-minute walk. The core purpose of the transit village is to encourage fewer car trips, but its benefits also include several environmental, social, and economic features. Michael Bernick and Robert Cervero outline six core sustainability elements of a transit village:

1. **Increased Mobility and Environment.** The most direct benefit to transit villages is that it almost certainly leads to increased public transportation ridership. This means fewer car trips, which translates to less automobile traffic and decreased pollution and greenhouse gas emissions. Further, it increases mobility for those who do not own a car. Landscape architect Richard Sommer believes transportation brings with it freedom, saying “increasing mobility in both geographic and socioeconomic terms is as critical to human emancipation as traditional notions of civil liberty and equal representation.”²⁹ It is important, however, to distinguish between “accessibility” and “mobility” when planning transit communities. Professor Sam Staley of Florida State University, author of *Mobility First*, differentiates between the two, defining mobility as “is about moving people and goods from place-to-place” and accessibility as “something

²⁹ Schröpfer, *Ecological Urban Architecture*, 2012., 81.

that is easily approached, entered, obtainable, or attained.”³⁰ When planning transit, increasing both mobility and accessibility are goals, but one does not prompt the other, and simply building new transit systems will not necessarily impact either.

- 2. Pedestrian Access.** If the fundamental goal of the transit village is to reduce car ridership, then careful attention needs to be given to designing a pedestrian friendly downtown. Unlike the sprawling suburbs we see around the U.S. today, transit villages are designed so that one might easily (and pleasantly) walk between, for example, home, work, and a café. By integrating the transit station at the village center with quality bike and pedestrian paths, overall transit emissions can be further reduced. In the California Bay Area, almost 80% of BART riders make use of the many park-and-ride lots, driving on average 5 miles to reach their nearest BART station.³¹ Rather than surrounding transit centers with huge parking lots, we could develop the station area into a walkable space and urban amenity.

- 3. Alternative Residential and Working Environments.** Following the notion that many who move to the suburbs do so in order to get away from the chaos and industrial scene of downtown, transit villages offer an opportunity to experience the advantages a dense city has to offer within a smaller suburban community. The density of residential housing around transit stations means those who value their large, spread out single-family homes don't need to worry about

³⁰ Sam Staley, “Accessibility Vs. Mobility Redux,” *Planetizen: The Urban Planning, Design, and Development Network*, January 13, 2010, <http://www.planetizen.com/node/42367>.

³¹ Bernick et al., *Transit Villages in the 21st Century*.

development pressures within existing neighborhoods, halting sprawl.³² Different people have different housing preferences, and transit villages reflect and respect this diversity by offering a variety of apartments, condominiums, duplexes, and a few single-family homes. Housing is arranged according to density, placing the highest density apartment buildings closest to the transit station and tapering out to the single family home on the edge of that quarter mile radius, a phenomenon described by Bernick and Cervero as the “wedding cake” residential model.³³ Further more, this density of housing makes it easier to incorporate low-income, affordable housing into transit villages, a much more socially equitable option than relegating low-income housing projects to the low-density fringes of a city, especially given many of these families rely exclusively on public transportation to get to school, works, etc. The wide variety of housing options means a diverse residential population, including young professionals, families, and the elderly.

- 4. Neighborhood Revitalization.** In addition to inspiring new development, transit villages can help revitalize local economies by increasing pedestrian traffic. Past practices in struggling neighborhoods have been to knock down old buildings and replace them with massive public housing high-rises. Overlaid on single-use zoning patterns, however, this focus on housing overlooked the importance of creating jobs, and did little to change the local economy. Transit villages offer a more natural way to transform struggling inner city neighborhoods by providing a carefully planned mix of housing, businesses, and public space to keep jobs in the

³² Ibid.

³³ Ibid.

neighborhood while attracting more foot traffic. In California's Bay Area, employment along BART lines grew by 30.3% while non-BART zip codes only grew 19%.³⁴ Having a mix of land use helps attract more social diversity, which often has a positive effect on community strengthening and revitalization. The link between diversity and stability can be thought about through the biological metaphor of species resiliency. A genetically homogenous species has trouble evolving, and a hard time shaking negative traits. Further, this homogeneity puts the species at risk for mass extinction from minor changes in the environment. More diversity means positive traits are combined and propagated through natural selection and evolution, and protects against the risk of major population threats. If we apply this metaphor to cities, we can look at examples such as Detroit to see how a city with very little business diversity was so easily destroyed by the fall of one industry, ironically, in this case, the automobile industry. Thomas Schröpfer believes "sustainability through compact and integrated agglomerations increases the potential for human collaboration and sociability" creating better cities.³⁵

5. **Public Safety.** One of people's biggest fears when it comes to public transportation is the issue of safety. Stand-alone transit stations struggle with the issue of being left relatively unoccupied for many hours at a time, such as at night or on weekends. Finding ways to activate these spaces goes a long way in discouraging crime. According to urbanist Jane Jacobs, the importance having "eyes on the streets" is the biggest factor in controlling crime. However, transit

³⁴ Ibid.

³⁵ Schröpfer, *Ecological Urban Architecture*, 2012.

villages are designed to be active at all times of day, whether during the morning commute, midday shopping hours, or evening activities like dinner and a show.

By programming these sites to be monitored at all hours by civilians, crime rates decrease and, perhaps just as important, people feel safer and more comfortable in the space.

- 6. Public Spaces.** A critical element in most successful transit villages is a carefully designed public space that helps integrate the transit station into the village in a way that is both beautiful and functional. Many such public spaces are programmed for non-transit specific uses such as markets and celebratory or public gathering spaces, and are destinations in themselves. Special attention has to be given to the design of these spaces to eliminate the need for a car. By spending the extra time and money designing the public spaces around the transit station, cities and towns can demonstrate the importance of transit and their dedication to sustainability.

Each of the core elements contributes in some way to the overall sustainability of the transit station, whether ecologically, economically, or socially. Unfortunately, not all transit stations succeed in pulling together all six of these factors, and the town as a whole suffers as a consequence. We will take a look at some specific failures in the next chapter, but common issues are gentrification, environmental destruction, and a lack of local community. Little oversights by designers can have dramatic effects not only on the station, but on the community as a whole. This doesn't mean all transit stations look the

same though, nor should they. Designers have to carefully consider how transit should be incorporated on a case-by-case, town-by-town basis. In addition to these core elements, there are hundreds more design features that get considered, each of which can add or subtract from the success of the transit station and surrounding area. In Chapter 6, where we look at a design plan for the hypothetical Redmond station, I will highlight some of the features that impact the transit station experience.

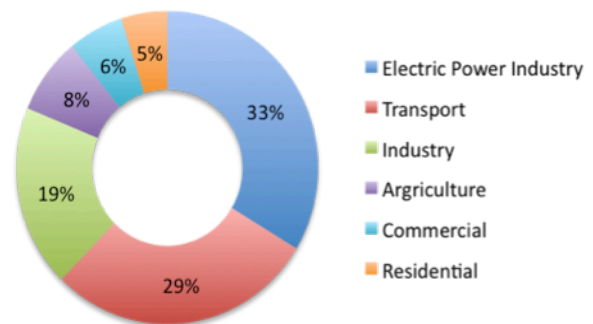
Chapter 3: Releasing Ourselves From the Car

Our nation's link with the automobile goes beyond its functional purpose of transporting us from point A to point B. It has become tied up with income, status, and personal identity, which make it extremely hard to let go of even in the face of environmental crisis. Despite increasing discussion on how bad cars are for the environment, car sales continue to increase. Even some of the greenest cities, such as Copenhagen, where the government is actively promoting bikes and public transit over personal vehicles, have experienced a 20% increase in car traffic in the last 10 years.³⁶

Part of this is attributed to growing population levels, but also the decrease in automobile prices and increased marketing has led to this increase in car sales, especially in developing countries.

This huge presence of cars brings with it a number of environmental issues. The transportation sector is responsible for 29% of the United States greenhouse gas emissions. Within that 29%, 59% of those emissions are coming from light-duty

GHG Emissions By Sector



Breakdown of the Transport Sector

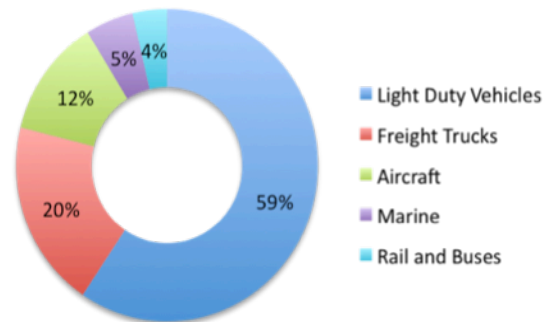


FIGURE 2. The breakdown of greenhouse gas emissions by sector. As the graphs show, transportation emissions are largely due to the use of light duty vehicles.

³⁶ Ibid. 89

vehicles (see **Figure 2**).³⁷ These are the personal vehicle trips that Transit-Oriented Development seeks to eliminate. Rail and buses combined only account for 4% of these emissions with more efficient systems being developed every day. In addition to the obvious issues of car pollution, cars require a disproportionately large amount of infrastructure to work effectively. After all, what good is a car if you don't have roads, freeways, or parking? Thomas Schröpfer states, "The automotive industry requires as much as 30% of the urban land surface for a supporting network of roadways and parking. Being parked over 80% of the time, vehicles are over-scaled relative to their amount of use and the space they consume."³⁸ Cars are directly responsible for decreased urban density. In addition to fostering the mass migration to the suburbs following WWII, the physical space occupied by cars has taken away valuable spaces in American downtowns. According to studies done by Schröpfer, a single-occupancy vehicle moving at 40km/hr requires 60m² in road space per person (accounting for the area of the car, parking, and a safe following distance behind another car). In contrast, a light rail train at 30% of its maximum occupancy only requires 2.2m² per person moving at the same speed. The space saved by transitioning to light rail or even a bus system (9.4m² per person) would free up significant portions of urban and suburban areas for new, dense development, decreasing the need for cars even further.³⁹ Especially given the expected population increases in cities, it is important now more than ever that we make the switch away from cars. If every new person moving to the city brings with them a car, they are

³⁷ US Department of Transportation, *Report to Congress*, 2010, <http://www.transportationissuesdaily.com/wp-content/uploads/2012/07/Transportation-Emissions-TRB-Circular-July-2012.jpg>.

³⁸ Thomas Schröpfer, *Ecological Urban Architecture* (Basel: Birkhäuser, 2012), 83.

³⁹ *Ibid.*

bringing an extra 60m² of space, and cities will start sprawling faster than ever, and sustainability and efficiency will decrease correspondingly.

The inherent sustainability found in transit villages is part of what makes them so attractive, yet until people become comfortable with the idea of giving up their cars, it will be difficult to support this shift in development. They are attached to the ideas of convenience, speed, comfort, and individual freedom that come along with owning a car.⁴⁰ Whether consciously done or not, our attachment to cars has had a profound impact on the shape of our cities. Thomas Schröpfer writes that “through a complex co-evolutionary process—involving interdependencies among vehicle engineering and design solutions, energy supply systems, street and road infrastructure, urban land use patterns, economic incentives, and government policies— personal transport systems, such as the automobile, have become part of the urgent problem that cities now face.”⁴¹

While the move to create denser cities will take a while to accomplish, incremental steps need to be taken now. For years, our tax system has subsidized this sprawling lifestyle through developing a complex system of freeways funded by the high property and income taxes collected in these affluent suburbs. Though real estate prices in urban areas are much higher than in the suburbs, we must demonstrate how urban development can pay off in the long run as cities become denser, more consumer friendly, and sustainable. As we have seen through history, cars are very susceptible to international markets and oil prices, making creating successful public transportation a matter of national security. According to the American Public Transportation Association (APTA),

⁴⁰ Gabriela Beirão and J. A. Sarsfield Cabral, “Understanding Attitudes towards Public Transport and Private Car: A Qualitative Study,” *Transport Policy* 14, no. 6 (November 2007): 478–89, doi:10.1016/j.tranpol.2007.04.009.

⁴¹ Schröpfer, *Ecological Urban Architecture*, 2012., 80.

citizens who live in areas served by public transit save almost 400 million gallons of fuel annually, and claim, “increased investment in public transportation is an investment in American energy independence and economic security”.⁴² Ultimately, this paradigm shift from car-domination to public transportation will take years and billions of dollars to accomplish. However, it is important that we start laying the groundwork for that change now. Investing in public transportation and transit villages needs to be a priority of our cities and federal government before it is too late; our economy, society, and perhaps most critically, our environment depends on this.

⁴² American Public Transportation Association, *Public Transportation Reduces Our Dependence on Foreign Oil*, November 6, 2014, http://www.mountainline.az.gov/media/pdf/energy_fact_sheet.pdf.

Chapter 4: The Evolution of Transit-Oriented Development

To illustrate some of the successes and shortcomings in Transit-Oriented Development over the past few centuries, this chapter looks at four case studies of transit villages. Through analyzing the trends that emerge through these studies, we start to get a sense of the priorities of the past, and the priorities we should have for future transit villages. While today's transit villages seek to accomplish all three pillars of sustainability—economic, social, and environmental—these elements have been prioritized differently over time, which has led to missed opportunities. We will begin with one of the earliest precedents, Ebenezer Howard's "Garden City," then look at the MetroTown Station in Vancouver, Fruitvale Station in Oakland, and the Transit Mall of Portland. As we will see, economic development has long been prioritized, with social considerations being integrated into projects during the late 1990s; and now finally, in the 21st century, environmentally sustainable transit villages have begun to be developed. In many ways, environmental sustainability is the final frontier of station-area development, and something that must be incorporated into stations in the future while being conscious of maintaining the economic and social pillars. Only when all three take place together can a transit station function at its fullest capacity.

Ebenezer Howard's Garden City: Early Origins of TOD

One of the earliest precedents for Transit-Oriented Development was Ebenezer Howard's hypothetical Garden City. Writing in London at the end of the 19th century, Howard was reacting to the "industrial city," cities overwhelmingly crowded with

factories, slums, pollution, and distinct lack of green or open space. Addressing overpopulation and congestion within cities and the mass migration to cities, Howard believed improving the metropolis was the key to the urban and rural movements.⁴⁴

Howard's garden city focused on creating walkable downtown communities with factories and cars relegated to the outside in a ring around the city. This type of planning allowed for wide, pedestrian-friendly streets downtown and a surrounding rail line, which connected to outside cities, a major component of the TOD movement. The goal was to create towns that were economically independent with

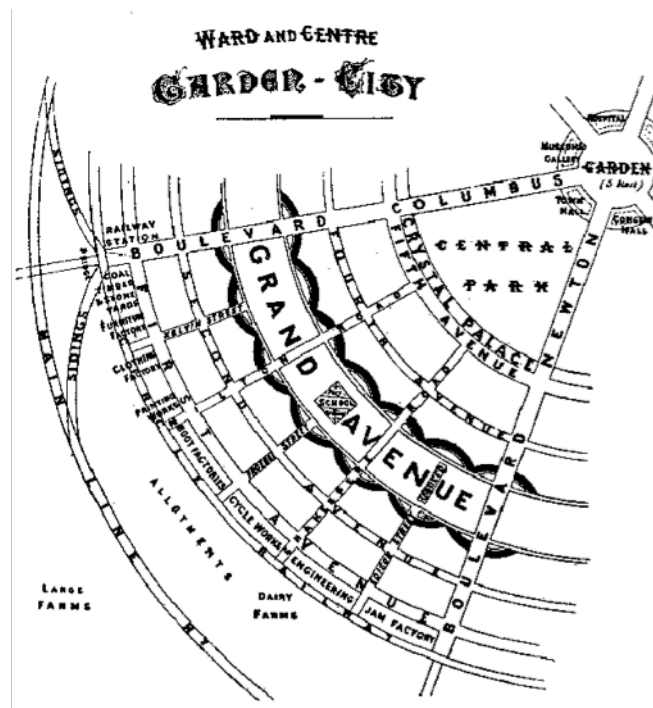


FIGURE 3. Ebenezer Howard's Garden City. The city is centered around a Central Park and civic buildings with pedestrian friendly walkways. Transportation and commercial businesses are relegated to the outskirts of the city. [Image courtesy of Cornell University Urban Planning Department].⁴³

easy, short transportation trips. He described towns as “population magnets” and that cities must be carefully constructed to accommodate its citizens.⁴⁵ However, Howard's idyllic city was planned to support a population of only 50,000. Urban theorists have predicted that in the next few decades are cities are going to have to house much more

⁴³ Ebenezer Howard, *Garden Cities of To-Morrow*, 1902, <http://urbanplanning.library.cornell.edu/DOCS/howard.htm>.

⁴⁴ Ebenezer Howard and Lewis Mumford, *Garden Cities of To-Morrow*, ed. F. J. Osborn, 1st edition (The MIT Press, 1965).

⁴⁵ *Ibid.*

than 50,000, some close to 50 million.⁴⁶ While Howard's garden city is an attractive idea, modifications to its design will have to be made to adjust for the rapidly increasing population. Furthermore, Howard did not believe that there was an easy way to change or adapt his hometown, London, into a garden city. His studies instead focused on new developments on the peripheries of existing cities. This certainly made it easier to design and plan these Garden Cities, but this development encouraged the kind of sprawl that TOD so adamantly seeks to avoid. While it is challenging, it is not impossible to transform pre-developed cities – even very large ones—into successful transit villages. Many urbanists such as Peter Calthorpe see the garden city movement as the basis for modern day Transit-Oriented Development movement, specifically in regards to preserving walkable, car-limited population centers, with a few changes in terms of density and a more flexible urban layout.⁴⁷ While Howard designed his cities around centralized civic spaces where people could gather to enjoy nature (in his case, a large public garden), TOD aims to place transit into the heart of these communities in order to foster this urban vibrancy. However, I see no reason why a transit center cannot function as public center, especially when care is taken to design them as spaces which foster economic, social, and environmental sustainability.

Vancouver SkyTrain: The Economic Incentives of Mass Transit

Transit-Oriented Development has gone through many shifts over the decades. Some of the early systems, which were coming about in the mid-80s, are in use today. However,

⁴⁶ “World's Population Increasingly Urban with More than Half Living in Urban Areas | UN DESA | United Nations Department of Economic and Social Affairs.”

⁴⁷ Ian Carlton, “Histories of Transit-Oriented Development: Perspectives on the Development of the TOD Concept,” *Institute of Urban & Regional Development*, 2009, <https://escholarship.org/uc/item/7wm9t8r6.pdf>.

the general attitude towards public transit then was not the same as it is now in the 21st century. In the early '80s, public transit was still viewed as a transportation mode of last resort, something for the lower class. The full benefits of TOD had yet to be realized and thus, transit was being built with the sole intention of gaining revenue through increased ridership. The major motivator at that time was economic development, and one clear example of this at Vancouver's MetroTown Station. Part of the SkyTrain system operated by TransLink, MetroTown was developed as part of the 1986 Expo World's Fair, named "Transportation and Communication: World in Motion - World in Touch."⁴⁸ This was one of the biggest events ever held in Canada and the legacy of the Expo can still be felt through its lasting infrastructure such as the SkyTrain. Quite advanced for its time, SkyTrain, appropriately named, was a fully automated, raised, rapid transit system designed to help facilitate transportation to and from different Expo venues in downtown Vancouver.

While the system was designed to showcase the future of transit, the idea of using transit as a way to connect existing urban centers had yet to be popularized. The system extended into the suburbs of Burnaby and Surrey with the hopes that doing so would spur more economic development and density in these areas that were mostly dominated by older retail centers and abandoned warehouses.⁴⁹ To help ensure the new system was successful, existing BC Transit, specifically the bus system, was rerouted to terminate at SkyTrain stations to help push commuters onto the new system, and in doing so, increased ridership and revenues, the primary goal for SkyTrain in the early years.

⁴⁸ Urso Chappell, "1986 Vancouver," *Expo Museum*, November 18, 2014, <http://www.expomuseum.com/1986/>.

⁴⁹ Seattle Department of Transportation, *Vancouver BC SkyTrain*, accessed November 16, 2014, http://www.seattle.gov/transportation/SAP/TOD_Case_Studies/Vancouver_Skytrain.pdf.

Before long, development began to pop up along the SkyTrain line, and in fact, development has more than tripled around MetroTown since 1986. However, the more sustainable mixed-use development that we will see in later case studies had yet to be popularized, and the development around MetroTown was almost exclusively retail and commercial offices. Most notably was the development of the Metropolis at MetroTown, Canada’s third largest shopping mall with close to two million square feet of retail space. The mall opened in 1986, almost simultaneously with the completion of the SkyTrain line, which conveniently stops right outside the mall, with a pedestrian sky bridge connecting the two. In the years that followed, several other businesses sprang up around MetroTown, including two other malls. In 1989, BC Transit released a report estimating that the SkyTrain line as a whole had been a catalyst for over \$5Billion (Canadian) worth

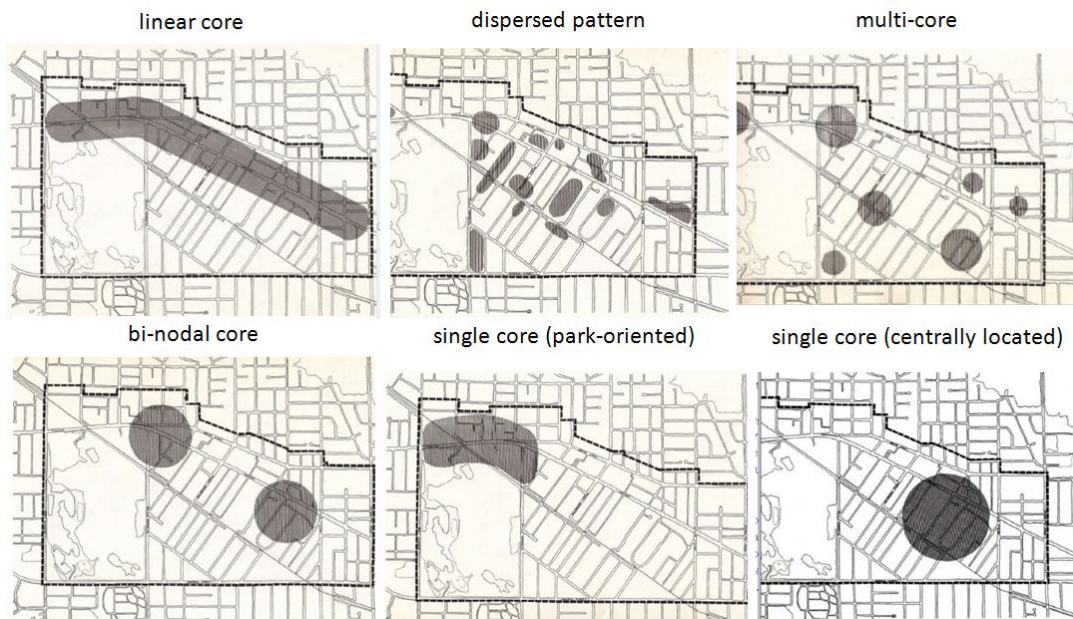


FIGURE 4. Development strategies following the completion of SkyTrain. Developers chose the single core (centrally located) plan, which led to the development of an almost strictly commercial district with little housing or social cohesion. [Image courtesy of the City of Burnaby.]⁵⁰

⁵⁰ David Pereira, “Metrotown | David Pereira,” accessed December 11, 2014, <http://davidpereira.ca/projects/burnabys-town-centres/metrotown/>.

of development within a 10-15 minute walking distance of a station, with another \$5Billion expected in the future.⁵¹

While the SkyTrain line is a clear example of economic success, especially around MetroTown, the priorities of the time did not include social or environmental development practices. The line was purposely laid down in low-density neighborhoods where little resistance was expected, with the expectation of collecting ridership-based revenue at first, and eventually broad-scale economic investments in the areas surrounding the station. However, with such a high focus on retail and business development, there was a lack of housing and accompanying social services. Little attention was paid to pedestrian and bike connectivity to the station, with the only real walkway being the bridge which connected the station to the mall, promoting a very specific kind of use.⁵² Once again, this focus on the economic investment side of transit was not an atypical style of development in the 1980s. As we will see in the subsequent case studies, social and environmental considerations would begin to become more important in the decades that followed. One signal that illustrates this change in station-area development practices is the fact that in November 2013, SkyTrain received a \$37 million dollars to renovate the MetroTown station. The new design renderings show a much larger focus on pedestrian and bicycle comfort and safety, with new green spaces on the street level and the incorporation of street-level retail units.⁵³ The surrounding area has also seen much more residential development in the past two years, with several more

⁵¹ Seattle Department of Transportation, *Vancouver BC SkyTrain*.

⁵² Ibid.

⁵³ “Designs for \$37-Million SkyTrain Metrotown Station Renovation Revealed,” *Vancity Buzz*, accessed November 20, 2014, <http://www.vancitybuzz.com/2013/11/skytrain-metrotown-station-renovation/>.

luxury, mixed-use high rises, almost all LEED certified, in the process of being built.⁵⁴ In the course of 25 years, Vancouver has exemplified the changing attitudes around public transportation and surrounding development.

Fruitvale Village: Promoting Social Resiliency Through TOD

One of the most successful examples of social development around a transit station is Fruitvale. Located in east Oakland and served by Bay Area Rapid Transit (BART), the surrounding area of Fruitvale had traditionally been a disadvantaged, impoverished community. As of 1991, the entire city of Oakland was made up of 72% people of color, while Fruitvale's population topped 90%, predominantly African Americans and Hispanics. Throughout the mid-20th century, Fruitvale was experiencing an economic decline. Major freeways were built through the neighborhood, facilitating the move towards suburbia, driving middle-class and businesses out of the area, leaving behind abandoned warehouses and a declining customer base for what business remained. Fruitvale faced high unemployment rates, inadequate housing, and a whole host of other social issues.⁵⁵ This led to the formation of the Unity Council, a community development organization committed to improving the lives of Fruitvale's residents. The Unity Council put on community events, offered business loans, and helped restore deteriorating homes.

When BART announced in 1991 that they would be building a huge, new multilevel parking garage next to the BART station, the Unity Council immediately recognized

⁵⁴“Metrotown City Center,” *Urban Centers Network*, accessed November 18, 2014, <http://www.metrovancouver.org/planning/development/urbancentres/Pages/MetroTownCentre.aspx>.

⁵⁵ The Unity Council, Bay Area Rapid Transit District, City of Oakland, *Fruitvale Transit Village Project* (U.S. Department of Transportation, Federal Highway Administration, November 18, 2014), http://www.fhwa.dot.gov/environment/environmental_justice/case_studies/case6.cfm.

what kind of issues this would create. The parking garage was mainly targeted at middle-class suburban residents who commuted to Fruitvale to catch BART into San Francisco. This target group would not boost the local economy, and the large parking garage would further cut off the town neighborhood of Fruitvale from the BART station. With so much opposition, BART officials decided to collaborate with the Unity Council to come up with a development plan that all could agree on, an opportunity Fruitvale had been waiting for. Unity Council CEO Arabella Martinez stated, "We felt we needed a project of scale, that a single housing project wasn't going to change the neighborhood," and so began the early stages of what would one day become the Fruitvale Transit Village.⁵⁷



FIGURE 5. Layout of the Fruitvale Transit Village. Dense, mixed-use, affordable housing was built on at-grade BART parking lots, with dramatic economic and social improvements to the town. [Image courtesy of the Rudy Bruner Award Digital Archive].⁵⁶

⁵⁶ Rudy Bruner Award Digital Archive, "Fruitvale Village," *The State University of New York, University at Buffalo*, 2005, <http://libweb1.lib.buffalo.edu/bruner/year/project.asp?searchby=year&entry=641>.

⁵⁷ The Unity Council, Bay Area Rapid Transit District, City of Oakland, *Fruitvale Transit Village Project*.

Throughout the early 1990s, several community meetings were held to begin visualizing how the Fruitvale redevelopment would take shape. BART officials, the mayor of Oakland, and many residents worked together to determine the best strategy for this development. The final plan was to take the existing at-grade, nine-acre BART parking lot and transform it into a tree-lined, pedestrian friendly street leading up to the BART station, surrounded by new restaurants, shops, public space, new housing, and new social services. In 1999, the \$100 million dollar project began, and within 10 years noticeable social improvements were already taking place. By providing a place for new businesses, more jobs and higher incomes were brought to the area, reducing poverty. Dilapidated buildings were fixed up, and new, high-quality affordable housing was constructed. Traffic calming techniques were put in place and ground-level shops encouraged a more lively street life. Vacant lots were transformed into beautiful, green, public gathering places with fountains and art, and the 24/7 activity and careful programming helped to reduce crime. Prior to the project, Fruitvale Station had the second highest instance of crime, and after its renovation, has one of the lowest.⁵⁸ BART ridership increased, meaning fewer cars on the streets and less pollution. A variety of social services were incorporated, such as La Clinica de La Rosa, a community health provider, The De Colores Child Development Center, The Fruitvale Senior Center, and the Cesar Chavez library, all which have been highly successful and heavily used by the community.⁵⁹

Fruitvale Village is a prime example of how Transit-Oriented Development can improve the social aspect of a neighborhood. At the Village opening, U.S. Secretary of

⁵⁸ *Fruitvale Village*, 2005, http://www.brunerfoundation.org/rba/pdfs/2005/3_Fruitvale.pdf.

⁵⁹ *Ibid.*

Transportation, Rodney Slater, stated: “transportation planning should be about more than concrete and steel. It should be about building communities, and we are all looking to Fruitvale as an example of how that can happen.”⁶⁰ Too often in the past, these kinds of TOD projects are driven solely by economics, and can fail to consider the social impacts of the project. The Fruitvale project was the first of several TOD projects in the 1990s that set the precedent for social development in the areas surrounding transit stations. However, the missing component here was the environmental piece. Though the project stated in its goals that it wanted to become a “sustainable and environmentally sound” village, there is little evidence that this was actively incorporated into the design.⁶¹ We will see in the next case study, which took place about 10 years later, how environmental considerations began to play a bigger role in TOD and the effects that can have on a community.

Economic, Social, And Environmental Sustainability In The City Of Portland

The final evolutionary step for Transit-Oriented Development was the incorporation of environmental sustainability. One of the clearest examples of an environmentally conscious TOD is in Portland, Oregon. Since the 1970s, the Portland Transit Mall, a transit corridor reserved exclusively for public transit, has run for 22 blocks of downtown along 5th and 6th avenue. This was one of the first systems in the United States to plan one-way streets specifically designed for mass transit efficiency.⁶² The Mall received several architectural awards, and led to a significant amount of

⁶⁰ Ibid.

⁶¹ Ibid.

⁶² “History of the Portland Mall,” *TriMet*, accessed November 20, 2014, <http://trimet.org/about/history/portlandmall.htm>.

economic development. However, over time, some flaws in the development began to emerge. Without a well-established maintenance strategy or real appreciation by the community outside of its functional offerings, the Mall began to become an eyesore and a plan for large-scale redevelopment was put into action. With the incorporation of the Portland Metropolitan Area Express (MAX) light rail system in 2006, the time was right to put this revitalization plan into action. The city developed a careful strategy to revitalize the corridor being sure to incorporate a number of new sustainability practices.⁶³

The result was over 28 blocks of ecologically designed light rail and bus lanes that not only revitalized the Mall, but also inspired a number of mixed-use green buildings around the area. The sustainability features along the Portland Transit Mall and light rail extension range from green construction practices to active ecological infrastructure, including:

Reusing and Reducing Materials

In renovating the existing Mall, a significant amount of

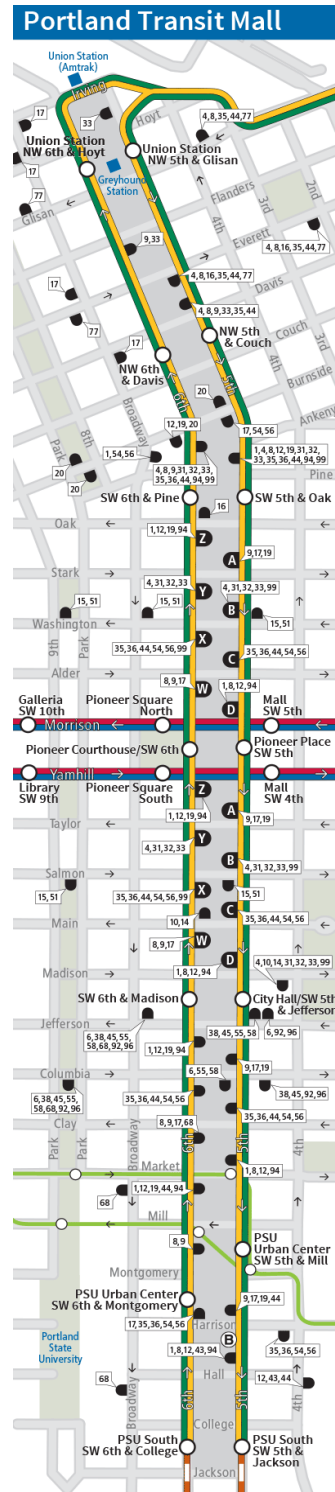


FIGURE 6. The Portland Transit Mall, a 22-block corridor which prioritizes public transit and has sparked a number of new ecological developments. [Image courtesy of Portland TriMet].⁶⁴

⁶³ Ibid.

⁶⁴ TriMet, “The Portland Transit Mall,” *TriMet*, accessed December 10, 2014, <http://trimet.org/portlandmall/>.

concrete, over 30,000 cubic yards, was recycled into base material for new pedestrian paths. Old gutters and curbs were incorporated into the surrounding landscape design and reclaimed granite was used for street furniture such as benches and tables. In addition, rather than constructing new retaining walls, rocky slopes were used instead to cut down on the CO₂ released by the production of concrete and on the amount of impermeable surfaces downtown. In areas where sound walls had to be built, a new material consisting of a plastic shell filled with recycled shredded tires were used, diverting over 9,000 tires from the landfill. Rather than ship off the existing topsoil for treatment, a remediation program was put into effect on site. Lastly, steel, bronze, and other metals were salvaged from the dilapidated bus shelters and were incorporated into a new public art program featuring a series of abstract sculptures, illuminated by sustainable LED lights.

Energy Efficiency

Following the city's goal to create an educational space at the Mall's South Terminus at Jackson Street, photovoltaic panels were included on the building, generating over 50 kilowatts of power. Along the light rail's catenary poles, 22 wind turbines expected to generate up to 1,760 kilowatts of power were installed. In total, over 70% of the South Terminus building's power is provided by renewable energy sources. Some of this energy will go into powering a proposed educational screen wrapping around the exterior of the building that will educate the public on green energy and stormwater practices at the site through the use of LED lighting. Lastly, the new 750-car parking garage will be designed with a lighting system that will reduce energy use by almost 500,000 kilowatts per year.

Stormwater Management

In the Pacific Northwest, stormwater runoff is a core environmental issue. To deal with this, a series of biofiltration planters, planting strips, and bioswales have been installed along the Mall to help treat polluted stormwater runoff and decrease the amount of impermeable surface downtown. For peak storm events, several new stormwater treatment facilities were installed along the light rail line to detain and filter stormwater, and pervious pavement was used in some of the surrounding parking lots to further reduce runoff. At Johnson Creek, near the south end of the Mall, a large demonstration bioswale was constructed to filter and cool down the temperature of 1.4 acres of runoff from the nearby freeway before it enters the creek. Additionally, a new bridge and 27 new trees were planted nearby to help restore the creek.

Trees and Landscaping

To accommodate the addition of the MAX light rail, 194 trees had to be removed. The trees were recycled into wood for the street furniture and bark for the bioswales, and in addition to the 537 trees that remained, 111 new trees were planted along 5th and 6th avenue along the Transit Mall. Trees were selected which would thrive in an urban environment while supplying appropriate light levels to the sidewalk below. Lastly, the implementation of Silva Cells, a newly developed modular, deep, urban tree well, enables street trees to live longer and act as biofiltration and retention systems.

Reducing Emissions

Lastly, construction crews working on the expansion and renovation of the Mall used B20 Biofuel (meaning 20% biodiesel and 80% petroleum) to cut down on pollution and greenhouse gas emissions.⁶⁵

Art

The Portland Transit Mall also features a wide variety of public art. In 2009, 14 artists were selected to create over 40 different sculptures along the Mall. Some of the pieces, such as “Urban Hydrology” by Fernanda D’Agostino, seek to highlight some of the environmental features of the mall. The piece features 12 large diatoms (microscopic organisms) made out of concrete and displayed in the biofiltration strips along the south end of the Mall. D’Agostino describes her piece by saying, “My concept for *Urban Hydrology* was to create a visually compelling urban journey that reveals some of the investigations in environmental science taking place at nearby Portland State University. A professor there told me that one problem humans have in addressing environmental problems is our limited ability to perceive at different scales...this made me think it would be valuable to reveal some hidden phenomenon, in particular the beautiful single-celled organisms used to evaluate water quality in urban streams.”⁶⁶ While not all the art directly deals with the environment, the beauty it adds to this public space around the Transit Malls helps create a positive experience for those who choose to visit.

Surrounding Green Development

While the Transit Mall operates along a very specific geographic corridor, its effects

⁶⁵ TriMet, *Sustainable Practices on the MAX Green Line* (Portland: TriMet, June 2009), <http://www.trimet.org/pdfs/maxgreenline/greenline-sustainability.pdf>.

⁶⁶ Fernanda D’Agostino, *Green Line Public Art Tour*, Audio Transcript, Urban Hydrology, accessed November 20, 2014, <http://trimet.org/publicart/greenline/index.htm>.

on sustainability have spilled out beyond 5th and 6th avenue. All around the Mall and MAX extensions throughout Portland, new green developments are popping up. K Station, for example, on Killingsworth Street, is a LEED Platinum building located directly across from a stop for the MAX yellow line. The four-story building features 33 affordable condos in addition to 21 market rate units, and has more than met the goals laid out in the region's Interstate Corridor Urban Renewal Plan which explicitly highlights economic and social development as focus points for its renewal plans.⁶⁷⁶⁸ The Beranger, a 2007 project, is a four story mixed-use building featuring ground level retail and 24 market rate condominiums⁶⁹. Located within walking distance of MAX and several bus lines, as well as a farmers market and other local attractions, the Beranger epitomizes the ideals of Transit-Oriented Development. The building features several green elements designed to help deal with stormwater runoff including an "ecorooft," a 3,000 square foot roof with flow-through planters and an integrated stormwater strategy that helps retain, filter, and release all stormwater for the building before it reaches the ground. The roof also features a 1000 square foot rooftop plaza for residents, created with permeable pavers, so that they can enjoy the eco garden.⁷⁰ A number of other green TOD projects have been completed around Portland's extensive MAX system, and with a well-developed Urban Renewal Plan, many more similar projects are expected in the future in Portland.

⁶⁷ Oregon Metro, *Project Profile: K Station* (Portland, September 2012), http://www.oregonmetro.gov/sites/default/files/kstation_final.pdf.

⁶⁸ Portland Development Commission (last), "Portland: Interstate Corridor Urban Renewal Plan," 2001, 8.

⁶⁹ Oregon Metro, *The Beranger*, Project Profile, Transit Oriented Development (Portland, September 2012), http://www.oregonmetro.gov/sites/default/files/theberanger_final.pdf.

⁷⁰ GreenWorks, "Béranger Condominiums Ecorooft," *GreenWorks*, accessed December 10, 2014, <http://greenworkspc.com/works/green-roofs/beranger-condominiums-ecorooft/>.

Portland is one of a few cities in the U.S. leading the way towards green urbanism. Naureen Khan, a journalist for *National Journal*, describes how Portland has rebranded itself as a “modern and hyper green city,” and how this branding has helped create a sustainable mindset for the city as whole that is now being marketed not only to attract new businesses and residents, but as a model of green urbanism both nationally and abroad.⁷¹ This “green mindset” has infiltrated the town, as seen through major investments in mass transit and greening the built environment, but it’s also extending to the individual practices of its residents. A 1986 study done by Archibald P. Sia, Harold R. Hungerford, and Audrey N. Tomera, a group of psychotherapists and environmentalists, sought to analyze the biggest predictors of “responsible environmental behavior.” The tested eight different factors: level of environmental sensitivity, perceived knowledge of environmental action strategies, perceived skill in using environmental action strategies, psychological sex role classification, individual locus of control, group locus of control, attitude toward pollution, and belief in technology. Their results proved all but the last were significant predictors of an individual’s “environmental responsibility,” but that the first three—level of environmental sensitivity, perceived knowledge of environmental action strategies, and perceived skill in using environmental action strategies—were the clearest indicators. In urban areas like Portland, which invest in these highly visible, sustainable projects, going green inadvertently becomes a part of the lifestyle for its citizens. While it may not be a priority initially, their day-to-day interactions with these green pieces of public infrastructure (whether the light rail system, a LEED building, or even a small bioswale) start to change the way they think about

⁷¹ Naureen Khan, “How One Green City Is Going Global,” *The National Journal*, June 13, 2013, <http://www.nationaljournal.com/back-in-business/how-one-green-city-is-going-global-20130613>.

environmental action strategies and encourage them to make more environmentally responsible choices in the future.⁷² Portland is a prime example of how government investment in the environment and increased citizen environmental awareness can build off each other. The implication for cities nationally is huge. Investing the extra time and money in incorporating sustainability into these basic pieces of public infrastructure could have major positive effects on the practices of its citizens, creating greener cities for our future.

Through looking at these case studies, we have seen the progression of Transit-Oriented Development over the course of three decades go from focusing purely on the economics, to including social development, and finally tying in environmental sustainability. We can also see how the scope of the benefits associated with these investments has expanded geographically around transit stations. In Vancouver, the economic improvements were concentrated on MetroTown Mall, in Fruitvale, the economic and social were extended to the whole community, and lastly, in Portland, we see how a few key investments have led to a city-wide change in identity to an urban community that values environmental sustainability in addition to its economic and social development strategies. In all three cases, transit was the starting point for change. These government-funded projects require so much time and capital, but have the ability to change the entire identity of a town. Moving forward, cities like Seattle who are interested in promoting sustainability should look to places like Portland for ideas on how Transit-Oriented Development can encompass all three components of sustainability in order to update their local identity to include “green” as part of their urban brand.

⁷² Archibald P. Sia, Harold R. Hungerford, and Audrey N. Tomera, “Selected Predictors of Responsible Environmental Behavior: An Analysis,” *The Journal of Environmental Education* 17, no. 2 (January 1, 1986): 31–40, doi:10.1080/00958964.1986.9941408.

Chapter 5: The Emerald City: Seattle's Transit Future

This increasing trend in population growth in urban areas presents some huge opportunities for public transit system overhauls. One city experiencing this rapid urban growth is Seattle, Washington. In 2014, Seattle became the fastest growing city in America with a 2.8% population increase between 2012 and 2013.⁷³ The City of Seattle has made a conscious effort to support the development of urban transit villages since the beginning of the 21st century, stating that this kind of development is of paramount importance in Seattle given the city's geographic limitations and existing urban form. Bordered to the west by Puget Sound and to the east by Lake Washington, Seattle is a dense city concentrated around an industrial port. However, given its geographic boundaries, the downtown area is relatively small compared to the broader network of towns and suburbs. There are a number of "urban villages" around Seattle that have been given different designations by the Seattle Department of Transportation:

1. **Urban Centers:** Areas that support both high-density employment centers as well as walkable neighborhoods, which tend to be highly dependent on transit.
2. **Manufacturing/Industrial Centers:** Areas that are almost exclusively dedicated to industrial business, for example the Port.
3. **Hub Urban Villages:** Moderately dense neighborhoods with both residential and business components that are somewhat supportive of transit.

⁷³ Gene Balk, "Census: Seattle Is the Fastest-Growing Big City in the U.S.," *The Seattle Times*, May 22, 2014, <http://blogs.seattletimes.com/fyi-guy/2014/05/22/census-seattle-is-the-fastest-growing-big-city-in-the-u-s/>.

4. **Residential Urban Villages:** Primarily residential neighborhoods with some retail but no significant employment centers.⁷⁴

These four neighborhood distinctions are mapped out in the **Figure 7** below, showing the

urban form of Seattle and its surrounding areas. Recent growth east of Seattle and Lake Washington in hub urban villages such as Bellevue, Kirkland, and Redmond are attracting a number of businesses and residents, leading to increasing transit demand. The city has five major transportation goals outlined in its

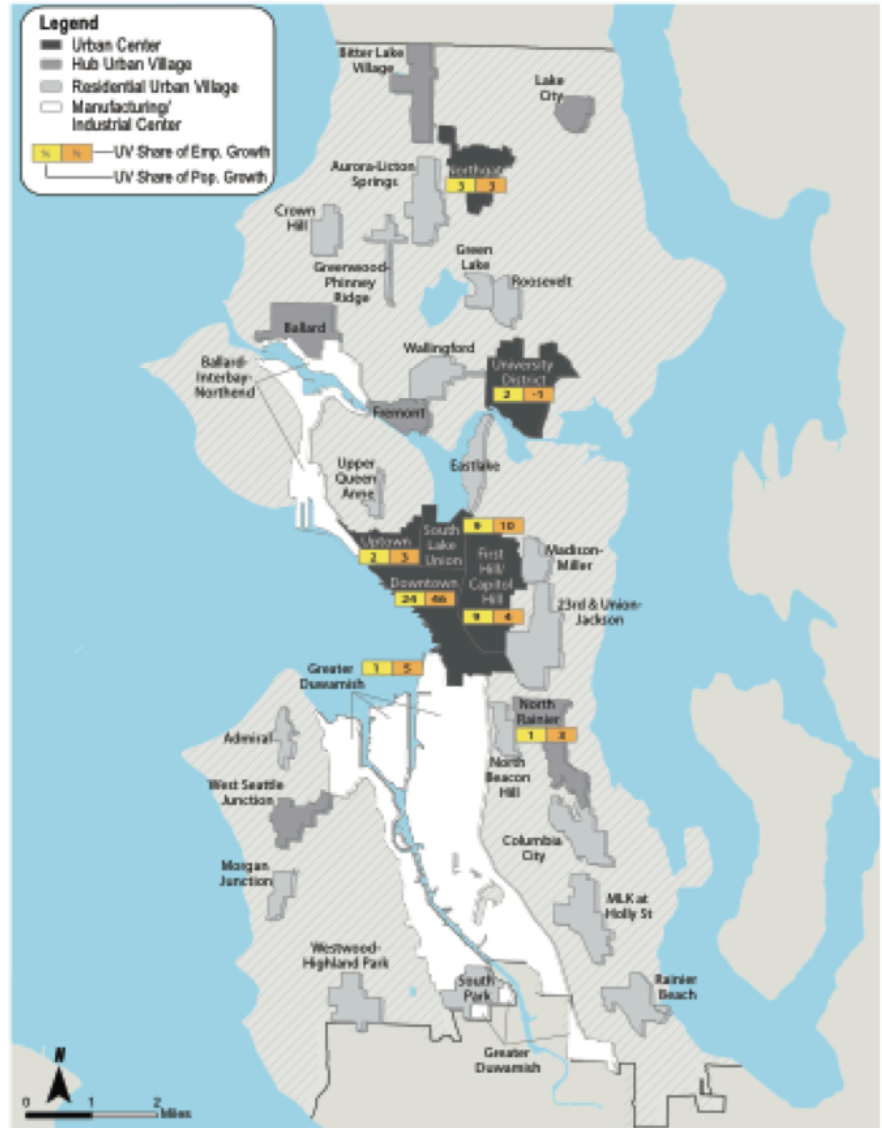


FIGURE 7. Classifications of Seattle neighborhood densities with breakdowns of their shares of population and employment growth. Recent growth east of Lake Washington has attracted attention for employers and residents alike. [Image courtesy of City of Seattle].⁷⁵

⁷⁴ City of Seattle, *Land Use and Development*, Seattle Transit Master Plan Briefing Book (City of Seattle), accessed December 9, 2014, <http://www.seattle.gov/transportation/docs/tmp/briefingbook/SEATTLE%20TMP%203%20Land%20Use.pdf>.

⁷⁵ Ibid.

Transportation Strategic Plan: to increase transportation options, to make transit a fast, reliable, safe, and convenient option, to encourage walking and biking, to price and manage parking in a way that supports the needs of residents and local economy, and to promote ecological sustainability.⁷⁶ Transportation planners will have to work closely with land use planners in order to maximize these goals within the network of existing urban villages, and develop plans to incorporate the new villages beginning to form. With an ever-increasing population, the successful implementation and regulation of mass transit and the surrounding development in Seattle is of utmost importance. Recent major investments in an extensive new light rail systems by the city and federal government demonstrate that Seattle and the surrounding Puget Sound Region are not only committed to furthering mass transit, but also presents an opportunity to inject new sustainability features into the core of some of its older and less-connected suburbs.

History of the Sound Transit Link Light Rail

Seattle Sound Transit (who gets its name from nearby Puget Sound) and King County Metro provide several mass transit options in the greater Seattle area, and with a universal fare card, the “Orca Card,” passengers can easily transfer between metro buses, bus rapid transit, ferries, water taxis, trains, and most recently, light rail. In 1996, Washington state voters passed a transit package including a 25-mile long light rail system that would stretch from the neighborhood of Northgate, through downtown Seattle, and south to SeaTac International Airport funded in part by increases in the state sales tax and vehicle excise taxes. Due to fluctuations in federally granted funding, the

⁷⁶Seattle Department of Transportation, *Making the Best Use of Our Transportation System*, Seattle Transportation Strategic Plan (Seattle Department of Transportation), accessed December 9, 2014, http://www.seattle.gov/transportation/docs/tsp_insert_2_making_the_best_use_072705.pdf.

proposed shape and scope of the project constantly changed over the years, but finally, in September 2000, the first Sounder Commuter Rail was opened, connecting the city of Tacoma and downtown Seattle. Shortly following this, Lyndon Wilson Jr., former director of the highly successful Portland light rail line, was appointed as interim director for the Seattle Link light rail, and in 2003 Sound Transit received a \$500 million grant from the Federal Transit Administration to begin work on the Central Link light rail, which would provide the much-needed connection between downtown Seattle and SeaTac Airport. In the interim, Sound Transit updated some of its busses to be hybrid/electric, especially those servicing downtown urban areas, to help resolve air-quality issues. With construction of the Central Link light rail on track and under budget, the transit board started putting together a draft for Sound Transit 2 (ST2), a program that would expand the Central Link north past the University of Washington Campus and south past SeaTac Airport, as well as the East Link across Lake Washington to the rapidly growing suburbs of Mercer Island, Bellevue, and Redmond. The plan was officially approved by the board in 2007 and passed by voters in 2008, funded by a vehicle excise tax as well as federal grants. Ground breaking for the East Link extension is expected to begin 2015, with service opening in 2023. A final phase, Sound Transit 3 (ST3), has been proposed to connect the East Link terminus at Overlake Transit Center, in the center of mega-employer Microsoft's campus, to downtown Redmond, which will be presented to voters on the 2016 ballot.⁷⁷ This final connection forms the basis for the hypothetical Downtown Redmond Station development presented in the next chapter of this paper.

⁷⁷ Office of Corporate Communications, *Sound Transit History and Chronology* (Sound Transit, October 2007), <http://www.soundtransit.org/Documents/pdf/about/Chronology.pdf>.

Link Light Rail’s Sustainability Initiative

Around the time Sound Transit 2 was passed, a new Sustainability Initiative was drawn up by the Sound Transit Board to ensure the responsible completion of these projects. The updated version, officially titled “Social, Economic, and Environmental Impacts; Performance Characteristics by Mode; and Integration with Regional Land Use,” as its name suggests, covers all three pillars of sustainability. The social component focuses on mobility and accessibility. The light rail expansion will pass through both traditionally low-

income and wealthy neighborhoods with the same amount of frequency, providing greater access to all. Further, the presence of easily accessible transit reduces the need for a car, and improves mobility for those who can’t afford or are unable to drive a car, such

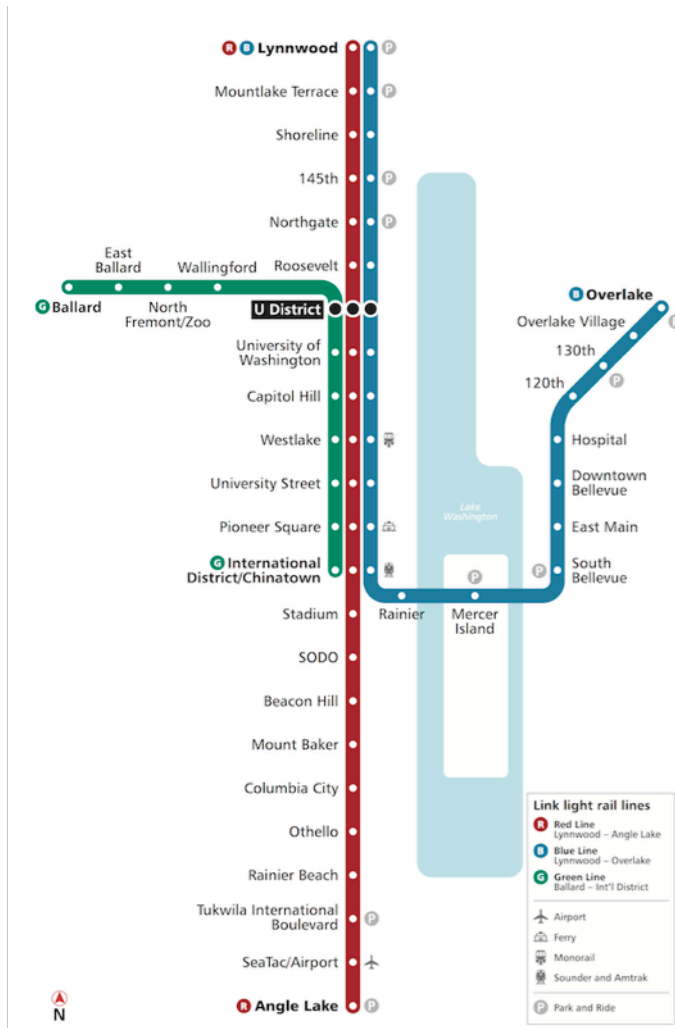


FIGURE 8. Overview of Seattle’s future light rail expansion plans, including extensions north of Westlake, south of SeaTac, and east across Lake Washington. The future downtown Redmond station would come after the Overlake stop as part of ST3. [Image courtesy of Seattle Transit Blog].⁷⁸

⁷⁸ Seattle Transit Blog, *Link Light Rail Lines*, Digital Map, accessed December 7, 2014, http://seattletransitblog.com/wp-content/uploads/2014/06/ST_Link-RGB-Lines.png.

as senior citizens, young children, and those with disabilities. Lastly, it mentions the number of social benefits that come from the walkable neighborhoods made possible by Transit-Oriented Development, such as increased sense of community and human interaction.

The economic component covers quantifiable benefits such as reduced travel times, vehicle cost savings, and environmental cost savings (such as air, water, and noise pollution). One report done in 2006 by the Partnership for New York City found that over \$13 billion dollars were lost annually due to traffic congestion in the New York metropolitan area. These costs came from things such as wasted fuel and vehicle operating costs, lost economic output, lost jobs, lost business revenue, and lost work time, all things which could be alleviated with successful mass transit.⁷⁹ The Sound Transit Sustainability Initiative also touches on less tangible economic benefits, such as job creation, retention, and neighborhood reinvestment. In Portland, over \$6 billion worth of development has been built within walking distance of MAX light rail stations so far, and a 1999 study done by the American Public Transit Association found that, on average, surrounding business development raises three times as much money as is invested in new transit infrastructure in the United States. Further, in 2006, the United States Department of Transportation (USDOT) estimated that 47,500 jobs are created for every one billion dollars invested in transportation. The report ends by outlining its environmental focus areas. The most obvious benefit is reduced single-occupancy vehicle use. Sound Transit estimates the ST2 expansion will lead to a reduction of 368 million

⁷⁹ Partnership for New York City, *Growth or Gridlock? The Economic Case for Traffic Relief and Transit Improvement for a Greater New York* (New York City, December 2006), <http://www.pfnyc.org/reports/Growth%20or%20Gridlock.pdf>.

vehicles miles traveled (VMT) in the year 2030.⁸⁰ They touch again on the addition of transit-villages around light rail stops, stating that transit villages “provide compact, urban, sustainable communities that have relatively small carbon footprints.” The electrically powered light rail will lead to a decrease in carbon monoxide, nitrogen oxides, volatile organic compounds (VOCs), hazardous air pollutants, and greenhouse gases, improving air quality throughout these urban areas. All in all, Sound Transit light rail trains are expected to produce 30% fewer air pollutants per rider than a car carrying three people. Water quality would also be improved through the construction of new pervious surfaces, minimized pollutant-producing surfaces, and culvert extensions. The Sound Transit Environmental Management System, developed in 2004, which assess all the environmental impacts of Sound Transit’s projects, achieved Silver Level Certification from ISO 14001, an international sustainability standard, the first transit agency on the west coast to do so. With a large list of publicized sustainability goals, Sound Transit’s commitment to the environment highlights the growing trend of incorporating sustainability into major investments in public infrastructure.⁸¹ While all three of these sustainability components have contributed to the success of light rail up to this point, there is potential to increase more visual sustainable design features in the surrounding station area. Many of the environmental benefits are not obvious to riders, and highlighting these components could go a long way in promoting sustainability through light rail, something that historically represented a purely economic and utilitarian investment.

⁸⁰ Sound Transit, *Social, Economic and Environmental Impacts; Performance Characteristics by Mode; and Integration with Regional Land Use*, Sound Transit 2: A Mass Transit Guide, July 2008, <http://www.soundtransit.org/Documents/pdf/st2/transitexpansion/Appendix%20D.pdf>.

⁸¹ Ibid.

Transit-Oriented Development Along the Central Link

There was a lot of concern about how the opening of the Central Link light rail between downtown Seattle and SeaTac airport would affect or influence development around the new light rail stations. For a while, immediately following its opening, there seemed to be little evidence that the light rail had had any positive impact on neighborhood development. Part of this was blamed on the economic recession, which affected the construction industry as a whole. Another reason considered was that the Central Link passed through what were commonly considered “disadvantaged” neighborhoods, such as Mt. Baker, Othello, Rainier Beach, and Columbia City, and that these neighborhoods were not seen as attractive places for new development. However, in the five years that have followed, the beginnings of Transit-Oriented Development have begun to take place. In Mt. Baker, the ArtSpace Mt. Baker Lofts, a new 57-unit mixed-use, affordable housing project, opened in 2014, and is expected to help spark the transformation of Mt. Baker from a car-dependent neighborhood to a much more walkable transit village.⁸² Around the Rainier Beach station, a new action plan has been drawn up to strengthen economic and social development, including increasing access to healthy food, trying to attract a local community college to the area, and developing nearby Beach Square into a mixed-use, affordable housing development and commercial hub for social activity. Environmental sustainability is also addressed through improved pedestrian and bicycle infrastructure and increased support for Rainier Beach’s Urban Farm and Wetland Project, two new types of ecosystem service-based land use projects emerging through the TOD movement. It is hoped that, over time, development will expand outwards to

⁸² Kiersten Throndsen, “New Development Hopes to Bring Pedestrian Feel to Mt. Baker,” *KOMO News*, March 1, 2013, <http://www.komonews.com/news/local/Pedestrian-friendly-development-planned-for-Rainier-Valley-194363741.html>.

create a fully functioning sustainable transit village.⁸³ Near the Columbia City Station, 879 new homes (both affordable and market rate) were built, 17 new businesses and bars were added, and a host of new summer community events were held.⁸⁴ These neighborhoods have seen some dramatic transformations since the opening of the Central Link light rail.

While there have been many successes regarding station-area development around Central Link, there were also some failures. There had been environmental justice concerns about the light rail stops in the Rainier Valley since they were built at grade, which created greater construction, pollution, and traffic congestion, while light rail stops in more affluent areas were built either on raised platforms or underground. Gentrification around Othello Station, the stop before Rainier Beach, raised land value by as much as 513% in some areas, forcing many low-income families to move into the suburbs, completely defeating the purpose of Transit-Oriented Development.⁸⁵ Going forward with the ST2 and ST3 expansion plans to the north and east side, it will be import to take these issues into consideration during the early stages of planning in order to help mitigate the harmful after effects.

Given Seattle's urban form, high-quality mass transit will play a big role in the future as suburb populations continue to increase in population and density thanks to major employers such as Microsoft, Amazon, Boeing, Nintendo, and DigiPen.⁸⁶ While

⁸³ City of Seattle, *Making Rainier Beach Great--A Call to Action*, Rainier Beach Neighborhood Plan, accessed December 5, 2014,

http://www.seattle.gov/dpd/cms/groups/pan/@pan/documents/web_informational/dpdd016770.pdf.

⁸⁴ Mike Lindblom, "Columbia City Light-Rail Station: Off the Beaten Path," *Seattle Times*, July 11, 2009, http://seattletimes.com/html/localnews/2009396059_stcolumbiacity29m.html.

⁸⁵ Loren Halstrom, "On the Wrong Track: Light Rail's Introduction to the Rainier Valley Systematically Excludes Minorities and the Poor," *The Modern American* 9, no. 1 (2013): 6.

⁸⁶ Joel Pfundt, Redmond City Planner, Redmond's Transportation Plans, Personal Interview, October 23, 2014.

downtown Seattle has a fairly comprehensive bus system, it doesn't extend very far into the suburbs, leading to high car ownership and single-occupancy vehicle commute trips between work and home. The expansion of light rail will not only make this commuting easier, but will lead to more development around these light rail stations which could help reduce the distances people have to commute in the first place while simultaneously encouraging intermodality. One advantage light rail has over bus systems is its permanence, and developers can rely on a steady stream of traffic coming through these areas for years to come. Finally, by bringing mass transit directly into these older, suburban town centers, it can help spur new, sustainable development, and become a very public display of the city's commitment to the environment. In time, it is hoped that sustainability will become ingrained in a town's collective identity and eventually become celebrated and adopted on an individual level.

Chapter 6: Redmond: Redefining a Suburban Town Around Sustainability

While East Link has been funded up to Overlake Transit Station on the fringe of Redmond, the proposed downtown stop, in the heart of Redmond, will have a huge impact on not only the shape of the system, but on the character of the town. There are a lot of things that can be taken away from Seattle's transportation history, especially since the opening of the Central Link light rail. That being said, no two places are exactly alike, and Transit-Oriented Development must adapt to fit the specific geographic and demographic needs of a region. Redmond, founded in 1871, started off as a logging town centered along the Sammamish River at the western edge of Lake Sammamish. Following the opening of the first floating bridge connecting Redmond to Seattle in 1940, the population slowly began to increase. Starting in the 1960's a series of high-tech companies began moving to Redmond, attracted simultaneously to the space for office development and its proximity to Seattle. First came United Control, an aircraft electronics company. Soon after followed Nintendo, and in 1986, Microsoft, perhaps the company that has influenced growth in Redmond the most, opened its doors.⁸⁷ Redmond has gained a reputation as an affluent, high-tech city, with a median income of \$96,088, 60% higher than the median income for the state of Washington. Almost 38% of the population falls between the ages of 25 and 44, and over 40% of households are non-family households, suggesting a large population of young, single professionals.⁸⁸ This demographic could play an overly large role in how the area around the future Redmond Station is developed, since the needs and wants of a group of young professionals will be

⁸⁷ Nao Hardy, Miguel Llanos, and Rosemarie Ives, "Overview of Redmond History," 2013, http://www.redmondhistoricalsociety.org/RHS/index.php?option=com_content&view=article&id=567&Itemid=299.

⁸⁸ U.S. Census Bureau, *Demographic Profile from the 2010 Census*, 2010, <http://quickfacts.census.gov/qfd/states/53/53575351k.html>.

different than those, say, of an older, retired population. Redmond prides itself on being a family-friendly city, and public amenities must be included for them as well. However, family-friendly and sustainable development does not have to be mutually exclusive. In terms of the need for public transportation, census data suggests current systems are lacking. Over 82% of Redmond workers commute by car (70% in single-occupancy vehicles), with only 6.3% taking public transportation and 4.4% walking.⁸⁹ Interestingly enough, Redmond has the single highest daytime population surge of any city over 50,000 residents in the United States, with a population increase of over 111% during the workday, mostly due to the influx of Microsoft employees.⁹⁰ It is not surprising that efficient mass transit has become a priority of the city. At the same time, Redmond is seeking to update its city's brand. While maintaining its identity as a quiet, family-friendly town, city planner Joel Pfundt expressed Redmond's desires to modernize in order to better connect it with downtown Seattle, and to become more sustainable in the process. "Light rail transit is what will enable to the city to grow into the future," he states.⁹¹ Though only 15 minutes away, the poor connection between the Redmond and Seattle has led to its isolation and car dependence, and better linking the two will not only lead to easier commutes, but could help facilitate the flow of some of Seattle's more progressive environmental values and ideas.

A new transit station offers the opportunity to redefine downtown Redmond as a modern, sustainable, residential urban village that is better integrated with Seattle. While the design breakdown below is tailored for Redmond, this system of using high quality

⁸⁹ Ibid.

⁹⁰ Gene Balk, "Census: Redmond Has Largest Daytime Population Surge in U.S.," *The Seattle Times*, June 3, 2013, <http://blogs.seattletimes.com/fyi-guy/2013/06/03/census-redmond-has-largest-daytime-population-surge-in-u-s/>.

⁹¹ Joel Pfundt, Redmond City Planner, Redmond's Transportation Plans.

transit to update a residential urban village and incorporate sustainability could be applied to many of the suburbs surrounding Seattle, as well as other cities nationally. By focusing on adding sustainability elements to the immediate station area, light rail could become the medium through which sustainable development explodes.



FIGURE 9. Overview of the possible design features for the proposed downtown Redmond light rail station.

1. Developing the North Side of the Redmond Town Center Mall

Transforming a space previously set up for cars into a walkable neighborhood means reorienting storefronts to create active and attractive streets. Urban activist, Jane Jacobs wrote about the importance for street activity to cultivate a sense of safety. She states, “The basic requisite for such surveillance is a substantial quantity of stores and other public places sprinkled along the sidewalks of a district; enterprises and public spaces that are used by evening and night must be among them especially. Stores, bars, and restaurants, as the chief examples, work in several different and complex ways to abet

sidewalk
safety.”⁹²
Providing uses
for a wide variety
of demographics
will be especially
important in a
town that



FIGURE 10. New development along the north side of Redmond Town Center will help activate the station area.

experiences such a large daily population swing in order to keep streets active at all hours of the day. Redmond Town Center, the city’s shopping mall and local destination, is currently oriented inwards, with little development on its northern side. With the addition of the light rail along NE 76th Street, there is new potential for both residential and retail development as well as a need to activate the streets surrounding the station. Ideally, development would include outdoor seating, perhaps a lunch café, a coffee shop, or a pharmacy, and be somewhat environmentally minded, serving fresh and organic food, or other green products to help reinforce a more sustainable lifestyle kick started by the light rail. By creating mixed-use development, you can help balance the energy demands throughout the day, as corporate users will be the primary occupants during the day and residents during the evening and night, a more sustainable option that also promotes more consistent street activity.

⁹² Jacobs, *The Death and Life of Great American Cities*. 36.

2. Parking/Cars

While one of the biggest criticisms of transit villages is that too much space gets devoted to parking, realistically some must be provided for those who live too far away to bike, walk, or take connecting mass transit to the station. The Sound Transit light rail, like BART, operates more like a regional transit system, operating at higher speeds with longer distances between trips. Thus, it is expected to attract commuters first and foremost, some of who will inevitably live further away. The expanded plaza will take over some of the existing at-grade parking spaces to the north of the light rail line, so to compensate, parking will be added to the existing parking structure at Redmond Town Center. The parking garage there is currently underused, with many customers opting for the at-grade parking on the south side of the mall. With residential development

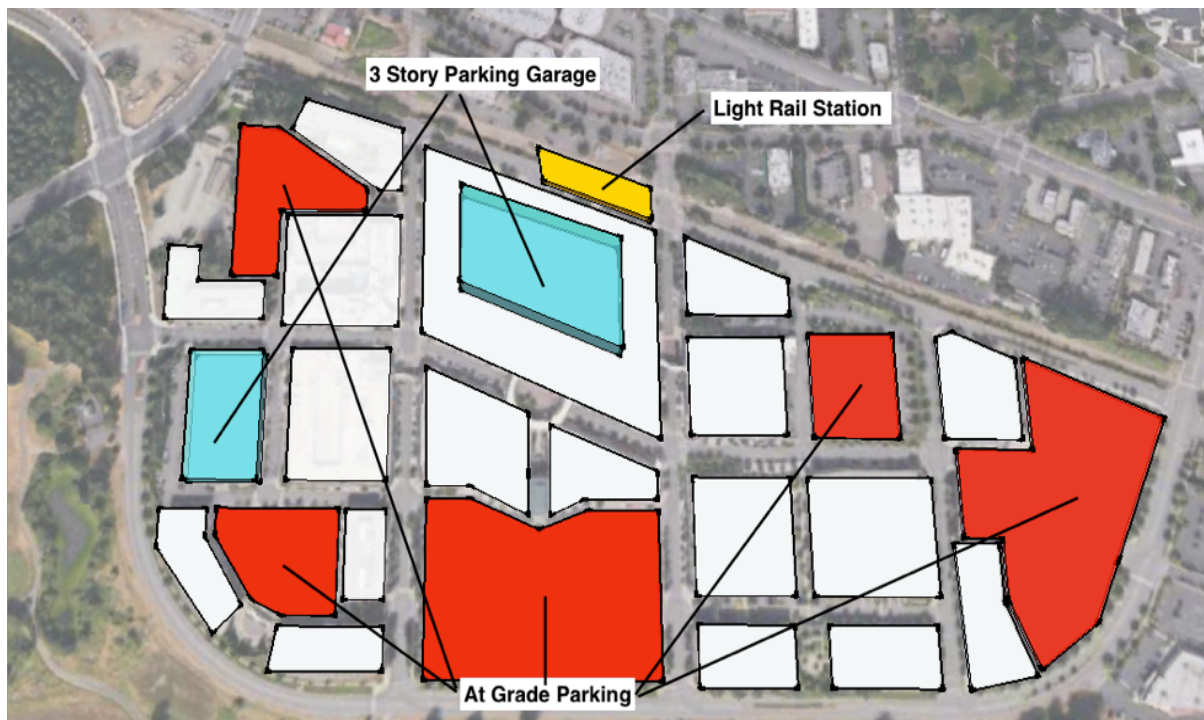


FIGURE 11. Current parking availability around Redmond Town Center. With increased traffic due to light rail commuters, one or more of the at-grade sights should be converted into multi-level parking. Existing commercial and retail development are shown in white.

expected to boost population in the downtown Redmond area, a new parking garage ought to be built on one of the at-grade parking lots nearby. Following a precedent set by the city of Santa Monica's 2008 LEED certified parking garage, the city of Redmond could make this new parking structure into a beautiful, sustainable local attraction if planned carefully.⁹³ Ideally, more mall users would park at the new garage and open up space in the existing garage on the north side for those looking to park and ride the light rail. It is still a central goal of Transit-Oriented Development that car use decrease, but part of there is still a large number of people who have no choice but to park and ride mass transit, so parking must be incorporated into the design.⁹⁴

3. Bicycles

Downtown Redmond, the self-proclaimed "Bicycle Capital of the Northwest" is one a few cities that has earned the distinction as a "Bicycle Friendly Community" by the League of American Bicyclists.⁹⁵ Its extensive number of painted bike lanes, separated bike lanes, and bike trails already encourage many to bike in Redmond. In 2010, the city completed the Redmond Central Connector, a beautiful bike trail through downtown built on top of the abandoned and overgrown BNSF Railroad Tracks. Though only one mile has been completed so far, the Central Connector has been enough to catalyze some early Transit-Oriented Development downtown, with four major new mixed-use high rises being built along its northwestern edge. The East Link Light Rail expansion will run parallel to a portion of the Connector as well as a narrowed NE 76th Street, and it is hoped

⁹³ Ali Lriscenski, "First LEED Parking Garage: Santa Monica Civic Center," April 14, 2008, <http://inhabitat.com/first-leed-certified-parking-garage/>.

⁹⁴ Scott Koppelman, Sustainable Development in Seattle, Personal Interview, October 17, 2014.

⁹⁵ City of Redmond, "Getting Around Redmond: Biking," *City of Redmond*, accessed December 9, 2014, <http://www.redmond.gov/Transportation/GettingAroundRedmond/Bicycling/>.

that more high-rise development will pop up along the northern edge after the completion of the downtown Redmond Station. City planner Joel Pfundt also expressed hope that downtown Seattle’s new Pronto Bike Share program might one day extend to downtown Redmond, so that commuters would be able to take bikes on and off the light rail with them to help solve the “last-mile problem,” the idea that one of the biggest barriers to using mass transit is the distance from the station to their destination.⁹⁶ When trying to fit transit into these spread out suburbs, it’s difficult to site a station within comfortable walking distance of everyone, so focusing the trip *to the station* requires just as much attention by planners as the light rail trip itself. Even if it’s a relatively short distance, people will choose to drive to their final destination if there is not an easy way for



FIGURE 12. Map of the different modes of transportation in downtown Redmond relative to the proposed light rail station. [Base map courtesy of Google Maps].

⁹⁶ Joel Pfundt, Redmond City Planner, Redmond’s Transportation Plans.

them to get to the station. Installing a bike share program makes this “last-mile” much more manageable. This helps encourage people to try biking over driving, and they might discover that it’s more fun and easier than they think.

4. Walkability

A key component of a transit village is walkability. Walkscore, an organization that assigns a score from 0-100 to an address based on their walkability gave Redmond an average 34, dubbing it a “car-dependent” city. The walkscore is determined by the distance to amenities such as grocery stores, restaurants, retail, etc. Amenities and services within a five minute walk of an address are given the highest number of points, with fewer and fewer points awarded as distance increases up to a 30 minute walk.

While Redmond’s average is quite low, new downtown developments such as the Red 160 high rise recently built along the Redmond Central Connector bike trail have a walkscore above 90, making it a highly walkable area, which almost completely eliminates the need for a car.⁹⁷ It is hoped that through densification of this downtown area, this walkscore will approach 100 and apply to a much higher number of both residents and commuters. Accomplishing this is as much about increasing walkability as it is about adding necessary amenities and services. Downtown Redmond, for example, could benefit from a local grocery store. Ensuring a quality pedestrian experience must be a priority in the design around the downtown Redmond Station. This will be accomplished through wide sidewalks and promenades, visual and audible crossing signals, and highly visible crosswalks, which both promote safety and attract pedestrians to the area. Walkability ties in directly with biking and public transit. Thomas Schröpfer

⁹⁷ “Walk Score Methodology,” *Walk Score*, 2014, <https://www.walkscore.com/methodology.shtml>.

states, “the mobility system is not only a system of transport; it is the whole understanding of a city and its surroundings. The more we create an integration of functions, the better a city will become. In order to provide mobility without compromising the quality of the urban environment, roads that are considered micro-environments incorporate pedestrians and bicycles in the streetscape.”⁹⁸ While the light rail project will certainly increase transit ridership, it is important to remember that riding public transit will almost always require a walk or bike trip at its beginning or end, and enhancing these trips, however brief they may be, is just as important as the 30 minutes you might spend on the light rail when you go downtown.

5. Station Layout

Given the narrow space between NE 76th and the Redmond Central Connector, the light rail tracks will split off slightly as they get to the station, allowing for a raised, common platform in between the two lines. Designing a central platform rather than two platforms on the outsides allows for more space and more distance between riders and the car or bike traffic on either side. Once the train has left the station, the tracks rejoin to allow a vegetated buffer between the light rail and the road and bike path. These buffers will feature natural plants that require little maintenance. The dense shrubbery will also add to pedestrian safety, providing a subtle yet effective barrier along the at-grade tracks.

⁹⁸ Schröpfer, *Ecological Urban Architecture*, 2012.



FIGURE 11. Given the limited space between car traffic on NE 76th Street and the Redmond Connector Bike Path, the light rail tracks will split immediately before and after stopping at the station to allow for a larger, shared platform in the center of the tracks. The tracks will meet up on either side to allow room for a vegetated buffer between car and bike traffic along the rest of the line.

6. Programming the Space, a Sustainability Showroom

One of the keys to success in creating a transit village is creating active space. One way of accomplishing this might be to include a community space. Putting an open-air space



FIGURE 12. The Plaza and surrounding station area will be carefully programmed with a variety of activities including farmers markets, food trucks, and outdoor concerts.

with frequent programs (perhaps a crafts fair, farmers market, or performance) attracts people from off the street and makes them feel like they are part of the community. So often, community spaces are forgotten and underused rooms tucked away in larger municipal buildings. By dedicating a space in the heart of downtown and giving it its own, inviting building will go a long way towards attracting commuters, visitors, and residents of the Redmond transit village. Often, one of the most overlooked aspects of public projects is successful programming. It is not enough to set up all the pieces and hope people come. You have to design programs and events that will draw people to the space. At the Redmond site, weekly farmers markets will be held, as well as summer concerts, outdoor plays, and a variety of other community events. Food trucks will come to the plaza over the lunch hour and ping-pong tables like those already popping up in downtown Seattle will be built. It is hoped that many of these will carry through the theme of sustainability, and to that effect there will be a small building that strives to meet the Living Building Challenge's strict performance requirements in order to "operate as cleanly, beautifully and efficiently as nature's architecture."⁹⁹ Built directly on the plaza, the building will be capable of being opened up to the outdoors as a showroom of sorts for all the sustainability efforts going on in Redmond. It can display the city's cultural and environmental history in a small gallery, a map of local attractions within walking distance, and information about the light rail and surrounding transit. This community space can also function as a venue for local events, especially in the summer. By keeping the building one story and open, people are much more likely to wander in casually while simply passing through or just waiting for the light rail. Even if they only

⁹⁹ International Living Future Institute, "The Living Building Challenge," accessed December 10, 2014, <http://living-future.org/lbc>.

stop in for five minutes or so, they will expose themselves to new knowledge about sustainability.

7. The Plaza

In order to establish the new transit station as a central hub of activity for downtown Redmond, thoughtful planning and design must go into the public space that surrounds it. Thus, a public plaza will be constructed over some of the underused at grade parking along the Redmond Connector bike trail. Danish urban designer Jan Gehl believes planning a neighborhood is like planning a party and claims that there are three uses of every public space. The first are the “necessary” uses; for example, walking to the light rail station so you can get to work, sitting on a bench because your legs are tired, etc. These activities happen regardless of the quality or design of the space. The next types of use are the “optional” uses. This kind of use is dependent on the quality of design, as users are choosing to, for example, sit outside while enjoying a cup of coffee, choosing to do some afternoon shopping, or meeting friends at a restaurant for dinner. Lastly are the “social” uses, which involve engaging with other people in the space. These might include informal meetings between acquaintances, or even just silently passing a stranger on the sidewalk. All three kinds of outdoor uses are vital for city life, Gehl argues, and ought to be provided at the Downtown Redmond Station Plaza.¹⁰⁰¹⁰¹

¹⁰⁰ Jan Gehl, *Life Between Buildings: Using Public Space*, Sixth Edition (Washington, DC: Island Press, 2011).

¹⁰¹ Bernick et al., *Transit Villages in the 21st Century*.

8. Passive Inspiration

Building on Gehl's three uses, I propose that there can be a fourth type of use of public spaces: passive inspiration. One of the goals with the downtown Redmond Station is that it might subtly nudge people into being more sustainable by subconsciously helping them form connections between their urban lifestyle on nature. Perhaps it starts with taking the light rail out of convenience, but then you begin to feel like you're a part of this broader community of "people who care" about sustainability. Or maybe you decide one day to rent one of the public bikes, and realize how easy it is to get around on one, which encourages you to bike more often. Maybe you see one of the many bioswales in the square and decide that would be a cool new feature in your home garden. The plaza becomes a place where people unintentionally learn to be sustainable, and this gradual change of mindset can extend beyond this station area and into the daily lives of its visitors.

9. Public Art

One place sustainability can be incorporated into the station area development is through commissioned public art. Potential art pieces could illustrate some aspect of natural systems or perform some sort of sustainable function (such as a sculpture that doubles as a bike rack, a bridge to promote pedestrian or bike connectivity, a water cleansing device, or a vegetated sound wall) in addition to simply attracting users to the station in the first place. In order to be successful, the area surrounding the light rail must not only function for commuters, but also offer enough to keep commuters there beyond the short amount of time necessary to board and disembark the light rail. The city will have to work

carefully with artists to get a good range of pieces that help promote sustainability brand and encourage users to walk around and explore downtown Redmond.

10. Stormwater Management

The Pacific Northwest is known for its rain, and in urban areas with a large amount of impermeable surfaces, stormwater runoff can pick up pollutants and carry them miles and miles before they finally reach a storm drain. All of this typically ends up untreated in Puget Sound where it is having a hugely negative effect on the marine plants and wildlife.



FIGURE 13. A number of bioswales will be put along the plaza to help retain and filter stormwater runoff, and the plaza itself will be constructed out of interlocking permeable pavers.

By using interlocking permeable pavers on the plaza, water is able to pass through and absorb directly back into the ground. This simultaneously eliminates the long distance the water must travel before reaching an impermeable surface or drain and also helps naturally filter out what little pollutants there are. Bioswales are another technique that do this; by creating a shallow gravel bed and planting it with species with deep root,

water is directed into the swale where it is naturally retained, filtered, and slowly released back into the ground, all while providing an aesthetically pleasing landscape feature. A number of these will be featured along the Redmond Central Connector bike path and NE 76th Street to help collect water off these impermeable surfaces as well as to take up carbon dioxide and mitigate urban heat island effects.

11. Seating

Famous urbanist William Whyte once said “This might not strike you as an intellectual bombshell, but people like to sit where there are places for them to sit.”¹⁰² Providing attractive seating options encourages people to stop and rest in a space, and their presence, in turn, attracts more people. The area surrounding a transit station has a lot of people moving through it, but getting people to stay is what can transform a public plaza into a vital urban amenity. According to Whyte, whose famous studies catalogue the patterns of people in open spaces, of the biggest reasons people flock to open spaces is simply to people watch, we are curious about the lives of those around us. Providing comfortable seating in ways that both allow people to watch others and simultaneously be observed themselves is all part of the important and valuable social dynamic taking place in these urban plazas. At the same time, we want people to stay in the space so that they are further exposed to this “passive inspiration” from the natural elements incorporated into the plaza. With people spending more and more time indoors, isolated from nature, attracting people outdoors is becoming increasingly important. The lack of green spaces in urban areas has caused us to fall out of touch with nature, and it becomes difficult for

¹⁰² Whyte, *The Social Life of Small Urban Spaces*. 28.

us to make connections between our actions in the built environment and their broader environmental impact.



FIGURE 14: A key to creating quality, urban space is to put in quality seating.

There are a number of factors that go into creating a successful open space, and these features are only a few of the thousands of decisions that go into the design of a transit station plaza. These factors were singled out because they tout the principles of green, transit-oriented development. By bringing nature back into the urban fabric, activating a piece of infrastructure typically seen solely for its utilitarian purpose, and encouraging citizens to ditch their cars in favor of walking, biking, or taking the light rail are some of the first steps towards rebranding sleepy suburbs like Redmond into active, sustainable, urban villages capable of moving into the 21st century ready to accommodate a growing population while furthering the sustainable practices laid out at the station.

Conclusion

Implementing a new transit station is not easy, and neither is ensuring that high quality development takes place around it. It requires close collaboration between scientist, engineers, architects, designers, the city, and its citizens. Further, urban theory is constantly updating itself, with changing priorities and practices. We are now entering a period in history where environmental sustainability is just as important as economic or social development. With the stronger and more visible effects of climate change beginning to be felt, it is important to start incorporating the environment into our plans for the neighborhoods, towns, and cities of tomorrow.

In the case of Redmond, I believe there is real potential to create significant positive change by extending light rail to its town center. Light rail could transform this 19th century town into a modern, thriving, urban village that is more reflective of its citizens. Downtown Redmond could join Portland as one of the first Transit-Oriented Developments to sparks a citywide identity shift around sustainable transit. The truth is, many people will not change their lifestyle solely to become more sustainable. They'll do it to save time or money. By making the sustainable choice the convenient one, cities can start to nudge people in the right direction until eventually, being green becomes the norm, and the environment comes to be valued just as much as the social or economic benefits that can be derived from a government investment in public infrastructure.

Rather than being trapped in the inherently unsustainable lifestyle that comes through living in the suburbs, the new Redmond would provide quick and easy options for people to get around without a car. Thomas Schröpfer says that investments in mobility “should not be restricted to the denser city center. Whether through simple

infrastructure adjustments, radical changes in vehicular design, or a systematic master plan, adjustments to personal urban mobility can envisage the progressive and incremental generation of a new urban environment.”¹⁰³ Creating a system where the car is rendered useless is the first step towards creating a sustainable city, and with careful attention to design details, the area surrounding the light rail station could become an active public space that further extends these environmental values to those who pass through or choose to live there. Ultimately, we will have to wait and see the impact these places have on citizens, but with billions of new urban residents expected in the next decades, can we really afford to stand by our current system of sprawl? Now is the time to act, to ensure a future of livable, sustainable cities.

¹⁰³ Schröpfer, *Ecological Urban Architecture*, 2012. 86.

Works Cited

- Ali Lriscenski. "First LEED Parking Garage: Santa Monica Civic Center," April 14, 2008. <http://inhabitat.com/first-leed-certified-parking-garage/>.
- American Public Transportation Association. *Public Transportation Reduces Our Dependence on Foreign Oil*, November 6, 2014. http://www.mountainline.az.gov/media/pdf/energy_fact_sheet.pdf.
- Arthurson, Kathy. "Creating Inclusive Communities through Balancing Social Mix: A Critical Relationship or Tenuous Link?" *Urban Policy and Research* 20, no. 3 (September 1, 2002): 245–61. doi:10.1080/0811114022000005898.
- Autler, Gerald, and Dena Belzer. *Transit Oriented Development: Moving from Rhetoric to Reality*. Center on Urban and Metropolitan Policy, the Brookings Institution, 2002. <http://www.brookings.edu/es/urban/publications/belzertod.pdf>.
- Balk, Gene. "Census: Redmond Has Largest Daytime Population Surge in U.S." *The Seattle Times*, June 3, 2013. <http://blogs.seattletimes.com/fyi-guy/2013/06/03/census-redmond-has-largest-daytime-population-surge-in-u-s/>.
- . "Census: Seattle Is the Fastest-Growing Big City in the U.S." *The Seattle Times*, May 22, 2014. <http://blogs.seattletimes.com/fyi-guy/2014/05/22/census-seattle-is-the-fastest-growing-big-city-in-the-u-s/>.
- Beirão, Gabriela, and J. A. Sarsfield Cabral. "Understanding Attitudes towards Public Transport and Private Car: A Qualitative Study." *Transport Policy* 14, no. 6 (November 2007): 478–89. doi:10.1016/j.tranpol.2007.04.009.
- Bernick, Micheal S., Michael Bernick, Robert Burke Cervero, and Robert Cervero. *Transit Villages in the 21st Century*. New York: McGraw-Hill Companies, 1996.
- Brueckner, Jan K., and Ann G. Largey. "Social Interaction and Urban Sprawl." *Journal of Urban Economics* 64, no. 1 (July 2008): 18–34. doi:10.1016/j.jue.2007.08.002.
- Carlton, Ian. "Histories of Transit-Oriented Development: Perspectives on the Development of the TOD Concept." *Institute of Urban & Regional Development*, 2009. <https://escholarship.org/uc/item/7wm9t8r6.pdf>.
- City of Redmond. "Getting Around Redmond: Biking." *City of Redmond*. Accessed December 9, 2014. <http://www.redmond.gov/Transportation/GettingAroundRedmond/Bicycling/>.
- City of Seattle. *Land Use and Development*. Seattle Transit Master Plan Briefing Book. City of Seattle. Accessed December 9, 2014. <http://www.seattle.gov/transportation/docs/tmp/briefingbook/SEATTLE%20TMP%203%20Land%20Use.pdf>.
- . *Making Rainier Beach Great--A Call to Action*. Rainier Beach Neighborhood Plan. Accessed December 5, 2014. http://www.seattle.gov/dpd/cms/groups/pan/@pan/documents/web_informational/dpdd016770.pdf.
- "Copenhagenize.com - Bicycle Culture by Design: Danish 180% Tax on Cars Is Rather Irrelevant." Accessed December 3, 2014. <http://www.copenhagenize.com/2012/10/danish-180-tax-on-cars-is-rather.html>.
- David Pereira. "Metrotown | David Pereira." Accessed December 11, 2014. <http://davidpereira.ca/projects/burnabys-town-centres/metrotown/>.

- “Designs for \$37-Million SkyTrain Metrotown Station Renovation Revealed.” *Vancity Buzz*. Accessed November 20, 2014. <http://www.vancitybuzz.com/2013/11/skytrain-metrotown-station-renovation/>.
- Dittmar, Hank, and Gloria Ohland, eds. *The New Transit Town: Best Practices In Transit-Oriented Development*. 3rd edition. Washington, DC: Island Press, 2003.
- Doherty, Patrick C., and Christopher B. Leinberger. “The Next Real Estate Boom.” *The Brookings Institution*, November 2010. <http://www.brookings.edu/research/articles/2010/11/real-estate-leinberger>.
- Ebenezer Howard. *Garden Cities of To-Morrow*, 1902. <http://urbanplanning.library.cornell.edu/DOCS/howard.htm>.
- Ewing, Reid, Tom Schmid, Richard Killingsworth, Amy Zlot, and Stephen Raudenbush. “Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity.” *American Journal of Health Promotion* 18, no. 1 (September 1, 2003): 47–57. doi:10.4278/0890-1171-18.1.47.
- Fernanda D’Agostino. *Green Line Public Art Tour*. Audio Transcript. Urban Hydrology. Accessed November 20, 2014. <http://trimet.org/publicart/greenline/index.htm>.
- Fruitvale Village*, 2005. http://www.brunerfoundation.org/rba/pdfs/2005/3_Fruitvale.pdf.
- Gehl, Jan. *Life Between Buildings: Using Public Space*. Sixth Edition edition. Washington, DC: Island Press, 2011.
- GreenWorks. “Béranger Condominiums Ecoroof.” *GreenWorks*. Accessed December 10, 2014. <http://greenworkspc.com/works/green-roofs/beranger-condominiums-ecoroof/>.
- Halstrom, Loren. “On the Wrong Track: Light Rail’s Introduction to the Rainier Valley Systematically Excludes Minorities and the Poor.” *The Modern American* 9, no. 1 (2013): 6.
- “Heat Island Effect | U.S. EPA.” *U.S. EPA*, July 31, 2014. <http://www.epa.gov/heatisland/>.
- “History of the Portland Mall.” *TriMet*. Accessed November 20, 2014. <http://trimet.org/about/history/portlandmall.htm>.
- Howard, Ebenezer, and Lewis Mumford. *Garden Cities of To-Morrow*. Edited by F. J. Osborn. 1st edition. The MIT Press, 1965.
- Imperatives, Strategic. “Report of the World Commission on Environment and Development: Our Common Future.” Accessed December 3, 2014. <http://www.ask-force.org/web/Sustainability/Brundtland-Our-Common-Future-1987-2008.pdf>.
- International Living Future Institute. “The Living Building Challenge.” Accessed December 10, 2014. <http://living-future.org/lbc>.
- Jacobs, Jane. *The Death and Life of Great American Cities*. Reissue edition. New York: Vintage, 1992.
- Joel Pfundt, Redmond City Planner. Redmond’s Transportation Plans. Personal Interview, October 23, 2014.
- Kennedy, Maureen, and Paul Leonard. *Dealing with Neighborhood Change: A Primer on Gentrification and Policy Choices*. Brookings Institution Washington, DC, 2001.
- Larry O’Hanlon. “Trees Eat Pollution Better Than Expected.” *DNews*, November 27, 2012. <http://news.discovery.com/earth/global-warming/trees-pollutants-voc.htm>.

- “Metrotown City Center.” *Urban Centers Network*. Accessed November 18, 2014.
<http://www.metrovancouver.org/planning/development/urbancentres/Pages/MetroTownCentre.aspx>.
- Mike Lindblom. “Columbia City Light-Rail Station: Off the Beaten Path.” *Seattle Times*, July 11, 2009.
http://seattletimes.com/html/localnews/2009396059_stcolumbiacity29m.html.
- Nao Hardy, Miguel Llanos, and Rosemarie Ives. “Overview of Redmond History,” 2013.
http://www.redmondhistoricalsociety.org/RHS/index.php?option=com_content&view=article&id=567&Itemid=299.
- Naureen Khan. “How One Green City Is Going Global.” *The National Journal*, June 13, 2013. <http://www.nationaljournal.com/back-in-business/how-one-green-city-is-going-global-20130613>.
- “Obesity and Overweight for Professionals: Data and Statistics: Adult Obesity - DNPAO - CDC.” *Centers for Disease Control and Prevention*, September 9, 2014.
<http://www.cdc.gov/obesity/data/adult.html>.
- Office of Corporate Communications. *Sound Transit History and Chronology*. Sound Transit, October 2007.
<http://www.soundtransit.org/Documents/pdf/about/Chronology.pdf>.
- Oregon Metro. *Project Profile: K Station*. Portland, September 2012.
http://www.oregonmetro.gov/sites/default/files/kstation_final.pdf.
- . *The Beranger*. Project Profile. Transit Oriented Development. Portland, September 2012.
http://www.oregonmetro.gov/sites/default/files/theberanger_final.pdf.
- Partnership for New York City. *Growth or Gridlock? The Economic Case for Traffic Relief and Transit Improvement for a Greater New York*. New York City, December 2006. <http://www.pfnyc.org/reports/Growth%20or%20Gridlock.pdf>.
- Portland Development Commission (last). “Portland: Interstate Corridor Urban Renewal Plan,” 2001, 8.
- Rudy Bruner Award Digital Archive. “Fruitvale Village.” *The State University of New York, University at Buffalo*, 2005.
<http://libweb1.lib.buffalo.edu/bruner/year/project.asp?searchby=year&entry=641>.
- Sam Staley. “Accessibility Vs. Mobility Redux.” *Planetizen: The Urban Planning, Design, and Development Network*, January 13, 2010.
<http://www.planetizen.com/node/42367>.
- Schröpfer, Thomas. *Ecological Urban Architecture*. Basel: Birkhäuser, 2012.
 ———. *Ecological Urban Architecture*. Basel: Birkhäuser, 2012.
- Scott Koppelman. Sustainable Development in Seattle. Personal Interview, October 17, 2014.
- Seattle Department of Transportation. *Making the Best Use of Our Transportation System*. Seattle Transportation Strategic Plan. Seattle Department of Transportation. Accessed December 9, 2014.
http://www.seattle.gov/transportation/docs/tsp_insert_2_making_the_best_use_072705.pdf.
- . *Vancouver BC SkyTrain*. Accessed November 16, 2014.
http://www.seattle.gov/transportation/SAP/TOD_Case_Studies/Vancouver_Skytrain.pdf.

- Seattle Transit Blog. *Link Light Rail Lines*. Digital Map. Accessed December 7, 2014. http://seattletransitblog.com/wp-content/uploads/2014/06/ST_Link-RGB-Lines.png.
- Sherer, Paul M. "Why America Needs More City Parks and Open Space." *The Trust for Public Land*, 2003. http://conservationtools.org/uploaded_files/0000/0046/parks_for_people_Jan2004.pdf.
- Sia, Archibald P., Harold R. Hungerford, and Audrey N. Tomera. "Selected Predictors of Responsible Environmental Behavior: An Analysis." *The Journal of Environmental Education* 17, no. 2 (January 1, 1986): 31–40. doi:10.1080/00958964.1986.9941408.
- Sound Transit. *Social, Economic and Environmental Impacts; Performance Characteristics by Mode; and Integration with Regional Land Use*. Sound Transit 2: A Mass Transit Guide, July 2008. <http://www.soundtransit.org/Documents/pdf/st2/transitexpansion/Appendix%20D.pdf>.
- The Unity Council, Bay Area Rapid Transit District, City of Oakland. *Fruitvale Transit Village Project*. U.S. Department of Transportation, Federal Highway Administration, November 18, 2014. http://www.fhwa.dot.gov/environment/environmental_justice/case_studies/case6.cfm.
- Thronsen, Kiersten. "New Development Hopes to Bring Pedestrian Feel to Mt. Baker." *KOMO News*, March 1, 2013. <http://www.komonews.com/news/local/Pedestrian-friendly-development-planned-for-Rainer-Valley-194363741.html>.
- "Tree Facts | American Forests." *American Forests: Protecting and Restoring Forests*. Accessed November 20, 2014. http://www.americanforests.org/discover-forests/tree-facts/#_ftn1.
- TriMet. *Sustainable Practices on the MAX Green Line*. Portland: TriMet, June 2009. <http://www.trimet.org/pdfs/maxgreenline/greenline-sustainability.pdf>.
- . "The Portland Transit Mall." *TriMet*. Accessed December 10, 2014. <http://trimet.org/portlandmall/>.
- Urso Chappell. "1986 Vancouver." *Expo Museum*, November 18, 2014. <http://www.expomuseum.com/1986/>.
- U.S. Census Bureau. *Demographic Profile from the 2010 Census*, 2010. <http://quickfacts.census.gov/qfd/states/53/53575351k.html>.
- "U.S.-China Joint Announcement on Climate Change." *The White House*, November 12, 2014. <http://www.whitehouse.gov/node/307541>.
- US Department of Transportation. *Report to Congress*, 2010. <http://www.transportationissuesdaily.com/wp-content/uploads/2012/07/Transportation-Emissions-TRB-Circular-July-2012.jpg>.
- "Walk Score Methodology." *Walk Score*, 2014. <https://www.walkscore.com/methodology.shtml>.
- Whyte, William H. *The Social Life of Small Urban Spaces*. Project for Public Spaces Inc, 2001.
- "World's Population Increasingly Urban with More than Half Living in Urban Areas | UN DESA | United Nations Department of Economic and Social Affairs," July

10, 2014. <http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html>.