A Pilot Study of Sprawl Repair Potential in Kingston, Ontario
Jeremy Johnston, 2013

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Queen’s University
Kingston, Ontario
Canada
Executive Summary

OVERVIEW

Retrofitting the suburbs into places that are more sustainable, accessible, and livable is considered by many to be the biggest challenge of the next century (Dunham Jones, 2011). New books are continually adding methods and case studies to a growing body of literature focused on tackling this massive task. The result of these projects are urbanized town centres with places to live, work and play, better transit, and more resilient local economies (Dunham Jones, 2011).

The objective of this report is to analyze the redevelopment, or retrofit potential of three study areas in Kingston, Ontario: the Riocan Centre, the Frontenac Mall, and the Kingston Centre. All three areas are along major arterial roads in Kingston and present qualities such as struggling retail, massive parking lots, or vacant land, which make them possible candidates for retrofit projects.

METHOD

By using Geographic Information Systems (GIS), this research is able to take fairly simple physical analysis and apply it easily to many (in this case three) large areas. The value of this tool is it’s potential for widespread application as a way to identify potential areas for redevelopment priority. This analysis tests the physical factors in each study area that contribute to, or reduce, the possibility of a retrofit project.

This study examines “urban tissues” to make judgments about each study area. Urban tissue refers to the pattern of streets and buildings in an area. Different patterns, or tissues, can dramatically change how an area feels to the person within it. For instance, a suburban neighbourhood has winding streets and spread-out houses, while a downtown in a city generally has straight streets and closely-spaced tall buildings. These differences have impacts on the likelihood of any area to experience change. The likelihood of change is being measured as retrofit potential.

Figure 1: The Study Areas

The images above are of the large commercial properties at the centre of the three study areas. There are similar aspects of each of these study areas, such as expansive surface parking lots, that make them potential targets for retrofit. The purpose of this study is to identify which study area has the most potential.
This study identifies three different types of urban tissue for analysis: Campus tissue, Elastic tissue, and Static tissue. Campus tissue is found where a single large property is owned by a single organization. Typical examples of Campus tissue include University campuses, big box retail outlets, and industrial lands. Elastic tissue is made up of smaller properties with single buildings, usually along an arterial road. Strip malls and commercial streets are examples of Elastic tissue. Static tissue is a collection of small properties with small buildings, typical of a residential neighbourhood. Static tissue, elastic tissue, and campus tissue have increasing potential for change in the same order. Potential for large scale retrofit projects (or change) is measured by comparing these three different types of urban tissues within each study area. Using theories from Scheer (2002), this will determine which study area may be more easy to retrofit on a large scale.

Strengths and weaknesses (connectivity, accessibility, density, diversity, and parking) for smaller-scale retrofits are analyzed using adapted methods from Emily Talen (2011). By using a standard sized circle for each study area, the quantitative results can be directed compared to one another. After analyzing each study area on a variety of characteristics, recommendations are made for prioritizing improvements to these areas.

RECOMMENDATIONS

The analysis reveals that while all three study areas present some opportunities for large scale retrofit, the Riocan Centre Study Area has the most potential. Recommendations for each study area are described below. These recommendations target the features in each study area that are considered to be the best opportunities, or the features that are most direly needed. Tables 1 through 3 describe the results for each study area in more detail.

Riocan Centre Study Area

Recommendation 1: Identify the Riocan Centre Study Area as a priority area for a large-scale retrofit project.

This study area scored highest on the Scale of Retrofit Score. This is a result of a combination of factors including that it had the most Campus tissue (very likely to change) of all three study areas, the least Static tissue (not likely to change), as well as having large lots with low lot coverage. This makes it the best candidate for a large scale retrofit project according to this measure. It is therefore recommended that this area be identified as a priority area for future redevelopment. This may be achieved when creating policies guiding areas for future development in the City of Kingston. Table 1 on the following page gives an explanation of the individual results for the Riocan Centre Study Area.
Executive Summary

Frontenac Mall Study Area

Recommendation 1: Improve connectivity by adding new streets and intersections.

Connectivity was low in this study area. This is likely a result of nature of a suburban road network. As a smaller scale intervention, connectivity should be improved to better accommodate nearby neighbourhoods and to improve internal movement. Suggestions for these improvements include adding connections between the mall property, Bath Road, and the neighbourhoods to the north and south-east.

Recommendation 2: Increase residential and employment density and diversity by adding new buildings on underutilized parking.

Density and diversity were considered low when comparing these values against targets for intensification corridors in the Places to Grow Act. With a large amount of parking in this study area, there is opportunity to increase density and diversity by using some of this parking for infill development. Table 2 details the individual results of this study area.

Recommendation 3: Consider this area for a large scale retrofit development site.

This area scored fairly high on the Scale of Retrofit Score due to the presence of Campus and Elastic tissues. The large Frontenac Mall property is a major source of this redevelopment potential. It is therefore recommended that this study area be considered for priority when considering areas for future growth within the City.

Table 1: Riocan Centre Study Area results

| Scale of Retrofit Score (out of 10): 7.56 | Highest scoring for large-scale retrofit
| Street Centreline Length: 7840 metres | Due to large lots with little coverage, typical of large-format retail developments
| Intersections per hectare: 0.09 | Lowest street centreline length
| | Due to suburban arterial road system and super-block structure
| Accessibility: 393 residential parcels | Lowest intersection density
| | Fewest residential parcels
| | Largely commercial and light industrial uses
| Diversity: 4.46 | Lowest diversity score
| | Residential units mostly single-family and duplexes, with a few apartment buildings
| Density: 33 people and jobs per hectare | Lowest density score
| | Mostly large-format retail which have low employment densities
| | Very few residents
| Parking: 34% | Most abundant parking of all three study areas
| | Significant infill opportunity

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Kingston Centre Study Area

Recommendation 1: Consider the central part of this area for a small scale retrofit project.

While this study area scored lowest on Scale of Retrofit Score, the strengths and weaknesses surrounding the central properties suggest that it has the potential for a smaller-scale retrofit focusing on improving connections to surrounding areas and increasing density to improve its functionality as a focal point and transit hub in Kingston. It is therefore recommended that this study area be a priority for future development near the core of the City.

Kingston Centre Study Area Recommendation 2: Create urban blocks to increase connectivity.

This area scored well on connectivity, but there are areas where improved connectivity could be beneficial. Adding new roads through the central area will improve access for people, cars and transit. The current entrances restrict access to the study area to the detriment of connectivity. New streets should first be created to connect surrounding neighbourhood streets directly to the area.

Kingston Centre Study Area Recommendation 3: Increase density by adding new buildings for residential and employment uses.

While this area scored highest of the three on density, it is still considered low density for its function as both a focal point in Kingston and a transit hub. Increasing density would support transit and commercial operations in the area. New buildings should frame streets, giving spatial definition and improving the pedestrian environment in the area.
CONCLUSIONS, LIMITATIONS, AND FUTURE WORK

The value of this study is to expand the understanding of the type of urban form that holds the greatest potential for redevelopment. This study uses urban design principles to make judgments about the appropriateness of redevelopment in three study areas. As such, it does not presume to estimate the financial feasibility or political importance of these developments. Future work could expand this tool to be applicable on a city-wide scale. This could be employed to identify sites for redevelopment consideration with a possible implication for development policy. The flaw in this tool is that it leaves out other important factors in the redevelopment process such as consideration the age of buildings, performing financial feasibility studies, and examining environmental factors. Therefore as a future step in the identification of possible redevelopment sites, methods to analyze these missing pieces should be explored.
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Chapter 1: Introduction

Sustainability is a term likely heard on a daily basis in every planning department across North America. For planners, sustainability usually means working to create cities that are more walkable, transit friendly, and economically resilient. One of the best places to look to make these changes are developments that already exist, but that have potential to be improved. This report is a pilot study of a method to identify sites that have the greatest potential for redevelopment. This report examines and evaluates the potential for sprawl repair, or retrofit, of three Study Areas in Kingston, Ontario. This concept is divided into two main categories: potential for large-scale retrofit, and strengths and weaknesses to target in smaller-scale retrofits. Evaluation occurs through Geographical Information Systems (GIS) analysis, which allows a simple physical analysis to be performed quickly over larger areas. This will highlight features for improvement in the study areas, as well as provide a better understanding of the types of places that can make good large-scale retrofit projects when using the lens of urban form.

THE PROBLEM

As a result of city-growth and the increasing prevalence of mega-retail, North America is littered with dead or dying malls and big box stores (Christensen, 2008). Also known as greyfields, these sites are often in prime suburban locations but have been left behind and ignored as their ability to generate earnings per square foot have diminished (Dunham Jones and Williamson, 2011). These sites typically take the form of single large buildings surrounded by expansive parking lots. Kingston, Ontario, like many other municipalities, has a few greyfield sites, one of which has been featured as a case study for greyfield redevelopment (CMHC, 2012).

With the realization of a not-so-cheap energy future comes the realization that we need to change the way cities grow (Kuntsler, 2009). Cities are beginning to understand this, and while they may not all refer to it as sprawl repair or retrofit, greyfield sites are increasingly being targeted for redevelopment to accommodate growth (Murray and Khor, 2011). This topic has been discussed in the recent books Retrofitting Suburbia, by Ellen Dunham Jones’, and Sprawl Repair Manual, by Galina Tachieva. These authors argue that by making targeted design changes to these specific types of places, designers and planners can raise the functionality of the suburbs into pedestrian friendly, community-oriented, sustainable places.
A SOLUTION
Successful retrofit projects have been taking place across North America for the past two decades in places like Don Mills in Toronto, Surrey City Centre in British Columbia, and Boulder, Colorado, to name a very few (Dunham Jones, 2005). The large amount of land available - usually from the oversized parking lots - makes these sites easier to redevelop than others, and thus a prime target for this type of project. The advantage of a retrofit, rather than creating a new development somewhere else, is that the sites are often in well-located areas near existing residential neighbourhoods, making them prime for redevelopment as new town centres (Dunham-Jones and Williamson 2011). They often contain good access for automobiles as they are usually commercial centres along arterial roads, however connections to nearby neighbourhoods may be poor. As retail areas, they are typically used for shopping and eating out.

The goal of a retrofit project is to capitalize on existing strengths and weaknesses and to create places that have a greater mix of uses. With a mix of uses there is a draw for different types of people during different times of the day, creating a more vibrant place. After a retrofit, these sites should be better connected to nearby neighbourhoods, the outside community, as well as internally, allowing pedestrian movement rather than requiring a car to move from store to store or between buildings. Parking should no longer be the primary feature of the landscape, but should be rationalized into structures, on-street parking, and behind buildings where it doesn’t interfere with pedestrians and the relationship between buildings and the street. Buildings frame streets, providing the possibility of active street life, rather than standing alone in large parking lots. With these types of changes, these places can take on a new role as fully functioning town centres, neighbourhood focal points, or commercial nodes, depending on the context.

RESEARCH QUESTION
The goal of this report is to examine three study areas in Kingston, Ontario for their potential for retrofit. This potential is measured in two different ways. The first is by examining urban tissue and determining the best choice of the three study areas for a large-scale retrofit project. This analysis will answer the research question: “Which of the three study areas provides the best opportunity for a large-scale successful retrofit development according to urban design principles?”. The second method uses analysis of strengths and weaknesses for smaller-scale interventions. This stage will answer the question: “Which specific strengths and weaknesses of three greyfield study areas in Kingston should be targeted for retrofit?”
SCOPE OF WORK

This report focuses on three areas within Kingston that were chosen because they are suburban commercial developments which are typical choices for retrofit projects (Dunham Jones and Williamson 2011). The analysis is limited to physical features and basic measures of density and diversity. It therefore ignores important aspects such as financial feasibility for the sake of time and resource constraints. The value of analyzing urban form on its own is that it presents the opportunity to imagine ideal scenarios, which allows consideration of best case scenarios. It is intended to be the first step in what could be a larger process for retrofit site selection and analysis in Kingston, Ontario.

REPORT STRUCTURE

The following chapters are structured to provide an outline of the research process. Chapter 2 describes the reason for selection and the context of each study area. Chapter 3 details the methods used in analysis. Geographic Information Systems (GIS) were the primary data collection method, with data supplemented by the 2006 census, as well as digital photography obtained during site visits. Chapter 3 also provides a theoretical background for the criteria used in the two stages of analysis. Chapter 4 reports the results of the analysis in order of execution for each criteria discussed in Chapter 3. Chapter 5 presents key findings and recommendations based on the results of analysis in Chapter 4. Limitations, suggestions for future work, and closing statements follow these recommendations.
Chapter 2: Context

This Chapter briefly presents an explanation for the choice of Kingston, Ontario as the case study for this research. Following this is a description of the unique case for each study area and how it might fit the parameters for a retrofit project. The most prominent properties are highlighted here to demonstrate why each one is chosen; however, the study area will be an 800-metre circle drawn around the centre of these properties. The reason for this circle is described in detail in Chapter 3.

KINGSTON, ONTARIO

The City of Kingston was chosen as the larger study area because it contains features that the literature suggests are ripe for retrofit: failing malls, built form typical of suburban sprawl, and a policy direction that emphasizes sustainability (City of Kingston, 2010). Recent growth in Kingston has been clustered at east and western edges of the city, however the need to minimize this outward growth with density and changes in land use has been acknowledged in the Urban Growth Strategy (Kingston, City, 2004). Section 2.1 of the Kingston Official Plan calls for development of key areas where sustainable practices can be utilized as well as to foster transit, pedestrian activity, and accessibility for all residents (Kingston, City, 2011). The goals of retrofit projects serve these policies. Kingston is very accessible from a research perspective because Queen’s University is located there and it is the researcher’s home town. Kingston, as a mid-size Canadian municipality, also provides a new case to test a research method (described in Chapter 3) that was developed and first applied in Arizona in the United States. However this difference also provides a significant limitation to this research, which is discussed in the Limitations section of Chapter 3.

Riocan Centre

With the first construction completed in 1998, the Riocan Centre is the newest of the three study areas. The property consists of a large format (big box) retail development. This area was chosen because large format retail is a common target for retrofit in the literature (Dunham Jones and Williamson, 2011). The area has seen turnover of smaller tenants in the last few years, and steps have been taken to improve transit infrastructure in the area (Kingston, City, 2012). It is toward the western edge of the city on Gardiners Road, a commercial north-south arterial road. It is designated as Regional Commercial and Arterial Commercial in the Official Plan (Kingston, City, 2011). The immediate surroundings of the Riocan Centre consist of scattered commercial development, a vacant factory building to the east, light industrial areas to the west, and residential areas to the south-east.

Figure 2-1: The Riocan Centre is a large-format (big box) shopping centre in the east end of Kingston. These types of centres have been targeted in other retrofit projects. Image Source: Google Maps, 2013
**Frontenac Mall**

The Frontenac Mall was chosen as a study area because it has experienced turnover of anchor stores and currently has a high tenant vacancy rate (Riocan, 2012). The mall shows signs of age and the parking lot infrastructure is crumbling, both of which are juxtaposed against a large new residential development on a property adjacent to the mall. The study area is in the relative middle of the city on Bath Road, one of Kingston’s three main arterial roads. It is bordered on the north by a residential neighbourhood, another factor which may make it a good candidate for retrofit. To the south is a conservation area and federal penitentiary land. Bath Road stretches for another few kilometers to the west with scattered commercial developments before reaching the end of city limits. Schedule 3-1 of the Official Plan designates this area as Arterial Commercial and Institutional land uses (Kingston, City, 2011).

**Kingston Centre**

The Kingston Centre borders the core of the city to the east, and is at the convergence of three major arterial roads: Bath Road, Princess Street, and Sir John A. Macdonald Boulevard. Formerly an indoor mall, the study area is now comprised of large format retail development. The center of the study area also includes one of Kingston’s largest transit hubs. It is bordered on two sides by large residential neighbourhoods, and a future research and development area on the north-east side. This area contains District Commercial, Residential, Business Park Industrial, and General Industrial designations in the Official Plan (Kingston, City, 2011). The City of Kingston has also placed planning priority on Williamsville, a neighbourhood with a struggling commercial strip that ends at the Kingston Centre (Kingston, City, 2013). The surrounding neighbourhoods, existing uses, and nearby opportunities all make this study area a good option to examine more closely for its retrofit potential.
Chapter 3: Method

This Chapter describes the criteria used to evaluate three study areas in Kingston, Ontario. There are two different but complimentary tools that will be used to measure 1) potential scale of retrofit and 2) strengths and weaknesses specific to each study area. Strengths and weaknesses relate to different features that a retrofit may attempt to improve, while scale refers to the amount of land that could be easily retrofitted. A brief theoretical background will be provided for each criterion demonstrating its relevance to the potential opportunity for change in a study area. Both tools will use the same scale: an 800-metre circle will be drawn around each study area and only features inside the circle will be measured. The reason for this scale will be provided in the next section. Finally, this Chapter will describe the methods of data collection and summarize the limitations of the study to ensure research validity, generalizability, and reliability.

Urban Morphology

In order to follow the method of this study, it is first necessary to clarify an understanding of the study of urban morphology. Urban morphology is the study of the city as a human habitat and the components of that habitat (Moudon, 1997). Streets and buildings are two of the major components that shape the city. Streets and buildings together make different patterns in different parts of the city. For instance, a collection of large houses with front lawns on windy streets usually represents a suburban neighbourhood. That is in contrast to a city’s downtown, which typically has straight streets and buildings placed right along the street. These patterns of streets and buildings can be referred to as urban fabric or urban tissue (Scheer, 2007). A major component of this study is comparing different patterns, or tissues, within a study area.

Scales of Measurement

The study areas will be aggregated by circles with 800 metre radii. These 800 metre circles are a standard scale when considering transit-oriented developments (Schlossberg, 2004; Canepa, 2007), which are a significant part of sustainable development form literature (Cervero, 2011). 800 metres is often considered a reasonable walking distance, which makes it an ideal choice when designing more sustainable neighbourhoods where walking is emphasized as a mode of transportation (Tachieva, 2010). The advantage of using a circle rather than examining a single property is that it allows the consideration of surrounding assets and impediments that ultimately affect the success of a site.

Retrofit Criteria

Two sets of criteria are detailed below. The first include criteria intended to be a measure of the propensity of an area to receive large-scale retrofit. Using a tissue analysis, an estimation of relative permanence of urban form (discussed below) will determine which areas will have a tendency to persist, and which will be more prone to change. The second set includes criteria which measure different strengths and weaknesses
of each study area. These provide an opportunity to target specific weaknesses and benefit from existing strengths in the study areas. The purpose of this is to expedite the retrofit process by focusing on problem areas first.

**Scale of Retrofit Score Criteria**

Arman Tolentino (2011) used a method to catalogue and score sites on the scale of potential retrofit based on the presence of three different types of urban tissue. Using the works of Scheer (2001; 2002; 2007) as his main source, Tolentino scored sites on three features: Static Tissue, Campus Tissue, and Elastic Tissue. Because of their structure, these three patterns of urban form, or tissues, are recognized as having different propensities to change, or be redeveloped. Each tissue will be measured in relative proportion to the others. This will give an overall picture of each site as having more or less potential for large scale retrofit, with higher scores meaning more potential.

**Static tissue**

Static tissue, as Scheer describes it, forms a clear pattern of lots and form (Scheer, 2007). Lots are relatively small, and ownership is abundant and decentralized. Because static tissues usually make up neighbourhoods, there tends to be significant sense of ownership and resistance to change. This is often due to the fear of the effect any change may have on nearby property values. Neighbourhoods do not tend to change much over time. This makes static tissue the most permanent of the three types of urban tissues, and therefore it has low potential for retrofit (Scheer, 2010). If one area contains relatively more static tissue than the other two tissues, the site will score lower on Scale of Retrofit Score. There are precedents for retrofit in the face of static tissues, but these involve more costly buy-outs and present more challenges (Dunham Jones and Williamson, 2011).
Elastic tissue
Elastic tissue is typically found on suburban arterial roads in the form of scattered buildings and significant surface parking lots. Lot sizes tend to vary dramatically, and this has the effect of creating very disorganized places. Typical examples of Elastic tissue include strip-malls, small outlet shops and restaurants along suburban commercial corridors. Elastic tissue changes frequently. It has fewer owners, is often undergoing change, and generally doesn’t conform to a larger area plan, making it very flexible and highly conducive to retrofit (Scheer, 2007). A high proportion of Elastic tissue increases a Scale of Retrofit Score.

Campus tissue
Campus tissue is characterized by a large piece of land typically a single owner and multiple buildings all with a similar intent (i.e. a University campus). It generally has its own internal network of streets with only a few access points to surrounding roadways. Business parks, big-box malls, and hospitals can often be described as campus tissue. Campus tissue is regarded as the most conducive to retrofit due to single ownership, large lots, and low lot coverage (Scheer, 2010). A high proportion of Campus tissue will result in a higher Scale of Retrofit Score.

Strengths and Weaknesses Criteria
These criteria are borrowed from Emily Talen’s research on urban design and sustainability (Talen, 2009; Talen, 2011). They are also supported by Galina Tachieva’s method for redeveloping greyfield sites in the Sprawl Repair Manual. Each criterion speaks to a specific characteristic of urban design that is recognized to impact the sustainability of a site, which is one of the driving forces behind suburban retrofits (Dunham Jones and Williamson, 2011). Each criterion will be considered separately, so that specific problems can be targeted, providing a more efficient method for retrofitting the study areas.

Connectivity
This criterion includes the amount of physical connections to places by various modes of travel. This may be in the form of sidewalks, off-road pathways, roadways etc. More connectivity is part of more pedestrian friendly neighbourhood design because it provides more route choice to pedestrians (Talen, 2009). Connectivity is higher on grid-pattern streets typical in more urban areas and lower in suburbs where long blocks and cul-de-sacs are prevalent (Saelens, 2003). Lack of walkable block structure is a deficiency in Galina Tachieva’s Sprawl Repair Manual and is targeted for repair with the introduction of more connections and networked streets (Tachieva, 2011).
Connectivity will be measured by intersection density and street centerline length in each study area. More intersections allow more connections to surrounding areas, implying better connectivity for the site in general. The resulting logic is that a site with high connectivity will likely not need retrofit in the form of more connections to surrounding neighbourhoods. If a site scores low on connectivity, an important first step in retrofit may be to create new connections to surrounding areas to facilitate movement to and from the site. This measurement will be made using GIS for counting intersections, and measuring street centerline lengths.

**Accessibility**

Accessibility is a measure of how close the study area is to residential neighbourhoods. The closer a site is to neighbourhoods, the fewer people may rely on the automobile or public transit to get there. A site is more accessible to more people if it is closer to all people, including those who can’t afford a car or don’t use public transit. If a study area scores low on accessibility, the introduction of residences inside the study area may be an important step in retrofit. Accessibility will be measured by counting residential parcels within the 800m circle of the site.

**Density**

Density, in this case measured as people and jobs per hectare, is an important factor in sustainable developments (Talen, 2009). Increased density is correlated with increased walking and transit mode shares while it is negatively correlated with automobile mode share (Frank, 1994). One possible reason for this is that if there are more people and jobs in an area, there is more demand for amenities close by, leading to more walking trips. There is also more demand for transit, making more dense areas more transit supportive. There is a belief that certain densities are required to accommodate various levels of public transportation (Ottawa, City of, 2009. pp 72). Density will be measured as the amount of residents and employees in a standardized area. More density in this case is generally regarded as part of more sustainable development, and as such will be less of a priority for retrofit. P-Census will be used for residential density calculations, while standard employee per square feet calculations will be used for employment density.

**Diversity**

Diversity of land use is a long held indicator of resilient, pleasurable (Jacobs, 1961), and more sustainable development (Talen, 2011). This study specifically refers to diversity as the presence of different housing types. This creates a situation where there are different types of people in an area at different times of the day, contributing to what Jane Jacobs called the safety of having ‘eyes on the street’. Eyes on the street make places feel safer, and in doing so make them more pleasurable places to be throughout all hours.
of the day. Housing diversity implies a diversity of incomes, rather than homogeneous neighbourhoods. Single building type and use is a deficiency in Tachieva’s method for sprawl repair for similar reasons (Tachieva, 2010). Diversity will be measured by comparing the amount of each different housing type in each study area. The Simpson index of diversity will be used to turn measurements into diversity scores. This index was used by Emily Talen in her sustainability research involving diversity (Talen, 2011).

**Surface Parking Area**

This criterion measures the amount of available surface parking. This can be considered a weakness of the current form because abundant surface parking prioritizes automobile travel and creates an unpleasant pedestrian environment. It can also be considered a strength, however, because it provides opportunity for development without the added cost of removing existing buildings.

**DATA**

Two methods were used to gather information for this study: a literature review, and Geographical Information Systems (GIS) analysis. The information from the GIS analysis will be gathered into a chart where each study area will be scored on the relative size of possible retrofit. The value of GIS for this tool is described in a later section in this Chapter. The overall score of a study area for scale is calculated using a combination on average lot size, average lot coverage, which is multiplied by a weighted factor derived from the proportions of each of these tissues present. The underlying concept is that larger lot size and less lot coverage contribute to the possibility of larger scale retrofit. A sample scoring sheet with instructions on following the calculation are on the following page.
**The Scoring Sheet for Scale of Retrofit Score**

Table 3-1 shows a sample calculation for Scale of Retrofit Score from the original author of the method. The images at the top of the table separate the study area into the three types of tissue being compared. Each tissue is compared for its average lot size, lot coverage, and proportion of the study area, which is reported in the columns directly below the images. These measurements are then translated into scores in the lower portion of the table. Starting with the Static Tissue column, the table shows that the average lot size is 0.2 hectares. In the Average lot size row, this result fits in the 0 - 0.2 hectares category. The corresponding points award are 0.0 as highlighted in dark grey. Each result for each type of tissue is inputted into the table and points are awarded as appropriate. The area-weighted factor is applied as a multiplier that uses the proportion of each type of tissue to adjust each score accordingly. For instance static tissue covers 58% of the study area, so the multiplier is 0.58, which is rounded up to 0.6. All the results from each column are added together to give a total Scale of Retrofit Score.

<table>
<thead>
<tr>
<th>STATIC TISSUE</th>
<th>ELASTIC TISSUE</th>
<th>CAMPUS TISSUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Lot Size: 0.2 Hectares</td>
<td>Avg. Lot Size: 0.80 Hectares</td>
<td>Avg. Lot Size: 4.85 Hectares</td>
</tr>
<tr>
<td>Avg. Lot Coverage: 19%</td>
<td>Avg. Lot Coverage: 20%</td>
<td>Avg. Lot Coverage: 18.5%</td>
</tr>
<tr>
<td>Proportion of study area: 58%*</td>
<td>Proportion of study area: 10%</td>
<td>Proportion of study area: 22%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Score</th>
<th>Static 1.0</th>
<th>Elastic 2.0</th>
<th>Campus 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average lot size:</td>
<td>0 - 0.2 hectares 0.0</td>
<td>0 - 0.2 hectares 0.0</td>
<td>0 - 0.2 hectares 0.0</td>
</tr>
<tr>
<td>0.2 or more</td>
<td>1.0</td>
<td>0.2 - 0.4 hectares 1.0</td>
<td>0.2 - 0.4 hectares 1.0</td>
</tr>
<tr>
<td>4 or more</td>
<td>3.0</td>
<td>4 - 8 hectares 3.0</td>
<td>4 - 8 hectares 3.0</td>
</tr>
<tr>
<td>Average lot coverage:</td>
<td>50% or more 0.0</td>
<td>50% or more 0.0</td>
<td>50% or more 0.0</td>
</tr>
<tr>
<td>25 - 50%</td>
<td>1.0</td>
<td>25 - 50% 1.0</td>
<td>25 - 50% 1.0</td>
</tr>
<tr>
<td>0 - 25%</td>
<td>2.0</td>
<td>0 - 25% 2.0</td>
<td>0 - 25% 2.0</td>
</tr>
<tr>
<td>0 - 10%</td>
<td>3.0</td>
<td>0 - 10% 3.0</td>
<td>0 - 10% 3.0</td>
</tr>
<tr>
<td>Total Possible Points:</td>
<td>3.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Area-Weighted Factor:</td>
<td>X 0.6</td>
<td>X 0.1</td>
<td>X 0.2</td>
</tr>
<tr>
<td>Area Weighted Score:</td>
<td>1.7</td>
<td>0.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

*Note: The area-weighted factor is derived from the proportion of each type of tissue present on the study area.*

*Scale of Retrofit Score: 4.1*
Strengths and weaknesses will be then compared on a relative basis. Because of the standardized size of study area, strengths and weaknesses can be directly compared to one another. Recommendations will be made accordingly.

**Literature Review**

Research began with a literature review focused on the topic of urban morphology, characteristics of urban form, sustainable development, and suburban retrofits. The literature review primarily informed the method and criteria development stage of this research. Two specific studies, as mentioned earlier, provided the methods used in the analysis for this study.

**Geographic Information Systems**

GIS was used to measure characteristics of scale criteria including the size of each type of tissue, the size of lots, and lot coverage. It was used to measure characteristics of strengths and weaknesses including intersection density, street centerline length, etc. GIS data and map files were obtained with permission from the Queen’s Maps, Data & Government Information Centre. A competent urban designer could replicate the analysis done for one of these areas fairly easily by hand drawing and using expert judgment. However, the value of GIS as a tool in this research is that it makes this simple physical analysis possible to apply on a large scale over multiple areas using computers. This would be an essential tool to apply the method in this study over an entire city.

**Data Analysis**

Data analysis was performed in two ways. For scale criteria, data were entered into a chart used to calculate a score which relates to the potential for change within a study area. This potential for change is also referred to as large-scale retrofit potential. For strengths and weaknesses criteria, data were used as relative values to compare between each study area. Comparing quantitative data was possible because of the standardized size of each study area.

**Limitations**

One of the main limitations of this research is that it applies techniques used formerly in Atlanta, Georgia and Pheonix, Arizona to a very different municipality, Kingston, in southeast Ontario. These locations were chosen as case studies for the US context in their respective studies. This limitation is mitigated by the fact that sprawl is considered ubiquitous in North America and the nature of sprawl within North America is fairly consistent (Sorensen, Marcotullio, Grant, 2004 pp.11; Kuntsler, 1993; Duany, Plater-Zyberk, Speck, 2010). The effort to make measurements objective improves the reliability of the study reliability (Yin, 2009). This study may be adapted to other municipalities because the issue is pervasive and there are no components
that are unique to the broader study area of Kingston.

There are other relevant aspects of successful suburban retrofits that are not included in the scope of this research. One shortcoming is a lack of a financial analysis; this study does not account for financing, cost of land, remediation, or developer profiles. It also does not consider age of buildings, environmental factors, or market factors. These are important features of a redevelopment project, but due to time and resource constraints were not within the scope of this study. This study is intended to be an analysis of built form and land use, and is only one step in the process for successful redevelopment of these types of sites. There is value in the analysis in that it expands the understanding of the type of urban form that may require and may be conducive to redevelopment.
Chapter 4: Analysis

This chapter presents the findings from the GIS analysis of the three study areas. These results will be used to describe the presence or lack thereof of physical features that enhance the potential for retrofit of an area. This chapter is broken up into two sections; Scale of Retrofit Score, and strengths/weaknesses.

SCALE OF RETROFIT SCORE

The first stage of analysis was to use GIS to evaluate the scale of potential retrofit in each study area. This Tissue analysis compares proportions of Static, Elastic, and Campus Tissues. Each type of tissue has a different effect on the overall score based on how easy it is to retrofit, as discussed in Chapter 3. Scores fit on a scale of 1-10, with 10 being the most ideal scenario for large scale retrofit based upon Tolentino’s method. Each study area will be described separately. Results are organized into three main tables.

Table 4-1: Study Area 1: The Riocan Centre

<table>
<thead>
<tr>
<th>Tissue Type</th>
<th>Avg. Lot Size</th>
<th>Avg. Lot Coverage</th>
<th>Proportion of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATIC TISSUE</td>
<td>0.05 hectares</td>
<td>36%</td>
<td>9%</td>
</tr>
<tr>
<td>ELASTIC TISSUE</td>
<td>0.74 hectares</td>
<td>20%</td>
<td>43%</td>
</tr>
<tr>
<td>CAMPUS TISSUE</td>
<td>10.49 hectares</td>
<td>15%</td>
<td>48%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Score:</th>
<th>Static 1.0</th>
<th>Elastic 2.0</th>
<th>Campus 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average lot size:</td>
<td>0 - 0.2 hectares 0.0</td>
<td>0 - 0.2 hectares 0.0</td>
<td>0 - 0.2 hectares 0.0</td>
</tr>
<tr>
<td></td>
<td>0.2 or more 1.0</td>
<td>0.2 – 0.4 hectares 1.0</td>
<td>0.2 – 0.4 hectares 1.0</td>
</tr>
<tr>
<td></td>
<td>0.4 – 4 hectares 2.0</td>
<td>4 – 8 hectares 3.0</td>
<td>4 – 8 hectares 3.0</td>
</tr>
<tr>
<td></td>
<td>4 or more 3.0</td>
<td>8 or more 4.0</td>
<td>8 or more 4.0</td>
</tr>
<tr>
<td>Average lot coverage:</td>
<td>50% or more 0.0</td>
<td>50% or more 0.0</td>
<td>50% or more 0.0</td>
</tr>
<tr>
<td></td>
<td>25 – 50% 1.0</td>
<td>25 – 50% 1.0</td>
<td>25 – 50% 1.0</td>
</tr>
<tr>
<td></td>
<td>10 – 25% 2.0</td>
<td>10 – 25% 2.0</td>
<td>10 – 25% 2.0</td>
</tr>
<tr>
<td></td>
<td>0 – 10% 3.0</td>
<td>0 – 10% 3.0</td>
<td>0 – 10% 3.0</td>
</tr>
</tbody>
</table>

Total Possible Points: 20 60 100
Area-Weighted Factor: X 0.09 X 0.43 X 0.48
Area-Weighted Score: 0.18 2.58 4.8

Scale of Retrofit Score: 7.56
The Riocan Centre

Tissue analysis reveals that the Riocan Centre study area is made up largely of Campus (48%) and Elastic Tissues (43%) with very little Static Tissue (9%). The bulk of the Campus Tissue comes from the large format retail centre which is Riocan Centre itself, and the centre of the study area. Another large property, a former Nortel manufacturing centre, makes up a significant portion of the Campus Tissue in the study area. The average lot size for this type of Tissue is over 10 hectares. It is the nature of large format retail to provide vast amounts of surface parking for customers, and analysis confirms this with the average lot coverage of Campus Tissue being 15%. As Table 4-1 shows, large lot size combined with small lot coverage contributes to higher total scores.

The Elastic Tissue in this study area is composed of scattered smaller format retail developments including traditional strip style developments lining Bath Road, smaller commercial buildings, and some light industrial uses to the west. The average lot size of this type of Tissue is 0.74 hectares, significantly smaller than the Campus Tissue. Lot coverage is higher at 20%. Both of these results are consistent with the theory for identifying Elastic Tissue.

Small portions of residential neighbourhoods are included in the study area to the east, and this is the source of the Static Tissue proportion. Lot sizes are significantly smaller (0.05 hectares) and coverage is higher (36%). These features have a lowering effect on the overall score.

The total Scale of Retrofit Score for the Riocan Centre study area is high at 7.56 out of 10. This score is achieved by the large proportions of Campus and Elastic Tissue and relatively small proportion of Static Tissue. It is also a result of the large lot sizes and very low lot coverage of the Campus Tissue in the study area.

Above: Vast surface parking in the Riocan Centre is easy to develop and contributes to a higher Scale of Retrofit Score.
Table 4-2: Study Area 2: Frontenac Mall

<table>
<thead>
<tr>
<th>TISSUE Type</th>
<th>Avg. Lot Size:</th>
<th>Avg. Lot Coverage:</th>
<th>Proportion of Study Area:</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATIC TISSUE</td>
<td>0.05 hectares</td>
<td>29%</td>
<td>23%</td>
</tr>
<tr>
<td>ELASTIC TISSUE</td>
<td>1.24 hectares</td>
<td>13%</td>
<td>35%</td>
</tr>
<tr>
<td>CAMPUS TISSUE</td>
<td>18.49 hectares</td>
<td>11%</td>
<td>42%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Score:</th>
<th>Static 1.0</th>
<th>Elastic 2.0</th>
<th>Campus 3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average lot size:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - 0.2 hectares</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.2 or more</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>0.4 – 4 hectares</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4 or more</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Total Possible Points:</td>
<td>2.0</td>
<td>7.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Area-Weighted Factor:</td>
<td>X 0.23</td>
<td>X 0.35</td>
<td>X 0.42</td>
</tr>
<tr>
<td>Area-Weighted Score:</td>
<td>0.46</td>
<td>2.45</td>
<td>3.78</td>
</tr>
</tbody>
</table>

**Scale of Retrofit Score: 6.69**

**The Frontenac Mall**

The Frontenac Mall study area is made up of nearly even amounts of Elastic Tissue (35%), and Campus Tissue (42%) with a moderate amount of Static Tissue (23%). The majority of the Campus Tissue comes from the Frontenac Institution property in the south. This property is notably underdeveloped and because of its size also contributes to the low lot coverage of this study area. The other Campus

Above: The Frontenac Mall is one of three Campus Tissue type properties in this study area.
Tissue is the Frontenac Mall Property and retirement home north of the mall. Together these combine for an average lot size of 18.49 hectares, the largest of all three study areas. The average lot coverage is 11%, slightly lower than the Riocan Centre.

The Elastic Tissue in this study area has an average lot size of 1.24 hectares. This is larger than in the Riocan Centre study area, but still significantly lower than Campus Tissue lot size. Lot coverage is 13%, lower than the Riocan study area. This is likely due to the different nature of these properties which include car and boat dealerships, and lumber supply stores. These types of properties require more open space to store their inventory. Large lots with smaller lot coverage contribute to higher over scores.

There is a significant amount of Static Tissue (23%) in this study area from the neighbourhood to the north. Average lot size is .05 hectares which is the same as the Riocan Centre study area. Lot coverage is moderate at 29% which contributes to a lower overall score.

The large, undeveloped Frontenac Institution property and equally significant Campus and Elastic Tissue proportions yield a moderate-high Scale of Retrofit Score of 6.69 for the Frontenac Mall study area.
### Table 4-3: Study Area 3: Kingston Centre

<table>
<thead>
<tr>
<th>TISSUE</th>
<th>Avg. Lot Size</th>
<th>Avg. Lot Coverage</th>
<th>Proportion of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATIC TISSUE</td>
<td>0.07 hectares</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>ELASTIC TISSUE</td>
<td>0.58 hectares</td>
<td>20%</td>
<td>34%</td>
</tr>
<tr>
<td>CAMPUS TISSUE</td>
<td>7.78 hectares</td>
<td>11%</td>
<td>46%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Score</th>
<th>Static</th>
<th>Elastic</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average lot size</th>
<th>Static</th>
<th>Elastic</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.2 hectares</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.2 or more</td>
<td>1.0</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>0.4 – 4 hectares</td>
<td>0.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4 or more</td>
<td>3.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average lot coverage</th>
<th>Static</th>
<th>Elastic</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% or more</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>25 – 50%</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>10 – 25%</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>0 – 10%</td>
<td>3.0</td>
<td>0.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

| Total Possible Points | 3.0 | 6.0 | 8.0 |

<table>
<thead>
<tr>
<th>Area-Weighted Factor</th>
<th>Static</th>
<th>Elastic</th>
<th>Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.2</td>
<td>0.34</td>
<td>0.46</td>
</tr>
</tbody>
</table>

| Area-Weighted Score  | 0.6   | 2.04   | 3.68   |

Scale of Retrofit Score: 6.32

**The Kingston Centre**

The Kingston Centre study area contains a large amount of Campus Tissue (46%), with about a third Elastic Tissue (34%) and a moderate amount of Static Tissue (20%). There are several properties that have been classified as Campus Tissue in this study area including the major properties in the Kingston Centre commercial area, multiple primary and secondary schools, and the Innovation Park property north of Princess Street. Average lot size: 0 - 0.2 hectares 0.0 0 – 0.2 hectares 0.0 0.2 – 0.4 hectares 1.0 0.4 – 4 hectares 2.0 4 or more 3.0 4 – 8 hectares 3.0 8 or more 4.0

Above: Vast surface parking in the Kingston Centre is easy to develop and contributes to a higher Scale of Retrofit Score.
sizes in the Campus Tissue are slightly larger than the Frontenac Mall at nearly 8 hectares. Average lot coverage is smaller than the other study areas at 11%, and this is likely due to a large vacant parcel north of Princess Street, as well as the undeveloped Innovation Park property. This property is currently going through the site plan process for future development.

There is abundant Elastic Tissue scattered around the study area along the arterial roads. The lots are smaller (0.58 hectares) than in the other two study areas. This is likely due to the proximity of this study area to the more urban City core, where lot sizes are typically much smaller. Lot coverage is higher (20%) as a result of the smaller lot sizes. Elastic Tissue here is made up of apartment and office buildings, as well as strip malls and individual commercial buildings.

There is a significant amount of Static Tissue (20%) which is made up of a combination of multiple single family neighbourhoods surrounding the study area. Average lot size of these properties is slightly higher than in the other study areas which is likely due to the presence of older, larger traditional suburban lots.

Campus and Elastic Tissue combine to account for 80% of the study area. This gives the Kingston Centre a moderate-high Scale of Retrofit Score of 6.32.

**Summary of Scale of Retrofit Score Analysis**

The three study areas achieved Scale of Retrofit Scores of 7.56 (Riocan Centre), 6.69 (Frontenac Mall), and 6.32 (Kingston Centre). All of these scores are considered moderate to high, implying that each study area has potential for large scale retrofit. In all cases, this is due to the presence of suburban commercial developments. The form of these developments leave room for intensification and change, due to their relatively underdeveloped built form and oversupplied parking space.

While all have potential for retrofit, the Riocan Centre study area stands out as having the most potential for retrofit. The Riocan Centre has almost no Static Tissue - single family neighbourhoods - present, which means there are fewer obstacles to change. The large format retail and former industrial property are large Campus Tissues which have significant potential for retrofit. Abundant parking and low lot coverage...
Retrofit Strengths and Weaknesses

The second phase of retrofit analysis is to examine the strengths and weaknesses of each study area. In contrast to the section on Scale of Retrofit Score, this section will report results by characteristic across all three study areas, rather than by study area.

Connectivity

Connectivity is the first feature of this phase of analysis. As discussed in Chapter 3, the goal of better connectivity is to ensure people have multiple ways to navigate to a place by any mode of travel. This is a feature that suburban retrofits attempt to create. Connectivity is broken down into two distinct parts: street centreline length, and intersection density. Street centreline length is a measure of the total length of street in each study area. It does not include private right of ways such as parking lot lanes.
Riocan Centre

Figure 4-2 shows streets in black. It is easy to observe that the public street networks differ greatly between the study areas. The Riocan Centre has a large block structure with one arterial street, Gardiner's Road, running north-south. Another arterial, Taylor-Kidd Boulevard, runs east-west and partially crosses through the study area. Other than these two, there are few streets within this study area. Collector streets provide access to the commercial areas to the west. These large blocks are designed to ensure smooth flow of automobile traffic along these streets; however, pedestrians are left with few route choices and large right of ways to cross. A small portion of the neighbourhood street network to the west is included in the study area.

Kingston Centre

With three arterial roads, the Kingston Centre has approximately twice as much length of road as the other two study areas (See Figure 4-3). The street network around the main Kingston Centre properties is similar to the Riocan Centre, with large right of ways and long blocks. This study area includes significant portions of residential neighbourhoods which account for large street lengths. The neighbourhood to the southeast has a more traditional grid-style network which has more streets than suburban style neighbourhoods. Shorter blocks and narrower right-of-ways improve the pedestrian realm here by offering route choice and more pleasant conditions.

Frontenac Mall

The Frontenac Mall has slightly more road length than the Riocan Centre (Figure 4-4). Most of this comes from the two arterial streets; Bath Road (east-west) and Centennial Drive (north-south). These are high speed arterial roads with very few options for pedestrian route choice. The neighbourhood in the north has a suburban style street network with culs-de-sac and ring roads. This minimizes through traffic for residents but increases traffic and speed on arterial and collector streets. Route choice for pedestrians is also impeded by this type of street network.
Street Centreline Length Implications for Retrofit

Each study area has multiple types of street network within them and different types of street network between them. The Kingston Centre, with the most street length currently, provides more options for pedestrians than the other two study areas. For this reason, a retrofit of the Kingston Centre would require less in the way of introduction of new streets. The opposite is true for the remaining two study areas. The Riocan Centre would benefit from the introduction of new streets to decrease block length, reduce speed, and increase route choice for all road users. The Frontenac Mall also requires more connectivity in the form of more streets. The suburban neighbourhood in this study area provides an opportunity to improve its street network by introducing connecting streets between culs-de-sac and curved streets. The fourth image is a figure ground drawing of the area around a regional mall, Villa Italia in Lakewood, Colorado. The street length in this study area is approximately 11000 metres, not largely different from the Kingston study areas. Below it is a planned retrofit development of the Villa Italia site. The redevelopment is already underway with many new streets and buildings already created. The new area is called Belmar and contains a significantly more consistent grid and has close to twice as much street length. This redevelop demonstrates the possibly of achieving a more urban street network surrounding a commercial focal point that will support pedestrians and cyclists, as well as transit and private automobiles.
Intersection density measures the number of intersections in each of the study area. This provides a measure of the formal connections for pedestrians and automobiles throughout an area.

**Riocan Centre**

The Riocan Centre has very few intersections. Similar to the road network in this study area, the lack of intersections is intentional to improve vehicular traffic flow. The result is very few connection points which has a negative impact on other travelers, such as pedestrians and cyclists. The intersection density is 0.09 intersections per hectare.

**Kingston Centre**

The road network in the Kingston Centre study area provides a higher intersection density (0.23 intersections per hectare) than the Riocan Centre. The majority of these intersections come from the grid network in the southeast; however, the arterials also have more frequent intersections than in the Riocan Centre study area. The network provides many options for route choice in the southern portion of the study area; however, this decreases toward the centre where the arterial roads still prioritize traffic flow over route choice.

**The Frontenac Mall**

The Frontenac Mall falls in the middle at 0.15 intersections per hectare. These intersections are almost entirely located in the neighbourhood to the north. Bath Road only has two intersections as it passes through the study area. Of all the arterial streets in all three study areas, this portion of Bath Road has the fewest intersections. As a result, automobile traffic flow on this road is smooth and fast, but the pedestrian traveler must walk long distances alongside high speed automobiles with almost no options to take a different route. The cyclist is also placed uncomfortably close to high speed traffic. Speeds on Bath Road are largely over the speed limit of 60 km/hr.
**Intersection Density Implications for Retrofit**

All three study areas suffer from lack of intersections in their centres. This fact increases their impermeability via all modes of transportation. The Kingston Centre and Frontenac Mall study areas contain neighbourhoods that have higher intersection density allowing for more route choice and slower automobile travel speeds; however, they also have arterial roads with fewer intersections. A retrofit of the Riocan Centre study area would likely include a significant increase in intersection density to spread traffic over more streets and increase route choice for pedestrians. The two images of the Villa Italia and projected retrofit project, Belmar, in Lakewood Colorado demonstrate the increase in intersections as a result of retrofit. In 1975, intersection density of the Villa Italia area was 0.18 intersections per hectare, falling in the same range as the Kingston study areas. The planned redevelopment achieves an estimated 0.35 intersections per hectare, just under twice the amount of intersections than previously. Notably, the centre of the development has some of the highest intersection density. This maximizes route choice, disperses traffic, and creates a more pleasant experience for pedestrians.
Accessibility & Diversity

Accessibility is a count of the number of residential parcels within each study area. This is a measure of access based on proximity. Diversity is a measure of the proportions of different types of housing within each study area. More diversity generally means more income levels and more mixed demographics. Theory predicts that diversity (also may be referred to as mixed-tenure) is important for community well being as well as contributing to overall sense of community in an area (Kleit, 2005).

**Riocan Centre**

The Riocan Centre study area contains 393 residential parcels. These parcels are part of larger neighbourhoods adjacent to the study area. They are mainly single-family and attached units with the exception of an apartment tower (approximately 100+ units) in the south and the nursing home in the southeast. This lack of diversity of housing types gives the Riocan Centre study area a Diversity Index of 4.46. The area is mainly commercial and light industrial and would not currently be a very attractive place for residences. The neighbourhood to the east is separated by a railroad, however there is a informal dirt path across a field, showing the interest in pedestrian access by these nearby residents. A future retrofit would seek to increase the number of residential parcels as well as increase the diversity of housing types in this area.

**Kingston Centre**

There are 606 residential parcels in the Kingston Centre study area. The center commercial area is almost entirely surrounded by residential neighbourhoods or pockets. There are a variety of different types of residential units including low and mid-rise apartments, single-family homes, attached units, and multiple-attached units. This diversity of housing type yields a Diversity Index of 23.17. The Kingston Centre is clearly more diverse and residentially concentrated than the Riocan Centre. This is largely due to the growth of neighbourhoods over time around the area and the high concentration of apartment buildings all resulting from typical 1960s and 1970s planning. Retrofitting the Kingston Centre would require little in the way of increased diversity or accessible residences when compared with the Riocan Centre.
Frontenac Mall

The Frontenac Mall study area contains the most residential parcels with 617. It is, however, less diverse in housing type than the Kingston Centre. Most of the residential parcels are single-family and attached units, with two clusters of mid-rise apartment buildings. The Diversity Index of this study area is 10.85, lower than the Kingston Centre but higher than the Riocan Centre. Some low-rise apartments are clustered adjacent to the Frontenac Mall providing good access to these residents. A new building is also being built immediately adjacent to the mall’s east edge. The Frontenac Mall has good access in terms of nearby residences; however, a railroad running east-west cuts off the nearest residences, forcing them to access points further from their front doors.

Accessibility and Diversity Implications for Retrofit

The study areas differ dramatically in their amount of accessibility and diversity. The Kingston Centre, the most diverse of the study areas in terms of housing type, would not require an increase in diversity for retrofit. More of the same would be diverse in this case. The Riocan Centre, on the other hand, would benefit from a significant increase in the types of housing, and the proximity of residences to the study area. An increase in residences within the study area would contribute to a more lively public realm and to the creation of a proper town centre. Increasing diversity in this case would bring in more income levels and options for different types of people and demographics. The Riocan Centre and Frontenac Mall both have a significant barrier, an east-west railroad, that flaws this measure of accessibility. Residential parcels on
the inside of this barrier are nil in both cases, and this is where it would be more important to increase the number of residences to avoid increasing the number of people who must overcome this barrier to access the services these places provide.

**Density**

Density is a measure of people and jobs per hectare in each study area. Desirable density depends on the type of area that is being considered. All three study areas are along commercial corridors that could be compared to “intensification corridors” as outlined in the Places to Grow objectives for the Greater Toronto Area. Planned and completed case study projects from Places to Grow for intensification corridors all have well over 100 people and jobs per hectare.

**Riocan Centre**

The Riocan Centre has very few residents within the study area (less than 1/ha). This is expected as there are few residential parcels in the study area. Employment density, on the other hand, is highest of all three study areas (21/ha). This also is not surprising since most of the study area is commercial and light industrial in nature. This study area has a total gross density of 22 people and jobs per hectare. Retrofit of the Riocan Centre would likely include a significant increase in residents. Office space has more employees per square metre and could be used to increase employment density.

**Kingston Centre**

Multiple neighbourhoods and apartment clusters give the Kingston Centre many more residents (30/ha) than the Riocan Centre or Frontenac Mall. It has fewer employees (7/ha), as more space is devoted to residential uses. This study area has a total gross density of 37 people and jobs per hectare. The Kingston Centre would benefit from increased employment density and in fact this is already being planned with the redevelopment of the Innovation Park property.

**Frontenac Mall**

The Frontenac Mall has a more balanced density with nearly equal numbers employees and residents. (See Figure 4-16) The neighbourhood and apartment clusters are balanced by the commercial uses as well as the employees of Frontenac Institution. This number may be overestimated because of vacancy in the

---

**Figure 4-16:** Study areas in comparison: Gross Density*

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Population Density</th>
<th>Employment Density</th>
<th>People and jobs per ha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Riocan Centre</strong></td>
<td>less than 1/ha</td>
<td>32/ha</td>
<td>33</td>
</tr>
<tr>
<td><strong>Kingston Centre</strong></td>
<td>30/ha</td>
<td>26/ha</td>
<td>56</td>
</tr>
<tr>
<td><strong>Frontenac Mall</strong></td>
<td>14/ha</td>
<td>23/ha</td>
<td>37</td>
</tr>
</tbody>
</table>

Frontenac Mall. This study area has a total density of 27 people and jobs per hectare.

**Density Implications for Retrofit**

The highest density of all three study areas is in the Kingston Centre with 46 people and jobs per hectare. The Riocan Centre is the lowest with 22 people and jobs per hectare. Density is too low in all three study areas to achieve the type of urban, lively places that have been objectives for retrofits elsewhere. These densities are all lower than the minimum required density for greenfield developments in the Places to Grow plan, and given that they are within the built area of Kingston, this is too low. All three study areas would therefore require significant intensification and resulting increase in employment and residents.

**Parking**

The amount of parking (excluding private driveways) in each study area is reported below. This gives a measure of infill opportunity. Parking lots are often oversupplied in large format retail situations and can be consolidated.

*Riocan Centre*

The Riocan Centre has vast amounts of parking space mostly as a result of the large format retail strip along Gardiner’s Road and the abandoned lot in the northeast. It has the most of all the study areas at 34% of its area totaling approximately 68 hectares of parking. This is an immense opportunity for infill development. It also provides more flexibility in the type of infill. For instance there are patches of vacant land large enough to be transformed into large public plazas, or community centres.

*Kingston Centre*

This study area has the second largest proportion of parking. The majority of this is located in the central Kingston Centre properties where large format retail is located. Approximately 44 hectares, or 22% of this study area is utilized for surface parking. Of the three study areas, the Kingston Centre parking lot was most full during site observation. With so many residences in close proximity, a full parking lot may be a sign of the need for better pedestrian connectivity to these residences.
**Frontenac Mall**

The Frontenac Mall has the least amount of surface parking. This is due to the low proportion of Campus Tissue which is the main source of surface parking in the other study areas. The Frontenac Mall property has a large parking lot which is very underutilized as a result of the struggling mall. Lack of parking is a weakness in this study area because it means there is less available land for easy redevelopment.

*Figure 4-19:*
Frontenac Mall
Parking space: 13%

There are observable trends between the amount of Campus Tissue and the amount of excess parking space in the three study areas. The Riocan Centre, with the most Campus Tissue, has significantly more excess surface parking than the other two study areas. The Frontenac Mall, with far less Campus Tissue, also has much less parking space. Dispersed and exposed (surface) parking provides opportunities for consolidation of those spaces, infill development or re-greening where appropriate.

*Figure 4-20: Study areas in comparison: Parking Supply*
Summary of Analysis and Overall Implications for Retrofit

<table>
<thead>
<tr>
<th></th>
<th>Riocan Centre</th>
<th>Kingston Centre</th>
<th>Frontenac Mall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale of Retrofit Score</td>
<td>7.56</td>
<td>6.32</td>
<td>6.69</td>
</tr>
<tr>
<td>Street Centreline Length</td>
<td>7840</td>
<td>16227</td>
<td>8987</td>
</tr>
<tr>
<td>Intersection Density</td>
<td>0.09/ha</td>
<td>0.23/ha</td>
<td>0.15/ha</td>
</tr>
<tr>
<td>Accessibility</td>
<td>393</td>
<td>606</td>
<td>617</td>
</tr>
<tr>
<td>Diversity</td>
<td>4.46</td>
<td>23.17</td>
<td>10.85</td>
</tr>
<tr>
<td>Density (People and jobs per hectare)</td>
<td>33</td>
<td>56</td>
<td>37</td>
</tr>
<tr>
<td>Parking</td>
<td>34%</td>
<td>22%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Table 4-4: Summary of Analysis Results

Riocan Centre
The Riocan Centre study area has the most potential for large scale retrofit. This is due to the high proportion of Campus Tissue present, and this has implications for the strengths and weaknesses of this study area as well. Connectivity is poor as a result of super-block development that is symptomatic of large format retail and pervasive Campus Tissue. Accessibility, diversity, and density are also lowest in this study area because it is mostly a commercial and light industrial district. It is clear that this area was designed for efficient flow of automobile traffic and its weaknesses stem from this design choice. Ample parking is considered a strength as it provides real opportunity and flexibility for infill development.

Kingston Centre
This study area is the most urban of the three. It does not have as much potential for large scale retrofit as the other two study areas, primarily because it is already more urban in nature and it contains multiple neighbourhoods which leads to fragmented ownership. It has strengths in its accessibility, diversity, and density, which are all highest in this study area. This result is not surprising given its proximity to neighbourhoods and the City core. Surface parking is moderate and provides some opportunity for infill, particularly in the Kingston Centre properties in the center of the study area. The Kingston Centre provides a good opportunity for small improvements in areas such as connectivity, as well as infill, specifically in the major properties in the center and north-east portions of the study area. This study area has the most strengths, and is considered the most advanced in regard to the goals of retrofit. It would require therefore smaller scale, more focused interventions.
**Frontenac Mall**

The Frontenac Mall study area has moderate-high potential for large scale retrofit. This is a result of the large single family neighbourhood and lack of Campus Tissue in this study area. Its weaknesses include a severe lack of connectivity, diversity, and density. It also has the least amount of easily developable land in the form of surface parking. This study area drastically needs improved connectivity and has an opportunity for infill on the major surface parking lot at the Frontenac Mall property. Its major strength is the presence of residential parcels near commercial areas, however this proximity is misleading because of the railroad which creates a significant barrier in terms of connectivity for many of these parcels. Intervention here would need to be significant.
Chapter 5: Key Findings, Recommendations, Conclusion

This chapter will use the results of the analysis to make recommendations concerning the potential retrofit of the three study areas. Key findings from the analysis will be presented first, in the same order as they appeared in the Analysis. Recommendations then are made for each study area.

KEY FINDINGS

### Table 5-1: Riocan Centre Study Area

| Scale of Retrofit Score (out of 10): **7.56** | • Highest scoring for large-scale retrofit  
|                                                | • Due to large lots with little coverage, typical of large-format retail developments |
| Street Centreline Length: **7840 metres**      | • Lowest street centreline length  
|                                                | • Due to suburban arterial road system and super-block structure  
|                                                | • Railway creates permanent barrier between centre of study area and adjacent residential developments |
| Intersections per hectare: **0.09**            | • Lowest intersection density |
| Accessibility: **393** residential parcels     | • Fewest residential parcels  
|                                                | • Largely commercial and light industrial uses  
|                                                | • Residential parcels are separated by a railway |
| Diversity: **4.46**                            | • Lowest diversity score  
|                                                | • Residential units are mostly single-family and duplexes, with a few apartment buildings |
| Density: **33** people and jobs per hectare    | • Lowest density score  
|                                                | • Mostly large-format retail which have low employment densities  
|                                                | • Very few residents |
| Parking: **34%**                               | • Most abundant parking of all three study areas  
|                                                | • Significant infill opportunity |

### Table 5-2: Frontenac Mall Study Area

| Scale of Retrofit Score (out of 10): **6.69** | • Middle scoring for large-scale retrofit |
| Street Centreline Length: **8987 metres**    | • Middle street centreline length  
|                                                | • Suburban arterial road system  
|                                                | • Local streets in neighbourhood  
|                                                | • Railway creates permanent barrier between neighbourhood and commercial centre |
| Intersections per hectare: **0.16**           | • Middle intersection density |
| Accessibility: **617** residential parcels    | • Most residential parcels  
|                                                | • Significant residential neighbourhood |
| Diversity: **10.85**                          | • Middle diversity score  
|                                                | • Single family, multi-units, and apartment buildings |
| Density: **37** people and jobs per hectare   | • Middle density score |
| Parking: **13%**                               | • Smallest proportion of parking space  
|                                                | • Large parking lot at the Frontenac Mall provides infill opportunity |
Summary of Key Findings

The tables above demonstrate a degree of similarity between the three study areas. Each study area scored relatively high (above 6 out of 10 possible points) on Scale of Retrofit Score. Campus and/or elastic tissue is pervasive in every study area which presents opportunities for larger scale and easier retrofit projects. All three study areas have poor connectivity on both measures. In all cases this is due to their location along suburban arterial roads which tend to have few intersections and even fewer connections to local streets. Even the Kingston Centre study area, which is nearest to the urban downtown core of Kingston, suffers from suburban style arterial roads with very few entrances to large blocks. Accessibility and density are less consistent but are all still considered low when compared with more urban developments and successful retrofit projects. The starkest differences appeared in diversity, with the Kingston Centre study containing exponentially more diverse housing types than the other study areas. The Kingston Centre study area also presented the most existing strengths across almost all measures. The consistency of the analysis is a result of the broadly similar suburban fabric in these study areas.

RECOMMENDATIONS

The results of analysis provide the opportunity to make recommendations for the City of Kingston as it makes decisions in the future regarding the growth of the City. Recommendations are made by study area. Preparing detailed development schemes was beyond the scope of this study, but examples of schemes are included to illustrate the recommendations. The order of recommendations may be taken as a priority scheme, with later recommendations being contingent on earlier ones in some cases. Due to the similarity in some results there is overlap in the recommendations.

Table 5-3: Kingston Centre Study Area

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale of Retrofit Score (out of 10): 6.32</td>
<td>Lowest scoring for large-scale retrofit</td>
</tr>
<tr>
<td></td>
<td>Due to large proportion of fragmented land, and small amounts of Elastic Tissue</td>
</tr>
<tr>
<td>Street Centreline Length: 16227 metres</td>
<td>Highest street centreline length</td>
</tr>
<tr>
<td></td>
<td>Three major arterial roads</td>
</tr>
<tr>
<td></td>
<td>Many local neighbourhood streets, some existing gridded street network</td>
</tr>
<tr>
<td>Intersections per hectare: 0.23</td>
<td>Highest intersection density</td>
</tr>
<tr>
<td></td>
<td>Intersections lacking on arterial roads preventing good connectivity to commercial centre</td>
</tr>
<tr>
<td>Accessibility: 606 residential parcels</td>
<td>Three mixed-housing neighbourhoods within study area</td>
</tr>
<tr>
<td>Diversity: 23.17</td>
<td>Highest diversity score</td>
</tr>
<tr>
<td></td>
<td>Many single family homes, duplexes, multi-unit buildings, and larger apartment buildings</td>
</tr>
<tr>
<td>Density: 56 people and jobs per hectare</td>
<td>Highest density score</td>
</tr>
<tr>
<td></td>
<td>Mix of office and different retail types</td>
</tr>
<tr>
<td></td>
<td>Residents from large neighbourhoods</td>
</tr>
<tr>
<td>Parking: 22%</td>
<td>Significant infill opportunity mainly on central property</td>
</tr>
</tbody>
</table>
**Riocan Centre Study Area**

**Recommendation #1**

Identify the Riocan Centre Study Area as a priority area for a large-scale retrofit project.

Of the three study areas, the Riocan Centre Study Area provides the most opportunity for a large-scale retrofit project. The outcome of this intervention would be to transform a single-use, commercial into a complete community/town centre which would be a commercial, residential and employment focal point in the west end of Kingston. New buildings could be introduced in between existing buildings and to frame new streets. This would be particularly useful on the larger properties that have a high degree of parking lot coverage and create barriers to connectivity as a result. New uses would create balanced density (workers and residents) and support new types of civic activities. Adding new streets and intersections between existing thoroughfares could improve area-wide connectivity and create a more urban, walkable block structure. The series of images to the right show a theoretical retrofit example in an area with form similar to that of the Riocan Centre Study Area. This conclusion is based on urban design considerations, and therefore it is recommended that this study area be identified as a priority area for consideration for future growth within the City of Kingston. The mechanism for implementation of this recommendation could be to introduce priority areas for growth in new policies that guide future development in Kingston. This type of policy would include a schedule of the various high scoring areas that would be subject to further investigation for the best choices. Future study would be required for a more complete picture of priority areas and this is discussed in a later section in this Chapter. This recommendation provides the urban design case for this study area to be included in further study.

*Image 5-1: A section of the Riocan Centre Study Area*

*Image 5-2: Dominant parking lots in a similar shopping centre context. (Image source: (Tachieva, 2011, pp. 114)*

*Image 5-3: New roads and buildings improve connectivity and density, transforming the area comparable to the Riocan Centre Study Area into a town centre. (Image source: (Tachieva, 2011, pp. 114)*
**Frontenac Mall Study Area**

**Recommendation #1**

Improve connectivity by adding new streets and intersections.

The Frontenac Mall Study Area scored low on connectivity measures (Image 5-4). The most notable absence of connections is between existing neighbourhoods and the mall property. A new connection across the railroad north of the mall would support pedestrians and the utility of the mall. There are only two entrances to the mall which require an unnecessarily long trip for pedestrians and cyclists traveling along Bath Road. Stronger connections across Bath Road in the eastern portion of the study area would improve the pedestrian environment for nearby residents who don’t have the option to drive as well as those who may choose to walk if better connections existed. Internal streets would improve crossing the mall property and could provide more direct access between commercial areas within the center of the study area (Image 5-5). The images below demonstrate a desirable theoretical retrofit to a commercial strip similar in form to the Frontenac Mall Study Area. New streets create new connections for existing residents and demonstrate the possibility for new development on unused or underused land (See Recommendation #2).
Recommendation #2

Increase residential and employment density and diversity by adding new buildings on underutilized parking.

This Recommendation targets the strength of the large underutilized parking lot adjacent to the Frontenac Mall and the weakness of low density in this study area. This is a smaller scale intervention. The parking lot on the Frontenac Mall property provides a significant opportunity for infill development (See Images 5-7 and 5-8). Without changing the existing building, new residential and commercial development would increase density (See Image 5-9). A development is currently under construction just east of the mall that will improve the residential density of the study area. More density helps to create more demand for amenities for surrounding residents and would improve this area’s function as a commercial district. Adding new residential buildings would also serve to increase the diversity of housing type in the area, effectively achieving two outcomes with the same intervention. Recommendation #1 and #2 are complimentary because if done properly, infill development can capitalize on increased connectivity by framing new streets.

Image 5-7: The Frontenac Mall property and adjacent land. Image Source: Google Maps

Image 5-8: Underutilized parking surrounding a shopping mall. Image source: (Tachieva, 2011, pp. 141)

Image 5-9: Consolidating parking lots creates room for infill around the mall. Image source: (Tachieva, 2011, pp. 141)
Recommendation #3

Consider this study area as a possible large scale retrofit development site.

Recommendations #1 and #2 target specific strengths and weaknesses in specific areas, however another option would be a larger scale retrofit project. It is located along a major arterial road which provides good access, and it benefits from having more accessibility than the Riocan Centre Study Area with its larger existing residential population. A significant portion of the developable land is south of Bath Road. This land would be key to creating a well centered focal point on the major Frontenac Mall property. Development on this land would require more connections crossing Bath Road, as it would otherwise be a significant barrier between the new areas. Without the property south of Bath Road, smaller scale infill projects would be more appropriate (See Recommendation #1 and #2). The outcome of this retrofit would be to create a node of development along the Bath Road corridor. This node would support transit as well as achieving goals of increased density and more sustainable development. The series of images to the right show a theoretical retrofit of an area similar in form to the Frontenac Mall Study Area. The scattered properties along the corridor are rationalized into a node. As with the Riocan Centre Study Area, this recommendation is for consideration should future work be done for identifying the best sites in Kingston for a project of this scale.

Image 5-10: The Frontenac Mall Study Area

Image 5-11: This theoretical image has similar issues to the Frontenac Mall Study Area: poor connectivity, low density with some nearby residents, and significant open space to develop. Image source: (Tachieva, 2011, pp. 155). Image has been altered from its original state to better resemble Frontenac Mall Study Area conditions

Image 5-12: Retrofit could extend development to the south and improve area-wide connectivity. The existing commercial properties become the centre of the node. Image source: (Tachieva, 2011, pp. 155)
Kingston Centre Study Area

Recommendation #1

Consider the central part of this area for a small scale retrofit project.

While this study area scored lowest on Scale of Retrofit Score, the strengths and weaknesses surrounding the central properties suggest that it has the potential for a smaller-scale retrofit focusing on improving connections to surrounding areas and increasing density to improve its functionality as a focal point and transit hub in Kingston. It is therefore recommended that this study area be a priority for future development near the core of the City. This area is considered the best option for a successful retrofit at a smaller scale because of its existing strengths, including the large residential neighbourhoods surrounding it. The most fit place for retrofit in this study area is the triangle of Campus Tissue bound by Sir John A. Macdonald Boulevard, Bath Road, and Princess Street. A major redevelopment of this large piece of land could transform this area into a focal point within the Kingston community as well as improve its utility for nearby residents. The series of images to the right demonstrate a retrofit of a theoretical area very similar in form to the Kingston Centre. This redevelopment would see the creation of an internal street network that connected external streets and improved pedestrian access. Infill in the form of new residential and commercial buildings would increase density, diversity, and accessibility. This would also support the current transit hub located here. The two main components of this retrofit are detailed in Recommendation #2 and #3.

Image 5-13: The Kingston Centre and adjacent properties. Image source: Google Maps

Image 5-13: A theoretical commercial area similar to the Kingston Centre. Image source: (Tachieva, 2011, pp. 115)

Image 5-14: Retrofit of the area in Image 5-13 shows new buildings, streets and uses creating a focal point at the intersection of major arterial roads. Image source: (Tachieva, 2011, pp. 115)
**Recommendation #2**

Create urban blocks to increase connectivity.

Connectivity in this study area was highest of all three, however, there are improvements to be made. The center triangle formed by the three arterial roads is very inaccessible by pedestrians and automobile traffic as entrances to the large block are few, illogical, and often unidirectional (See image 5-15). Adding streets and intersections to divide this land into smaller urban blocks would improve route choice for all users, as well as make the area easier to navigate. These new streets should align with existing neighbourhood streets to maximize direct connections for existing residents. The series of images to the right demonstrate what a good retrofit could achieve in terms of improved connectivity. Formerly large blocks are split up into more urban scale blocks, and a clear centre is created. Local streets are given direct connections to thoroughfares. This introduces improved connectivity for those residents and alternate routes for local traffic.
Recommendation #3

Increase density by adding new buildings for residential and employment uses.

While this study area has the highest density of the three, comparison with projects from the Places to Grow plan reveals it may still be low for its position along commercial corridors. There is ample space for development in vacant land and oversupplied parking that could significantly increase density (See Image 5-18). The largest opportunity exists in the Kingston Centre properties, and the Innovation Park property north of Princess. Innovation Park is already being considered for development, however no plan exists for the Kingston Centre properties. This Recommendation provides the opportunity to compliment Recommendation #2 with new buildings being of more urban nature along internal and arterial roads to urbanize the landscape (See Image 5-20). This would frame streets, increase density and diversity, reduce surface parking, and if designed properly, could delineate a focal point for this area of Kingston. The series of images to the right show the outcome of this type of infill development in a theoretical area similar in form to the Kingston Centre Study Area. The retrofitted area has a clear centre, more diversity of building types, increased density, and a more legible street network.

Image 5-18: A section of the Kingston Centre Study Area

Image 5-19: A theoretical commercial area similar to the Kingston Centre. Image source: (Tachieva, 2011, pp. 117)

Image 5-20: Retrofit of the area in Image 5-19 shows new buildings on former parking lots. Image source: (Tachieva, 2011, pp. 117)
CONCLUSIONS

Three study areas were examined for their potential for large-scale retrofit and for specific strengths and weaknesses to target in smaller interventions. Revisiting the research question “Which of the three study areas provides the best opportunity for a large-scale successful retrofit development according strictly to urban design principles?”, the study area that presented that best opportunity for large-scale retrofit was the Riocan Centre Study Area. Analysis demonstrated that with a large amount of Campus Tissue, and large lots and low lot coverage, the Riocan Centre Study Area provides the most amount of land with potential for change. Table 5-4 shows the results of the analysis. This result is significant because it demonstrates the types of urban form that have the greatest potential for retrofit. The shortcoming of this result is that the Riocan Centre Study Area also presented the most weaknesses, meaning that there may be conflicting factors that would influence the success of such a retrofit. These missing measurements are a flaw of the tool that has been applied. The power of the tool is its ability to quickly identify patterns of development that hold potential for retrofit. The further study of these identified areas would be required to get a more complete picture of an area’s potential, however that was not within the scope of the tool and is discussed in the Future Research section of this Chapter.

The research question “Which specific strengths and weaknesses of three greyfield study areas in Kingston should be targeted for retrofit?” has a few answers. Connectivity and density were the most obvious shortcomings in each study area, a result that is not surprising given their suburban nature. However, different strengths provide different opportunities, and subsequently different recommendations for each area. In the Riocan Centre Study Area, overwhelming weaknesses suggest that a large-scale project

<table>
<thead>
<tr>
<th>Large-scale retrofit</th>
<th>Riocan Centre Study Area</th>
<th>Kingston Centre Study Area</th>
<th>Frontenac Mall Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths and weaknesses</td>
<td>Scale of Retrofit Score</td>
<td>7.56</td>
<td>6.32</td>
</tr>
<tr>
<td>Street Centreline Length</td>
<td>7840</td>
<td>16227</td>
<td>8987</td>
</tr>
<tr>
<td>Intersection Density</td>
<td>0.09/ha</td>
<td>0.23/ha</td>
<td>0.15/ha</td>
</tr>
<tr>
<td>Accessibility (residential parcels)</td>
<td>393</td>
<td>606</td>
<td>617</td>
</tr>
<tr>
<td>Housing Diversity (larger is more diverse)</td>
<td>4.46</td>
<td>23.17</td>
<td>10.85</td>
</tr>
<tr>
<td>Gross Density (people and jobs per hectare)</td>
<td>33</td>
<td>56</td>
<td>37</td>
</tr>
<tr>
<td>Surface Parking Area as percentage of whole</td>
<td>34%</td>
<td>22%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Table 5-4: Research questions answered. Results that were targeted in recommendations are in bold, however in many cases a recommendation would impact more than one criteria (i.e. increasing density would also increase accessibility and diversity if done properly). The standardized size of the study areas allows these results to be directly comparable with each other.
may be the best approach to improvement, supporting the answer from the first research question. In the Frontenac Mall Study Area, connectivity between existing neighbourhoods and density were the major shortcomings. This area also presents a unique opportunity for large-scale retrofit that relies on the possibility of acquiring land south of Bath Road, which would alter the function of Bath Road significantly. The Kingston Centre Study Area presented the best opportunity for a smaller-scale retrofit project that would take advantage of its existing strengths. The main weaknesses in this study area were connectivity and density, but existing strengths including accessibility, diversity, and surface parking lots suggest that the central property could be a target for a retrofit. The value of these results is that they begin to identify specific areas for intervention when considering a retrofit project. They also provide some insight into which areas may be better candidates for retrofit projects when moving beyond the Scale of Retrofit Score. For instance, the Riocan Centre Study Area was identified as the study area with the greatest potential for redevelopment, however, with substantial weaknesses, this area may not actually be a good candidate for a successful retrofit project. The strengths and weaknesses tools are useful as next steps in the process of choosing sites for redevelopment projects.

**Future Research and Implications for the City of Kingston**

Analysis of retrofit potential as conducted in this study seeks to expand the understanding of the types of urban form that hold the greatest potential for redevelopment. The method in this pilot study could be applied to an entire city to catalogue and rank sites based on the criteria presented. The value of a GIS based analysis is its scale of application as GIS would allow this type of analysis to be done by computers across an entire city. By applying this method city-wide, planners would be able to create a strategy to address these types of properties and adopt policy to guide redevelopment toward the best sites. The strategy could be implemented through policy documents such as the Official Plan or the Urban Growth Strategy. While the Scale of Retrofit tool quickly identifies areas with potential, the strengths and weaknesses tools used in this study are examples of the kinds of further study required to identify the best and most practical sites for redevelopment. Future research should attempt to resolve some of the limitations of this research discussed in Chapter 3. For instance, adding an age of building criterion to the strengths and weaknesses criteria would give a better indication of the preferable choice for redevelopment.

More analysis at the regional scale would help to prioritize sites that are appropriate for different types of evolutions (i.e. town centre, corridor node, or neighbourhood centre). Future steps would include analyzing site feasibility including assessing leasing structure of major properties, financial feasibility studies, acquisition strategies, lobbying provincial governments, and phasing strategies. The end goal of this process would be to create a strategy for the redevelopment of greyfield sites to help contain sprawl and create more sustainable cities.
References


