ABSTRACT

COX, ADINA JEANNE. Shared-Use Pathways Located in Natural Settings within the Urban Context: A Multiple Case Study Exploring How Design Affects Use by Children. (Under the direction of Professor Robin Moore.)

With an increasingly urbanized world, children have less opportunity to move freely about their neighborhood environments, interact with nature, and engage in free-play behaviors. Vehicle traffic and parental concerns about safety have limited biking and walking for children. Pathways provide opportunities for multiple healthy behaviors for children, including opportunities for physical activity, contact with nature, active transportation, access to play, and independent mobility. Pathway use by children has not been studied, although the federal government provides transportation funding for pathways and children have need for such recreation and transportation alternatives. Understanding children’s use of pathways is essential for communities that they may effectively utilize transportation dollars in planning and designing high quality pathways for use by children.

A case study approach that includes four pathways in four states and utilizes multiple methods informed this research. Two types of pathways were selected as cases: pathways located within destination parks that incorporated play equipment in play pockets, located in Springfield, Missouri; Chattanooga, Tennessee, and pathways located along neighborhood greenways, located in Richardson, Texas; and Cary, North Carolina. Behavior Mapping was used to observe pathway affordances and behavior in settings that occurred along pathway corridors. Parental perceptions of benefits, safety, and independent mobility were determined through
surveys conducted at all four sites. Pathway traffic counts conducted on site provided information on the age of.

Results suggest the following conclusions:

1. While vegetation may provide benefits such as shade, wildlife habitat, contact with nature, and scenic beauty, dense vegetation may discourage use by increasing parental fears.

2. Installation of play pockets may lead to more frequent pathway visits and increased duration of visits. This is important as time spent outdoors is associated with higher levels of physical activity for children.

3. Children are attracted to wildlife along pathway corridors. This important attribute may be encouraged by pathway planners and managers through careful attention to pathway location and landscape quality.

4. Parents ranked ‘family fun’ highest as a desired pathway benefit, followed closely by physical activity, contact with nature, and scenic beauty. These family benefits may be useful information to public health, and park and recreation system officials to promote pathway use.

5. Parents are concerned about social safety of children in natural environments but high visibility along pathway corridors may decrease parental fears.
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Shared-Use Pathways Located in Natural Settings within the Urban Context: 
A Multiple Case Study Exploring How Design Affects Use by Children

by
Adina J. Cox

A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy

Design

Raleigh, North Carolina

2013

APPROVED BY:

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Professor Yu-Fai Leung
DEDICATION

To Chloe and Thomas

I thank you for the sacrifices you made and the encouragement you provided.

I could not have done it without you.
BIOGRAPHY

Adina Cox was born the third of five daughters to second generation California parents. Her grandparents included migrant farm workers and lumberjacks. Growing up in a rural part of northern California, she spent much of her childhood outdoors climbing trees, picking blackberries, splashing in creeks, and roaming freely around the redwood forest near her home. Her parents both worked in law enforcement, so the parental perception of fear was focused on humans and, thankfully, did not extend to the wilderness.

Adina has always followed unconventional pathways in her life. She left home at the age of eighteen and spent the next fourteen years sampling several different retail jobs and college majors. She worked and paid her way through college, and graduated from Cal Poly Pomona in 1993 with a Bachelor’s of Science in Landscape Architecture. That program had strengths in art and science, which she complemented with elective courses in ecology and regenerative studies.

After graduating at a time of recession for the profession, she married, moved to North Carolina, and had two children. Those children became the focus of her life. As a stay at home mom, Adina worked in a pre-school, gardened, homeschooled, remodeled homes, and volunteered for numerous organizations including as a seamstress for a dance company, the Asheville Tree Commission, elementary schools, and the Girl Scouts.
When it came time to return to the work force, she moved to Raleigh and pursued a master’s degree in Natural Resource Management from North Carolina State University (NCSU). She was drawn to that field as her exposure to GIS as an undergraduate student inspired further curiosity.

After earning that degree in another recession, she decided to pursue her doctorate in a field that combined her interests in the natural world and in design for children at the College of Design at NCSU. She has spent the last three and a half years as a single mother, doctoral student, and research assistant. Her interests include laughing with her children, traveling, hiking, camping, gardening, sewing, watching hockey, remodeling homes, and visiting art museums.

She considers herself an advocate for children, independent mobility, single mothers, and other underdogs everywhere.
ACKNOWLEDGMENTS

I would like to acknowledge Professor Robin Moore for his assistance with this research and for providing the opportunity to pursue this project. The entire committee provided invaluable assistance over the course of the project. Dr. Nilda Cosco has tremendous experience with research and knowledge of children’s behaviors; Professor Art Rice offered his pragmatic and thoughtful perspective; and Professor Yu-Fai provided his research experience and scientific mindset to assist in this project. I thank each of you for the time and energy you have provided over the last three years to guide and improve this work.

PlayCore made this project possible by providing the initial inspiration, financial support and thoughtful input along the way. I thank them for their commitment to research and their passion for children and play. In particular, Lisa Moore and Jennie Sumrell were involved in this project from the beginning and provided valuable assistance every step of the way. The involvement of Tom Norquist, Bob Barron, and Bob Farnsworth was inspirational and invaluable as well. The people at PlayCore have demonstrated a devotion to making the world a more playful place, for which I thank them.

I would like to thank my fellow graduate students for the knowledge I have gained through working with them over the last few years, as well as the emotional support they provided along the way. The thoughtful discussions and sorting out of research strategies, methods, and data gathering tips were beyond helpful.
Charlynne Smith always provided words of wisdom (and encouragement) from outside the College of Design. George Hallowell, Aliaa Elabd, and Dr. Dwane Jones were invaluable for sharing their experiences with me, and allowing me to share mine, over the entire course of this work. I appreciate the questions, discussions and support from Zhara Zamani, Jong Seon Lee, Muntazar Monsur, and Mohsen Ghorveh that helped me sort out my own questions. Sarah Little provided the opportunity for intelligent conversations, as well as unintelligible conversations, and always kept me laughing. You were all a very important part of my education and I appreciate what I have learned from you. Let’s work together again in the future.

I am grateful for the assistance I received from the community members of the study sites who assisted in numerous ways for this research. From the Parks and Recreation Directors, to the parents who agreed to participate in the survey research, I encountered a great deal of enthusiasm and support for this project. My sincere appreciation goes to all of the people who made this possible.

I would like to thank my family members and friends who encouraged me and supported me in many ways that allowed me to make the sacrifices necessary for such a project.
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CHAPTER 1: INTRODUCTION

1.1 Introduction

Biking and walking are important activities as they may increase physical activity opportunities, reduce traffic congestion, lower use of natural resources, produce fewer greenhouse gas emissions, connect people to their destinations, and thus improve the quality of life for community residents. Walking is the most commonly reported physical activity among adults and is beneficial in meeting requirements for healthy physical activity levels (Centers for Disease Control and Prevention, 2012; Kruger, Ham, Berrigan, & Ballard-Barbash, 2008). The likelihood of biking and walking are linked to attributes of the built environment (Forsyth & Krizek, 2010). Greenway trails or pathways provide experiences for biking and walking that, in addition to providing the same benefits offered by sidewalks and streets, may reduce conflict with motor vehicles, connect people to nature, and create a more enjoyable walking or biking experience.

According to the 2010 Benchmarking Report by the Alliance for Biking and Walking (Steele, 2010), youth make up a disproportionately large amount of walking and biking trips. Data from the National Household Travel Survey (NHTS) indicates that youth under age 16 account for 28% of walking trips and 58% of biking trips, although this age group makes up only 24% of the population (Steele, 2010). The
built environment may influence children’s travel differently than that of adults. The presence of vehicle traffic plays a larger role in children’s walking and biking behavior (Giles-Corti, Kelty, Zubrick, & Villanueva, 2009) and the availability of separate infrastructure designated for walking and biking may increase the likelihood of walking and biking for children (Forsyth & Krizek, 2010).

Transportation trail projects became eligible for federal highway funds with the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 (Douwes, 2012). In 1998, the updated version of ISTEA, TEA-21, expanded the policy to include funding for recreation trails (Douwes, 2012). In the ten year period between 2001-2011, the average expenditure of federal dollars for pedestrian and bicycle projects has been $652.06 million annually (Rousseau, 2012). This has increased the availability of trails, with the National Trail System now totaling over 60,000 miles, which is longer than the Interstate Highway System. The biking and walking needs of children and the potential for health promotion must be addressed with the commitment of public money to support biking and walking infrastructure and the national effort to plan and design for more community trails. Research on children’s use of trails, or pathways, is virtually non-existent (Starnes, Troped, Klenosky, & Doehring, 2011) and should be considered a research priority.

A study that inspired and guided this research was Robin Moore’s *Childhood’s Domain* (1986). In that rich, qualitative study, Moore pointed out two
aspects of what he termed ‘children’s continuity of behavior’ along pathways. Moore referred to “…the way in which they hopped, climbed, balanced, skipped, rolled, swiveled and squeezed through, on, over, around and inside their surroundings…” and the way in which children stop “…at every point of interest along the way, until the original purpose and destination of the trip become completely forgotten” (Moore, 1986, pp. 56-57). Similar ideas of children’s movement along pathways drove the intention to study children’s travel with the mindset of ‘playing along the way’.

Pathways or trails can include a spectrum of linear routes from wilderness trails to urban promenades. Pathways of interest to this study include those located in public parks and along greenways. Pathways in public parks provide opportunities to understand children engaged in play behaviors with adults present. Pathways located along greenways are of interest as these pathways may provide transportation options for children to reach neighborhood destinations. These pathways are commonly found in urban areas and are, therefore, appropriate for consideration in this research. As there is currently a scarcity of research on children’s use of pathways (Starnes et al., 2011), this research takes an exploratory approach utilizing multiple methods to create a beginning point for future research.

1.2 Background of Problem

The use of pathways by children is an important topic of study due to the number of health benefits derived from the use of such pathways. Pathways can
provide children with opportunities for physical activity, exposure to nature, outdoor play, safe travel to destinations, and independent mobility. Research disciplines that relate to the use of pathways by children include parks and recreation, public health, planning, geography, transportation, child development, environmental psychology and landscape architecture. This dissertation borrows information from many fields of study in order to investigate the factors that influence use of such pathways. The following table outlines the problem areas that link to this study (see Table 1).

Table 1: Problem Areas and Potential Benefits of Pathway Use

<table>
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<tr>
<th>Problem area</th>
<th>Benefit</th>
<th>How related to pathways?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>Reduce obesity / overweight Increase health 60 minutes / day.</td>
<td>Pathways can provide opportunities to be physically active by encouraging translocation and by providing access to neighborhood park and playground facilities.</td>
</tr>
<tr>
<td>Contact with nature</td>
<td>Health benefits of nature.</td>
<td>Pathways can provide opportunities for contact with nature – can be located in parks or along greenways. Greenways offer ability to bring nature into neighborhoods.</td>
</tr>
<tr>
<td>Active transportation</td>
<td>Access to neighborhood destinations Reduction of vehicle traffic.</td>
<td>Barrier to active transportation is vehicular traffic, and pathways can offer protection or avoidance from traffic.</td>
</tr>
<tr>
<td>Access to play</td>
<td>Important for healthy child development unstructured play and family play.</td>
<td>Pathways can and should offer opportunities to play along the way, and provide play affordances. Adults can get their physical activity alongside their children, and have family time.</td>
</tr>
<tr>
<td>Independent mobility</td>
<td>Important for healthy child development Parents may have less time available for supervision now.</td>
<td>Pathways can provide opportunities for IM if they are appropriately designed as distance and vehicle traffic are barriers to IM.</td>
</tr>
</tbody>
</table>
1.2.1 Physical Activity

The rate of childhood obesity in the United States has been climbing and has severe negative health implications. The prevalence of obesity tripled in the population of youth ages 6-11 in the time span between 1971 and 2000 (Ogden, Flegal, Carroll, & Johnson, 2002). The epidemic of childhood obesity promises severe repercussions for the health conditions and life expectancy of adults in the future, as obesity and overweight that exist in childhood affect premature mortality and physical morbidity in adulthood (Reilly & Kelly, 2010). Increased physical activity can lower the risk of childhood overweight and obesity (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010).

For children to burn an appropriate amount of calories, the U.S. Government recommends that children receive 60 minutes of moderate to vigorous physical activity every day (Physical Activity guidelines Advisory Committee, 2008). Pressures in education have led to a decrease in physical activity children receive during the school day. The result is increased pressure on the need for after school and weekend opportunities for physical activity. Children (and adults) have a difficult time maintaining an impetus to exercise for the sake of losing weight. In a scientific statement, the American Heart Association acknowledges: “Recommended activities must be enjoyable and congruent with the child’s and family’s lifestyle and be rewarding independent of the health benefit” (Daniels et al., 2005).
Families typically have more hurried lifestyles than was true in the past (Elkind, 2006), and there is evidence to show that parenthood often results in a decrease in women’s physical activity levels (Brown & Trost, 2003). Walking is often a top-rated activity for adult recreation and physical activity. Adults may be able to spend more time outdoors being physically active if the built environment supports activities that include opportunities that are desired by children and include pathways for adults to be active.

Built environment factors that may influence physical activity for children include opportunities for biking and walking, access to parks and playgrounds, and opportunities to be physically active in a child’s home yard and immediate surroundings (such as neighborhood streets). Children’s biking and walking needs and barriers are different than adults. For example, high street connectivity is associated with higher levels of walking for adults (Frank, Schmid, Sallis, Chapman, & Saelens, 2005), but low connectivity and cul-de-sacs appear to increase physical activity for youth Carver, Timperio & Crawford, 2008; Mecredy, Pickett, & Janssen, 2011; Norman et al., 2006). This may be associated with decreased vehicle traffic and lower speeds for automobiles in neighborhoods with low connectivity. Reviewing the literature, Davison and Lawson (2006) found that increased road crossings and increased vehicle traffic were negatively associated with children’s physical activity.
Access to parks and playgrounds is important for increasing physical activity in youth. Davison and Lawson (2006) linked children’s participation in physical activity with publicly provided recreational infrastructure. In a Canadian study, children living within one kilometer of a park with a playground were more than five times more likely to have a healthy body mass index (BMI), although there was no such association for children living within that distance of parks without playgrounds (Potwarka, Kaczynski, & Flack, 2008). Proximity and the ability to bike or walk to a recreation site has been associated with children and adolescents’ frequent use of recreation sites (Grow et al., 2008).

Pathways that are child friendly may contribute to increased physical activity by providing opportunities for safe active travel, physical activity within a park, or by providing access neighborhood parks and playgrounds. Research that examines children’s physical activity in relation to walking is an emerging field, however little research exists regarding pathways and children. In a study on preschool children’s use of preschool play areas, Cosco (2006) found evidence suggesting that wide, curvy pathways may motivate higher levels of physical activity. However, this finding may not be generalizable to older children and pathways in larger, public areas.

1.2.2 Contact with Nature

A multitude of health benefits can accrue from contact with nature, including decrease in stress levels and improved emotional health, increased cognitive
functioning, decreased rates of myopia, decrease in allergies, and an increase in vitamin D absorption (Kuo, 2010). Increasing numbers of people are living in urban areas, which can result in the likelihood of less exposure to the natural environment. The US Census Bureau reports that the nation’s urban population increased by 12.1% from 2000 to 2010, resulting in 80.7% of the U.S. population now living in urban areas (defined as densely developed residential, commercial and other nonresidential areas) (US Census Bureau, 2012). This may affect children more than adults as the lack of freedom of mobility children have in urban areas where crime and vehicle traffic may restrict movement (Pucher & Buehler, 2010) and their access to environments which support their developmental needs. While research is continuing to show the multitude of health benefits derived from exposure to nature, research on increasing opportunities to improve children’s contact with nature is in limited supply.

Studies that examine the effects of neighborhood ‘greenness’ on walking have found positive results for adults and children. Liu, Colbert, Wilson, Yamada, and Hoch (2007) found that children reported more positive experiences with walking in areas with higher neighborhood greenness. Aesthetics, often including street trees and natural scenery, appears to be associated with increased walking for adults (Humpel, Owen, & Leslie, 2002).
1.2.3 Active Transportation

Many children do not have safe access to their neighborhoods due to the presence and domination of vehicular traffic. Most communities are planned to improve vehicle access and do not consider the mobility needs of children. Available data for active transportation to and from school shows dramatic decreases since the 1960’s. Based on data from the National Household Travel Survey (NHTS), the number of children walking and biking to school dropped from 40.7% in 1969 to 12.9% in 2001 (McDonald, 2007). A preliminary look at data collected in the 2009 NHTS shows the rate continuing to drop to approximately 10% (U.S. Department of Transportation, 2009). One reason for lower rates of walking and cycling may be the danger from vehicle traffic. As compared to the Netherlands, Denmark, and Germany, cyclist fatalities per kilometer cycled are three to five times higher in the U.S. (Pucher & Buehler, 2010). Pedestrian fatalities are five to six times higher (Pucher & Buehler, 2010). Children, women, and older adults are more adversely affected by dangers from vehicle traffic (Pucher & Buehler, 2010).

Travel to and from school has been the focus of recent research, but other countries expand the definition of transportation to include and measure independent mobility for children. This is important as transportation for children includes opportunities for socializing and being physically active after school and on weekends.
1.2.4 Access to opportunities for play

Free play has an important impact on healthy child development; however, play opportunities or affordances along pathways and greenways have not been studied. The outdoor environment provides a stimulating and diverse palette for children’s activities (Moore & Wong, 1997) but has been traditionally studied only in playgrounds. This study has expanded the frame of reference by adding pathways as play spaces.

A recent study in Canada of children living within one kilometer of a park with a playground were five times more likely to be of healthy weight than those who did not have such access. Numerous studies have looked at children’s access to park and exercise facilities, as determined by the distance of travel to reach a park or exercise facility, and found that closer proximity to facilities may be a way to increase physical activity (Kaczynski & Henderson, 2007; Sallis, Prchaska, & Taylor, 2000). Troped, Wilson, Matthews, Cromley, and Melly (2010) examined the impact of distance on adult use of a rail-trail and found that use declined with further distance from the trail. As distance appears to be a critical factor in pathway/park use, greenway paths that intertwine residential neighborhoods may provide more opportunities for play as they more directly access numerous homes.
1.2.5 Independent mobility

The term ‘independent mobility’ begins appearing in the literature in 1990 in Hillman’s book, *One False Move, a Study of Children’s Independent Mobility* (Hillman, Adams, & Whitelegg, 1990). The term appears most often in research literature from Australia and European countries, including Britain, Denmark, Finland, Italy, and Norway (Fyhri, Hjorthol, Mackett, Fotel, & Kyttä; Kyttä, 2004; Mackett, Brown, Gong, Kitazawa, & Paskins, 2008; Prezza et al., 2001; Weitch, Bagley, Ball & Salmon, 2006; Wen, Kite, Merom, & Rissel, 2009. The concept, if not the terminology, of independent mobility in regard to children in the US is referenced in a special edition of *Children, Youth and Environments* where children’s “freedom of movement” is recognized “particularly when it comes to children’s possibilities of exploring their neighborhoods on their own” (Karsten & van Vliet, 2006). A research project conducted in Australia defined ‘independent mobility’ as a positive answer to the question "are you allowed to walk on your own, near where you live?" (Wen, Kite, Merom, & Rissel, 2009). Mackett, Brown, Gong, Kitazawa and Paskins (2007) refer to independent mobility as simply children traveling without an adult present. The clearest definition is from Australian researchers who define independent mobility as “the ability of children and adolescents to walk or cycle around their neighbourhood without adult accompaniment” (Carver et al., 2010).

Independent mobility is important as it allows children opportunities to gradually develop skills necessary for adulthood. Independent mobility is declining in
most countries (Carver et al., 2010; Fyhri, Hjorthol, Mackett, Fotel, & Kytt, Hillman et al., 1990; Mackett, Brown, Gong, Kitazawa, & Paskins, 2008), however little research is being conducted in the United States to understand all of the reasons why. Research conducted in other countries may not be generalizable to the U.S. as cultural factors are likely to play a part in children’s use of pathways.

It is known that children alter their behavior when they are with adults as compared to moving about on their own (Mackett et al., 2007). Children even thirty years ago had opportunities for independent travel in their neighborhoods by walking and biking on the streets, sidewalks, and footpaths linking children to schools, parks, playgrounds, stores, and friends’ houses. Children who have more independent mobility are more likely to spend time outdoors, and spending more time outdoors is associated with higher levels of physical activity (Sallis, Prochaska, & Taylor, 2000). If children and adolescents have access to neighborhood greenway pathways to connect them to destinations, it is possible that independent mobility, and thus physical activity, will increase.

1.3 Study Objectives

This study seeks to explore multiple facets of pathway use in order to understand how the context and design of the built environment affects behaviors of children along pathways and thus contribute evidence to assist in the planning and design of child friendly pathways.
1.4 Introduction to Research Design

This research is primarily concerned with the actions of children along pathway environments as well as perceptions of parents and caregivers of these environments. As such, it is important to utilize research strategies that consider the relationship between the participants and the built environment. This calls for a naturalistic inquiry that can explore the environment and behavior relationships. As children are the subject of interest, this research may also have an additional degree of complexity because children are subject to supervision by parents or caregivers that may permit or restrict their behaviors.

As there is very little literature available on children’s use of pathways, a broad approach was taken to explore a diversity of factors that may affect use of pathways, rather than to focus on a narrow set of factors that would prematurely restrict exploration of the topic. The research also includes, in effect, a post occupancy evaluation of the play pocket installations piloted in Springfield, Missouri, and Chattanooga, Tennessee. As the ‘play pocket’ concept is new and unstudied, multiple evaluation methods may provide insight as to the value of play pockets and offer ideas for future development and research.

1.5 Definition of Terms

**Corridor:** The area immediately adjacent to a pathway tread that includes public space associated with the pathway.
Greenway: ..."corridors of land and water (and networks of such corridors) designed and managed for multiple purposes, such as nature conservation, recreation, stormwater management, community enhancement, social equity, and scenery protection, with an overall aim of sustaining the integrity of the landscape, including both in its natural (biophysical) and social components." (Hellmund & Smith, 2006)

Independent mobility: Children and adolescents moving around their neighborhood without adult accompaniment

Play Pocket: A play space located adjacent to a pathway tread and providing play opportunities

Shared Use Pathway: ‘The term “shared use path” means a multi-use trail or other path, physically separated from motorized vehicular traffic by an open space or barrier, either within a highway right-of-way or within an independent right-of-way, and usable for transportation purposes. Shared use paths may be used by pedestrians, bicyclists, skaters, equestrians, and other nonmotorized users.’ – (U.S. Department of Transportation, Federal Highway Administration)

Tread: The surface of a pathway meant for travel.
CHAPTER 2: LITERATURE REVIEW

Research on children’s use of pathways or trails is virtually non-existent. Related fields of study include play, contact with nature, children’s active transportation, independent mobility, perceptions of safety, neighborhood walkability, adult use of pathways or trails, and parental attitudes towards children’s outdoor activities. A recent review of the literature on trails and physical activity considered studies from five disciplines, public health, transportation, environmental science, planning, and leisure science (Whitcomb, Troped, Klenosky, & Demano, 2011). The authors also reported that with the recent interest in the obesity epidemic, research by scholars in the field of public health has shown a dramatic increase since 2000.

2.1 Environment Behavior Framework

The research reported here was guided by the over-arching framework of Ecological Psychology, which is concerned with the relationship between human behavior and the physical environment. It attempts to understand what people expect or desire from the environment, how they perceive the environment, and how the environment affects behavior. Three psychologists have independently contributed to the ecological approach: James Gibson, Roger Barker, and Urie Bronfenbrenner. Gibson developed the concept of ‘affordance’, Barker the concept of ‘behavior setting’, and Bronfenbrenner the nested ecological model of human development. For Heft, these three concepts of Ecological Psychology are linked by
‘a careful and systematic consideration of the environmental context for psychological processes’ (Heft, 2004).

Ecological psychology is primarily relevant for this study because of its concern with children’s behavior as influenced by the physical environment and the environmental perceptions of parents / caregivers. In examining children’s participation in community planning, Chawla and Heft (2002) discuss ecological psychology as a relevant theoretical base because “it focuses on children’s agency; it provides a rich description of the environmental context for action and development; and it places children and the environment together in a common realm.”

2.1.1 Bioecological Model of Human Development

Bronfenbrenner, a development psychologist, advanced the theory that the study of human development must include the concept that humans, as ‘active producers’ of their own development, must be studied within the context of the physical and cultural environment that shapes their actions. The objectives of his model were to devise new, more precise and replicable research findings that would lead to more valid scientific knowledge; and to provide a scientific base for the design of effective social policies and programs that could respond to the changing and developmentally disruptive influences on human development (Bronfenbrenner, 2001). Human development, according to Bronfenbrenner, could be researched and
understood within the context of the model as a series of interrelated systems which he later referred to as the *Bioecological Theory of Human Development* (Bronfenbrenner, 2005). These systems and the connections between them, all have impact on the developmental outcomes of a growing child and include the following nested structures (Bronfenbrenner, 1977):

- **Microsystem**: immediate face-to-face setting experienced by the child (family, school, peer group, workplace)
- **Mesosystem**: interrelations and interactions between two or more microsystems
- **Exosystem**: linkages and processes between two or more settings, at least one of which does not contain the child but indirectly influences the child’s environment
- **Macrosystem**: overarching pattern within a given culture, or societal blueprint
- **Chronosystem**: passage of time

This model is useful when studying the connection between children’s environment and behavior. When examining independent mobility, for example, the connection between a child and the parent or the child and a peer, are part of the Microsystem. The parent’s confidence in the abilities of the child, for example, is part of the Microsystem. The effect that the child-peer relationship has on the child-parent relationship is part of the Mesosystem. The policies that drive (or do not drive) development of pedestrian and bike infrastructure are part of the Exosystem. The
cultural context regarding bike vs. automobile for transportation and the natural land use policies that make it feasible or not are part of the macrosystem. All of these systems are interconnected but exist in a nested system.

2.1.2 Concept of Affordance

According to Gibson and Pick, an ecological approach “is a theory about perceiving by active creatures who look and listen and move around” (2000, p. 14). This theory recognizes the significance of the human and the interaction of the human within the environment. It describes the relationship as “reciprocal,” as the environment presents opportunities, resources and information to guide action, and the action (of the human) results in more information for the human perceiver.

The ecological approach “helps us to understand the impact of the physical environment on children and to identify environmental attributes that are associated with specific behavioral responses” Cosco & Moore, 2009, p. 163). An ecological approach provides a method to categorize the environment and the human responses to it in order to analyze the human actions in a way that facilitates understanding of the actions of individuals. To better understand how to design pathways and the surrounding environments for children and families, it is important to understand the relationship between the environment and the people using this environment. The ecological perspective assists with understanding the environment as it is perceived by children. The ecological approach helps create an
objective measure of response. This approach is important because children may perceive the environment differently than adults do, and we want to understand the specific affordances of physical features in the environment that may explain the difference.

Affordance can be described as the properties of the environment as it is related to the humans that use the environment. These are objective qualities that can be described as a fit between the environmental properties of the environment, its layout, objects, and events, and the possibilities for action.

Information is the stimulus or the action of perception. It is how the environment is perceived over time and space. As individuals interact and move through the environment, they continually shift their point of view. The information is changing as the individual’s movements in the layout change. An individual perceives the environment and co-perceives oneself in the environment. This movement and active interaction allows children to learn about the environment from experience. Applied to movement along a pathway, children will collect their own data as to what opportunities they see for action.

Sometimes children can be observed walking along a pathway and touching all of the grass or vegetation within reach. They might stop to pick up a walnut that lies on the ground, and examine it with their hands. This is known as ‘active touch’ (Gibson, 1962). They are learning about the grass or the walnut by feeling it’s
weight, and texture. The information they receive can guide the possibilities for future action.

Active touch can be exploratory, which allows the child to gather knowledge. They might pick up a stick and run it along a frequently passed fence in order to hear the tapping sound that it makes. This pickup of information can be performatory, allowing the individual to perform a task and gain expected results based on previous learned affordances (Gibson & Pick, 2000).

Heft describes a functional approach as a method for understanding children’s outdoor environments (Heft, 1988b). With this concept, he describes affordances as its ‘functionally significant properties considered in relation to an individual.’ Heft's approach provides a descriptive language to describe the environment from a psychological perspective. It helps us understand not the physical properties of the environment, but how those physical properties of the environment are perceived. Heft began a typology of affordances that included such categories as: graspable/detached object: affords throwing (Heft, 1988b). Kyttä added affordances for sociality including: affords role playing (Kyttä, 2002).

We perceive the world as it relates to us. The layout of the environment, the objects in the layout, and the events that happen over time determine what the environment affords for individuals.
2.1.3 Behavior Settings

Barker’s notion of behavior settings refers to the physical environment that contains the interactions of human activity. His intention was to develop a theory of behavior that, in psychology, had previously been limited to laboratory analysis. Prior to Barker, researchers had shied away from investigating the effect the naturally occurring environments had on behavior. Barker focused on the psychological habitat which he defines as ‘the intersection of the behaving person and the non-psychological milieu; it is jointly determined by the person and the milieu’ (Barker & Wright, 1954, p. 11). Heft explains a behavior setting as ‘standing patterns of behavior and milieu - on-going patterns of activity and the environmental features that support as well as constrain this activity (Heft, 1988a). The interactions with the environment are viewed as observable and either constrained or supported by the qualities of the physical environment.

Barker noticed in his work as a psychologist that ‘some attributes of behavior varied less across children within settings than across settings within the days of children’ (Barker, 1968). He believed that the environment consisted of arrangements of objects and events which coerced an individual to behave in predictable ways. He sought to develop a method to analyze and describe the environment and the set of arrangements in order to measure the effect of the environment on the behaviors of individuals.
Behavior settings are used here to refer to areas that are observed to function as settings, which attract standing patterns of behavior.

Barker, as said earlier, was interested in studying human behavior in the physical environment in which the behavior actually occurred. He described as the ‘ecological environment (the objective, pre-perceptual context of behavior; the real-life settings within which people behave)’ (Barker, 1968, p. 1). Barker specifically provided this definition: “A behavior setting consists of one or more standing patterns of behavior” (Barker, 1968, p. 18).

2.2 Conceptual Framework

The overall conceptual framework illustrates (see Figure 1) the three main factors affecting the use of pathways by children and families. Parents and caregivers respond to the environment, as they perceive benefits and affordances, and confront lifestyle demands, and judge safety based on their perceptions. All of these influences affect whether or not the parent allows, encourages, or prevents use of pathways by children. The environment exerts influence over the child as well. It may attract, repel, seem boring or uncomfortable. Ultimately, it will attract children by affording playful and interesting activities.

Regardless of how attractive a pathway is, the intrinsic likes or dislikes of parents / caregivers may be influential as well as the daily schedules of parents and child. And finally, a parent’s perception of the child’s needs, wants, and dislikes will
have an effect on the activities of the child. This complex set of largely hidden relationships reside in the microsystem of the child. The research reported here will attempt to uncover part of this system as far as it may affect pathway use by children.

2.3 Supporting research

This research is supported by research from numerous disciplines including planning, parks and recreation, and research on children’s play behaviors.

2.3.1 Children’s Use of Pathways
A recent review of trail use and physical activity reported that age was negatively associated with trail use in five of the ten studies examined (Starnes et al., 2011). It is important to note that these studies examined ages of adult users, predominately on rail-trails. Results were mixed, with five studies finding that the adult users were more likely to be younger adults. Other studies find different results, indicating that older adults are more likely to use pathways, but use by children is not usually considered. A study conducted in Raleigh in August of 1989 surveyed users of the Capital Area Greenway and found that the presence of children in the household resulted in a 25% decline in frequency of use (Furuseth & Altman, 1991). This was the only study of the reviewed literature that examined presence of children in the greenway user's household. A study conducted on three long distance rail-trails is the only example discovered that reported pathway use by children under the age of 18 (Reynolds et al., 2007). The results of that study are shown in the following table (see Table 2-1). Use by children is relatively low, particularly on the Dallas and Chicago trails. This is not surprising, given that trail count times included hours when children might be expected to be in school, and given that these were long distance trails and not necessarily connected close to residential neighborhoods.
Table 2-1: Reynolds et al. study reporting trail counts.

<table>
<thead>
<tr>
<th></th>
<th>Chicago</th>
<th>Dallas</th>
<th>Los Angeles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 18</td>
<td>6%</td>
<td>3%</td>
<td>12%</td>
</tr>
<tr>
<td>18-39</td>
<td>64%</td>
<td>48%</td>
<td>45%28</td>
</tr>
<tr>
<td>40-64</td>
<td>29%</td>
<td>46%</td>
<td>37%</td>
</tr>
<tr>
<td>18-64</td>
<td>93%</td>
<td>94%</td>
<td>82%</td>
</tr>
<tr>
<td>65+</td>
<td>1%</td>
<td>2%</td>
<td>7%</td>
</tr>
</tbody>
</table>

The data collection method used in the Reynolds study was a manual count of users, in which researchers stood at predetermined locations along the trail to collect data. Although manual counts allow for estimates of age of users, age is rarely collected. Many municipalities are now collecting data with infrared counters, which do not indicate age of pathway users. They also tend to be less accurate than estimates made from 10 minute manual sampling intervals (Lindsey & Lindsey, 2004).

2.3.2 Perceived Benefits

Perceived benefits of pathway use by children may be thought of in terms of motivational factors. Beck (2004) defines motivation as follows: ‘a theoretical concept that accounts for why people (or animals) choose to engage in particular behaviors at particular times. Our basic motivational premise is that organisms approach goals or engage in activities that are expected to have desirable outcomes
and that they avoid activities that are expected to have unpleasant or aversive outcomes’ (Beck 2004, p. 31). In a study that sought to understand barriers and facilitators that might explain greenway use suggested that motivations can be utilized by recreation managers to market recreational products, evaluate existing services and amenities, and assist in planning for future needs (Frauman & Cunningham, 2001).

Environmental facilitators might be thought of as qualities of the environment that ‘pull’ visitors toward a particular destination, but benefits sought might be thought of as personal, higher level motivational factors that ‘push’ a visitor to participate in a particular activity (Dann, 1977; Klenosky, 2002). In the study reported here, perceived benefits are considered as motivational factors that may influence pathway use.

In a recent review of the literature on trail use and physical activity, thirteen studies were listed that reported intrapersonal items as facilitators or barriers to use (Starnes et al., 2011). Of the thirteen, only four (Bichis-Lupas & Moisey, 2001; Frauman & Cunningham, 2001; Lee & Moudon, 2006; Moisey & Bichis, 1999) specifically asked about personal enjoyment or fun. Of those four studies it was clear that respondents ranked ‘personal enjoyment’ and ‘fun’ high on the list of motivators. None of these studies asked questions regarding the use of trails by children, and three of four did not ask whether or not there were children living in the household. However one study (Cronan, Shinew, & Stodolska, 2011) mentioned in the review
noted that Latina women frequently were accompanied to the park with children and commented that this may have prevented women from using the trails.

A study that examined urban trail use motivation conducted in Cleveland, Ohio, found that trail users who reported the purpose for trail use was exercise and health reasons reported higher recreational use of trails than trail users who reported use of the trail for social interaction, enjoying nature, or for walking pets (Dunton et al., 2009). They found no such connection between reason for trail use and transportation use. This study only questioned adults and did not specifically ask about ‘family fun’, but rather asked about personal ‘enjoyment’ of the activity. Respondents reported in descending order that exercise, enjoyment, relaxation, and appreciation of nature were the most popular motivations.

A study that examined physical activity and psychosocial correlates of adolescents found that normal weight adolescents reported more fun in physical activity and had higher total levels of physical activity than their overweight counterparts (Bourdeaudhuij et al., 2012). Although this study examined perception and did not evaluate the actual physical environment, increasing the amount of enjoyable or fun activities in the environment for adolescents may encourage higher use.

The literature includes several studies examining benefits of trail use reported by adults, but none were identified that looked at perceived benefits for children. Also, those studies that examine benefits frequently utilize questions that ask about
the importance of physical activity, connection with nature, scenic beauty, relaxation, and other adult oriented benefits. Studies that list ‘fun’ or ‘personal enjoyment’ as response options for perceived benefits are rare, but may be important for children and families.

2.3.3 Play

Play is important to a child’s healthy cultural, social, cognitive, language, and motor development, and may be utilized as a motivational force to encourage children to be active outdoors (Frost, 1992). Play has also proven difficult to define. Frost, in acknowledging the difficulty of defining complex play behaviors and of reconciling the many definitions of play across multiple disciplines stated that “it is still not possible to arrive at a simple, clear, scientific definition of play” (Frost, 1992, p. 21).

Play is valuable to children when they engage with their parents as it may help the generations to connect, alternatively, play independent from adults is also important for children’s development and well-being. The importance of balancing autonomous and parent-connected play is echoed in the report by Ginsburg and the Committee on Psychosocial Aspects of Child and Family Health (2007): which includes the following conclusions about play:

• Children are most likely to gain essential resiliency traits (such as confidence, competence to master the environment, and deep-seated connectedness and
ability to care about others) within a home in which parents and children have quality time together.

• Pediatricians can promote free play as a healthy, essential part of childhood. They should recommend that all children are afforded ample, unscheduled, independent, nonscreen time to be creative, to reflect, and to decompress. They should emphasize that although parents can certainly monitor play for safety, a large proportion of play should be child driven rather than adult directed.

• Pediatricians can reinforce that parents who share unscheduled spontaneous time with their children and who play with their children are being wonderfully supportive, nurturing, and productive.

2.3.3.1 Play Behavior Categories

The most widely used categorical descriptions of play are based on Smilansky’s categories of cognitive play and Parten’s categories of social play. Piaget, building on the work of others, categorized play as practice games, symbolic games, and games with rules, and describes construction play as a higher level combination of symbolic and games with rules (Piaget, 1962). Smilansky modified Piaget’s categories to define functional games, construction play, dramatic play, and games with rules (Smilansky, 1968). Parten’s categories of social play included
unoccupied behavior, onlooker behavior, solitary play, parallel play, associative play, and cooperative play (Parten, 1932).

Advocating for the need for teachers and play leaders to develop skills in monitoring children’s play status as well as planning for future play, Frost recommends the use of observation and classification of children’s behaviors (Frost, 1992). He suggests that the observer first collect anecdotal evidence or a direct recording of the observed behavior, followed by categorization of the observed behavior, and then a summarization of the child’s behavior (Frost, 1992, p. 95). Combining multiple classification schemes from earlier authors, Frost provides the following table of categories along with descriptions (Frost, 1992, p. 101).
Table 2-2: Frost’s categories of play and non-play behaviors.

<table>
<thead>
<tr>
<th>Types of Behavior</th>
<th>Child’s Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive</strong></td>
<td></td>
</tr>
<tr>
<td>Functional</td>
<td>Repetition of actions for the fun of it</td>
</tr>
<tr>
<td>Dramatic or symbolic</td>
<td>Substitution of an imaginary situation or object in pretend play situations</td>
</tr>
<tr>
<td>Games with rules</td>
<td>Acceptance of prearranged rules and adjustments to them in organized play</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>Solitary</td>
<td>Child plays alone and independently</td>
</tr>
<tr>
<td>Parallel</td>
<td>Child plays beside rather than with other children</td>
</tr>
<tr>
<td>Group</td>
<td>Child plays with another child or group of children striving to attain a common goal</td>
</tr>
<tr>
<td><strong>Exploratory</strong></td>
<td>Child seeking sensory information or stimuli</td>
</tr>
<tr>
<td><strong>Constructive</strong></td>
<td>Manipulation of objects to construct or create something</td>
</tr>
<tr>
<td><strong>Rough and Tumble</strong></td>
<td>Play fighting or playful physical activity</td>
</tr>
<tr>
<td><strong>Chase games</strong></td>
<td>One or more children planning to chase or actually chasing another child or children</td>
</tr>
<tr>
<td><strong>Non-Play</strong></td>
<td></td>
</tr>
<tr>
<td>Unoccupied</td>
<td>Child is not playing. Watching anything of momentary interest</td>
</tr>
<tr>
<td>Onlooker</td>
<td>Watching other children play. May converse with players but does not participate</td>
</tr>
<tr>
<td>Transition</td>
<td>Preparing for or moving from one activity to another</td>
</tr>
<tr>
<td>Aggression</td>
<td>Real fighting—with intent to hurt or defend</td>
</tr>
</tbody>
</table>
These categories have evolved to a sophisticated and useful level, however are more effective at describing indoor behaviors which can be evaluated up close and in a contained environment. It is much more difficult to utilize these categories for outdoor pathway behaviors, which present three main obstacles. First, it is more difficult to observe behaviors well enough to determine exact categories. Dramatic play, for instance, may require the observer to listen to a conversation. Second, the diversity of behaviors occurring along a pathway can be more varied. Children engage in many behaviors that do not fit in to the defined categories, for instance, observing wildlife. Finally, it is not as likely that children will be engaged with peers in the pathway environment. The school or daycare setting would be a familiar setting and less likely to involve adults. For these reasons, all though it is important to understand these play categories, they are not appropriate for this research.

2.3.3.2 Play Equipment

The role of play equipment in a landscape is described by Moore in *Childhood’s Domain*, where he stated that “it became clear that a brightly painted collection of play equipment often provided the initial pretext for a park visit” (Moore, 1986, p. 113). From a child’s perspective, play equipment may serve as an invitation to play or as a meeting point for social interaction. As the concept of spacing play equipment along a pathway is new, research that examines playground use in this context has yet to be undertaken by other researchers. This study is a beginning
attempt to explore how playground equipment is used within the context of a linear natural environment.

In a study related to playground choice, women in the U.S. and in Denmark were more likely to report that the opportunity for socialization was an important function of playgrounds while men regarded appealing and varied play equipment as essential for playground satisfaction. Men reported that their stays were less lengthy if the equipment did not provide sufficient opportunities for activity (Refshauge, Stigsdotter, & Cosco, 2012).

In an observational study in New Orleans, Farley, Meriwether, Baker, Rice and Webber (2008) found that children who played at a school playground on weekends and after school were more likely to play in areas with more installed play equipment. This finding is interesting as adults did not accompany children to the playground in this study. A limitation is that only one playground was studied and the variability of play opportunities may have been low. A study examining renovated schoolyards in the Midwest found that the total number of play features was related to schoolyard use (Colabianchi, Maslow, & Swayampakala, 2011). The more features available in the schoolyard, the higher the use was during afterschool hours. This was particularly true for girls as compared for boys.

These studies suggest that in addition to schoolyards, playground equipment may signal that a park or greenway has been designed to accommodate children, and may signal the opportunity for socialization. Although playground equipment has
been studied in relation to designated playgrounds, it has not been studied in relation to the linear context. It would appear that variation in the equipment may be necessary to attract males, while the social aspect may be more significant to females.

2.3.4 Nature

Contact with nature has significant and measurable effects on humans, and may be even more significantly related to children’s well-being (Kuo, 2010). Diverse natural environments support attention functioning, gross motor development, children’s health, and richer play. When adults who have more access to parks and green environments were compared to people who had less, they were found to exhibit differences in well-being across the social, psychological, and physical health domains (Kuo, 2010). For example, Faber-Taylor conducted an experiment with children and found that when children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) spent 20 minutes walking in a green park as opposed to a walk in an urban environment, their ADHD symptoms were reduced (Fabor Taylor, 2009). The impact green environments have on resilience (e.g. the ability to cope with loss, and deal with challenging situations…) is clear, and as Kuo (2010) stated, “the importance of green environments is all the keener for more vulnerable individuals—the young, the very old, the poor, and the infirm” (2010, p. 24).
2.3.5 Play in Nature

A study by Fjørtoft (2004) was conducted in a diverse landscape in a schoolyard in Sweden where nine out of ten available Swedish landscape classifications were identified. That playground afforded functional play, construction play, and symbolic play. In addition, young students who utilized the playground for one year had a significant improvement in motor abilities as compared to students who played in a traditional playground (Fjørtoft, 2004).

The positive impact of diverse natural play areas on children’s behavior is documented in Moore and Wong’s (1997) description of the Environmental School Yard in Berkeley, California, where they found that the barren and asphalt schoolyard prior to renovation created a harsh environment that led to fighting and boredom. The change to a naturalized schoolyard after renovation led to a higher diversity of play and less social conflict. For them, “the relationship between poor environmental quality and physical, social, and psychological health was supported by the accident records” (Moore & Wong, 1997, p. 5). For them, it was clear that the naturalized schoolyard led to fewer altercations and hence, fewer injuries.

2.3.6 Vegetation

Vegetation plays a critical role in the assessment of pathways defined as children’s play spaces as it has the opportunity to provide ecologic value, shade, physical barriers, aesthetic value, scientific interest, and play value. As humans have
moved from wilderness areas, to rural areas, to increasingly densely populated urban areas, the value of natural areas in urban cities has increased -particularly for children. Vegetation form can alter views and create a sense of enclosure or openness. Diversity in vegetation can enhance visual interest as well as provide opportunities for children to learn about the life cycles of nature. Diversity in vegetation can also provide sensory stimulation and play value when accessible to children. Neatly mown grass and ‘bushwhacked’ vegetation that is cleared from the pathway’s tread will limit the amount of nature children experience, but may increase a perception of safety.

Nature also provides support for Nicholson’s (1973) theory of loose parts which says ‘In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it” (1973, p. 174). The benefits of play outdoors in the natural environment are enhanced by access to the increased variety and number of loose parts afforded. Moore (1989) mentioned the value of large scale vegetation for shelter-building, but also the value of small scale plant parts that support children’s play. Moore’s (1989) description includes numerous accounts of children’s creative uses of flowers, seeds, leaves, berries, twigs and branches.
2.3.7 Measuring Vegetation

Vegetation has been measured in some studies with the Normalized Difference Vegetation Index (NDVI) data in two studies on walking (Lindsey, Wilson, Yang, & Alexa, 2008; Liu et al., 2007). Vegetation form was also included by Lindsey (Lindsey et al., 2008) by utilizing LIDAR data for viewshed analysis. In a study by Larsen (2009), vegetation was measured by the city’s street tree inventory GIS shapefile and compared to aerial photography to insure accuracy. Reynolds et al. (2007) examined several vegetation characteristics through observable field data collection. Data collected indicated whether or not natural features were present alongside the trail; these included ‘parks’, ‘wildlands’, ‘hills’, ‘wetlands’, and three categories of water bodies. Vegetation density was assessed for each segment (1/2 mile) through visual determination of one of 4 categories from ‘none’ to ‘dense’. Vegetation height was assessed for each segment with three categories, ‘short’, ‘medium’, and ‘tall’; while tree canopy was either ‘full’, ‘partial’ or ‘no’ coverage.

Each of these methods has serious weaknesses for the study reported here. The NDVI data is too coarse to be considered useful for measurement of a pathway corridor. LIDAR data, even if available for all four research sites, would be too expensive. Street tree inventories do not exist for greenway corridors and offer measurement of only one aspect of vegetation. Methods from the Reynolds study (visual assessments of quality) could be utilized effectively, although the assessment
for ½ mile segments used in the study were also too coarse a measurement for this research.

2.3.8 Animals

Vegetation attracts wildlife by providing shelter and food. Wildlife encounters may be an important factor for children developing an emotional connection with nature. Myers and Saunders (2002) explain the human connection with animals by suggesting: “One of the reasons animals are so fascinating to us is that they are highly responsive and offer many dynamic opportunities for interaction. We are social creatures, and animals appeal to our propensity to interact socially”. Children and adults tend to be more interested in animals than in plants (Lindemann-Matthies, 2005).

Several studies examine children’s preferences and responses to animals in the contrived settings of zoos, and with domestic pets. Neither of these environments apply to the free play conditions of pathway use. It is clear that children have an affinity for naturally occurring small animals (Moore & Wong, 1997), and that such animals (all manner of insects, fish, reptiles, birds, etc.) in the environment will affect children’s behavior.

2.3.9 Children’s Active Transportation

Active travel to school should provide strong arguments for children’s daily pathway use. However, active transportation to and from school has decreased
severely in the United States since 1969 (McDonald, 2007). As schools become larger and fewer in number, the average distance children must travel has increased, and accounts for 47% of the reduction in active transport (McDonald, 2008). Walking and cycling to and from school is important as it may provide opportunities for children to be outdoors, socialize with friends, be physically active, and may lead to a reduction in traffic and air pollution. A recent study in London, England measured physical activity with accelerometry, and location with GPS receivers. Results indicated that children who walked to school received eleven percent of their daily moderate to vigorous physical activity during the morning commute (Cooper et al., 2010). Activity levels during the walk to school were twice as high as they were during playground use.

In a literature review on walking to school in the U.S., McMillan (2005) lists three mediating factors that affect school mode travel choice, neighborhood safety (real/perceived), traffic safety (real/perceived), and household transportation options. Results from the 2009 National Household Transportation Survey indicate that traffic volume and speed are the largest issues that prevent their children from walking to school, as indicated in Figure 2-2.
It appears that traffic volume and speed, along with distance necessary for travel are the main barriers to children’s active commuting to school. Pathways that offer separation from traffic may provide additional opportunities for safe active travel to school.

2.3.10 Children’s Walkability

Walkability is an essential factor in considering children’s independent, active travel. A study conducted in Atlanta looked at urban form variables (intersection density, residential density, mixed land-use, access to recreation/open space, access to commercial use) compared to use as measured by travel diaries for youth under age 18. They found that all five measures were related to walking for whites,
but only land use mix and access to recreation spaces were significantly related to likelihood of walking for non-whites (Kerr, Frank, Sallis, & Chapman, 2007). Urban form variables were more significantly related to walking in high-income households. The study mentions that intersection density was positively associated with walking for youth.

A review of environmental determinants of active travel in youth (Panter, Jones, & Van Sluijs, 2008) covering multiple fields including health and physical activity, transportation, and planning found positive associations for walking and social interactions, facilities to assist active travel as well as shorter route length and road safety along the route. This review found that distance was a strong and consistent predictor of likelihood of walking. Children aged five to six years who had a school trip of less than 800 m were over 5 times more likely to walk or cycle to school, but children aged ten to twelve were over 10 times likely to walk the same distance. Distance plays a role, but many variables can alter the perception of distance, such as volume and speed of vehicular traffic.

A public health study found that neighborhood greenness, when measured with Normalized Density Vegetation Index (NDVI), and lower neighborhood speed limits were positively associated to children’s’ perception that the neighborhood was a pleasant place to walk (Liu et al., 2007). Statistical modeling indicated that children who reported that their neighborhood was a pleasant place to walk could be expected to be active one additional day per week, and those reporting nice drivers
could be expected to be active an additional \( \frac{1}{2} \) day per week. This study is strengthened by access to a large database collected by the Health Department that included data on health status of children, residential address, survey about neighborhood walkability, and a strong GIS analysis of neighborhood walking determinants. Neighborhood greenness, however, was measured with NDVI, which is a relatively coarse measure of vegetation. A Canadian study found the likelihood of walking or biking to school was positively associated with shorter trips, male gender, higher land use mix, and presence of street trees (Larsen et al., 2009). Taken together, the results of these studies support the premise that safe, green walking places for children could motivate use by children.

2.3.11 Perception of Safety

Parental fear is a recognized factor affecting children’s neighborhood walkability, but it is difficult to measure. Although conventional wisdom suggests that so-called ‘stranger danger’ has increased, it has not been systematically studied. Perhaps it is related to the rapid availability of up-to-the-minute global access to media coverage of child abductions, and perhaps growth of parental fear is related to a decrease in community social capital. A factor that has increased each decade is traffic volume and speed, which present significant and real fear for parents. A longitudinal study in Australia found that children had increased rates of independent
mobility when parents perceived that local traffic speed was low and when there were traffic calming measures in place (Carver et al., 2010).

2.3.12 Sense of Enclosure or Openness

A sense of enclosure or openness may affect the perception of safety along a shared-use pathway. Stamps (2010) suggests that there is one area of the brain responsible for detecting enclosure, indicating its significance to humans. Continuously changing, subtle built environment attributes such as this are notoriously difficult to measure reliably. Psychologists who study enclosure identify ‘sense of enclosure’ as a proxy for potential impression of safety or danger. Stamps (2010) found that sense of enclosure was most strongly associated with three features of the built environment: permeability of boundaries, the amount of available light, and the amount of horizontal surface within the boundary.

In a study conducted in Sheffield, UK, participants were asked to examine photographs that had been altered to represent three spatial arrangements, open, partially enclosed, and enclosed views of a pathway in a proposed local park (Jorgensen, Hitchmough, & Calvert, 2002). The understory, or edge treatment, had been altered to represent five different types of woodland edge, including no understory, no understory with flowers, dense understory with flowers, dense understory, and native woodland edge. The participants were asked to rate the photographs for safety and, preference. As expected, the safety scores
corresponded with the spatial arrangements. High safety scores were given for no-enclosure, intermediate safety scores with partial enclosure, and low safety for full enclosure scenes. Preference was not related to spatial enclosure, however, although 'no understory with flowers' was the most preferred treatment overall. The Jorgensen et al. study is valuable for demonstrating that pathways can be designed with a variety of edge treatments, but that providing no enclosure or partial enclosure may enhance feelings of safety.

Two large scale studies (Lindsey et al., 2008; Reynolds et al., 2007) that examined trail use (as measured by trail traffic counts) as related to the trail environment found lower use associated with enclosure. Reynolds et al. (2007) found that higher vegetation density and natural areas adjacent to the trail correlated with lower use. A study examining trail use in Indianapolis, LIDAR data was used to determine that higher trail use was also related to openness of trail viewshed (Lindsey et al., 2008). As these studies looked at adult use on long distance pathways in urban areas, both studies used coarse measures of pathway environment utilizing available GIS data, which was appropriate for examining adult use of these long distance pathways, but may not be appropriate for examining children’s use of pathways closer to home.
2.3.13 Independent Mobility

The term ‘independent mobility’ first appeared in the literature in 1990 in One False Move, a Study of Children’s Independent Mobility (Hillman et al., 1990). The term appears most often in research literature from Australia and European countries, including Britain, Denmark, Finland, Italy, and Norway. A research project conducted in Australia considered independent mobility as a positive answer to the question "are you allowed to walk on your own, near where you live?" (Wen et al., 2009). Mackett et al. (2007) referred to independent mobility as simply children traveling without an adult present. The clearest definition is from Australian researchers who described it as “the ability of children and adolescents to walk or cycle around their neighbourhood without adult accompaniment” (Carver et al., 2010).

Independent mobility is important for school children for a number of physical, cognitive, and emotional reasons. Mackett (2007) argued that experiencing the local environment allows children opportunities to ‘learn how to make decisions, build up social networks, and acquire knowledge by observation and experimentation. Equally important, it allows them to enjoy themselves and be active.’ The Mackett, Gong, Kitazawa and Paskins (2007, p. 15) study of children using GPS and travel diaries concluded:

“Being with an adult affects children’s spatial behavior. They tend to walk faster, more energetically and straighter when with an adult. Without an adult
they tend to ‘potter about’; in a much more exploratory way. Whilst speed has its benefits, there is a need for children to explore the environment at their own pace, gaining experience and learning about the world.”

As Hillman (1990) stated: “The acquisition of progressively more personal autonomy through greater independent mobility is an aspect of ‘growing up’. It promotes self-esteem in children by permitting them to do things on their own.” Children who were allowed more freedom of mobility where they lived have been shown to spend more time playing outdoors (Wen et al., 2009). More time spent outdoors is associated with higher levels of physical activity in children and adolescents (Sallis, Prochaska, & Taylor, 2000).

A study by Prezza and Pacilli (2007) demonstrated that independent mobility and higher utilization of public spaces for play in childhood predicted lower fear of crime and resulted in a stronger sense of community in adolescence (Prezza & Pacilli, 2007). Significantly, a better relationship with community also predicted lower feelings of loneliness in adolescents. Research has also shown that children who walk to school on their own are better at mapping environmental features of their neighborhood, even as compared to those who walk with an adult (Rissotto & Tonucci, 2002).

In a study in conducted in Germany (Hillman et al., 1990), children over the age of 11 were all allowed to cross the street on their own, while only half of those age 7 were allowed to do so, demonstrating a gradual increase in independent
mobility between the ages of 7 and 13, when most all children are allowed to undertake weekend activities on their own. In English children the same study found similar results.

The body of literature demonstrates the importance of independent mobility and justifies the need to study it more vigorously in the U.S. as a factor supporting children’s healthy development.

2.3.14 Pathways

Urban trails or shared use pathways have only recently appeared in the research literature. A national study conducted on three long distance trails (in Los Angeles, Dallas, and Chicago), resulted in multiple papers, each highlighting selected components of the larger study. Reynolds et al. (2007) reported user counts and compared levels of trail use to an inventory, or audit of the pathway environment. They found that mixed views, street lights, good trail condition, and trailside amenities positively correlated with trail use. Litter, noise, drainage features, tunnels, and natural areas with dense vegetation were negatively associated with pathway use. Spruijt-Metz et al. (2010) conducted a survey of adults and found that intrinsic motivation, general health status, perceived safety, perceived miles between home and pathway, and neighborhood connectivity were significantly related to pathway use. Wolch et al. (2010) found negative associations for working-class status, commuting distance, and physical barriers to access. While the user
counts included a category for users (under age 18) and provided valuable information for comparison, the surveys were administered to adults and not children, and the studies themselves did not specifically consider use by children.

A similar study that correlated physical activity use with land use found that pathway segments that intersect parks and downtown areas with commercial land use had highest use (Coutts, 2009). Data collected on children and adolescent use indicated that the two cities in the study (Battle Creek and Lansing Michigan) had a striking difference in use with Battle Creek results indicating 13% of users in those two categories and Lansing, 3.2%. Field observations indicated that the highest use by children and families came in single-family residential developments. This study was examining physical activity use in particular, so users participating in obvious recreational activities were not counted.

Gobster and Westphal (2004) examined the 150 mile Chicago River corridor with multiple methods and from different stakeholder perspectives. They identified six ‘interdependent human dimensions of greenways: cleanliness, naturalness, aesthetics, safety, access, and appropriateness of development’.

Although several useful studies appear in the literature addressing shared use pathways in green spaces within the urban context, none have addressed the needs of children. Although some studies collected user data on children, results focus on use by adults and do not examine possible functionality for children.
CHAPTER 3: RESEARCH METHODOLOGY

3.1 Overview of the Study

This study explores multiple facets of pathway use to better understand how the built environment affects behaviors of children along pathways. The purpose is to explore children’s use of pathways and contribute evidence to assist in the planning and design of child friendly pathways.

This research centers on the relationship between the built environment of pathway corridors and the behavior of children and families. In order to explore how and why children use pathways, it is important to understand the relationship between the pathway environment and the child. Through careful observation, it is possible to observe pathway affordances actualized by children. As physical characteristics of pathways affect parental perceptions, and parents behave as gatekeepers for children’s activities, parental perceptions are also important to consider.

3.2 Research Questions

The first question is: Are children using the exemplar pathways selected for this study? To answer this question, use levels of children along case study pathways were assessed as a comparative measure and expression of the desirability of the sites used by children and families. Trail traffic counts were conducted and the age ranges of pathway users were observed and recorded.
The second question is: What are parental perceived benefits of pathway use by children? As perceived benefits may affect pathway use, benefits parents expect to gain from children’s pathway use were surveyed. These data could help determine the importance of pathway use by parents and could aid in developing appropriate designs to support use by children and families. If designers clearly understand the benefits sought by parents, design criteria could be implemented to increase pathway use by these groups. The survey question asked was: How important are the following potential benefits of the pathway experience to you? Optional benefits were listed as: family fun, physical activity, engaging with nature, scenic beauty, learning, and meeting new people. For the neighborhood greenway sites, Richardson and Cary, they were also asked about the importance of safe travel to destinations. They were provided with the above six or seven benefit options, and allowed to rate the importance of each option on a four point rating likert scale (very important, somewhat important, neutral, not at all important).

The third question is: How do play pockets affect use of pathways by children? The goal of adding play pockets to the two park pathways selected for study was to encourage higher frequency and duration of use. This study assessed if the installation of play pockets achieved its goal; i.e., whether or not the addition of play pockets attracted users or encouraged users to stay longer at the sites. Questions were asked on the parental survey at the Springfield and Chattanooga locations to determine if the frequency or duration of use was affected by the
addition of the play pockets. The following question was asked: ‘Did you visit this park before the Play Trail components were added?’ If the respondent responded positively, they were asked: “How has the frequency of your visits changed since the Play Trail components were added?” The next question was asked to determine whether or not the duration of visits changed with the addition of play pockets. The following question was asked, “Do you feel the play equipment: ☐ Increases duration of your visits in this park, ☐ Decreases duration of your visits in this park, or ☐ Does not change length of your visits in this park.”

The fourth question of the research is: What are the behavioral affordances occurring along pathways and what are the behavior settings that affect these behaviors? A basic notion of this study is that the natural and built environment offers meaningful experiences as children move along a pathway. If the affordances actualized by children along pathways are understood, it may be possible to plan and design more playful and therefore successful pathways. Through systematic observation, affordances and behavior settings were observed and described.

The fifth question is: What built environment characteristics support independent mobility along the greenway paths? Neighborhood greenways may enhance independent mobility due to the protection from motor vehicle traffic that pathways provide. Thus, how parents perceive pathways for this purpose was investigated through questions on the parental survey.
It was assumed that opportunities for independent mobility were most reasonable along the neighborhood greenway pathways, Cary and Richardson. For that reason, questions related to independent mobility were only asked on surveys for those sites. Parents were asked the age they allowed their children, or would allow their children, to travel along the greenway without an adult present. The following question was also asked: 'What is the main reason for not allowing your child to go alone?' Possible responses were taken from Hillman’s study on independent mobility in England and Germany (Hillman et al., 1990). Those responses were as follows:

- Child unreliable or too young
- Fear of Assault or molestation by adult
- Fear of bullying by other children
- Destination too far away
- Traffic danger

**Primary Research Inquiry:** How do physical characteristics of pathways and their immediate surroundings affect behaviors of child users?

**Questions:**

1. What motivates children to use exemplar pathways?
2. What are parental perceived benefits of pathway use by children?
3. How do play pockets affect use of pathways by children?
4. What are the behavioral affordances occurring along pathways and what are the behavior settings that affect these behaviors?
5. What built environment characteristics support independent mobility along the greenway paths?
3.3 Research Strategy

A pragmatic worldview grounds the study and mixed methods are used. Cresswell (2009) discussed the pragmatic worldview as a strategy “…for the mixed methods researcher, [where] pragmatism opens the door to multiple methods, different worldviews, and different assumptions as well as different forms of data collection and analysis” and categorizes research strategies into three groups, qualitative, quantitative, and mixed methods. According to Creswell (2009), quantitative strategies include experimental, quasi-experimental, and correlational studies. Qualitative strategies include ethnography, grounded theory, case studies, phenomenological research, and narrative research.

The suitability of quantitative research strategies for this study involves the consideration of experimental and correlational research. Groat and Wang (2002) discuss experimental research as focusing on causality. Experimental research, while often the ‘gold standard’ for research, presents challenges to human behavior researchers as well as researchers investigating the natural environment because of the number and inter-relatedness of variables. This would be the case for a study of multiple pathway sites involving a multitude of variables impossible to control rendering an experimental approach impractical.

Correlational research, on the other hand, allows the researcher to document the naturally occurring relationships among variables without the necessity of control. This may be more practical than experimentation; however, the approach
still leaves many variables to be documented. It may not be possible to control the levels of all variables. Ethical considerations may also exert an influence because human behavior cannot be controlled especially of children.

For this study, because observation of natural conditions was called for, and experimental research strategy was rejected. Although correlational research was considered, a robust degree of knowledge on the subject of children's use of pathways could not be demonstrated by employing a correlational research strategy. Due to the limited amount of existing literature the study is exploratory in nature and a correlational approach was dropped from consideration.

Groat and Wang (2002) explain the strategy of qualitative research as emphasizing natural settings, focusing on interpretation and meaning, and appropriate for understanding how respondents make sense of their own circumstances. While qualitative research is appropriate for many aspects of this study, it often lacks the credibility of quantitative research (Groat & Wang, 2002). Qualitative research focuses on the meaning the participants develop concerning the problem or issue. However, results are not considered generalizable. As a primary focus of the research presented here is to generalize the conclusions to theory or design recommendations, a qualitative approach was also deemed impractical.
3.4 Case Study Methodology

Case study methodology was selected as the most appropriate and feasible approach. Qualitative and quantitative research tools were applied to this methodology. Yin (2009) defined a case study as a study where the scope is “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (2009, p. 18). Yin (2009) also added this to the definition of a case study: “The case study inquiry – copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result – relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result – benefits from the prior development of theoretical propositions to guide data collection and analysis” (2009, p. 18).

Groat and Wang (2002) describe the following as characteristics of a case study:

1) a focus on either single or multiple cases, studied in their real life contexts
2) the capacity to explain causal links
3) the importance of theory development in the research design phase
4) a reliance on multiple sources of evidence, with data needing to converge in a triangulating fashion
5) the power to generalize to theory.

(2002, p. 346)
Yin (2009) adds that the case study is particularly appropriate for questions that ask 'how' and 'why' phenomena occur. The case study research strategy is appropriate for the pathway topic as mixed methods may provide a better understanding of this under-researched area. The study is considered exploratory as it attempts to utilize mixed methods to begin to understand relationships between children and pathways.

As multiple case studies are considered more robust than single case studies, four cases will be selected for this study. As Zeisel (1984) suggested, case study strategy is useful “to develop intensive knowledge about one complex object, because case studies are designed to understand an object as a whole.” (p 97)
3.5 Case Selection

Cases were selected based on replication logic, and not sampling logic (Yin, 2009, p. 53). Replication logic provides that cases be selected as multiple experiments, and not selected randomly. Experiments look for similar situations to repeat the experiment and expect similar results, or a different situation to repeat the experiment but to expect different results. Yin (2009) defines these choices as literal replication, where similar results are expected, or theoretical replication, where different results are expected for anticipated reasons. In this research, two types of contexts for shared use pathways are identified for this research. The first setting is that of shared use pathways that exists in parks where the primary function is recreation. The second type of pathway is that of the shared use pathway that is in a greenway corridor and connects neighborhood residents to meaningful destinations. Such pathways are used for transportation and recreation. To serve both literal replication and theoretical replication, two pathway sites were chosen for each type. It was expected that two pathways in greenway settings would yield similar results, as would two pathways in park settings.

For the first type, two shared use pathways located in park settings were chosen by PlayCore as pilot sites incorporating play pockets that had been installed as design elements adjacent to the pathways. These play pockets contained small, nature themed pieces of play equipment and amenities such as benches and informational kiosks. PlayCore chose the two sites, located in Chattanooga,
Tennessee and in Springfield, Missouri, as they were the first two demonstration sites for the Gametime product line designed specifically for play pockets. Springfield was selected as the then Director of Parks and Recreation displayed a commitment to the concept. Chattanooga Tennessee was selected as it was close to PlayCore headquarters, and the site could be used as a demonstration site for the then upcoming 2010 American Trails Conference.

Although Springfield and Chattanooga pathways have similar play pocket settings, the park contexts are different from each other in important ways. The Chattanooga park is located in an industrial area of Chattanooga, and far from residential areas. The pathway there is an out-and-back configuration with a view of the river as the destination. Springfield’s pathway is located in a large regional park that, although not immediately accessible to a residential neighborhood, is within two miles of numerous residential neighborhoods. The pathway in Springfield is a looped configuration, which offers a different, more flexible pathway experience than an out-and-back configuration.

For the second type, that of greenway settings, two pathways were sought that connected neighborhood residences to meaningful destinations. The Hinshaw Greenway located in Cary, North Carolina was chosen because data collected for the Town of Cary identified this pathway as having higher use by children than other pathways surveyed and can be considered an exemplary case (unpublished data; see Bush, 2010). The greenway also connected neighborhood residents to
neighborhood parks with well used, and well-maintained playgrounds. This shared use pathway was also located within a 20-minute drive from NC State University, where the author was based.

The Richardson site included a shared use pathway located along a greenway corridor that connected neighborhood residents to a neighborhood school, as well as a neighborhood playground. A route used for walking and biking to and from school may offer particularly meaningful insight about a key destination for children and the activities surrounding active transportation. A non-magnet school system was sought, as the potential for increased neighborhood social capital exists in this situation. Magnet schools, which seek to racially or economically balance school-wide attendance across a district result in further travel distance for children. In addition to further travel distance, it may decrease the familiarity families have with neighborhood children as children in one neighborhood may attend many different schools.

An extensive search was made in order to locate the second greenway pathway. A request was posted to a trail and greenway list-serve, asking recipients for recommendations. A few were received but all turned out to be under construction, planned, or not located near currently open schools. An on-line visual search around densely populated metropolitan areas using Google Earth was conducted and a site in Richardson, Texas was identified that appeared to meet the desired criteria (residential area, connection to meaningful destinations). Telephone
calls were then made to local authorities to confirm the usability of this site for the research.

3.6 Data Collection Methods

Multiple methods inform this study. All methods were submitted to the University’s Internal Review Board (IRB), and approval was received (See Appendix A). The following table (See Table 3.1) illustrates the data collection methods as they correspond to the research questions.
# Table 3-1: Methods as Related to Study Measures

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Method of Data Collection</th>
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<tr>
<td></td>
<td>Pathway User Counts</td>
</tr>
<tr>
<td>1 How is use divided among different aged users at case sites?</td>
<td>✓</td>
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<tr>
<td>2 What are parental perceived benefits of pathway use by children?</td>
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<tr>
<td>3 How do play pockets affect use of pathways by children?</td>
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<tr>
<td>4 What are the behavioral affordances occurring along pathways and what are the behavior settings that affect these behaviors?</td>
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<td>5 What built environment characteristics support independent mobility along the greenway paths?</td>
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## 3.6.1 Surveys

Pathway intercept surveys were created that asked about frequency of use, duration of use, and perceptions of shared use pathways and their use by children and families (See Appendix C for complete surveys). Specific questions about independent mobility were included on the surveys that were created for the Cary
and Richardson sites. Certain demographic data was also included on the surveys, such as household make up, and gender and ages of household members.

Portions of the survey were taken from a previous survey that was administered as a class project for Human Use of the Urban Landscape course with Professor Robin Moore. That survey was piloted in early 2011. Changes were made including the addition of questions about play pockets, and barriers to independent mobility. Questions from Hillman’s study on children’s independent mobility were adapted to fit this survey (Hillman et al., 1990).

The survey was planned to be distributed to parents and caregivers who were traveling along the pathways as an intercept survey. The researcher stopped the adults and asked if they were interested in completing a survey about children’s use of the pathway. If the adult indicated that they were interested, they were invited to participate in the research.

### 3.6.2 Pathway Traffic Counts

As the Reynolds et al. study provides a national sample for comparison of the percentage of use by age, the protocols that were employed in that study were adapted for this study (Reynolds et al., 2007). That research estimated age, gender, and types of activities. Age categories were broken into four brackets including ‘under 18’, ‘18 to 39’, ‘40 to 64’, and ‘65+'. Counters bicycled to pathway segment dividers (1/2 mile segments) and counters tallied users as they passed by each
segment for a period of 15 minutes. Counts were taken on two weekdays and two weekend days and were performed between 8 a.m. and 5 p.m. These data are valuable for comparison, but for this study the age brackets were broken down even further in the ‘under 18’ category to include ‘under 2’, ‘2-5’, ‘6-12’ and ‘teens’. The adult categories were lumped together, as that information is difficult to estimate and not useful for the purpose of this study. Information on gender of users was also collected. Gender is commonly collected data as gender has been shown to affect physical activity, play preferences, and independent mobility (Reynolds et al., 2007).

Information on mode of transportation and group size was also collected. A pilot study on traffic counts was conducted and the chart shown in Appendix B reflects the final form developed for traffic count data collection.

Pathway traffic counts were conducted at all four locations. The purpose of conducting the traffic counts was to gain an understanding of the age of the users of the trails. Based on the literature available, it is assumed that pathways users are predominately adult men. The sites for this research were selected because these pathways were sought out for their exemplary design in accommodating the needs of children; it was hypothesized that these pathways will have higher use by children. Results from the Reynolds et al. study indicate that of the three pathways in the study, the Los Angeles pathway had the highest use by children. Users under the age of 18 accounted for 12% of the users in Los Angeles, 6% in Chicago, and 3% in Dallas. It was also hypothesized that perhaps pathways that accommodate
the needs of children might also be better suited to seniors as well. The Reynolds et al. (2007) study found that, of the three pathways, the Los Angeles pathway had the highest use by seniors at 7%. Therefore, data on senior use was also collected.

3.6.3 Direct Observation and Behavior Mapping

Direct observation can include trail user counts, behavior mapping, or tracing. Some advantages to direct observation are that it allows for data to be gathered in the natural setting and allows observers to see how the physical environment supports behavior. Zeisel (1984) described four qualities of observation methods: empathetic, direct, dynamic, and variable. The directness of observation allows the observer to notice occurrences that might not be deemed significant enough to be reported by other methods. Referring to the dynamic nature of observation, Zeisel stated that “No other method gives a researcher such a rich idea of how people bring places to life” (1984, p. 195). As the use of pathways by children is under researched and few studies exist of children in this context, direct observation is an appropriate method, allowing for a broad glimpse of the activities that take place in pathway environments.

Behavior Mapping was conducted to explore which features of the environment were utilized by children. The goal was to understand which environmental features are providing play affordances. Behavior mapping has been used to understand physical activity in children’s environments (Cosco, Moore, & Islam, 2010). In that
research, mapping was used in conjunction with SOPLAY or a similar method of measuring physical activity through observation. That measurement, when compared to the environmental measures, reveals places in the environment that may be influencing behaviors.

Behavior Mapping is a method using direct observation that provides a spatial location for observed actions. It can link physical activity levels with the environment supporting those actions. Behavior mapping is based on Barker’s ‘behavior settings’, and Gibson’s concept of ‘affordances’.

Base maps for the study areas were digitally created. The base map was put in to ArcMap 10 and include location features to simplify coding of behaviors. Scanning methods used in SOPLAY were adapted for data collection. The data collector traveled along the pathway at peak use time periods and coded behavior as viewed in front of the data collector. The data collector scanned the pathway corridor from left to right, and code behavior of children and adolescents as encountered en route. The following chart illustrates data variables collected during the behavior mapping episodes (See Table 3-2).
Table 3-2: Coded Behavior Mapping Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>“baby” (not traveling independently)</td>
</tr>
<tr>
<td>-baby</td>
<td></td>
</tr>
<tr>
<td>-&gt;5</td>
<td></td>
</tr>
<tr>
<td>-elementary</td>
<td>These age categories have been modified from the SOPLAY (Floyd, Spengler, Maddock, Gobser, &amp; Suau, 2008; McKenzie, Marshall, Sallis, &amp; Conway, 2000)</td>
</tr>
<tr>
<td>school</td>
<td></td>
</tr>
<tr>
<td>-middle school</td>
<td></td>
</tr>
<tr>
<td>-teen</td>
<td></td>
</tr>
<tr>
<td>-adult</td>
<td></td>
</tr>
<tr>
<td><strong>Group Membership</strong></td>
<td></td>
</tr>
<tr>
<td># of Adults</td>
<td>As the study of independent mobility is of importance in this study, group membership was recorded. Independent mobility is defined as the absence of an adult, however, girls may be more likely to travel with peers or siblings in order to avoid restrictions on mobility (Brown, Mackett, Gong, Kitazawa, &amp; Paskins, 2008). The number of adults in the group was recorded, as well as the number of children in the group.</td>
</tr>
<tr>
<td># of children</td>
<td></td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>Mode of travel will include cycling, walking, biking, skating, skateboarding, as consistent with earlier pathway user counts (Reynolds et al., 2007).</td>
</tr>
<tr>
<td>-walking</td>
<td></td>
</tr>
<tr>
<td>-biking</td>
<td></td>
</tr>
<tr>
<td>-skateboarding</td>
<td></td>
</tr>
<tr>
<td>-skating</td>
<td></td>
</tr>
<tr>
<td>-stroller</td>
<td></td>
</tr>
<tr>
<td>-other</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental Interaction</strong></td>
<td>These variables give us an indication of the object of the environment that the child is interacting with. The location point will give us the information of the layout, but the object of the environment is a more detailed piece of information concerning the activity of the child. This category relates to the theory of loose parts which states: 'In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it' (Nicholson, 1973) The benefit of play outdoors in the natural environment is the access to the variety and number of loose parts. Any object that is attached and unable to be held free in the hand is considered ‘fixed’. Any object that remains in its natural state are ‘natural’. Objects designed and constructed for a purpose are ‘man-made’. They were also utilized in Cosco’s dissertation study (2006)</td>
</tr>
<tr>
<td>-natural loose</td>
<td></td>
</tr>
<tr>
<td>-man-made</td>
<td></td>
</tr>
<tr>
<td>loose</td>
<td></td>
</tr>
<tr>
<td>-natural fixed</td>
<td></td>
</tr>
<tr>
<td>-man-made fixed</td>
<td></td>
</tr>
<tr>
<td><strong>Affordance</strong></td>
<td>Affordance is helpful for understanding this project as children often perceive features of the environment in a way other than that intended of the designer. Affordances were open coded to allow for a collection of typologies to be further developed, as recommended by Frost (1992).</td>
</tr>
<tr>
<td>-Open coded</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4: SITE DESCRIPTIONS

4.1 General Site Descriptions

The logic behind the selection of cases for this study included finding pathways that were desirable for use by children. It was theorized that two pathways enhanced with play pockets and two pathways located within residential neighborhoods and along greenways would be the most desirable pathways for children and families. This determined the two typologies.

The four sites are compared using census data from the 2010 census. Census tracts immediately surrounding the pathways were selected for the neighborhood greenway pathways. For the parks, which were much larger and are thought to serve a larger territory, census tracts within a 1.5-mile radius of the pathways were selected.

Ages:

Age of nearby residents at all four sites is similar. The table below (Table 4-1) shows percentages of adults, and children under the age of 19.

<table>
<thead>
<tr>
<th></th>
<th>Under 19</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springfield, MO</td>
<td>21.4%</td>
<td>78.6%</td>
</tr>
<tr>
<td>Chattanooga, TN</td>
<td>24.8%</td>
<td>75.2%</td>
</tr>
<tr>
<td>Cary, NC</td>
<td>22.2%</td>
<td>77.8%</td>
</tr>
<tr>
<td>Richardson, TX</td>
<td>21.1%</td>
<td>78.9%</td>
</tr>
</tbody>
</table>

Data from US 2010 Census

Table 4-1: Adult/Under 19 in Nearby Neighborhoods
Ethnicity

Ethnicity across the sites is compared in the chart below (see Figure). The most diversity occurs in Richardson. Chattanooga has the highest proportion of blacks. The Chattanooga neighborhood closest to the pathway is fairly cut-off from the site, however, as a highway and a rail yard are located between the site and the neighborhood.

![Ethnicity Chart](image)

**Figure 4-1: Race/Ethnicity from 2010 Census Data**

**Housing Occupancy Status**

Housing status is reported as a proxy for socioeconomic status. The chart below (See Figure) displays housing status across the four sites. Cary has the highest number of owner occupied housing, indicating a higher socioeconomic
status for this neighborhood. The Springfield neighborhood exhibits the highest level of renter occupied housing, indicating a potentially lower socioeconomic level.

![Figure 4-2: Owner / Renter / Unoccupied Housing Status](image)

Pathway Length

Pathway length is displayed in the table below (see Table 4-2). The length includes the pathway as studied and does not compare the network length of the pathways. The greenway paths in Cary and Richardson are significantly longer than the pathways located within parks. It should be noted that the pathway in Springfield must be accessed from other pathways, and the Chattanooga pathway is accessed primarily from a parking lot.
Table 4-2: Length of Pathways in Feet

<table>
<thead>
<tr>
<th>Trail</th>
<th>Length in feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springfield, MO</td>
<td>3685’</td>
</tr>
<tr>
<td>Chattanooga, TN</td>
<td>1907’</td>
</tr>
<tr>
<td>Cary, NC</td>
<td>8562’</td>
</tr>
<tr>
<td>Richardson, TX</td>
<td>9705’</td>
</tr>
</tbody>
</table>
4.2 Sites within Parks

4.2.1 Springfield, Missouri

The Springfield location was selected for the addition of play pockets by PlayCore and the Parks and Recreation Department in Springfield / Greene County based on the recommendations of the researcher and Robin Moore. This site was centrally located, close to residential neighborhoods, and within walking distance to neighborhood schools. The portion that was used for the research was considered the first phase of the project with expectations that the connecting neighborhood greenway will also have play pockets installed.

The pathway is located within the context of a large regional park. The park also contains the Botanical Garden and Botanical Center for the region. Unique to
this Botanical Garden, there are numerous gardens developed and maintained by volunteers. The looped pathway is adjacent to the lake, which provides opportunities for wildlife interaction due to the large number of turtles, ducks and geese that live in or near the lake.

4.2.2 Chattanooga, Tennessee

Figure 4-4: Aerial of Chattanooga Pathway
The Chattanooga pathway is located in a park adjacent to a river. The pathway is a part of a longer pathway that currently is eight miles long, with plans to extend the pathway for at least fifteen more miles. The park contains a parking lot, but is not immediately accessible by a residential neighborhood. The residential neighborhood closest to the park is separated by the highway, and also a railroad yard.

The park entrance contains clean restrooms and picnic tables. This park is highly maintained, with few 'loose parts' left by the maintenance crew. The pathway is wide, concrete, relatively new, and in excellent condition. The vegetation surrounding the pathway is mostly deciduous trees, with a few landscaped areas. There is a large grassy area adjacent to the pathway.
4.3 Sites Along Greenways

4.3.1 Cary, North Carolina

Figure 4-5: Aerial Showing Cary Pathway
The Cary pathway connects a large, popular and well-designed playground on the southernmost end, to another playground adjacent to a freeway. A pedestrian bridge with community artwork spans the freeway, which allows viewing of the traffic which appeals to many people. Residential neighborhoods are abundant within the neighborhood. A grocery store is also at the southern end of the pathway. A school exists in the neighborhood but does not connect to the pathway. As the school system is a magnet based system, there are many children who attend the school from outside the neighborhood, and many neighborhood children do not attend this school.

The pathway is open and wide on the southern end, and narrows on the northern end. The northern end is also surrounded by dense vegetation. The houses that are adjacent to the pathway face the opposite direction, and the pathway is in the back of the houses. There is a creek that runs along the pathway. Although the pathway is fairly well maintained, the northern portion is asphalt and is showing signs of age and has many places in need of repair.
4.3.2 Richardson, Texas

Figure 4-6: Aerial of Richardson Pathway

The Richardson pathway runs along a creek through the middle of a densely populated residential area. The newest section, which runs east-west, connects
residents to a large park with a large playground. There are two schools, an elementary school and a middle school in the neighborhood. The neighborhood has an extensive system of alleyways which back-up to almost every house, which are in addition to the streets which the houses face.

The pathway is open, with few trees on the majority of the site. The east-west link is the most heavily vegetated. The name of the park is ‘Duck Creek Linear Park,’ which is aptly named due to the large supply of ducks and geese. There are a few picnic tables along the north-south extensions of the pathway. They do not appear to get much use. The park is highly visible to houses, and the streets and alleyways that run nearby. There are numerous trash cans and maintenance is very good. The pathway itself is very wide, and made of concrete.

Table 4-3: Summary of Site Descriptions

<table>
<thead>
<tr>
<th>Site</th>
<th>Context</th>
<th>Length in feet</th>
<th>Corridor Character</th>
<th>Designated Play Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springfield</td>
<td>Regional Park (Botanical Garden)</td>
<td>3685’</td>
<td>Pathway loops around lake.</td>
<td>Play Pockets</td>
</tr>
<tr>
<td>Chattanooga</td>
<td>Regional Park (Riverfront)</td>
<td>1907’</td>
<td>Wooded areas, open grassy area</td>
<td>Play Pockets</td>
</tr>
<tr>
<td>Cary</td>
<td>Neighborhood Greenway</td>
<td>8562’</td>
<td>Dense vegetation, backyards</td>
<td>Two destination playgrounds</td>
</tr>
<tr>
<td>Richardson</td>
<td>Neighborhood Greenway</td>
<td>9705’</td>
<td>Grassy areas, 69 few trees, front and backyards</td>
<td>Destination Playground, elementary school</td>
</tr>
</tbody>
</table>
CHAPTER 5: DATA COLLECTION

5.1 Data Collection Timeline

Trips were scheduled to the three sites that required travel. An optimistic schedule was created that allowed for multiple bouts of data collection a period of five days at each site. As trail use is usually highest on weekends (Wolch, Lindsey), the researcher included one weekend for each site visit.

The first site selected for data collection was Springfield. Although the weather had been predicted to be fair and moderate, a storm approached ahead of schedule which resulted in torrential rain for most of the first visit. This required that the Springfield location be rescheduled for a later date.

The following calendar shows the dates of data collection (See Table 5-1). Springfield was visited in September, but due to rain, there was not sufficient data collected. A second trip to Springfield was made in October. The calendars also display the high temperature for the day, as recorded by the National Weather Service.
Figure 5-1: Locations of Pathways in Study
Table 5-1: Calendar of Behavior Mapping Data Collection and Daily High Temperature.

<table>
<thead>
<tr>
<th></th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
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<tr>
<td>Sept. 11-17</td>
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<td>Week 2</td>
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<td>Week 3</td>
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<td>Sept. 25-Oct. 1</td>
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<td>Week 4</td>
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<tr>
<td>Oct. 2-8</td>
<td>Chattanooga 83°</td>
<td>Chattanooga 73°</td>
<td>Chattanooga 64°</td>
<td>Chattanooga 64°</td>
<td>Chattanooga 64°</td>
<td>Chattanooga 64°</td>
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<td>Week 5</td>
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<tr>
<td>Oct. 9-15</td>
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<td>Week 6</td>
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<tr>
<td>Oct. 16-22</td>
<td>Richardson 57°</td>
<td>Richardson 84°</td>
<td>Richardson 57°</td>
<td>Richardson 57°</td>
<td>Richardson 57°</td>
<td>Richardson 57°</td>
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<td>Week 7</td>
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<tr>
<td>Oct. 23-29</td>
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<td>Week 8</td>
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</tr>
<tr>
<td>Oct. 30-Nov. 5</td>
<td>Springfield 64°</td>
<td>Springfield 67°</td>
<td>Springfield 67°</td>
<td>Springfield 67°</td>
<td>Springfield 67°</td>
<td>Springfield 67°</td>
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<tr>
<td>Week 9</td>
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<tr>
<td>Nov. 6-12</td>
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<tr>
<td>Week 10</td>
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<td></td>
</tr>
<tr>
<td>Nov. 13-19</td>
<td>Cary 64°</td>
<td>Cary 64°</td>
<td>Cary 75°</td>
<td>Cary 77°</td>
<td>Cary 76°</td>
<td>Cary 76°</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Week 11</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 20-26</td>
<td>Cary 62°</td>
<td>Cary 64°</td>
<td>Cary 75°</td>
<td>Cary 77°</td>
<td>Cary 76°</td>
<td>Cary 76°</td>
<td></td>
</tr>
</tbody>
</table>

5.2 Surveys

The surveys were designed and planned to be distributed to pathway users as intercept surveys. However, after the first site visit to Springfield it was determined that a desired number of responses could not be achieved within the time allotted. There are small periods of peak use along the pathways, and with the need to conduct other data collection methods, there were simply not enough users to collect enough surveys.
In Springfield, a total of 32 surveys were collected at the site as pathway intercept surveys. The researcher collected some, and volunteers collected the remainders.

In Chattanooga, the researcher collected twenty pathway intercept surveys. The remaining ten were collected with a web version of the original pathway intercept survey. That survey was created in Qualtrics, an on-line survey system made available to North Carolina State University students. That survey was distributed through an email sent to a list serve by Outdoor Chattanooga, an organization that works with the city of Chattanooga to promote and develop the region's outdoor recreation opportunities ("Outdoor Chattanooga," 2005).

Richardson presented a unique opportunity in that the Duck Creek Linear Park is completely encapsulated by the Duck Creek Homeowners Association. That HOA had a membership list serve with approximately 600 email addresses. The President of the HOA was contacted, and agreed to distribute an on-line version of a survey. The new survey, utilizing the same basic questions as the paper survey, was created and sent to the University's Internal Review Board for approval (See Appendix A). After receiving the approval, the survey was mailed out in December and again in January to the Duck Creek HOA membership email list through the President. A total of 65 responses were received, but due to incomplete surveys and surveys where the respondents had no children, a total of 45 were usable.
In Cary, several attempts were made to collect surveys as pathway intercepts with surprisingly poor results. This was partially due to low use, but also to the difficulty in stopping adults moving along pathways with active young children. Attempts to locate an appropriate neighborhood association were unsuccessful. Therefore, paper surveys were delivered door-to-door. In order to achieve optimal response rates with a minimum amount of surveys distributed, a method to find homes that children lived in was developed. Data from Cary’s GIS were downloaded that included parcel ownership. That data included the date of deed transfer. Homes were selected within a ¼ mile buffer distance from the pathway. Homes that had transferred ownership within the most recent fifteen year period were selected from all homes within the buffer zone. It was hypothesized that people who had children under the age of twelve would have been more likely to purchase their homes within the last fifteen years. With the addresses listed in a data table and printed out, the researcher walked the neighborhood placing envelopes with a copy of the survey, an introductory note explaining the purpose of the research, and a stamped envelope addressed to the researcher near the front doors of selected residences. If there were traces of children present (play equipment, bikes, children’s muddy shoes, or ‘honor roll’ type bumper stickers on automobiles) then the house was selected for the survey. On a few occasions, people were home and were asked to participate in the survey in person. People were sometimes also willing to indicate the homes on their blocks which included children. 150 surveys were distributed in this manner.
Sixty-five surveys were returned, however many respondents indicated no children living in the home, therefore the remaining 46 were used for the study results. Overall, 153 surveys were collected and compiled into an excel database with separate pages for each site.
5.3 Pathway Traffic Counts

The researcher located a place where users of the pathway were visible. A paper chart was developed that contained spaces for the data to be recorded. Attributes included the approximate age of the user by predetermined categories, gender, presence / absence of a dog, group size, and mode of transportation (See Appendix A). The research observed the pathway for 15 minute intervals and recorded data with a pen on the paper.

Originally, a schedule was created that allowed for equal amounts of time at all four sites for traffic counts. Due to poor weather, special events, and due to the need to devote more time to behavior mapping than previously expected, unequal time was devoted to pathway traffic counts. An effort was made to capture data on a weekday afternoon and at times during expected high use over the weekends. Because information on Cary's traffic use has been collected by the Cary Greenway committee (see publication and correspondence between Bush (Bush, 2010)) less time was spent collecting data at that site. A total of 18.5 hours was spent collecting pathway traffic counts. The amount of time spent collecting traffic counts is detailed in the following table (See Table 5-2).
### Table 5-2: Time Spent Collecting Pathway Traffic Counts

<table>
<thead>
<tr>
<th></th>
<th>9am</th>
<th>10am</th>
<th>11am</th>
<th>12</th>
<th>1pm</th>
<th>2pm</th>
<th>3pm</th>
<th>4pm</th>
<th>5pm</th>
<th>6pm</th>
<th>TOTAL min.</th>
<th>SITE TOTALS (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Texas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td>60</td>
<td>45</td>
<td>60</td>
<td>165</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
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</tr>
<tr>
<td>Sunday</td>
<td>30</td>
<td>30</td>
<td>15</td>
<td>75</td>
<td>240</td>
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<td><strong>Cary</strong></td>
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<td><strong>Chattanooga</strong></td>
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<td>30</td>
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<td>45</td>
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<td>195</td>
<td>525</td>
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<tr>
<td><strong>Springfield</strong></td>
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<td>Thursday</td>
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<td>Friday</td>
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<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>1</td>
<td>5</td>
<td>45</td>
<td>15</td>
<td>15</td>
<td>90</td>
<td>195</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**5.4 Behavior Mapping**

Behavior Mapping was conducted on all four sites. Base maps were loaded into a Sahara Tablet in to ESRI’s ArcMap v.10 software program. It was the intention to use ArcPad 7 as the software program to collect the data as it is the appropriate program to use for field data collection. Due to the delay in arrival of the Sahara
Tablet and due to some difficulties encountered in our understanding of the Universities software licensing for ESRI ArcPad, the data collection began with ArcMap. ArcPad software was eventually loaded on to the tablet and was found to be a preferred method for data collection because of the simplicity of data entry. However, as the data collection began at the first site with ArcMap data was collected for the remaining sites with ArcMap.

Although a schedule had been written before any site visits, weather and low trail use prevented the data collection as scheduled. Instead, the researcher waited for breaks in the weather and for opportunities of heavy use to conduct behavior mapping.

When use was heaviest, the researcher would walk the pathway from beginning to end, and scan the pathway corridor for children present. When a child was encountered along the pathway at a distance of approximately 30 feet, an observation was made in ArcMap in ‘edit’ mode. The attribute table was then populated with variables about the child, the group, and the child’s activities. The researcher then moved forward along the trail, scanning in a forward pattern along the pathway corridor.
CHAPTER 6: RESULTS

6.1 Question 1: Traffic Counts

How is Use Divided among Different Aged Users at Case Sites?

Pathway traffic counts were conducted at all four sites in order to understand the age ranges of pathway users at the study sites. Data was collected during the after school hours on weekdays and weekends. A total of 18.5 hours were spent collecting user count data. The counts are shown below in Table 6-1. Those figures are displayed as percentages of use in Table 6-2 below.

The highest percentage of pathway users under the age of 18 was in Richardson (46%), followed by Cary (42%), then Springfield (26%) and Chattanooga (16%). Although Richardson had the highest use of under age 18, Cary was highest in the under age 12 category (29%). Highest use by teens (21%) was in Richardson, which accounted for the highest use under age 18. Figure 6-1 displays the same information in a graph form.

Table 6-1: Pathway Traffic Counts Results by Age Groups

<table>
<thead>
<tr>
<th></th>
<th>&lt;2</th>
<th>2-5</th>
<th>6-12</th>
<th>teen</th>
<th>adult</th>
<th>senior</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cary</td>
<td>6</td>
<td>16</td>
<td>9</td>
<td>13</td>
<td>49</td>
<td>13</td>
<td>106</td>
</tr>
<tr>
<td>Richardson</td>
<td>2</td>
<td>4</td>
<td>26</td>
<td>27</td>
<td>70</td>
<td>0</td>
<td>129</td>
</tr>
<tr>
<td>Springfield</td>
<td>3</td>
<td>12</td>
<td>18</td>
<td>17</td>
<td>118</td>
<td>22</td>
<td>190</td>
</tr>
<tr>
<td>Chattanooga</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>114</td>
<td>8</td>
<td>146</td>
</tr>
</tbody>
</table>
Table 6-2: Percentages of Use by Age Ranges.

<table>
<thead>
<tr>
<th>User age range</th>
<th>Cary</th>
<th>Richardson</th>
<th>Springfield</th>
<th>Chattanooga</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>29%</td>
<td>25%</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>teen</td>
<td>12%</td>
<td>21%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>&lt;18 (Total)</td>
<td>42%</td>
<td>46%</td>
<td>26%</td>
<td>16%</td>
</tr>
<tr>
<td>18-64</td>
<td>46%</td>
<td>54%</td>
<td>62%</td>
<td>78%</td>
</tr>
<tr>
<td>65+</td>
<td>12%</td>
<td>0%</td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>&gt;18 (Total)</td>
<td>58%</td>
<td>54%</td>
<td>74%</td>
<td>84%</td>
</tr>
</tbody>
</table>

Figure 6-1: Chart Showing Age of Pathway Users by Site

6.2 Question 2: Benefits

What are Parental Perceived Benefits to Pathway Use by Children?

Results are displayed in Figure 6-2 below. There was little variation between the sites so all data from the four sites are grouped here for analysis. ‘Family fun’
was the highest ranked benefit at all sites, followed by ‘physical activity’, ‘engagement with nature’ and ‘scenic beauty’. The most variation appeared in ‘safe travel to destinations’ which was only asked at two sites, Richardson and Cary, as those two sites had pathways which could be used for travel to destinations. ‘Learning’ did not receive high rankings in the ‘very important’ category, but was high in the ‘somewhat’ category, while ‘meeting new people’ received the highest scores in the ‘neutral’ and ‘not at all’ categories.

Figure 6-2: Perceived Importance of Benefits, All Sites Combined
6.3 Question 3: Play Pockets

How do Play Pockets Affect Use of Pathways by Children?

It was determined whether or not the respondent had used the park prior to the installation of the play equipment. Respondents who had not visited the park before were not tallied concerning any change in use. This decreased the number of responses tallied to 26 from Springfield, and 21 from Chattanooga.

Springfield  \( n = 26 \) Chattanooga  \( n = 21 \)

Change in frequency of visits indicated that 77% of respondents use the parks more often since the addition of play pockets when data from both sites were combined. Springfield received a higher ranking than did Chattanooga, however the results were positive that frequency of visits was higher, or remained the same with the addition of play pockets. The results are displayed in Figure 6-3, below.
One hundred percent of respondents from Springfield and 81% of Chattanooga respondents indicated that the duration of visits increased since the addition of play pockets. Data from both sites combined indicates over 90% of respondents spend more time at the parks since the addition of play pockets. The remaining 19% of responses from Chattanooga indicated that the duration of visits did not change since the installation of the play pockets. The results from this question are shown in the following
In addition, respondents were provided the opportunity to comment on the addition of the play pockets. Below are the comments received. (See Table 6-3)

**Table 6-3: Open-ended Responses Regarding Play Pockets' Addition**

<table>
<thead>
<tr>
<th>Comment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 'When I bring my kids here, it provides focus on the journey from point A to point B rather than concentrating solely on the playground.'</td>
<td>100%</td>
</tr>
<tr>
<td>2. The kids like the &quot;play stations&quot; so they want to visit more</td>
<td>81%</td>
</tr>
<tr>
<td>3. We love the new playtrail the kids enjoy walking with us now.</td>
<td>19%</td>
</tr>
<tr>
<td>4. 'I always come to visit the gardens - but make more frequent trips because of the playground due to children.'</td>
<td>8.5%</td>
</tr>
<tr>
<td>5. 'Enjoy the play trail and the information about the trees and plants along the path'</td>
<td>19%</td>
</tr>
<tr>
<td>6. 'The kids love it! They recognize now that it is a place for them.'</td>
<td>19%</td>
</tr>
</tbody>
</table>
6.4 Question 4: Affordances

6.4.1 Overall

What behavioral affordances occur along pathways and what are the behavior settings that affect these behaviors?

Behavior mapping data answers this question. Behavior mapping was conducted at all four sites. There were not enough observations at the Chattanooga site, so the observations made at that location were discarded. A total of 169 observations were made at Springfield, Cary, and Richardson combined. Because of the low numbers of observations, data were grouped for analysis.

Once the behaviors had been exported out of ArcMap and in to an excel table, a qualitative analysis was conducted to identify various affordances that were appearing in the behavioral affordances observed. Themes emerged from the analysis. Those themes included Gross Motor Activity, Fine Motor Activity, Adult-Child Interaction, Peer Interaction, Observing, Flora Interaction, and Fauna Interaction. (See Table 6-4 for definitions). Initially, ‘Fantasy’ had been included as a theme, but after discussion it was determined that many observations were made from a distance or at a rapid speed that did not allow the observer to include all activity that may have been ‘fantasy’ related, so that category was dropped from
further inclusion. These themes were evaluated with other play experts (Robin Moore, and Nilda Cosco) to verify their relevance.

Table 6-4: Themes of Behaviors Emerging from Observations

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross motor</strong></td>
<td>Children were engaged in activities that required gross motor skills. This included walking, biking, climbing, spinning, and jumping.</td>
</tr>
<tr>
<td><strong>Fine Motor</strong></td>
<td>Children were using fine motor skills to pick up leaves, sticks, and other small items.</td>
</tr>
<tr>
<td><strong>Social – Adult</strong></td>
<td>Children were interacting with adults, often talking.</td>
</tr>
<tr>
<td><strong>Social – peer</strong></td>
<td>Children were interacting with other children, often playing games.</td>
</tr>
<tr>
<td><strong>Observing</strong></td>
<td>Children were paying close attention to something in the environment. This category included natural objects, as well as those children observing from a vantage point such as a bridge.</td>
</tr>
<tr>
<td><strong>Engagement – Nature</strong></td>
<td>Children were engaged with natural items, which was further broken down into categories of Flora and Fauna</td>
</tr>
</tbody>
</table>

It was possible, and common, to have multiple themes for each open-coded observation. For example, if a child was walking and talking to a parent, the observation was coded for ‘gross motor’ as well as ‘social-adult’. Once behaviors were categorized into themes, they were displayed at each site in ArcMap. It was
apparent that the sites contained patterns of activities. A high number of observations were made at play pocket sites in Springfield, a garden observation area in Springfield, observation and seating areas in Richardson and in Springfield, and many were made along the pathways. Children observed along the pathways were either involved with translocation or with an alternative behavior that the child would stop to participate in.

Based on the patterns of observations and the behaviors observed, behavior settings were classified as **Resting/Viewing** areas, **Play Pockets**, **Pathways**, and **Ephemeral** areas. These behavior settings are further defined in the table below (See Table 6-5). The behavior settings have also been color coded to simplify the mapping and charting of observation data. The behavior settings did not occur equally across all of the sites. Springfield was the only site to have Play Pockets. Springfield also had the highest number of Resting/Viewing areas. As Ephemeral settings occurred based on the events occurring at the specific time (i.e. child present, duck present) there were opportunities at each site for Ephemeral settings.
Table 6-5: Description of Behavior Setting Classifications

<table>
<thead>
<tr>
<th>Behavior Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting-Viewing</td>
<td>Areas that were designed for resting and viewing areas. This included benches that faced a view, or situated overlooking the water. There was also a garden area in Springfield that attracted a large number of children. In Richardson, there were bench areas and table areas that could classify as Resting/Viewing areas. Some of the resting/viewing areas were areas that appeared to be designed to allow adults the opportunity for wildlife (ducks, geese, and turtle) observations.</td>
</tr>
<tr>
<td>Play Pocket</td>
<td>Play Pockets include those areas that were created in Springfield to include small groupings of nature-themed play equipment, as well as benches and informational signs. These areas were designed specifically for children and families.</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>These behavior settings were dependent upon the child stopping along the pathway to engage in an activity that involved something other than translocation, but was not an area specifically designed for an activity other than translocation. Most frequently, this involved a child stopping to observe an insect or an animal, or to engage with an animal, such as feeding the ducks and geese.</td>
</tr>
<tr>
<td>Pathway</td>
<td>This behavior setting category was defined to include all observations that predominantly were translocation related. This was recorded when the child was moving forward along the pathway and not stopped engaging in an alternative activity.</td>
</tr>
</tbody>
</table>
Table 6-6: Numbers of Observed Behaviors by Behavior Settings Type

<table>
<thead>
<tr>
<th></th>
<th>Ephemeral</th>
<th>Resting/Viewing</th>
<th>Play Pockets</th>
<th>Pathway</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richardson</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>Cary</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>34</td>
<td>41</td>
</tr>
<tr>
<td>Springfield</td>
<td>16</td>
<td>20</td>
<td>42</td>
<td>17</td>
<td>95</td>
</tr>
<tr>
<td>TOTAL</td>
<td>37</td>
<td>23</td>
<td>42</td>
<td>67</td>
<td>169</td>
</tr>
</tbody>
</table>
Resting/Viewing Behavior Settings

Settings designed as seating, wildlife viewing, or as small gardens were popular with children. These settings were primarily designed for adults but often offered children opportunities for gross motor activities, adult interactions, observing nature, and wildlife viewing, as indicated in Figure 6-7 below.

**Figure 6-5:**
Dwarf Conifer Garden with Intensive Plantings, Water, Bridge, and Rocks

**Figure 6-6:**
Bench with View of Lake

**Figure 6-7:**
Chart Showing Percentages of Behaviors Observed at Resting / Viewing Settings
Play Pocket Settings

Play pockets were areas that contained nature themed play equipment. They were not only popular, but showed the highest levels of social interactions, as shown in Figure 6-10. Gross motor skills were frequently utilized for climbing and reaching activities.

Figure 6-8: View of Play Equipment in Play Pocket

Figure 6-9: View of Children at Play Pocket

Figure 6-10: Chart Showing Percentages of Behaviors Observed at Play Pocket Settings
Ephemeral Settings

Children were observed stopping to engage in activities when they encountered wildlife or other interesting objects in the environment. These settings are temporary events related to spontaneous activities of children. A variety of behaviors were observed, including observing, gross motor, and fauna interactions, as shown in Figure 6-13.

Figure 6-11: Children Interacting with Wildlife

Figure 6-12: Children Observing Ducks and Turtles

Figure 6-13: Percentages of Behaviors Observed at Ephemeral Settings
Pathway Settings

When pathways were used for translocation, the observations were put into this category. In addition to translocation, numerous conversations occurred, often between parent and child. Figure 6-15 displays the behaviors observed while children moved along pathways.

Figure 6-14: View of Family Walking on Pathway

Figure 6-15: Chart Showing Behaviors Observed Along Pathway Settings
All Settings Combined

Behaviors observed across all settings are displayed in Figure 6-16. The pathway environment supported behaviors of gross motor activity, adult interaction, observing, fauna interaction, peer interaction, flora interaction and fine motor activities in order from highest to lowest. Gross motor activities were dominate in all but ephemeral settings. Children moving along pathways and playing on play pockets had the highest gross motor activity. Adult interactions and peer interactions were highest in play pocket settings. Both observing and fauna interactions were highest in resting/viewing areas and in ephemeral settings.

Figure 6-16: Behaviors across all Settings
6.4.2. Springfield

Behavior Mapping in Springfield demonstrated a high number of observations (represented as stars in Figure 6-17) in play pockets, as well as in observation areas. The green area to the right of the map represents the dwarf conifer garden. Children were attracted to this garden, which was not surprising as the garden contained grasses, a bridge, a water feature, and boulders. The peninsula allowed for viewing of ducks, geese, and turtles, and was popular with children. There were several observations of children made on the edges of the pathway on the left, or west, of the pathway, as the edges of the pathway were flatter in those areas and afforded children the opportunity to get closer to the water's edge. The grass is left to grow taller at the water's edge in order to discourage geese from nesting at the site, which does not permit easy access to the water itself.
The majority of observations in Richardson occurred at the central area where the adjacent street allows for parking and the site offers tables and benches, and paved edges near the waterway (see Figure 6-18). Many families lingered in this area, which allowed children to interact with ducks and geese. There were also numerous observations on the east-west branch of the pathway, which led neighborhood children to the large park with the playground. This area also contained the highest number of children traveling independently, without an adult present. There were no observations of children on the northern most portion of the pathway, and only one observation on the southernmost section.
Figure 6-18: Behavior Mapping Results from Richardson

6.4.4 Cary

The majority of observations in Cary were located at the central section of the pathway (see Figure 6-19). This area is closely connected to the two playgrounds and offers a wider pathway. There were a few observations on the bridge that crosses the busy interstate, and where children often pause and watch traffic passing by below. The noise level of the traffic is high, preventing easy conversations. There
were only two observations on the northern most portion of the pathway, despite the fact that there was equal opportunity for observations in this area. The sole observations were teenagers, and not young children or adolescents. This area is the most remote and enclosed, with the houses backing up to the greenway corridor.

Figure 6-19: Behavior Mapping results from Cary

6.5 Question 5: Independent Mobility

What Built Environment Characteristics Support Independent Mobility along the Greenway Paths?
The Cary and Richardson study sites were investigated for measures of independent mobility. Springfield and Chattanooga were not investigated as both sites are far enough from residential neighborhoods that children are not expected to travel to the parks independently on a regular basis.

There are a cluster of responses for the age parents allow children to be independently mobile between the ages of 10 and 15. Cary parents were highest between 12-15, while Richardson responses spiked at 10, followed by 12 and 13. The responses are shown in the table below (see Figure 6-20).

The mean age of the responses for Cary is 12.6, as compared to Richardson’s mean age of 10.4. There were relatively high numbers of people
whose response indicated they were unsure of the age, and also a high number of people who did not respond to this particular question (See Table 6-7).

Table 6-7: Mean Age Parents Do/Will Allow Children To Use The Neighborhood Pathways Without Adults Present

<table>
<thead>
<tr>
<th></th>
<th>Mean Age</th>
<th>Not sure</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cary (n=46)</td>
<td>12.6</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Richardson (n=45)</td>
<td>10.4</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

When parents were asked about the reasons for not allowing their children to be independently mobile, Cary and Richardson responses were similar for concerns about the child’s age or maturity, but very different for other social fears. Cary responses indicated a higher fear of molestation from adults, as well as higher fear of bullying. The responses are shown in the chart below (See Figure 6-21).
Several parents specifically expressed concerns over the wooded areas in Cary, including one parent who wrote that she was concerned over “weirdoes” in the woods. Optional write-in responses included one Cary parent who wrote ‘Parts of the trail are isolated.’ Another Cary parent wrote this comment: “Children's safety issue on streets has more to do with cars / children's safety issue on path has more to do with predators.” One Cary parent mentioned that they countered the fear of danger by equipping their children with cell phones, and another mentioned walkie-talkies.

Richardson parents had less to say about safety and security in relation to children’s safety, but also in relation to general safety and security along the pathway. When asked the open ended question ‘How could the safety and security be improved,’ Cary and Richardson also showed striking differences (see Figure 6-
22). While Richardson’s parents were concerned about night lighting, Cary’s parents mentioned concerns about the seclusion or the woods twenty percent of the time. One Cary parent commented, ‘I just don't think it's ever totally safe/secure walking through woods/secluded areas.’ That statement typifies many of the responses about wooded areas and seclusion.

Figure 6-22: Improving Safety And Security.
CHAPTER 7 DISCUSSION

7.1 Pathway Use by Children

Four pathways were selected for this study that were believed to have characteristics that followed the Pathways for Play (PlayCore and Natural Learning Initiative, 2010) guidelines developed to attract children and families to pathways. Two of the pathways (Springfield and Chattanooga) were located in parks and were enriched with play pockets in order to attract children and families, and two others (Cary and Richardson) were located along greenways and were selected because they were expected to be popular with children and families. The “park pathways,” in addition to having play pockets, were high quality pathways with adjacent natural features. The “greenway pathways” were expected to be popular due to the context (intermixed within a neighborhood, connected to parks with playgrounds) and the pathway quality (adjacent natural features such as creeks and vegetation). Pathway traffic counts indicated a higher percentage of children present at the case study sites than a national trail study (Reynolds et al. 2007) showed for typical rail-trail pathways (see Table 7-1). This suggests that the pathways selected were friendlier to children than the pathways in the national study, although the two studies cannot be directly compared due to differences in data collection, it does suggest that the pathways selected for this study are attractive to children and families as expected.
Table 7-1: Data from National Study Compared to This Study

<table>
<thead>
<tr>
<th>Percentage of Trail Use by Age</th>
<th>Chicago*</th>
<th>Dallas*</th>
<th>Los Angeles*</th>
<th>Cary</th>
<th>Richardson</th>
<th>Springfield</th>
<th>Chattanooga</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>29%</td>
<td>25%</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>teen</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>12%</td>
<td>21%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>&lt;18</td>
<td>6%</td>
<td>3%</td>
<td>12%</td>
<td>42%</td>
<td>46%</td>
<td>26%</td>
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*data collected and reported by Reynolds et al., 2007
** data not collected in category sub-divisions

Researchers for the national study (Reynolds et al., 2007) used for comparison here did not attempt to locate pathways that were friendly to children and in fact, the selection criteria used to select sites in that study may have resulted in sites which were particularly unattractive to children and families. For instance, the authors looked for rail-trails that traversed at least fifteen miles. This study avoided straight trails (most rail-trails), as it was expected that those trails would be less interesting to children. Long distance trails that are used heavily by cyclists who drive at higher speeds may be perceived as dangerous near children as children’s behaviors are often unpredictable and children often travel at slower speeds, creating a greater speed differential. This research does suggest that pathways planned in neighborhood contexts and those designed with children in mind may be utilized more than the current literature suggests. Researchers may broaden their
data collection strategies to include children as a user category on future pathway and trail studies.

Findings indicated age ranges of users varied across the sites. However all sites were frequented by a higher percentage of those under age 18 than those pathways studied by Reynolds et al. (2007) (See Table 7-1), which included selected pathway selection criteria that included a minimum of 15 miles in length and a location in large metropolitan area, and traversing diverse neighborhoods. One discrepancy in data collection methods was that in the Reynolds et al. study, data were collected over four days, including two weekdays and two weekend days, between 8 am and 5 pm. For this study, traffic counts were not conducted in the mornings of weekdays when school age children were not expected to be present. This may account for the low numbers of children present in the Reynolds et al. study.

Highest use by younger children under the age of 12 (29%) was observed at the Cary location (See Table 7-1). As that pathway connects two well-visited playgrounds together and is located in a residential neighborhood, this was an expected result. Use by children was also high in this age category at the Richardson site (25%). The greenway pathways in neighborhoods, Cary and Richardson, both showed higher use by children than did the park pathways in Springfield (17%) and Chattanooga (15%). Both Springfield and Chattanooga have high use by adults as the parks there contain amenities for those age groups. The
park pathway in Springfield was located in a botanical garden, which attracted many adult and senior users. Also, the pathway connected to a large network of pathways that can be used by adults who travel further distances than children usually would. The Chattanooga site was a popular destination for fishing and was connected to a well-used long distance bike pathway. Although the pathways in Chattanooga and Springfield contained play pockets, the longer distance between home and the pathways may have limited use by children.

Highest use under the age of 18 was observed in Richardson (46%). Although Cary had the highest use by children under the age of 12, highest use by teens (21%) was observed in Richardson, which accounts for the higher total (See Table 7-1). The Richardson pathway connected to a nearby middle school, which could help account for the high number of users in the teen category. Anecdotally, there were also teens observed using the pathway to connect to other teens in the evening hours and on weekends. Higher teen use observed in Richardson could be a result of higher levels of independent mobility found there, as indicated by parental surveys. Research suggests that independent mobility is linked to increased time spent outdoors (Wen et al., 2009) which could account for higher use in Richardson. With higher levels of independent mobility, it would be expected to find higher frequency of use by those with more license to use the pathways without adults present.
7.2 Pathway Context

In the world at large, pathways may exist along a continuum of contexts from those wild and untamed footpaths in forests to urban promenades. This research examined two pathways contexts: play pocket enhanced pathways located within urban parks, and neighborhood greenway pathways. This study brings attention to the potential pathways have to provide children with necessary healthy developmental benefits including opportunities for active transportation, physical activity, contact with nature, play, family fun, and exposure to wildlife.

Families with children often seek parks for leisure activities. These parks offer scenic beauty, contact with nature, playgrounds for children, walking / strolling pathways, restrooms, and social features such as picnic areas and comfortable seating. Pathways in parks are typically removed from vehicle traffic, allowing children the freedom to move about with few constraints, which is relaxing for parents and caregivers. Parks concentrate valuable community recreation resources in one area that serve surrounding residents.

Greenway corridors, strips of nature often set along waterways for flood control and conservation, can intermingle with residential neighborhoods in a way that is different from neighborhood parks. The linear form of greenways may offer higher accessibility with a high edge to area ratio than a typical neighborhood park (Hellmund & Smith, 2006, p. 220). Pathways located along greenway corridors can connect children to meaningful destinations, and bring nature in to the daily lives of
children (Hellmund & Smith, 2006; PlayCore & Initiative, 2010). Greenway pathways offer enticing opportunities for children’s active transportation as they are free of vehicular traffic and connect children to nature by exposing them to urban ecology. Findings from this study suggest that children will use pathways in parks and along greenways, when they are located and designed to appropriately. It also suggests that higher use will occur on pathways located along greenways in residential neighborhoods.

7.3 Play

Play was a focus of this research from the beginning. It was expected that children would move along pathways in a way that differs from adult movement. Children are less conscious of time constraints, and perceive the environment differently. Children’s purposes for walking may be less distinguishable in categories of recreation vs. transportation than adults, as children may be more likely to play along the way while walking for transportation (Mackett et al., 2007; Moore, 1986). Research by Moore (1986) brought attention to the way children move along pathways “playing along the way.”

Play equipment, in the form of “play pockets” was added at intervals to the pathways in Chattanooga and Springfield in order to attract children and families by offering ‘play’ opportunities. It was expected that the play equipment, disbursed throughout the pathways in play pockets, would increase visitation by children and families, and also increase the duration of visits. Survey results indicated that the
frequencies of visits in Springfield were increased by 88%, and in Chattanooga by 62% (See Figure 7-1). The reasons for the difference in use levels between the two sites was not uncovered by this study; however, their contrasting locations may offer an explanation. The Chattanooga site was relatively further from residential neighborhoods and likely more time-consuming for families to reach. In contrast, the Springfield site was directly connected to nearby residential neighborhoods and reachable by foot and bicycle. The Springfield location also offered more amenities, such as multiple playgrounds and the botanical garden.

![Figure 7-1: Change in Frequency of Visits after Addition of Play Pockets.](image)

It was evident from the surveys that a nearly all (100% in Springfield and 80% in Chattanooga) parents felt the duration of their park visits increased with the addition of the play pockets (see Figure 7-2). This is notable, as time spent outdoors has been correlated with higher levels of physical activity (Sallis, Prochaska, & Taylor,
The CDC recommends children spend 60 minutes per day engaged in moderate to vigorous physical activity and pathways with play pockets may help children reach that goal by increasing the amount of time families spend at parks with play pockets.

Prior research suggests that play equipment can serve as a destination for children (Farley et al., 2008) or as the basis of a park visit (Moore, 1986). This study supports these earlier findings by demonstrating the effect of added play equipment and the observed use by families of the play pockets.

![Figure 7-2: Change In Duration of Visits after Addition of Play Pockets.](image)

**7.4 Benefits of Pathway Use**

A key finding of this research is the high ranking of “family fun” as a perceived benefit of pathways. The chart below (see figure 7-3) shows that parents responded to the importance of potential benefits most positively in the family fun category with
three quarters of respondents placing family fun in the very important benefit category. This is significant as a higher value placed on desired benefits to parents may act as a motivation for increased use (Beck, 2004). Designing and planning pathways that encourage use by providing opportunities for family fun may be one method of increasing use by children and families.

Physical activity, engaging with nature, safe travel to destinations (greenway sites), and scenic beauty all ranked high in importance to parents. Although learning was ranked lower, 60% of parents still considered it ‘very important’ or ‘somewhat important’. Although pathways may provide excellent opportunities for learning, families viewing recreation as a need to relax and get away from more formal learning environments of school and homework may have influenced their response to the idea of “learning” through pathway use.
7.5 Pathway Affordances

Behavioral affordances occurring at the sites were open coded so that behaviors could be documented without bias as to a priori play categories. When conducting the pilot study, searching for an established behavioral classification system for children and their activities that encompassed the variety of behaviors observed proved daunting. This was due in part to the finding in pilot studies that behaviors were more diverse along pathways than behaviors those categories included in existing play scales. It was, therefore, decided that new categories would be developed based on a qualitative analysis of open coded responses. Working
with experts in the field of children’s outdoor play, thematic behavioral categories were developed for this study.

Behavior categories developed for this research include gross motor, fine motor, social-adult, social-peer, observing, flora engagement, and fauna engagement (See Figure 7-4). These behaviors were observable and are important for healthy child development. Providing an environment with the settings that support these diverse behaviors would be beneficial. Behaviors observed during behavior mapping were difficult to classify into the widely accepted ‘play’ categories as defined by Frost (1992), although that system recommends the method used in this research for open coding of observed behaviors. That classification system was developed over time for the purpose of measuring play behaviors of children in group situations. Along pathways, children typically travel in small groups and confront a more varied and dynamic physical environment. Indoors, children interact with other children and caregivers that may be more familiar to them. The indoor environment is more controlled and familiar. It may also be easier for the observer to overhear children’s conversations indoors, which proved difficult along pathways. Overhearing the conversation allows the observer to determine if fantasy play is occurring and that was not always possible outdoors. Utilizing Frost’s method of observing and recording behaviors (open coding) resulted in a varied list. It was apparent that children’s behaviors in the outdoors are more diverse than indoor play behaviors.
This begs the question: are the behaviors witnessed ‘play’? It was important to understand the definition of play to determine if that topic can apply to the behaviors observed. Frost acknowledged that ‘it is still not possible to arrive at a simple, clear, scientific definition of play’ (1992, p. 22). Brown and Vaughan (2009) are reluctant to define play as it is a ‘preconscious and preverbal’ activity (Brown & Vaughan, 2009, p. 15). Brown and Vaughan describe the properties of play as: apparently purposeless, voluntary, inherent attraction, freedom from time, diminished consciousness of self, improvisational potential, and continuation desire (Brown & Vaughan, 2009, p. 17).

Figure 7-4: Behavioral Affordances across the Settings.
7.6 Social Interactions

There were many social interactions observed along pathway corridors. In play pocket settings one third of all observations included adult-child interactions. Parents assisted children with climbing, engaged in imaginary games, and sometimes involved in play themselves. Peer interactions were also highest in the Play Pocket settings with 14% of the observations. The other settings showed fewer peer interactions (less than 10%); however, this might not be directly representative of the interactions. For example, if three children were observed riding bikes to the park and no conversation was taking place, no interaction was recorded. Nonetheless, the fact that they were together implies a prior or future interaction.

Approximately one fifth of observations made in the remaining three behavior settings included interactions between adults and children. The majority of those observations along pathways were conversations taking place as families strolled along the Pathway Settings. In the Ephemeral Settings and Resting / Viewing Settings, adults and children were mostly discussing the local wildlife and plants. Because Play Pockets in these case studies were located in regional parks, the mix of social interactions may not be representative of Play Pockets located along neighborhood greenways. In regional parks, children are typically accompanied by parents or adult family members, which may affect peer to peer social interactions and increase adult-child interactions.
7.7 Wildlife

The attraction children had for wildlife was striking. Children poked sticks in the water trying to reach turtles. They fed, chased, and sometimes quietly observed ducks and geese. A young boy and his father rescued a caterpillar from the pathway tread, moving the creature safely to nearby vegetation.

It may be difficult to consider as 'play' behaviors the high number of observations in the category of 'observing' (49 out of 169 observations) or the interactions of children with animals (37 out of 169 observations), until we accept Brown’s (2009) broad definition of 'play' as stated above. Almost one third of the observations made were of children observing animals, plants, and other people in the environment.

Consistent with previous research (Lindemann-Matthies, 2005; Myers & Saunders, 2002), animal interaction in this study appeared to be a favorite activity for children. This interaction, whether it be feeding ducks, watching a caterpillar on a leaf, or looking for turtles in the water, may fall most closely into Frost’s (1992, p. 101) category of ‘non-play’ behavior, but would qualify as a play behavior in Brown’s description of play properties. Brown (2009, pp. 100-103) emphasizes the connection between learning and memory enhanced with play. He suggests that play may support the retention of knowledge. If so, children interacting with animals or observing animals when ‘purposeless, voluntary…’ etc. as part of play behavior, may lead to retention of knowledge of the natural world.
7.8 Loose Parts

Children engaged with natural objects as play props in 17 behavior-mapping observations. There were no observations of children manipulating loose parts in play pockets, perhaps signaling the lack of adjacent, appropriate vegetation and accessible loose parts. Although part of the play pocket concept is play equipment nested within vegetation, the sites in both Chattanooga and Tennessee had not yet been 'naturalized' (i.e. landscaped with grasses, perennials, shrubs, and trees) at the time of these observations. The Chattanooga site, it should be mentioned, was managed by efficient maintenance crews who removed a majority of leaves, twigs, and seed pods, resulting in a lack of loose parts available for play.

7.9 Free Play

Unstructured free play has an important role in children’s healthy development. Article 31 of the United Nations Convention on the Rights of the Child states in part that “…Parties recognize the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child…” The American Academy of Pediatrics released a guide for clinicians regarding the importance of play in the development of strong parent-child bonds (Ginsburg, 2007). The same report recommends that children receive ample time for independent child driven play. This allows children the opportunity to develop skills necessary for resilience. Pediatricians are also urged to encourage parents to spend unscheduled free play
time with their children and that family members should make time to “be together, to listen, and to talk, nothing more and nothing less” (Ginsburg, 2007, p. 187).

With the American Academy of Pediatrics recommending children have opportunities for child driven free play, it makes sense that our communities be designed to allow children to connect with one another and with parks and playgrounds during after school and weekend hours. Unstructured leisure time is difficult for many families to achieve as parents and children are under intense pressure to meet external obligations. Schools are expected to meet high academic standards resulting in recess being removed from the schedule. Neighborhood parks and pathways allow children and adults opportunities for daily leisure experiences.

7.10 Independent mobility

Independent mobility occurred more often at the case study site in Richardson as compared to the site in Cary. When parents were asked about the age of independent mobility, the mode average for Richardson was 10 years as compared to 15 years for Cary while the mean age for Richardson was 10.4 and Cary 12.6 years of age. It was more common to see children and groups of children traveling along the pathway in Richardson without adults. There are several possible reasons for the difference. The attributes of the pathway corridors are different, the school system is different, the destinations are different, perception of crime may be different, the actual crime levels may be different, and the people residing in the two neighborhoods are different.
An observable and compelling reason for the difference is that the Cary pathway corridor in Cary was densely wooded and, for the most part, not visible to neighboring houses. In open-ended responses, parents frequently mentioned the sense of enclosure and the woods as reasons for limiting children’s use of the Cary pathway. The pathway there runs along the back yards of many houses. The most used portion of the pathway connected two parks with playgrounds and crossed a bridge over a busy freeway. Richardson, on the other hand, had an open and highly visible corridor. In some portions, the corridor abutted the neighborhood streets or alleyways. In other portions, the back yards ran along the corridor; however there was no dense vegetation to block views. Reynolds et al. (2007) also found a negative correlation between trail use and dense vegetation. There were many high fences and gates in Richardson, so views may be obstructed, but there was always the potential for people to be present and within view. The Richardson environment created what Jane Jacobs (1992) referred to as “eyes on the street.” This high visibility may increase the public perception of safety, and previous research indicates high visibility with long view distances close to populated areas enhance the perception of safety (Schroeder & Anderson, 1984).

7.11 School System Differences

Cary’s magnet school system allows children from anywhere in the County system to apply for attendance in the district’s magnet schools. Children who reside in the Cary neighborhood may not necessarily attend that neighborhood school.
While this may achieve a balance of socio-economic backgrounds for the children at any given school, it may lead to lower community social capital among families with children who live in the neighborhood where children attend several different schools. In contrast, Richardson’s neighborhood school system allowed all children in the neighborhood who attend public schools to attend the same schools. This may improve walking and biking to and from school as parents may know other neighborhood children and thus feel more confident about their children’s safety.

7.12 Pathways for Transportation

The destinations for children were different at the Cary and Richardson case study sites. Cary has two parks with playgrounds, both of which contain play equipment for young children. Cary has a neighborhood convenience store nearby, as well as a large grocery store. As mentioned above, the Cary school may or may not be a destination for neighborhood children. The pathway did not connect directly with the school, and pedestrians must leave the pathway and cross a somewhat busy street to reach the market. It did appear, however, that children did visit the market and the parks in Cary via the pathway. In Richardson, there was one large park with a playground and many pathways and open fields, and two schools adjacent to the pathway. There were no markets connected to the pathway, and leaving the pathway to travel to commercial businesses requires walking along streets with high traffic volume and high speeds. Children frequently access the parks and playgrounds at both pathway sites.
The Richardson pathway is used for transportation to and from school, but not as much as possible. In casual conversations with Richardson residents, the most popular way for children to arrive at school is still via the automobile, although other options are available.

The potential pathways have for use as transportation corridors for children is compelling as they often avoid vehicle traffic which has been shown to present a barrier to children’s walking and biking (Gielen et al., 2004; Grow et al., 2008). Vehicle traffic poses a real danger to children, particularly in the United States. Pedestrians and cyclists in the United States are at higher risk of death than many other countries, for example, pedestrians in the U.S. are approximately 3 times more likely than German and over 6 times more likely than Dutch pedestrians to be killed per mile and per trip walked (Pucher & Dijkstra, 2003). Young children have not yet developed the necessary abilities to be able to safely negotiate vehicle traffic (Schieber & Thompson, 1996) which puts them at higher risk than adults.

7.14 Vegetation

Vegetation is directly related to many of the benefits of pathways, but also has the potential for acting as a barrier to children’s pathway use. Vegetation provides shade, contact with nature, loose parts for play props, scenic beauty, and food and shelter for wildlife. On the other hand, parents appeared reluctant to allow children to use Cary’s densely vegetated pathway corridor. Results suggest that pathways in
Richardson elicited less parental fear and resulted in fewer concerns regarding social fears and “weirdoes” in the woods than did Cary pathways.

Forty-two percent of parents in Richardson suggested the site needed more trees, as compared to only 2% of parents in Cary. Interestingly, the portions of Richardson pathways that received the lowest use by children were those lacking trees and consequently located in full sun. In prior research, shade has been found to be a determining factor in use of playgrounds (Tucker, 2007). This research was not conclusive, however, as other variables may have influenced use (e.g. the shaded portion was adjacent to the park and playground) along the different portions.

There is a need to achieve a delicate balance with vegetation along pathways in urban neighborhoods. Remarks about dense vegetation and delayed onset of independent mobility in Cary indicate higher fear of social dangers than those expressed in Richardson. As the pathway along the Cary site had higher density of vegetation and less visibility, it is likely that this dense vegetation presented a barrier to pathway use. On the other hand, wildlife interactions and loose part interactions were observed across the sites. None of these activities would have been possible without the vegetation that supported the wildlife and provided play props. Greenway pathways provide an opportunity to support connections between children and nature. Planting to support wildlife, whether that be birds, butterflies, turtles, or chipmunks can enhance the experience children have with the environment.
Vegetation must be carefully located and selected to allow the necessary benefits but minimize the potential barriers that can limit use of the urban natural environment for children.

7.15 Play Pockets

Play pockets with play equipment bring children to parks, and encouraged families to stay longer. They afford opportunities for gross motor activities, and socialization. Serving as a gathering point for children and families, they have the potential to breakdown social barriers within parks. Properly designed, they support physical activity, cooperation, and fun. As the play pockets were installed in these case studies, they may encourage movement along the pathways. Children returning to the site remember what is next and anticipate the next destination. This relieves boredom for children (and parents), and keeps families moving.

The opportunity to study pathways with play pockets in the context of parks elicited useful results, which may have broader application. From a park and recreation perspective, the installation of play pockets is an acceptable and novel concept. However, from a trail management perspective, play pockets may not be readily accepted along greenways. When play pocket installation was suggested for greenways, concerns about vandalism, NIMBYism, and appropriateness of development were raised. It is possible to include play pockets along greenway pathways that connect children and families to neighborhood destinations. This
hybrid model, although it does not yet exist, has the potential for increasing the
numbers of children who use pathways.

7.16 Summary

The aim of this research is to contribute knowledge that can aid planners and
designers to provide better community pathways in order to encourage use by
children and families. Key steps for successful pathway planning and design include
the following:

- If pathways are located in residential neighborhoods near children’s
  homes, then children will have opportunities for more frequent access.

- Pathways can be used as active transportation corridors protecting
  children from vehicular traffic when linking children’s homes to
  meaningful destinations such as schools and parks and playgrounds.

- If pathways are located and designed with high visibility, then parental
  concerns of social dangers may decrease.

- Vegetation can provide shade, scenic beauty, and habitat for wildlife,
  but should be carefully located to allow for visibility in urban areas.

- Pathways should be fun and safe places for children and families. The
  incorporation of a variety of behavior settings such as play pockets,
  wildlife viewing areas, seating areas, and heavily landscaped areas,
  can allow for multiple beneficial affordances.
7.17 Limitations

This study has several limitations. The number of respondents in the surveys was low. It was difficult to achieve the desired number, particularly in the park settings in Springfield and Chattanooga. It was thought that the ideal time for data collection would have been in September and October; however the weather during the weekends that data collection had been scheduled was uncooperative. Behavior mapping observations were also low, due in large part to uncooperative weather during the weekends of site visits. It may have been overly ambitious to schedule four site visits in four different states in a 2 month time period. It resulted in a lot of travel time, and weather conflict.

Another serious limitation to this study is that children were not asked for their input. Although mental mapping exercises were planned, the only site where a substantial number of drawings were collected was in Chattanooga. Because an event with booths for children’s activities was coincidently scheduled for one of the days of data collection in Chattanooga, visitors agreeably participated in the additional activity of drawing for the research. IRB restrictions did not allow for the researcher to directly approach children, and children and families moving along the pathways at other sites did not often wish to stop and participate in drawing.

Regarding independent mobility, although the findings suggest that independent mobility is higher in Richardson, there are many factors that might contribute to reasons for such a difference. The personalities of people who select to live in the
neighborhoods, prior media reports of criminal activities, neighborhood social capital, neighborhood schools, and many other uncontrolled variables may link to differences in independent mobility.
CHAPTER 8: CONCLUSIONS

Several themes emerge from the four exploratory case studies of pathway use by children and families that may prompt re-assessment of local park and greenway policies or at least provide guidance towards that end. The results may also help the research community recognize the need for evidence that may offer deeper understanding of the dynamics of pathway use by children—an under-researched and largely un-recognized user group. A key conclusion is that pathways both in parks and in the form of greenways offer potential to support children’s independent mobility and therefore their physical health, mental well-being, and improved social relations with peers and parents. Several factors summarized below emerged from the research that support this potential.

8.1 Context and Community Connections

The influence of context in differences in patterns of use between pathways in parks and pathways in residential neighborhoods underscored the importance of spatial relationships between pathways and where children live, and their most common destinations of daily life, particularly schools and parks. Because of their proximity, pathways in residential areas offer immediate potential for supporting independent mobility and dollar for dollar may offer greater investment value than pathways in parks, particularly if inaccessible by foot or bicycle. On the other hand, parks connected seamlessly to neighborhoods via playful pathways may offer the greatest benefit. Regardless, even drive-to parks may offer substantial, untapped
potential for family fun and healthy exercise when appropriately designed and managed. Whether in parks or residential areas, corridor quality and level and distribution of play value are key to pathway attractiveness.

8.2 Corridor Landscape Quality

Corridor size and shape in relation to pathway tread alignment are factors that may influence pathway attractiveness and level of independent mobility. The quality of landscape and spatial visibility can affect parental perception of safety. Pathways in urban areas can allow for higher independent mobility when visibility and openness are high. However, vegetation also provides necessary shade, supports wildlife, and offers scenic beauty. However, it may need to be managed to maintain sufficient visibility in residential areas to increase use by children, allowing them to gradually develop autonomy as they age in place and achieve the best developmental outcomes.

8.3 Play Value

Play value is not only the key factor related to the attraction of pathways to children, it can be increased and enhanced by design and management of corridor landscape quality and investment in playful features. These include play pockets containing manufactured play equipment and natural play objects, intensely designed areas with vegetation, water, boulders and bridges, the presence of animals, vegetation, seating opportunities, and loose parts for play props.
Manufactured play equipment appears to signal to children that an area is designated for them. When play pockets are naturalized, play value may be increased and the corridor may provide a more aesthetically pleasing atmosphere. Play equipment can provide opportunities for social interaction along pathways. Combined with natural areas, manufactured equipment may be assessed as the most cost effective because vegetation can elevate play value and increase opportunities for diverse behavior. Pathways within high quality landscape corridors with varied play pockets are more likely to support higher levels of play and more diverse play behaviors.

8.4 Vegetation

Vegetation offers numerous benefits some of which were already mentioned. Shade is particularly crucial in increasing comfort and therefore use but only up to the point where lack of visibility is a deterrent to use. Vegetation provides habitat for wildlife, which may likely include birds, insects, and other small animals that captivate the attention of children. Vegetation can provide a limitless supply of play props, including sticks, fallen leaves, seed pods, and flowers, all of which hold intrinsic play value for the numerous creative games children devise. Vegetation provides scenic beauty, an important benefit valued by parents and other adult family members. Vegetation, including mere views of vegetation have been shown in other studies to provide health benefits.
Dense vegetation can elicit an intuitive response that indicates danger that may accentuate parental concerns for safety. Although vegetation provides numerous positive benefits, in urban areas it may need to be tempered by high levels of visibility if independent mobility for children is to be encouraged.

8.5 Wildlife

Children are attracted to animals. They increase play value. This study included insects, turtles, and geese, among others. Locating pathways in areas of higher wildlife value (e.g., near water and species that support wildlife) can increase children’s natural curiosity. The dynamic nature of animals captivates children and may increase their environmental awareness and in their longterm development of environmental ethics. Naturalized plantings that increase habitats for local critters may be beneficial for the environment, as well as for encouraging outdoor play by children.

8.6 Multiple Benefits of Playful Pathways

Playful pathways can attract more children and family users if designed to support family fun, physical activity, engagement with nature, connection to children’s destinations, and enjoyment of scenic beauty. If opportunities for family fun are incorporated into community pathways, users may be ‘pulled’ to use them, especially independently mobile children. Addition of play pockets can increase both frequency and duration of use.
8.7 Recommendations for Future Research

Several opportunities were suggested by this study to explore further children’s use of pathways in varied contexts. Engaging children themselves in pathway research to directly tap their perceptions of playful pathway qualities and barriers to use could be revealing and provide valuable evidence to affect policy. Several methods are available, including surveys and in-depth interviews, photovoice, mental mapping and other drawing-based approaches, and focus groups, all of which could produce valuable results to help increase understanding of environment-behavior connections from the point of view of children. Linking these data to direct counts of pathway use by children would add strength. The many variables associated with pathway use by children and families calls for larger scale studies that include multiple sites with a mix of community variables for the factors identified in the exploratory study reported here to be fully understood.

An important outcome variable not included in this study, which focused on play and fun, was physical activity. Although it may easily be hypothesized that pathway use is associated with physical activity, the next step would be to gather empirical evidence that pathways enriched with play pockets increase frequency and duration of visits to greenways and parks. A highly significant result could substantially change policy towards pathway design and investment.
REFERENCES


APPENDICES
Appendix A

IRB Forms / Approval Letters
From: Carol Mickelson, IRB Coordinator
North Carolina State University
Institutional Review Board

Date: August 17, 2011

Title: Pathway Behavior Mapping
IRD#: 2172

Dear Ms. Cox,

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption 46.101.b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

NOTE:
1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

Please forward a copy of this letter to your faculty sponsor, if applicable. Thank you.

Sincerely,

Carol Mickelson
NC State IRB
North Carolina State University
Institutional Review Board for the Use of Human Subjects in Research
REQUEST FOR EXEMPTION (Administrative Review)

GENERAL INFORMATION

1. Date Submitted: August 10, 2011
2. Title of Project: Hallway Behavior Mapping
3. Principal Investigator: Adam Cox
4. Department: College of Design
5. Campus Box Number: 2907
6. Email: adam.cox@ncsu.edu
7. Phone Number: 901-234-5678
8. Fax Number: 
9. Faculty Sponsor Name and Email Address: Robin Moore
c/o [email protected]
10. Source of Funding? (required information): [ ] [ ] [ ]
11. Is this research receiving federal funding? [ ]
12. If externally funded, include sponsor name and university account number:

RANK:
Academic [ ] Undergraduate [ ] Masters, or [ ] PhD [ ]
Other (specify): [ ]

As the principal investigator, my signature attests that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted exactly as outlined in the Proposal Narrative and that any modifications to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.

Principal Investigator: [ ]
[ ] (signature) [ ] (date)

As the faculty sponsor, my signature attests that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the principal investigator of record.

Faculty Sponsor: [ ]
[ ] (signature) [ ] (date)

*Electronic submission to the IRB are considered signed via an electronic signature

PLEASE COMPLETE AND DELIVER TO:
[ ] (carol.micklejohn@ncsu.edu) or Institutional Review Board, Box 7514, NCSU Campus (Administrative Services III, Room 245)

For IRB office records:
Regulatory Compliance Office Disposition
[ ] Exemption Granted [ ] Not Exempt: Submit a full protocol
Exempt Under: [ ] [ ] [ ] [ ] [ ]

IRB Office Representative [ ] (signature) Date [ ]

Page 1 of 4
Project Description: Describe your project by providing a summary and answering the requests for information below.

1. Project Summary. Please make sure to include the purpose and rationale for your study as well as a brief overview of your study.

   This project aims to map and record observations of the behavior of children and accompanying adults while they are out on public pathways. The purpose of the study is to learn about the activities of children and families while they use pathways and the immediate surrounding environment in order to understand the influences of the built and natural environments on their activities. It is anticipated that this information will be used to improve the design of future pathways in order that they might better serve children and families.

2. Description of participant population, including age range, inclusion/exclusion criteria, and any vulnerable populations that will be targeted for enrollment.

   Children, adolescents and teens, ages 5-19, are of particular interest in this study. Adults who are accompanying children will also be observed and data recorded. All observations will be made in public areas and any visitors to the selected public locations will be subject to inclusion in the study.

3. Description of how potential participants will be approached about the research and how informed consent will be obtained. Alternatively, provide an explanation of why informed consent will not be obtained. Include a copy of recruitment materials, such as scripts, letters of introduction, emails, etc. with your submission.

   Informed consent will not be obtained as this study will be in public locations and is meant to record naturally occurring behaviors.

4. Description of how identifying information will be recorded and associated with data (e.g. code numbers used that are listed via a master list to subjects' names). Alternatively, provide details on how study data will be collected and stored anonymously ("anonymously" means that there is no link whatsoever between participant identities and data). Describe management of data security, storage, access, and final disposition.

   Each observer will be recorded via a number, and gender and age group are also used. This information will be stored in a table in an electronic device. The location of the observation will also be recorded on a map with a number representing the observation. Subjects' names will not be collected or recorded.

5. Provide a detailed (step-by-step) description of all study procedures, including descriptions of what the participants will experience. Include topics, materials, procedures, for use of assessments (interviews, surveys, questionnaires, testing methods, observations, etc.).

   The data collector will walk along the selected pathways and observe people who are using the pathway and the immediately adjacent environment. As the data collector moves in to view of a pathway, user data collection will include, age range, gender, mode of transportation, group size, whether or not a pet is present, whether or not an adult is present, and the activity of the observed person. The data will be recorded in a handheld electronic device such as a good tablet. The location of the person will be recorded on a map that is either paper or digital format. The observations will be linked to the mapped location by a consecutive number, beginning with '1'.

6. Will minors (participants under the age of 18) be recruited for this study?

   Minors will be observed but not recruited for this study.

7. Is this study funded? Yes. If yes, please provide the grant proposal or any other supporting document.

   [Proposal text not visible]
8. Is this study receiving federal funding? No

9. Do you have a significant financial interest or other conflict of interest in the sponsor of this project? No

10. Does your current conflicts of interest management plan include this relationship and is it being properly followed? No

11. HUMAN SUBJECT ETHICS TRAINING
   *Please consider taking the Collaborative Institutional Training Initiative (CITI), a free, comprehensive ethics training program for researchers conducting research with human subjects. Just click on the underlined link.

12. ADDITIONAL INFORMATION:
   a) If a questionnaire, survey or interview instrument is to be used, attach a copy to this proposal.
   b) Attach a copy of the informed consent form to this proposal. See the IRB website for a Sample Consent Form and Informed Consent Checklist [link]
   c) Please provide any additional materials (i.e., recruitment materials, such as “flyers”, recruitment scripts, etc.) that may aid the IRB in making its decision.

*If a survey instrument or other documents such as a consent form that will be used in the study are available, attach them to this request. If informed consent is not necessary, an information or fact sheet should be considered in order to provide subjects with information about the study. The informed consent form template on the IRB website could be modified into an information or fact sheet.

The following are categories the IRB office uses to determine if your project qualifies for exemption (a review of the categories below may provide guidance about what sort of information is necessary for the IRB office to verify that your research is exempt):

Exemption Category: (Choose only one of the following that specifically matches the characteristics of your study that make this project exempt)

☐ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (a) research on regular and special education instructional strategies, or (b) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

☐ 2. Research involving the use of educational terms (cognitive, diagnostic, episode, achievement, survey procedures, instructional processes, or observations of public behavior, unless (i) intervention, obtained, or recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects, and (ii) any disclosure of the human subjects, responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects, financial standing, employability, or reputation.
   *Please Note: this exemption for research involving survey or interview procedures or observation of public behavior does not apply to research conducted with minors, except for research that involves observation of public behavior when the investigator(s) do not participate in the activities being observed.

☐ 3. Research involving the use of educational terms (cognitive, diagnostic, episode, achievement, survey procedures, intervention procedures, or observations of public behavior that is not exempt under paragraph (b)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for
4. Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

5. Not applicable

6. Taste and food quality evaluation and consumer acceptance studies if wholesome foods without additives are consumed, or if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe by the Food and Drug Administration, or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
From: Carol Mickelson, IRB Coordinator  
North Carolina State University  
Institutional Review Board  

Date: August 17, 2011  
Title: Pathway User Counts  
IRB#: 2173  

Dear Ms. Cox,  

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101 b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

NOTE:
1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 3 business days.

Please forward a copy of this letter to your faculty sponsor, if applicable. Thank you.

Sincerely,  
Carol Mickelson  
NC State IRB
**North Carolina State University**

**Institutional Review Board for the Use of Human Subjects in Research**

**REQUEST FOR EXEMPTION (Administrative Review)**

### GENERAL INFORMATION

<p>| | |</p>
<table>
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<td>1.</td>
<td>Date Submitted: August 11, 2011</td>
</tr>
<tr>
<td>2.</td>
<td>Title of Project: Pathway User Counts</td>
</tr>
<tr>
<td>3.</td>
<td>Principal Investigator: Adina Cox</td>
</tr>
<tr>
<td>4.</td>
<td>Department: College of Design</td>
</tr>
<tr>
<td>5.</td>
<td>Campus Box Number: 2101</td>
</tr>
<tr>
<td>6.</td>
<td>Email: <a href="mailto:adina_cox@ncsu.edu">adina_cox@ncsu.edu</a></td>
</tr>
<tr>
<td>7.</td>
<td>Phone Number: 919 515 3246</td>
</tr>
<tr>
<td>8.</td>
<td>Fax Number:</td>
</tr>
<tr>
<td>9.</td>
<td>Faculty Sponsor Name and Email Address if Student Submission: Robin Moore, <a href="mailto:rmoore@ncsu.edu">rmoore@ncsu.edu</a></td>
</tr>
<tr>
<td>10.</td>
<td>Source of Funding? (required information): No</td>
</tr>
<tr>
<td>11.</td>
<td>Is this research receiving federal funding? No</td>
</tr>
<tr>
<td>12.</td>
<td>If externally funded, include sponsor name and university account number:</td>
</tr>
<tr>
<td>13.</td>
<td>RANK:</td>
</tr>
</tbody>
</table>

As the principal investigator, my signature verifies that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted, exactly as outlined in the Proposal Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.

**Principal Investigator:** Adina Cox  
(typed printed name)  
August 10, 2011  
(signature)  
(date)

As the faculty sponsor, my signature verifies that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the principal investigator of record.

**Faculty Sponsor:** Robin Moore  
(typed printed name)  
(signature)  
(date)

*Electronic submissions to the IRB are considered signed via an electronic signature*

**PLEASE COMPLETE AND DELIVER TO:**

(carol.mickelson@ncsu.edu) or Institutional Review Board, Box 7514, NCSU Campus (Administrative Services III, Room 245)

**Regulatory Compliance Office Disposition**

- [ ] Exemption Granted  
- [ ] Not Exempt, Submit a full protocol

**Exempt Notes:** b.1  b.2  b.3  b.4  b.6

**IRB Office Representative**  
(Date)  

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**Page 1 of 4**
**Project Description:** Describe your project by providing a summary and answering the requests for information below.

1. **Project Summary.** Please make sure to include the purpose and rationale for your study as well as a brief overview of your study.

   This study will count users and record general data about the users at selected public pathways. Data collected will include an estimate of age range, gender, mode of travel, whether or not there is a dog present, and whether or not children are traveling without an adult present. A similar study was conducted on three national trails, and this data will be compared to those results in order to gain an understanding of pathway users. As these pathways are selected for the reference, they may have to children and families, it is presumed that data collected will help us to understand the demographics of the selected pathway users.

2. **Description of participant population, including age range, inclusion exclusion criteria, and any vulnerable populations that will be targeted for enrollment.**

   All participants walking along the selected public pathways will be included. This includes minors and adults.

3. **Description of how potential participants will be approached about the research and how informed consent will be obtained.** Alternatively, provide an explanation of why informed consent will not be obtained. Include a copy of recruitment materials, such as scripts, letters of introduction, emails, etc. with your submission. Informed consent will not be obtained as this study is strictly observational and will be conducted in a public setting. Participants will be counted but not identified.

4. **Description of how identifying information will be recorded and associated with data (e.g. code numbers used that are linked via a master list to subjects’ names). Alternatively, provide details on how study data will be collected and stored anonymously ("anonymously" means that there is no link whatsoever between participant identities and data). Describe management of data security, storage, access, and final disposition.**

   No identifying information will be recorded. Participants will be counted and numbered in a digital handheld device such as an iPod or tablet. Demographic data such as age range and gender will be entered into a database software program that will create a unique identification number for each observed pathway user.

5. **Provide a detailed (step-by-step) description of all study procedures, including descriptions of what the participants will experience. Include topics, materials, procedures, for use of assessments (interviews, surveys, questionnaires, testing methods, observations, etc.).**

   The data collector will arrive and specific locations on each pathway. For fifteen minute intervals, the data collector will remain at the spot and record data for each pathway user that passes the specified location on the pathway. The data collector will record the gender of the individual passing, the approximate age range, the mode of transportation, whether a pet is present or not, and whether a child or children are traveling without an adult present.

6. **Will minors (participants under the age of 18) be recruited for this study?**

   Minors will be counted in this study.

7. **Is this study funded? Yes. If yes, please provide the grant proposal or any other supporting documents.**

   A grant has been awarded to support the research. These funds will cover the educational costs and stipend of the researcher under university contract 127889.

8. **Is this study receiving federal funding? No**
9. Do you have a significant financial interest or other conflict of interest in the sponsor of this project?  
   No

10. Does your current conflict of interest management plan include this relationship and is it being properly followed?  
   

11. HUMAN SUBJECT ETHICS TRAINING  
   *Please consider taking the Collaborative Institutional Training Initiative (CITI), a free, comprehensive ethics training program for researchers conducting research with human subjects. Just click on the underlined link.

12. ADDITIONAL INFORMATION:  
   a) If a questionnaire, survey or interview instrument is to be used, attach a copy to this proposal.
   b) Attach a copy of the informed consent form to this proposal. See the IRB website for a Sample Consent Form and Informed Consent Checklist: http://www.rnc.edu/research/informs.html
   c) Please provide any additional materials (i.e., recruitment materials, such as flyers, recruitment scripts, etc.) that may aid the IRB in making its decision.

*If a survey instrument or other documents, such as a consent form that will be used in the study are available, attach them to this request. If informed consent is not necessary, an information or fact sheet should be considered in order to provide subjects with information about the study. The informed consent form template on the IRB website could be modified into an information or fact sheet.

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☑ 2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey, or interview procedures, or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

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☐ 3. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey, or interview procedures, or observation of public behavior that is not exempt under paragraph (A)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for
public office, or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research, and thereafter.

4. Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

5. Not applicable

6. Taste and food quality evaluation and consumer acceptance studies. (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural, chemical, or environmental contaminant at or below the level found to be safe by the Food and Drug Administration, or approved by the Environmental Protection Agency, or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
From: Carol Mickelson, IRB Coordinator
North Carolina State University
Institutional Review Board

Date: August 17, 2011

Title: Pathway User Counts
IRB#: 2173

Dear Ms. Cox,

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 45.101 b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

NOTE:
1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.

2. Any changes to the research must be submitted and approved by the IRB prior to implementation.

3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

Please forward a copy of this letter to your faculty sponsor, if applicable. Thank you.

Sincerely,

Carol Mickelson
NC State IRB
North Carolina State University
Institutional Review Board for the Use of Human Subjects in Research
REQUEST FOR EXEMPTION (Administrative Review)

GENERAL INFORMATION
1. Date Submitted: August 11, 2011
2. Title of Project: Pathway User Counts
3. Principal Investigator: Adina Cox
4. Department: College of Design
5. Campus Box Number: 2173
6. Email: adina.cox@ncsu.edu
7. Phone Number: 519-515-3324
8. Fax Number:
9. Faculty Sponsor Name and Email Address: Robin Moore, robin.moore@ncsu.edu
10. Source of Funding: (required information)
11. Is this research receiving federal funding? No
12. If externally funded, include sponsor name and university account number:

Pledge 521768

RANK:
Faculty: ☐
Student: ☐ Undergraduate; ☐ Masters; or ☐ PhD
Other (specify):

13. RANK:

As the principal investigator, I hereby sign and attest that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted, exactly as outlined in the Protocol Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.

Principal Investigator:

Adina Cox
(typed printed name)
(signature)
August 10, 2011
(date)

As the faculty sponsor, I hereby sign and attest that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the principal investigator of record.

Faculty Sponsor:

Robin Moore
(typed printed name)
(signature)
(date)

*Electronic submissions to the IRB are considered signed via an electronic signature

PLEASE COMPLETE AND DELIVER TO:
(carol_nichols@ncsu.edu) or Institutional Review Board, Box 7514, NCSU Campus (Administrative Services III, Room 246)

Regulatory Compliance Office Disposition
☐ Exemption Granted  ☐ Not Exempt, Submit a full protocol
Exempt Notes: ☐ 0.1 ☐ 0.2 ☐ 0.3 ☐ 0.4 ☐ 0.5

IRB Office Representative Date

Page 1 of 4
**Project Description:** Describe your project by providing a summary and answering the requests for information below.

1. **Project Summary.** Please make sure to include the purpose and rationale for your study as well as a brief overview of your study.

   This study will count users and record general data about the users on selected public pathways. Data collected will include an estimate of age range, gender, mode of travel, whether or not there is a pet present, and whether or not children are traveling without an adult present. A similar study was conducted on three national trails, and this data will be compared to those results in order to gain an understanding of pathway users. As these pathways are adopted for the relevance they may have to children and families, it is presumed that data collected will help us to understand the demographics of the selected pathway users.

2. **Description of participant population, including age range, inclusion/exclusion criteria, and any vulnerable populations that will be targeted for enrollment.**

   All participants walking along the selected public pathways will be included. This includes minors and adults.

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   Informed consent will not be obtained as this study is strictly observational and will be conducted in a public setting. Participants will be counted but not identified.

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   No identifiable information will be recorded. Participants will be counted, and numbered in a digital handheld device such as on a popup or tablet. Demographic data such as age range and gender will be stored in a database software program that will create a unique identification number for each observed pathway user.

5. **Provide a detailed (step-by-step) description of all study procedures, including descriptions of what the participants will experience. Include topics, materials, procedures, for use of assessments (interviews, surveys, questionnaires, testing methods, observations, etc.).**

   The data collector will arrive at specific locations on each pathway. For fifteen minute intervals, the data collector will remain at the spot and record data for each pathway user that passes the chosen location on the pathway. The data collector will record the gender of the individual passing, the approximate age range, the mode of transportation, whether a pet is present or not, and whether a child or children are traveling without an adult present.

6. **Will minors (participants under the age of 18) be recruited for this study?**

   Minors will be counted in this study.

7. **Is this study funded? Yes. If yes, please provide the grant proposal or any other supporting documents.**

   [Grant name and details]

8. **Is this study receiving federal funding? No.**
9. Do you have a significant financial interest or other conflict of interest in the sponsor of this project? 
No

10. Does your current conflicts of interest management plan include the relationship and is it being properly followed? 

11. HUMAN SUBJECT ETHICS TRAINING
*Please consider taking the Collaborative Institutional Training Initiative (CITI), a free, comprehensive ethics training program for researchers conducting research with human subjects. Just click on the underlined link.

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   c) Please provide any additional materials (e.g., recruitment materials, such as ‘flyers’, recruitment scripts, etc.) that may aid the IRB in making its decision.

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☑ 2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to them, subjects and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

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☐ 3. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (A)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for

Page 3 of 4
public office, or (ii) federal statute(s) require(s), without exception, that the confidentiality of the personally identifiable information will be maintained throughout the research, and thereafter.

4. Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

5. Not applicable

6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, by the Food and Drug Administration, or approved by the Environmental Protection Agency, or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
## Appendix B: Pathway Traffic count Form

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<th>PATHWAY TRAFFIC COUNTS</th>
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<td>stroller</td>
</tr>
</tbody>
</table>
Appendix C: Surveys

Survey: Cary
Before we begin the survey can you confirm that you are at least 18 years of age.

Thank you for your participation in this research.

This survey should take 5 to 10 minutes to complete.

The purpose of this study is to increase our understanding of how children and families use shared use pathways. Your participation is voluntary. You may choose not to participate or you may stop participating at any time without penalty.

Since you will not be asked to write your name, your name will not be associated with your answers to this survey. There are no risks in participating in this study.

It is expected that the information learned from this study will help others to design better pathways for use by children and families. If you have any questions about this study or the procedures, you may contact:

Adina Cox
College of Design, North Carolina State University
Campus Box 7701/101 Leazar Hall
Raleigh, NC 27695-7701
919.515.8345

If you feel you have not been treated fairly or have any concerns about your participation, you may contact:
North Carolina State University
Regulatory Compliance Administrator
919.515.4514

Please answer the following questions in regards to the Hinshaw Greenway pathway!!!

Thank you for your time!
1. How often do you or other members of your household use the pathway?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>First time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each week</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What modes of travel are usually used by your family along the pathway?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running or jogging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skating or skate boarding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What was the purpose of your most recent trip? You may mark more than one.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>To enjoy nature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To spend time with family/friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh air - spend time outdoors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach destination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walk the dog</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. How long was your most recent visit?

- 0-15 minutes
- 15-30 minutes
- 30-45 minutes
- 45-60 minutes
- 60-90 minutes
- Other:
5. Is the length of the trail
   - Too short
   - Too long
   - Just right

6a. How much time does it usually take you to get to the pathway from your home?
   - Less than 15 minutes
   - Between 15-29 minutes
   - Between 30-60 minutes
   - More than 60 minutes

6b. ...when you travel by:
   - Foot
   - Bikes
   - Vehicle
   - Other ________________

7. To determine the distance you live from the pathway, what is your street address or the closest intersection to your home?

8. What days of the week do you usually use the pathway?

<table>
<thead>
<tr>
<th>Days of the week</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekends only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekdays and Weekends</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. Who are you usually with when you use this pathway?

<table>
<thead>
<tr>
<th></th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other family members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-Workers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Club or organized group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. In your opinion, is the maintenance of the pathway Excellent, Good, Fair, or Poor?

- [ ] Excellent
- [ ] Good
- [ ] Fair
- [ ] Poor
- [ ] Not sure

If you marked less than EXCELLENT, what in your opinion could improve the maintenance?

11. In your opinion, is the safety and security along the trail Excellent, Good, Fair, or Poor?

- [ ] Excellent
- [ ] Good
- [ ] Fair
- [ ] Poor
- [ ] Not sure

If you marked less than EXCELLENT, what in your opinion could improve the safety and security?
12. Is there anything that prevents you from using the pathway more often?

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to travel here</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear of Bullies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No bathrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undesirable social elements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. What type of trail amenities or improvements would you like to see for the pathway?

- Fitness equipment
- Benches/seating
- Water fountains
- Public art
- More trees
- Fewer trees
- Wider path surface
- Narrower path surface
- Less landscaping
- More landscaping
- Increased length/more connections
- Increased shade
- Lighting
- More signage
- Educational/informational kiosks
- Play Equipment added
- Different path surface
- More tables
- Other: ______________________
14. How important are the following potential benefits of the pathway experience to you and your family:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all Important</th>
<th>Neutral</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Family Fun</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Engaging With Nature</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Meeting New People</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Scenic Beauty</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Safe Travel to Destinations</td>
<td>□</td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

15. How well does this pathway work for people with special needs / disabilities?

☐ Not sure  ☐ Poor  ☐ Fair  ☐ Good  ☐ Excellent

Why?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

16. What destinations does your child visit via the pathway? You may mark all that apply.

☐ School
☐ Friend’s House
☐ Grocery Store/Market
☐ Park
☐ Playground
☐ Other ____________________________________________________________
17. Is your child usually allowed to use the greenway without an adult present?

☐ Yes    ☐ No

17. a. If you answered ‘No’ what is the main reason for not allowing your child to go alone?

☐ Traffic Danger
☐ Child unreliable or too young
☐ Fear of assault or molestation by adult
☐ Destination too far away
☐ Fear of bullying by other children
☐ Other

17. b. What is the age at which you are likely to allow your child to use the pathway without an adult present?

________________________

17. c. If you answered ‘Yes’ what is the age when your child was first allowed to use the pathway without an adult?

________________________

17. d. Is your child usually allowed to use the pathway with other children present (no adult)?

☐ Yes    ☐ No

17. e. Is your child usually allowed to use the pathway with a family dog present (no adult)?

☐ Yes    ☐ No
18. Which of the following options do you feel are safe places for children to **walk** in your neighborhood?

<table>
<thead>
<tr>
<th></th>
<th>Very safe</th>
<th>Moderately safe</th>
<th>Neutral</th>
<th>Slightly Dangerous</th>
<th>Dangerous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Which of the following options do you feel are safe places for children to **bike** in your neighborhood?

<table>
<thead>
<tr>
<th></th>
<th>Very safe</th>
<th>Moderately safe</th>
<th>Neutral</th>
<th>Slightly Dangerous</th>
<th>Dangerous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. Do you feel that the pathway and the creek is a fun place for children to play?

- Yes
- No

21. Does your child own a bike?

- Yes
- No

22. Are there any other comments you would like to make about the greenway and pathways?

________________________________________________________________________
________________________________________________________________________
23. How many vehicles are owned in your household?
- 1
- 2
- 3
- 4 or more

24. Which of the following best describes your household?
- Single parent with children under 18
- Two parents with children under 18
- Multigenerational household
- Other ________________

25. What is your age?
- 18-24
- 25-40
- 41-65
- 65+

26. What is your gender?
- Male
- Female

27. What is the gender/age of the other members of your household?

Adults:
1. M F 18-24 25-40 41-65 65+
2. M F 18-24 25-40 41-65 65+

Children:
1. M F __________
2. M F __________
3. M F __________
4. M F __________
Richardson On-Line Survey:

Q1  How often do you or other members of your household use the pathways (shown in purple on the above map) in your neighborhood?

<table>
<thead>
<tr>
<th></th>
<th>Never (1)</th>
<th>Less than Once a Month (2)</th>
<th>Once a Month (3)</th>
<th>2-3 Times a Month (4)</th>
<th>Once a Week (5)</th>
<th>2-3 Times a Week (6)</th>
<th>Daily (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q2 What mode of travel is usually used by your family along the pathways?

<table>
<thead>
<tr>
<th></th>
<th>Walking (1)</th>
<th>Running or Jogging (2)</th>
<th>Cycling (3)</th>
<th>Skating or Skateboarding (4)</th>
<th>Something else (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q3 What is the purpose of your most recent trip? You may mark more than one.

<table>
<thead>
<tr>
<th></th>
<th>Enjoy nature (1)</th>
<th>Exercise (2)</th>
<th>Play (3)</th>
<th>Spend time with family/friends (4)</th>
<th>Fresh air - be outdoors (5)</th>
<th>Reach destination (6)</th>
<th>Walk the dog (7)</th>
<th>Something else (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>household (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q4 How much time do you usually spend on the pathways on a typical visit?

<table>
<thead>
<tr>
<th></th>
<th>0-15 minutes (1)</th>
<th>15-30 minutes (2)</th>
<th>30-45 minutes (3)</th>
<th>45-60 minutes (4)</th>
<th>60-90 minutes (5)</th>
<th>other (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Other adults living in household (2)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Children in household (3)</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
</tbody>
</table>

Q5 Is the length of the pathways

☑ Too short (1)
☑ Too long (2)
☑ Just right (3)

Q6 How much time does it usually take you to get to the pathway from your home?

☑ Less than five minutes (1)
☑ Between 5 and 15 minutes (2)
☑ Between 15 and 30 minutes (3)
☑ More than 30 minutes (4)
Q7 Which quarter (see map) of the Duck Creek Neighborhood do you live in?

- Northwest (1)
- Northeast (2)
- Southeast (3)
- Southwest (4)

Q8 What days of the week do you usually use the pathway?

<table>
<thead>
<tr>
<th></th>
<th>Weekdays only (1)</th>
<th>Weekends only (2)</th>
<th>Weekdays and Weekends (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Other adults living in household (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Children in household (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Q9 Who are your children usually with when using the pathways?

- Alone (1)
- Other children in family (2)
- Adults in family (3)
- Other children not in family (4)
- Pet (5)
- Adults not in family (6)
Q10 In your opinion, is the maintenance of the pathways Excellent, Good, Fair, or Poor?

- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- Not sure (5)

Q11 How could the maintenance be improved?

Q12 In your opinion, is the safety and security along the pathway Excellent, Good, Fair, or Poor?

- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- Not sure (5)

Q13 How could the safety and security be improved?
Q14 Is there anything that prevents you from using the pathway more often?

<table>
<thead>
<tr>
<th></th>
<th>Time available (1)</th>
<th>Traffic (2)</th>
<th>Fear of bullies (3)</th>
<th>Desire (4)</th>
<th>Lack of Facilities (5)</th>
<th>Undesirable social elements (6)</th>
<th>Climate (7)</th>
<th>Other (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yourself (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other adults living in household (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Household children (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q15 What type of trail amenities or improvements would you like to see on the pathway?

You may mark all that apply.

- Fitness Equipment (1)
- Benches/seating (2)
- Water fountains (3)
- Public art (4)
- More trees (5)
- Fewer trees (6)
- Wider path surface (7)
- Narrower path surface (8)
- Play equipment added (9)
- Increased length/more connections (10)
- Increased shade (11)
- Lighting (12)
- More signage (13)
- Educational/informational kiosks (14)
- Different path surface (15)
- More landscaping (16)
- More tables (17)
- Other (18) ____________________
Q16 How important are the following potential benefits of the pathway experience to you and your family:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all Important (1)</th>
<th>Neutral (2)</th>
<th>Somewhat important (3)</th>
<th>Very Important (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Family Fun (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Engaging With Nature (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Meeting New People (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Physical Activity (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Scenic Beauty (6)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Safe Travel to Destinations (7)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q17 How well does this pathway work for people with special needs/disabilities?

- ☐ Not sure (1)
- ☐ Poor (2)
- ☐ Fair (3)
- ☐ Good (4)
- ☐ Excellent (5)

Q18 Why?
Q19 What destinations does your child visit via the pathway? Mark all that apply.

- School (1)
- Friend's House (2)
- Grocery Store/Market (3)
- Park (4)
- Playground (5)
- Other (6) ____________________

Q20 Is your child usually allowed to use the greenway paths without an adult present?

- Yes (1)
- No (2)

Answer: If Is your child usually allowed to use the greenway paths w... No Is Selected

Q21 What is the main reason for not allowing your child to go alone?

- Traffic danger (1)
- Child unreliable or too young (2)
- Fear of assault or molestation by adult (3)
- Destination too far away (4)
- Fear of bullying by other children (5)
- Other (6) ____________________

Answer: If Is your child usually allowed to use the greenway paths w... No Is Selected

Q22 What is the age at which you are likely to allow your child to use the pathway without an adult present?
Q23 What is the age when your child was first allowed to use the pathway without an adult?

Q24 Is your child usually allowed to use the pathway with other children present (no adult)?

- Yes (1)
- No (2)

Q25 Is your child usually allowed to use the pathway with a family dog present? (No adult)

- Yes (1)
- No (2)
Q26 Which of the following options do you feel are safe places for children to WALK in your neighborhood?

<table>
<thead>
<tr>
<th></th>
<th>Very safe (1)</th>
<th>Moderately safe (2)</th>
<th>Neutral (3)</th>
<th>Slightly Dangerous (4)</th>
<th>Dangerous (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalks (2)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alleys (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathways (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q29 Which of the following options do you feel are safe places for children to BIKE in your neighborhood?

<table>
<thead>
<tr>
<th></th>
<th>Very safe (1)</th>
<th>Moderately safe (2)</th>
<th>Neutral (3)</th>
<th>Slightly Dangerous (4)</th>
<th>Dangerous (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sidewalks (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alleys (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathways (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q30 Do you feel that the pathway and the creek is a fun place for children to play?

- Yes (1)
- No (2)
Q31 Does your child own a bike?

☐ Yes (1)
☐ No (2)

Q32 Are there any other comments you would like to make about the greenway and pathways?

Q27 What is your age?

☐ 18-24 (1)
☐ 25-40 (2)
☐ 41-65 (3)
☐ 65+ (4)

Q34 What is your gender?

☐ Male (1)
☐ Female (2)

Q35 How many vehicles are owned in your household?

☐ 1 (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 or more (4)
Q36 What is the gender/age of the other ADULT members of your household?

<table>
<thead>
<tr>
<th></th>
<th>18-24 (1)</th>
<th>25-40 (2)</th>
<th>41-64 (3)</th>
<th>65+ (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male  (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Female (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q37 What is the gender/age of the CHILDREN in your household?

<table>
<thead>
<tr>
<th>Age of Child</th>
<th>Male (1)</th>
<th>Female (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q38 Which of the following best describes your household?

- Single parent with children under 18 (1)
- Two parents with children under 18 (2)
- Multigenerational household (3)
- Other (4) ____________________
Springfield and Chattanooga Intercept Paper Surveys:
This form provides information about a research study that I would like to have you participate in. This study is not for minors, so before I begin can you confirm that you are at least 18 years of age.

The purpose of this study is to increase our understanding of how children and families use shared use pathways. It is expected that this information will assist designers and planners in improving pathways for use by children and families. Your participation is voluntary. You may choose not to participate or you may stop participating at any time without penalty.

This survey should take 5 to 10 minutes to complete.

Since you will not be asked to write your name, your name will not be associated with your answers to this survey. There are no risks in participating in this study.

If you would like a copy of this form one can be provided for you.

If you have any questions about this study or the procedures, you may contact:
Adina Cox
College of Design, North Carolina State University
Campus Box 7701/101 Leazar Hall
Raleigh, NC 27695-7701
919.515.8345

If you feel you have not been treated fairly or have any concerns about your participation, you may contact:
North Carolina State University
Deb Paxton, Regulatory Compliance Administrator
919.515.4514

Do you agree to participate in this study?

Thank you for your participation in this research.
Survey About Play Trail Pathway

1. How often do you or other members of your household use the Play Trail pathway?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>First time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each week</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What types of transportation activity do you usually engage in on the pathways? You may mark more than one.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running or Jogging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skating or skate boarding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What is the purpose of your trip today? You may mark more than one.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>To enjoy nature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To spend time with family/friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To spend time outdoors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. How long was/will be your visit today?

- 0-15 minutes
- 15-30 minutes
- 30-45 minutes
- 45-60 minutes
5. Did you visit this park before the Play Trail components were added?

☐ No

Yes, but I visit **more** often now. ☐ Very true ☐ somewhat true

Yes, but I visit **less** often now. ☐ Very true ☐ somewhat true

☐ Yes, the frequency of my visits has not changed

If the frequency of your use has changed, can you explain why?

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

6. Do you feel the play equipment:

☐ Increases duration of your visits in this park

☐ Decreases duration of your visits in this park

☐ Does not change length of your visits in this park

7. Do the ‘play pockets’

Have ample seating? ☐ Yes ☐ No

Have adequate shade? ☐ Yes ☐ No

Provide valuable information on the signs? ☐ Yes ☐ No

Provide appropriate play opportunities for your children? ☐ Yes ☐ No

8. Are the ‘play pockets’ spaced:

☐ Too far apart

☐ 60-90 minutes

Other: __________________________________________
9. How important are the following potential benefits of the pathway experience to you:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Very important</th>
<th>Somewhat important</th>
<th>Neutral</th>
<th>Not at all important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Fun</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engaging with Nature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting New People</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenic Beauty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. How well does this pathway work for people with special needs/disabilities?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Not sure</td>
<td></td>
</tr>
</tbody>
</table>

11. Is the length of the trail

<table>
<thead>
<tr>
<th>Length</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too short</td>
<td></td>
</tr>
<tr>
<td>Too long</td>
<td></td>
</tr>
<tr>
<td>Just right</td>
<td></td>
</tr>
</tbody>
</table>

12a. How much time does it usually take you to get to the park from your home?

<table>
<thead>
<tr>
<th>Time</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 15 minutes</td>
<td></td>
</tr>
<tr>
<td>Between 15-29 minutes</td>
<td></td>
</tr>
<tr>
<td>Between 30-60 minutes</td>
<td></td>
</tr>
<tr>
<td>More than 60 minutes</td>
<td></td>
</tr>
</tbody>
</table>
12b. When you arrive by:

- Foot
- Bikes
- Vehicle
- Other ___________________________

12c. What is your residential zip code? ________________

12d. To help us determine the distance you live from the pathway, what is your address or the nearest intersection closest to your residence? _____________________________________________________________

13. What days of the week do you usually use the pathway?

<table>
<thead>
<tr>
<th>Days of the week</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekends only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekdays and Weekends</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. Who are you usually with when you use this pathway?

<table>
<thead>
<tr>
<th></th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other family members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-Workers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Club or organized group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. How many participants are in your group today, including yourself?

- Adults ____________
- Children ages 0-3 ____________
- Children ages 11-12 ____________
- Pets ____________
- Children ages 4-10 ____________
- Teens ________________________
16. Which of the following best describes your household?

- Single parent with children under 18
- Two parents with children under 18
- Multigenerational household
- Other ________________________________

17. In your opinion, is the maintenance of the pathway Excellent, Good, Fair, or Poor?

- Excellent
- Good
- Fair
- Poor
- Not sure

If you marked less than EXCELLENT, what in your opinion could improve the maintenance?

_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________

18. In your opinion, is the safety and security along the trail Excellent, Good, Fair, or Poor?

- Excellent
- Good
- Fair
- Poor
- Not sure

If you marked less than EXCELLENT, what in your opinion could improve the safety and security?

_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________
_______________________________________________________

19. Is there anything that prevents you from using the pathway more often?

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Yourself</th>
<th>Household children</th>
<th>Other adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to travel here</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety concerns: (please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20. What type of trail amenities or improvements would you like to see for the pathway?

- Fitness equipment
- Benches/seating
- Water fountains
- Public art
- More trees
- Fewer trees
- Wider path surface
- Narrower path surface
- Less landscaping
- More landscaping
- Increased length
- Increased shade
- Lighting
- More signage
- Educational/Informational kiosks
- Different path surface

-Specify_______________________

21. What is your age?

- 18-24
- 25-40
- 41-65
- 65+

22. What is your gender?

- M
- F

23. What is the gender/age of the other members of your household?

Adults

1.  M  F  18-24  25-40  41-65  65+
2. □ M □ F □ 18-24 □ 25-40 □ 41-65 □ 65+
Children
3. □ M □ F □
4. □ M □ F □
5. □ M □ F □
6. □ M □ F □

Any other comments?
___________________________________________________________
___________________________________________________________
___________________________________________________________
Thank you for your participation!!!
By completing this survey, you confirm that you are at least 18 years of age. The purpose of this study is to increase our understanding of how children and families use shared use pathways. It is expected that this information will assist designers and planners in improving pathways for use by children and families. Your participation is voluntary. you may choose not to participate or you may stop participating at any time without penalty. This survey should take 5-15 minutes to complete. As you will not be asked to write your name, your name will not be associated with your answers to this survey. There are no risks in participating in this study. The software used to collect this data may record the computer IP address used to complete this survey. If you have any questions about this study or the procedures, you may contact: Adina Cox College of Design, North Carolina State University 101 Leazar Hall, Raleigh, NC 27695-7701, (919)515-8345 If you feel you have not been treated fairly or have any concerns about your participation, you may contact: North Carolina State University Deb Paxton, Regulatory Compliance Administrator (919) 515-4514 Your help is GREATLY APPRECIATED!
Q2 How often do you or other members of your household use the Play Trail pathway?

<table>
<thead>
<tr>
<th></th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other Adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each year (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each month (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A few times each week (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q3 What types of transportation activity do you usually engage in on the pathways?

<table>
<thead>
<tr>
<th></th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other Adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running or Jogging (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycling (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skating or skateboarding (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q4 What was the purpose of your most recent trip? You may mark more than one

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other Adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To enjoy nature (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To exercise (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To play (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To spend time with family/friends (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To spend time outdoors (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (7)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q5 How long was your most recent visit?

- 0-15 minutes (1)
- 15-30 minutes (2)
- 30-45 minutes (3)
- 45-60 minutes (4)
- 60-90 minutes (5)
- Other (6) ________________

Q6 Did you visit this park before the Play Trail components were added?

- Yes (1)
- No (2)
Q7 How has the frequency of your visits changed since the Play Trail components were added?

- We visit less often now (1)
- We visit about the same amount now (2)
- We visit more often now (3)
- Can you explain any change in the frequency of your use? (4) ____________________

Q8 Do you feel the play equipment:

- Increases the duration of your visits in this park (1)
- Decreases duration of your visits in this park (2)
- Does not change length of your visits in this park (3)

Q9 Do the 'play pockets' have ample seating?

- Yes (1)
- No (2)

Q10 Do the 'play pockets' have adequate shade?

- Yes (1)
- No (2)
Q11 Do the signs provide valuable information?

☑ Yes (1)  ☑ No (2)

Q12 Do the play components provide appropriate play opportunities for your children?

☑ Yes (1)  ☑ No (2)

☑ Any comments you would like to make? (3) ____________________

Q13 Are the 'play pockets' spaced:

☑ Too far apart (1)  ☑ Too close together? (2)

☑ About the right distance apart (3)

Q14 Do you have any additional comments about the play pockets?

Q15 Is the length of the trail:

☑ Too short (1)  ☑ Too long (2)

☑ Just right (3)
Q16 How important are the following potential benefits of the pathway experience to you:

<table>
<thead>
<tr>
<th></th>
<th>Very important (1)</th>
<th>Somewhat important (2)</th>
<th>Neutral (3)</th>
<th>Not at all important (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning (1)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Family Fun (2)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Engaging with Nature (3)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Meeting New People (4)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Physical Activity (5)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Scenic Beauty (6)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Other (7)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Q17 How much time does it usually take you to get to the park from your home?

- Less than 15 minutes (1)
- Between 15-29 minutes (2)
- Between 30-60 minutes (3)
- More than 60 minutes (4)

Q18 When you arrive by:

- Foot (1)
- Bike (2)
- Vehicle (3)
- Other (4) ____________________
Q19 What is your residential ZIP Code?

Q20 To help us determine the distance you live from the pathway, what is your address OR the nearest intersection closest to your residence?

Q21 What days of the week do you usually use the pathway?

<table>
<thead>
<tr>
<th></th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WeekDAYS only (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WeekENDS only (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekdays and Weekends (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q22 Who are you usually with when you use this pathway?

<table>
<thead>
<tr>
<th></th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other family members (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Friends (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Co-Workers (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Neighbors (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Pet (6)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Club or Organized group (7)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other (8)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q23 Which of the following best describes your household?

☑ Single parent with children under 18 (1)
☑ Two parents with children under 18 (2)
☑ Multi-generational household (3)
☑ Other (4) ____________________

Q24 In your opinion, is the maintenance of the pathway:

☑ Excellent (1)
☑ Good (2)
☑ Fair (3)
☑ Poor (4)
☑ Not sure (5)
Q25 What could improve the maintenance?

Q26 In your opinion, is the safety and security along the trail:

- Excellent (1)
- Good (2)
- Fair (3)
- Poor (4)
- Not sure (5)

Q27 What could improve the maintenance?

Q28 Is there anything that prevents you from using the pathway more often?

<table>
<thead>
<tr>
<th></th>
<th>Yourself (1)</th>
<th>Household Children (2)</th>
<th>Other adults (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time available (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to travel here  (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety: Traffic (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety: Social (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety: Other (5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire (6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (7)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q29 What type of added trail amenities or improvements would you like to see for the pathway?

- Fitness Equipment (1)
- Benches/Seating (2)
- Water fountains (3)
- Public art (4)
- More trees (5)
- Fewer trees (6)
- Wider path surface (7)
- Narrower path surface (8)
- Less landscaping (9)
- More landscaping (10)
- Increased length (11)
- Increased shade (12)
- Lighting (13)
- More signage (14)
- Educational/Informational kiosks (15)
- Different path surface (16) ____________________
- Other (17) ____________________

Q30 What is your age?

- 18-24 (1)
- 25-40 (2)
- 41-65 (3)
- 65+ (4)

Q31 What is your gender?

- Male (1)
- Female (2)
Q32 What is the gender/age of the other members of your household?

<table>
<thead>
<tr>
<th></th>
<th>Male (1)</th>
<th>Female (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult age (1)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Adult age (2)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Adult age (3)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 1 age (4)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 2 (5)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 3 (6)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 4 (7)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 5 (8)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Child 6 (9)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
<tr>
<td>Other (10)</td>
<td>☑️</td>
<td>☑️</td>
</tr>
</tbody>
</table>

Q33 Are there any additional comments you would like to make?