

GET MOVING TO SCHOOL

Comparing Influences on the Potential for Active
School Travel in Four School Neighbourhoods
in a Large Urban Centre in Western Canada

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Regional Planning in partial fulfillment of the requirements for
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ABSTRACT

As physical activity among youth declines, various conditions, including overweight, obesity, and related health concerns like diabetes, have become more common among children and adolescents. As a purposeful activity, active school travel (AST) is thought to conveniently provide children with many benefits, including decreasing their chances of developing health problems as adults. Yet, rates of AST in Canada are declining.

Numerous factors that influence AST have been identified for various demographic groups and locations. While distance from home to school is presented as the most influential factor in the prevalence of AST, other individual, community, and environmental characteristics also encourage or restrict youth engagement in, and influence parents' and youths' perceptions of, AST. This study looked at potential influences of features from the built environment and characteristics of neighbourhood socioeconomic status, and compared the presence of absence of these factors with estimated rates of AST in four elementary schools in Calgary, Alberta.

The study captured information through three methods: 1) neighbourhood socio-demographic analyses, 2) built environment observations, and 3) key informant interviews. Findings from the three sources of data showed that rates of AST ranged dramatically between almost 0% to 90%. The lower-income, lower-connectivity school had consistently high rates of AST (90%), and the lower-income, higher-connectivity school and the higher-income, lower-connectivity school had consistently low rates throughout the year (25% and 0-10% respectively). The higher-income, higher-connectivity school, however, had varying rates between seasons (60-90%), although the range of rates was still considered high. Features that appeared to be important in influencing AST included: proximity to streets with higher volumes and speeds of traffic; connectivity of the street network; median household income of the neighbourhood; parent education levels; presence of greenspace; availability of school AST programs; and dominant dwelling types or mixtures.

The findings from this study suggest that neighbourhood-level socioeconomic status (SES) and built environment characteristics do influence the potential for AST, but that it is important to distinguish context-specific features (e.g. proximity to major roads) within these broader categories to fully understand the influence on rates of AST. Given the diversity of neighbourhood characteristics at each school and the range of factors influencing rates of AST, recommendations focused on providing a comprehensive strategy for each individual school, as well as broader recommendations for decision-makers both in planning and at the school board. Ultimately, stronger and more consistent collaboration is needed between municipal officials and the school board, and both bodies must commit to filling the gaps in available information that is necessary for those trying to foster engagement in AST.

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1. INTRODUCTION

“Fewer than half of all children in Canada and the United States are active enough to experience the well-known health benefits of physical activity”

Larsen et al., 2009, p. 520

Numerous recent studies have shown that overweight, obesity, and related health concerns are becoming increasingly common among children and adolescents in North America as physical activity (PA) declines (Hume et al., 2009; McDonald, 2008; McMillan, 2007; Panter et al., 2010; Pont et al., 2013; Timperio et al., 2006). Meanwhile, other studies have shown that active school travel (AST) can contribute to the recommended daily PA requirements for youth, and can even encourage additional PA (Hume et al., 2009; Larsen et al., 2009; McMillan, 2007). As a purposeful activity, AST is thought to conveniently provide children with the opportunity to meet these recommended daily quotas, interact with their environments, and reduce their environmental footprint (Stewart, 2011), while also decreasing their chances of developing health problems as adults (Bringolf-Isler, 2008). However, in Canada and the United States, the number of children engaging in AST has declined dramatically in the past 20 to 30 years, and sedentary travel has become the primary mode of transportation to school (McMillan, 2007; Pabayo et al., 2012).

Congruent with the socio-ecological health model, numerous factors can influence the decision of youth to use, or of parents to allow their children to use, AST (Stewart, 2011; Panter et al., 2010). The decision making process to use or allow AST is comprised of a complex system of influences that includes individual factors (such as the attitudes or socio-demographic characteristics of parents and children), external factors (such as the weather or school policies), and physical environment factors (such as neighbourhood, route, or school site characteristics) (Panter et al., 2010). Much of the past research has focused on school-related factors, while less work has been done to capture the potential influence of neighbourhood characteristics on AST.

This study examined the potential for built environment characteristics and neighbourhood-level socio-demographics to hinder or facilitate AST among elementary school-age children in four contrasting school neighbourhoods in Calgary. The research was guided by the following questions:

1. *What are the patterns of AST among children in the selected school neighbourhoods?*
2. *How might qualities of the surrounding built environment and socio-demographic context of the neighborhood positively or negatively influence the potential for children to use active travel as a means of commuting to and from school?*
3. *What can planners, communities, and institutions do in order to improve access to and opportunities for AST in school neighbourhoods?*

In answering the research questions, the report highlights where improvements to infrastructure, community programs, school policies, or other initiatives could facilitate AST and ultimately provide more opportunities for children to engage in the recommended amount of PA. The report makes practical recommendations for policy- and decision-makers at various levels whose work addresses the broader context of AST, as well as recommendations for the selected schools, their surrounding communities, and Calgary as a whole.

This report is organized into four subsequent chapters. Chapter Two provides an overview of existing literature on AST. Chapter Three outlines the scope of this study and the methods used to gather data. Chapter Four reviews the findings from the collected data and the outcomes of the data analyses. The final chapter, Chapter Five, provides a discussion of trends and important findings from the study, and provides recommendations for various levels of stakeholders with an interest in increasing rates of AST.

2. LITERATURE REVIEW

2.1 BACKGROUND

Historically and currently, researchers have sought to identify and understand relationships between planning and contemporary public health concerns and trends (Corburn, 2009; Frumkin et al., 2004). Indeed, recently the Canadian Institute of Planners (CIP) has issued a call to action, directing planners to not only understand the potential health consequences of various planning practices, but to actively promote the development of communities that support and contribute to healthy lifestyles and individuals (CIP, 2013). Part of this call to action has been a recognized need for further academic research that examines how planning intersects with one of the primary factors thought to contribute to the high prevalence of overweight, obesity, and related health challenges: lack of physical activity (PA). Many recent planning studies have investigated this topic, providing a better understanding of how the nature and structure of built environments support or discourage physical activity for the general public (Frank and Kavage, 2009; Devlin et al., 2009; Corburn, 2009; Harrison et al., 2011; Besser and Dannenberg, 2005; Janssen, 2011; Bopp et al., 2012; Lee and Moudon, 2004; Reynolds et al., 2010; Weyman et al., 2013; Butler et al., 2007; Yang et al., 2011).

Significant changes to the structures of cities in North America have occurred over the past half-century, which have altered daily norms and approaches to PA (Corburn, 2009; Buliung et al., 2009). Frumkin et al. (2004) make the distinction between two types of PA: 1) recreational and 2) utilitarian. Prior to the dominance of the car, people relied on non-motorized transportation, which, for daily purposes, was often self-powered and required PA. This utilitarian activity has since been replaced by the motorization of movement in many parts of current daily practices, and ultimately resulted in a shift towards sedentary lifestyles (Frumkin et al., 2004; McMillan, 2007; Corburn, 2009).

Numerous studies have demonstrated increasing prevalence of overweight and obesity among children and adolescents (Hume et al., 2009; McDonald, 2008; McMillan, 2007; Panter et al., 2010; Pont et al., 2013; Timperio et al., 2006). Larsen et al. (2009) note that, “fewer than half of all children in Canada and the United States are active enough to experience the well-known health benefits of physical activity” (p. 520). O’Loughlen et al. (2011) state that Canadian children are particularly less likely to commute actively to school in comparison to other countries such as Australia, Scotland, England, and Sweden. Public health officials and planners have advocated for actions to address environmental barriers to physical activity, as it can result in severe and lasting health consequences such as cardiovascular disease, stroke, and mortality (Frumkin et al., 2004).

Children are especially vulnerable to the consequences of obesity and overweight because the negative effects of excess body weight can extend in adulthood (Hume et al., 2009). Meanwhile, research has also shown that younger children have unique environmental needs, but that these considerations are not often included in traditional or mainstream planning processes (Haider, 2007; McAllister, 2008). These findings, in conjunction with studies showing reduced daily PA in youth and an exponential growth of childhood obesity in many countries, have prompted efforts to introduce PA into the daily routines of children, such as through active commuting to school (Pont et al., 2013; Buliung et al., 2009; van Loon and Frank, 2011).

AST can contribute to the recommended daily PA requirements for youth, and can even encourage further physical activity (Hume et al., 2009; Larsen et al., 2009; Zuniga, 2012; Pont et al., 2013; McMillan, 2007; Schlossberg et al., 2006; Panter et al., 2010). As a purposeful activity, “AST is believed to be a convenient way for children to obtain regular physical activity, explore their local environments, and reduce their environmental impact” (Stewart, 2011p. 127), while also decreasing their chances of developing health problems as adults (Bringolf-Isler, 2008). The number of children engaging in AST, however, has declined dramatically in the past several decades, and sedentary travel has become the primary mode of transportation to school (McDonald, 2007; McMillan, 2007; Zuniga, 2012; Yang and Markowitz, 2012; Buliung et al., 2009; Schlossberg et al., 2006).

Much of the work on AST has been done in the United States, Australia, and the United Kingdom, with significantly less coming from Canada. This study adds to both the body of literature addressing the Canadian context, as well as the broader scope of studies on AST.

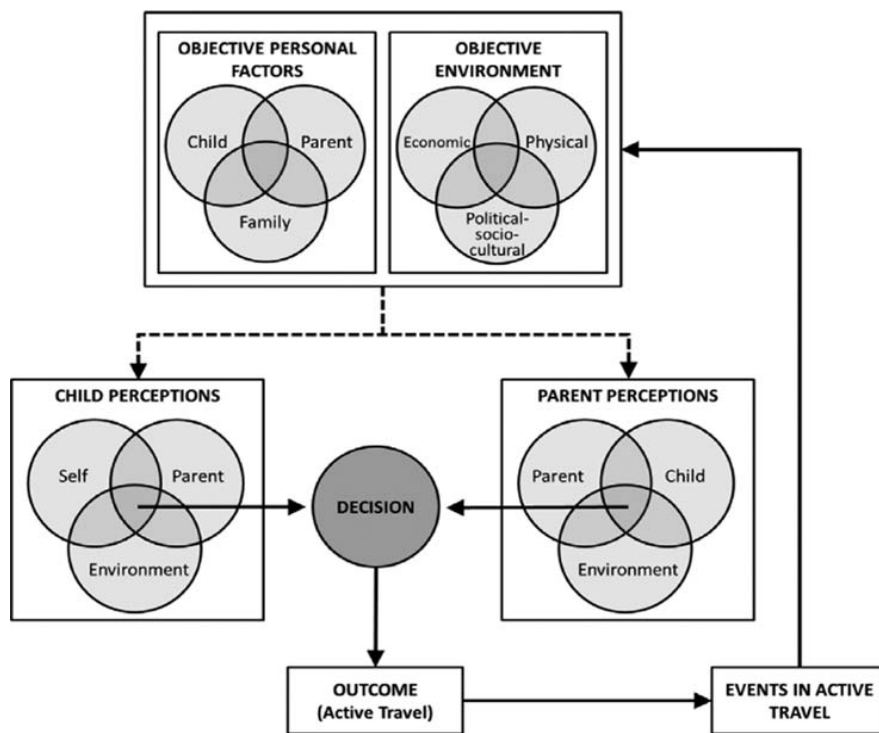
2.2 FACTORS INFLUENCING ACTIVE SCHOOL TRAVEL

Numerous factors that influence AST have been identified for various demographic groups and locations. While distance from home to school is presented as the most influential factor in the prevalence of AST (Stewart, 2011), other individual, community, and environmental characteristics also encourage or restrict youth engagement, as well as influence parents’ and youths’ perceptions, towards AST (Ahlport, 2008; Bringolf-Isler et al., 2008; Hume et al., 2009; Kerr et al., 2007; McMillan, 2007; Pabayo et al., 2012; Panter et al., 2010; Stewart, 2011). Commonly cited factors include parental attitudes and reasoning, travel distance, built form and environmental characteristics, age, supervision, socio-demographic characteristics, and school policies and environments.

2.2.1 Child and Parent Decisions

Parent decisions can significantly influence the mode of travel a child or children use to get to school. The framework created by Pont et al. (2011), as illustrated in Figure 2.1, shows the ways in which objective factors influence parent and child perceptions, which in turn determine the outcome of a child's commute travel mode. This model effectively captures the complexity of the relationship between the actual outcome of the decisions, and the influence of what are termed mediating and moderating factors (McMillan, 2005; van Loon and Frank, 2011; Stewart, 2011). Mediating factors are comprised of those factors that have a direct influence on parent or child decisions to use AST (such as weather, collision or crime rates in the neighbourhood, parent perceptions of safety, school characteristics, or schedule constraints), and moderating factors are those which have an indirect effect on the decision (such as age, height, race or ethnicity, parent employment, education, or socioeconomic status) (Stewart, 2011). AST involves the perceptions, views, and decisions of both parents and children and is influenced by many, both direct and indirect, factors. Understanding the resulting relationship between all of these factors and the travel mode outcome must appreciate this complexity, and take into consideration the specific context in each study site.

Figure 2.1: Model of Children's Active Travel (M-CAT)



Source: Pont et al. 2013 (taken from Pont et al., 2011)

2.2.2 Distance Between School and Home

Distance, measured and perceived, does appear to play a large role, and has been cited as the most common barrier to AST (Pont et al., 2013; Stewart, 2011). Children living closer to the school, usually within a 1.6 kilometre radius of their school (although variation in area covered being dependent on the specific study), are significantly more likely to use AST (Ahlport et al., 2008; Bringolf-Isler et al., 2008; McDonald, 2008; McMillan, 2007; Panter et al., 2010; Pont et al., 2011; Stewart, 2011; Timperio et al., 2006). A study by McDonald (2008) noted that even the greater AST rates seen in low-income and minority groups was likely due, in part, to those populations living closer to the school.

2.2.3 Built Environment Characteristics

Direct associations between body composition (e.g., Body Mass Index [BMI]) and built environments have been difficult to demonstrate empirically, and researchers have tended to focus on measuring associations between built environments and engagement in PA. While most studies find that there is correlation between the built environment and rates of AST, findings are somewhat inconsistent regarding what features of the built environment are most influential (Harrison et al., 2011; Stewart, 2011). A study by Kerr et al. (2007) found that youth engaging in walking was positively correlated with the number of intersections. Meanwhile, a study by Panter et al. (2010) observed that lower street connectivity but higher street density increased the likelihood that children would use AST. And yet, a recent review of AST literature by Stewart (2011) found that a majority of studies have observed a positive relationship between connectivity and AST rates.

While direct associations between built environments and PA have been difficult to demonstrate, perceptions of the built environment, especially those held by parents, can have a particularly strong influence on AST (Pont et al., 2011; Pabayo et al., 2012; Hume et al., 2009). For instance, one study found that open land could negatively affect parent and child perceptions of neighborhood safety, which may have a negative affect on the use of the land itself, and on the streets around it (Harrison et al., 2011). Fears of strangers, bullies, or societal dangers have also been found to negatively influence parents' decisions to allow children to use AST (Ahlport et al. 2008; Pont et al., 2011).

Similarly, fear of street and traffic dangers lessened the likelihood of parents allowing their children to walk to school (Ahlport et al. 2008; O'Loughlen et al., 2011; Bringolf-Isler, 2008; Hume et al., 2008; McMillan, 2007; Pabayo et al., 2012; Panter et al., 2010; Pont et al., 2011; Timperio et al., 2006), as high injury and fatality rates have been associated with active travel to and from, as well as near schools, for both pedestrians and cyclists (McMillan, 2007; McDonald and Aalborg, 2009). Conversely, AST has been found to be positively associated with infrastructure that parents deem to be supportive

of a safe trip, such as pedestrian crossings, crosswalks, sidewalks and cycling infrastructure (Bringolf-Isler et al., 2008; Harrison et al., 2011; Hume et al., 2008; Panter et al. 2010; Pont et al., 2011). These studies suggest that built environments exert their influence over AST through parental perceptions, and their resulting decisions to allow or not allow their child(ren) to engage in AST, particularly for younger children (Yang and Markowitz, 2012; van Loon and Frank, 2011).

2.2.4 Age

There is some debate over the influence of children's age on AST. Some studies found that ages of children influenced parent decisions (Bringolf-Isler, 2008; Hume et al., 2008; Pabayo et al., 2012), while a recent review of AST literature observed more mixed findings, particularly in studies with younger children (Stewart, 2011). For instance, a study by Pont et al. (2013) showed no significant relationship between age and rates of AST, while others have found a stronger correlation (Bringolf-Isler, 2008; Hume et al., 2008; Pabayo et al., 2012). Hume et al. (2009) saw a small increase in the number of adolescent active commuters over a two-year study period, which the authors attributed to an increase, or perceptive increase, in autonomy as the child got older. Other studies have attributed the increase in AST as children age to greater comfort with AST (Bringolf-Isler, 2008; Hume et al., 2009; Buliung et al., 2009). Hume et al. (2009) observed that, "social factors were associated with increased active commuting among children, whereas physical factors were important among adolescents" (p. 199). They attributed this to younger children being less independent and requiring supervision, compared to their older, more independent counterparts that may be more influenced by urban form.

2.2.5 Commute Supervision

Time management and parent availability also appear to factor in as, given adequate proximity to the school, those parents who did allow their children to use AST cited flexibility of work hours as a primary facilitator in their decision (McDonald and Aalborg, 2009; Ahlport et al., 2008). The presence of families in which siblings could commute to school together positively affects the rates of AST (Ahlport et al., 2008; McMillan, 2007; Payabo et al., 2012), and in one study it was the variable that predicted increase in active commuting over a two-year period (Hume et al., 2009). Similarly, proximity to other children in the neighborhood that allowed children to walk to school in groups also increased rates of AST (Ahlport et al., 2008; Timperio et al., 2006).

2.2.6 Socio-demographics

Research has also generated variations by racial/ethnic and income groups. A study done by McDonald (2008) found the highest rates of AST among Hispanics, with whites having the lowest recorded rates. The same study noted that children from households with an income below \$30,000 were twice as likely to walk than those from household incomes above \$60,000 (McDonald, 2008), which is consistent with other studies

measuring the influence of income (McMillan, 2007; Pabayo et al., 2012; Stewart, 2011). Kerr et al. indicated that, “Youth in households with less than \$30,000 annual income were significantly more likely to walk only if they lived in an area with mixed land use or at least one recreation space.” (p. 180). In areas with higher income averages, the residential density and access to recreation facilities were strongly correlated with walking (Kerr et al., 2007).

Lower levels of education have also been associated with higher AST rates (Oluyomi et al., 2014; Pont et al., 2009). However, a study by Yang and Markowitz (2012) noted that higher levels of parent education were associated with a greater belief and recognition of the benefits associated with AST for both the health of their child(ren) and the environment. The same study found, however, that levels of education were only very weakly associated with car-dependence, which the authors suggested likely has a closer relationship with situational constraints such as scheduling and access to a private vehicle (Yang and Markowitz, 2012).

These findings have raised questions regarding environmental justice and the increased possibility of exposure to harm and environmental detriments that children from lower socioeconomic backgrounds face in commuting through potentially unsafe conditions (Pabayo et al., 2012; Pont et al., 2013). Conversely, a study by Panter et al. (2010) showed that children were less likely to actively commute if they lived in more-deprived areas, suggesting avoidance of potentially harmful environments and situations as a possible explanation. Transportation options factored into this, and some studies also showed that the availability of a car at home decreased the use of AST (Bringolf-Isler et al., 2008; Kerr et al., 2007; McDonald, 2008). Stewart (2011) suggests that AST programs should focus on areas in which children have less transportation options, which would improve safety for children with fewer commuting options.

2.2.7 School Characteristics and Policies

School programs and policies can also influence rates of AST (Ahlport et al., 2008; Panter et al., 2010). Ahlport et al. (2008) found that schools that established programs for crossing guards and supervision of travel had students that were more likely to use AST, with parents feeling more comfortable allowing their children to actively commute. Similarly, the same study found that school policies that allowed self-powered transportation equipment on school property and the provision of proper storage also positively influenced rates of AST (Ahlport et al., 2008). Programs designed specifically to facilitate AST, as well as school-parent communication and early notification systems, have also been identified as increasing the likelihood of parents allowing their children to actively commute (Panter et al., 2010; Stewart, 2011).

2.3 RESEARCH PRECEDENTS

Several studies have examined the relationship between AST and various influencing factors in Canada. While a significant portion of the existing literature covers studies conducted in Australia, the United Kingdom (UK), and the United States (US), Canadian researchers in the fields of planning, health, and geography are increasingly examining how the characteristics of Canadian communities influence rates of AST (O’Loughlen et al., 2011; Pabayo et al., 2012; Buliung et al., 2009; Stewart, 2011).

In their work, Pabayo et al. (2011) examined determinants of AST in a longitudinal study in Quebec. The information was collected from a birth cohort that was formed in 1998 by a public health agency. Their data analysis included examining AST rates and various variables pertaining to socioeconomic status and dangers in the neighbourhood environment measured consistently over six years. The findings from the study indicated that children from lower SES backgrounds were much more likely to use AST, starting from kindergarten and into their early schooling years. The authors argued that although these students were using AST, which is promoted as a healthy activity, there is greater potential for exposure to environmental elements more common in lower SES neighbourhoods that can be detrimental to health (Pabayo et al., 2012).

A national study conducted by O’Loughlen et al. (2011) looked at 397 schools across Canada. Using data collected from surveys distributed to school administrators as part of a larger research project, the study found that traffic and crime, as has been found in other countries, are significant barriers to AST. The researchers also found that while prohibitive policies are not very common at most Canadian schools, neither are programs that would encourage AST.

A study by Buliung et al. (2009) found that rates of AST have been declining, and are continuing to decline, in the Greater Toronto Area (GTA). The researchers found that while rates of AST are higher than those found in many urban and suburban areas in Australia and the US, they are below what is being reported by studies in the UK. The study noted, however, that these comparisons do not adjust for the difference in data or information collection or data analysis used for the various studies.

Indeed, a wide variety of methods have been employed in previous research to capture data on rates of AST and the factors that are potentially influential. Numerous studies used a cross-sectional approach to compare a few or numerous schools in a geographic area (Zuniga et al., 2012; Schlossberg et al., 2006; Timperio et al., 2006; Chris, 2012; MacDonald, 2008). Some also used a range of tools or systems to assess the supportiveness of built environments at the study sites, which included Geographic Information Systems (GIS), ranking systems, and neighbourhood checklists (O’Loughlen et al., 2011; Pont et al., 2013; Timperio et al., 2006; Chris, 2012). Others used data, either exclusively or in combination with other sources, collected from parents, school

staff, and in some cases students, through surveys, questionnaires, interviews, or focus groups (Panter et al., 2010; Timperio et al., 2006; O’Loughlen et al., 2011; MacDonald and Aalborg, 2009; Schlossberg et al., 2006; Lang et al., 2010). Several studies had access to larger data sets that had been collected through government or large-scale studies, and analyzed this available data to draw conclusions (Kerr et al., 2007; Buliung et al., 2009; Panter et al., 2010; MacDonald, 2008). There were also several studies that had data collected over a specified time period, which allowed the researchers to examine longitudinal trends (Hume et al., 2009; Pabayo et al., 2012).

This study builds from work done by Chris (2012), which examined factors influencing AST rates at four schools in Kingston, Ontario. This report includes similar methodologies as the Chris (2012) study: community profile analyses, observational analyses and interviews. As previously mentioned, a large portion of the studies reviewed for this report used interviews, surveys, or workshops to engage parents, and even the students, directly, but this often required extensive periods of time and work by multiple researchers. Such findings helped narrow the scope of this report, confirming that interviews with school administrators such as those conducted in the study by Chris (2012), would be advantageous for the given time period of this study.

2.4 EXISTING INITIATIVES TO INCREASE AST

A great deal of work regarding AST has also been done outside of academia. Organizations in Canada, as well as the United States, Australia, and various European countries have produced educational and awareness campaign materials that emphasize the benefits, barriers, and facilitators of AST. These initiatives are present at all scales, from the individual school programs, to provincial partners and nation-wide collaborations. At a national scale in Canada, Active and Safe Routes to School (ASRTS) has provided guidance for AST programs and resources, with similar counterparts in the other countries. The Canadian ASRTS has partnered with other organizations and government branches such as the Canadian Partnership Against Cancer, the Heart and Stroke Foundation, the Public Health Association of Canada, and Transport Canada (ASRTS, 2013).

2.5 CONCLUSION

Studies have identified a wide range of influences on rates of AST. Findings on some influencing factors have been inconsistent, while others, such as the positive relationship between AST rates and distance, have remained clear. As Timperio et al. (2006) note, the social, environmental, and personal factors that influence active commuting in adults differ from those that influence active commuting in children. More research is therefore required to better understand AST, and ultimately provide the most comprehensive, targeted, and preventative programs and policies that encourage children to walk and ride to school as part of an active daily routine.

3. METHODS

As a starting point, a preliminary literature review was conducted during the summer of 2013. The review covered articles that informed the researcher's understanding of what could influence AST, as well as studies that have used similar methods to gauge the prevalence of AST in various locations. The review covered literature published primarily after 2008, but looked at a broad geographic scope, including studies from the United States, Australia, Switzerland, and the United Kingdom.

3.1 Scope of the Study

This research was conducted in Calgary, Alberta. As per the request of the city's school board, the identities of the schools selected for this study were kept confidential, and the name of the city was excluded from the report title.

This study involved observations of the built environments in the neighbourhoods surrounding four elementary schools in Calgary, as well as gathered input from elementary school officials who could reflect broadly on AST trends observed at their respective schools. This report focused on AST patterns among elementary school-aged children for several reasons, but most importantly because studies show that rates of AST have declined most sharply for elementary school-aged children (Pabayo et al., 2012). The negative effects of excess body weight can extend in adulthood, and younger children have unique environmental needs that are not often included in traditional or mainstream planning processes (Haider, 2007; Hume et al., 2009). As highlighted by movements such as the *8-80 Cities*, planning with consideration for the needs of children warrants the attention of all planners (8-80 Cities, 2014; Hume et al., 2009; Haider, 2007).

Studies show that children living within a 1.6-kilometer radius of their school are significantly more likely to use AST (Ahlport et al., 2008; Bringolf-Isler et al., 2008; McDonald, 2008; McMillan, 2007; Panter et al., 2010; Pont et al., 2011; Stewart, 2011; Timperio et al., 2006). Thus, a radius of 1.6 kilometers was adopted for this study because it is considered a feasible maximum distance for children to commute to school on a daily basis.

3.2 School and Neighbourhood Selection

As outlined in the study by Chris (2012), the selection of schools for this study involved a preliminary analysis of the built environment and socioeconomic profiles of the neighbourhoods surrounding every elementary school serving kindergarten through grade six from Calgary's public school board district. These domains were examined using two measures: 1) street connectivity, as a proxy for neighbourhood built environment; and 2) average household income, as a proxy measure for neighbourhood socioeconomic profile. Data for average household income was gathered from the City of Calgary's website, while street connectivity analysis was performed using maps

available through Google Maps. Only schools offering kindergarten through Grade 6 that did not run any special programs or curriculums were selected, thereby ensuring consistency of age and program of the children attending.

All eligible schools were entered into a spreadsheet, along with median income and street connectivity level from their surrounding neighbourhoods. From this, four schools from neighbourhoods with contrasting built environment and socioeconomic profiles were selected for the study (Table 1.0). Given the links established in the literature between built environments and socioeconomic characteristics and AST, it was suspected that these four contrasting schools would generate differing rates of AST.

TABLE 1.0

	High Income	Low Income
High Connectivity	<i>School 2 (HIHC)</i>	<i>School 3 (LIHC)</i>
Low Connectivity	<i>School 4 (HILC)</i>	<i>School 1 (LILC)</i>

3.3 Data Collection

To facilitate triangulation and strengthen the validity of the study results, three sources of data were used (Yin 2009).

3.3.1 Neighbourhood Analyses

Neighbourhood analyses involved in-depth reviews of community profile data gathered from the City of Calgary’s website. Data from several categories of information, such as median income, education levels, and dwelling type mixture, was inputted into tables and compared between the four school neighbourhoods. This provided a comparative view of each neighbourhood context and allowed the researcher to identify trends and differences. Analysis provided in-depth information about the socio-demographic characteristics of the four school neighbourhoods, such as median income, labour force activity, level of education, and dwelling type.

3.3.2 Observational Analyses

Observations were conducted of the study areas, which were determined using a 1.6-kilometer radius around each of the four schools. Information from these analyses was collected using two tools: a Neighbourhood Walkabout Checklist (NWC) and photo-documentation (Green Communities Canada, 2004).

The NWC used is a systematic evaluation tool developed by Green Communities Canada in 2004 as part of their Ontario Active and Safe Routes to School Resource

Guide, and is widely used across Canada (Chris, 2012). This same NWC was also used in the study by Chris (2012) to evaluate schools and the surrounding neighbourhoods in Kingston, Ontario. The walkabout checklist looks at components of the built environment that may influence the potential for children to actively commute, targeting three categories: the school site itself, the areas surrounding the school, and non-traffic related items (Green Communities Canada, 2004). The guidelines and checklists for this tool can be found in Appendix A.

Using the NWC to guide the observational analysis of each neighbourhood improved the consistency and comprehensiveness of the information collected. While the researcher was able to observe a majority of the streets in each radius, not all areas were covered. However, to produce more detailed and accurate information, the researcher divided each radius into quadrants and made observations for each quadrant at all four sites. Maps of this are not provided to maintain the confidentiality of the schools. This ensured that variation within the radius of each school was documented, and facilitated a more detailed analysis.

Photo-documentation generated images of the built environments surrounding the schools, which were analyzed along with the NWC results. Care was taken to ensure that absolutely no photographs were taken of the children, parents, staff, or any other persons in the schools or neighbourhoods at any time during the research process. Photos were strictly for the researcher's analysis and were not included in the report to protect the schools' confidentiality.

The walkabout and photo-documentation was conducted over the course of five days between October 10th and October 14th, 2013, between 10:00 a.m. and 5:00 p.m. These dates were chosen to ensure that the checklist and photographs could assess and show features of the built environment without snow cover, more clearly distinguishing aspects that could positively or negatively influence the potential for AST aside from weather.

Similar to the analysis technique used by Chris (2012), the information collected through the observational analyses was analyzed in tables for each of the three categories (traffic conditions, non-traffic conditions, and school site conditions). This allowed the researcher to code the findings as strong, intermediate, or weak, based on their potential to influence AST, and to compare the results within the tables.

3.3.3 Interviews

Semi-structured interviews comprised the final data source. The interviews took place in February 2014, and were conducted in person, by phone, and e-mail based on the availability and preferences of the interviewees. The interviewees were school principals

or administrators who are knowledgeable about the patterns and use of AST at their respective schools. The primary goal of the interviews was to identify the prevalence and patterns of AST at each school. Rather than conduct interviews directly with children attending the schools and their parents, interviewing school staff generated anonymous information and a broader, more inclusive perspective of AST patterns at each school. Participants were also asked if they were aware of, or able to identify any, environmental or social influences on potential use of AST at their schools, as well as school or school board policies on AST. The interview questions used for this study can be found in Appendix B.

Permission for the study was sought and granted from the school board prior to interviewee recruitment. The researcher assumed responsibility for contacting participants by first seeking permission from the principals of each school via direct email. The principals were asked to suggest a knowledgeable staff member, or to participate themselves if they felt that they would be able to provide the most accurate information. Once the participant was identified, prospective interviewees were issued a letter of information and consent form via email (Appendix B).

Identifying the patterns of AST and possible barriers or facilitators was essential to the conclusions of this study, and was the major theme throughout the interview questions. The information gathered about the prevalence of AST in each community facilitated inferences regarding the presence or absence of certain characteristics in each neighbourhood that might influence AST. Interviewees were also asked to identify and provide information about possible barriers and facilitators, as well as school and school board policies on AST.

Interviews were analyzed using thematic network analysis as described by Attride-Stirling (2001). Initially guided by the interview questions, the analysis created a list of basic themes from the interview, from which organizing themes, and eventually global themes, were derived (Attride-Stirling, 2001). This “methodical systematization of textual data” organized the data collected, and also highlighted important differences and common themes (Attride-Stirling, 2001, p. 386).

3.4 Ethics Approval

This research involved human subjects and thus, required General Research Ethics Board (GREB) approval. This application ensured that the research conducted did not fall outside of the regulations set by the board to protect research participants. An application was also made to the school board to conduct research with its staff, which was completed once approval from the GREB had been received. This latter application informed the school board of the objectives and methods of the study, and allowed the research to proceed with the permission of all parties.

4. FINDINGS AND ANALYSIS

4.1 COMMUNITY PROFILE ANALYSES

An initial review of the neighbourhood characteristics of each school under the city's public school board was used to guide the selection of the four study sites. Once selected, a finer analysis of the characteristics was completed for each of the four school neighbourhoods using data available on the City's website (City of Calgary, 2013a). This information includes data from the 2006 Statistics Canada federal census and the City of Calgary's own 2011 Civic Census, and all findings in the following section are drawn from this information. From this in-depth analysis, the researcher found several trends among the compared characteristics of each school, which mostly coincided with those identified in the literature. Table 4.1 shows the findings for each school neighbourhood from the community profile analyses.

Several neighbourhood characteristics varied with the SES category of each study area. Notably, the median incomes of the lower SES neighbourhoods were half or less than half of the median incomes in the higher SES neighbourhoods. Education levels appeared to vary with SES, where approximately 50% of residents in lower SES neighbourhoods had education up to a high school diploma, or no certificate or diploma. Contrastingly, approximately 40-60% of residents in the higher SES neighbourhoods had either a university degree or university certificate. Interestingly, the percentage of residents (over the age of 25) who were employed was relatively similar for each of the school neighbourhoods, ranging only between 72% and 75%.

Housing mix also varied with SES in these neighbourhoods, where single detached dwellings were the overwhelmingly dominant type of housing in the higher SES neighbourhoods. Lower SES neighbourhoods had a greater mix of housing types and noticeably larger proportions of residents living in apartments and row houses. Within each category of SES status, the neighbourhoods with higher connectivity also had a greater diversity of housing types. This is consistent with the literature, which indicates that a greater diversity of housing types is often found in areas of higher connectivity and density, which is a factor that can contribute to higher AST rates in school neighbourhoods (Leung, 2003; Stewart, 2011; Panter et al., 2010).

Table 4.1: Socioeconomic status attributes for each school neighbourhood.
(City of Calgary, retrieved from the City's website)

ATTRIBUTE	LILC	HIHC	LIHC*	HILC
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
Median Family Income 2005 (\$)	\$50,085	\$133,288	\$42,327	\$108,874
Labour Force Participation (Age 25+)				
<i>Employed</i>	72.3%	72.9%	74.5%	73.8%
<i>Unemployed</i>	1.5%	1.6%	4.3%	3.2%
Level of Education				
<i>University Degree</i>	13.4%	56.1%	15.6%	33.2%
<i>University Certificate</i>	6.3%	7.4%	4.6%	7.6%
<i>College Degree/Certif.</i>	15.1%	7.8%	20.4%	17.4%
<i>Apprenticeship/Trade</i>	9.4%	2.2%	10.5%	7.0%
<i>High School</i>	24.3%	17.9%	26.2%	23.1%
<i>No Certificate/Diploma</i>	31.1%	8.3%	23.2%	11.6%
Dominant Dwelling Types	Single Detached (48.0%) Row House (46.1%)	Single Detached (72.9%) Apartment (24.0%)	Single Detached (25.3%) Apartment (59.5%)	Single Detached (93.7%) Apartment (5.6%)

*Figures represent the average for the multiple school neighbourhoods served by this school. The numbers did not vary greatly between the neighbourhoods.

4.2 NEIGHBOURHOOD OBSERVATIONS

Observational analyses were conducted in October to ensure that data were captured before snowfall. Weather conditions on the observation days were stable (i.e., moderate temperatures and no precipitation of any kind), which allowed for full visibility of landscape conditions. The observations were guided by the Green Communities Canada (GCC) Neighbourhood Walkabout Checklist, which provides a framework for analyzing traffic conditions, non-traffic conditions, and school site attributes of school neighbourhoods (Chris, 2012; GCC, 2004). The following section describes the researcher's observations as guided by the checklist.

4.2.1 TRAFFIC CONDITIONS

Table 4.2 summarizes the findings from observations of traffic conditions at each of the four school neighbourhoods.

4.2.1.1 Traffic Speed

Some common traffic patterns between the four school sites were identified, including 30 kilometre speed zones around the schools and playgrounds in the area, and generally similar speed limits for each class of road (i.e., 40-kilometre speed limits on all residential streets and between 50-80 kilometres on surrounding arterial and collectors). These similarities do not, however, reveal information about the proximity of each school to the various road classes, and ultimately higher or lower speeds and volumes of traffic adjacent to the school site.

4.2.1.2 Street Hierarchy

The school neighbourhoods with higher street connectivity both had arterial or collector streets directly adjacent to the school site, while the neighbourhoods with lower connectivity were located on less busy residential streets. Perhaps relatedly, the amount of overall signage (school, pedestrian, cyclist, public transportation, and vehicle) in the higher connectivity neighbourhoods was greater than in those with lower connectivity, particularly along the central arterial and collector streets adjacent to those two school sites. Still, both higher SES neighbourhoods had clearer, more appropriate, and more frequent pedestrian signage throughout.

4.2.1.3 Adjacent Land Uses

The mix of land uses present in each neighbourhood was consistent with trends identified in the literature, and may have also influenced the amount of overall signage in each neighbourhood. Higher connectivity neighbourhoods had a greater mix of land uses including commercial and industrial throughout the neighbourhoods, while the lower connectivity neighbourhoods were comprised of almost entirely residential, with only some institutional interspersed. This is consistent with findings from other studies and was anticipated by the researcher given the style in which the neighbourhoods were built and the dominant planning practices used at the times of construction (Leung, 2003; Stewart, 2011; Hodge and Gordon, 2013). Greater signage in the higher connectivity neighbourhoods may have been a result of both higher volumes of traffic along arterial and collector streets and the mixture of land uses in the area. Both of these factors, in addition to the assumption that areas of higher connectivity are more conducive to active modes of travel, might create higher volumes of both vehicular and pedestrian traffic, which would require a greater number of signs to regulate the interaction of all transportation modes (Leung, 2003).

4.2.1.4 Infrastructure

While both school neighbourhoods with higher connectivity also had more continuous and consistently present sidewalks, so too did the HILC school neighbourhood. All neighbourhoods also had signaling pedestrian devices, although the LILC school had the fewest. Notably, both higher connectivity neighbourhoods had signaling pedestrian devices leading onto school grounds, but the HIHC neighbourhood had the crosswalk leading directly into the school's parking lot. While pedestrian crossing devices may facilitate increased AST, it should be noted that the location of the device at the LIHC school significantly increases the potential for pedestrian-vehicle conflict.

Table 4.2: Findings from observations on traffic conditions.*

	LILC	HIHC	LIHC	HILC
Relative Income	LOW	HIGH	LOW	HIGH
Street Connectivity	LOW	HIGH	HIGH	LOW
TRAFFIC				
Speed	MODERATE	MODERATE	POOR	GOOD
Signage	POOR	GOOD	MODERATE	MODERATE
SIDEWALKS				
Presence of Sidewalks	MODERATE	GOOD	GOOD	GOOD
Extension of Sidewalks	POOR	MODERATE	MODERATE	GOOD
PEDESTRIAN CROSSING				
Presence of Devices	POOR	MODERATE	GOOD	GOOD
On-Street Signage	POOR	MODERATE	MODERATE	GOOD
TYPES OF BUILDINGS	POOR	GOOD	GOOD	MODERATE

* Further information on the grading of these categories can be found in Appendix C.

4.2.2 NON-TRAFFIC CONDITIONS

Table 4.3 summarizes the findings from observations on non-traffic conditions at each of the four school neighbourhoods.

4.2.2.1 Sidewalks

Overall, the sidewalks in all four neighbourhoods were at least standard width (1.5 metres) if not larger, and in relatively good condition. The sidewalks in the HILC neighbourhood were in particularly good condition, while the sidewalks in the LILC neighbourhood were below the standard observed in the other three neighbourhoods. The LILC neighbourhood also had some smaller sidewalks and fewer street trees and less vegetation, whereas the other three neighbourhoods had notably larger amounts of trees and greenery.

4.2.2.2 Greenspace

All neighbourhoods had some community parks or greenspaces, but the LIHC neighbourhood had considerably less than the other three. Both lower connectivity neighbourhoods had larger park spaces on the periphery, although most parks in the LILC neighbourhood abutted industrial lands or major traffic thoroughfares on the opposite side. Both higher SES neighbourhoods had better access to parks and greenspaces; the HIHC was in closest proximity to a concentration of parks, while HILC had the largest area of greenspace that was accessible from points relatively close to the school site.

Several studies have found that the proportion of greenspace around a school, including on the school site, is one factor that can increase the potential for AST by providing spaces for active play close to a travel destination (Pont et al., 2009; Kerr et al., 2007;

Kemperman and Timmermans, 2014). Of the actual school sites, the LILC school had the highest proportion of greenspace, with only approximately 10% of the site as concrete space (~90% greenspace). The school site in the LIHC neighbourhood had the second highest percentage of greenspace (around 80%), and the two higher SES neighbourhood schools had approximately 70% greenspace.

4.2.2.3 Community Facilities and Upkeep

The higher SES neighbourhoods had a greater number of community facilities and centres, but of all four neighbourhoods the HIHC neighbourhood had the only private community club. Libraries were not present in any of the neighbourhoods.

The higher connectivity neighbourhoods both had graffiti on some buildings along their commercial corridors, but no graffiti was observed on any of the buildings in the low-connectivity neighbourhoods. The low-connectivity, higher SES neighbourhood was the only neighbourhood in which garbage was not observed on the streets. The higher connectivity neighbourhoods had most street garbage concentrated near the commercial and higher-density areas, but the lower connectivity, lower SES neighbourhood (LILC) had garbage along residential streets near the school. The LILC neighbourhood was the only one in which a Neighbourhood Watch sign was observed.

Table 4.3: Findings from observations on non-traffic conditions.*

	LILC	HIHC	LIHC	HILC
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
PUBLIC SPACES				
Parks	GOOD	GOOD	MODERATE	GOOD
Library	None observed	None observed	None observed	None observed
Community Centres	POOR	MODERATE	MODERATE	MODERATE
Churches	MODERATE	POOR	MODERATE	MODERATE
STREETScape				
Trees	MODERATE	GOOD	GOOD	GOOD
Physical state of sidewalks	MODERATE	MODERATE	GOOD	GOOD
Size of sidewalk	MODERATE	GOOD	MODERATE	MODERATE
Obstruction of sidewalk	GOOD	GOOD	GOOD	GOOD
Garbage Along Routes	MODERATE	MODERATE	MODERATE	GOOD
SCHOOLYARD				
Green space/ brown space	GOOD	MODERATE	GOOD	MODERATE
Concrete space				
OTHER				
Neighbourhood Watch	GOOD	MODERATE	MODERATE	MODERATE
Graffiti on buildings (lack of)	GOOD	MODERATE	MODERATE	GOOD

* Further information on the grading of these categories can be found in Appendix C.

4.2.3 SCHOOL SITE CONDITIONS

Table 4.4 summarizes the findings from observations on the school site conditions.

4.2.3.1 Student Access Points

The HILC school was the only school in which children accessed the site equally consistently from the front or back. Students at the other three schools accessed the school site from the sides, and usually particularly from one side. All schools had a moderate to high potential for conflict between vehicles and students accessing the site due to the proximity of access points to roads with higher volumes of traffic or entrances to parking lots. The HIHC school had a high potential for vehicular conflict (previously noted) as the signaled pedestrian crossing, located on the side of the school from which most students access the site, leads directly into the school parking lot.

4.2.3.2 Bicycle Infrastructure

All schools had at least one bicycle rack or bicycle parking area, and the HILC school had a particularly high number located at the back side of the school site. The neighbourhood around the LIHC school, however, was the only one in which the researcher observed bicycle lanes or paths near the school. The potential for conflict between vehicles and students riding bicycles to school was highest for the higher SES, higher connectivity neighbourhood, in which students might have to navigate hills, unaligned corners, and, cross collector streets to get to the school. The potential for conflict was also high in the other higher connectivity neighbourhood, as students might have to cross an arterial street.

Table 4.4: Findings from observations on school site conditions.*

	LILC	HIHC	LIHC	HILC
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
WALKING PATHS				
Access Point(s) for students	GOOD	MODERATE	GOOD	GOOD
Potential Vehicle Conflict	MODERATE	POOR	MODERATE	MODERATE
BICYCLE FACILITIES				
Bike racks	GOOD	GOOD	GOOD	GOOD
Bike paths or lanes	POOR	POOR	POOR	POOR
Potential for vehicle conflict	MODERATE	POOR	POOR	MODERATE
SCHOOL BUSES				
Location of loading zone(s)	GOOD	MODERATE	MODERATE	MODERATE
PARKING LOTS				
Location of lot	POOR	MODERATE	GOOD	MODERATE
Potential for vehicle conflict	MODERATE	MODERATE	MODERATE	MODERATE
Size and design	GOOD	MODERATE	GOOD	POOR

* Further information on the grading of these categories can be found in Appendix C.

4.3 INTERVIEWS

Interviews were conducted in February 2014 and done either in person (three of the four) or by e-mail with a follow-up telephone conversation, dependent on the availability of the interviewee at each school. The interviews were semi-structured and all participants were asked the same set of questions with the opportunity to seek clarification and provide further information as needed (Appendix B). The interviews focused on capturing information related to school and neighbourhood conditions, transportation options available to students, parent and student attitudes towards AST, known barriers to AST, and current rates of AST. Once collected, the interviewee responses were organized into a chart, and analyzed using thematic network analysis to identify themes within these findings (Attride-Stirling, 2001). The details of this analysis can be found in Appendix D.

4.3.1 Student Access Points to the School

As with findings from the other methods, several trends emerged in the information provided by the interviews. In terms of getting onto the school site, the primary student access point at three of the four schools (LILC, HIHC, LIHC) was from the side, whereas the HILC school had equal student access from the front and the back. The LIHC school was the only school for which the access point was adjacent to a collector road and the main crossing led directly into the parking lot entrance. There is greater potential for conflict with vehicle traffic at the LIHC school given the proximity to a busier street and the location of the crosswalk, and at the HILC school given the access point at the front of the school with potentially higher volumes of traffic at pick-up and drop-off times.

4.3.2 Primary Mode of Travel to School

At all four schools, fairly low proportions of children were bused to school, and, in fact the LILC school had zero students bused. Although the LIHC school had the highest proportion bused (approximately 15%), this was mostly attributed to the number of special needs students who required buses for transportation to the school. The city's school board mandates that students within a certain radial distance from the school cannot regularly take the bus without demonstrated need, so lower proportions were expected. Although only a limited number of buses served each of the three schools with at least some proportion of students riding, all bus-loading areas were also located at the main student access points, increasing the potential for pedestrian-vehicle conflict. However, all three of these schools had bus patrollers or staff supervisors that facilitated bus loading and unloading times, which may reduce the potential for conflict. The HIHC school had a particularly large team of bus patrollers that also facilitated use of the crosswalk.

The proportions of students that used AST and those who were driven to school were much more varied than proportions of those bused, and in some cases also varied for both milder and colder temperatures. Based on findings from other studies and literature on AST, the researcher had predicted that the lower income schools would have higher rates of AST due to the repeatedly found association of AST with lower SES (Pabayo et al., 2012; Kerr et al., 2007). As seen in Table 4.5, the LILC school and the HIHC school had the highest rates of AST and lowest rates of students being driven to school. The LIHC and HILC schools both had much higher proportions of students who are driven to school, with the HILC school having 95% to almost 100% of their students driven regardless of temperature. The researcher was not expecting to find lower AST rates at the LIHC school, or higher rates at the HIHC school.

4.3.3 Influence of Temperature on Mode

Interestingly, as shown in Table 4.5, temperature did not appear to have a major effect on proportions of students using AST, except at the HIHC school. Both lower SES schools had no change in the proportion of students using AST between temperature categories. This was not surprising to the researcher, given that other studies have found that those in lower SES communities are less likely to have reliable access to a private vehicle and children would walk or cycle because they could not be driven or bused (Pont et al., 2013; MacDonald and Aalborg, 2009; McMillan, 2007; Kerr et al., 2007). Thus, these students would use AST regardless of the temperature.

In the higher SES neighbourhoods, however, there is change of proportions between temperature categories. The HILC school showed a very small decrease in the proportion of students using AST in colder temperatures, bringing the proportion of students driven in colder temperatures to almost 100%. In contrast, at the HIHC school, where a significantly larger proportion of students use AST in milder temperatures, there is a noticeable decrease in the proportion that uses AST in colder temperatures. This may be facilitated by access to a private vehicle, which is more likely to be an option for those in higher SES neighbourhoods like the HIHC school (Pont et al., 2013; MacDonald and Aalborg, 2009; McMillan, 2007; Kerr et al., 2007).

Table 4.5: Summary of school travel mode proportions for students at each school as estimated by the interviewee.

Mode of Travel on Regular Basis	LILC	HIHC	LIHC	HILC
BUSSED TO SCHOOL	0%	~5%	15%	~5%
DRIVEN TO SCHOOL				
Milder Temperatures	10%	10-15%	75%	90-95%
Colder Temperatures	10%	15-40%	75%	Almost 100%
WALK OR BIKE TO SCHOOL				
Milder Temperatures	90%	85-90%	25%	5-10%
Colder Temperatures	90%	60-85%	25%	Almost 0%

4.3.4 Existing Approaches to AST-Promotion

Of the four schools, only the HIHC school had direct AST-promotion campaigns or programs, and none of the schools had anti-driving campaigns or programs.

Interviewees at the LILC school and the HIHC school felt that a good proportion of students used AST to get to school, whereas interviewees at the LIHC school and the HILC school thought that a larger proportion could use AST. All school interviewees felt that individual or parent views and decisions were the primary factors that discouraged AST at his or her school. Interestingly, interviewees from the LIHC and the HILC schools cited distance from home to school as a potentially discouraging factor for those neighbourhoods, which is consistent with the literature citing distance as the clearest influence on rates of AST (Panter et al., 2010; Stewart, 2011; McDonald, 2007; Pont et al., 2013; McMillan, 2007).

4.3.5 Potential Changes to Increase AST at Each School

When asked what changes they felt would facilitate or encourage more AST, all interviewees had differing answers that were ultimately reflective of the school and surrounding neighbourhood characteristics.

4.3.5.1 Increasing AST at LILC School

At the LILC school, where no students took the bus and nearly all used AST regardless of temperature, the interviewee felt that safer infrastructure was needed. While the interviewee noted that the traffic in the neighbourhood was primarily local (due to the community's street layout and surrounding uses), concern was expressed for the lack of attention given to children using AST around the school. The interviewee felt that more pedestrian and cyclist infrastructure could contribute to a safer active commute for students, noting that there were too few crosswalks in the neighbourhood. According to the interviewee, parents in the neighbourhood were less likely to have access to a private vehicle, and either used public transit or AST in their own commutes or did not leave the neighbourhood because they were unemployed.

4.3.5.2 Increasing AST at HIHC School

In contrast, the interviewee at the HIHC school emphasized policy changes that would encourage further use of AST. The interviewee felt that incorporating AST into the school curriculum, and particularly as a component of Health or Physical Education, would facilitate increased rates at the school. As explained in the literature, higher SES communities are more likely to have a higher proportion of residents with access to a private vehicle, which would allow for more transportation options (MacDonald and Aalborg, 2009; MacDonald, 2008). Thus, not surprisingly, the interviewee noted that it is not uncommon for households in this neighbourhood to have a single wage-earner, leaving one parent or caregiver with greater flexibility to accompany or facilitate an active commute for their child(ren). These factors, likely combined with other factors

such as high education levels of parent and/or proximity to greenspace, may contribute to the higher levels of AST to this school (between 60% to 90%).

4.3.5.3 Increasing AST at LIHC School

The interviewee at the LIHC school felt that an increase in programs that offer supervision of commutes would be the most effective way to increase the lower proportion (25%) of students using AST at the school. The interviewee indicated that a relatively large proportion of the students were involved with extracurricular activities or were part of before- or after-school care, making their commutes at early or later times in the day. Parents, it was noted, were not comfortable with letting the students walk between school and home at these times, which contributed to higher rates of students being driven to and from school. Indeed, as mentioned previously, parent or individual views and decisions were thought to be a major barrier to AST at the school.

4.3.5.4 Increasing AST at HILC School

Similar to the interviewee at the LIHC school, the interviewee at the HILC thought that programs would be the most effective way to increase the proportion of students actively commuting to school. This school had the lowest proportion (approximately 0% to 5%) of students who are using AST for their commutes. Along with parent or individual views and decisions, the interviewee thought that distance was also a significant factor that discouraged the use of AST to the school. As indicated by the interviewee, approximately 150 students live in the neighbourhood directly surrounding the school, with the remaining 220 residing in adjacent neighbourhoods. Still, the interviewee thought that the proportion, particularly of the 150 students living in the surrounding neighbourhood, could be higher. The interviewee explained that, as at the LIHC school, many students have extracurricular activities that push their commutes to early or late times of the day and influence parent comfort levels around unaccompanied travel. Programs providing supervised commutes, the interviewee thought, would alleviate some of these fears and encourage more parents to allow their children to use AST. Programs such as Walking School Buses, Walk-to-School days, or before- and after-school supervision programs were suggested by the interviewee as potentially most effective in increasing rates of AST. This demonstrates the interviewee's familiarity with some well-known programs and initiatives that are designed to increase AST rates.

4.3.5 Differences in Approaches to Increasing AST

The two schools with higher rates of AST (LILC and HIHC) both emphasized either infrastructure or policy changes as initiatives that could have the greatest effect on increasing AST rates. Schools with lower rates of AST (LIHC and HILC) both identified programs and initiatives that could have the greatest impact on increasing AST.

For the two schools with lower rates of AST, both interviewees also noted a significant number of before- and after-school programs available at the school. While these programs differed in their purpose and structure, their availability may contribute to “trip-chaining”, or a greater propensity for parents using vehicles to drop off or pick up their child(ren) at school on their way to another destination (MacDonald and Aalborg, 2009; Pont et al., 2013; Stewart, 2011).

4.3.6 Interview Analysis

In the analysis of the interview findings (Appendix D), some overarching themes emerged for all four schools. To begin, very few students were bused to school, which made bus transportation a low proportion of the travel modes used. This is likely a result of the school board’s decision to provide bus services only to those students who live outside of a certain radial distance (1.6 kilometres) from the school site or who could not commute by active modes due to physical or other constraints. Thus, very small proportions of the students at these schools were eligible to be bused, leaving significant proportions to use either active modes of travel, or to be driven to school.

Another theme commonly stated by all four interviewees was the feeling that individual or parent views and decision were some of the most direct influences on discouraging AST. While both schools with lower AST rates also noted that distance might be factor, personal views (either parent or child) and the resulting decisions were identified as a strong influence at each of these schools. This is consistent with much of the literature on AST, which shows personal, and especially parental, views and decisions as having possibly the most direct influence on the child(ren)’s mode of travel outcome (Yang and Markowitz, 2012; Pont et al., 2013; Panter et al. 2010; Pabayo et al., 2012; Stewart, 2011; Hume et al., 2009).

4.4 SUMMARY

Table 4.8 shows the primary findings derived from analysis of the information collected through the three sources for each of the four school study areas. Based on the connectivity and SES profiles of the schools neighbourhoods, few of the predicted trends of AST rates were observed. For instance, the two schools with the highest rates of AST (LILC and HIHC) were expected to have only modest rates of AST. The school that the researcher predicted would have the highest rates of AST, the LIHC school, in fact had the second-lowest rate. Only one school had AST rates that matched the researcher’s prediction; that is, the HILC school had the lowest rates of AST as predicted.

In comparing the rates of AST with the results from the neighbourhood observations, an unanticipated pattern emerged: the rates of AST appeared to be negatively correlated to the observed supportiveness of the built environment. While this trend might represent

some association between the built environment and the proportion of students engaging in AST, it may also be a factor of context-specific conditions that were unaccounted for in the neighbourhood checklist that guided the observations. These issues will be addressed more thoroughly in the discussion in Chapter Five.

Table 4.8: Summary of key findings and analysis.

	LILC	HIHC	LIHC	HILC
Street Connectivity	<i>LOW</i>	<i>HIGH</i>	<i>HIGH</i>	<i>LOW</i>
Relative SES	<i>LOW</i>	<i>HIGH</i>	<i>LOW</i>	<i>HIGH</i>
Predicted AST Rates	MID	MID	HIGH	LOW
COMMUNITY PROFILE ANALYSES				
Residents with education above high school	44.2%	73.5%	51.1%	65.2%
Median family income	\$50,085	\$133,288	\$42,327	\$108,874
Dominant dwelling type	Single Detached (48.0%) Row House (46.1%)	Single Detached (72.9%) Apartment (24.0%)	Single Detached (25.3%) Apartment (59.5%)	Single Detached (93.7%) Apartment (5.6%)
NEIGHBOURHOOD OBSERVATIONS*	<i>Least</i> supportive built environment.	<i>Less</i> supportive built environment.	<i>More</i> supportive built environment.	<i>Most</i> supportive built environment.
INTERVIEWS				
AT Campaigns	No	Yes	No	No
Rates of AST	90%	60-90%	25%	0-10%

*As determined by the graded observation charts

5. DISCUSSION AND RECOMMENDATIONS

The findings from this study showed significant variation between the proportions of students actively commuting at the four schools, with rates of AST ranging between approximately 0% and 90%. This wide range, however, is somewhat predictable given the diverse environments examined and the differing demographics at each school neighbourhood. Community profile analyses showed a wide range of education levels and dwelling-type mixtures, even between school neighbourhoods with similar connectivity or SES. Neighbourhood observations showed that while all neighbourhoods had environments fundamentally supportive of a moderate level of AST, key differences, such as access to parks or proximity to a major road could influence the potential for AST. Interviews with school administrators indicated that only one of the four schools, the HHC school, had AST-promoting campaigns.

Based on the findings from previous studies and the literature reviewed regarding the association between AST and both neighbourhood SES and connectivity, the researcher expected that the LHC school would have the highest rates of AST, the LLC school and the HHC school would have moderate rates, and the HILC school would have the lowest rates. The findings from this study showed that the LLC school had consistently high rates of AST (90%), and the LHC school and the HILC school had consistently low rates throughout the year (25% and 0-10% respectively). The HHC school, however, had varying rates between seasons (60-90%), although the range of rates was still considered high. Of the predictions, only the HILC school matched the researcher's expectations, with the lowest rates of AST year-round.

There were several trends observed in the analysis. Most notably, analyses showed that the scores from the graded neighbourhood observation checklists were negatively associated with the rates of AST; these findings run counter to the majority of findings from other studies on AST (Harrison et al., 2011; Stewart, 2011; Kerr et al., 2007; Panter et al., 2010; Pont et al., 2011; Pabayo et al., 2012; Hume et al., 2009). Yet, between the schools with same connectivity levels, the schools with lower SES had a higher proportion of students consistently engaging in AST, which is in keeping with previously identified trends (McMillan, 2007; Pabayo et al., 2012; Stewart, 2011; Oluyomi et al., 2014; Pont et al., 2009). Although findings were somewhat inconsistent with those from other similar studies, some common trends in the analysis were identified that may partially explain the deviations from predicted associations. These trends are addressed in sections 5.1- 5.4.

5.1 Proximity to Busy Streets

The higher connectivity neighbourhoods both had busier streets adjacent to the school site. While the schools in both of these sites had signaling pedestrian devices to facilitate crossings, there were several major differences that may have influenced the potential for AST at each school. The road adjacent to the LHC school was an arterial

street, which carried high volumes of traffic travelling at relatively high speeds. The road adjacent to the HIHC school was a higher-traffic residential street, which, although carrying traffic travelling at somewhat higher speeds, did not carry the same volume of traffic as that at the LIHC school. From the neighbourhood observations, it appeared that the arterial street at the LIHC school would be more likely to be a barrier to the potential for AST, with four lanes of higher-speed, higher-volume traffic. As outlined in the literature, parents and students alike could view this as an unsafe part of a potentially active commute, and might forego AST in favour of driving (Ahlport et al. 2008; O’Loghlen et al., 2011; Bringolf-Isler, 2008; Hume et al., 2008; McMillan, 2007; Pabayo et al., 2012; Panter et al., 2010; Pont et al., 2011; Timperio et al., 2006).

In contrast, both the lower connectivity school neighbourhoods had relatively isolated street networks with low-speed, low-volume, and primarily local traffic. Previous studies have identified this as a potential strength of neighbourhoods with lower connectivity, as there is less potential for pedestrian-vehicle conflict with fewer and slower moving vehicles (Panter et al., 2010). This may increase parents’ and students’ comfort levels with AST, as the route to and from school appears safer with less potential for pedestrian-vehicle conflict (Pont et al., 2011; Pabayo et al., 2012; Hume et al., 2009; Harrison et al., 2011). However, the association between AST and traffic characteristics of low connectivity neighbourhoods requires further research, as the findings from this study do not support any definitive conclusions about this specifically.

5.2 Types and Mixture of Dwellings

Among the two higher SES neighbourhoods, the school with higher connectivity had much higher rates of AST than that with lower connectivity. While this may be an indication of a relationship between neighbourhood connectivity and the potential for AST, the difference in types and mixtures of dwelling types might also be important to consider. Numerous studies have shown that neighbourhoods with greater mixtures of dwelling types, and specifically lower proportions of single family houses, are associated with higher neighbourhood density and higher rates of AST (Stewart, 2011; Panter et al., 2010). The HIHC school had a lower proportion of single-family houses between the two neighbourhoods, and a more diverse mix of housing types, which may have impacted the rates of AST observed at that school. In keeping with this, a homogenous dwelling mixture, comprised of almost 94% single-family houses, could have impacted the very low rates of AST found at the HILC school.

The findings were considerably different for a comparison between the lower SES school neighbourhoods. While the LIHC school had a greater mixture of dwelling types, this school still had lower rates of AST. In comparison, the LILC school, for which the dwelling types were approximately half row houses and half single-family houses, had the highest consistent rates of AST. In comparing all four school neighbourhoods, the

relatively lower proportion of single-family houses found at the LILC school could have influenced the higher rates of AST observed. As the findings for the LIHC school are inconsistent with the literature regarding the association between AST and dwelling type and mixture, other factors must be at play.

5.3 Context Specific Findings

5.3.1 Low Income, Low Connectivity School

The rates of AST at the LILC school were higher than the researcher had predicted based on the neighbourhood's low SES and low connectivity, and are likely accounted for by several other factors. First, the interviewee at this school was clear that parents in the neighbourhood are less likely to have cars and that students often walk because they do not have access to other modes of transportation. This is consistent with many of the findings from other studies examining the relationship between SES and AST rates (Bringolf-Isler et al., 2008; Kerr et al., 2007; McDonald, 2008). In addition, the presence of a greater mix of and more dense building types, which could signify a higher neighbourhood density (also associated with more active commuting), may have contributed to the higher AST rates found in a lower connectivity neighbourhood (Panter et al., 2010).

The interviewee also noted that the traffic within the neighbourhood was primarily local, significantly reducing the amount of vehicles on the streets. This was confirmed by the neighbourhood observations, which showed that the school was not in close proximity to any major roads and was surrounded by low-speed, low-volume streets. This likely makes the potential route used for AST seem safer to both parents and students, which could increase comfort levels with using or allowing AST (Timperio et al., 2006). Thus, while the LILC school scored the lowest on the graded neighbourhood observations, both the lack of transportation options and the reduced potential for pedestrian-vehicle conflict likely contribute to the high rates of AST.

5.3.2 High Income, High Connectivity School

Although it scored relatively poorly on the neighbourhood observation checklist and residents were from a higher SES background (two factors that might have reduced the rates of AST), the neighbourhood around the HIHC school had some prominent features that made it conducive to AST. As identified in the literature, access and proximity to greenspace can influence rates of AST, and the neighbourhood around this school had excellent access (the best among the four schools) to several greenspaces directly adjacent to the school site (Harrison et al., 2011). Similarly, the neighbourhood also had good signage throughout all quadrants, and numerous pedestrian signaling devices in key locations with higher volumes of traffic. The neighbourhood environment also contributed to an enjoyable and comfortable commute, with an abundance of street trees and several public gardens at intersections or community greenspaces. Numerous

studies have found that commute enjoyment can influence the likelihood of engaging in AT, and while this has only been examined in adults, there is potential for these findings to translate to youth (Fusco et al., 2011; Lee and Moudon, 2004).

An important factor, which may have played a role in facilitating the influence of the factors discussed above, is the prevalence of single wage-earner and highly educated households in the area. Previous studies have found that the availability of a parent of caregiver to accompany a student or students on their commute significantly increases comfort with, and subsequently the decision to allow or facilitate, AST (Ahlport et al., 2008; McMillan, 2007; Payabo et al., 2012; McDonald and Aalborg, 2009; Ahlport et al., 2008). High levels of education may also influence the potential for AST, as parents with higher education levels have demonstrated a greater understanding and inclination towards the benefits of physical activity and AST (Yang and Markowitz, 2012). All of these factors combined may influence the propensity for students in this neighbourhood to engage in AST, which might explain the higher rates observed.

Additionally, this school was also the only one to report any school-driven AST programs. Numerous studies have found that school programs that encourage AST noticeably increase rates (Ahlport et al., 2008; Panter et al., 2010; Stewart, 2011). While several other factors might have contributed to higher-than-expected rates observed at the HHC school, the influence of AST-encouraging programs might factor in as well.

5.3.3 Low Income, High Connectivity School

Given the lower SES and high connectivity of the neighbourhoods surrounding this school, AST rates were expected to be significantly higher than those reported. Numerous findings that have been associated with high AST rates in other studies were observed at this school. The neighbourhood scored second highest on the neighbourhood observation checklist, had the lowest proportion of single-family houses (25%), and the lowest median family income. The interviewee also indicated that the school ran several school-facilitated programs that encouraged healthy lifestyles and the well-being of the students. Even with these factors present, the rates of AST were still the second lowest of the four schools.

One factor that certainly could have contributed significantly to the lower AST rates is the proximity of the school site to a major arterial road. While the HHC school was also in close proximity to a street with relatively higher-volume traffic, the arterial adjacent to the LIHC school carried considerably more traffic and at higher speeds for a longer distance. Although facilitated by a signaled pedestrian device and several crosswalks, the amount and speed of traffic might have made parents and children less comfortable with, and subsequently less likely to engage in or allow, AST.

AST rates did not fluctuate with temperature, potentially indicating that there is less flexibility in the choice of school travel mode for the students and parents at this school. This may indicate the presence of different barriers that have been observed in other AST studies, such as time constraints or drop-off and pick-up timing, which were not covered by this study (Yang and Markowitz, 2012). Further research that included data collection from parents might capture these factors and provide a better understanding of the impact on the potential for AST.

5.3.4 High Income, Low Connectivity School

The HILC school was predicted to have lower rates of AST, and in fact had the lowest rates among the four schools. Although it scored the highest on the graded neighbourhood checklist, the information provided by both the interview and the community profile analyses would suggest that both the higher SES and low connectivity were factors in the low AST rates observed. For example, studies show that people in higher SES neighbourhoods are more likely to have access to a private vehicle, making driving a more likely option for parents in getting their child(ren) to school (Bringolf-Isler et al., 2008; Kerr et al., 2007; McDonald, 2008; Yang and Markowitz, 2012). The findings in this study are consistent with those reports, as the rates of students driven to school ranged between 90% to almost 100%, varying by season.

Furthermore, the interviewee cited distance as one of the primary deterrents that influences whether students engage in AST on a regular basis. While this school is larger and serves a larger area, the interviewee noted that even the students who live in the neighbourhood directly adjacent to the school site did not engage in AST more than the given rates. Students in lower connectivity neighbourhoods are more likely to have to take a route that is less direct to their destination, making the trip longer in both distance and time. This could decrease the potential for students and parents to want to engage in or allow AST, especially when other transportation options are available.

5.4 Summary

Based on the findings, this study shows that SES and connectivity do influence the potential for AST, but that it is important to distinguish context-specific features within these broader categories to fully understand the influence of each on rates of AST. Built environment factors that appear to be important in influencing AST to the schools studied here include: proximity to streets with higher volumes and speeds of traffic; presence of greenspace; school AST programs; and dominant dwelling types or mixture of dwelling types. These conclusions demonstrate an association between both the built environment and neighbourhood SES, and show that more research is needed. For future studies the researcher would recommend that selection of the schools control for not only connectivity and SES, but also proximity to major arterial roads and the dominant dwelling types and mixtures of housing. In keeping with this, although the

neighbourhood checklist used for this study captures an extensive variety of neighbourhood characteristics and is widely used for schools across Canada, it is also recommended that future studies consider using a different or modified version of the tool that includes dwelling type mixture and places a greater emphasis on major structural barriers such as proximity to arterial roads.

5.5 LIMITATIONS

It is important to note several limitations of this study's findings. First, the neighbourhood observations conducted to examine the characteristics of the built environment are subjective, and informed by the researcher's views and perceptions. However, to minimize the potential for bias and to standardize the findings, a widely used and well-recognized checklist was used to guide observations at all four sites. This ensured that the researcher was examining or attempting to identify the same attributes in all neighbourhoods, and helped to standardize the findings in a way that allowed for direct and accurate comparisons. That being said, the researcher identified some concerns with the checklist, namely that it excludes an evaluation of connectivity and would benefit from weighting of different categories given their likelihood of influencing the potential for AST.

Second, three of the four schools had similar enrollment numbers between approximately 145 and 195 students, whereas one school had around 370 students enrolled. While it was indicated that this raised the average distance that students travelled to school, the interviewee clarified that conditions were the same for the students that lived within the immediate neighbourhood.

Third, due to time and logistical constraints, the study was not able to collect primary data on the views, ideas, or perceptions of individual parents and students. Instead, the study opted for collection of data that emphasized capturing a comprehensive picture of the current context. While this does rely on the ability of the interviewee to provide accurate information, and does not capture parent or student perceptions, it facilitated a strong comparison between all four schools, as the sources of this information were very similar and provided a more inclusive assessment. Still, it should be noted that the rates of AST were estimated by the interviewees and may not be completely accurate.

Finally, the analyses were not conducted with longitudinal data, so any conclusions from this study are based on the data collection periods. A limitation within this was the use of 2006 Census Data for the community profile analyses, while both the neighbourhood observations and interviews collected data from 2013 and 2014 respectively. While this may present some inconsistency between the data and findings, the researcher was careful to, as much as possible, verify the findings from the community profile analyses with the information collected in the neighbourhood observations and interviews.

5.6 RECOMMENDATIONS

All recommendations for each school should be taken together as part of a broader strategy designed for the neighbourhood context, and collaboration should be strongly encouraged between all identified stakeholders. Increasing and sustaining higher rates of AST will require a comprehensive strategy that includes the cooperation of various levels of authority in the realization of numerous integrated initiatives.

The recommendations in this report align with and support numerous city-wide goals that encourage comprehensive sustainability and support the development of complete communities. These overarching goals are outlined in the Calgary Transportation Plan (CTP), the City's Municipal Development Plan (MDP), and the Long Range Urban Sustainability Plan, imagineCALGARY. Although the plans do not explicitly address school travel, the outcomes and benefits of efforts to increase AST are not isolated to the student and youth population, but also contribute to realizing the types of communities and broader city vision identified in these plans. The implementation of these recommendations and continued work for AST can aid in reaching many of the built environment targets in imagineCALGARY and help to achieve numerous development- or transportation-specific goals, objectives, and policies outlined in the MDP and CTP (City of Calgary, 2009; City of Calgary, 2014; City of Calgary, 2013b). These recommendations also align with the Key Directions and Sustainability Principles that jointly guide the MDP and CTP. Calgary has taken a progressive approach in integrating their land use and transportation planning, and the recommendations presented here directly and indirectly contribute to meeting these joint goals. Some of these principles and key directions include: providing more choice within complete communities; linking land use and transportation planning; increasing mobility choices; optimizing infrastructure; creating complete streets; creating walkable communities; fostering a strong sense of place; using green infrastructure; connecting people, goods, and services; and providing safe, effective, affordable, and efficient transportation options.

Encouraging and facilitating AST not only has the potential to increase the current proportion of the City's population that regularly uses active modes of travel, but also increases the potential for these young generations to continue to value and use AT in their adult lives. This enhances the longevity of current efforts, and further contributes to the overarching vision that the City has delineated for its future.

5.6.1 Schools

As with the recommendations proposed at a broader scale, schools should recognize the importance of a comprehensive strategy in increasing and improving active commuting. Schools in Canada are more likely to implement passive policies- such as

allowing but not encouraging bicycles on school grounds- or infrastructure over active programs, but these strategies should cover a combination of initiatives that include attention to programs, policies, and infrastructure improvements (O’Loughlen et al., 2011).

A lack of time and resources can constrain the ability of schools to take definitive action in addressing neighbourhood or school characteristics that discourage AST. To maximize the outcomes from available resources, it is recommended that schools prioritize efforts based on the required input and expected output. In most situations, for shorter time periods, schools should focus on facilitating programs and policies that aim to overcome or mitigate barriers that limit AST, and implementing lower-cost or easier infrastructure upgrades. In longer-term scenarios, emphasis should be placed on removing or systematically addressing these barriers and the constraints of the built environment, and simultaneously encouraging programs that actively promote the use of AST.

Schools also have the closest contact with both parents and students, whose views and perceptions directly influence the potential for AST. It is recommended that the schools find ways to incorporate parents and students into the process of assessing neighbourhood characteristics, and in generating ideas or suggestions for programs, policies, or infrastructure improvements. This collaboration will not only ensure that a broader scope of potential barriers are identified, but can also foster investment in the success AST-promoting initiatives (Fusco et al., 2011).

Given the diversity of context-specific barriers between the neighbourhoods, site-specific recommendations are appropriate to ensure that the recommendations are comprehensive and useful for the participating schools. It is imperative for school staff and administration to understand the basis of the recommendations, as the successful implementation of any programs and policies will rely on the continued input of time and resources at the local level.

5.6.1.1 Low Income, Low Connectivity School

A high proportion of students at the LILC school already engaged in AST largely because other travel modes are likely unavailable, yet this school scored the lowest on the graded neighbourhood checklist. It is therefore **recommended that the individual school, school board, and city departments responsible for infrastructure planning and maintenance prioritize improving the infrastructure and built characteristics of the routes to this school, and develop school-facilitated programs that will increase the safety of students.** These types of changes, which address the safety of students commuting actively, are consistent with the school

interviewee's suggestions for improving AST at the school. In school neighbourhoods where a large majority of students already use AST due to lack of other transportation options, programs that facilitate safer AST, such as a Walking School Bus, have been found to offer significant benefits such as improved attitudes to regarding AST and peer- or adult-accompanied travel (Stewart, 2011).

Numerous infrastructure upgrades are proposed that could facilitate a safer and more comfortable commute. **More crosswalks should be implemented on the residential streets directly surrounding the school site.** Crosswalks facilitate AST by providing a designated access point for students using AST and improving driver awareness of pedestrian and cyclist activity on the road. Crosswalks are crucial, particularly on the east side of the school grounds, to ensure that students using AST have a defined location where the possibility of vehicle conflict is minimized.

Signaling pedestrian devices should be implemented along nearby collector and arterial roads. Although traffic on the collector and arterial roads was relatively lower, there was still very little infrastructure to facilitate safe crossings for students travelling to the school site. While some signaling devices were present, it is recommended that more be implemented to ensure that pedestrians have a distinct presence on the streets and can safely cross at points that make accessing the school easy and convenient.

As well, the condition of all sidewalks should be improved and sidewalks adjacent to the school site should be widened where possible. Although the condition of the sidewalks was not directly prohibitive or dangerous for those engaging in AST, widening and improving the condition of the sidewalks could significantly improve the quality and safety of the commute for the already high number of students walking to the school. In particular, widening the sidewalks directly around the school would accommodate the higher pedestrian traffic volumes as students access the school site.

Depending on scope and scale, infrastructure improvements may not be an immediately feasible option. However, **collaboration between the numerous stakeholders can ensure that, where possible, AST-promoting infrastructure can be included into public works projects that are taking place or scheduled, minimizing the associated costs and ensuring integration into the surrounding built environment.** Open communication between the organizations can translate to the implementation of more and better AST infrastructure. Improvements to the built environment in any neighbourhood are often also beneficial to a wider portion of the population, and can be leveraged accordingly.

5.6.1.2 High Income, High Connectivity School

This school was the only of the four to report facilitating programs that promote AST. It is recommended that the programs be maintained and expanded,

particularly to increase student engagement in AST in colder temperatures. In tandem, **it is also recommended that the school encourage those parents who are able to accompany their children in commuting actively to school, to consider extending this supervision to children living close by or friends of their children.** Similarly, a portion of the extensive staff supervision provided for students being bussed could be reallocated to the sidewalks, streets, and pedestrian areas around the school from which the largest proportions of students are actively commuting. Both of these options could include the establishment of programs that encourage and facilitate AST, both increasing and improving the potential for students to actively commute.

The interviewee had identified the inclusion of AST in the curriculum as a further initiative that could increase the number of students engaging in AST, which is also recommended for this school. **Emphasizing the benefits and importance of daily physical activity in classes and developing classroom policies or programs, such as an outdoor, out-of-classroom physical education curriculum that involves active commuting, might make rates of AST more consistent throughout temperature fluctuations.** Indeed, involving staff in these programs and thus improving the continuity of information being relayed to the students and parents may institutionalize the emphasis on AST, and facilitate even higher rates at the school.

It is also recommended that the main access point be located away from the parking lot, which, in the current arrangement, increases the likelihood of pedestrian-vehicle conflict. Moving the primary access point would separate pedestrian and vehicle traffic, making it easier for students to negotiate potential traffic hazards. This does not need to involve extensive changes to the built environment, but could be done by relocating the pedestrian access point and existing infrastructure just south of the current location towards the middle of the school site edge.

The school should also consider advocating for an improved network of bicycle infrastructure that could connect the numerous greenspaces and the school site within the neighbourhood. This infrastructure could define a space for students engaging in AST on the road, making parents and students more comfortable with cycling to school. **In particular, the cycle paths could be implemented on streets where only a single side has a sidewalk, using the space where a sidewalk would be for a bicycle lane.** The school and neighbourhood could see significant long term benefits for all travel modes such as reduced speeds, increased use of active travel, and less traffic on residential streets.

5.6.1.3 Low Income, High Connectivity School

The LIHC school had the second lowest AST rates of the four schools examined, despite both the lower SES and higher connectivity characteristics of the school

neighbourhoods that have been associated with higher rates (Harrison et al., 2011; Stewart, 2011; Kerr et al., 2007; Panter et al., 2010; Pont et al., 2011; Pabayo et al., 2012; Hume et al., 2009, McMillan, 2007; Oluyomi et al., 2014). However, given these characteristics, **this school could potentially benefit most from initiatives to increase and improve AST (Stewart, 2011). Both the higher connectivity of the neighbourhood and the higher score on the graded neighbourhood checklist indicate that the built environment is conducive to facilitating higher rates of AST.**

It is recommended that the school administration work with staff, parents, and students to identify opportunities and resources for promoting AST and establish programs that support those students already commuting actively, and encourage more to engage in AST. A collaborative approach that involves all stakeholders at the local level might generate a greater community investment in the success of initiatives, and help to create an informed base of support. **It is also recommended that these efforts use the existing school-facilitated programs as a basis from which to establish AST programs.** The programs provide an opportunity to foster a base of engagement that could expand the programs, further increasing rates of AST. It could also provide an opportunity to share resources in pursuit of common goals, and establish partnerships that benefit all initiatives. These types of initiatives can be less expensive and require less external support than infrastructure improvements, often making them easier to implement in a shorter period of time.

Making connections between a healthy lifestyle and the benefits of active commuting can contribute to the longevity of the programs and ultimately, higher rates of AST (McDonald and Aalborg, 2009). **It is recommended that this school facilitate the dissemination of information about the benefits of AST and increase awareness of the programs and supportive structural elements (such as bicycle racks or the location of signaling pedestrian crosswalks) in place to facilitate a more active commute for students.** It is suggested that this material be distributed to both parents and students to ensure a consistent flow of information.

Studies on AST have shown that parents are much less likely to allow their children to commute if it involves crossing a busy road (Timperio et al., 2006; Harrison et al., 2011). In light of these findings, and inferences made in this study about the potential influence of the adjacent arterial road, **it is recommended that this school give particular consideration to addressing the resulting barriers to AST. To start, increasing supervision of crossings during the hours in which students arrive at and depart from school could be very helpful in increasing rates of AST.** This could impact both parent and student perceptions regarding the safety of an active commute, and could increase rates of AST.

While supervision will provide support for those actively commuting, in this context, changes to the built environment will likely have more influence on increasing the number of students and parents who actually engage in and support AST. In the current location adjacent to the arterial road, the school is easily accessible by vehicle, and the arterial road serves as a connection for traffic travelling from different parts of the city. **This report suggests that major infrastructural changes will be required to ensure the safety of students, and other pedestrians, accessing the school site and other destinations on either side of the street.** Several signaling pedestrian devices are located along the arterial road, but observations indicate that the effectiveness of these installations in facilitating crossings, increasing driver awareness, and delineating a space for pedestrians is limited. **It is recommended that more direct traffic-calming measures be implemented along this street, and that a phased approach be taken to ensure financial sustainability and that the changes to the street's functions are gradual.**

In a shorter time period it is recommended that less-costly or time-intensive options be implemented. **First, the addition of all-day on-street parking can provide many benefits to the area, notably narrowing the street to reduce traffic speed and increasing driver awareness (Macbeth, 1998).** Allowing on-street parking during peak traffic times, which are similar to when students commute to school, would slow traffic and perhaps encourage drivers to take a different route, further calming traffic. **To complement this, street trees as well as increased and clearer signage indicating not only the presence of a school zone, but that there are also children in the area and crossing the street, would make drivers more attentive to the potential for pedestrian-vehicle conflict.**

Over a longer period of time, it is recommended that two infrastructural changes take place. The first is the addition of bicycle lanes. **For the purpose of traffic calming, cycling lanes would serve much the same function as the on-street parking, which narrows the street and forces drivers to slow and pay attention, but would also contribute to a more complete street that supports several modes of travel and especially defines a safer, more comfortable space for active modes of travel.** These combined changes would not only improve the conditions for AST by calming traffic, providing safer infrastructure, and changing the nature and function of the street, but would also improve the overall streetscape for all demographics.

Similarly, the addition of a median and implementation of pedestrian islands could, in longer-term scenarios, contribute to the same objectives outlined above. While these infrastructure changes involve the investment of both time and money, the

location of the school directly adjacent to the arterial road is problematic for several important reasons, but is also only one of many problems that can be remedied by changing the nature of the street. These changes are predicated on the City's recognition that the car culture is unsustainable and that the convenience of vehicles should no longer be prioritized over the significant community and citywide benefits possible with a change in mentality.

5.6.1.4 High Income, Low Connectivity School

This school had the lowest AST rates of the schools participating in this study. While these comparatively low rates were expected based on neighbourhood SES and connectivity characteristics, the proportion of students engaging in AST was still below what was expected. **It is recommended that the school take a strong stance on addressing the potential barriers, and implement several initiatives to promote AST.**

This school scored the highest on the graded neighbourhood checklist, indicating a very supportive environment for AST, but the streets still offer very little connectivity, which can make it inconvenient for parents and students to engage in or support AST. Thus, **programs and policies that aim to facilitate supervision, and make AST a more convenient travel option for both parents and students are highly recommended for this school. Initiatives might include programs like Walking School Buses, Walk-to-School days, or classroom challenges that promote AST as a fun activity. Policies could also be implemented to make driving a less convenient option for parents and students.**

While the layout of street networks are largely static and the connectivity of the built environment is difficult the change, this report recommends a few structural changes be implemented in the HILC school neighbourhood. **It is recommended that the expansive greenspaces, which are accessible from many different points throughout the neighbourhood, be connected to the school and other destinations by a cycling network.** Multiuse paths are already present within the greenspaces, but designating a space for cyclists on the residential and collector roads would make better use of these pathways by offering connections throughout the neighbourhood. **Cycling is a strong option for this neighbourhood, as it allows for slightly less travel time than walking, which would mitigate some of the inconvenience caused by longer commutes through disconnected street networks.**

Multiple crosswalks should be implemented immediately in front of and behind the school grounds. The interviewee and the HILC school indicated that students access the grounds from both the front and the back, and there should be additional

infrastructure to facilitate safe street crossing and driver awareness of the importance of these areas. **This is particularly important for the front of the school, where the potential for pedestrian-vehicle conflict is higher.**

Wherever possible, informal pedestrian and cyclist routes in public spaces that act or could act as shortcuts through the neighbourhood should be structurally formalized by paving or path enhancements. Minor changes to the physical appearance and function of footpaths or trails can greatly improve the connectivity of the neighbourhood without the financial barriers or cost of time caused by street construction. By making these public paths and trails safer, the commute times for students could be reduced and AST may become a more appealing and convenient option for students and parents.

5.6.2 School Board

The school board is in a unique position to coordinate between municipal officials or decision-makers, and the individual schools under its administration. A two-pronged approach is recommended to facilitate AST-promoting programs, policies, and infrastructure improvements: 1) collaboration with external organizations and departments; and 2) continued internal facilitation of initiatives at individual schools.

5.6.2.1 External Collaboration

It is strongly recommended that the school board establish external partnerships with municipal departments that deal with planning and transportation to facilitate further discussions and initiatives to promote AST. Both school board officials and municipal planners have an interest in developing environments that support active modes of travel, for which infrastructure can be mutually beneficial (Kerr et al., 2012; Stewart, 2011; Buliung et al, 2009). The school board should, however, initiate conversations with planners and other municipal officials that highlight the unique needs of students, and children more broadly, and the range of barriers that can discourage AST.

External collaboration could also take place with public health officials, particularly in support of education and awareness campaigns that highlight the benefits of AST. Public health officials share an interest in protecting and promoting the health of youth, and active commuting to school can be a significant component of healthy lifestyles for students. **Jointly-run education and awareness campaigns could help staff, parents, and students understand the benefits, requirements of, and barriers to AST, and potentially change perceptions that could be a factor in lower proportions of engagement.**

5.6.2.2 Internal Facilitation

While external partnerships are recommended as means to improve the built environments in which students commute to school, numerous studies, including this one, indicate that there are other factors influencing the potential for AST. **The school board should work with individual schools to address barriers tied to, for example, student and parent perceptions and views, convenience of the commute, or commute supervision** (Hume et al., 2009; Kerr et al., 2007; Buliung et al., 2009; McMillan, 2007; Pabayo et al., 2012; Panter et al., 2010; Yang and Markowitz, 2012; Stewart, 2011; van Loon and Frank, 2011; McDonald and Aalborg, 2009).

In a shorter time frame this could involve the **establishment of projects that continue assessments of how school neighbourhood characteristics influence the potential for AST. This would provide information that could not only be useful for individual schools in addressing context-specific barriers, but also identify systematic or policy barriers common to all schools that can be addressed by the school board or at higher levels of authority.** With this information, the school board could also implement universal policies and programs aimed at increasing and improving AST across their jurisdiction, and help individual schools address context-specific barriers.

Over a longer period of time, it is **recommended that the school board invest in the continued assessment of school and neighbourhood characteristics for their supportiveness of AST and ways of tracking rates of AST at each school. Without this information, there is a critical gap in available information that is necessary for those trying to increase levels of AST.** Making AST a priority for the organization would involve not only identifying and removing barriers, but also actively encouraging and facilitating programs, policies, and infrastructure improvements. Working systematically with the individual schools to ensure a consistent flow of information regarding AST rates, the promotion of AST, and the potentially associated neighbourhood characteristics would help both the school board and schools in their efforts to facilitate and improve conditions for students to actively commute to school.

5.6.3 PLANNERS

There is ample evidence to indicate that all stakeholders should continue to investigate the relationship between the built environment and AST, and make temporary and long-term improvements to the built environment. The characteristics of the built environment at all four school neighbourhoods in this study were, in the researcher's informed opinion, adequately conducive to relatively safe active commuting, but varied primarily based on the presence or absence of certain facilitating characteristics.

It is recommended that planners actively seek to take part in some of the larger decisions for which the school board is responsible. Rather than operating in silos, planners can offer guidance, information, and ideas to school board officials that could contribute to the proactive development of safer and more supportive environments for students. An example of this could be the development of a task force to jointly negotiate the siting of new schools. Both the school board and planning departments have necessary information and expertise that would be useful to the other, and coordination on decisions of this scale would ensure that a more comprehensive range of concerns and perspectives are addressed.

The structural improvements required and designed to facilitate AST are often ones that will enhance the streetscape and public realm of a neighbourhood, as transportation infrastructure that is safer for children is generally safer for the broader public, regardless of age (Buliung et al., 2009; Stewart, 2011; Kerr, 2012). **It is therefore recommended that planners more systematically consider the locations of schools and school neighbourhoods when planning for new transportation infrastructure and other public works projects, as various designs and settings could either facilitate or discourage AST.** Likewise, it is also recommended that planners communicate with school board officials regarding future public works projects in school neighbourhoods to allow the individual schools and the school board an opportunity to express concerns or the need for specific infrastructure.

Rather than connecting on an as-needed basis, it is also recommended that planning departments establish of a formal partnership with the school board to strengthen collaboration and communication between the two organizations. Both have similar goals of fostering environments conducive to improved public and individual health and safety, and can capitalize on opportunities to share information, staff, and resources.

5.6.4 SUMMARY

Ultimately, all four schools had built environments that were already supportive of AST. The presence and condition of sidewalks, low-speed schools zones, access to greenspaces, low proportions of students being bused, availability of bicycle racks, and, in most cases, access to safe crossings all contribute to environments that can facilitate an active commute for students. However, in all four neighbourhoods, improvements can be made, as outlined above, that will make the commute safer and more comfortable.

Although implementation will take place at the neighbourhood level, the individual schools will require the support of the school board and municipal officials. The strategic and comprehensive changes that should occur to facilitate and improve AST, not only at

these schools, but also throughout the city, require not only the input of all stakeholders, but their active cooperation to ensure that initiatives are implemented efficiently. The individual schools, the school board, and municipal planners each have resources and expertise that are needed to effectively address the current issues, and partnerships between these groups will enable the necessary dialogues, joint initiatives, and decisions.

CONCLUSION

Overall, this study did find a correlation between rates of AST, and the built environment and characteristics of neighbourhood SES. For the current context of Canadian communities, one of the most relevant findings from this study is the extent to which surrounding traffic and street conditions can critically influence the potential for AST. In a time when schools are increasingly being consolidated and built in or relocated to larger parcels of land away from neighbourhood centres, this study's findings hold a greater weight. Locating on these larger sites often places schools along major roadways with higher-speed and higher-volume traffic. In this study, and most notably for one school, it was found that a school's proximity to a major roadway was a significant barrier that parents and students could not overcome, even in the presence of other factors that have been previously associated with higher rates of AST. The results of this study, in keeping with findings from similar studies, show that a school's proximity to roadways with more dangerous traffic conditions can be one of the most influential factors on the potential for AST. This conclusion is particularly important for both municipal planners and decision- and policy-makers at the school board, as it clearly demonstrates the need for the two generally unconnected fields to collaborate to a higher degree in the siting of schools.

Within the planning field, further research is needed to examine several factors that this research did not capture. First, more research that focuses on the Canadian context, and particularly for each region of the country, will build a body of literature that can offer more insight into both the similarities and differences of AST in communities across the country. At a smaller scale, more research should take place that accounts for the differences between AST in neighbourhoods at different parts of city areas (e.g. ex-suburbs, suburbs, inner-city). This could offer greater insight into factors such as access to a family vehicle, which can be dependent on a parent's travel options. Indeed, more studies are also needed that show the relationship between rates of AST and parent behaviours and attitudes, which will offer a better understanding of the complex system of parent and child decisions regarding AST.

It is imperative that planners not only continue to investigate how to increase and improve conditions for AST, but also implement and act on the recommendations from this study and others. The decline or increase of AST has ramifications that do and will continue to impact many aspects of urban life for generations. This research fuels recognition of the lasting role that AST can have in improving the health and well being of children and their communities, and the importance of assessing school neighbourhood environments to encourage more children to actively travel to school. Planning practice must go beyond simply addressing the cautions and policies from health professionals about the built environment; it must participate in including and prioritizing health in all aspects of decision- and policy- making processes, programs, and designs.

APPENDICES

APPENDIX A

NEIGHBOURHOOD OBSERVATIONS GUIDE

School site:

- The number of arrival and dismissal times at school
- School entrances for kindergarten students
- Teacher parking area/available visitor parking
 - Potential for vehicle and pedestrian conflict
 - Size and design of parking lot. Is traffic flow clearly signed?
 - Pavement markings on the parking lot
 - Parking and driving behaviour of driving parents
- Walking paths to the school
 - Where are the access points for students?
 - Potential for conflict with vehicles
 - Lighting along walkways
 - Maintenance of walkways, i.e. snow and ice removal
 - Alternate school grounds access routes
- Bicycle facilities
 - Bike racks
 - Bike paths or lanes
 - Potential for conflict with vehicles
- Location of School Bus Loading Zone, if applicable
 - Where do students wait for the buses; what type of supervision is employed
- Number of buses, vans and handicapped vehicles employed
- Location of garbage dumpsters and other school maintenance equipment
- Emergency vehicle access

Areas surrounding the school site:

- Volume and speed of traffic on surrounding streets – perceived and real – obtain latest 24 hour counts
- Are there sidewalks? How far do they extend around the school and the surrounding community?

- Pedestrian crossing devices present and utilized
- Number and position of bus/student patrollers (if any – are they needed?)
- Sight distances of school crossings to road curves and bus zones
- Number and position of adult crossing guards (if any – are they needed?)
- Placement of school crossings in relation to driveways and bus loading zones
- Timing of traffic lights
- On-street signs
- Providing a “hand-to-hand” area where parents of kindergarten students can take their children into the school

Non-traffic items to consider:

- Types of buildings surrounding school: residential, commercial, industrial, vacant/run-down
- Location of other public spaces near school: parks, community centres, libraries, churches
- Number of shade trees on streets
- Green space vs. concrete space
- Graffiti on buildings
- Physical state of the sidewalks
- Size of the sidewalks
- Garbage along the routes to school
- Snow piles at intersections or along route that may be climbing/sliding hazards
- Obstructions on the sidewalks (i.e. branches extending into walking space, broken concrete and tripping hazards, etc.)
- Block Parent or Neighbourhood Watch community – if so, where are Block Parents located?

NEIGHBOURHOOD OBSERVATIONS CHECKLISTS

	LILC	HIHC	LIHC	HILC
<i>Street Connectivity</i>	LOW	HIGH	HIGH	LOW
<i>Relative SES</i>	LOW	HIGH	LOW	HIGH
LOCATION OF PUBLIC SPACES				
<i>Parks</i>				
<i>Library</i>				
<i>Community Centre</i>				
<i>Churches</i>				
STREETSCAPE				
<i>Trees</i>				
<i>Physical State of Sidewalk</i>				
<i>Size of Sidewalk</i>				
<i>Obstruction of Sidewalk</i>				
<i>Garbage Along Routes</i>				

	LILC	HIHC	LIHC	HILC
<i>Street Connectivity</i>	LOW	HIGH	HIGH	LOW
<i>Relative SES</i>	LOW	HIGH	LOW	HIGH
SCHOOLYARD				
<i>Green/Brown Space</i>				
<i>Concrete Space</i>				
OTHER				
<i>Neighbourhood Watch</i>				
<i>Graffiti on Buildings</i>				

	LILC	HIHC	LIHC	HILC
<i>Street Connectivity</i>	LOW	HIGH	HIGH	LOW
<i>Relative SES</i>	LOW	HIGH	LOW	HIGH
TRAFFIC				
<i>Speed</i>				
<i>Signage</i>				
SIDEWALKS				
<i>Presence</i>				
<i>How Long?</i>				
PEDESTRIAN CROSSINGS				
<i>Devices</i>				
<i>Street Signs</i>				
TYPES OF BUILDINGS IN AREA				

APPENDIX B

INTERVIEW QUESTIONS

1. How many students are enrolled in this school?
2. Between what times are students expected to arrive at school? Leave school?
3. From which side of the school grounds do most children access the school?
4. On a regular basis, what proportion of students are bussed to school?
5. In milder temperatures, approximately what proportion of students are **driven** to school on a regular basis?
6. In milder temperatures, approximately what proportion of students **bike or walk** to school on a regular basis?
7. In colder temperatures, approximately what proportion of students are **driven** to school on a regular basis?
8. In colder temperatures, approximately what proportion of students **bike or walk** to school on a regular basis?
9. Are programs available at this school to encourage students to actively commute to and from school?
10. Are there programs available at this school to discourage parents from driving their children to and from school?
11. Are bus patrollers and/or crossing guards present when children are coming to and going from school? If so, how many? Where are they located?
12. Do you think that a good proportion of students walk or bike to school? Is this expected?
13. What do you think discourages or prevents children from actively commuting to this school?
 - a. Physical environment of the neighbourhood(s) around the school
 - b. Social barriers
 - c. School or neighbourhood policies
 - d. Individual or parent decisions or views
14. In your opinion, what changes would have the greatest impact on increasing the number of children who actively commute to school? Are there any specific locations or policies?
15. Is there any additional information you would like me to know?

GET MOVING TO SCHOOL: COMPARING INFLUENCES ON THE POTENTIAL FOR ACTIVE SCHOOL TRAVEL IN FOUR SCHOOL NEIGHBOURHOODS IN A LARGE URBAN CENTRE IN WESTERN CANADA

This research is being conducted by Sarah Nielsen, a student at the School of Urban and Regional Planning at Queen's University in Kingston, Ontario. Dr. Patricia Collins, a professor at the School of Urban and Regional Planning, will be supervising the project.

What is this study about?

This study is about how the built environment and socio-demographic characteristics of neighbourhoods surrounding schools might influence whether children walk or bicycle to and from school. Using active transportation to get to school is known as Active School Travel (AST), and has many documented health benefits for children. However, certain components of the neighborhood environments can either facilitate or pose barriers for AST. This research will compare four Calgary elementary school neighborhoods, analyzing the patterns of AST and neighborhood characteristics for each site. This will highlight which components of the neighborhood might influence the potential for children to use AST. The interviewees for this study are school officials or staff who are knowledgeable about the patterns and use of AST at their respective schools. The primary goal of the interviews will be to identify what the prevalence and patterns of AST are at each school.

Is my participation voluntary?

Yes, your participation in this project is entirely voluntary. While every effort will be made to ensure that your responses will remain confidential, there is a risk that your identity, and the identity of your school, could be recognized in study reports. The schools and participants will be coded and remain unnamed, but it may be possible for anyone familiar with the school areas to identify the schools and/or the participants. As such, it is important for you to know that the confidentiality of your responses cannot be absolutely guaranteed. If any questions or discussions make you uncomfortable, you may withdraw your information and end your involvement at any time during the research process.

How long will it take to participate?

The interview will take no more than one hour. It is recognized that your time is valuable, and every effort will be made to minimize disruption to your teaching and other commitments, and the daily structure of the school day. Interviews will ideally take place in person at your school, but if this cannot be arranged, the interview can be conducted by telephone or e-mail.

What are the benefits to participating?

Ideally, the findings and conclusions drawn from this report will inform future decisions and initiatives that will support AST at Calgary schools where possible. The responses gathered from interviews will help give the researcher a better understanding of the

current context of AST in Calgary, and will allow potential barriers and facilitators of AST to be identified and documented. The recommendations from this report may also be useful for the schools, school board(s), and municipal officials in future efforts to create environments and programs that encourage active commuting.

What will happen to my responses?

During the interview the researcher will be taking notes, but no responses will be audio-recorded. Any responses given during the research process will be kept confidential in password-protected computer and files. Only the researcher will have direct access to this information, and the responses will be destroyed upon completion of the project. To help with this, **please do not put your name on any study response sheets or materials**. No individual, school, or school board names will be conveyed in the final report, and coding (example: "Participant A" or "School A") will be used in reference to the schools and participants throughout the findings, recommendations, conclusion, and any discussions.

How do I find out about the results of the study?

The final report will be made available to all participants interested in the findings. Please indicate on the consent form if you would like to receive a copy of the report upon completion. The completed report will also be available on the School of Urban and Regional Planning's website once it has been through the School's review process.

What if I have concerns?

Any questions or concerns about the research or the questions being asked may be directed to Sarah Nielsen at sarah.nielsen@queensu.ca, or Dr. Patricia Collins at patricia.collins@queensu.ca or (613) 533-6000 x 77060. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

Thank you for your participation in this study. Your time and responses are greatly appreciated.

Sincerely,

Sarah Nielsen, B.A. Honours
Masters of Planning Candidate 2014
School of Urban and Regional Planning
Queen's University
sarah.nielsen@queensu.ca

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

GET MOVING TO SCHOOL:
COMPARING INFLUENCES ON THE POTENTIAL FOR ACTIVE SCHOOL
TRAVEL IN FOUR SCHOOL NEIGHBOURHOODS IN A LARGE URBAN CENTRE IN
WESTERN CANADA

This consent form, a copy of which has been given to you, is only part of the process of informed consent. Please take the time to read this carefully in order to understand any accompanying information. If you would like more details about this project or anything not mentioned here, please feel free to ask.

The Calgary Board of Education has approved this research study.

Name (please print clearly): _____

1. I have read and understand the Letter of Information that was given to me, and all of my questions about the research and my participation have been answered.

I consent to participate in the study, "Get Moving to School", and understand that I will be asked to provide anonymous and general information about patterns of active school travel at my school.

3. I understand that my participation in this study is voluntary, and that I may withdraw at any time. I understand that any responses I provide during the interview process will be kept confidential in password-protected files and locked storage. Only the researcher will have access to this information, and the responses will be destroyed upon completion of the project. No individual, school, or school board names will be conveyed in the final report, and any information I give will be anonymous.
4. I am aware that any questions or concerns about the research may be directed to Sarah Nielsen at sarah.nielsen@queensu.ca, or Dr. Patricia Collins at patricia.collins@queensu.ca or (613) 533-6000 x 77060. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

I have read the above statements and agree to participate in this research:

Participant's Printed Name: _____

Participant's Signature: _____

Date: _____

APPENDIX C

Table C1: Findings from observations on traffic conditions.

	SCHOOL 1	SCHOOL 2	SCHOOL 3	SCHOOL 4
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
TRAFFIC				
Speed	50-80 km on peripheral arterials, 40 km on inner residential streets, 30 km in playground or school zones	50-60 km on collectors and arterials (50km on collector adjacent to school), 40 km on residential streets, 30km for playground or school zones	50-70 km on arterials and collectors directly adjacent to school grounds, 40km on residential streets, 30 km in playground and school zones	50 km on peripheral street, 40 km on residential streets, 30 km in playground or school zones
Signage	Lots on periphery, almost none in inner neighbourhood (particularly lacking pedestrian signage)	Lots of traffic signage indicating speed, hills, visibility, turns; concentrations of speed bumps	Good signage on main street adjacent to the school, limited signage apart from stop signs within residential	Limited speed signage, except on peripheral collectors and arterials
SIDEWALKS				
Presence of Sidewalks	Often only on one side of the street	Varied throughout area, but most streets had sidewalks on both sides (particularly in northern half) , some on one, some streets with no sidewalks	Sidewalks on both sides throughout most areas, some buffered, but missing in parts around industrial areas	Sidewalks on both sides of the street throughout area except along paths
Extension of Sidewalks	Discontinuous in areas, particularly periphery	Varied through areas, some abrupt stops around school site	Continuous in residential areas except on periphery of industrial areas	Continuous in almost all areas
PEDESTRIAN CROSSING				
Presence of Devices	Some pedestrian devices, primarily across collectors	Few pedestrian devices; one leading directly into the parking lot behind school	Numerous pedestrian devices along arterial adjacent to school site	A few pedestrian devices along peripheral streets

On-Street Signage	Limited pedestrian signage aside from school or playground zone	Some pedestrian signs, but many more traffic signs than pedestrian; crossing with bollards directly in front of school	Scarce throughout most of the residential areas, except in playground and school zones	Good pedestrian signage throughout
TYPES OF BUILDINGS	Isolated residential with industrial and commercial on outer	Primarily residential with high-density mixed use and commercial/retail along northern border	Commercial along central arterial, residential on either side, and industrial northeast of school site	Entirely residential with some small-scale community institutional

Table C2: Findings from observations on non-traffic conditions.

	SCHOOL 1	SCHOOL 2	SCHOOL 3	SCHOOL 4
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
PUBLIC SPACES				
Parks	Surrounded on two sides by parks, few parks located inside residential areas	Several extending throughout neighbourhood	Some parks	Surrounded on two sides by large-scale greenspace park and multiple parks within residential areas
Library	None observed	None observed	None observed	None observed
Community Centres	None observed	One public, one private	One observed	One main centre
Churches	Several observed	None observed	Several observed	Multiple observed on periphery
STREETSCAPE				
Trees	Some trees, mostly smaller	Many larger trees	Larger trees	Many larger trees
Physical state of sidewalks	Average condition, some sloped	In generally good condition	Good condition	Excellent condition
Size of sidewalk	Smaller on some streets	Average, some wider	Average	Average
Obstruction of sidewalk	None observed	Temporary construction	None observed	None observed
Garbage Along Routes	Some garbage,	Some in higher-	Yes, mainly	None observed

	mostly on periphery	density areas along commercial	along central collector near commercial	
SCHOOLYARD				
Green space/ brown space	90%	70%	80%	70%
Concrete space	10%	30%	20%	30%
OTHER				
Neighbourhood Watch	Yes, community watch signs	None observed	None observed	None observed
Graffiti on buildings	None observed	Some along commercial concentration	Some observed at commercial, and along collector and arterial roads	None observed

Table C3: Findings from observations on school site conditions.

	SCHOOL 1	SCHOOL 2	SCHOOL 3	SCHOOL 4
Street Connectivity	LOW	HIGH	HIGH	LOW
Relative SES	LOW	HIGH	LOW	HIGH
WALKING PATHS				
Access Point(s) for students	Side	Side	Side	Front and back equal
Potential Vehicle Conflict	Moderate	High	Moderate	Moderate
BICYCLE FACILITIES				
Bike racks	Yes	Yes	Yes	Yes (many)
Bike paths or lanes	No	No	Yes	No
Potential for vehicle conflict	Moderate	High	High	Moderate
SCHOOL BUSES				
Location of loading zone(s)	No buses	Side	Side	Front and back
PARKING LOTS				
Location of lot	Front	Side	Back	Side
Potential for vehicle conflict	Moderate	Moderate	Moderate	Moderate
Size and design	Small, side access	Medium size, side access	Medium, back access	Medium, front access

APPENDIX D

INTERVIEW ANALYSIS

Analysis of the interview data was guided by Attride-Stirling’s (2001) thematic network analysis framework, which allows the researcher to clearly and systematically examine common themes in the information. The primary stage of analysis identified basic or “singular” themes specific to each school, the second stage identified “categorical” themes within neighbourhood characteristic groups, and the third stage examined “universal” themes common in all four interviews. The findings from each stage of this analysis are described in turn below.

Singular Themes

The identification of singular themes brought forward the most emphasized points from each of the four interviews. As seen in Table 4.6, each school neighbourhood had unique urban form and socioeconomic characteristics, and each school had different orientations to AST. These neighbourhood and school characteristics influenced what initiatives the interviewees thought would be most effective in increasing AST rates at their own school.

Table D1: Singular Themes of Interview Findings

LILC	HIHC	LIHC	HILC
AT motivated by limited access to private vehicles and buses Major concern: lack of safe infrastructure No AT programs Comprised of almost entirely residential Just local traffic	Influence of temperature was greatest at this school Affluent, diverse community Single wage-earner household common Existing programs AT policies would be most effective to increase AST rates	Numerous before- and after-school programs on site Highest proportion of students bused at this school Existing healthy living campaigns; no AT-promotion More supervision programs might help increase AT	Some programs and policies for student safety when entering or exiting school site No initiatives directly for AT After-school activities influence time of commute Desire to see new AT programs

Categorical Themes

Along with the themes outlined in Table 4.7, it should be noted that the two schools with higher rates of AST (LILC and HIHC schools) both emphasized either infrastructure or policy changes as initiatives that could have the greatest effect on increasing AST rates. Schools with lower rates of AST (LIHC and HILC schools) both identified programs as initiatives that could have the greatest impact on increasing AST.

For the two schools with lower rates of AST, both interviewees also noted a significant number of before- and after-school programs available at the school. While these programs differed in their purpose and structure, their availability may contribute to “trip-chaining”, or a greater propensity for parents using vehicles to drop off or pick up their child(ren) at school on their way to another destination (MacDonald and Aalborg, 2009; Pont et al., 2013; Stewart, 2011).

Table D2: Categorical Themes of Interview Findings

NEIGHBOURHOOD CHARACTERISTICS		
	Socioeconomic Status	Connectivity
LOWER	Highest (LIHC) and lowest (LILC) indicated proportions of students bused Very similar enrollment numbers Main point of student access on the side No AT programs, no anti-driving programs	No AT-promotion campaigns Mostly residential or community facilities/institutions: mostly local traffic at lower volumes
HIGHER	Used newsletters or brochures to communicate with parents about AT or traffic/student safety Staff involved in AST or bus patrols and supervision- emphasis on student safety Temperature (cold vs. mild) influenced rates of AST, most notably at the HIHC	Both accessed school grounds from the west side Existing healthy lifestyle campaigns, although only one promoted AT (HIHC)

Universal Themes

Some overarching themes emerged for all four schools. To begin, very few students were bused to school, which made bus transportation a low proportion of the travel modes used. This is likely a result of the school board’s decision to provide bus services only to those students who live outside of a certain radial distance (1.6 kilometres) from the school site or who could not commute by active modes due to physical or other constraints. Thus, very small proportions of the students at these schools were eligible to be bused, leaving significant proportions to use either active modes of travel, or to be driven to school.

Another theme commonly stated by all four interviewees was the feeling that individual or parent views and decision were some of the most direct influences on discouraging AST. While both schools with lower AST rates also noted that distance might be factor, personal views (either parent or child) and the resulting decisions were identified as a strong influence at each of these schools. This is consistent with much of the literature on AST, which shows personal, and especially parental, views and decisions as having possibly the most direct influence on the child(ren)’s mode of travel outcome (Yang and Markowitz, 2012; Pont et al., 2013; Panter et al. 2010; Pabayo et al., 2012; Stewart, 2011; Hume et al., 2009).

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