VICTORIA'S SUBURBAN SPRAWL AS A BARRIER TO SUSTAINABLE DEVELOPMENT

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ABSTRACT: Canada is a nation where over two-thirds of the population lives in some form of suburb (Gordon & Janzen 2013). It is important to monitor the locations of population growth within our nation as it has profound effects on our economic effectiveness, environmental sustainability, and our overall public health. The purpose of this study is to estimate Victoria's 2016 suburban population using housing density and journey-to-work transportation data to classify the Census Metropolitan Area (CMA) into exurban, auto suburb, transit suburb, or active core. Using Transportation Method 9 (Gordon 2018), it was found that 74.9% of Victoria's population lived in suburban settings in 2016, with 65.3% situated in auto suburbs at the time of the 2016 census. Victoria had Canada's highest active transportation average at 16.9%, with the second highest being Kingston at 9.5%. The population living in Victoria's active cores was 21%, a 4% increase from 2011 with only 17% active core.

Keywords: Victoria, CMA, Suburbs, CT

INTRODUCTION

In 2011, Statistics Canada estimated the 'urban' population to be 81% based on the Stats Canada definition of 'Urban' and 'Rural' (Statistics Canada 2015). However, these classifications fail to incorporate the spectrum of 'suburban' development, and thus paints a false picture of Canadian urbanization. In 2013, Gordon & Janzen classified Canada as a suburban nation, with 66% of all Canadians living in some form of suburb in 2006. This is an important distinction to make, as suburban development has important impacts on social, environmental, and economic growth. The urbanization of suburban areas is a key issue in contemporary urbanism, in particular in North America where suburban, car-oriented development was prevalent in the last 60 years (Taranu, A. 2018). While urban areas are becoming more and more expensive, the urban lifestyle is becoming more and more popular, so suburban towns and developers are increasingly catering those looking for a more walkable, dense community.

This article is a continuation of Gordon et. al's Still Suburban? Growth in Canadian Suburbs 2006-2016 (August 2018). We begin by demonstrating that Canada is a suburban Nation, with two thirds of residents living in suburban areas. By mapping population growth for the 2006 – 2016 period, we determined that only 15% of Canadian growth was in sustainable active cores and transit suburbs, and that 67.5% of Canada's population lived in some form of suburb in 2016.

This article takes a more in-depth look at the Victoria CMA growth trends in the 2006-2016 period, using the Transportation Method 9 (T9) from Gordon et al (2018) to classify the Census Tracts (CTs) into four distinct categories based off housing density and journey-to-work data: active core, transit suburb, auto suburb, and exurban. Dr. Gordon's research team determined this to be the best algorithm to define Canadian

cities after testing the method over all Canadian CMAs with consistent results (Gordon et al 2018). Active core and transits suburbs represent the more 'sustainable' neighborhoods, having high active transportation (walking and biking) averages. Auto suburbs and exurban areas represent the auto-dependent 'unsustainable' neighborhoods or areas of 'urban sprawl'. The findings of this article show the auto-dependence of Canadian residents, and insignificance of the inner-city condos booms as compared to the population growth in auto suburbs and exurban sectors. This article will also compare Victoria's results to other mid-sized Canadian cities and Vancouver, both covered in Still Suburban? Growth in Canadian Suburbs 2006-2016.

LITERATURE REVIEW

Why should we care?

Despite the recent condominium booms and intensification trends of downtown cores, Victorian planners should still be worried about suburban sprawl as a threat to sustainable development. The increase of dwelling units in 'sustainable' neighborhoods looks great initially but does less to balance the numbers in terms of population count. Sprawling suburban areas are witness to higher rates of automobile use and vehicle ownership (Ewing et al. 2002). In such areas, people own more cars, drive longer hours, and commute less by public transit. Extensive automobile use leads to more air pollution and greenhouse gas emissions compared to commuting by transit, walking, or cycling. With more people commuting longer distances and living consumer lives in their single-detected homes, these suburban settings demand more transit cost, infrastructure, and loss of greenfield (Ewing et al. 2002).

The migration of residents to the automobile-dependent suburbs has also taken a toll on human health and vitality. A study from Universities of Oxford and Hong Kong show evidence that suburban lifestyles are correlated with higher obesity rates and that walkability is no longer just an ideal (Florida 2014). Obesity is less common in densely-built areas because of amenities within easy walking distance, providing more incentive to walk to them, while densely-built environments can also de-incentivize driving because of their congestion and limited parking. The study also suggests that "a highly compact dense residential environment might act as a proxy for enhanced community social capital and support," (pg. 284, Sarkar et. Al 2017) thus reducing crime, improving health, spurring creativity, and encourage more civic engagement in our communities. Furthermore, the lack of walkability has also been found to be significantly and negatively correlated with neighbourhood foreclosures, as found when examining a cities Walk Score (Gilderbloom et al 2015). There are substantial costs associated with urban sprawl, which are, ultimately, paid for by the taxpayer. Greenfield development and servicing infrastructure investments burden the city with costs that are far below the cost-benefit of the inner city (Thompson 2013). A report on suburban sprawl estimates that infrastructure of low-density development costs $1.50 per every real-estate tax dollar, meaning that large cities such as Halifax and Calgary could save upwards of $700 million and $11 Billion respectively by densifying development already in the urban core (Diamond & Thompson 2013).

Defining the Core

The original construction of a North American city had the commercial node of the city surrounded by the lower-income housing. City residents were migrating into the suburbs as the result of higher incomes, rising city crime, and industrial pollution. Higher income families were willing to pay higher transportation costs (i.e. time) for the country lifestyle. With the rise of densification planning, gentrification of Canadian cities has introduced desirable inner-city apartments; forcing low-income families out of the city and attracting highly educated and

skilled workers (Gordon & Vipond, 2005). A study done by Peter Saunders (2017) shows that core cities are attracting educated Millennials that desire pedestrian friendly, mixed-use neighborhoods. The incoming generation's living habits are more aligned with that of city-living, valuing social time over longer commutes to suburban estates, and desiring to congregate where they work, live, and play (Saunders 2017).

Defining the Suburbs

Defining the suburbs is a difficult task and has many plausible answers (Forsyth 2012). Over the years, definitions have been made based upon dwelling age, individual assessment, commuting status, income, and home ownership. Arthur Nelson describes American suburbs as "low densities spread across vast landscapes, they are dominated by one land use: the single-detached home on a large lot, dependent on the automobile, and so inefficiently developed as to rob America of economic vitality" (Grant et al 2013). Anthony Hommik notes that there also appear to be at least two types of suburbs: inner and outer (Hommik n/d). Since urban growth is a fluid process, it can therefore be reasoned that some current inner suburbs will likely be enveloped by the inner city in the future. It might then be assumed that these inner suburbs are more densely populated and therefore better served by public transit. Consequently, rates of transit usage would be higher than in outer suburbs where the automobile is likely to be more dominant. As summarized by Jackson (1985), suburban residents "commute elsewhere to work, [whereas] city residents work nearby". Studies on urban sprawl and public health have also found the built environment of outer suburbs a growing concern. The lack of sidewalks and mixed-use infrastructure partnered with high speed traffic and mobile focused transit functions to discourage physical activity, ultimately increasing the risk of obesity and poorer overall health (Lopez & Hynes, 2006). Based on the literature above, this study will classify suburban CTs based on auto-dominance and limited active transportation and public transit use.

Defining Exurban

Defining exurban (or rural) areas appears to be a lot simpler, as there is often a clear visual line between the uniform suburban town houses and the farmhouses that require a ten-minute walk just to see your neighbor's driveway. In general, rural areas are defined by location and density. Statistics Canada loosely defines rural as "sparsely populated lands lying outside urban areas" and more specifically where the "population is located outside centres of more than 1000 people and with densities less than 400 people per square kilometre" (Statistics Canada 1999, 226). Drawing on the findings on Chris Vandyk's (2009) Masters research in this project, Victoria's CTs with a population density <150 / km2 will be classified as exurban.

Victoria Official Community Plan

The purpose of the Official Community Plan (OCP) Annual Review 2016 was to provide an annual snapshot of progress towards achieving the OCP, which Council approved in July 2012. The review focused primarily on land management and development and was used to identify emerging trends and issues that may impact the OCP. The key findings of this review included the "highest amount of housing unit creation since the OCP was adopted" and a "greater vibrancy through increased number of activities in public spaces", encouraging a strong downtown core and a network of vibrant walkable villages. The three main Targets relatable to this paper observed in the OCP were:

- 90% of all housing units are within 400 metres of either the Urban Core, a Town Centre or an Urban Village by 2041
- The Urban Core accommodates a minimum of 10,000 additional residents from 2011 to 2041

- At least 70% of journey to work trips by Victoria residents take place by walking, cycling and public transit by 2041
- OCP Annual Review 2016

The measurement of urban and suburban growth is paramount to coordinated and consistent decision making that focuses on how people, land use, transportation, infrastructure and technology can mitigate and adapt to change (2018 CRD Regional Growth Strategy). The classifications in this article provide a visual aid of the suburban areas requiring planning attention to achieve the OCP goals.

METHODS

This article compared the 2006 and 2016 CT data by examining the changes in population and dwelling unit counts. 2006 Census data was extracted from P-Census and 2016 data was downloaded from the Statistics Canada 2016 long-form census. The CT shape files were also obtained from Statistics Canada and edited in ArcMap to remove all water features and grouped into the CMAs. CTs that were split from old CTs in 2016 were given estimated 2006 data by using Allen and Taylor's (2018) calculation method based on day-symmetric and built-form weights. This report then applied Transportation Method 9 (T9), modified from Transportation Method 8 (T8) established by the Canadian Suburbs research program (Gordon & Janzen, 2013), to classify each of Victoria's CTs as outlined below:

Exurban areas are defined as areas with gross population density less than 150 people per square kilometre.

Auto Suburbs are defined as CTs with a gross population density greater than 150 people per square kilometre, transit use less than 150% of the metro average, and active transit less than 150% of the metro average.

Transit Suburbs are defined as CTs with transit use greater than 150% of the metro average for journey to work, active transit less than 150% of the metro average, and transit use at greater than 50% of the national average and 150% of the metro average.

Active Cores are defined as CTs with active transit greater than 150% of the metro average for the journey to work and greater than 50% of the national average.

Using the Victoria CMA data, the Victoria active core floor was calculated as ((CMA total commuters using active transit) / (Total CMA commuters)) *1.5

Active core floor T9 = 28 885/ 170 830 = 16.9% x 1.5 = 25.37%

Since 25.37% is over the national floor of 10.34%, the Victoria CMA active floor is used to classify the Victoria CMA (table 2).

A similar method was used to classify the transit suburbs, using instead the average public transit use data to calculate the floor.

Transit suburb floor T9 = 18 610 / (170 830) = 10.89% * 1.5 = 16.34%

All remaining CTs not meeting the standard for exurban, active core, or transit suburb are classified as 'auto suburb' (using the method outlined by Gordon & Janzen, 2013). Any CTs without journey to work data or determined by visual analysis to be significantly unpopulated are changed to 'unclassified'. This may include industrial yards, First Nation reserves, and parks.

Mapping

Once classified, the Excel worksheets were imported into ArcMap and the data was joined with the corresponding CT, using the FID number as the unique identifier. Using Google Earth and Google Maps to verify the results, Geographic Information System (GIS) mapping techniques were used to create final classification maps available to overlay on satellite imagery and compare with previous research results. Any anomalies found on the transportation map where CT classification seemed to differ from the overall pattern were checked by overlaying the map layers in Google Earth.

FINDINGS

Using the 2016 classification, the Victoria CMA was 21% active core and 65% auto suburb. 19% (7,222) of Victoria's growth over the 10-year period occurred in active cores, while 73% (27,274) occurred in auto suburbs. In comparison to other mid-sized Canadian cities, Victoria has almost double the population (21% to 12%) living in active cores and 11% less than the average exurban area (15%). This is unusual for mid-sized cities, as the exurban population surrounding them is not exposed to the longer and slower commute found in larger metropolitan areas, and thus often have more exurban residents. When looking at other Canadian mid-sized cities, the exurban sprawl is often in the form of farmland surrounding the cities suburbs. Victoria's geographical location, surrounded by a mountain range and the Juan De Fuca Strait, provides a physical barrier to restrict exurban areas from spreading as much as they do on the mainland. Compared to most other Canadian CMAs, Victoria has achieved more sustainable results. With a 10.3% walking average, and a 6.6% biking average, it has gained bragging rights as the CMA with the highest proportion of active transportation in the journey to work (Figure 1).

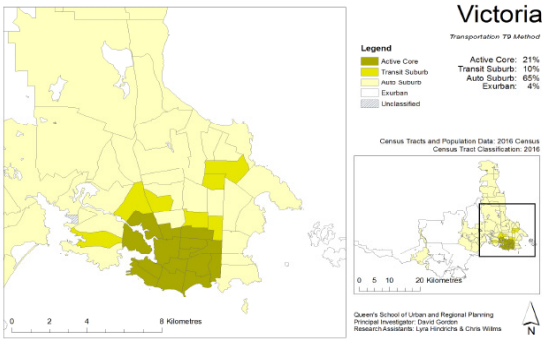
Walking and Biking Across Canada

2016 Rank (of 33)	CMA	Walking (%)		Cycling (%)		Active Transportation total (%)	
		2006	2016	2006	2016	2006	2016
1	Victoria	10.4	10.3	5.6	6.6	16.0	16.9
2	Kingston	9.6	7.6	2.4	1.9	12.0	9.5
3	Halifax	10.1	8.2	1.0	1.3	11.1	9.5
4	Vancouver	6.3	6.7	1.7	2.3	8.0	9.1
5	Ottawa-Gatineau	6.8	6.3	2.1	2.4	8.9	8.7
9	Montréal	5.7	5.2	1.6	2.0	7.3	7.2
National CMA average		5.7	5.3	1.4	1.6	7.1	6.9
11	Toronto	4.8	5.2	1.0	1.4	5.8	6.7
14	Winnipeg	6.0	4.6	1.7	1.7	7.7	6.2
15	Calgary	5.4	4.7	1.3	1.5	6.7	6.2
27	Edmonton	5.1	3.7	1.1	1.0	6.2	4.7

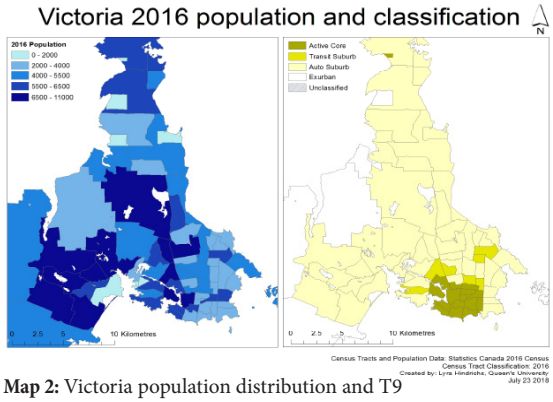
Figure 1: Walking and biking in The Journey to work across Canada. Data source: Statistics Canada

Classification

Map 1 shows the Victoria CMA classified using the T9 method. The Census Tracts classified as active core are highly clustered around Victoria's downtown sector (Map 2). This aligns very well with the Metropolitan center in the Victoria OCP as well as the visually identifiable areas as seen on Google Earth Street view.



Map 1: Victoria T9 classification, 2016



Map 2: Victoria population distribution and T9 classification

Using the Transportation Method 9 developed by the research team, there are two main ways to analyze the growth data, each of which will be further discussed. The CT classification changes over the years depending on the census data, and therefore the data can be examined by freezing the classifications as they were at 2006 or looking at them as they are most recently in 2016. A third option would be to examine the changes with 2006 data classified as it was in 2006 and 2016 data classified as it was in 2016. However, this method provides challenges as it provides no common ground for comparison due to the difference in CT classification, and therefore the growth numbers will be highly affected by classification changes.

2006 Classification Looking Forwards (Table 1)

By retrieving 2006 journey to work census data and classifying it using T9, we can examine the growth patterns according to the development as it progressed over the years. As seen in table 1, 16.2% of Victoria's growth was in the pre-existing active cores, but a 75.2% increase in the unsustainable auto suburbs. In this case however, the distribution of total population living in active cores actually decreased by 0.5% and increased by 1% in auto suburbs.

	Moving Forward -->		2016 CTDataMaker data using 2006 T9 classifications				
Victoria	**2006 Population**	**2006 Population (%)**	**2016 Population**	**2016 Population (%)**	**Population Growth 2006-2016**	**% Population Growth 2006-2016**	**% of Total Population Growth 2006-2016**
Active Core	70,775	21.4%	76,855	20.9%	6,080	8.6%	16.2%
Transit Suburb	29,579	9.0%	32,010	8.7%	2,431	8.2%	6.5%
Auto Suburb	216,273	65.5%	244,565	66.5%	28,292	13.1%	75.2%
Exurban	13,508	4.1%	14,340	3.9%	832	6.2%	2.2%
Total	**330,135**		**367,770**		**37,635**	**11.4%**	

Table 1: *2016 Classification in both 2006 and 2016*

2016 Classification Looking Back (Map 2 & Table 2)

By using the population values in 2016 classification, the story shows an even higher growth in active core areas, due to more CTs in 2016 being classified as active cores. This analysis shows that over the last 10 years, the population grew by 8.6% in the CTs that were active core in 2006 (Table 2), for an overall 10.3% growth rate in the active core CTs identified in the 2016 classification including the 2016 classifications (Table 2). This shows a successful densification and use of active transportation in more sectors, and the continued improvement of mix-use areas. An impressive 25.1% of Victoria's overall growth was in the sustainable active cores and transit suburbs, as compared to the national CMA average (15%). A total of 30.6% of the population lives in these sustainable CTs, which is over the CMA average of 26% and mid-sized city average of 20% (Figure 1). Victoria has out-done larger cities such as Toronto (27%) and is almost on par with Vancouver and Montreal at 31% (Gordon et al 2018).

Neighbourhood	GEOUID 2016	2016 Population	2011 Population	2006 Population	Population change 06-16	Population change % 06-16	Population Density per sqKm
Happy Valley	9350154.02	7,720	5,353	3,701	4,019	108.6%	565.8
Bear Mountain	9350151.03	10,030	8,791	6,245	3,785	60.6%	600.1
Langford Lake	9350151.02	9,363	7,803	6,336	3,027	47.8%	1465.3
Sooke	9350156.06	10,393	8,903	7,372	3,021	41.0%	424.3
Downtown	9350010.00	9,207	7,971	7,001	2,206	31.5%	4961.5
Mill Hill	9350151.04	8,229	7,281	6,177	2,052	33.2%	2529.4
Colwood & Braemar Height	9350154.01	9,277	8,647	7,478	1,799	24.1%	1049.2
Victoria West	9350011.00	7,669	6,806	6,023	1,646	27.3%	4758.3
Thetis Lake & View Royal	9350150.02	6,563	5,794	5,178	1,385	26.7%	526
Burnside	9350012.00	5,368	5,277	4,873	1,295	27.7%	3532

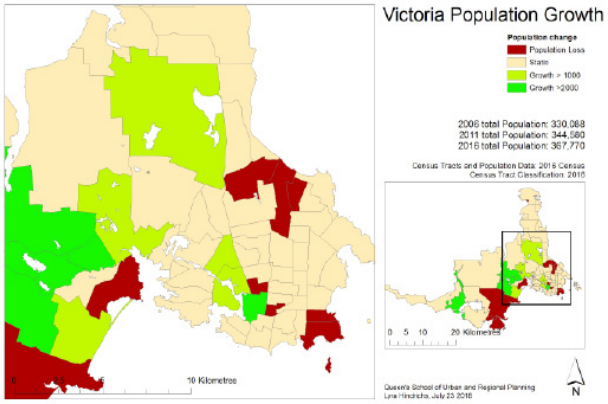
Neighbourhood	GEOUID 2016	Total Dwelling Units 2016	Total DU 2006	Total DU change	Total DU change %	Occupied DU 2016	Occupied DU 2006	Occupied DU change	Occupied DU change %	Classification
Happy Valley	9350154.02	3041	1,475	1,566	106.2%	2916	1,381	1,535	111.2%	Auto Suburb
Bear Mountain	9350151.03	4243	2,486	1,757	70.7%	3897	2,337	1,560	66.8%	Auto Suburb
Langford Lake	9350151.02	4129	2,675	1,454	54.4%	3954	2,573	1,381	54.1%	Auto Suburb
Sooke	9350156.06	4306	2,979	1,327	44.5%	4045	2,825	1,220	43.2%	Auto Suburb
Downtown	9350010.00	6523	4,546	1,977	43.5%	5570	4,169	1,401	33.6%	Active Core
Mill Hill	9350151.04	3494	2,489	1,005	40.4%	3402	2,363	1,039	44.0%	Auto Suburb
Colwood & Braemar Height	9350154.01	3821	2,840	983	34.6%	3622	2,716	906	33.4%	Auto Suburb
Victoria West	9350011.00	4484	3,455	1,029	29.8%	4162	3,163	999	31.6%	Active Core
Thetis Lake & View Royal	9350150.02	2505	1,934	571	29.5%	2428	1,834	594	32.4%	Auto Suburb
Burnside	9350012.00	3195	2,726	469	17.2%	3049	2,584	465	18.0%	Active Core

Table 2: *Top 10 Growth Census Tracts*

Population Change (Map 3, Table 3 & 4)

The 2018 CRD growth strategy has predicted the greatest growth areas from 2011 to 2038 to be Saanich, Colwood, Langford and Sooke (Table 3), aligning with the 2006-2016 results that show the largest growth areas (Table 2). However, most of these areas highlighted as large growth areas are classified as auto suburbs, presenting a concern for increase in suburban sprawl. As shown in Map 3, there are a few high growth CTs in the downtown area, but the majority are large CTs in the suburban and outlying communities. The greatest auto-suburban population growth areas are: Happy Valley (doubled from 3,701 to 7,720), Bear Mountain, Langford Lake, and Sooke inner city. The downtown core, Victoria West, and Burnside active core areas all have population growth over 1000. The census tracts with population decline (Table 4) did not surpass a loss of 100. The two active cores also had a small dwelling unit decline, while the

population loss in the other census tracts may be either maturing neighbourhoods with children leaving or family homes being converted to student housing.



Map 3: Population change in Victoria CMA 2006 – 2016

	2011			2038			Population Change	
	Population	Dwellings	Employment	Population	Dwellings	Employment	Total	Percentage
Core								
Esquimalt	16,600	8,300	11,100	18,300	9,500	12,200	1,700	10.2%
Oak Bay	18,200	8,000	7,300	15,300	8,400	7,200	-2,900	-15.9%
Saanich	112,100	46,600	42,300	128,600	56,300	55,500	16,500	14.7%
Victoria	82,400	44,400	76,400	99,500	56,500	84,100	17,100	20.8%
View Royal	9,600	4,100	4,800	15,000	6,700	5,900	5,400	56.3%
Total	*238,900*	*111,400*	*141,900*	*276,700*	*137,400*	*164,900*	*37,800*	*15.8%*
Saanich Peninsula								
Central Saanich	16,100	6,500	8,900	21,600	8,300	10,700	5,500	34.2%
North Saanich	11,100	4,400	5,300	13,800	6,000	6,600	2,700	24.3%
Sidney	11,200	5,200	6,100	11,900	6,600	7,600	700	6.3%
Total	*38,400*	*16,100*	*20,300*	*47,300*	*20,900*	*24,900*	*8,900*	*23.2%*
West Shore								
Colwood	16,600	6,100	4,000	31,100	12,200	6,800	14,500	87.3%
Highlands	2,100	800	400	2,600	1,000	2,300	500	23.8%
Juan de Fuca EA	4,400	1,900	800	6,200	2,700	1,100	1,800	40.9%
Langford	29,900	11,600	12,200	48,000	19,200	22,700	18,100	60.5%
Metchosin	4,900	1,800	1,400	5,200	2,200	6,500	300	6.1%
Sooke	11,700	4,500	2,700	24,700	9,300	3,300	13,000	111.1%
Total	*69,600*	*26,700*	*21,500*	*117,800*	*46,600*	*42,700*	*48,200*	*69.3%*
Totals	**346,900**	**154,200**	**183,700**	**441,800**	**204,900**	**232,500**	**94,900**	**27.4%**

Source: Urban Futures, 2014

Please note that First Nations populations are not included in Table 1, as First Nations Reserves are outside the GMPA.

Please note that projections were prepared using 2011 Census data. Implementation Measure I-6 identifies the need to update the projections using the most recent census data at the time of the first update to the 2018 Regional Growth Strategy.

Table 3: Population, dwelling unit, and employment trends, 2018 CRD Growth Strategy

Neighbourhood	GEOUID 2016	2016 Population	2011 Population	2006 Population	Population change 06-16	Population change % 06-16	Population Density per sqKm
Oak Bay	9350101.00	3,178	3,185	3,251	-73	-2.2%	3039.7
Oak Bay 5	9350100.00	3,908	3,902	3,981	-73	-1.8%	1559.3
Metchosin	9350155.04	4,708	4,803	4,779	-71	-1.5%	66.2
Hillside- Quadra	9350013.01	4,539	4,459	4,601	-62	-1.3%	5859.8
Harris Green & Fernwood	9350008.00	3,486	3,316	3,540	-54	-1.5%	7015.5
Cheanuh Marina	9350155.03	129	324	148	-19	-13.0%	49

Neighbourhood	GEOUID 2016	Total Dwelling Units 2016	Total DU 2006	Total DU change	Total DU change %	Occupied DU 2016	Occupied DU 2006	Occupied DU change	Occupied DU change %	Classification
Oak Bay	9350101.00	1835	1,833	2	0.1%	1728	1,718	10	0.6%	Auto Suburb
Oak Bay 5	9350100.00	1725	1,698	27	1.6%	1626	1,631	-5	-0.3%	Auto Suburb
Metchosin	9350155.04	1932	1,815	117	6.5%	1818	1,717	101	5.9%	Exurban
Hillside- Quadra	9350013.01	2337	2,412	-75	-3.1%	2224	2,296	-72	-3.1%	Active Core
Harris Green & Fernwood	9350008.00	2099	2,112	-13	-0.6%	2003	1,970	33	1.7%	Active Core
Cheanuh Marina	9350155.03	54	56	-2	-4.0%	43	53	-10	-19.2%	Exurban

Table 4: *Tracts with population decline*

Dwelling Units (Table 5 & 6)

If we look at the change in dwelling units, a slightly different story will be told (Table 5). It can be seen that there is a higher growth rate in active core dwelling units than with the population. On average, a dwelling unit in Victoria's active core houses 1.8 residents, while a dwelling unit in an auto suburb contains 2.4 persons (Table 6). Similarly, there is lower growth in the auto suburbs dwelling units. This can be understood when one considers the average number of persons living in a downtown apartment versus a suburban townhouse.

By calculating population / occupied dwelling units, we can determine the average persons per dwelling unit in each type of classification (Table 6).

Since there is a higher average population per unit in auto suburbs and exurban areas, it can be realized that new units in these communities will have a higher demand for human services such as schools and health care. For every downtown apartment suite, 1.3 times the numbers will be moving into a new townhouse. Map 5 outlines the higher population associated with the dwelling units in the suburban regions. The dwelling unit map shows the highest concentration clustered around the City of Victoria, whereas the population map shows the greater spread of higher numbers throughout the CMA. Thus, when planning for human sustainability, it is best to focus on population numbers and not dwelling units.

Victoria	2006 Total Dwelling Units	2006 Total Dwelling Units (%)	2016 Total Dwelling Units	2016 Total Dwelling Units (%)	Total Dwelling Unit Growth 2006-2016	% Total Dwelling Unit Growth 2006-2016	% of Total Dwelling Unit Growth 2006-2016
Active Core	40,982	26.6%	45,212	26.2%	4,230	10.3%	22.8%
Transit Suburb	16,097	10.5%	16,945	9.8%	848	5.3%	4.6%
Auto Suburb	90,978	59.1%	103,828	60.2%	12,850	14.1%	69.3%
Exurban	5,953	3.9%	6,574	3.8%	621	10.4%	3.3%
Total	**154,010**		**172,559**		**18,549**	**12.0%**	

Table 5: 2016 classification used in both 2006 and 2016, Dwelling unit counts

Classification	Average number of persons per household
Active Core	1.8
Transit Suburb	2.2
Auto Suburb	2.4
Exurban	2.5

Table 6: persons per household ratio 2016

City of Victoria Versus Victoria Suburbs

When comparing the results of this report to the goals of the CRD Regional Growth Strategy (2018) and the Official Community Plan Annual Review (2016), there is questionable success. The Urban Containment Area outlined by the CRD contains not only the active cores and transit suburbs, but also the majority of the auto suburbs. The goals of achieving 95% of new dwelling units within the Urban Containment Policy Area by 2038 is well on track with and 96.7% of growth in active cores, transit suburbs and auto suburbs in 2016 (Table 7). However, when looking at the City's OCP, the municipal boundaries only include the inner core of the CMA. By breaking down our results into 'City of Victoria' and 'Victoria suburbs', we can compare the growth patterns. By comparing with the municipal OCP boundaries, the City of Victoria was determined to be CTs 001.00 to 014.02. The growth within the city was 7,734 new residents, 95.5% of which was sustainable (Table 8) in active cores and transit suburbs. In the suburbs however, only 7.0% of the 29,901 population growth was sustainable (Table 7) in comparison to Vancouver's suburbs at 16.7% sustainable growth (Table 9). Similarly, the dwelling unit growth in the city was 97.6% sustainable (Table 10), but only 5.4% sustainable in the suburbs (Table 11). The OCP Annual Review outlining that at least 70% of journey to work trips by Victoria residents take place by walking, cycling and public transit by 2041. The 2016 Victoria City public transit use was 14.3% and active transit use was 34.4%, totaling 48.7% (Table 12). So, the City of Victoria is only 22% under the its ambitious 2041 goal.

Victoria Suburbs	2006 Population	2006 Population (%)	2016 Population	2016 Population (%)	Population Growth 2006-2016	% Population Growth 2006-2016	% of Total Population Growth 2006-2016
Active Core	109	0.0%	94	0.0%	-15	-13.6%	0.0%
Transit Suburb	28,753	11.4%	30,841	10.9%	2,088	7.3%	7.0%
Auto Suburb	209,447	83.1%	236,371	83.8%	26,924	12.9%	90.0%
Exurban	13,769	5.5%	14,672	5.2%	903	6.6%	3.0%
Total	**252,077**		**281,978**		**29,901**	**11.9%**	

Table 7: 2016 T9 classification, population growth in Victoria Suburbs

Victoria City	2006 Population	2006 Population (%)	2016 Population	2016 Population (%)	Population Growth 2006-2016	% Population Growth 2006-2016	% of Total Population Growth 2006-2016
Active Core	70,038	89.7%	77,275	90.1%	7,237	10.3%	93.6%
Transit Suburb	4,462	5.7%	4,610	5.4%	148	3.3%	1.9%
Auto Suburb	3,557	4.6%	3,907	4.6%	350	9.8%	4.5%
Exurban	0	0.0%		0.0%	0	0.0%	0.0%
Total	**78,057**		**85,792**		**7,735**	**9.9%**	

Table 8: *2016 T9 classification, population growth in Victoria City*

City of Vancouver	2006 Population		2016 Population		2006-2016 Population Growth		Share of Population Growth
Active Core	269,015	46.6%	310,311	49.0%	41,296	15.4%	73.9%
Transit Suburb	181,113	31.4%	193,382	30.5%	12,269	6.8%	22.0%
Auto Suburb	127,119	22.0%	129,445	20.4%	2,326	1.8%	4.2%
Exurban	-	-	-	-	-	-	-
Total	**577,247**		**633,138**		**55,891**	**9.7%**	

Vancouver Suburbs	2006 Population		2016 Population		2006-2016 Population Growth		Share of Population Growth
Active Core	66,913	4.4%	86,765	4.7%	19,852	29.7%	6.7%
Transit Suburb	140,539	9.2%	169,923	9.3%	29,384	20.9%	10.0%
Auto Suburb	1,279,416	83.3%	1,514,074	82.7%	234,658	18.3%	79.6%
Exurban	47,757	3.1%	58,658	3.2%	10,901	22.8%	3.7%
Total	**1,535,553**		**1,830,293**		**294,740**	**19.2%**	

Table 9: *Vancouver population growth inner city and suburbs, 2016 T9 classification, Gordon et al 2018*

Victoria City	2006 Total Dwelling Units	2006 Total Dwelling Units (%)	2016 Total Dwelling Units	2016 Total Dwelling Units (%)	Total Dwelling Unit Growth 2006-2016	% Total Dwelling Unit Growth 2006-2016	% of Total Dwelling Unit Growth 2006-2016
Active Core	40,936	91.4%	45,172	91.8%	4,236	10.3%	95.6%
Transit Subu	2,080	4.6%	2,168	4.4%	88	4.2%	2.0%
Auto Suburb	1,767	3.9%	1,872	3.8%	105	5.9%	2.4%
Exurban	0	0.0%	0	0.0%	0	0.0%	0.0%
Total	**44,783**		**49,212**		**4,429**	**9.9%**	

Table 10: *2016 T9 classification, dwelling unit growth in Victoria City*

Victoria Suburbs	2006 Total Dwelling Units	2006 Total Dwelling Units (%)	2016 Total Dwelling Units	2016 Total Dwelling Units (%)	Total Dwelling Unit Growth 2006-2016	% Total Dwelling Unit Growth 2006-2016	% of Total Dwelling Unit Growth 2006-2016
Active Core	46	0.0%	40	0.0%	-6	-13.1%	0.0%
Transit Suburb	14,017	12.8%	14,777	12.0%	760	5.4%	5.4%
Auto Suburb	89,211	81.7%	101,956	82.7%	12,745	14.3%	90.3%
Exurban	5,953	5.5%	6,574	5.3%	621	10.4%	4.4%
Total	**109,227**		**123,347**		**14,120**	**12.9%**	

Table 11: *2016 T9 classification, dwelling unit growth in Victoria Suburbs*

	Total commuters	Active transportation users	Active transit %	Public Transit users	Public transit %
Victoria City	42,965	14,800	34.4%	6,145	14.3%
Victoria Suburbs	127,895	14,085	11.0%	12,470	9.8%
total	170,860	28,885	16.9%	18,615	10.9%

Table 12: *Active transit and public transit use, city and suburbs, 2016*

CONCLUSION

Although the City of Victoria is growing in the sustainable active cores and transit suburbs, if the metropolitan area is to reach its sustainability objectives it must also focus on building more sustainable suburban regions. The CRD can be happy that it is meeting its goal of having 95% of new dwelling units within the Urban Containment Policy Area, but unfortunately 74.6% of the total dwelling unit growth (Table 5) is in unsustainable auto suburbs and exurban areas. The suburban areas outside of the City of Victoria account for 76% of total dwelling unit growth from 2006-2016, containing 3.3 times the population as the city (Table 7 & 8). Within the suburban area, only 5.4% of dwelling unit growth (Table 11) is in the sustainable transit suburbs. Sidney and Sooke are examples of suburban towns that must be developed in a less auto-dependent manner if the region's sustainability objectives are to be met during future periods of suburban growth. If the current trends of continue, the Victoria CMA will become less sustainable and more suburban.

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