University Transportation Center Research Project

Impact of the Location of New Schools on Transportation Infrastructure and Finance

Final Report

IMPACT OF SCHOOL LOCATION ON TRANSPORTATION INFRASTRUCTURE AND FINANCE

By

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Contract with

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Georgia Transportation Institute / University Transportation Center



Impact of School Location on Transportation Infrastructure and Finance

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Georgia Transportation Institute
University Transportation Center

Report 08-06
March 1, 2009

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16. Abstract

Public school planning and land use planning have become increasingly separated fields over the last 35 years. This results in misaligned goals when school districts do not plan facilities that support a community's land use planning goals. The result is a disjointed growth pattern where new schools are built on the urban fringe and act as a magnet for new development that often goes against desired development patterns. Previous research on school locations and development patterns has focused on institutional barriers to cooperation and strategies to help local governments cooperate better with local land use planners. To date, there has been no significant research that attempts to quantify the relationship between school location and development patterns and the transportation infrastructure necessary to serve new development.

This research shows that there is a relationship between school location and new development. Four counties in Georgia were selected as case studies and analyzed with a Geographic Information System (GIS) to determine the significance of the link between these activities. Counties were selected based on their character (urban, suburban, exurban, rural) and analyzed separately. An elementary school and high school were analyzed for each county. In addition, interviews with school facility planners were conducted to further define what institutional barriers prevent cooperation among local land use planners and school planners. It was found that there is a wide range of levels of cooperation between school planners and local planners. Some school districts had a formalized communication process with local planners, some had an ad-hoc communication process, and others had no process at all. Recommendations are made on ways to improve the cooperation between these two professional fields. This report also examines the link between education and transportation capital funding. Georgia lawmakers are struggling to determine what type of capital funding mechanism would be appropriate for new transportation projects, but these new projects may negatively impact educational funding, which is currently based on a sales tax.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
APFO	Adequate Public Facilities Ordinance
AYB	Actual Year Built
CBD	Central Business District
CEFPI	Council of Educational Facility Planners International
CFCC	Census Feature Class Code
EPA	United States Environmental Protection Agency
ESPLOST	Educational Special Local Option Sales Tax
EYB	Effective Year Built
GaDOE	Georgia Department of Education
GDOT	Georgia Department of Transportation
GIS	Geographic Information System
GSBA	Georgia School Boards Association
IU	Instructional Unit (classroom)
LOST	Local Option Sales Tax
MOU	Memorandum of Understanding
mph	Miles Per Hour
PFA	Priority Funding Area

SUMMARY

Public school planning and land use planning have become increasingly separated fields over the last 35 years. This results in misaligned goals when school districts do not plan facilities that support a community's land use planning goals. The result is a disjointed growth pattern where new schools are built on the urban fringe and act as a magnet for new development that often goes against desired development patterns. Previous research on school locations and development patterns has focused on institutional barriers to cooperation and strategies to help local governments cooperate better with local land use planners. To date, there has been no significant research that attempts to quantify the relationship between school location and development patterns and the transportation infrastructure necessary to serve new development.

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CHAPTER 1
INTRODUCTION

1.1. Study Overview

Over the past 35 years, school planning and land use planning have become separated fields due to a complex school planning environment that must take into account changing student enrollments, equity, and complicated facility funding sources. In high growth states, school facility planners are building multiple new facilities each year and sometimes build in areas just beyond the development frontier, primarily due to cost and land availability constraints. This can cause these areas to become more attractive to developers and result in transportation agencies filling the gap in infrastructure to serve the new development.

While some states have recognized this issue and implemented mandatory statewide planning initiatives to require school districts and county governments to work together, Georgia has not yet done so. In many cases, county planning staff and school planning staff have no formal communication and are forced to take reactive measures rather than plan cooperatively. Ultimately school districts and county government are separate entities, chartered by the state constitution, and can operate autonomously. However, uncoordinated actions do not benefit the community. Figure 1.1 illustrates the current institutional framework viewed from the taxpayer's perspective.

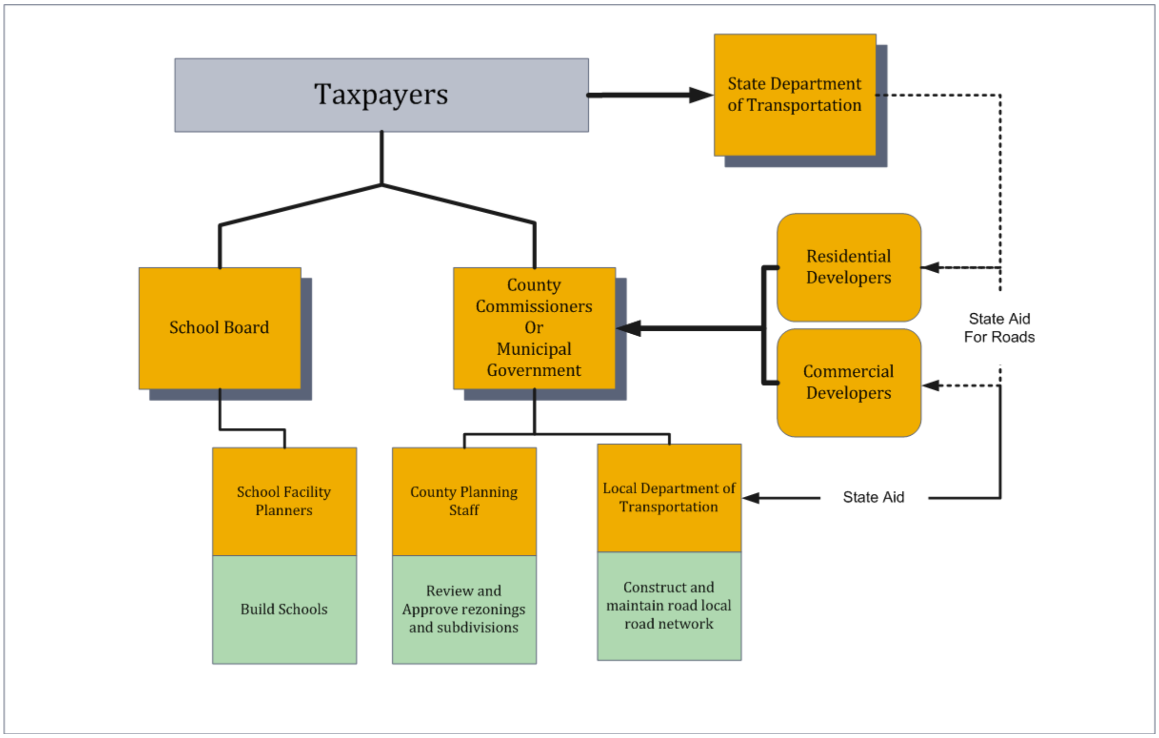


Figure 1.1 – Institutional Relationships
Source: Author

School quality has been shown to be a top criterion for home buying and residential choice [1]. Families look to school quality as a very important consideration when choosing where to locate. Often, a new school is perceived as higher quality simply because it is new [2]. This often causes homebuyers to view those places where new schools have been built as having more desirable qualities than those with older schools. Furthermore, due to state policies that provide a higher funding match for new construction, many school districts have a better return on investment for building new schools rather than renovating existing schools [3]. Some have blamed this funding policy for creating a bias towards new construction on greenfield sites which results in increased sprawl development and inefficient use of existing public infrastructure [4].

This research effort has three primary objectives: 1) quantify the relationship between school site decisions and resulting development, 2) identify the institutional barriers to cooperative school site planning, and 3) examine the funding relationship between school capital funding and proposed transportation funding in Georgia. Although the issues in school planning are applicable to all states, this work will focus on Georgia.

1.2. Methodology Overview

To analyze the relationship between development patterns and school site selection, four school districts having different developmental characteristics were selected: mature urban, mature suburban, developing exurban, and rural. Within these four districts, an elementary school and high school were selected for spatial analysis, resulting in a total of eight schools selected for analysis. Parcels were analyzed for new construction between 1990-2007. Parcels were assigned a travel-time from the school site and analyzed based on travel distance from the school. Pre-construction growth rates were compared to post-construction growth rates to determine if growth occurred more rapidly after the school was built.

To identify institutional barriers between school planning and local planning, 17 interviews were conducted with school planners, school board members, and statewide facility officials from the Georgia Department of Education (GaDOE) and the Georgia School Boards Association (GSBA). Interviews were summarized and strategic objectives were suggested to improve communication and collaboration between school districts and local governments.

Capital funding is a large part of school planning policy. The state of Georgia funds a portion of school capital funding, but recently school districts have come to rely heavily on the Educational Special Local Option Sales Tax (ESPLOST). This one cent sales tax is used in 154 of the 159 Georgia Counties[1] [5]. However, the sales tax as a revenue source is used by many jurisdictions as a source of revenue for other purposes. For example, there has been a push in the Georgia General Assembly to implement a region-wide sales tax for transportation purposes. In addition, Georgia allows up to two cents to be collected for a Local Option Sales Tax (LOST). This can be used for transportation projects, municipal or county buildings, and parks. Currently 158 of Georgia's 159 counties have a LOST program[2] [5]. This poses potential conflicts as voters may choose to approve one but not the other. This report examines the issues with school district funding and their potential impacts on a proposed transportation sales tax.

[1] Burke, Camden, Muscogee, Twiggs, and Wayne Counties do not have an ESPLOST program
[2] Only Rockdale County does not have a LOST program.

1.3. Document Organization

The remainder of this document is organized into the following chapters:

- **Chapter 2: Literature Review.** This chapter contains a summary of literature regarding the history of school planning, contemporary residential location theory, educational literature on small schools, and requirements specific to Georgia with regard to school planning.
- **Chapter 3: Data Collection and Preparation.** This chapter includes a detailed description of the data collection effort and the processes that were required to prepare the data for analysis. The interview process is also described in detail.
- **Chapter 4: Methodology and Analysis.** This chapter describes the specific statistical methods used for the analysis and the rationale behind the methods utilized.
- **Chapter 5: Discussion and Results.** This chapter includes a detailed description of the analysis and an interpretation of the results. Interview results are also summarized and analyzed.
- **Chapter 6: Recommendations and Conclusion.** The final chapter is dedicated to specific recommendations based on the analysis of the data. In addition, a summary of conclusions is presented.

CHAPTER 2
LITERATURE REVIEW

This chapter summarizes the literature with regard to school planning and site selection. Beginning with a history of school planning and land use planning, this review seeks to understand theory on urban development patterns and residential choice. An extensive body of literature on urban location theory has examined why households choose to locate in certain areas of a metropolitan region.

The literature has also shown a relationship between smaller schools and student performance. Although there has been a move since the 1950s to consolidate school districts and build larger schools, research has shown that student performance and social development improves when school enrollment is smaller [6].

Finally, it is necessary to look at Georgia's site requirements for school districts. Although school districts are autonomous governing bodies, the Georgia Department of Education has site requirements for any state-funded school building. These requirements seek to protect the health and safety of Georgia's students.

2.1. Brief History of School Planning

School planning and land use planning historically have been linked through a recognition that public schools and communities have interactive roles. However, school planning and local land use planning today are independent professional fields. Although schools play a large role in the way cities and counties develop, school site planning and land use planning have become very much separate activities. Thirty-five years ago this was not the case. School planning and local land use plans were developed simultaneously, often by the community planner in the municipal or county government. The community planner knew the details of how development would impact the school district and how to place development so that it would not adversely impact schools that did not have the capacity for new students. When housing developments were approved, the schools were made aware and often asked for input before subdivision approvals were granted. When new schools were needed, a developer would usually donate a small, walkable site that could also double as a neighborhood playground [7].

Everything changed after the United States Supreme Court's 1954 *Brown v. Board of Education* decision. School districts, not wanting to face the possibility of lawsuits and judges' desegregation orders, hired specialized planners to implement redistricting so that schools would be more integrated. This would prevent mandatory busing, but at the same time split up neighborhood schools. A 1973 Gallup poll revealed that a majority of blacks and whites favored redistricting, but only nine percent of blacks and four percent of whites favored busing children outside of their own neighborhoods [8]. Suburban exodus was exacerbated in the 1974 Supreme Court *Milliken* v. *Bradley* [9] decision, which held that busing could not cross municipal boundaries. White middle-class families reasoned that to avoid the highly unpopular busing programs, they could move to the suburbs.

In the 1970s the federal government began to offer federal funding for capital improvements to schools that met desegregation compliance standards. School districts needed the funds to build facilities that were equivalent for both blacks and whites. To be able to chase the federal "carrot," school districts needed specialized planners who would implement the federal requirements. Because of the level of specialization needed for this type of work, by the

1970s the two professions had become completely separated. School planners focused only on planning for new schools and redistricting for equity, while local planners focused on all other aspects of the community [7].

2.2. Urban Location Theory

Urban location theory attempts to explain residential location based on principles of economic decision making. Urban location theory has been primarily separated into two different theoretical strands, specifically urban residential location models and Tiebout models of community choice. William Alonso developed urban residential location models, which use travel costs as the predicting factor in location. Charles Tiebout's model focuses on consumer choice as the primary driver of residential location selection.

2.2.1. Urban Residential Location Models (Alonso)

Urban residential location models were pioneered by William Alonso and are an extension of standard consumer behavior theory. Each household not only decides how much housing and other commodities to consume, but also where to locate. The household must not only decide the price at which to buy housing, but also how to alter its work trip and pay the additional commuting costs for longer trips. The model assumes that the city is "viewed as if it were located on a featureless plain, on which all land is of equal quality, ready for use without further improvements, and freely bought and sold" [10]. The Alonso model assumes that: 1) the city is circular and density is concentrated in the Central Business District (CBD), 2) every household has one member employed in the CBD, 3) residential location is based on work location, 4) all housing has the same characteristics, and 5) unit transportation costs are constant in all directions. Therefore, the theory asserts that land cost and commuting costs are the primary determinants of residential location. Commercial uses will outbid residential uses and residential uses will outbid agricultural uses. Land costs and commuting costs are inversely related and are driven by accessibility through the transportation network. The value of public goods, such as schools, parks, and community facilities are not considered in the model.

Alonso recognizes transportation as the driving force to increasing accessibility, which in turn increases the cost of land. Transportation improvements have two effects: 1) they make commuting easier, and 2) they make commuting less expensive. Both have the effect of increasing accessibility, therefore decreasing commuting costs, and increasing land costs. Alonso points out that suburbanization requires an increase in per capita income and transportation improvements. Without these two elements, cities would continue to grow, but instead of suburbanization increasing, densities would increase. Although the basis for much of the model development that followed, these models often did not include any key decision factors such as school quality.

2.2.2. Public Goods and Residential Location (Anas)

An addition to residential location models was suggested by Alex Anas [11]. He suggested building upon the monocentric city model (where land prices decrease as distance from the CBD increases) by adding public goods to the variables that determine household location. This model recognizes that higher income households will locate farther away from the CBD than lower income households. Anas explains that this occurs "because as income increases, a household's preference for housing, lot size, and suburban public services increases faster than the household's dislike of commuting." This model is more helpful in determining the value of public schools as a driver of residential location. It recognizes that choices of residential location are not based solely on land and commuting costs, but in fact have a consumer component in the form of public goods.

In a study of Chicago, Anas looked at average income in two-mile ranges from the CBD going out to 34 miles. The results showed that average income was highest in the first two miles from the CBD and then decreased out to 10 miles. Then average income increased consistently until reaching its highest level at 22-24 miles from the CBD. This suggests that higher income households are able to outbid commercial uses closest to the CBD. The data show a revealed preference for shorter commute distances and show that higher income households are able to pay for the benefit of having shorter commute distances [11]. Figure 2.1 shows the spatial distribution of income in the Chicago area.

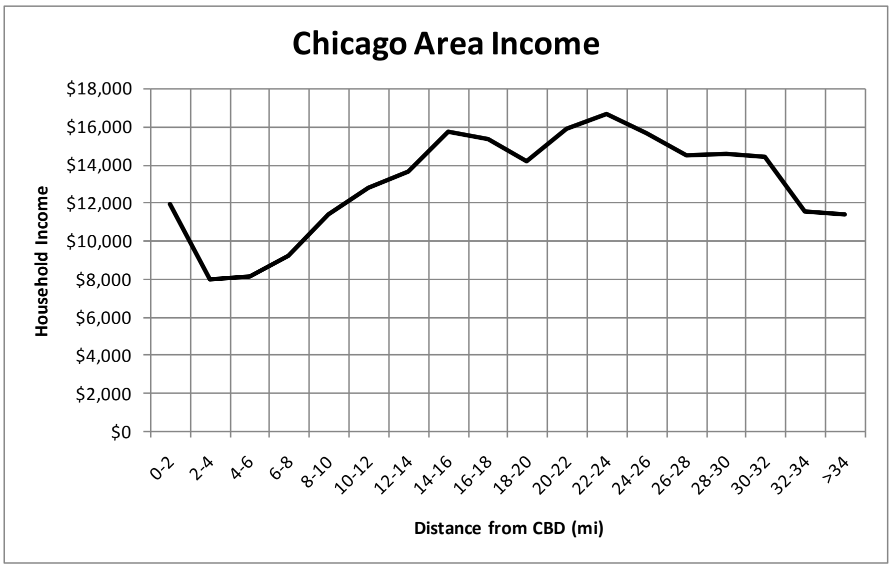


Figure 2.1 – Spatial Distribution of Income in Chicago
Source: Anas, 1982, p. 131 (from 1970 Census data)

Contrary to the Alonso model, this suggests that housing characteristics *do* have an impact on residential location (Alonso assumed that all housing has the same characteristics). Since average income is lower in the 2-10 mile ranges, it suggests that the higher income households have the ability to choose the density of their neighborhood, and they have a preference for very high density (with short commute times) or low density located outside the urban core.

2.2.3. Models of Community Choice (Tiebout)

Charles Tiebout introduced a model of community choice that incorporated the concept of the consumer-voter who chooses a community that "best satisfies his preference pattern for public goods" [12]. Consumer-voters will 'vote with their feet' locating in a community that fits their preferences with respect to a combination of taxes and public services. With this argument, Tiebout asserts that the greater number of communities, the greater the probability that a consumer-voter will find a community that more closely satisfies his or her preferences. Tiebout explains that a “resident who move to the suburbs to find better schools, more parks, and so forth is reacting, in part, against the pattern the city has to offer.” In order for this framework to be possible, Tiebout makes several assumptions including some that he recognizes that may not be completely representative. He assumes that consumer-voters are “fully mobile and will move to that community where their preference patterns…are best satisfied.” However, he recognizes that mobility has a cost and that sometimes the cost is too high to make it worthwhile to relocate.

Tiebout asserts that taxation is the primary cost for a household and that public services are the primary benefit. As with any market, the most efficient allocation takes place where there are many buyers and many sellers. Here the buyers are the households and the sellers are the communities. In the school context, a household would choose a district with better schools and be willing to pay higher property taxes for the improved services. Tiebout argues that the more communities there are to choose from, the better the market will allocate the limited resources, in this case public education.

This hyporeport is predicated on the assumption that mobility is available to all within the region. Without mobility and access to the communities, provided by the transportation network, families are not able to choose freely. Tying back to the Alonso model, mobility is determined in part by income and the cost of commuting. Higher income households have more choice because access to the transportation network is a lower proportional cost of income than for lower income households.

2.2.4. Schools and Residential Location

Traditional residential location models typically view the work trip as the most important transportation cost that a household considers. However, research shows that households with children comprise a significant portion of the morning peak hour traffic. So, although the school trip may not be a big consideration on a daily basis, the traffic impact during congested hours can be significant. One study in California estimated that there was a 30% increase in vehicles on the road during the school year between the hours of 7:15 A.M. and 8:15 A.M [13]. The 2007 National Household Transportation Survey found that 7-11% of non-work trips during the morning peak were trips to school [2]. This study did not take into account a trip chain that included a school as an intermediate stop. For example, a parent dropping a child off at school is not included in this statistic. This understates the impact of school traffic on the roadway network. Clearly, school trips are significant and should be considered in the framework of regional transportation planning.

Recently, models have been developed that more fully consider the impact of schools on residential location. Specifically, Hanushek and Yilmaz [14] have developed a model that incorporates the tenets of community choice models and also takes into consideration commuting costs, school quality, and land rents. Their model also takes into account the polycentric city theme, where there are multiple employment centers, as many United States cities experience today. Their conclusions indicate that property taxes serve as a surrogate “fee” for public education and location. Individuals who value public education locate in districts that have high quality public education (and taxes). Individuals that do not place a high priority on public education locate in places where property taxes are less, but public education is not as strongly emphasized. This conclusion supports having more school districts, so that households can choose, following the Tiebout model of consumer-voters “voting with their feet.” This results in more school districts, more choice, and therefore more efficient allocation of resources.

However, this also creates more bureaucracy and increased administration cost associated with having many school districts.

One long accepted tenet of real estate is that local schools have a significant impact on property values. Lack of a quality education system can mean property values are not retained. For example, in Clayton County, Georgia when the school district lost its accreditation, 30% of properties in the county lost value [15]. Studies have also shown that high performing schools can boost home values by up to 10 percent or more [16]. Developers desire sites within a catchment area of a good school as a marketing tool for their development. Many times developers will take into consideration school quality within an area when deciding on a specific venture.

A study of schools built in Michigan showed that schools built on the edge of the community were strongly correlated with the conversion of open land near the school. Furthermore, the study found that "the more extensively a school district engaged its citizens and the more intensively it studied existing facilities, the more frequently the district decided to either renovate existing buildings or construct new facilities near town centers" [17]. This finding speaks not only to the importance of the impact of school sites on residential development, but also to the value in public participation in the school planning process.

2.2.4.1. Understanding Why Families Move

Residential choices are influenced by a variety of variables for different types of households. As Peter Rossi points out in his book *Why Families Move,* small households without children are less likely to consider schools in their choice of dwelling (except for the consideration of property value retention). Larger households with school-aged children do consider this an important factor [18]. With regard to school considerations, his study of families in the United States found that when asked about existing housing, 22% of households complained about living space while only 6% complained about schools in their neighborhood. While this may seem to indicate that households do not consider schools as a key issue, this particular subset only looked at households that were *dissatisfied* with their current housing situation, so it is possible that households that were satisfied with their housing situation chose their residential location with schools in mind and were content with their choice.

One important consideration in looking at the impact of schools on travel and development patterns is understanding why families with school-aged children move. Research has shown that families without children choose multi-family housing much more frequently than those with children over the age of five. Preference for higher density housing is determined as a function of age and stage in the life cycle [19]. Figure 2.2 shows the relationship between stage in life and choice of multi-family housing (usually located in denser environments). This research showed that by the time the youngest child is over five years old, the percentage of households living in multi-family housing decreased to 20 percent. The percentages decrease further once the family has children in their teenage years.

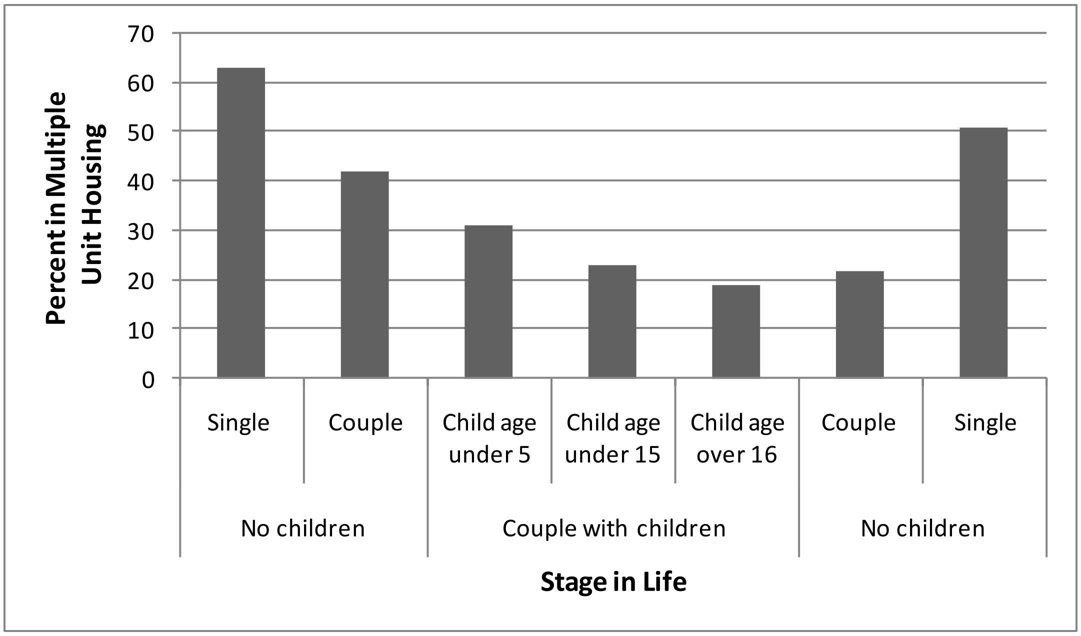


Figure 2.2 – Life-Cycle Stages and Choice of Multi-Family Housing
Source: TCRP Report 123 [19]

This suggests that multi-family housing is not meeting the needs of households with children. Households with children are "voting with their feet" and choosing single family housing communities that provide services they are looking for. Households look for services and amenities like more open space, a safe environment, and newer and better educational services [19]. Denser development tends to attract households without children, while less dense development attracts households with school-aged children.

Another study from the real estate literature concludes that households are not so much looking for quality education, but for similar peer groups. David Brasington shows through regression and data from modeling that "parents do not choose schooling based on which school districts are best able to improve students' academic achievement; instead they appear to choose school systems based on peer group effects, valuing the type of children who attend the school district" [20]. Again, this shows consistency with the Tiebout model of households choosing to "self select" based on consumer preferences, which are driven by socio-demographic characteristics.

2.3. Smaller Schools and Student Performance

Over the past 70 years average school size in the United States has increased significantly. In 1930 one-room schoolhouses accounted for 70% of the nation's public education facilities. Between 1940 and 1990, the number of elementary and secondary schools fell from 200,000 to 62,000. During the same time period, student population increased from 28 million to 53.5 million. Average school size increased fivefold from 127 to 653 students nationwide. The most pronounced increase has been seen in secondary schools. From 1990 to 2000, the number of high schools with more than 1,500 students doubled [21].

Why has this happened? There are a few reasons. Many experts point to a 1967 book by former Harvard University President, James B. Conant. He argued that to improve education nationwide, smaller schools should be eliminated in favor of large, comprehensive high schools. Along with this policy, he suggested that new schools should be built if the cost of renovation exceeded 50% of replacement cost [22]. Many researchers have pointed to this work as a turning point in school size policy [23].

School size also plays a large role in the location of schools. Many schools in Georgia today are very large due to a long-standing belief that larger schools provide economies of scale. One of the major drawbacks to large schools is the quantity of land they require. In many Georgia school districts, *minimum* site sizes for elementary schools can be as large as 25 acres [24]. School districts usually see this as an advantage because the site can later be used for other facilities or expansion of the existing building. However, sites that large are difficult to find in existing neighborhoods. This forces school districts to look for undeveloped parcels that are usually far from current development. In turn, this decreases walking access and increases traffic to and from the school site.

Small schools tend to create other benefits aside from the transportation impacts. In a smaller setting, students get more time with teachers and administrators, which can lead to higher student achievement. Although it is often argued that large schools offer more curriculum alternatives, with advances in distance learning technology, even specialized courses can now be offered in neighborhood schools. Students have more opportunities to participate substantively in extracurricular activities and school security is increased with a smaller student body.

2.4. Public School Siting Decisions

A 2003 study by the Environmental Protection Agency (EPA) looked at the environmental impacts of school siting including emissions and mode of travel to school by students. The conclusion of the study was that schools built close to students (called "neighborhood schools") would reduce traffic, increase walking and biking by 13%, and could create a 15% emission reduction due to decreased travel to and from the school site [13].

In Georgia, school siting decisions are largely left up to individual school districts. Although the Georgia Department of Education (GaDOE) does have site selection criteria, the school district is usually the primary decision-maker in the location of the school site [25]. School sites are chosen by facility planners employed by the school district and those sites are voted on by the board of education. Sometimes public hearings are held, but in many cases there is no public involvement process. GaDOE prefers not to get involved in school site decisions beyond determining if there is adequate utility provision (i.e. water, sewer, electricity) and adequate separation from environmental hazards (i.e. major highways, large natural gas transmission lines) [26].

2.4.1. Georgia Requirements

The Georgia Department of Education has published a guidance document that school districts can use to evaluate a school site [27]. The document provides minimum acreage requirements, hazard guidance, and geographical considerations that should be taken into consideration when selecting a school site. GaDOE uses this document to evaluate all sites where state funds are used for construction. Although state funding cannot be used for land acquisition, the school must gain approval from the state school facilities office before proceeding with acquisition.

Site Size. The GaDOE currently requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high schools, plus one acre per 100 students for each school type. For example an elementary school with 600 students would require a minimum of eleven acres. The acreage requirement can be reduced via a waiver process if the school district can provide adequate proof that the school site can still provide a safe and effective learning environment.

Until 2004, the Council of Educational Facility Planners International (CEFPI) recommended that school sites have minimum acreage requirements as follows:

- Elementary – 10 acres plus one acre for every 100 students
- Middle – 20 acres plus one acre for every 100 students
- High – 30 acres plus one acre for every 100 students

Many states have used this recommendation as a basis for their own site requirements [28]. In 2004 CEFPI removed minimum site requirements from their influential publication entitled *Guide for Planning Educational Facilities* citing that a “one size fits all” approach is outdated and works counter to a variety of goals [29]. The rescinding of site size requirements was a result of historic preservation literature and research in the education field related to small schools and their relationship to improved student performance. Although CEFPI no longer suggests a minimum site size, Georgia retains its minimum site size standards (along with 27 other states) [30]. The schools in this report were built when CEFPI’s site size recommendations were still in place.

Risk Hazard Assessment. Schools must consider potential safety hazards near the school site. These can include high voltage electrical transmission lines, petroleum transmission lines, propane storage facilities, railroads, major highways, airport flight patterns, and industrial facilities. For most hazards, GaDOE recommends that the site be “free of conditions and installations which endanger the life, safety, and health of children” [31]. GaDOE also recommends that school sites avoid sites adjacent to heavily traveled streets.

Geographical Factors. Finally, GaDOE recommends that the site be supportive to an efficient transportation system. This seems contrary to the previous requirement that the site be located away from heavily traveled streets. GaDOE also recommends that the site be “accessible to community services needed by the district and the school should be appropriately located with respect to other schools and the population to be served.” This recommendation suggests that the school should be in close proximity to the existing neighborhoods it serves.

2.4.2. Land Use Planning and School Planning

One of the criticisms of those interested in comprehensive planning has been the lack of cooperation between land use planning and school planning. As separate government entities, school districts and local governments can and often do operate in isolation from one another. This disjointed planning can result in decisions that negatively impact the community. One example of this is the effect of schools on development patterns. Research has noted that when schools are sited on the urban fringe or in rural areas, they act as magnets for growth. Young families with children often move out of older neighborhoods to have their children attend the new, modern schools [32].

Some observers have described the demand for schools as a circular process. Families see the declining quality of schools in urban areas and move to suburban locales so their children can attend higher quality public schools. Then, suburban school districts are overwhelmed with additional enrollment and are forced to build new facilities. From that point, "hopscotch development takes place and the process starts all over again" [33]. This pattern presents two problems. First, it leaves urban school districts with a declining enrollment and a disproportionate amount of low income students whose parents cannot afford to move to the suburban schools. Second, it promotes sprawl and puts development pressure on the land surrounding the new school.

When school planners respond to increasing enrollments in suburban districts, most often the response is to build new school buildings. The major question is, *where* should new schools be built? Some of the most compelling literature on school siting comes from the historic preservation literature. The National Trust for Historic Preservation has published studies that argue historic schools are worth renovating to ensure that traditional neighborhoods continue to have walkable school sites [34]. The literature points out several policy obstacles to making existing school preservation a priority including site size minimums, funding bias towards new schools, lack of maintenance on existing buildings, and lack of coordination between local government and school planners [3]. As described below, Maryland and Florida are both examples of states that have taken a leadership role to address the issue of school siting and its impacts on development trends.

2.4.2.1. Maryland's Priority Funding Areas

Maryland is one of the most notable states in terms of placing priority on smart growth. Maryland began recognizing the impact of school sites on sprawl development in 1991 when Yale Stenzler, Executive Director of Maryland's Public School Construction Program, sent a memo to school superintendents throughout the state. He wrote that sprawl development "unnecessarily harms the environment, is wasteful of public infrastructure investment, and is not cost effective. Therefore we will seek to avoid budgeting for [school] projects that contribute to sprawl development" [35].

The Maryland model for smart growth includes a program called Priority Funding Areas (PFAs). This program targets state funding for projects to build public sewer, water, schools, and housing for areas designated by the state that are targeted for growth. Infrastructure completely funded locally can still occur outside PFAs and has been criticized by some observers as being a serious flaw in the legislation. Many new extensions of sewer and water lines have been paid for by private developers, making it difficult to truly implement the PFAs as intended [36]. The locations of growth are intended to slow down sprawl development and concentrate public infrastructure dollars on already developed areas. When the program was first created in 1997, state funding was only allowed for schools in a PFA. Now the state has relaxed the requirements due to concerns that rural schools were adversely impacted by the requirement [33]. However, the state funding formula still favors schools that are located in established neighborhood or within municipal corporate limits. Figure 2.3 illustrates the percentage distribution of funding allocated to schools in PFAs.

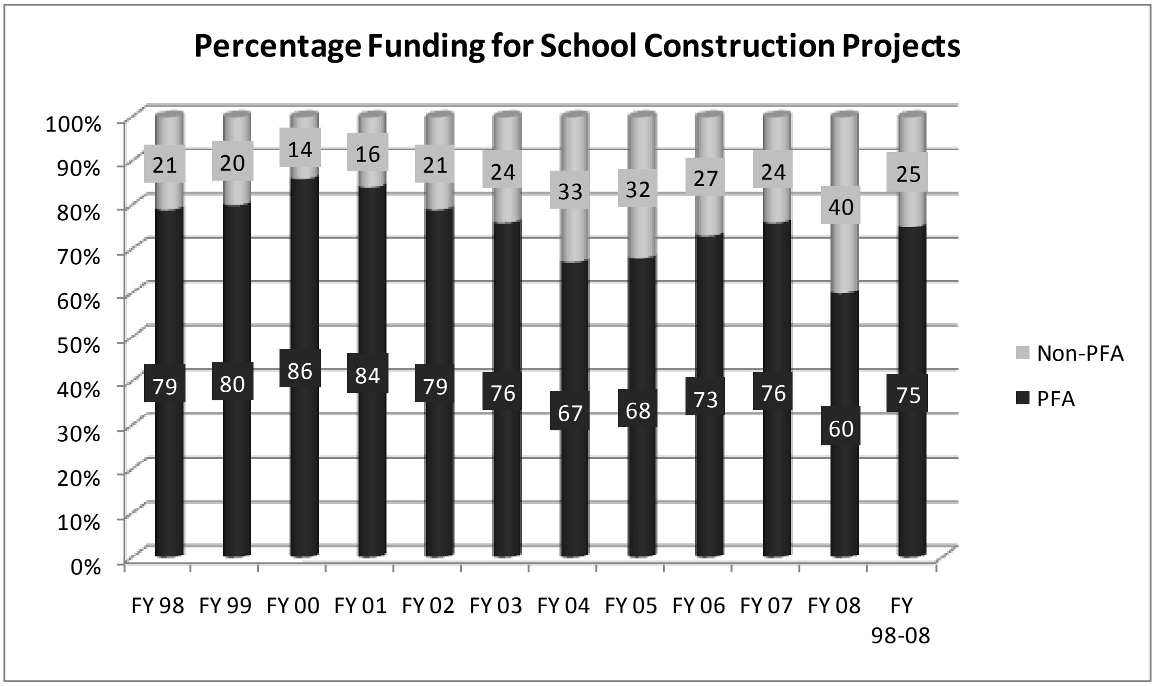


Figure 2.3 – Maryland Construction for Schools in PFAs
Source: Maryland Department of Planning [37]

In Maryland, the following criteria are used to evaluate the merits of school construction:

- "Projects should not encourage sprawl development
- Projects should not be located in agricultural preservation areas…unless other options are not viable and the project's development will have no negative effect on future growth and development in the area
- Projects should encourage revitalization of existing facilities, neighborhoods, and communities
- Projects should be located in developed areas or in locally designated growth areas
- Projects should be served by existing or panned water, sewer, and other public infrastructure" [38]

Another component to the Maryland program is a focus on funding improvements to existing infrastructure. Unlike most states, Maryland's policy on capital funding favors existing schools over new construction. Prior to the state's new policy, state renovation funds would only pay for existing building infrastructure such as electrical or mechanical equipment. Governor Parris Glendening's administration (1995-2003) changed the policy to include *improvements* to facilities that include computer equipment, air conditioning, and other structural elements. Prior to 1991, 66% of the school's construction funds went towards new construction, while only 34% went into renovations of existing schools. From 1997-2001 capital improvements to existing schools made up 95% of school capital projects. This comprised 83% of the state capital budget for schools in Maryland. Maryland's matching policy for schools also favors existing schools. The state will fund 50% of costs for schools that are between 16 and 25 years old; 60% if the school is 26 to 40 years old; and 85% if the school is 41 years or older [39]. This helps encourage districts keep to historic schools and makes the return on investment much higher for doing so.

Due to term limits, Governor Glendening's administration ended in 2003. However, the PFA program for schools remains in place. In 2006 the Maryland legislature passed HB 1141 which required additional elements be adopted into municipal comprehensive plans. The law calls for a Municipal Growth Element that, among other things, provides an analysis of school capacity by using the projections of students per household in a new development. This placed additional state requirements on land use planners to incorporate school planning into the comprehensive planning process [37].

2.4.2.2. Florida's School Concurrency

Florida is considered a national leader in smart growth principles. In Florida, Adequate Public Facilities Ordinances (APFOs) ensure that when development occurs, other public infrastructure is in place or planned to serve the development. Adopting an APFO is an option for each local government, and many have done so to help give utilities such as water and sewer districts a coordinated plan that would take into consideration capacity constraints as new development is approved.

In 2000, Orange County Chairman Mel Martinez asked county planners to start considering school capacity as part of their development approval process. This plan, known as the Martinez doctrine, states that if a development causes a school to increase its enrollment to greater than 125% of capacity, then the developer is required to help solve the capacity issue [2]. This doctrine was challenged by several lawsuits, but was ultimately upheld by the Florida Supreme Court in 2003 [40].

In 2002, Florida passed a law that requires school districts and local planners to use common growth management plans, population projections, development review bodies, and funding strategies. The legislation also requires that the school districts and local governments have a formally executed agreement [7]. A 2005 amendment to the law requires that all school districts integrate schools into their comprehensive land use plan by 2008 [41].

Many believe the new requirements have been effective. School planners are cooperating with local planners to share data and strategies to implement smart growth principles. According to a report by the International City/County Management Association, the law has improved all aspects of planning coordination [2]. Fewer schools are overcrowded and responsibility is placed on developers to help provide the public facilities necessary as a result of their development. School planners and local planners are sharing data and meeting regularly to review plans and discuss school capacity issues.

2.4.3. The Steinberg Act

In 1985, legislation was passed in Georgia that requires local government planning departments to take certain specific considerations into account when reviewing rezoning applications [42]. The law applies to counties with populations over 625,000 (originally 400,000 but amended in 2002) and municipalities with populations over 100,000. As of the 2000 Census this means the law only applies to Fulton, DeKalb, and Gwinnett Counties in Georgia. According to Census estimates, as of the 2010 Census, this will also apply to Cobb County, a suburban county just outside Atlanta. In addition to the counties, the Steinberg Act applies to the municipalities of Atlanta, Augusta, Columbus, Savannah, and Athens because they have populations that exceed 100,000. Six criteria are required to be taken into consideration:

1) Whether the zoning proposal will permit a use that is suitable in view of the use and development of adjacent and nearby property;

2) Whether the zoning proposal will adversely affect the existing use or usability of adjacent or nearby property;

3) Whether the property to be affected by the zoning proposal has a reasonable economic use as currently zoned;

4) Whether the zoning proposal will result in a use which will or could cause an excessive or burdensome use of existing streets, transportation facilities, utilities, or schools;

5) If the local government has an adopted land use plan, whether the zoning proposal is in conformity with the policy and intent of the land use plan; and

6) Whether there are other existing or changing conditions affecting the use and development of the property which give supporting grounds for either approval or disapproval of the zoning proposal [42].

The law is designed to better coordinate planning efforts in the developed and densely populated areas of the state. Although Georgia is a "Home Rule" state in which the local governments have the ability to enact land use and zoning regulation without interference from the state, the law provides the state the ability to specify procedures that the local government must follow [43].

This is particularly important to school districts because the law states that any rezoning must not cause "excessive or burdensome use" of the school facilities. In the case of school siting, this law may protect school districts from rezonings that they can prove are burdensome to the district. Many bedroom communities have a difficult time balancing budgets because of the high cost of educating students and the lack of commercial property tax revenue. School districts could possibly use this statute to encourage county commissions to think carefully about the amount of development approved and how it impacts the school district. It could provide a legal basis for a county's denial of a rezoning application based on the impact to the school district.

While the Steinberg Act was a big step towards coordinated land use planning in the state, the law only requires that these factors be considered, so rezoning decisions are not *necessarily* based on these criteria. Therefore, a county could choose to go through the checklist and still approve the rezoning even if the impact to the school would be burdensome.

2.5. Summary

The literature on how school sites relate to development patterns is limited. Although there has been extensive research done in the area of determining land values as the relate to neighborhood characteristics, little work has been done to specifically analyze the impact a school site has on development patterns. This is largely because of the difficulty of determining the reason households move from place to place. Economic conditions, social constructs, and job location all play important roles in households' decisions on where to locate, but usually these decisions need to be analyzed in the context of a household survey to determine causality.

School financing is done using a variety of methods in Georgia. Local funding is achieved by using the ESPLOST mechanism through a county-wide sales tax. This is often used to provide a local match to state funding for school construction. Georgia funds new construction at a higher level than existing schools, which only receive renovation funding once every 20 years. This creates an incentive for schools to use local money to build new facilities because there will be a higher return on investment.

In Georgia, the Steinberg Act (1985) required large population centers like Atlanta to take a look at schools as a consideration when approving new development. While counties and municipalities are not *required* to make development approval decisions on the basis of school (and other infrastructure), they must take these matters into consideration before making a decision to approve a development. School districts and local governments are not required to coordinate in their planning efforts in Georgia.

CHAPTER 3
DATA COLLECTION AND PREPARATION

The data used in this study came from a variety of sources. There were both quantitative and qualitative data needs for the scope of this study. Quantitative data came in the form of parcel data from counties, school construction date data from the Georgia Department of Education (GaDOE), transportation network data from TransCAD software (using 2000 Census TIGER/Line network), and traffic data from the Georgia Department of Transportation (GDOT). In addition, census data was used to determine counties in which school systems were growing rapidly. Qualitative data was obtained through a series of telephone interviews with school facility planners, school board members, GaDOE staff, and Georgia School Boards Association (GSBA) staff.

3.1. Parcel Data

Parcel data was collected from seven counties in Georgia. The methodology for selecting counties is discussed in section 4.1. Contact was made with the respective Geographic Information System (GIS) manager for each county and a data request was made. Parcel data for the entire county was requested, which included attribute information for Year Built and Land Use. In addition, school attendance boundary data was requested. Table 3.1 shows a summary of the data that was collected. Not all counties provided the requested data and therefore analysis was not possible on all of the counties. In addition the data was not available for the same time periods for all counties. In order to ensure that all the data had similar integrity, the records with the most recent year built were excluded from the analysis. For example, if the dataset had some values for 2007, it was considered to be complete only up to 2006. Therefore, no records with 2007 Year Built values were used.

Table 3.1 – Data Available for Analysis

County Code	Character Type	Land Use	Year Built	School Attendance Boundaries	Year of Data
A	Mature Urban	x	x	x	2005
B	Mature Suburban	x	x	x	2007
C	Developing Exurban	x	x	x	2006
D	Rural	x	x	x	2007
E	Developing Exurban	x	x	x	2007
F	Developing Exurban		x	x	2007
G	Rural	x	x	x	2007

The primary county types used in the data analysis were counties A, B, C, and D. This provided a sufficient cross-section of Georgia's development environments by representing four unique county types: 1) County A, *mature urban*, 2) County B, *mature suburban*, 3) County C, *developing exurban*, and 4) County D, *rural*. The rural county selected was within reasonable distance to a population center so some potential impact of growth could be observed. County names were kept confidential to respect the entities that provided the data and to comply with agreements for use of the data.

3.1.1. Preparation of Parcel Data for Analysis

Parcel data was provided as described in Section 3.1. However, this data was not ready for use in the analysis step. For many of the datasets, the geographic parcel data had to be joined with the cadastral data provided by the county tax assessor. In some cases this data had to be manipulated so that the Parcel ID matched the cadastral dataset from the county assessor. For this analysis the Effective Year Built (EYB) was used instead of the Actual Year Built (AYB). Assessors use AYB to record the first time a structure was built on a location. EYB differs from AYB when a significant renovation has been done on the existing foundation. Since this research is seeking to find the impact of school siting on development, using the EYB will give a better signal of development and incorporate renovations as well as new construction. Some counties provided data in a format where no processing was required. However, for some counties special processing steps were taken to get the data into a reasonable format. Those procedures are discussed here.

3.1.1.1. County E Data Preparation

The geographic parcel data collected from County E was in shapefile format. The data was obtained from the Georgia GIS Clearinghouse and appended with a comma delimited text file supplied by the County Tax Assessor's Office. The data for matching Parcel ID was not uniform and had to be processed in order to have a good common identifier for the data join. Out of 92,241 records in the original geographic dataset, 66,851 (72%) were successfully matched to the cadastral data provided by the tax assessor. The remaining parcels had no building information, and were assumed to be undeveloped. Due to later considerations of school selection criteria, this data was not used in the final analysis.

3.1.1.2. County G Data Preparation

The parcel data obtained from County G did not have a Parcel ID that was usable to join with the cadastral data. In order to make the table join possible, the Parcel ID was parsed out into its elemental components. These components were then concatenated to form a uniform Parcel ID that would be able to join to the cadastral data. In total, there were 35,098 records in the geographic parcel dataset. After the join was complete, there were 35,077 successful matches, for a success rate of 99.9%. The dataset yielded 12,663 (36%) parcels in which there was no building information. These parcels were assumed to have no improvements on the land. Due to later considerations of school selection criteria, this data was not used in the final analysis.

3.2. School Construction Database

A school construction database was obtained from GaDOE. This database was sent as Excel files that were imported into Access for more efficient data processing. Data was requested for each year from 1990 through 2007. In order to make this data useful for the analysis some processing had to be undertaken. First, all schools with a school code of "16xx" were removed. This was based on the advice of the GaDOE staff because these reference numbers did not represent new schools, but merely schools that had been renumbered. Next, schools with an opening date with 1/19/2008 were removed from the dataset. Again, this was on the advice of GaDOE staff because of a flaw in the dataset. After the dataset was cleaned, the process began to determine the schools that would be selected for analysis. This process is detailed in section 4.1.

3.3. Transportation Network Data

The transportation network data came from two primary sources; TransCAD data and GDOT traffic count data. The data included with the TransCAD software package contained street network data based on 2000 Census TIGER/Line files. The data includes attributes of roadway type in the form of the Census Feature Class Code (CFCC) and nodes at each intersection. The availability of CFCC and nodes allowed for a friction-based shortest time path network to be created to model travel time for different road classifications.

GDOT provided traffic count data for several of the counties in the study area. These were provided as shapefiles to be used in GIS. Data was provided as point data at selected sites throughout the counties. This data was available for years 1998-2007.

3.3.1. 2000 Census TIGER/Line Network

The information provided as part of the TransCAD package was street network data from the 2000 Census for the entire United States. The street network consisted of a line dataset that represented the street network and a node dataset that represented intersections of the street network. Before any analysis was done, the street dataset was clipped to the Georgia state boundaries to decrease the file size and processing time necessary to carry out procedures. The line dataset contained an attribute field called *length* that represented the length in miles of each line segment. There was also an attribute for CFCC. In order to develop travel time contours, average travel speeds for different road classifications were assumed. The assumed speeds and composition of road classifications are shown in Table 3.2. These speeds were adjusted down by five miles per hour from the posted speed limit to account for intersection and congestion delay associated with each node pair.

Table 3.2 – Adjusted Speed and Distance by Road Type

CFCC	SumOfLength(mi)	Pct Of Total	Speed (mph)	Name
A11	261.90	0.15%	50	Primary road with limited access or interstate highway, unseparated
A13	7.41	0.00%	50	Primary road with limited access or interstate highway, underpassing
A15	1,756.58	1.03%	50	Primary road with limited access or interstate highway, separated
A16	0.12	0.00%	50	Primary road with limited access or interstate highway, separated, in tunnel
A17	10.45	0.01%	50	Primary road with limited access or interstate highway, separated, underpassing
A18	0.07	0.00%	50	Primary road with limited access or interstate highway, separated, w/ rail line in center
A21	10,345.22	6.06%	35	Primary road without limited access, US highways, unseparated
A22	1.33	0.00%	35	Primary road without limited access, US highways, unseparated, in tunnel
A23	1.96	0.00%	35	Primary road without limited access, US highways, unseparated, underpassing
A25	1,186.57	0.70%	35	Primary road without limited access, US highways, separated
A27	0.06	0.00%	35	Primary road without limited access, US highways, separated, underpassing
A29	0.37	0.00%	35	Primary road without limited access, US highways, bridge
A31	6,659.37	3.90%	25	Secondary and connecting road, state and county highways, unseparated
A32	1.15	0.00%	25	Secondary and connecting road, state and county highways, unseparated, in tunnel
A33	7.26	0.00%	25	Secondary and connecting road, state and county highways, unseparated, underpassing
A34	0.24	0.00%	25	Secondary and connecting road, state and county highways, unseparated, with rail line in center
A35	101.32	0.06%	25	Secondary and connecting road, state and county highways, separated
A38	3.74	0.00%	25	Secondary and connecting road, state and county highways, separated, with rail line in center
A39	0.04	0.00%	25	Secondary and connecting road, state and county highways, bridge
A41	139,574.68	81.78%	20	Local, neighborhood, and rural road, city street, unseparated
A42	6.46	0.00%	20	Local, neighborhood, and rural road, city street, unseparated, in tunnel
A43	10.41	0.01%	20	Local, neighborhood, and rural road, city street, unseparated, underpassing
A44	1.85	0.00%	20	Local, neighborhood, and rural road, city street, unseparated, with rail line in center
A45	51.82	0.03%	20	Local, neighborhood, and rural road, city street, separated
A46	1.21	0.00%	20	Local, neighborhood, and rural road, city street, separated, in tunnel
A49	4.32	0.00%	20	Local, neighborhood, and rural road, city street, bridge
A51	1,609.86	0.94%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A52	0.22	0.00%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, in tunnel
A53	1.73	0.00%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, underpassing
A54	28.85	0.02%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated, underpassing
A56	8,462.19	4.96%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A57	78.17	0.05%	10	Vehicular trail, road passable only by 4WD vehicle, unseparated
A63	487.68	0.29%	10	Access ramp, the portion of a road that forms a cloverleaf or limited access interchange

Travel times were calculated for each link in the network. Next, a network model was calculated and implemented in TransCAD based on minutes of travel time for each link. The network model contains the underlying data necessary to calculate drive-time catchment areas (called service areas) based on an origin node.

3.3.2. GDOT Traffic Count Data

GDOT was asked to provide traffic count data for all roads in the counties studied. This was provided as a personal geodatabase that could be rendered in ArcGIS for analysis purposes. Each county had bidirectional Average Annual Daily Traffic (AADT) counts for years 1998 through 2007. Some counts were estimates, while others were taken annually and reflected actual traffic volume as measured by GDOT.

Analysis was done using GIS to extract the data points that fell within the school attendance boundary. Data was exported from GIS and analyzed in Excel. Any traffic count stations with a zero reading for any given year were removed. Valid data points ranged from two to seventeen. These data points were averaged for each year for analysis. This allowed for analysis on a year by year basis of average traffic within the school attendance boundary.

3.4. Interviews

In addition to data collection, phone interviews were a critical part of this research effort. A clear understanding of how site planning occurs in Georgia was critical to understanding the decision-making framework for site selection. Over the course of three months, 17 interviews were conducted with a variety of school districts and state agencies. Each interview lasted between 20 and 50 minutes and covered a variety of questions. Interviews were conducted with school facility planners, school board members, GaDOE, and the Georgia School Board Association. Separate questionnaires were created for each agency type interviewed. A complete list of questions can be found in APPENDIX A.

One week before each interview, the questions were emailed to the interviewee so that he/she could be prepared to answer the questions during the interview. During the interview, the interviewees were given an overview of the research project and asked to be as candid as possible about the planning process. Interviewees were assured that their personal information would be kept confidential and they would not be identified in the research. Notes were collected for each phone interview and summarized immediately after the interview ended.

A cross section of Georgia school districts were selected for interviews. All four districts selected for spatial analysis were interviewed as well as some professionals from other counties. In addition, the Facilities Services Director of the GaDOE and a representative from the Georgia School Board Association were selected for interviews. Developing exurban counties were oversampled due to the high growth rate these counties are experiencing. In these counties there was a greater likelihood to have a robust capital program, whereas counties that are more mature may have less in terms of new school site decisions. Table 3.3 shows the details of the interviews conducted.

Table 3.3 – Interview Summary

Interview Date	County Type	Title	Type
10/1/2008	Developing Exurban	Facilities Coordinator/CEFPI Georgia Chapter President	FP
10/17/2008	Developing Exurban	Board Chair	B
10/2/2008	Developing Exurban	Facilities Director	FP
10/13/2008	Developing Exurban	Board Chair	B
10/13/2008	Developing Exurban	Director of Facility Services	FP
9/24/2008	Developing Exurban	Facilities Planner	FP
9/25/2008	Developing Exurban	Board Chair	B
9/30/2008	Developing Exurban	Executive Director of Facilities & Maintenance	FP
10/13/2008	Developing Exurban	Board Chair	B
10/1/2008	Developing Exurban	Executive Director, Maintenance & Facilities	FP
10/6/2008	Mature Suburban	Board Member	B
10/13/2008	Mature Suburban	Facility Planner	FP
10/9/2008	Mature Urban	Director of Planning	FP
9/24/2008	Rural	Director of Administrative Services	FP
9/30/2008	Rural	Board Chair	B
10/9/2008	State Agency	Director, Facilities Services	S
10/9/2008	State Agency	Professional Development Specialist	S

Facility Planners (FP)	9
Board Members (B)	6
State Agencies (S)	2

CHAPTER 4
METHODOLOGY AND ANALYSIS

To develop a good understanding of how school sites impact development patterns, a two-part approach was developed. The first part of the analysis was a quantitative analysis using GIS software. This approach involved determining the number of newly developed parcels near school sites before and after the school was built and comparing that growth rate to the county average growth rate over the same time period. For clarification, from this point forward, the term "out years" will be used to describe the year the school opened and all subsequent years. To maintain consistency, the growth rates were calculated based on the number of structures, not the actual population. This method was used primarily because there was not a reliable method by which to get population data on a yearly basis. Population data was only available in five year increments. The second part of the research involved conducting phone interviews with school facility planners from across Georgia to ask questions related specifically to how school facility planning is done in the state.

4.1. School Selection

As discussed in section 3.2, the schools selected for the geographic analysis were made based on a database obtained from the GaDOE. A query was run to determine schools that were built between 1995-2000. This time period was desirable because it would provide a minimum of seven out years for the analysis. Next, specific school districts and county GIS departments were contacted and asked to provide the data necessary for analysis. This process had four main criteria for the data:

1) Sufficient GIS data from the county to support analysis (parcel geography and effective year built attribute data)
2) School located on site that was previously undeveloped
3) Traffic data from GDOT available
4) Met the county profile description (mature urban, mature suburban, developing exurban, and rural)

A number of schools were considered for the analysis, but only schools that had sufficient data were selected.

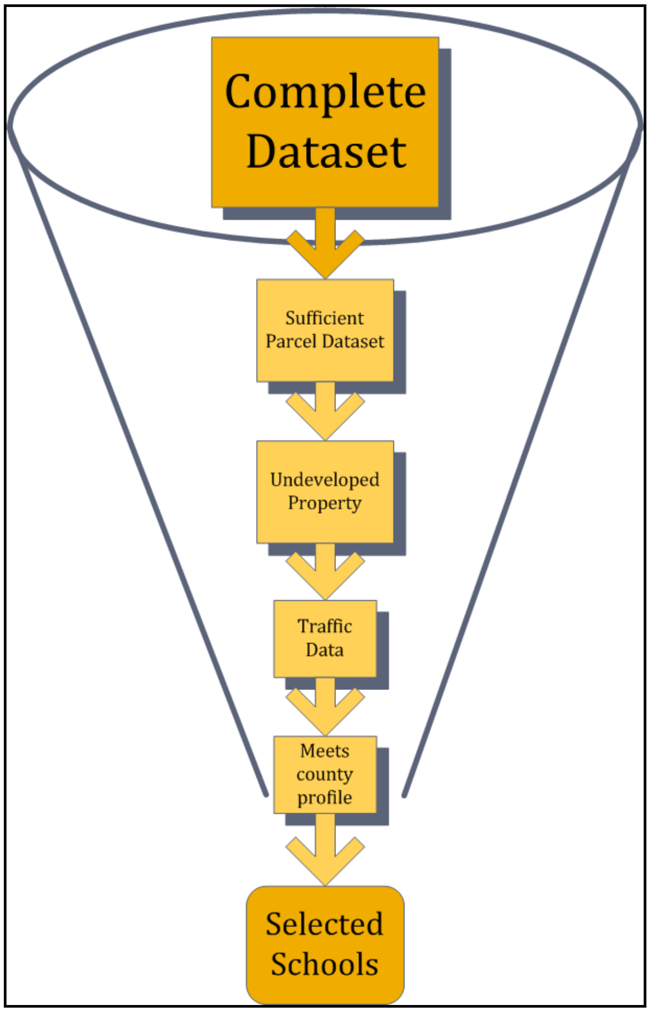


Figure 4.1 – School Selection Process

Figure 4.1 shows the selection process by which schools were chosen for the analysis. Due to the time necessary to analyze and prepare the data, only two schools were selected from each county. It was assumed that middle schools would have similar development characteristics as elementary schools and that the resulting development pattern would be similar. Therefore, only one elementary school and one high school were analyzed for each of the four districts, for a total of eight schools.

4.2. Developing Travel Time Contours

Spatial relationship between the school and the surrounding development is important. Two methods can be employed to determine spatial relationship: Euclidian distance and network distance. Euclidian distance refers to "as the crow flies" distance from a point. This would be easy to determine using a spatial buffer in any GIS software. Network distance is based on the street network and reflects the practical travel pattern of a vehicle or pedestrian. In the land use context, network distance is the most appropriate and most robust form of analysis, so this method was used.

The first step in developing the network distance was to construct a network model based on the 2000 Census TIGER/Line data files as described in section 3.3.1. This process provided the necessary friction factors to construct travel time contours.

The next step was to select the nearest intersection node to the school site (see Figure 4.2). This process involved visually identifying the nearest network node to the selected school site. That is, the nearest intersection from which a trip would begin from the selected school site. Next, travel time contours were computed using the nearest node as the base point and calculating network bands extending outward. Multiple network bands were computed to determine travel time in minutes from the school site. Increments of two minutes were used with travel time contours extending as far as necessary to encompass the entire attendance boundary of the school in question. Figure 4.3 illustrates the travel time contours calculated for a school. Note that the attendance boundary has been used as the reference for determining how far to extend the travel time contours. Travel time contours only extend to the point necessary to encompass the entire school attendance boundary.

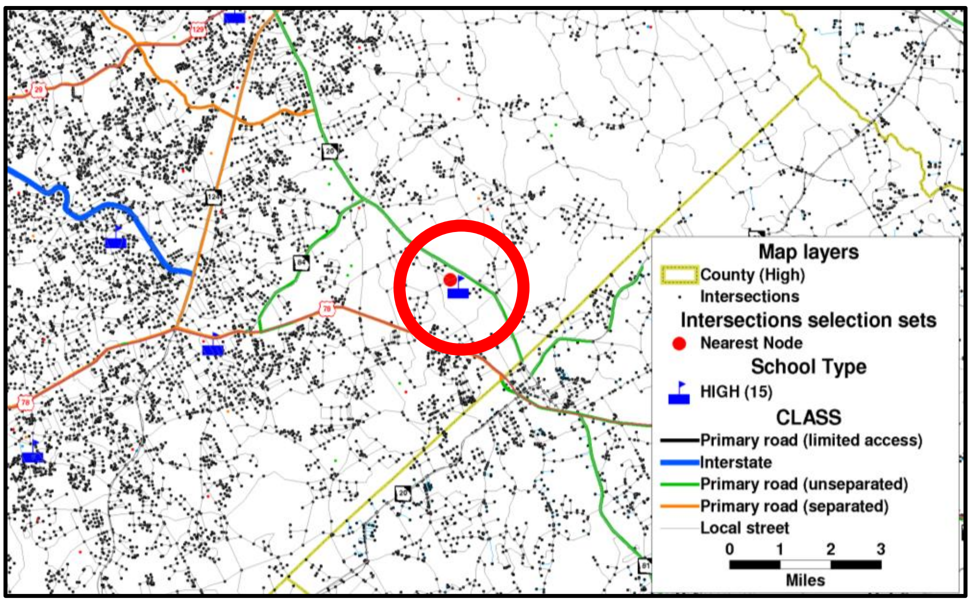


Figure 4.2 – Nearest Node to High School B

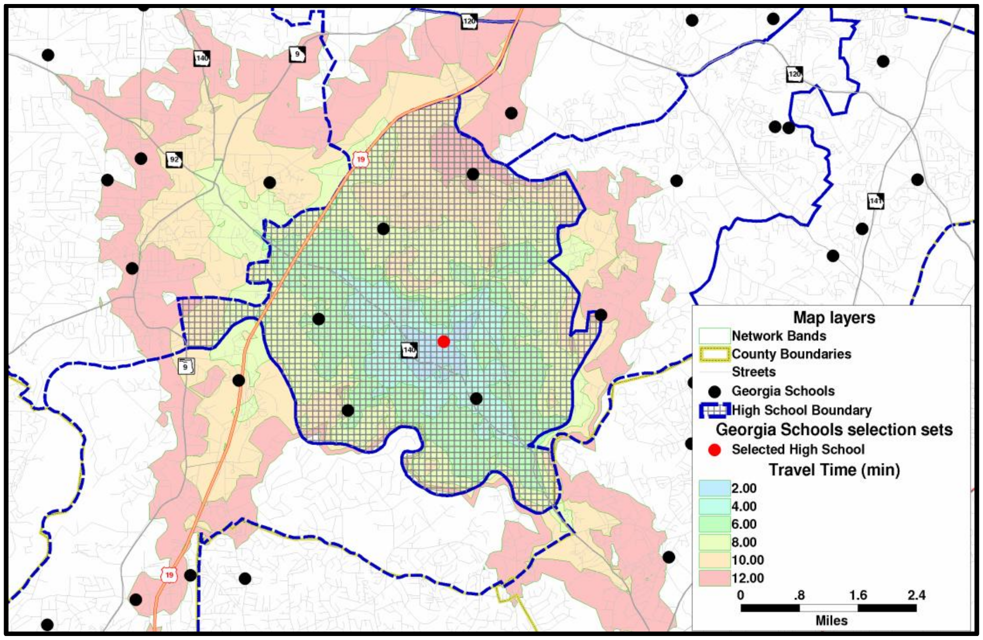


Figure 4.3 – Travel Time Contours from School's Nearest Intersection

4.3. Analysis in GIS

After the travel time contours were complete, the file containing the contour geography was exported to a shapefile so that it could be used in ArcGIS. The file was opened in ArcGIS and was re-projected so it would be in a datum consistent with the rest of the parcel data (this was usually Georgia West State Plane-Feet). Next, the *Select by Location* function was employed to select only the parcels that fell within the specific school attendance boundary. For analysis purposes, only parcels with year built dates 1990 and out were selected. These parcels were exported to a separate shapefile. Then this file was converted to points using the *Feature to Point* tool in ArcGIS. The output points represented the centroid of each parcel within the school attendance boundary. Figure 4.4 illustrates the travel time contours along with the parcel centroids within the school attendance boundary.

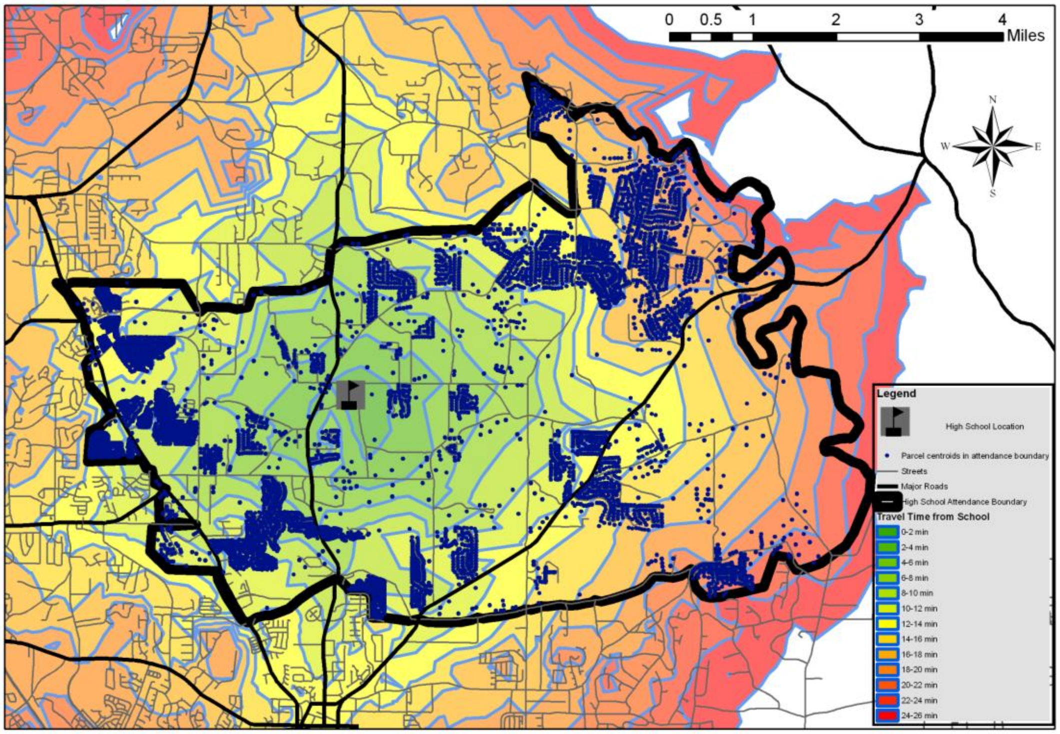


Figure 4.4 – Travel Time Contours with Parcel Centroids Since 1990

The objective of this data is to have parcel centroids that take on the attributes of the travel time contour in which each point is contained. Because points, not parcels, are used, each point can fall only in one travel time contour. Each parcel was then spatially joined to the travel time contour it was in. This produced a table output that would be summarized by travel time and a cross tabulation could be calculated based on year and network distance from the school. Table 4.1 illustrates the cross tabulation result for an elementary school. The school was built in 1999, so the cells from 1999 forward are shaded to indicate the time period after the school was built.

Table 4.1 – Cross Tabulation of Year Built and Travel Time

		Travel Time (min)										
	Year Built	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	Total New Structures
Before school opened	1990		4	5	5	5	9	2	1	12	2	45
	1991			3	11	1	28	6	1	5		55
	1992			4	5	3	22	3		7	4	48
	1993		2	5	28	6	19	5		1	2	68
	1994	1	1		28	18	18	1	2	1		70
	1995	1		30	14	12	38	4	5	2	1	107
	1996	2	3	16	18	9	45	14	7	32	15	161
	1997	5	5	43	33	22	40	10	7	27		192
	1998	14	19	15	53	23	35	2	2	25	26	214
After school opened	1999	5	20	2	28	27	33	3	5	8	7	138
	2000	4	15	30	25	22	28	19	6	37		186
	2001	3	9	25	59	55	61	21	23	12	1	269
	2002	4	13	29	30	48	20	8	14			166
	2003	1	27	42	22	39	20	12	12			175
	2004		5	28	31	31	4	12	20			131
	2005		6	12	10	11	17	8	16	3		83
	Total	**40**	**129**	**289**	**400**	**332**	**437**	**130**	**121**	**172**	**58**	**2108**

4.4. Analysis of Relationship

In social research, developing a *robust* case for causality involves four elements: association, non-spuriousness, time precedence, and theory [44].

The question of association can be addressed using statistical measures such as the chi-square test or correlation. In this case, the chi-square test and the Cramér's V were the most appropriate [45]. The variables were setup such that travel time contours could be grouped together and counted as column summations and the row variable would represent the time period before and after the school was built. This procedure is detailed in section 4.5.

The question of non-spuriousness is more difficult. With land development there are many factors that are not easily controlled for statistical significance. For example, this dataset does not control for neighborhood characteristics such as income, racial composition, and household size. The information was not available since the analysis was done on a school attendance boundary level and not census block group level. Furthermore, the data is based on an annual growth rate and the Census block group level data is available only at the decennial Census. This makes it difficult to determine the neighborhood characteristics over time. The lack of this information could leave out some spurious correlations between variables outside of the scope of this project.

Time precedence requirement asserts that if event A causes event B, then A must precede B. Time precedence can be achieved by showing the growth rate before the school was built and after the school was built. Since all school sites were selected based on the condition that there was no school on the site previously, it can be shown that there is time precedence by calculating the rate of growth at the time the school was built and compare the growth rate that occurred after the school was placed in service. To further separate extraneous impacts of the broader economy, the overall growth rate for the county was also calculated and subtracted from the growth rate for the school attendance boundary to segregate the school's impact from the environment of the economy and housing market at-large.

Finally, there must be theory to support the argument of causation. Although there has not been significant empirical evidence on school sites and growth, the majority of professionals interviewed as part of this effort agreed that there was definitely a relationship between residential choice and school location. This evidence supports the assertion that there is at least some degree of causal relationship.

4.5. Measures of Association

In order to develop sound measurement techniques, two statistical measures were employed. The first is the Pearson's chi-square test. This test is a comparison between the frequencies that would be expected if the variables were completely independent and the frequencies actually observed from the sample. While the chi-square test provides a way to positively test for independence, it says nothing about the strength of the relationship. To make the analysis more robust, a Cramér's V test was employed. The Cramér's V indicates the strength of the relationship proved using the chi-square test.

4.5.1. Pearson Chi-Square Test

The test was setup so that the null hyporeport was that the variables of school built and travel time from the school were independent. Table 4.2 illustrates the setup for the chi-square test. The percentage of the total for the category *School Built* is applied to the <=10 minute total and the >10 minute total to obtain values that would be expected if the travel time variable had no relationship to whether the school was built.

Table 4.2 – Chi-Square Test Setup

Observed	Travel Time		
	<= 10 min	>10 min	Total
School Built	4362	4533	8895 *(67%)*
School Not Built	1878	2473	4351 *(33%)*
Total	6240	7006	13246 *(100%)*

Expected	Travel Time		
	<= 10 min	>10 min	Total
School Built	4190	4705	8895
School Not Built	2050	2301	4351
Total	6240	7006	13246

To measure the association of development patterns, the Pearson's chi-square test is specified by the function:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where χ^2 = the chi-square statistic, O_i = the observed frequency for event i, E_i = the expected frequency for event i, and n = the number of possible outcomes for each event.

On the column summation, the travel time was aggregated based on how many travel time contours existed in the school attendance boundary. For example, the travel time contours for the high school in County B ranged from zero to twenty minutes. The travel time was separated into two bins: less than or equal to 10 minutes and greater than 10 minutes. The rows were the year of construction for each new structure in the school attendance boundary. These rows were aggregated into two categories: one for structures built before the school opened and one after the school opened. This essentially created a dataset of nominal categorical variables. In all cases, there was a sufficient sample size for statistical analysis.

Observed frequencies were first cross-tabulated and then expected frequencies were calculated based on a null hyporeport of no relationship between the two variables. A sample result for County B is illustrated in Table 4.3.

Table 4.3 – 2x2 Chi-Square Test Result for County B

	Observed	Expected	**(Obs-Exp)^2/Exp**
School Built, <=10 min	4362	4190	7.035
School Built, >10 min	4533	4705	6.266
School Not Built, <=10 min	1878	2050	14.382
School Not Built, >10 min	2473	2301	12.810
		Chi-Square	**40.492**
		Cramér's V	**0.055**
		Significant at:	0.05
			YES

A further step was taken to disaggregate the travel time into more than two bins. It was thought that this approach might give additional strength to the assertion that the two variables were not independent. As mentioned previously, the original travel time contours were at two minute intervals. Since each school had differing numbers of travel time contours based on the attendance boundary size, the data was aggregated such that the minimum bin size was two minutes and there was a maximum of six bins. A separate chi-square test was then run on the new disaggregated data. Results are discussed in section 5.1.1.

4.5.2. Cramér's V Test

While the chi-square test is useful to affirm that a relationship does exist, it says nothing about the *strength* of the relationship. In order to determine the strength of the relationship, the Cramér's V is used. This test is based on the chi-square test and can determine the strength of association between the variables. Cramér's V is specified by the function:

$$V = \sqrt{\frac{\chi^2}{n(k-1)}}$$

Where V = Cramér's V, χ^2 = the chi-square statistic, n = the number of observations, and k = the smaller of the number of rows and columns. Cramér's V has a range of 0.0 to 1.0, with 0.0 indicating no relationship between the variables, and 1.0 indicating a perfect relationship. This measure controls for the number of cases and provides a standardized method to analyze the strength of the relationship. Since Cramér's V is always positive, there is no assumption of the direction of the relationship, only that there is a relationship and the strength can be calculated.

For example, a value of 0.25 indicates that 25% of the variation of between school years can be explained by this relationship. The other 75% of variation is explained by variables not included in the analysis. It is likely that these omitted variables include the condition of the housing market, land use policies, price of land, and availability of developable land. These variables would come into play in a traditional hedonic pricing analysis, but are not included in this study.

CHAPTER 5
DISCUSSION AND RESULTS

5.1. Spatial Analysis of School Sites

The analysis on the sample of eight schools provided statistical evidence indicating there is a relationship between the time that the school was built and the growth rate around the school. The chi-square statistic showed that there was evidence to suggest that the school location had some impact on the growth pattern surrounding the site. The degree of causality leaves some question as to whether the schools caused the growth or if the school was simply a response to the growth already occurring. However, several interviewees stated that one of the primary marketing tools their chamber of commerce uses is the quality of the schools in their district. Therefore, it is possible that the *quality* of the schools is more of a driving force of development, and the physical location simply determines where the growth will occur. This suggests that a quality school in an already developed area may cause growth in a similar manner.

5.1.1. Statistical Results of Spatial Analysis

All the results that looked at the relationship between a school being built and development occurring in the school attendance boundary showed that there was a statistically significant relationship. For all eight schools analyzed, the relationship was significant at the 95% confidence level. These results can be interpreted to mean that the relationship between a school's existence and development around the school site are not independent. There is a significant relationship between the two variables. Table 5.1 summarizes results from the chi-square and Cramér's V tests. This table shows the results of two separate chi-square tests. The first combines travel contours into two bins (i.e. greater than 10 minutes and less than 10 minutes travel time). The second uses *x* travel time bins (depending on the furthest travel distance from the school), in two-minute increments. For example, a school with the furthest driving distance of 12 minutes would have six travel-time bins (0-2 min, 2-4 min, etc).

Table 5.1 – Summary of Chi-Square and Cramér's V Statistics

	Chi-Square (2 travel-time bins)	Cramér's V (2 travel-time bins)	Chi-square (*x* bins, 2-min increments)	Cramér's V (*x* bins, 2-minute increments)
County A: Elementary	38.0	0.134	95.8	0.213
County A: High	40.6	0.134	302.3	0.290
County B: Elementary	31.8	0.107	323.1	0.341
County B: High	40.5	0.055	839.3	0.252
County C: Elementary	73.9	0.195	261.5	0.368
County C: High	9.0	0.042	164.4	0.178
County D: Elementary	4.7	0.074	32.8	0.195
County D: High	8.4	0.047	288.7	0.274

Although the chi-square statistic was significant when travel-time contours were aggregated into two bins, the Cramér's V did not show a strong relationship. The only notable results were County A's elementary (0.134) and high schools (0.134) and County C's elementary school (0.195). When two-minute bins were used, the Cramér's V test revealed a much stronger relationship. Values ranged from 0.195 for the high school in County D to 0.368 for the elementary school in County C. The Cramér's V was consistently stronger in the mature suburban county. This would suggest that new school construction had a more significant impact on development patterns in the developing exurban setting than other county types.

Another way to look at the results is to compare the new structure growth rate in the school attendance boundary to the new structure growth rate in the county at-large. This method not only shows a localized growth rate, but controls for systematic economic effects that are occurring within the county as a whole. For each school the growth rates were compared year over year to determine if the school attendance boundary grew faster than the county. The results of County C's high school are shown in Table 5.2. The grey shaded area indicates the time after the school was opened in 2000. A complete listing of the statistical results can be found in APPENDIX C.

Table 5.2 – Growth Rate Comparison for County C, High School

Year Built	% Growth School Attendance Boundary (A)	% Growth County C (B)	Difference (A) - (B)
1990	11.07%	6.83%	4.24%
1991	7.29%	5.93%	1.36%
1992	8.43%	7.53%	0.90%
1993	10.94%	8.08%	2.86%
1994	9.80%	7.61%	2.19%
1995	10.77%	7.94%	2.83%
1996	14.02%	9.41%	4.61%
1997	14.74%	8.44%	6.30%
1998	15.05%	8.35%	6.70%
1999	15.74%	9.40%	6.34%
2000	12.70%	8.56%	4.14%
2001	8.93%	8.25%	0.68%
2002	9.64%	8.47%	1.17%
2003	9.21%	7.93%	1.27%
2004	7.59%	6.81%	0.78%
2005	7.30%	6.61%	0.70%
2006	5.34%	6.14%	-0.81%

In this case, in every year except 2006, the school district grew faster than the county as a whole. In the years leading up to the school's opening, the growth rate exceeded the county growth rate by as much as 6.7%. After the school opened, growth rate came more in line with the county growth rate as a whole. Determining why this occurred is difficult. It could be due to the fact that development occurred in anticipation of the new school opening. Usually school sites are announced several years before the school opens. Since this was the case it is probable that developers built around the school.

School districts are required to develop five-year facility plans that account for expected growth. In County C's five-year plan, this school was expected years before the school actually was built. The school district would have accounted for this growth within the district long before the structures were built in the few years leading up to its opening. This suggests that the growth around the school might have been growth that was already taking place and the school district accurately predicted where the growth would occur and built the school accordingly.

A comprehensive look at the eight schools growth relative to their county's growth is shown in Table 5.3. These figures are only for the "out years," meaning those years including and after the school was opened. Here we see the number of years that the growth outpaced the county growth rate.

Table 5.3 – 'Out' Years Growth Summary

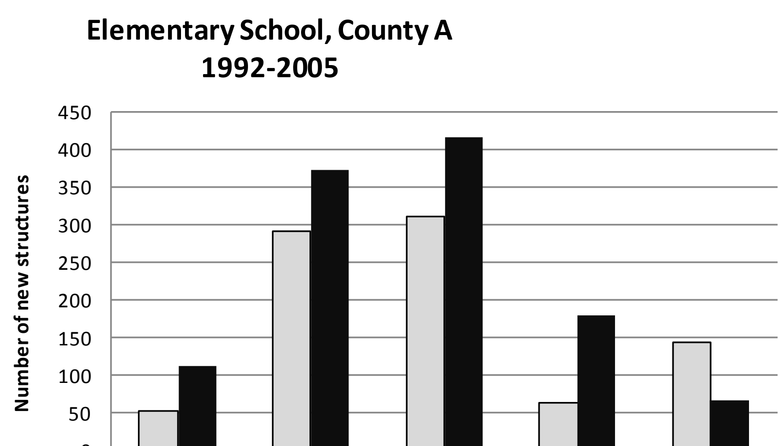
	No. of years School Dist **Grew Faster** than County Average	No. of years School Dist Did **Not Grow Faster** than County Average
County A (Mature Urban)		
Elementary	6	1
	86%	*14%*
High	2	7
	22%	*78%*
County B (Mature Suburban)		
Elementary	6	3
	67%	*33%*
High	8	0
	100%	*0%*
County C (Developing Exurban)		
Elementary	3	5
	38%	*63%*
High	6	1
	86%	*14%*
County D (Rural)		
Elementary	4	8
	33%	*67%*
High	5	7
	42%	*58%*

For the mature urban county (County A), the elementary school's growth consistently outpaced the county growth in 86% of the out years. County A's high school was the opposite. Growth was slower in school attendance boundary than for the county in 78% of the out years. In the mature suburban county (County B), the figures are more consistent. For elementary and high schools, growth in the school attendance boundary outpaces the county growth rate in 67% and 100% of the out years, respectively. For the developing exurban and rural county (Counties C and D), the results are mixed. The data show that only the high school in the developing exurban county (County C) showed higher growth in a majority of the out years. The elementary school for the developing exurban county and both schools in the rural showed that the school district grew slower than the county as a whole during the out years.

While these results may seem contradictory, it is recognized that the measures used here are subject to a number of different criticisms. First, the research only shows the number of structures built. Since population data was not available between census years at a detailed level, the structures had to act as a proxy for population. It is possible, however that the population numbers would result in different interpretations. Second, there are many more complex variables at play that are not taken into consideration. For example, school quality was not taken into consideration. Since the data used for this project narrowed down considerably the list of candidates for analysis, it was not possible to find schools that had similar characteristics in terms of quality and demographics. We know that school quality drives property values, so we could conclude that given a completely similar school, there might be more consistency between county types. Finally, due to limitations in the data it was impossible to control for the amount of developable land. Variations in the amount of developable land at the time of the school construction could mean that growth was hindered in some districts.

5.1.2. Growth-Travel Time Profiles for Schools

As part of this analysis, the relationship between travel time distance and growth was analyzed. Data was separated into two bins. One for the structures built before the new school opened and another for the structures built after the new school opened. Because school opening years differed, each graph was adjusted to include an equivalent number of years before the school was built as after the school was built. For example, for County A, the high school opened in 1999, so the years 1990-1996 (total of seven years) were used for the "before" years, and years 1997-2003 (total of seven years) were used for the "after" years. The data revealed that in most cases there was an increase in the number of structures built after the school opened. However, this data allows us to be able to look at the relationship between travel time and growth.



	0-4	4-8	8-12	12-16	16-20
1992-1998 (before school opened)	53	292	310	62	143
1999-2005 (after school opened)	112	373	416	179	68

Figure 5.1 – New Structures, County A, Elementary School

Figure 5.1 shows that for the elementary school in the developed urban county, the growth after the school was built exceeded the growth prior in every travel time band except the 16-20 minute band. We can also see from this figure that growth seems not to occur in great numbers in the area closest to the school. The 0-4 minute band has relatively small numbers compared to the 4-8 and 8-12 minute bands.

Figure 5.2 shows the same data for the high school in County A. Here we see that it appears that most of the growth occurred before the new school was in place. In the time period from 1990 to 1996 there were many more structures built than between the years of 1997-2003 after the school was opened. The pattern of structures located in the mid-range of travel-time remains consistent with what we have seen with the other school.

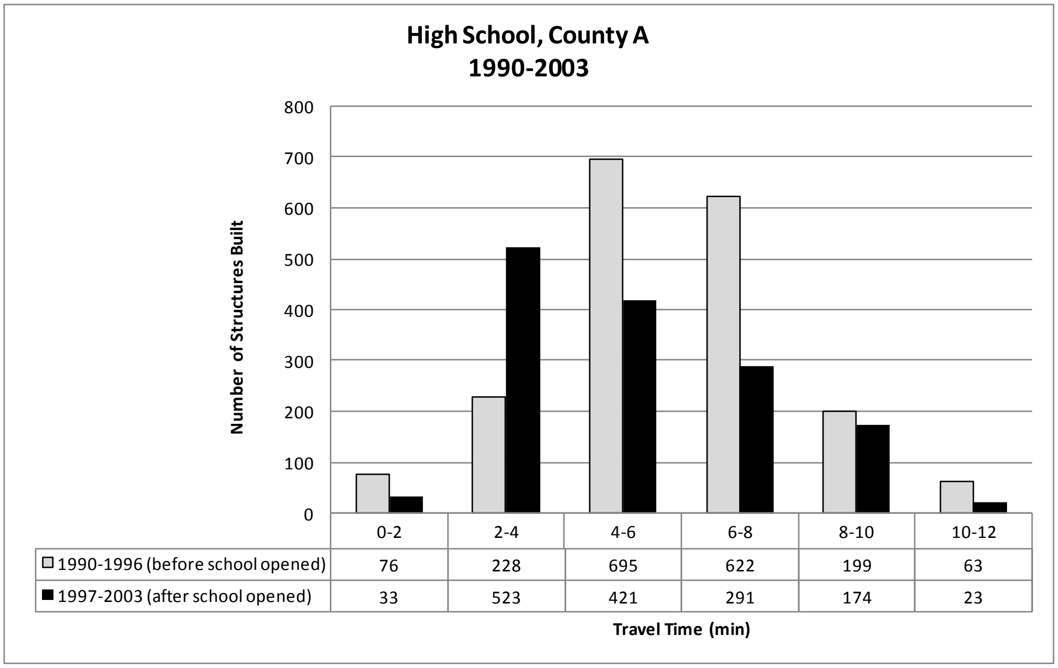


Figure 5.2 – New Structures, County A, High School

Figure 5.3 shows the results for the elementary school in the mature suburban county, County B. In this case, the pattern of not much development located in the 0-2 minute band remains consistent, but the results show that in some bands, growth was actually slightly higher than in the out years. However, the 4-6 minute band shows significantly more structures built in the out years. This was because a large development was built with 101 units the year after the school was built. Prior to that, the highest number of new structures for one year was 46.

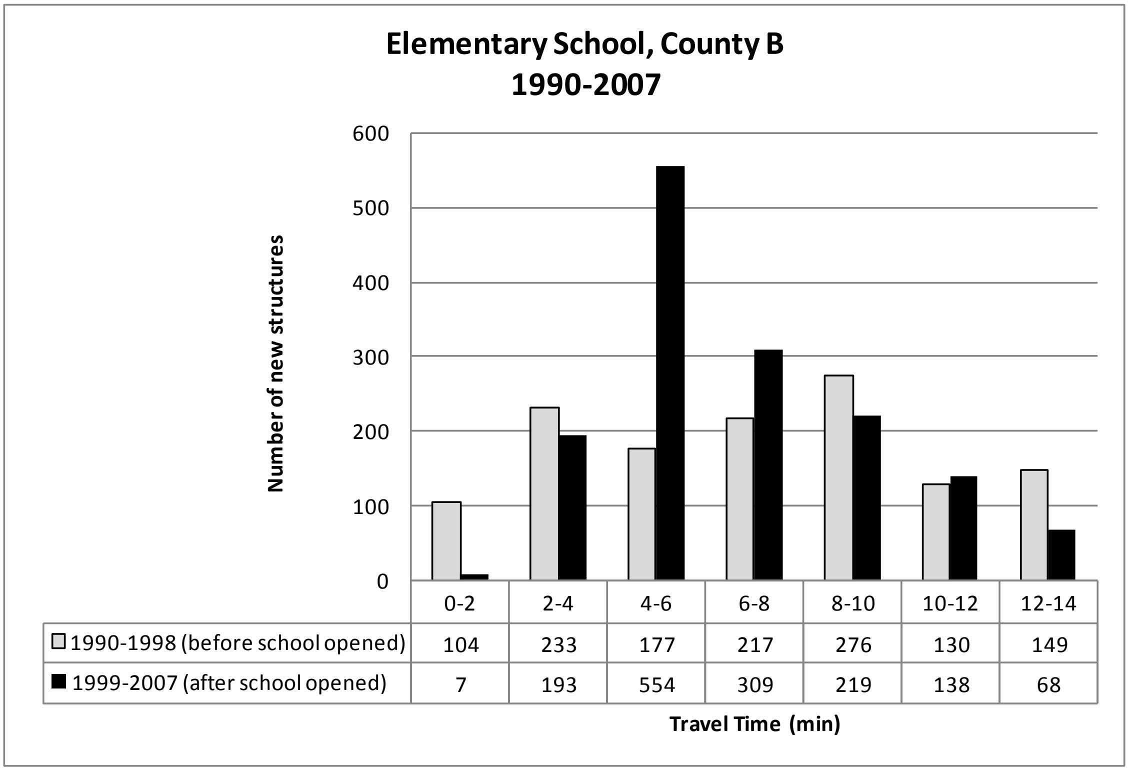


Figure 5.3 – New Structures, County B, Elementary School

The same pattern is even more pronounced in the mature suburban county where the growth is significantly higher in the years after the school was built (see Figure 5.4). Here, development also tends to follow a pattern that is most significant in the bands between 8-12 minutes from the school. There are very few structures built in the 0-4 minute band. One reason for this pattern may be that since it is a high school site, the school is located farther away from an existing neighborhood. In most cases, due to the high traffic volume generated from a high school and the increased parking requirements, the school is located in an area that is not in a neighborhood.

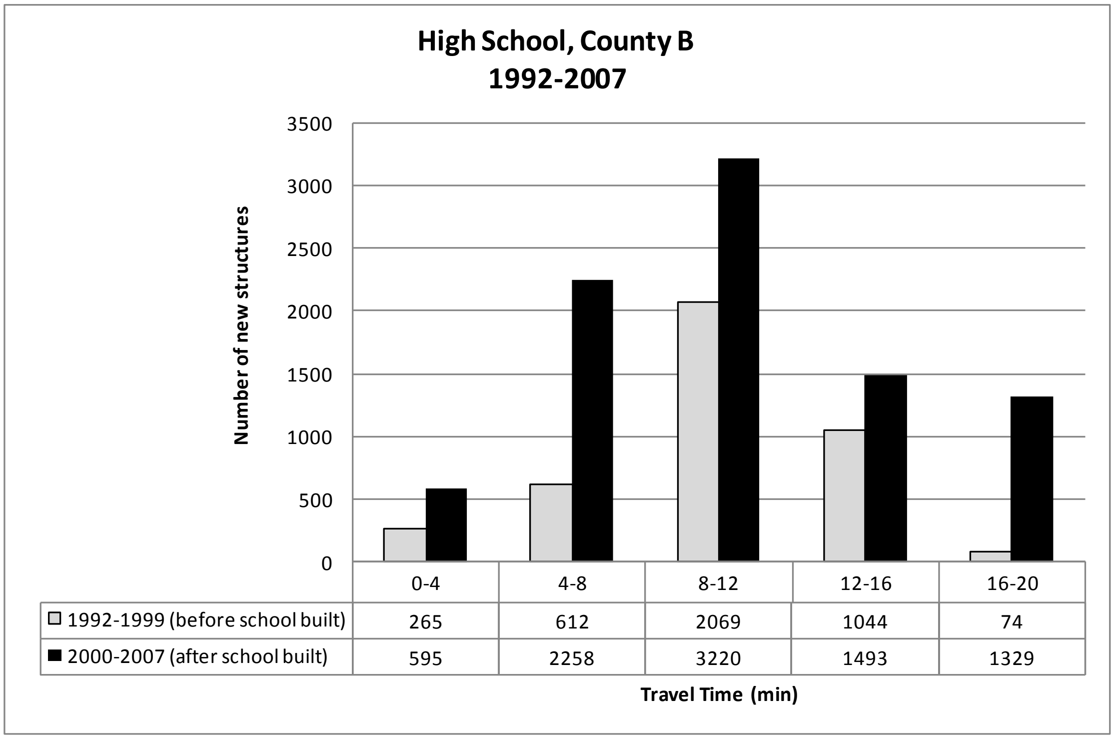


Figure 5.4 – New Structures, County B, High School

For the developing exurban counties, we see the same pattern for the elementary school, but a slightly different pattern for the high school. Figure 5.5 shows the elementary school and the pattern of fewer buildings within four minutes of the school and more going further away from the school until tapering off at 12-20 minutes. Development is significantly greater after the school opened for all bands except for those farthest away from the school. However, Figure 5.6 shows that the pattern is not as consistent for the high school. For the 12-16 minute contours the growth after the school was built is actually lower than previous to the construction. Otherwise the pattern remains consistent. Growth in the attendance boundary follows a pattern that is consistent with the other county types with growth tending to be in the middle range of travel times.

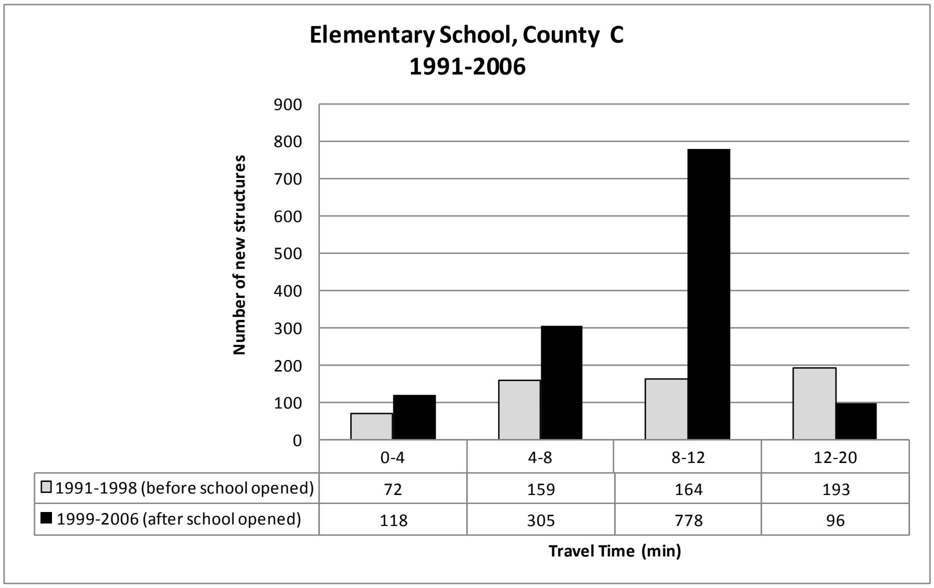


Figure 5.5 – New Structures, County C, Elementary School

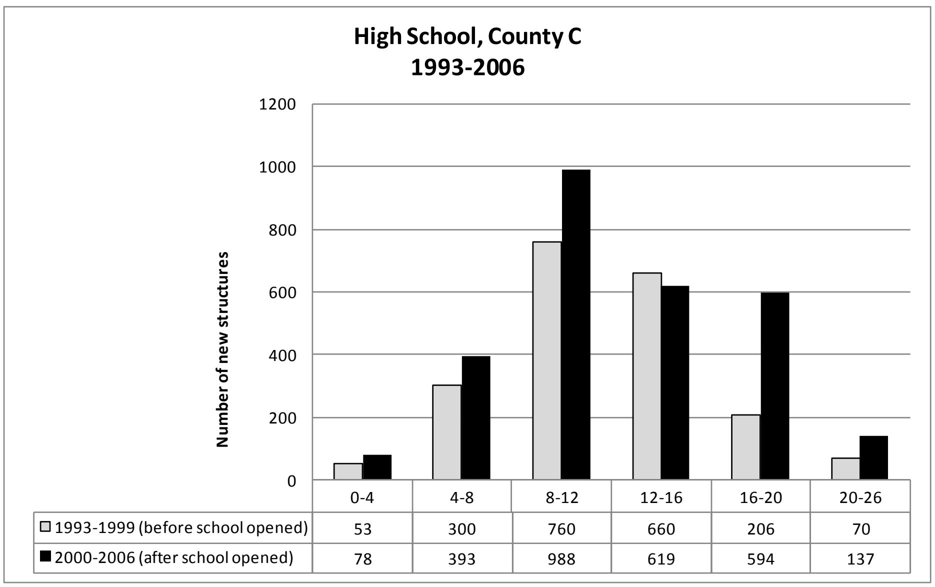


Figure 5.6 – New Structures, County C, High School

For the rural school districts, the pattern is not quite as clear. Figure 5.7 shows the elementary school growth patterns. In most travel-time bands, the growth increased, however not by as significant difference as seen in the other county types. Also the pattern of development occurring in a bell curve shape is not as pronounced here. Development seems to be somewhat evenly disbursed for all the travel-time zones except for the farthest away, where there is a slight decrease.

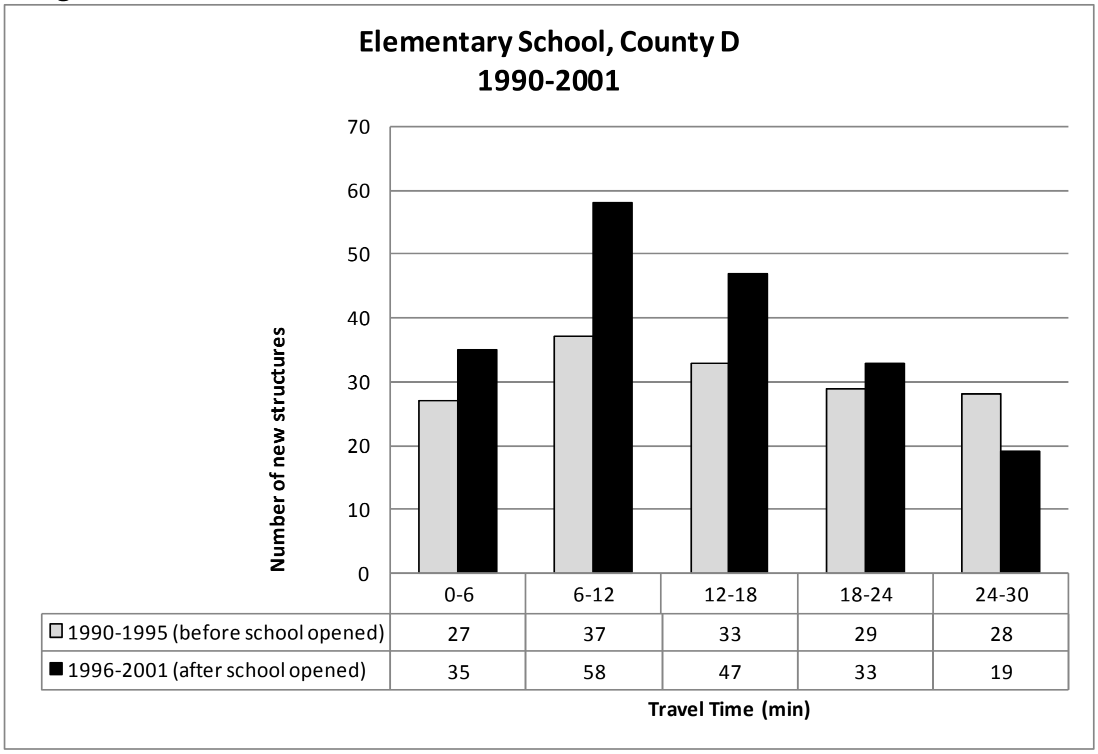
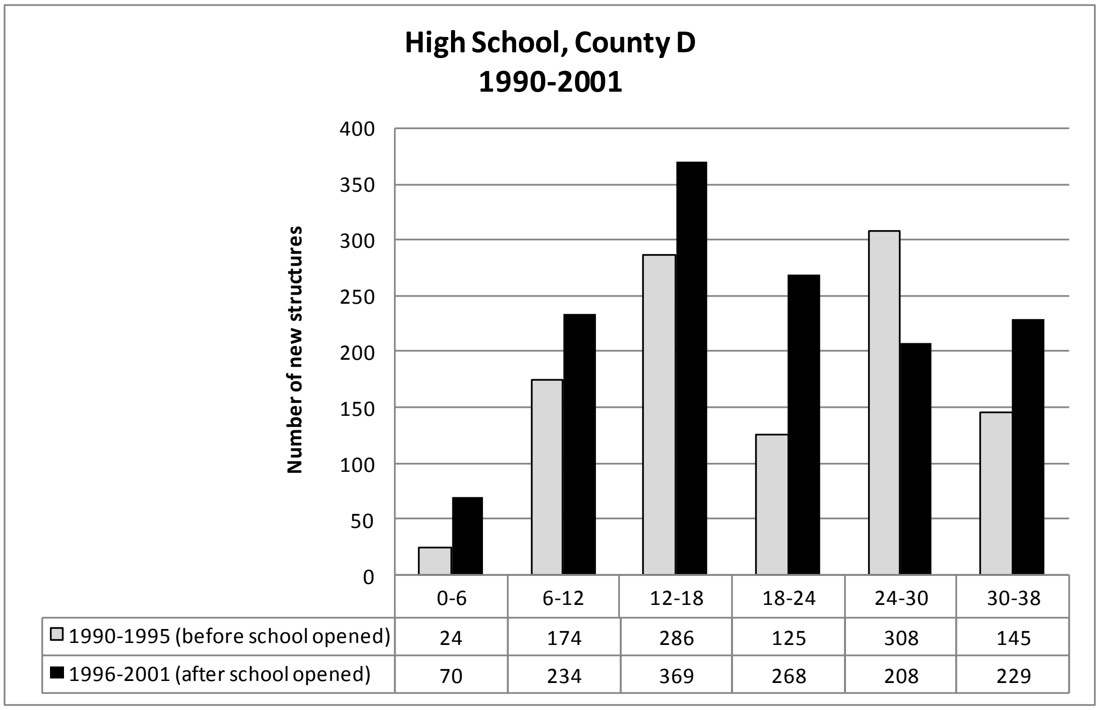


Figure 5.7 – New Structures, County D, Elementary School

Figure 5.8 shows how the growth in the out years exceeds growth before the school opened in all except the 24-30 minute travel time band. The major difference between the growth patterns seen here and every other county is that the growth tends to be dispersed somewhat more evenly than seen before. This could be a result of less defined growth areas in a rural county where there is likely not sewer to most areas anyway. When sewer access is limited, growth tends to happen sporadically and is not centered around a sewer line. Some of this could also be a result of the high school not impacting development patterns significantly. Prior to this high school, there was only one high school in the county. It is possible that there was a growth area that was previously served by the original high school and was intentionally brought into the school attendance boundary by way of redistricting when the school was opened.



	0-6	6-12	12-18	18-24	24-30	30-38
1990-1995 (before school opened)	24	174	286	125	308	145
1996-2001 (after school opened)	70	234	369	268	208	229

Figure 5.8 – New Structures, County D, High School

5.1.3. Summary of Growth-Travel Time Analysis

A matrix was completed to summarize the relationship between pre- and post- school construction development in each of the eight schools. Table 5.4 provides a quick overview of the data presented in the previous tables. To summarize the data, the travel time contours were grouped into three groups and the factor of growth before the school was built to the growth after the school was built were calculated.

In all cases except for the elementary school in the mature suburban county, growth increased after the school was built for the travel-time contours nearest the school site. In all cases except for the high school in the mature urban county, growth increased after the school was built for the travel-time contours in the mid-range. The results for the travel-time contours were mixed.

Table 5.4 - Growth Pattern Summary Matrix

Elementary School

District Type	Close to school	Mid-Range	Far from school
Mature Urban	+	+	+
Mature Suburban	—	+	—
Developing Exurban	+	+++	——
Rural	+	+	—

High School

District Type	Close to school	Mid-Range	Far from school
Mature Urban	+	—	—
Mature Suburban	+++	+	+++
Developing Exurban	+	+	++
Rural	+	+	—

— pre-school development exceeded post-school development by a factor of 1.0 - 1.99
—— pre-school development exceeded post-school development by a factor of 2.0 - 2.99
——— pre-school development exceeded post-school development by a factor of 3.0+

\+ post-school development exceeded pre-school development by a factor of 1.0 - 1.99
++ post-school development exceeded pre-school development by a factor of 2.0 - 2.99
+++ post-school development exceeded pre-school development by a factor of 3.0+

5.2. Interview Results and Discussion

A major input to this research was the 17 interviews conducted over a period of several weeks with school facility planners, school board members, and state educational facilities officials. The questions asked as part of this research effort were aimed at determining the context in which school site decisions are made and identifying the institutional barriers to improve cooperation between school districts and local governments.

In Georgia, there is a fairly wide disparity between school districts that cooperate with local governments and those that do not. The interviews brought to light some of the issues that different types of communities face. This discussion addresses some of the issues raised in the interviews. These include site size requirements, cooperation between county and school planners, school district view of renovation versus new construction, and overall challenges school districts face with regard to facilities. A summary of those responses are given here, but a detailed table of responses is given in APPENDIX A.

5.2.1. School Planning Process

In all counties interviewed, facility planners and school board members were asked to describe how the planning process worked in their district. Most commonly they gave a description of the five-year facility plan as required by GaDOE. This process includes looking at development patterns and projected land use and calculating the required space needed for the planned development. These factors are based on an average number of children per housing unit. Those projections are used as inputs to the existing educational facilities given the current attendance boundaries. When a school exceeds capacity, it is assumed that portable classroom units will take up the additional enrollment up to 120% of capacity. Then, a new school site must be found.

Most commonly, school sites are selected by simply choosing a point between two currently overcrowded schools. The district looks for land located geographically between the existing overcrowded schools and selects a site that has sewer access (or reasonable planned sewer service), adequate lot size, and adequate transportation facilities. In most cases, school districts wanted to avoid state highway routes as the main access point for the school because of problems getting traffic signalization warrants for the small peak hour generated by school traffic. Instead school districts tried to locate near a state route where a secondary arterial would serve as the main entrance for the site.

Does development lead schools or do schools lead development? This was viewed differently by each school district. Most acknowledged that it was difficult to determine what leads. The urban and suburban counties all had data-driven planning processes that projected where growth would occur and attempted to match school capacity with the anticipated growth. The exurban and rural districts, however, did not have a sophisticated method for school site selection and instead relied on site donations by developers and inexpensive land on the outskirts of existing neighborhood development.

Although there was no consensus about how development patterns occurred, there were several instances where facility planners suggested that practices relating to school siting did drive development patterns. Table 5.5 provides an example of some of the quotes from the interviews. School facility planners ranged from acknowledgement that growth would follow anywhere the district chose to build a school to stating that linking local government planning with school planning was a primary goal.

Table 5.5 – Selected Quotes from Interviews

School Type	Quote
Developing Exurban	"If schools were allowed to collect impact fees, our primary funding source for school construction, the ESPLOST, would be very difficult to implement."
Developing Exurban	"We have lost a sense of community in this county. We recognize that a school location will shift development patterns from where they need to be."
Developing Exurban	"We want a 'live, work, play' community, but 'educate' is always left out."
Developing Exurban	"You can bet if I just went out in the middle of nowhere and built a school, within five years there would be development around it."
Developing Exurban	"We're normally out there first. There are no [community facilities] where we want to go."
Developing Exurban	"Every time we go out and buy a piece of land, we're putting a school out in a rural area by itself."
Developing Exurban	"School districts are chartered by the state constitution with their own governing bodies. County governments are chartered by the state constitution. They don't talk to one another very much. That is a symptom of the Home Rule provision in the state constitution. Sometimes staff wants to talk to each other, but their bosses—the elected officials—don't want them to."
Mature Suburban	"We build our schools so big, existing neighborhoods are not as important."
Mature Suburban	"We're not going to build neighborhood schools; it's just not economical."
Mature Urban	"Our goal is to link up what happens in the local government to school planning and siting."
Mature Urban	"Everything that happens in our county in terms of operations—where are the teachers, classrooms, when to build a new school—is directly linked to what is happening in municipal and county planning departments."
Rural	"The educational system is definitely what brings people to our county; you can eliminate any question about that."
Rural	"We build schools where we can spread out and the neighborhoods tend to grow up around the schools."
State Agency	"The playing fields and parking lots are the 'tail that wags the dog' in facility construction and site selection."

5.2.1.1. Rating School Planning Intergovernmental Collaboration

Due to no state regulation in terms of who should be involved in school planning, collaboration occurred to a different degree in every county interviewed. To help frame the level of collaboration between municipal and county government with the school district, an evaluation framework was used. This framework is adapted from a paper by David Salvesen, Andrew Sachs, and Kathie Engelbrecht [46]. The framework consists of three levels along the "continuum of collaboration." The following describes the framework in detail:

- **Level 1** describes a situation in which each entity (school board, county commission, municipality) conducts its business independently from the other with little or no coordination beyond what is required by law. In Georgia this describes a situation where school districts only communicate with GDOT (as required by law) when a school site is near a state route. Level 1 collaboration means that there is no necessary communication with the local government. Under this level, counties and municipalities would approve new subdivisions and the school districts would select new school sites independently. Decisions are made without any input from each other.

- **Level 2** describes a situation where each entity understands that there is more to gain by working together than independently. School districts retain full authority to select school sites, but consult with other entities before making final decisions. Occasional meetings are held between staff members, and on rare occasions between elected officials. Usually agreements are made through a Memorandum of Understanding (MOU). Many times this level of collaboration would occur as a final approval stage. That is, rather than communicating with each other as the decision process is advancing, communication would happen at final approval after the decision already has significant momentum.

- **Level 3** describes a situation where collaboration is institutionalized. Each entity retains autonomy and authority to achieve its objectives, but executes its mission in collaboration with other entities. Proposed subdivisions are analyzed for their impact on schools, and approved only if adequate capacity exists. Potential sites for schools are identified in local land use plans. A school board representative sits on the county commission as a nonvoting member when rezoning is on the agenda and county commissioners sit on school boards as nonvoting members when school facility planning is on the agenda.

Schools surveyed in this research varied among these three levels. A total of nine school districts were interviewed as part of this research. The author took into consideration the responses to the interview questions and ranked the school districts based on those responses. Only one school district received a *Level 3* ranking. This was the developed urban school district because of the partnership between the district and the county commission and municipalities it served. In this case, data about development decisions was made available to the school district, and the school facility planner developed site recommendations based on yearly reports from the county and municipalities.

Four of the districts received a *Level 2* ranking for their limited cooperation with county and municipal governments. Some districts had policies in place that provided that there would be a representative of the school board on the planning and zoning commission for the county. This was an effective policy in most districts, but one facility planner complained that this position only allowed access to the end of the application process. By the time the planning and zoning commission reviewed the application, there was already so much momentum that it was difficult to reject. The facility planner felt limited in his ability to influence and shape the development around the school, but was complimentary about the access to the knowledge that the development would be coming online.

Other school districts had policies in place to meet periodically with county and municipal officials. This occurred either on a monthly basis or quarterly. In all cases, the meetings were at the request of the school district and hosted by the school district. The facility planners felt that this was a workable solution to communicating regularly with county officials.

Four school districts were rated as *Level 1* because of the lack of consistent cooperation with the local government. These districts indicated that there was little communication between staff at the school district and staff at the local government. Furthermore, there was little communication between the elected officials at these organizations. In one case, where there was little communication between agencies, the staff expressed desire to collaborate, but was unable due to political differences between board level officials. This resulted in uncoordinated action on the part of the school board and the county commission and forced the school district to constantly take a reactive position.

5.2.1.2. Relationship Between School Planning and Development

One of the common themes that came out of the interviews was the relationship between schools and development patterns. This is a circular pattern that is driven both by the schools themselves and by the municipality approving the subdivisions. Figure 5.9 illustrates the circular relationship. This is a simplification of the process by which developers, school districts, local government, and households relate to each other. It is important to note that these relationships are complex and involve much more than what is illustrated here, but the fundamental relationship is an accurate representation of the data collected in the interviews.

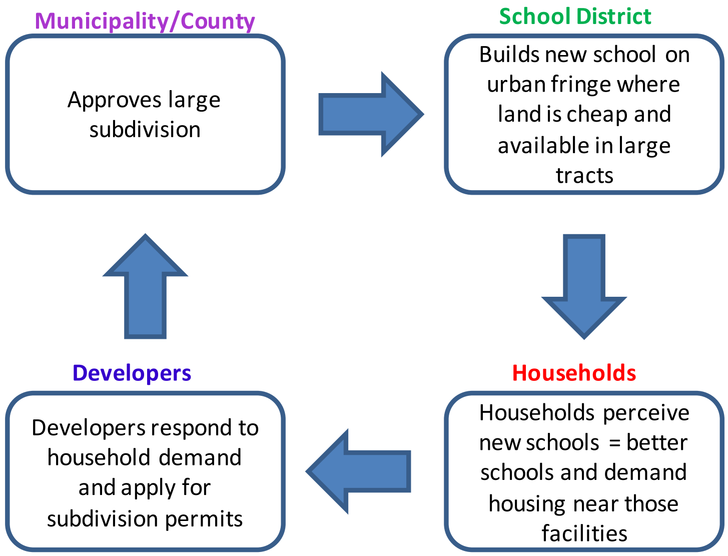


Figure 5.9 – Relationship Between Schools and Development
Source: Author

As local governments approve subdivisions and rezoning, school districts respond with planning new school facilities. In suburban and exurban settings where schools compete with housing for land, they often choose to locate on the fringe where land is least expensive. This "frontier" leadership causes households to demand housing near the new school. Developers respond to this by creating new housing and applying for subdivisions which starts the cycle again.

This pattern was confirmed through several interviews. School planners in districts where there was little cooperation with local government often felt as though they were always reacting to the decisions of the county commission on development. In order to make more collaborative decisions, it is necessary to have a framework in place by which school facility planners and local government planners can share in information and decision-making power.

5.3. Schools and Transportation

Although school planning and transportation planning are usually conducted in entirely different contexts, it is important to note the intersection between school planning and transportation infrastructure. In 1969, when the first National Household Transportation Survey (NHTS) was completed, 48% of students walked or biked to school. When the 2001 NHTS was done, less than 15% of students walked or biked to school [13]. This significant decrease in walking to school has many observers concerned that the facilities built today do not allow for safe biking and walking. Interviews with facility planners confirmed that existing neighborhood infrastructure development is not a significant consideration when siting a school.

Research has shown that 7-11% of morning non-work trips occur as a result of school drop-offs (this figure is actually understated because it does not include trip chains that include a stop for a school drop-off, as those would be considered work trips) [2]. The question becomes how to address school planning in the context of transportation planning. Although GDOT is notified of school siting decisions statewide, usually there is no comment on the location unless the school would directly impact a state route. Interviews showed that in almost all cases, school districts avoid building schools where the direct access point is on a state route. Instead, schools are designed to accommodate all pick-up and drop-off traffic on-site and many do not have adequate pedestrian or bicycle access. In many cases, this leaves driving as the only safe transportation mode to school.

What are the linkages between transportation and the development environment? Figure 5.10 illustrates a simplified version of these linkages. Three primary influences impact residential development: land use policy, transportation infrastructure (providing accessibility), and the local economy. Residential development then impacts commercial development. As the saying in commercial development goes, "follow the rooftops," meaning commercial development will follow where the residential areas develop. Both residential development and commercial development determine the local tax base. This dynamic is different for every local area. The mature urban and suburban communities have a diverse economy that better supports school funding through sales taxes. Developing exurban communities have a difficult time achieving a good balance between residential and commercial and often have shortfalls with sales tax revenue. This impacts school districts that rely on sales tax revenue for capital programs through the Educational SPLOST.

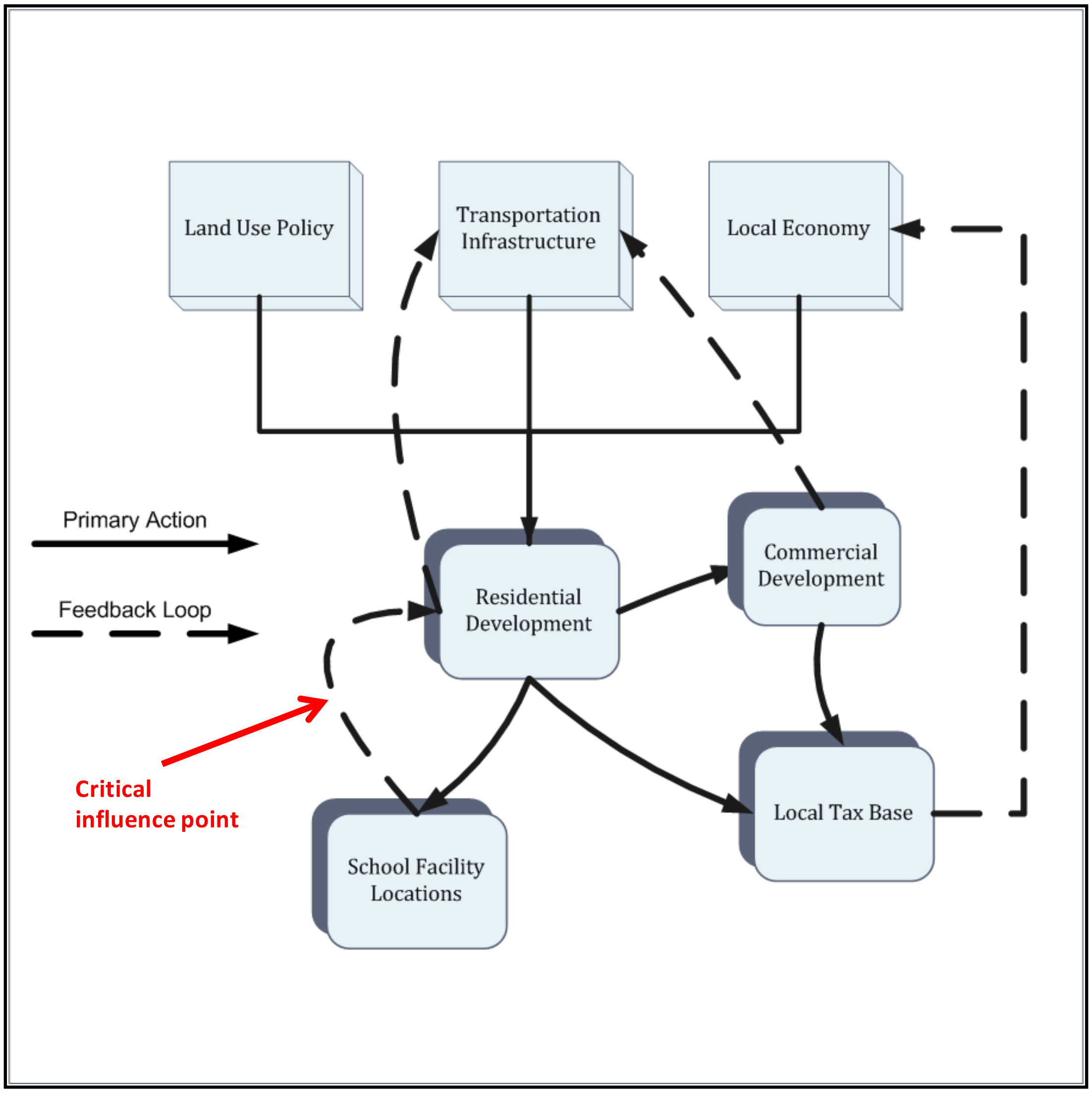


Figure 5.10 – Linkages Between Transportation and Development
Source: Author

The interviews showed that school facility locations are primarily impacted by the residential development patterns. Discussions with school officials also suggested that there is a feedback loop in which school facility locations also impact residential development. If planners strive to have more effective smart growth policies, this feedback loop seems to be a critical point at which local government can influence land development patterns. By harnessing the feedback effect of school sites on residential development, local government can influence patterns of schools on development patterns and influence the growth through means of public provision of schools in already developed areas.

5.3.1. Traffic Counts Near School Sites

Traffic counts were used to determine the amount of traffic growth in a school attendance boundary over time. Figure 5.11 shows an example of a school attendance boundary with traffic count stations located in and around it. The traffic count locations within each school attendance boundary were selected and their associated data exported to Excel. Upon exporting, further analysis was done to determine any travel patterns that can be easily seen. Elementary schools and high schools were analyzed separately.

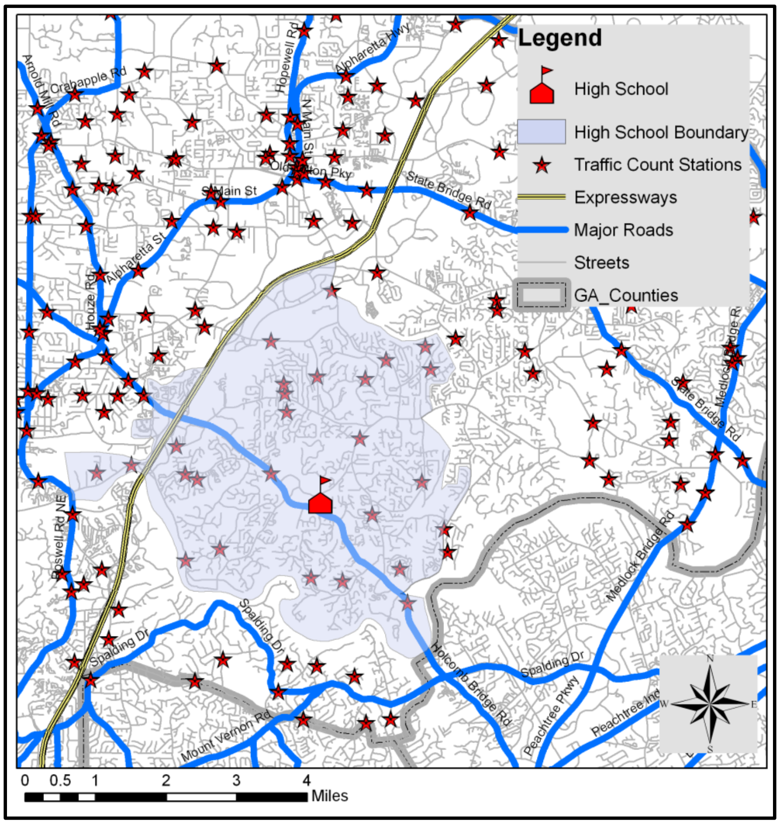


Figure 5.11 – Traffic Count Locations

Traffic levels did not fluctuate considerably for either the elementary school boundaries or the high school boundaries. Figure 5.12 and Figure 5.13 show the Average Annual Daily Traffic (AADT) all of the valid points (those with no zero values) for years 1998-2007. AADT is defined as the average 24-hour traffic volume on a road. The values are mostly flat; except for the mature suburban county (County B) elementary school which showed a gain from 4,900 to 8,400—almost doubling over the ten year time period—an increase of 71%. This only takes into account Average Annual Daily Traffic, and does not consider school peak hour as a separate measurement. Measures for specific sites around the school during peak hour were not available for this analysis. Further study could be done to measure the impact over time of schools on traffic, but that level of detail was not available for this study.

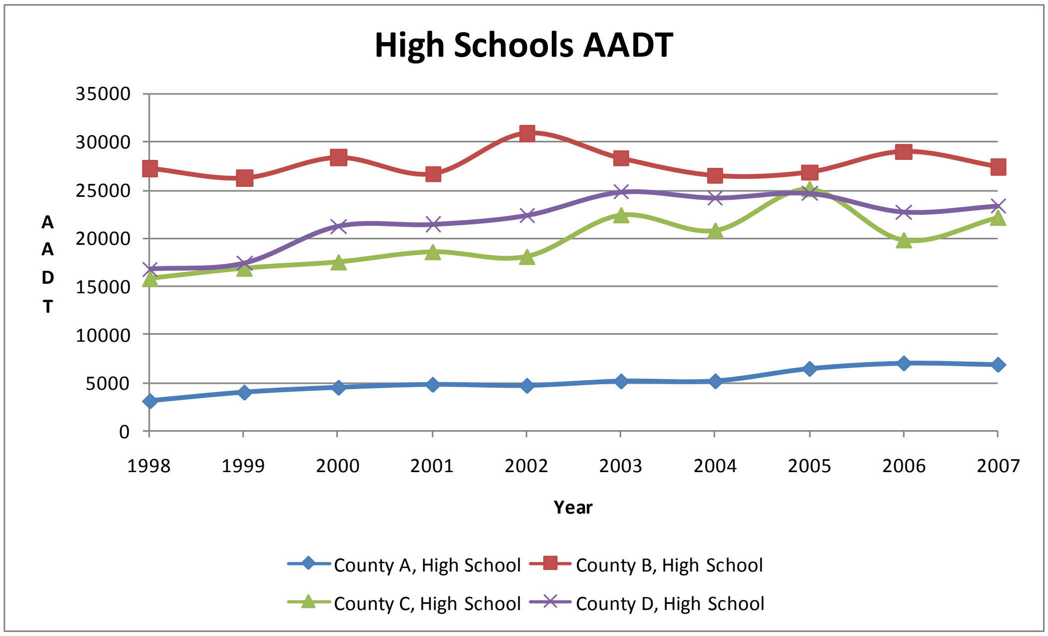


Figure 5.12 – High Schools AADT

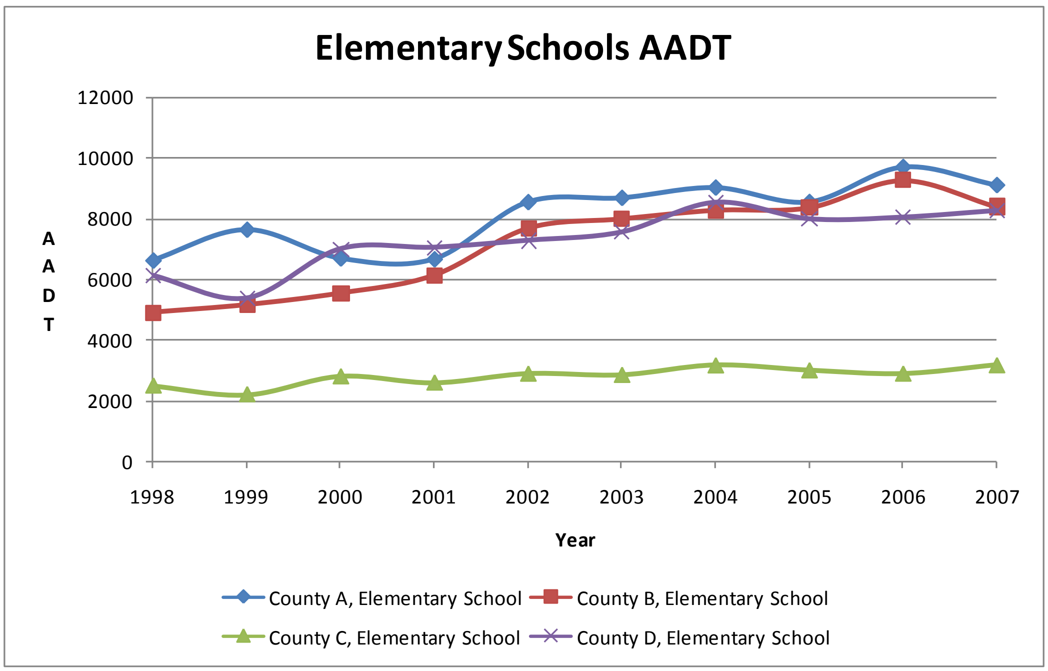


Figure 5.13 – Elementary Schools AADT

5.4. School Capital Funding Sources in Georgia

In 1985 the Georgia legislature authorized counties to levy a one percent sales tax to fund infrastructure projects, subject to a referendum at the local level. This program, known as the Special Local Option Sales Tax (SPLOST) could be used to pay down debt on existing infrastructure or build new infrastructure on a "pay-as-you-go" basis. This allowed counties to relieve the pressure and financing expense of bonding and pay for projects up front. Voters throughout Georgia supported this program, and in many counties continue to renew the funding when it expires. For example, Gwinnett County has had multiple SPLOST programs that have been used to pay for new county administration buildings, transportation projects, parks, and public safety [47]. By law, the SPLOST is limited to five years, and must be renewed by voters.

In 1996, the state legislature authorized another form of funding similar to the SPLOST. This funding mechanism, called the Educational Special Local Option Sales Tax (ESPLOST) was designed for school districts. It allowed districts to utilize the same financial vehicle as the counties had used for infrastructure improvements. ESPLOST programs also have a limit of five years before they must be renewed by voters.

The Georgia Department of Education also administers another source of capital funding, called Capital Outlay Funds. These are entitlement funds for which every school district is eligible. Capital Outlay is determined annually in the state budget and can be up to $200 million per year [48]. Although this is an important source of funding for school districts, the ESPLOST revenue far outweighs Capital Outlay. The following discussion details both the ESPLOST and the Capital Outlay programs.

5.4.1. Georgia's ESPLOST

In Georgia, many school districts are funded by the ESPLOST. By 2008, 154 of Georgia's 159 counties had an ESPLOST program [5]. These programs consist of a one-cent sales tax that can only be used for capital projects, repayment of existing bond debt, and issuance of new bond debt to be repaid with the ESPLOST revenue. The projects are limited by the Georgia Constitution to only include on-site capital improvements to schools; therefore, the ESPLOST cannot be used for operating funds. The revenues generated from the ESPLOST are usually used to match state funding administered by the GaDOE. Since state funding does not cover the full cost of construction, many school districts rely heavily on this funding source for their capital programs, maintenance, and renovation of their educational facilities.

Georgia is unique in that it is one of the few states that allow sales taxes to be designated specifically for education. The issue is that some argue that the ESPLOST program creates inequities because the school districts with high retail tax revenues are disproportionately advantaged compared to districts in bedroom communities [49]. Nonetheless, all school districts interviewed in this study strongly supported the ESPLOST program as the only way to secure sufficient capital funding without using bonding.

The ESPLOST represents a shift in the capital funding structure from the property tax to the sales tax. Before the program began (and currently for districts without an ESPLOST), districts relied solely on a property tax surcharge to repay the debt incurred with bonding. Property taxes still go to pay for operational expenses, but capital expenses are now heavily reliant on the ESPLOST. Interviews conducted in this research found that this financing structure is very popular with school districts throughout the state because they can now build schools without indebtedness. Most school planners agreed that the ESPLOST funding was crucial to fast-growing districts keeping up with the growth in enrollment, and that this funding mechanism saved the district considerable interest expense that would otherwise be borne with debt financing.

5.4.1.1. Sales Tax and Transportation

In 2008, the Georgia General Assembly considered allowing additional sales taxes to be levied at a *region-wide* level to fund transportation projects. In order for this to succeed, it would require a constitutional amendment through a referendum, enabling the sales tax cap to be raised. The legislation failed on the last day of the legislative session at the eleventh hour [50]. However, it is likely that in the 2009 legislative session a transportation sales tax (either regionally or on a statewide basis) will be approved to go to the voters in November 2009 [51]. If this occurs, school districts and transportation will be competing for funding at the ballot box. There will be increased competition to convince voters that both transportation and education are good infrastructure investments.

Because of this concern of competing interests for sales tax funding votes, it is even more critical for transportation and education to establish relationships to work together. Although it is still unknown what entity would administer a region-wide sales tax for transportation, it will be critical to maintain cooperation so that a new transportation funding source does not cannibalize education capital funding.

One way to build this trust is to have institutional arrangements *before* the referendum goes to the voters. This will prove that schools and transportation agencies, like GDOT, are cooperating to ensure that tax dollars are spent in the most efficient manner possible. By using education funds to strategically place education facilities where growth will utilize *existing* transportation infrastructure, there will be an increased synergy across governmental functions. By cooperating both education and transportation funds will stretch further and gain the trust of the electorate.

5.4.2. Capital Outlay Funds

School capital finance differs greatly throughout the United States. Some states, such as Missouri, Nebraska, and Oklahoma, prefer to leave the capital financing up to the individual school districts and local governments and only provide funding for operational expenses. Other states, like Georgia, New Jersey, and Maryland, actively participate in capital funding programs [34]. Georgia's capital program is called the Capital Outlay Program. This source of funding provides school districts a maximum of $200 million each year statewide for improvements and new construction to school facilities. Each year, these funds are authorized in the state budget from the general fund.

Funding is provided for four types of capital improvements: a) new construction, b) renovation of existing facilities, c) addition to existing facilities, and d) modifications (i.e. HVAC, roofing). In each case a local match is required. Funding is based on a ratio of need in a given school district versus need on a statewide basis. Districts with faster growth receive proportionally more than districts that have slow or no growth.

To be eligible for funding from the state, each school district must have a five year facility plan that includes projections for enrollment and available facility space in the district. The five-year plan must also include any plans to consolidate or divest any facilities. The funding structure is separated into four categories: a) regular entitlement funds, b) regular advanced funding, c) exceptional growth funds, and d) low wealth funds. These four funding pools are separated to ensure that funds for schools in rapidly growing districts do not consume all of the state funding for schools and leave other slower-growing districts behind. The separate funding pools also protect the low wealth districts from being unduly left out of the funding pool [48].

Entitlement funds are determined by a ratio of individual district need to statewide need. Each district is allocated an amount determined by the entitlement ratio. From this point, districts can choose to speed up the construction process by supplementing the state funds with local funding (many times from the ESPLOST), or wait until the annual authorization has accumulated enough to fund the construction project. The state will fund at the level specified in Table 5.6.

Exceptional growth funds are reserved for districts that have at least 1 ½ percent annual growth and add at least 65 students each year. The exceptional growth funding in almost all cases is used in metro Atlanta school districts, because this is one of the only areas of the state growing at a rate fast enough to qualify. Exceptional growth funds are set aside separate from the regular funding pool.

Table 5.6 – Funding Level for Regular Classrooms (IU)

Category	**New Construction**	**Additions**
Elementary	$71/sq. ft 1,800 sq. ft. per IU	$71/sq. ft 750 sq. ft. per IU
Middle	$73/sq. ft 2,200 sq. ft per IU	$71/sq. ft 660 sq. ft. per IU
High	$75/sq. ft 2,850 sq. ft. per IU	$71/sq. ft 600 sq. ft. per IU

Source: Georgia Dept. of Education Facilities Division
*Note: IU = Instructional Unit (one classroom equivalent)

Capital outlay funds can be accrued year over year, which allows the school district the flexibility to choose when to match the local dollars with state dollars to initiate a capital project. Because of the limits on what the state will fund (see Table 5.6), usually the school district must come up with additional funds to supplement the state funds. Rarely is the $71 to $75 per square foot allowance enough to actually construct a facility [52]. In addition, capital outlay from GaDOE may only be used for the building itself. Local funds must be used for land acquisition, athletic facilities, parking, and any other site improvements other than the instructional space.

Renovations are also funded by the Georgia Department of Education. Renovation funds are available after the school is 20 years old and are available at $12,000 per instructional unit (IU). Renovation funds from the state are only available once per building. If an entire school building is being renovated, the state will only provide funding if the total cost of renovation does not exceed 50% of the replacement cost for the same number of instructional units [53]. Table 5.7 illustrates some of the renovation and planning requirements from selected states. Some states do not have maximum renovation funding while others set maximum funding levels at 65% of replacement cost.

Table 5.7 – Funding and Planning Policies for Selected States

State	Funding for Capital School Improvements	Planning Requirements	Other
Arizona	When renovation exceeds 65% of replacement cost, state recommends new construction	No requirement to comply with zoning law	
California	No position on renovation vs. new construction	Schools and counties required to meet if one party request. Legislation requires schools districts and county planning officials to work closely on school siting	Set aside $50M of the total state capital budget for schools for joint-use facilities
Colorado	Renovation discouraged when cost exceed 65% of replacement cost	Board of Education must inform the local governing body of the proposed site	
Connecticut	Neutral on renovation vs. new construction	None	Local share of school funding must be approved by the town
Florida	$332M budgeted for construction and renovation in 2002-03	School board and governing body "shall agree on a process for assuring coordination with local, regional, and state governmental agencies to assure compatibility with comprehensive plans."	
Georgia	$200 million annually for school capital construction. When renovation cost exceeds 50% of replacement cost, state funds are not available.	School districts *are* required to meet local zoning laws. 5-year facilities plan required. No special requirements for community outreach, but 5-year plans are approved at public board of education meetings	Educational Special Local Option Sales Tax is an option on a county-wide basis in all Georgia Counties.
Maine	Neutral with respect to new construction vs. renovation. State has revolving loan fund to finance renovation projects	Requires superintendents to work with the State Planning Office when making decisions regarding new sites. Encourages districts to: a) avoid sprawl, b) consider renovation or expansion, c) analyze sites for proximity to established neighborhoods, and d) select sites served by adequate roads	
Maryland	Favors renovation over new school construction consistent with the Maryland Smart Growth Policy. 80% of state school construction funding is spent on existing schools	Planning requirements include: a) discouragement of sprawl development, b) located in developed areas or locally-designated growth area, c) served by water, sewer, and other public infrastructure	Maryland has some of the strongest planning policies of any state with regard to schools
Massachusetts	Will reimburse up to 100% of replacement cost for renovations	No consistency requirement between school facility planning and general land use planning	
New Jersey	All facilities considered to be suitable for rehab unless a pre-construction evaluation determines otherwise	School districts required to file long range school facility plans with local planning boards	
Pennsylvania	Provides same level of reimbursement to renovations and new construction	Districts must comply with local zoning codes. Districts must also conduct school facility studies prior to obtaining state funding	Eliminated the 60% rule in 1998, so that renovations could be funded at the same level as new construction

Source: Nat'l Trust for Historic Preservation [34]

CHAPTER 6
RECOMMENDATIONS AND CONCLUSION

6.1. Summary

From an institutional standpoint, this report concludes that there is a disconnect between school planning and land use planning in Georgia. Although some school districts actively coordinate with their local government, often coordination is not formalized, and therefore differs in terms of effectiveness. Even when school districts place staff on the planning and zoning commissions, often they are only asked for their input at the end of the process instead of at the beginning when a developer submits an application for a rezoning. This disconnect can result in two government agencies working against each other without knowing that one impacts the other.

While each agency may be fulfilling its goals and objectives from their viewpoint, from the perspective of the taxpayer, there is a conflict. Both county government and school districts are funded with taxpayer dollars, but are charged with different responsibilities and objectives. School planners are responsible for developing enrollment projections, facility plans, and building/renovating school facilities. County governments are charged with serving the interests of the community at-large by adopting land use plans and making decisions about the provision of infrastructure. Both school districts and county government have their own elected bodies that determine policy and make final decisions for their respective constituency. Each are given the authority to do what is necessary to carry out their mission by the state constitution. Each have funding mechanisms that allow them to determine budgets separately.

In areas where there is rapid growth and new development, school districts scramble to keep up with building facilities for students moving into their district. Often, residential development occurs years before significant commercial development and creates a lag in terms of sales tax revenue. It forces schools to make decisions quickly and based on where they can get the most "bang for the buck." In most cases this means siting schools on inexpensive land where a large school can be constructed and ensuring there is enough room to expand the school itself or even build another school on the same site in the future. School districts look to the state Department of Education to help fund capital improvements. In Georgia, although funding is available for existing school renovation, the funding match is higher for new construction. School districts usually recognize that new construction leads to the best return for their local match and choose to build new facilities more than renovate existing facilities.

Analysis of the data shows that in mature suburban counties, a school's attendance boundary shows some correlation with faster growth rates than the surrounding community (defined as the county as a whole). Although the causality of the growth rate cannot be absolutely determined, the statistical relationship between growth in the school attendance boundary and the school build date is moderate. This was determined through the chi-square statistic that measured independence between distance from school and whether or not the school was in place. The chi-square statistic suggested that these two variables were *not* independent. In mature urban, developing exurban, and rural counties, the results are unclear. In some cases, development occurred much more rapidly before the school was built, and other cases showed the growth increased after the school was built.

When the issue is examined from the perspective of distance from the newly built school, independent from the type of county, the results are somewhat clearer. In almost every case (except for close travel-time to the mature suburban elementary school and mid-range travel-time to the mature urban high school) the growth in the close and mid-range travel times increased in the years after the schools were built (see Table 5.4). This result may indicate that the construction of the new schools had some impact on the new development surrounding the school site.

The limitations of this research are primarily that a true causation cannot be determined. Without knowing the full range of factors that go into a home buying decision, it is difficult to conclude what actually caused the household to locate in the new school's attendance boundary. Future research involving household surveys that ask questions related to school choice may be able to answer this question more fully.

Interview results from the school planners and school board members indicated the need for coordination in school planning. Although some school districts have a limited form of collaboration, many do not. School planners were frustrated with always being in a state of reaction to new housing development approved by the county. School planners agreed that increasing inter-governmental collaboration is the key to solving the problems of disjointed planning. Some districts attempt to collaborate with their corresponding local governments by placing representatives on the local planning and zoning commission. This can result in increased coordination of infrastructure provision and adherence to land use goals for the county. However, the development approval process can involve many steps and many times the planning and zoning commission in a locality may not be involved in the decision until the very end of the process, making it difficult to stop a development from occurring, or requiring there to be adequate provision of educational facilities before the development is approved.

Transportation tax policy is sure to be an issue in the 2009 Georgia legislative session. With fewer resources and increased scrutiny from the public demanding responsible use of taxpayer dollars, it is important for transportation agencies like GDOT, GaDOE, local school districts, and local governments to coordinate so that better resource allocation can be achieved. Better relationships between staff *and* elected officials are needed to make coordinated planning work.

6.2. Recommendations

One of the most important outcomes of this research is a better understanding of the linkage between school facility planning and land use planning. As evidenced by the interviews conducted with this research, there is a wide disparity in the level of communication between local land use planners and school facility planners. Some districts cite very strong relationships between themselves and the local land use planners. Others admit that it is rare that they have any input into the development process.

One way school planning has been integrated with land use planning is by having the county incentivize the school district to build on sites that help to implement the county land use plan. In Orange County, North Carolina this was done successfully by giving the school district a bonus for making the school meet High Performance Building (HPB) standards. The school district was able to get $1.9 million for having sustainable design standards. In addition, the county was able to improve transportation around the school site to give students walking and biking facilities to access the school [2]. Although applied to a slightly different context, this same approach could be used to provide incentives for schools to build in areas where housing has already been planned.

Some specific recommendations for better coordination of school planning are:

Establish regular face-to-face meetings between county staff and school planning staff. Having regular meetings at the staff level will allow the agencies to know how to plan for what the other is doing. School districts will have more timely information and local land use planners can incorporate schools into their comprehensive land use plans.

Execute a Memorandum of Understanding (MOU) between school boards and municipal/county planning officials that commits to planning with smart growth objective in mind. This will formalize the relationship and commitment to cooperation between the two agencies. By having a formalized commitment, it ensures that staff knows the school district superintendent and the county commission have agreed to work together.

Establish a listserv of email addresses that can be used to facilitate communication between school and county staff. Communication is critical to make the collaboration between agencies work efficiently. Because school districts and county governments are rarely located in the same building, communication can be time consuming. Using email as a means to communicate up to date planning and school enrollment figures ensures that districts remain in constant contact.

Develop an Adequate Public Facilities Ordinance (APFO) for the county that addresses school siting with respect to development patterns and subdivision approvals. APFOs require coordination between development approval and infrastructure provision. This gives local governments and school districts time to catch up to growth in development and provide adequate public services.

Revise statewide funding formulas to favor renovation of existing schools by adjusting the state match percentage. School districts are encouraged to build new facilities through funding preference for new construction. Increase the share of funding for existing facilities so that districts have more incentive to renovate existing school sites.

Implement maximum parking requirements for schools. Parking is often looked to as the driving factor in determining the need for a large site, but parking requirements could be reduced by providing easy access to the school by means of safe walking routes and bicycle facilities.

Utilize shared athletic facilities by coordinating with county parks and recreation staff. Many counties surveyed had no significant park space, so resources could be combined to arrive at mutually beneficial solutions that provide citizens with park space and also provide the school with necessary athletic fields.

Establish school planning coursework in City & Regional planning programs so that planners have a context of school planning. Educational programs relating to school planning are virtually non-existent in city planning curriculum today. Many planners do not consider school sites as part of their scope because school planning falls outside the typical scope of land use planning.

In Exceptional Growth districts establish statewide requirements that schools be near existing development. Exceptional Growth funding can be used as a tool to encourage smart growth principles by siting the school near the neighborhoods that already exist.

6.3. Suggestions for Further Research

One major limitation of this research effort is that it does not identify the reasons for households moving into a particular neighborhood with respect to the school. This research effort used secondary data that only looked at growth patterns of new structures. It was assumed that new housing built in the school attendance boundary indicated a revealed preference for new schools. However, the actual home buyers and developers were not interviewed to determine their stated preferences.

Further research that examines household stated preference for schools relative to other factors would be valuable to further the knowledge about what is important to households. Would households choose older established neighborhoods if the schools in those neighborhoods were higher quality? Would renovating schools in older neighborhoods be enough to cause middle-class families to stay in town instead of fleeing to the suburbs? These are questions that could be answered by using stated preference surveys and interviews with individual households.

APPENDIX A
INTERVIEW QUESTIONS

School Facility Planning Questionnaire
School Facility Planners

1) In general, how is school planning done in <*blank*> County?

2) What factors are evaluated when considering school location decisions?

   Growth patterns | Transportation facilities
   Utility accessibility | Existing neighborhood development
   Price of land | Parcel size
   Accessibility to other community facilities (i.e. parks, libraries, rec center, etc.)

   Others (please specify)

3) Are recommendations about school locations made primarily by staff or by the school board members?

4) Are decisions about school locations made primarily by staff or by the school board members?

5) Is renovation considered a feasible option if an older school is located near existing residential development? Is this possible using the current Georgia Dept. of Education funding formulas?

6) Currently, the Georgia Department of Education requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high school facilities (plus one acre per 100 FTE). If there were less stringent acreage requirements from the Georgia Department of Education, would <*blank*> County Schools consider building multi-story buildings on smaller parcels?

7) Are developers ever required to provide a school site as part of the agreement for their approval to develop, or is that left completely up to the school district?

8) To your knowledge, has your county considered Adequate Public Facility Ordinances (APFOs) that would limit the development of housing subdivisions where there are not adequate public schools and infrastructure to support the development?

9) Is the lack of commercial tax revenue a significant hindrance for <*blank*> County schools in terms of obtaining funding for new school construction?

10) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?

School Facility Planning Questionnaire
School Board Members

1) What factors are evaluated when considering school location decisions?

    Growth patterns — Transportation facilities
    Utility accessibility — Existing neighborhood development
    Price of land — Parcel size
    Accessibility to other community facilities (i.e. parks, libraries, rec center, etc.)

    Others (please specify)

2) When considering a site for a new school, does the board prefer to renovate existing schools or build new school schools? Does the Georgia Department of Education make adequate funding available for school renovation?

3) Currently, the Georgia Department of Education requires a minimum of five acres for elementary schools, 12 acres for middle schools, and 20 acres for high school facilities (plus one acre per 100 FTE). If there were less stringent acreage requirements from the Georgia Department of Education, would the school board consider building multi-story buildings on smaller parcels?

4) Would the board be more likely to approve a school site further away from existing development and pay the higher transportation costs, or pay more for land an locate closer to existing development to save on transportation costs?

5) Has the school board ever considered working with the county to require developers to set aside parcels for neighborhood schools within their developments?

6) To your knowledge, has your county considered Adequate Public Facility Ordinances (APFOs) that would limit the development of housing subdivisions where there are not adequate public schools and infrastructure to support the development?

7) Is the lack of commercial tax revenue a significant hindrance for your school district in terms of obtaining funding for new school construction?

8) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?

School Facility Planning Questionnaire
Georgia Department of Education

1) How are current funding formulas designed with regard to school renovations and new construction?

2) When evaluating a school site, does DOE take into consideration the transportation impacts that a school's site will have or is that left primarily to the school district?

3) Many schools sites today are built apart from the current development. School districts cite a variety of reasons for locating beyond the fringe of development. Has the DOE ever considered a program that would incentivize school districts to build schools in already developed areas to avoid the added transportation costs to parents and the school district itself?

4) In the DOE Guide to Facility Site Selection there is recommendation for schools to be "appropriately located with respect to other schools and the population to be served." Does this definition allow school districts to build in areas with no development, but where development is expected to occur?

5) The Georgia Department of Education currently has minimum acreage requirements for school sites, however most school districts prefer larger tracts of land than the minimum. Has there ever been a consideration of a maximum site size to discourage excessive consumption of greenfield land?

6) If a school district decides to build on a smaller lot, does the DOE allow a waiver? What are the requirements to obtain a waiver?

7) What are the requirements of school districts and the DOE in terms of coordinating with local and state agencies (such as County Board of Commissioners, Regional Development Commission, and GDOT) regarding new school sites?

8) Does the DOE encourage school districts to coordinate with county government with regard to planning for growth and approving development plans? Has there been consideration to make that cooperation a regulatory mandate?

9) Are there any other policies you might recommend to integrate school planning with the land use planning process?

School Facility Planning Questionnaire
Georgia School Boards Association

1) According to the GSBA 2009 Legislative Positions section 1.C.9, the GSBA supports legislation that would require State and Local governmental planning offices to consider Local Boards of Educations' expansion plans as a separate planning and zoning factor in development decisions. Please expand on the issues related to zoning boards and school siting.

2) According to the GSBA 2009 Legislative Positions section 1.C.7, the GSBA calls for legislative action to provide waiver procedures for minimum acreage requirements. Does this request intend to encourage school districts to build on smaller sites?

3) How does the GSBA view the connection between land use and development and school siting decisions? Does the GSBA feel that school siting decisions should be made in cooperation with local land use planners?

4) Does the GSBA feel that the Georgia Department of Education allocates money fairly for the renovation of existing schools? If not, how should this policy be changed?

5) In section 1.C.11 of the GSBA 2009 Legislative Positions the GSBA recommends that there not be any redefinition of capital outlay for educational purposes. What does this mean?

6) In some other states, such as Florida, there is a requirement that development occur only when there are adequate public facilities (i.e. schools, sewer, roads, etc.) to support this development. Would GSBA support legislation that would require high growth areas to limit growth until the school districts catch up to the development?

7) Does the GSBA support school sites that are located in close proximity to existing development as a measure to help encourage smart growth principles?

8) Are there other policies or initiatives that the GSBA feels would better coordinate land use planning and school facility planning?

Question	**Summary of Responses from Facility Planners**
1) In general, how is school planning done in <*blank*> county?	Population is projected and the number of students is loaded into the existing instructional units. School sites are developed from a projection of where students will be in the next five years. The five-year plan is developed from these projections and submitted to GaDOE.
2) What factors are evaluated when considering school location decisions?	In almost every case, *growth patterns* were cited as the most important factor in school siting. Other important factors included utility accessibility, price of land, and parcel size. In almost every case, co-location with other community facilities was not an important issue. In the exurban districts, existing neighborhood development was not important because schools were typically not located within the neighborhoods.
3) Are recommendations about school locations made primarily by staff or by the school board members?	Unanimously all facility planners agreed that recommendations were made by the staff level facility planners.
4) Are decisions about school locations made primarily by staff or by the school board members?	Unanimously all facility planners agreed that final decisions were made by the school board. Some interviewees mentioned that on occasion politics does play a role in site selection, but often the staff recommendation is accepted by the board.
5) Is renovation considered a feasible option if an older school is located near existing residential development? Is this possible using the current Georgia DOE funding formulas?	Renovation will only be funded by GaDOE if the cost of renovation does not exceed 50% of replacement cost. Otherwise, renovation is usually considered for an option. This is particularly true in urban areas where land is less abundant. You can achieve more "bang for your buck" in building new facilities, but renovations are a viable option especially if the core capacity (cafeteria, kitchen, auditorium) allows for an expansion in classroom capacity.
6) Currently, the Georgia DOE requires a minimum acreage for a school site. If there were less stringent acreage requirements from GaDOE, would <*blank*> County Schools consider building multi-story buildings on smaller parcels?	Every school district said that these minimum requirements were not a hindrance to them because they desired larger sites than the minimum in almost every case. Schools with a need for a waiver found that GaDOE was willing to cooperate with them so the school could be located on a smaller site. Some schools had prototypical schools that were multi-story and others did not. Even some exurban districts built multi-story buildings so they could maximize parking space and athletic facility space.
7) Are developers ever required to provide a school site as part of the agreement for their approval to develop, or is that left completely up to the school district?	Georgia state law prohibits local governments from 'requiring' a developer to provide a site for a school. However, in many cases when the school district is at the table in the development approval process, developers are *encouraged* to donate land for a school. In all cases, these donated plots are on the edge of the development and not in the neighborhood itself. In many cases, the land has site issues needing extensive site work to be suitable for a school.
9) Is the lack of commercial tax revenue a significant hindrance for <*blank*> County schools in terms of obtaining funding for new school construction?	This issue was only significant in exurban and rural counties where the residential population is high and the commercial tax base is not enough to support facility construction through the ESPLOST. In these districts, it takes much longer to wait for sales tax revenue to come in and often school districts are forced to do their best by accepting donated parcels or saving on land costs by locating further away from major transportation facilities and existing development.
10) Are there any other resources or policies that you believe would integrate school planning with land use planning to make better use of existing infrastructure (i.e. roads, sewer, etc.)?	While the responses differed significantly between those who believed that their school district did a good job of collaborating with county and city planning departments. Some counties knew that the level of collaboration was low and needed to be improved, but felt that because of political differences between the school board and the county commission there could not be staff communication between the two governing bodies.

APPENDIX B
STATE SITE SIZE REQUIREMENTS

Table B.1 – Site Size Recommendations by State

State	Site Size Formula	Comments
Alabama	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 10 acres + 1 acre for each 100 students **High** – 15 acres + 1 acre for each 100 students	Recommendations only
Alaska	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students **High** – 30 acres + 1 acre for each 100 students	Recommendations only. Not formally regulated.
Arizona	**Elementary** – up to 8-18 acres **Middle** – up to 18-36 acres **High** – up to 30-70 acres	Apply for new construction only. Recommendations not listed in rules and policies.
Arkansas	No acreage recommendations	
California	**Elementary** – 10-18 acres **Middle** – 18-23 acres **High** – 33-53 acres	Alternative solutions to acreage recommendations are provided. Acreage is determined by number of students in the school.
Colorado	No acreage recommendations	
Connecticut	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 15 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	Maximum site sizes for state funding. Local funding may be used on smaller sites.
Delaware	**Elementary** – 10 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students **High** – 30 acres + 1 acre for each 100 students	Minimum recommendations only.
Florida	Guidelines do not address acreage guidelines	
Georgia	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 12 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	These are minimums. Waivers are possible if reduced acreage is considered appropriate. Large acreages are highly desirable.
Hawaii	**Elementary** – 12 acres **Middle** – 18 acres **High** – 50 acres	Recommendation for the "ideal" site
Idaho	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 20 acres + 1 acre for each 100 students over 500 **High** – 30 acres + 1 acre for each 100 students over 800	
Illinois	**Elementary** – 5 acres + 1 acre for every 100 students **Middle** – 15 acres + 1 acre for each 100 students **High** – 20 acres + 1 acre for each 100 students	Maximum site sizes
Indiana	**Elementary** – 7 acres + 1 acre for every 100 students (max) **Middle** – 15 acres + 1 acre for each 100 students (min) **High** – 20 acres + 1 acre for each 100 students	
Iowa	No acreage recommendations	
Kansas	No acreage recommendations	
Kentucky	**Elementary** – 5 acres + 1 acre for every 100 students **Middle/High** – 10 acres + 1 acre for each 100 students	Minimum requirements

continued

State	Site Size Formula	Comments
Louisiana	No acreage recommendations	
Maine	**Elementary** – 5 (min) to 20 (max) + 1 acre/100 students **Middle** – 10 (min) to 25 (max) + 1 acre/100 students **High** – 15 (min) to 30 (max) + 1 acre/100 students	
Maryland	No acreage recommendations	
Massachusetts	No acreage recommendations	
Michigan	No acreage recommendations	
Minnesota	**Elementary** – 10-15 acres + 1 acre/100 students **Middle** – 25-35 acres + 1 acre/100 students **High** – 40-60 acres + 1 acre/100 students	Guidelines with allowances for urban/rural schools
Mississippi	**Elementary** – 5 acres + 1 acre per 100 students **High** – 15 acres + 1 acre per 100 students	Minimum acreage requirements for newly constructed schools. Waivers are available.
Missouri	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Guidelines only. State has no oversight on capital construction
Montana	No acreage recommendations	
Nebraska	No acreage recommendations	
Nevada	No acreage recommendations	
New Hampshire	**Elementary** – 5 acres + 1 acre per 100 students **Middle** – 10 acres + 1 acre per 100 students **High** – 15 acres + 1 acre per 100 students	Minimum requirements, although waivers are frequently granted.
New Jersey	No acreage recommendations	
New Mexico	No acreage recommendations	
New York	**Elementary** – 3 acres + 1 acre per 100 students **Secondary** – 10 acres + 1 acre per 100 students	Does not apply to New York City
North Carolina	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 15 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Recommended acreage
North Dakota	No acreage recommendations	
Ohio	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 35 acres + 1 acre per 100 students	Waivers granted at the discretion of the Ohio State Facilities Commission
Oklahoma	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	
Oregon	No acreage recommendations	
Pennsylvania	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 35 acres + 1 acre per 100 students	Only used for state funding. No minimum or maximum by state law or regulation.
Rhode Island	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Sites should be located whenever possible in proximity to other community facilities which would enhance the educational program.
South Carolina	Acreage requirements repealed in July 2003	

continued

State	Site Size Formula	Comments
South Dakota	No acreage recommendations	
Tennessee	No acreage recommendations	
Texas	No acreage recommendations	
Utah	**Elementary** – 10 acres + 1 acre per 100 students **Middle** – 20 acres + 1 acre per 100 students **High** – 30 acres + 1 acre per 100 students	Size of site is more important than location. Inadequate size is a major factor in the obsolescence of educational facilities.
Vermont	No acreage recommendations	
Virginia	**Elementary** – 4 acres + 1 acre per 100 students **Middle/High** – 10 acres + 1 acre per 100 students	Minimum recommendations. Local districts may set higher standards. Urban areas may seek waivers for smaller sites.
Washington	5 acres + 1 acre per 100 students plus additional 5 acres if the school contains any grade above sixth	
West Virginia	**Elementary** – 5 acres + 1 acre per 100 students over 240 **Middle** – 11 acres + 1 acre per 100 students over 600 **High** – 15 acres + 1 acre per 100 students over 800	Urban schools should be urban in scale. The WV BOE must approve all sites not meeting minimum standards.
Wisconsin	No acreage recommendations	
Wyoming	**Elementary** – 4 acres + 1 acre per 100 students **Middle** – 10 acres + 1 acre per 100 students **High** – 20-30 acres + 1 acre per 100 students	Minimum size requirements. Districts shall refrain from addition to older schools that occupy a site less than 50% of the currently recommended site sizes.

Source: Weihs, Janell. "School Site Size - How Many Acres Are Necessary?" Scottsdale, AZ: Council of Educational Facility Planners International, 2003.

APPENDIX C
DETAILED STATISTICAL DATA

Elementary School: County A

Table C.1 – County A, Elementary School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	Total New Structures	Total Structures*	% Growth School Attendance Boundary (A)	% Growth County A (B)	Difference (A) - (B)
1990		4	5	5	5	9	2	1	12	2	45	743		2.59%	-2.59%
1991			3	11	1	28	6	1	5		55	798	7.40%	1.66%	5.74%
1992			4	5	3	22	3		7	4	48	846	6.02%	2.35%	3.67%
1993		2	5	28	6	19	5		1	2	68	914	8.04%	2.50%	5.54%
1994	1	1		28	18	18	1	2	1		70	984	7.66%	2.09%	5.57%
1995	1		30	14	12	38	4	5	2	1	107	1091	10.87%	2.08%	8.80%
1996	2	3	16	18	9	45	14	7	32	15	161	1252	14.76%	2.22%	12.54%
1997	5	5	43	33	22	40	10	7	27		192	1444	15.34%	2.77%	12.57%
1998	14	19	15	53	23	35	2	2	25	26	214	1658	14.82%	2.05%	12.77%
1999	5	20	2	28	27	33	3	5	8	7	138	1796	8.32%	2.92%	5.41%
2000	4	15	30	25	22	28	19	6	37		186	1982	10.36%	2.20%	8.16%
2001	3	9	25	59	55	61	21	23	12	1	269	2251	13.57%	2.86%	10.71%
2002	4	13	29	30	48	20	8	14			166	2417	7.37%	2.60%	4.78%
2003	1	27	42	22	39	20	12	12			175	2592	7.24%	2.58%	4.66%
2004		5	28	31	31	4	12	20			131	2723	5.05%	3.88%	1.18%
2005		6	12	10	11	17	8	16	3		83	2806	3.05%	4.46%	-1.41%
Total	**40**	**129**	**289**	**400**	**332**	**437**	**130**	**121**	**172**	**58**	**2108**				

*Based on 698 original structures in the attendance boundary before 1990

Table C.2 – County A, Elementary School, Cross-Tabulation Summary

			Travel Time 0-4 min	4-8 min	8-12 min	12-16 min	16-20 min	Total
school_built	no	Count	57	316	353	72	162	960
		Expected Count	77.0	313.8	350.2	114.3	104.7	960.0
	yes	Count	112	373	416	179	68	1148
		Expected Count	92.0	375.2	418.8	136.7	125.3	1148.0
Total		Count	169	689	769	251	230	2108
		Expected Count	169.0	689.0	769.0	251.0	230.0	2108.0

Table C.3 – County A, Elementary School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	95.803	4	.000
Likelihood Ratio	98.001	4	.000
N of Valid Cases	2108		

Table C.4 – County A, Elementary School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.213	.000
	Cramer's V	.213	.000
N of Valid Cases		2108	

High School: County A

Table C.5 – County A, High School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	Total New Structures	Total Structures*	% Growth School Attendance Boundary (A)	% Growth County A (B)	Difference (A) - (B)
1990	1	24	101	109	16	1	252	9435	2.74%	2.59%	0.16%
1991	3	75	114	43	5	1	241	9676	2.55%	1.66%	0.89%
1992	10	52	127	77	9	3	278	9954	2.87%	2.35%	0.53%
1993	36	19	148	172	49	12	436	10390	4.38%	2.50%	1.88%
1994	21	21	60	95	53	25	275	10665	2.65%	2.09%	0.56%
1995	4	22	60	87	30	14	217	10882	2.03%	2.08%	-0.04%
1996	1	15	85	39	37	7	184	11066	1.69%	2.22%	-0.53%
1997	14	162	79	60	42	11	368	11434	3.33%	2.77%	0.56%
1998	3	158	93	25	26	4	309	11743	2.70%	2.05%	0.65%
1999	3	40	138	20	30	3	234	11977	1.99%	2.92%	-0.92%
2000	10	57	43	22	23	5	160	12137	1.34%	2.20%	-0.86%
2001	2	29	58	69	24		182	12319	1.50%	2.86%	-1.36%
2002		48	6	20	17		91	12410	0.74%	2.60%	-1.86%
2003	1	29	4	75	12		121	12531	0.98%	2.58%	-1.60%
2004		29	8	29	12		78	12609	0.62%	3.88%	-3.26%
2005		34	34	41	49	1	159	12768	1.26%	4.46%	-3.20%
Total	**109**	**814**	**1158**	**983**	**434**	**87**	**3585**				

*Based on 9183 original structures in the attendance boundary before 1990

Table C.6 – County A, High School, Cross-Tabulation Summary

			Travel Time 0 to 2 min	2 to 4 min	4 to 6 min	6 to 8 min	8 to 10 min	10 to 12 min	Total
school_built	no	Count	76	228	695	622	199	63	1883
		Expected Count	57.3	427.5	608.2	516.3	228.0	45.7	1883.0
	yes	Count	33	586	463	361	235	24	1702
		Expected Count	51.7	386.5	549.8	466.7	206.0	41.3	1702.0
Total		Count	109	814	1158	983	434	87	3585
		Expected Count	109.0	814.0	1158.0	983.0	434.0	87.0	3585.0

Table C.7 – County A, High School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	302.293	5	.000
Likelihood Ratio	309.300	5	.000
N of Valid Cases	3585		

Table C.8 – County A, High School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.290	.000
	Cramer's V	.290	.000
N of Valid Cases		3585	

Elementary School: County B

Table C.9 – County B, Elementary School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	12-14	**Total New Structures**	**Total Structures***	**% Growth Rate School Attendance Boundary (A)**	**% Growth Rate County B (B)**	**Difference (A) - (B)**
1990		3	7	14	35	7		**66**	1397	4.96%	4.09%	0.87%
1991	5	19	6	9	14	1		**54**	1451	3.87%	3.90%	-0.04%
1992	21	75	20	9	43	2	1	**171**	1622	11.78%	4.90%	6.88%
1993	51	89	46	28	67	12		**293**	1915	18.06%	6.07%	11.99%
1994	22	31	28	44	25	59		**209**	2124	10.91%	6.11%	4.80%
1995	5	6	20	48	23	2	27	**131**	2255	6.17%	5.79%	0.38%
1996		5	12	4	14	14	20	**69**	2324	3.06%	5.47%	-2.41%
1997		4	13	27	39	15	27	**125**	2449	5.38%	5.54%	-0.16%
1998		1	25	34	16	18	74	**168**	2617	6.86%	5.84%	1.02%
1999	1	9	51	31	26	72	42	**232**	2849	8.87%	5.53%	3.34%
2000		35	101	27	43	26	2	**234**	3083	8.21%	5.48%	2.74%
2001	6	87	62	32	21	4		**212**	3295	6.88%	5.74%	1.14%
2002		38	75	53	27		1	**194**	3489	5.89%	4.90%	0.99%
2003		20	54	22	6			**102**	3591	2.92%	4.43%	-1.50%
2004		1	73	68	1	31	16	**190**	3781	5.29%	4.43%	0.86%
2005			51	43	3	2	7	**106**	3887	2.80%	4.68%	-1.88%
2006			19	4	44			**67**	3954	1.72%	3.99%	-2.26%
2007		3	68	29	48	3		**151**	4105	3.82%	2.47%	1.35%
Total	**111**	**426**	**731**	**526**	**495**	**268**	**217**	**2774**				

*Based on 1331 existing structures before 1990

Table C.10 – County B, Elementary School, Cross Tabulation Summary

			Travel Time 0 to 2 min	2 to 4 min	4 to 6 min	6 to 8 min	8 to 10 min	10 to 12 min	12 to 14 min	Total
school_built	no	Count	104	233	177	217	276	130	149	1286
		Expected Count	51.5	197.5	338.9	243.8	229.5	124.2	100.6	1286.0
	yes	Count	7	193	554	309	219	138	68	1488
		Expected Count	59.5	228.5	392.1	282.2	265.5	143.8	116.4	1488.0
Total		Count	111	426	731	526	495	268	217	2774
		Expected Count	111.0	426.0	731.0	526.0	495.0	268.0	217.0	2774.0

Table C.11 – County B, Elementary School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	323.085	6	.000
Likelihood Ratio	348.773	6	.000
N of Valid Cases	2774		

Table C.12 – County B, Elementary School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.341	.000
	Cramer's V	.341	.000
N of Valid Cases		2774	

High School, County B

Table C.13 – County B, High School, Total Structures

Year Built	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	Total New Structures	Total * Structures	% Growth School Attendance Boundary (A)	% Growth County B (B)	Difference (A) - (B)
	Travel Time (min)														
1990	3	20	12	17	50	7	27	4	1	1	**142**	3590	4.12%	4.09%	0.03%
1991	5	20	35	12	47	4	10	10	1	1	**145**	3735	4.04%	3.90%	0.13%
1992	28	56	26	11	65	15	22	19	2	2	**246**	3981	6.59%	4.90%	1.68%
1993	6	7	14	10	86	57	48	28	2		**258**	4239	6.48%	6.07%	0.41%
1994	6	3	11	22	95	109	61	43	5	2	**357**	4596	8.42%	6.11%	2.31%
1995	4	8	4	68	86	182	88	61	5		**506**	5102	11.01%	5.79%	5.22%
1996	10	19	12	67	166	227	89	27	2	3	**622**	5724	12.19%	5.47%	6.72%
1997	10	37	27	70	91	197	116	85	3	1	**637**	6361	11.13%	5.54%	5.59%
1998	2	24	64	67	108	243	86	90	14		**698**	7059	10.97%	5.84%	5.13%
1999	8	37	58	81	83	259	64	117	32	1	**740**	7799	10.48%	5.53%	4.96%
2000		45	88	45	164	274	89	120	60		**885**	8684	11.35%	5.48%	5.87%
2001	6	21	162	116	169	312	111	132	156	14	**1199**	9883	13.81%	5.74%	8.07%
2002	6	78	200	148	324	174	103	120	298	84	**1535**	11418	15.53%	4.90%	10.63%
2003	36	143	223	238	263	141	110	102	193	108	**1557**	12975	13.64%	4.43%	9.21%
2004	35	33	135	126	205	164	126	86	81	35	**1026**	14001	7.91%	4.43%	3.48%
2005	31	100	174	115	109	367	88	52	71	58	**1165**	15166	8.32%	4.68%	3.64%
2006		18	158	117	181	193	88	35	64	48	**902**	16068	5.95%	3.99%	1.96%
2007	2	41	164	49	94	86	78	53	34	25	**626**	16694	3.90%	2.47%	1.42%
Total	**198**	**710**	**1567**	**1379**	**2386**	**3011**	**1404**	**1184**	**1024**	**383**	**13246**				

*Based on 3448 existing structures prior to 1990

Table C.14 – County B, High School, Cross Tabulation Summary

			Travel Time					
			0 to 4 min	4 to 8 min	8 to 12 min	12 to 16 min	16 to 20 min	Total
school_built	no	Count	313	688	2177	1095	78	4351
		Expected Count	298.3	967.7	1772.8	850.1	462.2	4351.0
	yes	Count	595	2258	3220	1493	1329	8895
		Expected Count	609.7	1978.3	3624.2	1737.9	944.8	8895.0
Total		Count	908	2946	5397	2588	1407	13246
		Expected Count	908.0	2946.0	5397.0	2588.0	1407.0	13246.0

Table C.15 – County B, High School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	839.310	4	.000
Likelihood Ratio	991.745	4	.000
N of Valid Cases	13246		

Table C.16 – County B, High School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.252	.000
	Cramer's V	.252	.000
N of Valid Cases		13246	

Elementary School, County C

Table C.17 – County C, Elementary School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-20	Total New Structures	Total * Structures	% Growth School Attendance Boundary (A)	% Growth County C (B)	Difference (A) - (B)
1990	3	9	3	17	8	4	5	2		**51**	991	5.43%	6.83%	-1.41%
1991	2	5	4	10	8	7	4	6		**46**	1037	4.64%	5.93%	-1.28%
1992	2	16	10	12	5	11	30	12		**98**	1135	9.45%	7.53%	1.92%
1993	1	11	12	11	5	17	24	23		**104**	1239	9.16%	8.08%	1.08%
1994	1	8	7	5	6	14	36	9		**86**	1325	6.94%	7.61%	-0.67%
1995		8	2	25	7	10	16	4		**72**	1397	5.43%	7.94%	-2.50%
1996	1	2	6	4	7	10	4	1		**35**	1432	2.51%	9.41%	-6.90%
1997	3	6	9	15	8	12	13	4		**70**	1502	4.89%	8.44%	-3.55%
1998		6	13	14	8	29	5	2		**77**	1579	5.13%	8.35%	-3.22%
1999	1	6	17	18	14	11	11			78	1657	4.94%	9.40%	-4.46%
2000	1	3	8	20	11	17	17	2		79	1736	4.77%	8.56%	-3.79%
2001		3	5	11	18	52	6	2		97	1833	5.59%	8.25%	-2.67%
2002		3	3	37	36	45	7			131	1964	7.15%	8.47%	-1.32%
2003		1	9	20	57	50	9	1		147	2111	7.48%	7.93%	-0.45%
2004	4	7	6	13	91	21	25			167	2278	7.91%	6.81%	1.10%
2005	4	16	11	48	167	40	1		14	301	2579	13.21%	6.61%	6.61%
2006	27	42	21	58	101	47	1			297	2876	11.52%	6.14%	5.37%
Total	**50**	**152**	**146**	**338**	**557**	**397**	**214**	**68**	**14**	**1936**				

*Based on 940 structures existing prior to 1990

Table C.18 – County C, Elementary School, Cross Tabulation Summary

			Travel Time 0-4 min	4-8 min	8-12 min	12-20 min	Total
school_built	no	Count	84	179	176	200	639
		Expected Count	66.7	159.8	314.9	97.7	639.0
	yes	Count	118	305	778	96	1297
		Expected Count	135.3	324.3	639.1	198.3	1297.0
Total		Count	202	484	954	296	1936
		Expected Count	202.0	484.0	954.0	296.0	1936.0

Table C.19 – County C, Elementary School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	261.514	3	.000
Likelihood Ratio	258.364	3	.000
N of Valid Cases	1936		

Table C.20 – County C, Elementary School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.368	.000
	Cramer's V	.368	.000
N of Valid Cases		1936	

<u>High School, County C</u>

Table C.21 – County C, High School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	Total New Structures	Total * Structures	% Growth School Attendance Boundary (A)	% Growth County C (B)	Difference (A) - (B)
1990		5	45	24	24	10	9	1	3	5	3	1		130	1304	11.07%	6.83%	4.24%
1991		2	11	45	8	14	3	2	4	1		5		95	1399	7.29%	5.93%	1.36%
1992		5	30	18	22	25	6		5	4	2	1		118	1517	8.43%	7.53%	0.90%
1993		19	20	43	41	19	10	1	5	6	1	1		166	1683	10.94%	8.08%	2.86%
1994	1	17	19	34	32	24	13	4	8	10	2	1		165	1848	9.80%	7.61%	2.19%
1995		2	21	13	36	66	21		28	11		1		199	2047	10.77%	7.94%	2.83%
1996		7	25	9	65	66	60	6	15	24	9	1		287	2334	14.02%	9.41%	4.61%
1997		2	29	13	53	61	107	21	10	37	7	4		344	2678	14.74%	8.44%	6.30%
1998		4	20	7	50	70	162	39	25	5	11	9	1	403	3081	15.05%	8.35%	6.70%
1999		1	11	36	55	122	144	72	17	5	5	17		485	3566	15.74%	9.40%	6.34%
2000		1	14	31	51	140	74	67	55	12	2	6		453	4019	12.70%	8.56%	4.14%
2001		6	28	31	48	65	59	62	42	13	2	2	1	359	4378	8.93%	8.25%	0.68%
2002	2	13	27	56	78	62	40	26	66	45	6		1	422	4800	9.64%	8.47%	1.17%
2003	4	16	4	62	119	96	23	34	59	22	3			442	5242	9.21%	7.93%	1.27%
2004		15	8	58	98	24	36	29	81	25	14	10		398	5640	7.59%	6.81%	0.78%
2005	1	7	7	28	44	57	63	16	75	34	52	26	2	412	6052	7.30%	6.61%	0.70%
2006	4	9	15	24	63	43	69	21	27	38	5	4	1	323	6375	5.34%	6.14%	-0.81%
Total	**12**	**131**	**334**	**532**	**887**	**964**	**899**	**401**	**525**	**297**	**124**	**89**	**6**	**5201**				

*Based on 1174 structures existing prior to 1990

Table C.22 – County C, High School, Cross Tabulation Summary

			Travel Time 0-4 min	4-8 min	8-12 min	12-16 min	16-20 min	20-26 min	Total
school_built	no	Count	65	473	863	681	228	82	2392
		Expected Count	65.8	398.3	851.3	597.9	378.0	100.7	2392.0
	yes	Count	78	393	988	619	594	137	2809
		Expected Count	77.2	467.7	999.7	702.1	444.0	118.3	2809.0
Total		Count	143	866	1851	1300	822	219	5201
		Expected Count	143.0	866.0	1851.0	1300.0	822.0	219.0	5201.0

Table C.23 – County C, High School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	164.370	5	.000
Likelihood Ratio	169.309	5	.000
N of Valid Cases	5201		

Table C.24 – County C, High School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.178	.000
	Cramer's V	.178	.000
N of Valid Cases		5201	

Elementary School, County D

Table C.25 – County D, Elementary School, Total Structures

Year Built	Travel Time (min) 0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	Total New Structures	Total Structures*	% Growth School Attendance Boundary	% Growth County D	Difference
1990	2		1		1	5	1			2	3	1	2			**18**	707	2.61%	3.47%	-0.86%
1991	3	2	2	1	3		4	1		1	2		2		4	**25**	732	3.54%	4.29%	-0.75%
1992	3	2		2	2		7	2				1	4		2	**25**	757	3.42%	4.70%	-1.29%
1993	2	1	1	5	2	5	7			9	2			1	5	**40**	797	5.28%	6.60%	-1.32%
1994		3	2	1	1	1	4	4	1	3	3	2	2	1	1	**29**	826	3.64%	7.08%	-3.44%
1995	2		1	4		4	1		1					1	3	**17**	843	2.06%	5.26%	-3.20%
1996	1	2		3	4	4	2	5	2	3	4		1		3	**34**	877	4.03%	6.07%	-2.03%
1997	1	9	2	1		3	5		3	5	1		1		2	**33**	910	3.76%	5.42%	-1.66%
1998	2	8	2	3	1	7	3	3	1	3	1		4	1	3	**42**	952	4.62%	5.79%	-1.18%
1999	1	3		4	2	5	2	1	1	3	2	1			1	**26**	978	2.73%	6.12%	-3.39%
2000		1	3	1	1	4	2	2		3	1				1	**19**	997	1.94%	4.41%	-2.47%
2001				1	6	8	7	3	5	1	5		1		1	**38**	1035	3.81%	5.44%	-1.63%
2002	1		1	3	5	24	19	1	6		2		2		3	**67**	1102	6.47%	4.58%	1.89%
2003	8	9	1	3	1	9	4	1	4	5	1	1	2	1	3	**53**	1155	4.81%	6.67%	-1.87%
2004	9	12	4	1	1	55	15	8	12	13	10	1	2			**143**	1298	12.38%	6.15%	6.24%
2005	8	2	1	4	1	40	8	24	16	3	27		2		3	**139**	1437	10.71%	7.01%	3.70%
2006	7	5		1	2	11	4	10	4	5	18	2			2	**71**	1508	4.94%	7.46%	-2.52%
2007	3	7	1		3	3	3	4	6	2	5	3			2	**42**	1550	2.79%	2.62%	0.16%
Total	**53**	**66**	**22**	**38**	**36**	**188**	**98**	**69**	**62**	**61**	**87**	**12**	**25**	**5**	**39**	**861**				

*Based on 689 structures in the school district prior to 1990

Table C.26 – County D, Elementary School, Cross Tabulation

			Travel Time 0-8 min	8-16 min	16-24 min	24-30 min	Total
school_built	no	Count	40	55	31	28	154
		Expected Count	32.0	69.9	39.7	12.3	154.0
	yes	Count	139	336	191	41	707
		Expected Count	147.0	321.1	182.3	56.7	707.0
Total		Count	179	391	222	69	861
		Expected Count	179.0	391.0	222.0	69.0	861.0

Table C.27 – County D, Elementary School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.829	3	.000
Likelihood Ratio	28.243	3	.000
N of Valid Cases	861		

Table C.28 – County D, Elementary School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.195	.000
	Cramer's V	.195	.000
N of Valid Cases		861	

High School, County D

Table C.29 – County D, High School, Total Structures

Year Built	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	Total	Total Structures	% Growth School Attendance Boundary (A)	% Growth County D (B)	Difference (A) - (B)
	Travel Time (min)																							
1990		4	1	7	3	6	15	5	6	6	2	2	11	17	6	17	1			**109**	2088	5.51%	3.47%	2.04%
1991	1	1	2	4	4	12	23	21	2	8	5	3	4	18	7	12	1			**128**	2216	6.13%	4.29%	1.84%
1992		4	2	5	5	20	21	13	3	10	4	3	3	42	11	8			1	**155**	2371	6.99%	4.70%	2.29%
1993		1	2	3	2	23	25	12	21	12	9	8	6	36	39	15	4	7	5	**230**	2601	9.70%	6.60%	3.10%
1994		1	2	20	14	24	29	25	12	15	4	10	8	35	22	27	3	3	10	**264**	2865	10.15%	7.08%	3.07%
1995	1		2	8	3	11	6	14	33	10	9	5	2	26	15	19	11	1		**176**	3041	6.14%	5.26%	0.89%
1996		1	3	1	26	19	7	13	32	7	14	8	6	19	29	19	17	1		**222**	3263	7.30%	6.07%	1.23%
1997		3	2	2	22	23	2	19	25	9	17	31	2	18	14	23	12	8		**232**	3495	7.11%	5.42%	1.69%
1998		12		11	16	11		40	24	15	15	48	8	8	23	7	4	8		**250**	3745	7.15%	5.79%	1.36%
1999		32	2	14	12	12	6	49	16	5	13	37	8	14	18	8	5	5	1	**257**	4002	6.86%	6.12%	0.75%
2000		8	1	15	5	11		35	16	5	5	9	4	9	9	11	5	13		**161**	4163	4.02%	4.41%	-0.39%
2001		4	2	17	7	10	3	54	28	8	7	15		12	7	24	1	31	26	**256**	4419	6.15%	5.44%	0.71%
2002		1		7	5	13	1	13	19	15	16	13	2	11	9	24		1		**150**	4569	3.39%	4.58%	-1.19%
2003	1	8	3	18	6	34	9	44	13	26	39	7		11	8	37	5	21		**290**	4859	6.35%	6.67%	-0.33%
2004	1	19	1	10	8	36	9	19	11	17	39	7	2	10	6	6	7	14		**222**	5081	4.57%	6.15%	-1.58%
2005	2	24	3	6	15	12	22	11	7	20	54	9	3	9	5	1	4	18		**225**	5306	4.43%	7.01%	-2.58%
2006	25	37	21	11	20	8	41	32	4	53	100	5	1	7	7	1	3	14		**390**	5696	7.35%	7.46%	-0.11%
2007	13	16	12	5	9	5	14	7	6	29	14	3	1	1	1		1	2		**139**	5835	2.44%	2.62%	-0.18%
Total	**44**	**176**	**61**	**164**	**182**	**290**	**233**	**426**	**278**	**270**	**366**	**223**	**71**	**303**	**236**	**259**	**84**	**147**	**43**	**3856**				

*Based on 1,979 structures existing prior to 1990

Table C.30 – County D, High School, Cross Tabulation Summary

			Travel Time						
			0-6 min	6-12 min	12-18 min	18-24 min	24-30 min	30-38 min	Total
school_built	no	Count	24	174	286	125	308	145	1062
		Expected Count	77.4	175.2	258.1	236.6	168.0	146.8	1062.0
	yes	Count	257	462	651	734	302	388	2794
		Expected Count	203.6	460.8	678.9	622.4	442.0	386.2	2794.0
Total		Count	281	636	937	859	610	533	3856
		Expected Count	281.0	636.0	937.0	859.0	610.0	533.0	3856.0

Table C.31 – County D, High School, Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	288.681	5	.000
Likelihood Ratio	293.519	5	.000
N of Valid Cases	3856		

Table C.32 – County D, High School, Cramer's V

		Value	Approx. Sig.
Nominal by Nominal	Phi	.274	.000
	Cramer's V	.274	.000
N of Valid Cases		3856	

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