Transportation Infrastructure and Cost Impacts Of School Locations

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Abstract

The population in North Carolina is growing and will continue grow in the foreseeable future. North Carolina became the 10th largest state by population in 2006, and is the 7th fastest growing state as well (U.S. Census, 2006). A result of the increasing population is the demand on the infrastructure, both in maintenance and in new construction. Part of the infrastructure included in this demand is the primary and secondary school systems. A preliminary report recapping a Facility Needs Survey of North Carolina schools issued in April of 2006 by the Public Schools of North Carolina reported the estimated cost for the next five years for public schools for construction and renovation to be $9.7 billion.

There is an increasing demand on the highway infrastructure as well because of the continued growth. Both schools and roads are adversely affected by the rising costs of materials. The increase in the cost of materials and the price of petroleum products is primarily due to increasing demand around the world, as well as the effects from some natural disasters.

The intersection of these two areas (schools and roads) occurs when new schools are built and roadway changes are needed to support the safe travel to school and safe travel to all other roadway users. The sources of funds to make improvements, to address safety issues, and to respond to citizen demands comes from a variety of sources, primarily NCDOT Contingency Funds, NCDOT Access Funds, local municipal jurisdictions, and county funds.

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EXECUTIVE SUMMARY

The population in North Carolina is growing and will continue grow in the foreseeable future. North Carolina became the 10th largest state by population in 2006, and is the 7th fastest growing state as well (U.S. Census, 2006). A result of the increasing population is the demand on the infrastructure, both in maintenance and in new construction. Part of the infrastructure included in this demand is the primary and secondary school systems. A preliminary report recapping a Facility Needs Survey of North Carolina schools issued in April of 2006 by the Public Schools of North Carolina reported the estimated cost for the next five years for public schools for construction and renovation to be $9.7 billion.

There is an increasing demand on the highway infrastructure as well because of the continued growth. The increase in the price of petroleum products is primarily due to increasing demand around the world, as well as the effects from some natural disasters.

The intersection of these two areas (schools and roads) occurs when new schools are built and roadway changes are needed to support the safe travel to school and safe travel to all other roadway users. The responsible jurisdictions must react quickly to safety and access issues when new schools are established and when current schools facilities are expanded. The county is the primary jurisdictional unit for the school as the county is responsible for providing adequate school facilities. The NCDOT is the primary jurisdictional unit for the roadway system.

There were approximately 131 new schools opened in North Carolina between January 1, 2002 and January 31, 2006. A total of $8,508,576 was identified as being spent on school transportation infrastructure across the state related to these 131 schools. A per school average of the 131 schools is $64,950. However, of the 131 school projects identified, only 55 had funds directly attributable to the school. Using 55 schools as the base, the per school average rises to $154,700. The total dollar figure is believed to be low as some urban school districts (e.g., Charlotte-Mecklenburg) are required to include transportation infrastructure needs in the site design process and include the costs in the total costs for the individual school.

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INTRODUCTION

The population in North Carolina is growing and will continue grow in the foreseeable future. North Carolina became the 10th largest state by population in 2006, and is the 7th fastest growing state as well (U.S. Census, 2006). A result of the increasing population is the demand on the infrastructure, both in maintenance and in new construction. Part of the infrastructure included in this demand is the primary and secondary school systems. A preliminary report recapping a Facility Needs Survey of North Carolina schools issued in April of 2006 by the Public Schools of North Carolina reported the estimated cost for the next five years for public schools for construction and renovation to be $9.7 billion.

There is an increasing demand on the highway infrastructure as well because of the continued growth. The increases in the price of petroleum products due to increasing demand around the world, the problems caused by natural disasters such as Hurricane Katrina and the December 26, 2005 Tsunami in Southeast Asia, and environmental awareness has caused prices of petroleum to fluctuate, but primarily to increase. The North Carolina Department of Transportation (NCDOT) is funded by the state fuel taxes. The NC fuel taxes are indexed to the wholesale price of fuel and adjusted every six months, if necessary. While the legislation was scheduled to expire on July 1, 2007, a temporary cap on the state fuel tax for gasoline was put in place in 2006 capping the tax at 30.15 cents per gallon. Apparently, the cap was renewed as information indicates the North Carolina fuel tax is 30.15 cents per gallon. A review of the NCDOT Transportation Improvement Program (TIP) indicates there are far more projects identified than there is money available to fund the listed projects. Given that the fuel tax is the primary source of construction funds and is currently “capped” and that the cost of road building materials is increasing, fewer projects are likely to be funded.

The intersection of these two areas (schools and roads) occurs when new schools are built and roadway changes are needed to support the safe travel to school and safe travel to all other roadway users. There does not appear to be strong lines of communication between school districts and NCDOT when school districts plan for new school projects early in the process. What this leads to is identification of safety

problems at new school locations that need to be addressed quickly and limited funds to address the problem by NCDOT. The TIP is a seven year document, offering a plan to spend highway funds on identified problems and issues. While there is money available for urgent problems not identified and included in the TIP, there appears to be a need by school districts and NCDOT of a better understanding of the time frames and needs of both participants in the process.

In the five year period between January 1, 2002 and January 31, 2007, there were approximately 131 new schools opened in North Carolina [North Carolina Prototype School Design Clearinghouse]. Infrastructure funds identified through several NCDOT documents showed approximately $8.5 million spent on school related infrastructure improvements. This dollar amount is estimated to be only a part of what was spent on transportation infrastructure. Based on the collected data, the dollars per school spent on transportation related infrastructure was approximately $65,000. Using the data from the schools where dollar values were available, 55 schools (of the 131) showed funds expended. This breaks down to an average of approximately $155,000 per school.

The Charlotte-Mecklenburg school district supplied data on three school locations, two in process and one recently completed, where the school district was required to provide funding for transportation improvements. The total expended (or to be expended) by the school district was approximately $1,767,000. Data from three urban districts, Raleigh, Cabarrus County, and Charlotte-Mecklenburg, was not located through an Internet search of public documents. Contacting the three districts provided some general information that is comparable between the districts and is included in the general assessment of costs. The Charlotte Department of Transportation requires the Charlotte-Mecklenburg school district to complete a Traffic Impact Analysis (TIA) for proposed school construction. The school district then includes the costs of the transportation improvements in the estimated total cost of the school. The school district is to pay for the improvements as well [CDOT].

RESULT OF LITERATURE REVIEW

A thorough literature search was conducted at the Atkins Library on the campus of UNC Charlotte as well as an extensive search of the TRIS database and a general web-based search (e.g., Google, MSN) on keywords related to school transportation, school site location criteria, and school location processes. Three states, California, Georgia, and Oregon provided guidelines and worksheets for site analysis for locating school buildings. The procedures published by these three states were compared to the procedure published by North Carolina

The relationship to transportation infrastructure in the California process (School Site Selection and Approval Guide 2004) is related to Safety and Access. The guide indicates what to avoid (e.g., proximity to airports, railroads, open pit mines) in the safety area and what to look for in the access area (e.g., proximity to major streets, routing patterns for foot traffic). The general guidelines recommend that the school district contact the appropriate agencies such as utilities and the department of transportation with jurisdiction for the proposed site.

The Oregon document (Kileen et al.) provides general guidelines related to avoiding remote sites, if possible, locating in higher density areas to provide more opportunity for walking and biking to school in lieu of motorized transportation. There are also guidelines for avoiding “undesirable” areas (e.g., landfills, noise generators, busy streets and highways) from a safety perspective.

The Georgia document (A Guide to School Site Selection 2003) provides guidance for notifying the department of transportation when a potential school site is being evaluated. The document does not ask or direct the group completing the document to request information from the department of transportation, only that the department of transportation be notified. Again, the document focuses attention on safety issues related to undesirable locations.

The North Carolina document (The School Site Planner 1998) provides a five-step process for selecting a school site. Transportation issues are identified in step 2 (Technical Requirements). The sub-areas identified in this step are Access and Traffic. The guidelines here indicate that the site should provide a ready, safe, and economical access to the school site.

REPORT

The conduct of this research was intended to address two primary questions:

1. To what extent do school administrators (or the people responsible for making school site location decisions) consider transportation infrastructure costs?
2. What are the "true" transportation infrastructure costs for new and renovated elementary and secondary education facilities?

The initial plan was to communicate with a representative sample of school administrators whose responsibilities included the assessment of school sites for their school district.

Identifying the transportation costs related to school construction was difficult to quantify. The typical situation for calculating these costs occurred well after the school site was selected. The mechanism most frequently mentioned by the school district representative was a Traffic Impact Analysis (TIA). The TIA is an accepted process and practice to identify transportation costs associated with development. The North Carolina guidelines mentioned five steps to follow in the site selection process. The five steps are:

1. Education Program
2. Technical Requirements
3. Site Selection
4. Priorities
5. Acquisition

Transportation, primarily access to the site, is given greater detail in step two under the sub-heading of Access and Traffic. According to the document the site should:

- Be accessible at a reasonable cost to public roads and/or streets that are adequate or made adequate to hold the added traffic generated by the school.
- Provide adequate frontage to provide safe access from roads or streets approved by the Division of Highways of the N.C. Department of Transportation or by local street departments.
- Be adjacent to or readily accessible to modes of transport useful to students and staff: school buses, private vehicles, public transportation, bicycles and/or pedestrians.
- Not be too close to congested traffic arteries or highways that are noisy and will cause delays or special hazards for school traffic.

- Be adequate to handle peak load traffic at the beginning and end of the school day and for after-hours public assembly activities without undue delay or hazards.
- Avoid locations near manufacturing plants with large employee work forces.

Safety issues are also considered in the N.C. document such as convenience of police, fire, and hospital facilities.

Much of what is considered transportation related infrastructure at a school site is the on-site issues. How much parking is available for staff and students? How are buses routed through the site? Where are the pick-up and drop-off areas for parents who transport their children to and from school? Most of the rest of the reviewed literature does not provide or identify procedures or processes that will result in in-depth analyses of the external transportation infrastructure at school locations.

The North Carolina document does not explicitly call for a TIA or communication with the responsible DOT early in the process. Once the DOT is involved with the school planning, the school district, rightly or not, in some cases believe that the off-site transportation infrastructure is now being handled, or should be the responsibility of the NCDOT. This allows the school district to concentrate on other issues. The DOT now "owns" the analysis and also the responsibility for making the necessary changes, as far as the school district is concerned. Question 1 has now been addressed from the school districts perspective. The extent of consideration varies from approximately none to having to perform a TIA and include the transportation costs in the total cost of the school building site.

Question 2: What are the "true" transportation infrastructure costs related to the location of the school and the subsequent development? A search of the NCDOT 2006 Transportation Improvement Program (TIP) did not show any projects that were directly related to school construction. This is not surprising, given the nature of the TIP as a long range (seven year) document. Based on the information from the educational representatives, having a school related project placed on the TIP during the normal practice of creating the TIP each year is highly unlikely. School districts identify construction needs, and then identify the funding source for the construction. Typically the school construction needs are identified well before sufficient funds are available for construction. Placing a project on the TIP does not appear to fit within the typical

schedule for the school district process of identifying need, securing funding, and beginning construction.

Therefore, the funding for these projects must come from different sources, including the NCDOT funds, City DOT funds, and cities and counties that have funds that can be expended on transportation projects.

Information on Individual School Locations

Starting with a school planning document from the North Carolina Department of Public Instruction (NCDPI) titled “Costs of Recent School Projects,” school projects were sorted into counties and NCDOT divisions (1-14). Sorting through this document resulted in an estimated 131 school projects where school funds were expended during the January 1, 2002 to January 31, 2006 time period. These schools were used as the basis for identifying transportation funds expended on schools. The primary sources of funding were the NCDOT Access fund and the NCDOT Contingency fund. These funds were identified by searching the monthly minutes of the NCDOT Board of Transportation. Using this process, funds totaling $8,508,576.69 were identified for school related transportation projects. While 131 schools were identified as opening (or close to opening) during this period, funds could be associated with only 55 of the schools.

In discussion with NCDOT representatives, the process for an individual school to obtain $50,000 for bus access and parking out of the Access fund was presented as one that will be approved when the school district asks for the funds. Whether or not the76 schools where funds could not be associated with the particular school had asked for the Access funds is not clear. If all 76 schools requested the $50,000, it would add $3,800,000 to the amount identified, although not all of the school locations where Access funds could be identified used the entire $50,000.

Discussions with members of the Charlotte DOT revealed that CDOT does expend funds for transportation improvements around schools. However, sometimes these expenditures were included in other nearby projects (e.g., a road widening project near a residential development, funded in part by a developer, was extended to include widening the road in front of a new school). Charlotte DOT also requires the school district to perform a Traffic Impact Analysis for new school locations and to include the

costs for transportation improvements in the total cost of the new school and fund the transportation improvements.

Charlotte-Mecklenburg provided financial information related to three recent projects that totaled $1,767,063 for transportation improvements. In conversations with Mike Raible from the Charlotte-Mecklenburg schools, he estimated that the range of "typical" transportation improvements at schools ranged from $250,000 to $750,000. Mr. Raible also offered that schools located in already developed areas were usually less expensive (for transportation improvements) than for schools located in relatively undeveloped areas of the county (Raible, 2007). His assessment was similar to that of Ashton Watson from Charlotte DOT who offered that new schools located in an urban (developed) area were well served by the current configuration of streets and that new schools located in suburban areas usually required a significant amount (re: expensive) of transportation related improvements (Watson, 2007).

Monies expended per NCDOT Division

The data from the NCDOT Board minutes were allocated to the counties where the school was located. The counties were then placed in their respective NCDOT Divisions. The Monies Identified includes monies from Charlotte DOT at some Mecklenburg school locations. This information is shown in Table 1.

Table 1. Monies per NCDOT Divisions

Division	Monies Identified	# of Schools	# of Matches	Dollars Per matched School	Dollars Per School
1	$505,000	6	4 of 6	$126,250	$84,167
2	$367,772	6	3 of 6	$122,590	$61,295
3	$375,000	3	2 of 3	$187,500	$125,000
4	$220,869	12	4 of 12	$55,217	$18,405
5	$200,000	18	2 of 18	$100,000	$11,111
6	$150,000	3	3 of 3	$50,000	$50,000
7	$597,013	11	6 of 11	$99,502	$54,274
8	$1,800	1	1 of 1	$1,800	$1,800
9	$1,885,085	11	5 of 11	$377,017	$171,371
10	$2,399,106	38	11 of 38	$218,100	$63,134
11	$0	0	0	$0	$0
12	$305,530	10	6 of 10	$50,922	$30,503
13	$362,953	3	3 of 3	$120,884	$120,884
14	$1,112,848	8	5 of 8	$222,570	$139,106
Summary	$8,508,576	131	55	$151,930	$64,950

All of the monies in Table 1 are from actual monies identified through the document search. The total amount of $8,508, 576 would increase to $12,308,576 if it were assumed that all of the identified school locations had asked for the $50,000 identified by NCDOT for bus access and parking. The definition of a matched school is a school where funds can be associated with that particular school.

The appendices contain spreadsheets for each NCDOT Division as well as a summary sheet for all identified schools and funds. There is an additional spreadsheet for Mecklenburg County.

Additional Information from Charlotte-Mecklenburg Schools

Charlotte-Mecklenburg Schools Office of Facilities Planning provided additional financial information about three schools: Belmeade Elementary, Elon Park Elementary, and Bailey Middle School. Bailey Middle School was included in the list of 131 identified schools. Belmeade Elementary and Elon Park Elementary were not included in the base data for calculating the numbers in Table 1. In addition to the $255,000 identified for Bailey Middle School in the NCDOT Board minutes, Charlotte-Mecklenburg Schools expended $1,307,063, for a total of $1,562,063.

Mike Raible of Charlotte-Mecklenburg Schools offered his assessment that the proximate range of funds expended by Charlotte-Mecklenburg Schools at new school sites usually range from $250,000 to $750,000. There were 21 schools on the list of 131 that are located in Mecklenburg County. Using the average of $500,000 per school, the total amount expended at the 21 sites would be approximately $10,500,000. Evaluation of the collected data shows a total $2,971,169 expended in Mecklenburg County, an average of $141,484 per school. However, using only “matched” schools, the average rises to $495,195 per school. This amount is the middle of the range offered by Mike Raible, and offers support for his opinion. This information is summarized in Table 2.

Table 2. Monies for Mecklenburg County Schools

School Name	Funds Identified	Project	Source
Ardrey Kell HS	$32,500	Traffic Signal	NCDOT Board Minutes
Bailey Middle	$100,000	Left Turn Lane	Access Funds
Bailey Middle	$150,000	Extend Bailey Rd	Access Funds
Bailey Middle	$5,000	Signal Plan	Access Funds
Bailey Middle	$1,307,063		Char-Meck Schools
Barringer Acad Ctr	None		
Community House Middle School	None		
Endhaven Lane El	$15,000	Bus Drive & Park	Access Funds
First Ward El	None		
Hickory Grove El	None		
Highland Hills Mont	None		
J.H. Gunn El	$347,106		Board Minutes
Lincoln Hts El	None		
Mallard Creek HS	$100,000	Relocation (Johnston-Oehler)	Board Minutes
Mallard Creek HS	$300,000	Widening	Board Minutes
Mallard Creek HS	$64,500	Signal Work	Board Minutes
M.L. King El	None		
Merry Oaks El	None		
Metro School	None		
Mint Hill HS	None		
Mountain Island El	None		
Providence Spring E	None		
Sedgefield El	None		
Selwyn El	$550,000	Colony Road Exten	Charlotte DOT
Sterling El	None		
Torrence Creek El	None		
Windsor Park El	None		
Winget Park El	None		
		$2,971,169	Total
		$141,484	Average
		$495,195	Average per Match

At this point in the process, the researcher was at a loss as to how to proceed. The oversight committee met and recommended a process that would create a matrix that would include factors for comparing school locations in different settings. The school site categories selected were: High Density Urban, Urban, Suburban, and Rural. The associated cost factors for the matrix included: Transportation Infrastructure costs, Operations, Health, Environmental, and Lost Opportunity. What now follows is the explanation of the data and the manipulation of the data to try to provide meaningful factors for the matrix.

School Site Categories:

1. High Density Urban: (Wake and Mecklenburg Counties) High School (9-12): 1800 students; Middle School (6-8): 1000 students; Elementary (K-5): 700 students.
2. Urban
3. Suburban
4. Rural
5. Other

Cost Analysis Methodology:

The base category condition for comparison between the different categories will be the High Density Urban category. The population density of the category provides the best probability of attracting (or requiring) the largest percentage of students to walk to school, or at least not provide school bus transportation. The physical infrastructure needed for the site (water, sewer, gas, electricity, highway capacity), including the transportation infrastructure is more likely to be at or nearby the site. The higher density cities have more robust public transportation systems that would provide more options for students to access the school site.

The Operations subcategories (Traffic Control & Safety, Mass Transit, and Law Enforcement) would have a higher probability of having adequate capacity and sufficient traffic control (turn lanes, signals, parking), which would lessen the need for additional Law Enforcement efforts to aid pedestrians, school buses, and other vehicles safer ingress and egress at the site.

Since a greater number of potential “walk-to-school” students exists at the High Density Urban locations, this category would have the highest probability of producing a health benefit for the most people.

The Environmental benefits of the High Density Urban category would be derived from lower levels of exhaust emissions due to fewer school buses needed. Lower environmental impacts from the construction should be realized due to the higher probability that less vegetation exists within the site to be removed. If the site is a brownfield (or similar) site, less subsurface exploration and construction reinforcement would be required, although a higher cost of clearing the site of construction debris would likely occur. The capture of polluted water runoff from the site could use the existing storm sewer system.

Determining categories for Rural, Suburban, Urban, and High Density Urban for the state of North Carolina.

The top 25 cities in North Carolina are identified by total population (Table 3). The population density for each location was determined from US Census data (US Census, 2000). Population Density should be a better indicator of the coverage area of a school, assuming the capacity of the schools in each category are the same. To place a location into a category logical breaks (large gaps) in the population density were identified. The gap between Charlotte and Greensboro was 95 persons per square mile, and this appeared to be a reasonable break point. The five communities with densities as high or higher than Charlotte (2233 persons/sq. mile) were grouped in the High Density Urban (HDU) category. The five cities in the HDU category have relatively well developed public transportation systems that would support these cities being considered in the HDU category.

The gap between Wilmington and High Point was 100 persons per square mile. Therefore, Greensboro, Burlington, Fayetteville, Durham, Wilson, and Wilmington were grouped in the Urban category. The remaining 14 locations were grouped into the Suburban category. The case could be made to exclude Huntersville from the Suburban group as the difference in persons per square mile between Monroe and Huntersville is 267.

Table 3. Top 25 Cities in North Carolina: (2000 Census)

By Population	Population Density Persons per square mile
1. Charlotte – 540,828	2233
2. Raleigh – 276,093	2409
3. Greensboro – 223,891	2138
4. Durham – 187,035	1976
5. Winston-Salem - 185,776	1707
6. Fayetteville – 121,015	2059
7. Cary – 94,536	2246
8. High Point – 85,839	1750
9. Wilmington - 75,838	1850
10. Asheville – 68,889	1684
11. Jacksonville – 66,715	1500
12. Gastonia – 66,277	1439
13. Greenville – 60,476	2364
14. Concord – 55,917	1085
15. Rocky Mount - 55,893	1572
16. Chapel Hill – 48,715	2466
17. Burlington - 44,917	2111
18. Wilson - 44,405	1907
19. Goldsboro - 39,043	1575
20. Hickory - 37,222	1326
21. Kannapolis - 36,910	1236
22. Salisbury – 26,462	1488
23. Monroe - 26,228	1068
24. Huntersville – 24,960	801
25. Laurinburg – 15,874	1280

Based on the 2007 Texas Transportation Institute (TTI) Urban Mobility Report, the Raleigh-Durham area and the Charlotte area are the only North Carolina locations large enough to be included in their annual report. Both areas are listed in the third highest category, Medium-Average. Based on US Census data from 2005, neither Raleigh-Durham nor Charlotte are in the top 40 US cities ranked by population density. Chapel Hill, North Carolina is the state's most densely populated city at 2466 persons per square mile.

Assumptions were made for comparative processes. The capacity for a typical High School in North Carolina was assumed to be 1800 students for the HDU category. This is based on data from Raleigh area and Charlotte-Mecklenburg schools. The capacity for a high school in the Urban category was assumed to be 800, based on information from Greensboro and Wilmington area schools. Capacity for high schools for the Suburban category was selected as 1200, based on information from Cabarrus County schools and Asheville area schools.

The range of student population in elementary and middle schools mostly falls in the 450- 700 students in middle schools and 400-550 in elementary schools. The categories did not seem to have any correlation between elementary and middle school student numbers and HDU, Urban, and Suburban categories. For comparison purposes, a middle school will be assumed to have a capacity of 600 students and an elementary school will have an assumed capacity of 500 students. The School Site Categories were designated as High Density Urban (HDU), Urban, Suburban, Rural, and other. Cost Factors were identified as Transportation Infrastructure (Physical Improvements, Mass Transit, and Operations), Traffic Operations (Traffic Control and Safety, Mass Transit, and Law Enforcement), Health and Health Impacts, Environmental Impacts, and Lost Opportunities.
On the following pages, each School Site Category will be listed and the Cost Factors will be evaluated for each category. This will correspond with the Cost Analysis Matrix produced at the most recent committee meeting in Raleigh.

HIGH DENSITY URBAN

The cities of Charlotte, Raleigh, Cary, Greenville, and Chapel Hill were placed in the HDU category based on the population density of the cities.

Transportation Infrastructure Costs:

- Physical Improvements: The collected data indicated that physical infrastructure (paving, widening, signs, signals, access) at and near locations for school sites varied significantly. Review of NCDOT Transportation Board meeting minutes indicated a range of costs from $5,000 to $1.3 million. There are six sites that are High Density Urban, which have had monies identified as specifically spent for transportation improvements. The average spending was $195,000.

When a school was located in an area where suitable land was available but in a relatively low-density area (i.e., far away from the population), the transportation infrastructure costs were high. An example is Ardrey Kell High School in southern Mecklenburg County. The site is close to a number of housing subdivisions. However, sidewalks are not available between subdivisions located south of Ardrey Kell road and the school. There is not, currently, a traffic signal at the entrance to Ardrey Kell High School. Money spent for infrastructure improvements at this site were near 1 million dollars, according to Charlotte DOT and Mike Raible from Charlotte Mecklenburg schools. Despite the amount of money spent on infrastructure improvements, the school would not be considered “walkable” for the majority of students attending.

The Phillip O. Berry Academy high school is located in an established neighborhood and opened in 2002. The current transportation infrastructure (sidewalks, crossings) makes this school location “walkable.” The distance to nearby housing is similar to Ardrey Kell high school but the needed infrastructure improvements at this site were not as extensive or expensive as at Ardrey Kell (CDOT).

- Mass Transit: The five cities in this category all have developed Mass Transit systems that could be used to transport some students to and from school locations.

The costs associated with implementing this service would be in additional route coverage, if deemed necessary, and to offset the cost of transporting students, assuming that students would not be charged to ride public transportation. The operating cost per rider trip for bus transit averaged $2.28 for transit agencies in 10 US cities and light rail transit (LRT) operating costs averaged $2.16 per rider trip (Light Rail Now, 2001). With only one LRT system in operation in North Carolina (Charlotte) the bus cost should be used in calculations. A report by the Federal Transit Administration indicated that vehicle operating costs are estimated to be $60 to $70 per vehicle-hour, depending on the type of service (line haul and Bus Rapid Transit, respectively). Students using established bus service to access a school would use line haul service. For calculation purposes, $2.28 per rider trip can be used as a beginning point for calculations for per person costs when a student is transported on public transportation (not school buses). Sixty dollars per vehicle-hour can be used when calculating operating costs but the application to school costs is limited as North Carolina has an established school bus fleet.

- Operations: The impact on traffic operations based on school location would depend on how much additional traffic is added to the nearby traffic because of the additional trips generated by the school. A Traffic Impact Analysis (TIA) is an established procedure that can indicate the costs of improvements necessary to maintain the current level of service (LOS) when a school site is being considered.

In the High Density Urban scenario, it is much more likely that sufficient highway infrastructure surrounding the site exists. Multiple lane streets, traffic signals, intersections, and access points would exist in higher densities than in the Urban and Suburban scenarios. Using the NCDOT information, signal work and adding lanes at

the High Density Urban sites averaged $82,500. The number of treated sites identified was small (n = 4), although the sites were from two different divisions. The small number of sites can also be an indicator of the lower probability of needing to add lanes and/or signal work. The value of $82,500 will be the base scenario for comparative purposes.

OPERATIONS

- Traffic Control and Safety: Based on the median income of a police officer, the purchase price of a new police car, the average monthly miles driven, the life expectancy of the police vehicle, and maintenance costs, an hourly cost of providing traffic control was estimated to be $32.29 per hour. This is based on one officer and one police vehicle. The component costs: officer $23.75 per hour, $3.92 per hour for purchase price of vehicle ($30,600 purchase price, 26 month life, 300 hours per month in service), and $4.62 per hour for maintenance costs (39 cents per mile for 3550 miles per month).
- Mass Transit: For the HDU category, the probability of using Mass Transit to transport school students is higher than any of the other School Site categories. Based on Federal Transit Administration numbers, the hourly cost to operate a line-haul bus is $32.30. The cost breakdown is $16.53 per hour for the driver ($33,050 per year, 2000 hours per year), $7.43 per hour capital cost, and $8.24 per hour operating cost (12 year life expectancy, 300 hours per month in service) (FTA, July 2007). The capital cost per mile from the FTA report for the ULSD bus was 72.3 cents per mile. The operation cost per mile was 80 cents. The report used a 40-seat bus for comparative reasons and calculated at cost of 1.81 cents per seat mile for capital costs and 2.0 cents per seat mile for operation costs, not including the driver wages. Assuming 15% of the students would use bus mass transit, an assigned probability of 0.15 can be assumed. This probability helps in the comparison between the different site categories.

- Law Enforcement: The use of law enforcement would be primarily for traffic control and safety and is discussed in the first bullet under this heading (Traffic Operations).

The need for additional police supplied traffic control and safety would most likely be limited to special events at the site (e.g., graduation, sporting events). Using ten as an estimate of the number of times per year such assistance would be necessary (six football games, one graduation, 3 others), 3 hours per event, and 2 units per event, a total of 60 hours per year would cost approximately $2000 (calculated $1937.40). It is not likely that funds for additional geometric changes will result in reducing the need for additional police for High Density Urban locations.

HEALTH

Health and Health Impacts: Walking is obviously more active than riding in a vehicle. There are health benefits associated with walking and increasing the amount of walking that a person does. The results from a study conducted at Tennessee State University in 2006 provides some perspective (Caulkins, 2007). A ten- week walking intervention for 93 people between the ages of 40 and 70 indicated a significant increase in the average daily step totals and significant improvements in health for all six of the health measures (six minute walk test, resting heart rate and blood pressure, body mass index, waist girth, and the sit-and-reach flexibility test). However, findings of the Stepwise Regression showed a significant, positive relationship between increased activity levels and three of the six health measures (diastolic blood pressure, waist girth, and the sit-and-reach flexibility test). These findings suggest that there is a significant relationship between increasing physical activity levels and improved health for the tested group.

A study by Murphy and Topel calculated the value of a ‘Life-Year” as $373,000 (2005 dollars). A Life-Year value is the dollar value a person would be willing to pay to extend his or her current life expectancy by one year when assessed at age 50. The process to arrive at this figure focused on Heart Disease, Cancer, Stroke, and

Accidents. With the exception of accidents, there are exercise benefits associated with Heart Disease, Cancer, and Stroke.

A study published by the British Medical Journal (BMJ) indicated an approximate 26% difference (increase) in the mean number of minutes per day of moderate to vigorous physical activity (MVPA) for students (13-14 years old) who walked to and from school compared to their peer group who rode in a car, bus, or train both ways to school. The difference in minutes was 25.9 minutes more per day for the walking group. This would be approximately 130 minutes per week more of MVPA for the walking students.

If the MVPA increase for students walking to school resulted in a one year increase in an individual life expectancy, and that the effect was the same if the number of school years that an individual walked to school had no affect after the first year of walking to school, the individual value can be estimated at $373,000. This value can be used in calculations for benefits for walking to school.

For HDU sites, the population density average is 2344 persons per square mile. Assuming a uniform population distribution, assuming a household population of 2.48 persons per unit, and because of adjustments for single parent households and age distribution each square mile has .5 children for every 2 adults, a square mile will contain approximately 469 children. Assuming a walking speed of 4 feet per second and a 15-minute walk in one direction, the radius of a circle surrounding the school site would result in approximately 40,715,000 square feet “covered” by the circle. A square mile is 27,878,400 square feet so the circle covers approximately 1.46 square miles. This would give a population of children of 685. Under the HDU category, the capacity of a high school is 1800 students, a middle school is 600 students, and an elementary school is 500. Assume the ages of the children are evenly distributed across ages 1 through 18. This would result in approximately 38 children in each age group. The number of school age children for grades K through 6 would be 266. For middle school (grades 7-9) there would be 114 children. There would be 114 high school aged children. There would be 494 students within walking distance of the school. This is based on population density. The numbers can now be manipulated many ways. Assuming 10% of the 494 students walk to

school and do so for at least one year to attain the life-year benefit, the health benefit would total $18,426,200. If 50% of the 494 students walked to school and did so for at least one year, the health benefit would be $92,131,000. This is not a yearly benefit. However, as students cycle into and out of the system, the value can be applied to each individual student who walks in excess of one year.

For the High Density Urban category, a High School, Middle School, and Elementary School combination would have a total population of 2900 students. Based on population density of school-age children of 338 per square mile, an area of 8.5 square miles would be served by the three school combination. Assume 10 percent of students within a 15 minute radius of a school will walk to school, that 15 percent of the remaining students will travel via private vehicle to school, and that the remaining students will use school buses or existing mass transit. If each school bus can be used for two cycles of pick up and drop off, a total of sixteen school buses (66-passenger) would be needed to transport the remaining students. Assuming a bus carries the maximum number of students, to reduce the demand by one school bus 132 students (six percent of the remaining 2175 students) would need to use existing mass transit. Based on figures from the Federal Transit Administration (FTA) for driver costs and operating costs of transit buses, and using a purchase price of $75,000 for a 66 passenger school bus, the annual cost of operating a school bus is approximately $33,000. This assumes a bus life of 12 years and using 2005 dollars. Using the cost of $2.28 per trip for mass transit bus service from FTA, the yearly cost of transporting the 132 students would be approximately $108,000. However, transit fares are typically much less than operating costs. Using generally published thirty (30) percent fare box return (FTA) the fare that would be charged would be approximately 68 cents. Assuming the local transit agency can charge the school district 68 cents per trip per student carried, the cost to the school district for the 132 students would be approximately $32,500. This would likely be the worst-case scenario. Some transit agencies do not charge students for using public transit, and many others charge a significantly reduced fare. For calculation purposes the fare based on a 30% fare box return would be reduced by 50% for public school students. This would leave a fare of

approximately 34 cents. Based on this fare, the cost per year for using existing public transit would now be $16,250. The net benefit to the school district would be the difference between the cost of operating a school bus per year and the public transit cost for students per year. That benefit would be approximately $16,750. Base on 132 students, this dollar per student benefit is approximately $125.00 (calculated $126.90).

Because of a greater coverage area of mass transit in the High Density Urban areas, the probability of being able to attract students to mass transit is greater than in Urban and Suburban areas. Using a base scenario of 20% of the remaining 2175 students not walking or using private autos to access the school, there would be 435 students using mass transit. This number (435) is approximately 15% of the total number of students in the three school combination. The benefit to the school district would $54,375 per year.

ENVIRONMENTAL

Environmental Impacts: The average car emits one pound of pollution for every 25 miles it is driven. Cars emit four major pollutants: carbon monoxide, nitrogen oxides, particulate matter, and volatile organic compounds (or hydrocarbons) (Delaware). A standard diesel powered school bus emits 36,732 pounds of pollution per year (V-REMS). Assuming 180 school days per year, 204.7 pounds per day are produced. The value per day is rounded to 200 pounds per day for ease of calculation and comparison. The “cost” of Carbon Monoxide was calculated to be $78 per ton (3.9 cents per pound) (Parks & Hrunka). A unit cost for Diesel Particulate Matter (PM) was not located. There are various and wide ranging costs (values) associated with Hydrocarbons. The cost to treat one pound of hydrocarbon varied in one report from approximately $6 per pound to $226 per pound (Cosden). At a recent presentation related to fossil-based fuel electrical power production, the estimate for treating emissions from the power plant to meet government guidelines was $200 per ton (10 cents per pound). Obviously there is a wide disparity in these estimated costs. For calculation purposes, a value of $0.50 per pound ($1000 per ton) to treat hydrocarbons was chosen. There does not appear to be a consensus

on the “cost” of hydrocarbon pollution, but the subject continues to be discussed and researched. The value of $1000 per ton is as reasonable or unreasonable as any of the other values that have been presented.

For comparative purposes, in the HDU category the following assumptions are made: 2900 total students, 49 walk to school, 435 (15%) travel by private auto, 435 (15%) travel by bus public transit, and the remaining 1981 students travel by school bus. Each school bus makes two cycles in the morning and at the end of the school day, so each bus serves 132 students per day. This will require fifteen 66-passenger school buses. Each bus averages 6 hours of operation each day. Each bus produces approximately 200 pounds of hydrocarbon pollution per day. There are 180 days in the school year (North Carolina) resulting in each bus producing 36,000 pounds of pollution each year. At a value of $1000 per ton, the environmental cost per bus per year is $18,000. For the 15 bus fleet the yearly cost is $270,000.

Because treatment options and opportunities continue to evolve, this researcher estimates that decreases in emission pollution from school buses will continue at 5% every five years. Economies of scale will also reduce the cost of treating pollutants from school buses at a rate of 5% every five years. Therefore a net decrease in the cost of pollution from school bus emissions will be 10% every five years.

LOST OPPORTUNITIES

Most of the value of lost opportunities comes from the health benefit of walking to school. The benefit is not accrued by the school district but by the individual. The benefit is not cumulative as once a walking student completes one year of walking to school no additional benefit, related to the cited study, is gained in subsequent years.

A benefit accrued by the school district does occur when a student walks to school in lieu of riding a school bus. The average benefit to the school district is $250 per student per year. However, the increase in the number of students walking to school has to be sufficient to allow the school to defer purchasing a school bus

and the costs associated with the operation of the school bus. In the base scenario a school bus serves 132 students ($33,000 per year at $250 per student).

Another benefit accrued by the school district is when a student uses existing bus mass transit in lieu of a school bus. If the school district reimburses the transit agency at a rate of 50% of a fare that generates 30% fare box recovery based on operating costs, the net benefit to the school district is $125 per student per year. Any combination of walking and public transit use that allows a school district to defer purchasing a 66-passenger school bus will generate a benefit of between $16,500 and $33,000 per year.

An additional benefit can be assumed if it is assumed that a walk-to-school student is a lower health risk than the non-walk-to-school student. This should result in a lower demand for school supplied health care services. A monetary value for this scenario was not found.

URBAN

Transportation Infrastructure Costs:

- Physical Improvements. As in the HDU category, there are six sites that are determined to be Urban with monies identified as specifically spent on transportation improvements. The average spent was $107,000. This dollar value is approximately 55% of the average dollars spent at sites in the HDU category.
- Mass Transit. The six cities in this category are served by bus mass transit. The coverage of the systems are less dense than in the HDU category. The population density in this category is also less than the HDU category. The service is less frequent, on average, than in the HDU category. The assumed transit use in the Urban category is 10% of the remaining students after 10% walking (42 students) and 15% private auto (285 students) are subtracted from the total. This results in 157 students using bus mass transit to access the school. This figure is 36% (157/435) of the number using bus mass transit in the HDU category. Using the same cost and benefit numbers as calculated in the HDU category, which resulted in a net annual savings of $125 for each student using bus mass transit in lieu of a school bus, an Urban school district "loses" $19,625 per year because the bus mass transit serves 10% of the students instead of the 20% service rate in the HDU category.
- Operations. The amount of identified monies spent on signal work and lane additions at Urban school sites averaged $633,500. Again, the sample size was small. Using this value and comparing it to the monies similarly identified in the HDU category, approximately 7.5 times as much money was spent at the urban sites for operations ($633,500 v $82,500).

Operations

- Traffic Control and Safety. The same value for one police officer and needed equipment of $32.29 per hour was used for this analysis. There are differences for Urban locations for comparative purposes. It was assumed

that there would be a need for police supplied traffic control each morning and each afternoon for the first two years after the opening of the school. It was assumed that one police unit would be sufficient for the site. There are 180 school days in North Carolina. The traffic control would be needed for one hour in the morning and one hour in the afternoon for a total of 360 hours per year for daily traffic control. Added to this number is the 30 hours of traffic control needed for special events as identified in the HDU category, resulting in a total of 390 hours with an annual cost of approximately $12,600. It is assumed that after two years of operation, changes will be made to reduce the need for daily traffic control supplied by police. These changes can include new traffic signals and possible routing changes for ingress and egress that will reduce the need for police oversight. The need for traffic control for special events will continue to be needed. A cost of $150,000 per site was used for the necessary improvements to reduce the need for police provided traffic control. The police provided traffic control for special events was still included for ten events per year.

- Mass Transit. The operational costs are likely to be close to the values used for the HDU category. The probability of a student using bus mass transit is lower because of less frequent service, lower density population, and lower coverage of the geographical area. If 157 students access the school out of 1900 total students, the probability of using transit could be assumed to be approximately 0.08. This factor can be used as a multiplier in various comparisons between the site categories. Assuming 42 students walk, 327 (15%) use private auto, and 157 students use bus mass transit, the remaining 1416 students will need to be transported by school bus. The school district would need 11 buses to serve these students, assuming each 66-passenger bus makes 2 cycles per morning and 2 cycles per afternoon serving 132 students total.
- Law Enforcement. The costs are included in the Traffic Control and Safety category previously discussed.

Health

- For all of the same reasons stated in the HDU Health section, for each child that walks to school for an entire year, a one time health benefit of $373,000 is accrued by the student. Because of the lower population density, the number of children within the 15 minute walking radius of a school is approximately 14% less than in the HDU category. Therefore, any recognized, perceived, or established health benefit derived from walking to school would be 14% (multiply benefit by 0.86) less likely to occur at a school under the Urban designation.

Environment

For comparative purposes, in the Urban category the following assumptions are made: 1900 total students, 42 walk to school, 285 (15%) travel by private auto, 157 (8%) travel by bus public transit, and the remaining 1416 students travel by school bus. Each school bus makes two cycles in the morning and at the end of the school day, so each bus serves 132 students per day. This will require eleven 66-passenger school buses. Each bus averages 6 hours of operation each day. Each bus produces approximately 200 pounds of hydrocarbon pollution per day. There are 180 days in the school year (North Carolina) resulting in each bus producing 36,000 pounds of pollution each year. At a value of $1000 per ton, the environmental cost per bus per year is $18,000. For the eleven bus fleet the total yearly pollution/ environmental cost is $198,000.

Because treatment options and opportunities continue to evolve, this researcher estimates that decreases in emission pollution from school buses will continue at 5% every five years. Economies of scale will also reduce the cost of treating pollutants from school buses at a rate of 5% every five years. Therefore a net decrease in the cost of pollution from school bus emissions will be 10% every five years.

Lost Opportunity

Again, most of the value of lost opportunities comes from the health benefit of walking to school. The benefit is not accrued by the school district but by the individual. The benefit is not cumulative as once a walking student completes one

year of walking to school no additional benefit, related to the cited study, is gained in subsequent years.

A benefit accrued by the school district does occur when a student walks to school in lieu of riding a school bus. The average benefit to the school district is $250 per student per year. However, the increase in the number of students walking to school has to be sufficient to allow the school to defer purchasing a school bus and the costs associated with the operation of the school bus. In the base scenario a school bus serves 132 students ($33,000 per year at $250 per student). Because of the lower population density as compared to the HDU category, the probability of replacing a school bus student-trip with a walking student-trip is lower. The lost opportunity cost exists but at a lower level than in the HDU category.

Another benefit accrued by the school district is when a student uses existing bus mass transit in lieu of a school bus. If the school district reimburses the transit agency at a rate of 50% of a fare that generates 30% fare box recovery based on operating costs, the net benefit to the school district is $125 per student per year. Any combination of walking and public transit use that allows a school district to defer purchasing a 66-passenger school bus will generate a benefit of between $16,500 and $33,000 per year.

Additionally, a student walking to school can be assumed to be a lower health risk compared to non-walking students. A lower health risk should result in fewer services needed from school supplied health care workers. A dollar value for this benefit was not found.

SUBURBAN

Transportation Infrastructure Costs:

- Physical Improvements. There are six sites that are determined to be in the Suburban category with monies identified as specifically spent on transportation improvements. The average spent was $156,000. This dollar value is approximately 80% of the average dollars spent at sites in the HDU category.
- Mass Transit. Some of the cities in this category are served by bus mass transit, but several are not. The coverage of the identified systems are less dense than the systems in the Urban and HDU categories. The population density (1394 per square mile) in this category is 40% less than the HDU category. The service is less frequent, on average, than in the HDU category. The assumed transit use in this category is zero. The number of potential bus transit users is small, and the services provided, in general, do not cater to school students.
- Operations. The amount of identified monies spent on signal work and lane additions at Suburban school sites averaged $235,636. The sample size was 6 locations. Using this value and comparing it to the monies similarly identified in the HDU category, approximately 2.85 times as much money was spent at the suburban sites for operations ($235,636 v $82,500).

Operations

- Traffic Control and Safety. The same value for one police officer and needed equipment of $32.29 per hour was used for this analysis. There are differences for suburban locations for comparative purposes. It was assumed that there would be a need for police supplied traffic control each morning and each afternoon for the first two years after the opening of the school. It was assumed that two police units would be needed for the site. There are 180 school days in North Carolina. The traffic control would be needed for one hour in the morning and one hour in the afternoon for a total of 720 hours per year for daily traffic control. Added to this number is the 30 hours of traffic

control (times 2 units) needed for special events as identified in the HDU category, resulting in a total of 780 hours with an annual cost of approximately $25,200. It is assumed that after two years of operation, changes will be made to reduce the need for daily traffic control supplied by police. These changes can include new traffic signals and possible routing changes for ingress and egress that will reduce the need for police oversight. The assumed cost of the necessary improvements was estimated at $150,000 per site. The two units for traffic control at special events would continue to be needed for the 10 special events per year.

- Mass Transit. The use would likely be specific to the individual site and not because of the low area coverage and low frequency of suburban bus mass transit systems in the identified cities.
- Law Enforcement. The costs are included in the Traffic Control and Safety category previously discussed.

Health

- For all of the same reasons stated in the HDU Health section, for each child that walks to school for an entire year, a one time health benefit of $373,000 is accrued by the student. Because of the lower population density, the number of children within the 15 minute walking radius of a school is approximately 41% less than in the HDU category. Therefore, any recognized, perceived, or established health benefit derived from walking to school would be 41% (multiply benefit by 0.59) less likely to occur at a school under the suburban designation.

Environment

For comparative purposes, in the Suburban category the following assumptions are made: 2300 total students, 29 walk to school, 345 (15%) travel by private auto, and the remaining 1926 students travel by school bus. On average, it is assumed each school bus makes one and one-half cycles in the morning and at the end of the school day, so each bus serves 99 students per day. This will require twenty 66-

passenger school buses. Each bus averages 6 hours of operation each day. Each bus produces approximately 200 pounds of hydrocarbon pollution per day. There are 180 days in the school year (North Carolina) resulting in each bus producing 36,000 pounds of pollution each year. At a value of $1000 per ton, the environmental cost per bus per year is $18,000. For the twenty bus fleet the total yearly pollution/environmental cost is $360,000.

Because treatment options and opportunities continue to evolve, this researcher estimates that decreases in emission pollution from school buses will continue at 5% every five years. Economies of scale will also reduce the cost of treating pollutants from school buses at a rate of 5% every five years. Therefore a net decrease in the cost of pollution from school bus emissions will be 10% every five years.

Lost Opportunity

Again, most of the value of lost opportunities comes from the health benefit of walking to school. The benefit is not accrued by the school district but by the individual. The benefit is not cumulative as once a walking student completes one year of walking to school no additional benefit, related to the cited study, is gained in subsequent years.

A benefit accrued by the school district does occur when a student walks to school in lieu of riding a school bus. The average benefit to the school district is $330 per student per year. However, the increase in the number of students walking to school has to be sufficient to allow the school to defer purchasing a school bus and the costs associated with the operation of the school bus. In the base scenario a school bus serves students ($33,000 per year at $330 per student). Because of the lower population density as compared to the HDU and Urban categories, the probability of replacing a school bus student-trip with a walking student-trip is low. The lost opportunity cost exists but at a lower level than in the HDU category.

Additionally, a student walking to school can be assumed to be a lower health risk compared to non-walking students. A lower health risk should result in fewer services needed from school supplied health care workers. A dollar value for this benefit was not found.

RURAL

In general it is difficult to find common comparison data for Rural school sites to compare to Suburban, Urban, and High Density Urban. A few of the common comparison points are discussed below.

Transportation Infrastructure Costs.

- Physical Improvements. There are thirty-three (33) sites that are determined to be in the Rural category with monies identified as specifically spent on transportation improvements. The average spent was $64,000. This dollar value is approximately 33% of the average dollars spent at sites in the HDU category.
- Mass Transit. None or not evaluated.
- Operations. There were nine sites that were identified as having signal work and/or lane widening or adding. The average amount spent on this type of work was $145,250. Comparing this to sites in the HDU category, the Rural factor is 1.75 times the HDU (145,250/82,500).

Operations.

- Traffic Control and Safety. There will likely be the need for police provided traffic control for special events such as football games and graduation. It is estimated there would be 10 such events per year and the officer and equipment would be needed for 3 hours at each event. This gives a total of 30 hours per year in Traffic Control and Safety costs at $32.29 per hour. The total cost would be approximately $1000. The need for the police provided traffic control would continue indefinitely.

Health.

Any student that walks to school in a rural setting will benefit from the exercise. It is difficult to estimate how many students would walk at a typical rural school because of so many location variables. Quantifying this benefit would need to be done on a school by school basis. The closer to a population center the school is located, the

greater the probability of enticing students to walk or bike to school in lieu of riding a school bus.

Environment.

The major environmental impact will be from the use of school buses. Given the low population density of a typical rural school site, it is most likely that a school bus would be able to make only one cycle in the morning and one cycle in the afternoon. Therefore, each 66-passenger bus could serve 66 students. Each bus produces approximately 200 lbs of hydrocarbon pollution per day. The number of school days per year in North Carolina is 180 days. Each bus will produce 36,000 lbs of pollution per year. At a cost of $0.50 per pound to treat the pollution, the cost per bus per year is $18,000. Use this figure and multiply by the number of buses operated on a daily basis by the school district.

Lost Opportunities.

In a rural setting, providing some accommodations for students to access the site other than roads can improve the probability of walking or biking to school. The installation of sidewalks, walking trails, or bike paths can entice students to chose an alternative mode to travel to school. Based on the cost of a school bus with a 12-year service life, a $500 per student benefit can be realized by enticing students to walk or bike to school. There needs to be sufficient numbers or walking and biking students to allow the school district to defer the purchase and subsequent operation of a school bus.

FINDINGS AND CONCLUSIONS

The primary source of funds for school transportation infrastructure appears to be the Access Fund and the Contingency Fund at NCDOT. Other funds were appropriated by the NCDOT Board of Transportation but the source of the funds was not clearly identified. Over the 4-year period examined, it can be shown that the average expended per school for transportation infrastructure improvements is approximately $64,950. At only 32 of the schools evaluated could the Access funds for bus parking and access be definitely identified as being allocated. If all the 131 identified schools requested and received NCDOT Access funds of $50,000, the average spent per school would rise to $102,724. The data acquired for this report indicated a range of monies spent for transportation infrastructure improvements on a school by school basis from zero to $1,562,063.

The primary finding of this project was the realization of the need to have a relatively quick and easy process for school location planners to assess the off-site transportation infrastructure costs. While this process could be helpful in the planning process for a new school location, funding sources for the necessary improvements are varied and the process for identifying and obtaining the funds is not clear.

Since there are likely to be unique aspects to any school site, defining a set of standard calculations to perform related to off-site transportation infrastructure in the planning process is not likely to occur.

What appears to be lacking is a process. Urban districts appear to have an established process where the school district completes a TIA and includes the necessary transportation improvements in the cost of the school. Rural districts do not appear to have a process in place.

ANALYSIS MATRICIES

A series of Cost Analysis Matrices are produced for comparative analysis of the cost factors identified in the section of the report analyzing the School Site Categories (High Density Urban, Urban, Suburban, and Rural). The data in the matrices are presented in five-year increments up to 40 years.

To use the matrices, the High Density Urban is the base condition. The factors in subsequent columns contain a multiplier that indicates the difference (increase or decrease) in an amount based on available data. For example: the average amount expended on all transportation infrastructure at a High Density Urban site was determined to be $195,000. The amount in the same category at the Suburban category was determined to be $156,000. This is approximately 80% (0.80) of the HDU amount. Under the operations line in Transportation Infrastructure, the amount of dollars allocated only for signal work and lane work (e.g., left turn lane, reconfiguring intersection) was calculated and compared. For each dollar spent at a HDU site, 7.5 dollars were spent at an Urban site.

For Operations, $32.29 per hour for police supplied units for traffic control is the base value. The scenario for the HDU sites concluded that 30 hours of this service would be needed per year; 390 hours at an Urban site, 780 hours at a Suburban site, and 30 hours at a Rural site. The factors for Mass Transit were determined by and estimation of transit system coverage and population density. A probability value of 0.15 for the HDU site is established as the starting point. A similar scenario in the Urban category resulted in a value of 0.08 for potential mass transit use.

For Health, the factors were determined by comparing the number of students walking at 10% within a fifteen minute walking radius of the site and population density. The density in the Urban category is 86% of the HDU category and the Suburban category is 59% of the HDU category. The dollar values for walking distance and mass transit use are based on the net cost of not operating a bus per student.

For Environmental, the dollar values are the cost of operating a fleet of buses necessary to serve the students after subtracting for walking, personal auto, and mass transit students (HDU 15 buses; Urban 11 buses; Suburban 20 buses).

For Lost Opportunity, there is a $373,000 benefit for each additional student who walks to school for at least one year. After the first year, which can occur at any time during the student's attendance (first grade through senior year) at the school. No further benefit is accrued after the first year of walking. There is a lost opportunity of $250 per student for using a school bus instead of walking and a $125 lost opportunity cost when a student uses a school bus instead of bus mass transit.

TRANSPORTATION COST ANALYSIS MATRIX (Year 1) Start
Secondary School Locations
School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1	13	26	2	Need for police supplied traffic control events per year at $32.29 per unit	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI	1 $12,250@10% walking dist $54,375@15% mass tran	0.86 $10,500@10% walking dist $19,625@8% mass tran	0.59 $7500@10% walking dist	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI	1 $270,000/yr for typical bus fleet of 15	0.73 $198,000/yr for bus fleet of 11	1.33 $360k/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

RECOMMENDATIONS

Potential solutions to the issue are presented as follows:

- Create a category within the NCDOT budget to allocate funds for transportation infrastructure related to building new schools based on more than bus parking and access.

- NCDOT and NCDPI collaborate to create a process where there is a cost sharing agreement between the two agencies that will fund transportation infrastructure improvements directly related to school construction.

- School districts request from NCDOT a preliminary Traffic Impact Analysis for potential school locations as the locations are first being discussed. There may need to be some guidelines established to determine whether a TIA is necessary in rural areas.

- A general agreement that school districts should place greater emphasis on locating schools such that walking and bicycling to and from school is encouraged, and motor vehicle transportation for students to and from school would be discouraged.

IMPLEMENTATION AND TECHNOLOGY TRANSFER PLAN

It is recommended that representatives from NCDPI and NCDOT meet to discuss and determine what needs to occur for the issue of off-site transportation infrastructure to be better addressed.

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APPENDICES

Transportation Infrastructure Expenditures
2002-2006
Summary of NCDOT Divisions
1 through 14

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
1	Bertie Middle	Bertie			
1	First Flight HS	Dare	$50,000.00	Access Funds	Bus drive and parking
1	Manteo Middle	Dare	$50,000.00	Access Funds	Bus drive and parking
1	Manteo El	Dare	$45,000.00	Access Funds	Bus drive and parking
1	Manteo El	Dare	$30,000.00	Trans Board mtg min	Extend access at US-64 650 ft
1	Northhampton El	Northhampton	$50,000.00	Access Funds	Bus drive and parking
1	Northhampton El	Northhampton	$150,000.00	Trans Board mtg min	Curb, gutter, sidewalk, widening & resurfacing Roberts Rd
1	Northhampton El	Northhampton	$85,000.00	Contingency	Turn lane on NC 305
1	Elizabeth City Middle	Pasquotank			
1	Nags Head El	Dare	$45,000.00	Access Funds	Bus drive and parking
2	Bridgeton El	Craven	$25,000.00	Trans Board mtg min	Widen Old Airport Rd 1.5 ft each side
2	Bridgeton El	Craven	$50,000.00	Bus drive and park	
2	Havelock El	Craven	$32,772.00	Bus drive and park	
2	Havelock El	Craven	$210,000.00	Construct 3-lane section	
2	Beaufort El	Carteret	$50,000.00	Bus drive and park	
2	Creekside Ele	Pitt		no matches	
2	Hope Middle	Pitt		no matches	
2	PS Jones Middle	Beaufort		no matches	
3	Carolina Forest Ele	Onslow	$50,000.00	Access Funds	School bus drive
3	Murrayville Ele	New Hanover	$325,000.00	NC Board Trans Funds	Bike lane
3	Edwin A. Andrson El	New Hanover			
4	Dixon Road Ele	Johnston		no matches	
4	West View Ele	Johnston	$80,000.00	Trans Board mtg min, May 06	Signal
4	Creekside Ele	Durham		no matches	
4	W.G. Pearson Ele	Durham		no matches	
4	Royal Ele	Franklin		no matches	
4	South Forest Pines El	Wake		no matches	
4	Four Oaks Middle	Johnston	$50,000.00	Access Funds	Bus drive and parking
4	Darden Middle	Wilson			
4	McGee's Crossroads Middle	Johnston			
4	River Dell El	Johnston			
4	Benson Middle	Johnston	$40,869.00	Access Funds	Bus drive and parking
4	Enfield / Inborden	Halifax	$50,000.00	Access Funds	Bus drive and parking
5	Royal Ele	Franklin	$140,000.00	Access Funds	Grade, drain, pave Centaur Road
5	Forest Pines Ele	Wake			
5	N. Forest Pines Ele	Wake			
5	Sanford Ele	Wake			

5	Brier Creek Ele	Wake			
5	Barwell Road Ele	Wake			
5	Harris Creek Ele	Wake			
5	Panther Creek High	Wake			
5	Holly Springs High	Wake			
5	Carpenter Ele	Wake			
5	Forestville Rd. Ele	Wake			
5	Highcroft Drive Ele	Wake			
5	Cedar Fork El	Wake		no matches	
5	Phillips HS	Wake		no matches	
5	Salem Middle	Wake		no matches	
5	Heritage El	Wake	$60,000.00	Trans Board Funds	Signal
5	Reedy Creek Middle	Wake		no matches	
5	Holl Ridge Middle	Wake		no matches	
6	Gray's Creek HS	Cumberland	$50,000.00	Access Funds	School bus drive
6	Lillington/Shawtown Ele	Harnett	$50,000.00	Access Funds	School bus drive
6	Overhills HS	Harnett	$50,000.00	Trans Board mtg min, Dec 05	School bus drive
7	Northern Guilford HS	Guilford	$5,000.00	Trans Board mtg min,	Signal work
7	Northern Guilford Middle	Guilford	$7,013.44	Trans Board mtg min,	Widen shoulders, remove trees
7		Guilford	$180,000.00	Trans Board mtg min	Widen Spencer Dixon Road 1.82 miles
7		Guilford	$75,000.00	Trans Board mtg min	Realignment at intersections, remove trees, add 2 feet to shoulders NC150
7	Gibsonville El	Guilford			
7	Triangle Lake Montessori El	Guilford			
7	Gravelly Hill Middle	Orange			
7	Bethany El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Monroeton El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Williamsburg El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Huntsville El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Huntsville El	Rockingham	$130,000.00	Trans Board mtg min	Install Island
7	Carrboro HS	Orange		no matches	
7	Rashkis El	Orange		no matches	
8	Southern Lee HS	Lee	$1,800.00	Trans Board mtg min	Upgrade Beacons

9	Middle Fork Ele	Forsyth	$150,000.00	Trans Board mtg min,Nov 03	Left & right turn lanes
9	Whitaker Ele	Forsyth			
9	Ronald Reagan HS	Forsyth	$50,000.00	Access Funds	Bus drive
9			$300,000.00	Trans Board mtg min, Nov 03	Left & right turn lanes
9			$200,000.00	Trans Board mtg min, Mar 04	Extend three lane section
9	William Ellis Middle	Davie	$180,000.00	Trans Board mtg min, Oct 05	Turn lane
9			$70,000.00	Trans Board mtg min, Jun 07	Extend turn lane project
9	Friendship Ele	Davidson			
9	Brier Creek Ele	Davidson	$65,000.00	Trans Board mtg min, Apr 03	Left turn lane
9	East Forsyth MS	Forsyth	$180,000.00	Trans Board mtg min, Oct 03	Grade, drain, pave access road
9			$250,000.00	Trans Board mtg min, Nov 03	Construct 3-lane, curb & gutter
9			$195,000.00	Trans Board mtg min, Jan 04	New access road to Pisgah Church Rd
9			$50,000.00	Trans Board mtg min, Apr 04	Bus driveway
9			$150,000.00	Trans Board mtg min, Oct 04	Raise grade on West Mountain St
9			$40,000.00	Trans Board mtg min, Feb 05	Signal work
9			$5,085.00	Trans Board mtg min, Feb 06	Railroad Pre-emption signal
9	Atkins A&T HS	Forsyth			
9	Shive Ele	Rowan			
9	Koontz Ele	Rowan			
9	Millbridge Ele	Rowan			
9	Carson HS	Rowan			
10	Hickory Grove El	Mecklenburg			
10	Bailey Middle	Mecklenburg	$100,000.00	Access Funds	Left Turn lane
10			$150,000.00	Access Funds	Extend Bailey Road
10			$5,000.00	Access Funds	Signal Plan (reimbursement)
10	Torrence Creek El	Mecklenburg			
10	Metro School	Mecklenburg			
10	Community House Middle	Mecklenburg			
10	Ardrey Kell HS	Mecklenburg	$32,500.00	NCTrans Board mtg min	Traffic Signal
10	Endhaven Lane El	Mecklenburg	$15,000.00	Access Funds	Bus drive and parking
10	First Ward El	Mecklenburg			
10	Martin Luther King El	Mecklenburg			
10	Mint Hill HS	Mecklenburg			
10	Selwyn El	Mecklenburg	$550,000.00	Charlotte DOT	Colony Road Extension
10	Windsor Park El	Mecklenburg			

10	Fairview El	Union		no matches	
10	Antioch El	Union		no matches	
10	Marvin El	Union	$55,000.00	Trans Board mtg min, Jun 04	Signa at Rae, Creekstone, and Marvin Sch
10	Porter Ridge El	Union	$5,000.00	Trn Board , Jul 04	Signal work
10	Porter Ridge Middle	Union			The 3 Porter Ridge schools are located on the same road and close to one another
10	Porter Ridge El	Union			
10	Sandy Ridge El	Union			
10	Marvin Ridge Middle	Union	$215,000.00	Trn Board Apr 07	Left turn lane & signal work
10	Marvin Ridge Middle	Union	$35,000.00	Trans Board mtg min, Apr 07	R-O-W & utilities
10	YYY	Union			Not identified
10	Barringer Center	Mecklenburg		no matches	
10	J.H. Gunn El	Mecklenburg	$347,106.00	Trn Brd Mar/Apr 07	
10	Merry Oaks El	Mecklenburg		no matches	
10	Albemarle Middle	Stanly		no matches	
10	Rock Rest El	Union	$175,000.00	Trans Board mtg min	Grading, draining, paving on Monroe Rd
10	Marvin Ridge HS	Union	$250,000.00	Trn Board mtg min	Left turn lane, signal work
10	Mountain Island El	Mecklenburg		no matches	
10	Sterling El	Mecklenburg		no matches	
10	Highland Hills Montessori	Mecklenburg		no matches	
10	Linclon Heights El	Mecklenburg		no matches	
10	Providence Spg El	Mecklenburg		no matches	
10	Sedgefield El	Mecklenburg		no matches	
10	Mallard Creek HS	Mecklenburg	$100,000.00	Trans Board min	Relocation (Johnston-Oehler)
10	Mallard Creek HS	Mecklenburg	$300,000.00	Trans Board min	Widening
10	Mallard Creek HS	Mecklenburg	$64,500.00	Trans Board min	Signal work
10	Hickory Ridge HS	Cabarrus			
10	Pitt School Rd El	Cabarrus			
10	Bethel El	Cabarrus			
10	Kannaplolis IM	Cabarrus			
10	Winget Park El	Mecklenburg			
11	Westwood El	Ashe		no matches	
12	Lincoln County El	Lincoln	$50,000.00	NC Brd Trn Funds	Bus Parking stabilization
12	St. James Ele	Lincoln	$75,000.00	Access Funds	Widen 3 lns St. James Ch Rd
12	E.D. Sadler El	Gaston	$7,000.00	Trans Board min	Signal work
12	Woodland Hts El	Iredell	$50,000.00	Trans Board min	Signal at Brawley School Rd
12	Woodland Hts El	Iredell	$50,000.00	Access Funds	Signal work
12	Woodland Hts El	Iredell	$50,000.00	Trans Board min	Turn lanes
12	Third Creek El	Iredell	$21,530.00	Trans Board min	Bus drive and parking
12	E Mooresville El	Iredell			
12	N.S. Childers El	Lincoln			
12	Lincolnton Middle	Lincoln	$1,000.00	Trans Board min	Bus drive and parking
12	Lincolnton Middle	Lincoln	$1,000.00	Access Funds	Bus Parking stabilization
12	Ellendale El	Alexander		no matches	

12	Maiden HS	Catawba		no matches	
13	Sunshine Ele	Rutherford	$24,305.00	NC Board Trans Funds	Bus Access
13	Sunshine Ele	Rutherford	$40,800.00	Trans Board mtg min, Oct 03	Grade, drain, pave Harrison Rd
13	Sunshine Ele	Rutherford	$7,985.89	Trans Board mtg min, Dec 05	Grade, drain, pave Harrison Rd
13	Walter Johnson	Burke	$85,000.00	School Sys Impr Doc	Turn lane, metal poles, signal
13	Walter Johnson	Burke	$24,862.36	Trans Board mtg min, Jan 05	unknown
13	Unknown	Burke	$180,000.00	Trans Board mtg min, Mar 05	Intersection realign near two schools
13	Tipton Hill El	Mitchell	$25,600.00	Access Funds	Bus drive and parking
14	Polk City Middle	Polk	$100,000.00	Trans Board mtg min Jun 05	Access to new school
14	Polk City Middle	Polk	$12,000.00	Trans Board mtg min May 05	Warning signs
14	Glen Marlowe El	Henderson	$43,348.00	Access Funds	Bus drive and parking
14	Smoky Mountain El	Jackson	$130,000.00	SC	Signal work at US 441
14	Smoky Mountain HS	Jackson	$50,000.00	Access Funds	Bus drive and parking
14	Smoky Mountain HS	Jackson	$300,000.00	Contingency Funds	Drive off SR 1723
14	Smoky Mountain HS	Jackson	$150,000.00	Trans Board mtg min	Drainage, curbs, resurface, striping
14	Bethel El	Haywood	$50,000.00	Access Funds	Bus drive and parking
14	Bethel El	Haywood	$100,000.00	Trans Board mtg min	Left turn lane
14	Bethel El	Haywood	$120,000.00	Trans Board mtg min	Left turn lane
14	Bethel El	Haywood	$7,500.00	Trans Board mtg min	School flashers
14	Bethel El	Haywood	$50,000.00	Trans Board mtg min Apr 07	Utility move
14	Mt Vernon-Ruth El	Rutherford			
14	Ellenboro El	Rutherford			
14	Spindale El	Rutherford			
	131 Schools	Total	$8,508,576.69		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 1

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
1	Bertie Middle	Bertie			
1	First Flight HS	Dare	$50,000.00	Access Funds	Bus drive and parking
1	Manteo Middle	Dare	$50,000.00	Access Funds	Bus drive and parking
1	Manteo El	Dare	$45,000.00	Access Funds	Bus drive and parking
1	Manteo El	Dare	$30,000.00	Trans Board mtg min	Extend access at US-64 650 ft
1	Northhampton El	Northhampton	$50,000.00	Access Funds	Bus drive and parking
1	Northhampton El	Northhampton	$150,000.00	Trans Board mtg min	Curb, gutter, sidewalk, widening & resurfacing Roberts Rd
1	Northhampton El	Northhampton	$85,000.00	Contingency	Turn lane on NC 305
1	Elizabeth City Middle	Pasquotank			
1	Nags Head El	Dare	$45,000.00	Access Funds	Bus drive and parking
		Total	$505,000.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 2

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
2	Bridgeton El	Craven	$50,000.00	Access Funds	Bus drive and park
	Bridgeton El	Craven	$25,000.00	Trans Board mtg min	Widen Old Airport Rd 1.5 ft each side
2	Havelock El	Craven	$32,772.00	Trans Board mtg min	Bus drive and park
2	Havelock El	Craven	$210,000.00	Trans Board mtg min	Construct 3-lane section
2	Beaufort El	Carteret	$50,000.00	Access funds	Bus drive and park
2	Creekside Ele	Pitt		no matches	
2	Hope Middle	Pitt		no matches	
2	PS Jones Middle	Beaufort		no matches	
		Total	$367,772.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 3

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
3	Carolina Forest Ele	Onslow	$50,000.00	Access Funds	School bus drive
3	Murrayville Ele	New Hanover	$325,000.00	NC Board Trans Funds	Bike lane
3	Edwin A. Andrson El	New Hanover			
		Total	$375,000.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 4

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
4	Dixon Road Ele	Johnston		no matches	
4	West View Ele	Johnston	$80,000.00	Trans Board mtg min, May 06	Signal
4	Creekside Ele	Durham		no matches	
4	W.G. Pearson Ele	Durham		no matches	
4	Royal Ele	Franklin		no matches	
4	South Forest Pines El	Wake		no matches	
4	Four Oaks Middle	Johnston	$50,000.00	Access Funds	Bus drive and parking
4	Darden Middle	Wilson			
4	McGee's Crossroads Middle	Johnston			
4	River Dell El	Johnston			
4	Benson Middle	Johnston	$40,869.00	Access Funds	Bus drive and parking
4	Enfield / Inborden	Halifax	$50,000.00	Access Funds	Bus drive and parking
		Total	$220,869.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 5

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
5	Royal Ele	Franklin	$140,000.00	Access Funds	Grade, drain, pave Centaur Road
5	Forest Pines Ele	Wake			
5	N. Forest Pines Ele	Wake			
5	Sanford Ele	Wake			
5	Brier Creek Ele	Wake			
5	Barwell Road Ele	Wake			
5	Harris Creek Ele	Wake			
5	Panther Creek High	Wake			
5	Holly Springs High	Wake			
5	Carpenter Ele	Wake			
5	Forestville Rd. Ele	Wake			
5	Highcroft Drive Ele	Wake			
5	Cedar Fork El	Wake		no matches	
5	Phillips HS	Wake		no matches	
5	Salem Middle	Wake		no matches	
5	Heritage El	Wake	$60,000.00	Trans Board Funds	Signal
5	Reedy Creek Middle	Wake		no matches	
5	Holl Ridge Middle	Wake		no matches	
		Total	$200,000.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 6

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
6	Gray's Creek HS	Cumberland	$50,000.00	Access Funds	School bus drive
6	Lillington/Shawtown Ele	Harnett	$50,000.00	Access Funds	School bus drive
6	Overhills HS	Harnett	$50,000.00	Trans Board mtg min, Dec 05	School bus drive
		Total	$150,000.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 7

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
7	Northern Guilford HS	Guilford	$5,000.00	Trans Board mtg min,	Signal work
7	Northern Guilford Middle	Guilford	$7,013.44	Trans Board mtg min,	Widen shoulders, remove trees
7		Guilford	$180,000.00	Trans Board mtg min	Widen Spencer Dixon Road 1.82 miles
7		Guilford	$75,000.00	Trans Board mtg min	Realignment at intersections, remove trees, add 2 feet to shoulders NC150
7	Gibsonville El	Guilford			
7	Triangle Lake Montessori El	Guilford			
7	Gravelly Hill Middle	Orange			
7	Bethany El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Monroeton El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Williamsburg El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Huntsville El	Rockingham	$50,000.00	Access Funds	Bus drive and parking
7	Huntsville El	Rockingham	$130,000.00	Trans Board mtg min	Install Island
7	Carrboro HS	Orange		no matches	
7	Rashkis El	Orange		no matches	
		Total	$597,013.44		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 8

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
8	Southern Lee HS	Lee	$1,800.00	Trans Board mtg min	Upgrade Beacons
		Total	$1,800.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 9

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
9	Middle Fork Ele	Forsyth	$150,000.00	Trans Board mtg min,Nov 03	Left & right turn lanes
9	Whitaker Ele	Forsyth			
9	Ronald Reagan HS	Forsyth	$50,000.00	Access Funds	Bus drive
9			$300,000.00	Trans Board mtg min, Nov 03	Left & right turn lanes
9			$200,000.00	Trans Board mtg min, Mar 04	Extend three lane section
9	William Ellis Middle	Davie	$180,000.00	Trans Board mtg min, Oct 05	Turn lane
9			$70,000.00	Trans Board mtg min, Jun 07	Extend turn lane project
9	Friendship Ele	Davidson			
9	Brier Creek Ele	Davidson	$65,000.00	Trans Board mtg min, Apr 03	Left turn lane
9	East Forsyth MS	Forsyth	$180,000.00	Trans Board mtg min, Oct 03	Grade, drain, pave access road
9			$250,000.00	Trans Board mtg min, Nov 03	Construct 3-lane, curb & gutter
9			$195,000.00	Trans Board mtg min, Jan 04	New access road to Pisgah Church Rd
9			$50,000.00	Trans Board mtg min, Apr 04	Bus driveway
9			$150,000.00	Trans Board mtg min, Oct 04	Raise grade on West Mountain St
9			$40,000.00	Trans Board mtg min, Feb 05	Signal work
9			$5,085.00	Trans Board mtg min, Feb 06	Railroad Pre-emption signal
9	Atkins A&T HS	Forsyth			
9	Shive Ele	Rowan			
9	Koontz Ele	Rowan			
9	Millbridge Ele	Rowan			
		Total	$1,885,085.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 10

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
10	Hickory Grove El	Mecklenburg			
10	Bailey Middle	Mecklenburg	$100,000.00	Access Funds	Left Turn lane
10			$150,000.00	Access Funds	Extend Bailey Road
10			$5,000.00	Access Funds	Signal Plan (reimbursement)
10	Torrence Creek El	Mecklenburg			
10	Metro School	Mecklenburg			
10	Community House Middle	Mecklenburg			
10	Ardrey Kell HS	Mecklenburg	$32,500.00	NCTrans Board mtg min	Traffic Signal
10	Endhaven Lane El	Mecklenburg	$15,000.00	Access Funds	Bus drive and parking
10	First Ward El	Mecklenburg			
10	Martin Luther King El	Mecklenburg			
10	Mint Hill HS	Mecklenburg			
10	Selwyn El	Mecklenburg	$550,000.00	Charlotte DOT	Colony Road Extension
10	Windsor Park El	Mecklenburg			
10	Fairview El	Union		no matches	
10	Antioch El	Union		no matches	
10	Marvin El	Union	$55,000.00	Trans Board mtg min, Jun 04	Signal at Rae, Creekstone, and Marvin Sch
10	Porter Ridge El	Union	$5,000.00	Trans Board mtg min, Jul 04	Signal work
10	Porter Ridge Middle	Union			The 3 Porter Ridge schools are located on the same road close to one another
10	Porter Ridge El	Union			
10	Sandy Ridge El	Union			
10	Marvin Ridge Middle	Union	$215,000.00	Trans Board mtg min, Apr 07	Left turn lane & signal work
10	Marvin Ridge Middle	Union	$35,000.00	Trans Board mtg min, Apr 07	R-O-W & utilities
10	YYY	Union			
10	Barringer Acdemic Center	Mecklenburg		no matches	

10	J.H. Gunn El	Mecklenburg	$347,106.00	Trans Board mtg min, Mar/Apr 07	
10	Merry Oaks El	Mecklenburg		no matches	
10	Albemarle Middle	Stanly		no matches	

10	Rock Rest El	Union	$175,000.00	Trans Board mtg min	Grading, draining, paving on Monroe Rd
10	Marvin Ridge HS	Union	$250,000.00	Trans Board mtg min	Left turn lane, signal work
10	Mountain Island El	Mecklenburg		no matches	
10	Sterling El	Mecklenburg		no matches	
10	Highland Hills Montessori	Mecklenburg		no matches	
10	Linclon Heights El	Mecklenburg		no matches	
10	Providence Spring El	Mecklenburg		no matches	
10	Sedgefield El	Mecklenburg		no matches	
10	Mallard Creek HS	Mecklenburg	$100,000.00	Trans Board mtg min	Road relocation (Johnston-Oehler)
10	Mallard Creek HS	Mecklenburg	$300,000.00	Trans Board mtg min	Widening
10	Mallard Creek HS	Mecklenburg	$64,500.00	Trans Board mtg min	Signal work
10	Hickory Ridge HS	Cabarrus			
10	Pitt School Road El	Cabarrus			
10	Bethel El	Cabarrus			
10	Kannaplolis IM	Cabarrus			
10	Winget Park El	Mecklenburg			
		Total	$2,399,106		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 11

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
11	Westwood El	Ashe		no matches	

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 12

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
12	Lincoln County Ele	Lincoln	$50,000.00	NC Board Trans Funds	Bus Parking stabilization
12	St. James Ele	Lincoln	$75,000.00	Access Funds	Widen to 3 lanes St. James Church Rd
12	E.D. Sadler El	Gaston	$7,000.00	Trans Board mtg min	Signal work
12	Woodland Heights El	Iredell	$50,000.00	Trans Board mtg min	Signal at Brawley School Rd
12	Woodland Heights El	Iredell	$50,000.00	Access Funds	Signal work
12	Woodland Heights El	Iredell	$50,000.00	Trans Board mtg min	Turn lanes
12	Third Creek El	Iredell	$21,530.00	Trans Board mtg min	Bus drive and parking
12	East Mooresville El	Iredell			
12	N.S. Childers El	Lincoln			
12	Lincolnton Middle	Lincoln	$1,000.00	Trans Board mtg min	Bus drive and parking
12	Lincolnton Middle	Lincoln	$1,000.00	Access Funds	Bus Parking stabilization
12	Ellendale El	Alexander		no matches	
12	Maiden HS	Catawba		no matches	
		Total	$305,530.00		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 13

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
13	Sunshine Ele	Rutherford	$24,305.00	NC Board Trans Funds	Bus Access
13	Sunshine Ele	Rutherford	$40,800.00	Trans Board mtg min, Oct 03	Grade, drain, pave Harrison Rd
13	Sunshine Ele	Rutherford	$7,985.89	Trans Board mtg min, Dec 05	Grade, drain, pave Harrison Rd
13	Walter Johnson	Burke	$85,000.00	School Sys Impr Doc	Turn lane, metal poles, signal
13	Walter Johnson	Burke	$24,862.36	Trans Board mtg min, Jan 05	Unknown
13	Unknown	Burke	$180,000.00	Trans Board mtg min, Mar 05	Intersection realign near two schools
		Total	$362,953.25		

Transportation Infrastructure Expenditures
2002-2006
NCDOT Division 14

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
14	Polk City Middle	Polk	$100,000.00	Trans Board mtg min Jun 05	Access to new school
14	Polk City Middle	Polk	$12,000.00	Trans Board mtg min May 05	Warning signs
14	Glen Marlowe El	Henderson	$43,348.00	Access Funds	Bus drive and parking
14	Smoky Mountain El	Jackson	$130,000.00	SC	Signal work at US 441
14	Smoky Mountain HS	Jackson	$50,000.00	Access Funds	Bus drive and parking
14	Smoky Mountain HS	Jackson	$150,000.00	Trans Board mtg min	Drainage, curbs, resurface, striping
14	Smoky Mountain HS	Jackson	$300,000.00	Contingency Funds	Drive off SR 1723
14	Bethel El	Haywood	$50,000.00	Access Funds	Bus drive and parking
14	Bethel El	Haywood	$100,000.00	Trans Board mtg min	Left turn lane
14	Bethel El	Haywood	$120,000.00	Trans Board mtg min	Left turn lane
14	Bethel El	Haywood	$7,500.00	Trans Board mtg min	School flashers
14	Bethel El	Haywood	$50,000.00	Trans Board mtg min Apr 07	Utility move
14	Mt Vernon-Ruth El	Rutherford			
14	Ellenboro El	Rutherford			
14	Spindale El	Rutherford			
		Total	$1,112,848.00		

Transportation Infrastructure Expenditures
2002-2006
Mecklenburg County

Division (NCDOT	School name	City/County	Funds	Funds Source	Project Description
10	Ardrey Kell HS	Mecklenburg	$32,500	NCTrans Board mtg min	Traffic Signal
10	Bailey Middle	Mecklenburg	$100,000	Access Funds	Left Turn lane
10	Bailey Middle		$150,000	Access Funds	Extend Bailey Road
10	Bailey Middle		$5,000	Access Funds	Signal Plan (reimbursement)
10	Bailey Middle		$1,307,063	Charlotte-Meck Schools	none
10	Barringer Acdemic Center	Mecklenburg		no matches	
10	Community House Middle	Mecklenburg			
10	Endhaven Lane El	Mecklenburg	$15,000	Access Funds	Bus drive and parking
10	First Ward El	Mecklenburg			
10	Hickory Grove El	Mecklenburg			
10	Highland Hills Montessori	Mecklenburg		no matches	
10	J.H. Gunn El	Mecklenburg	$347,106	Trans Board mtg min, Mar/Apr 07	
10	Linclon Heights El	Mecklenburg		no matches	
10	Mallard Creek HS	Mecklenburg	$100,000	Trans Board mtg min	Road relocation (Johnston-Oehler)
10	Mallard Creek HS	Mecklenburg	$300,000	Trans Board mtg min	Widening
10	Mallard Creek HS	Mecklenburg	$64,500	Trans Board mtg min	Signal work
10	Martin Luther King El	Mecklenburg			
10	Merry Oaks El	Mecklenburg		no matches	
10	Metro School	Mecklenburg			
10	Mint Hill HS	Mecklenburg			
10	Mountain Island El	Mecklenburg		no matches	
10	Providence Spring El	Mecklenburg		no matches	
10	Sedgefield El	Mecklenburg		no matches	
10	Selwyn El	Mecklenburg	$550,000	Charlotte DOT	Colony Road Extension
10	Sterling El	Mecklenburg		no matches	
10	Torrence Creek El	Mecklenburg			
10	Windsor Park El	Mecklenburg			
10	Winget Park El	Mecklenburg			
	21 schools	Total	$2,971,169		
		Average	$141,484		
	6 matches	Average	$495,195		

Analysis Matrices

TRANSPORTATION COST ANALYSIS MATRIX (Year 0 through Year 5)
Secondary School Locations
School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations	1 $150,000 est	7.5 $1,125,000 est	2.85 $427,500 est	1.75 $262,500 est	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $4,850/5 yr	13 for 2 yrs $25,186 Then 1 $28,100/5yr	26 for 2 yrs ($50,370) Then 2 $56,175/5yr	2 $9690/ 5yr	Need for police supplied traffic control events per year at $32.29 per unit, adj for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $66,625 (benefit)	0.86 $30,125 (benefit) $36,500 (lost)/yr $182,500 tot	0.59 $7500@10% wlkng dst $4,750 (lost)/yr $23,750 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $243,000/yr for typical bus fleet of 15	0.73 $178,200/yr for bus fleet of 11	1.33 $324k/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.
*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 6 through 10)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $5,335/5 yr	1 $5,335/5yr	2 $10,670/5yr	2 $10,670/ 5yr	Need for police supplied traffic control events per year at $32.29 per unit	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $73,287 (benefit)	0.86 $33,137 (benefit) $40,150 (lost)/yr $200,750 tot	0.59 $8250@10% wlkng dst $5,225 (lost)/yr $26,125 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $218,700/yr for typical bus fleet of 15	0.73 $160,380/yr for bus fleet of 11	1.33 $291,600/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 11 through 15)
Secondary School Locations
School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $5,868/5 yr	1 $5,868/5yr	2 $11,737/5yr	2 $11,737 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $80,615 (benefit)	0.86 $36,450 (benefit) $44,165 (lost)/yr $220,825 tot	0.59 $9075@10% wlkng dst $5,745 (lost)/yr $28,725 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $196,830/yr for typical bus fleet of 15	0.73 $144,342/yr for bus fleet of 11	1.33 $262,440/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.
*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 16 through 20)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $6,455/5 yr	1 $6,455/5yr	2 $12,910/5yr	2 $12,910 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr (1)	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $88,676 (benefit)	0.86 $40,095 (benefit) $48,580 (lost)/yr $242,900 tot	0.59 $9982@10% wlkng dst $6,325 (lost)/yr $31,625 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $177,147/yr for typical bus fleet of 15	0.73 $129,900/yr for bus fleet of 11	1.33 $236,200/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 21 through 25)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $7100/5 yr	1 $7,100/5yr	2 $14,200/5yr	2 $14,200 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr (1)	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $97,500 (benefit)	0.86 $44,105 (benefit) $53,395 (lost)/yr $266,975 tot	0.59 $10,980@10 % wlkng dst $6,955 (lost)/yr $34,775 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $159,430/yr for typical bus fleet of 15	0.73 $116,910/yr for bus fleet of 11	1.33 $212,580/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 26 through 30)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $7810/5 yr	1 $7,810/5yr	2 $15,620/5yr	2 $15,620 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr (1)	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $107,250 (benefit)	0.86 $48,515 (benefit) $58,735 (lost)/yr $293,675 tot	0.59 $12,078@10 % wlkng dst $7,650 (lost)/yr $38,250 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $143,487/yr for typical bus fleet of 15	0.73 $105,220/yr for bus fleet of 11	1.33 $191,325/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 31 through 35)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $8,590/5 yr	1 $8,590/5yr	2 $17,180/5yr	2 $17,180 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr (1)	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $117,975 (benefit)	0.86 $53,365 (benefit) $64,610 (lost)/yr $323,050 tot	0.59 $13,285@10 % wlkng dst $8,465 (lost)/yr $42,325 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $129,140/yr for typical bus fleet of 15	0.73 $94,700/yr for bus fleet of 11	1.33 $172,200/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

TRANSPORTATION COST ANALYSIS MATRIX (Year 36 through 40)
Secondary School Locations

School Site Categories

	High Dens. Urban	Urban	Suburban	Rural	Methodology	Citations for Methodology
Cost Factors						
Transportation Infrastructure: (1) Physical Improvements	1	.55	.80	.33	Total Trans $ per site	NCDOT Trans Board, Char-Meck Schools, NCDPI report.
(2) Mass Transit	1	.36	N/A	N/A	Probability of Trans use	Calculated with pop density and route coverage
(3) Operations Costs accrued in first 5 years	1	7.5	2.85	1.75	Signal & lane work only comparing $	Calculated using NCDOT information
Operations: (1) Traffic Control & Safety	1 $9,450/5 yr	1 $9,450/5yr	2 $18,900/5yr	2 $18,900 /5yr	Need for police supplied traffic control events per year at $32.29 per unit adjusted for inflation	Oregon State Police; ALLPar LLC; Kirkwood, MO city report
(2) Mass Transit 10% increase per 5 yr (1)	0.15	0.08	N/A	N/A	Probability of use based on coverage and pop density	Calculated using 2000 census; FTA report
Health, and others identified by PI 10% increase per 5 yr	1 $129,775 (benefit)	0.86 $58,700 (benefit) $71,075 (lost)/yr $355,375 tot	0.59 $14,610@10 % wlkng dst $9,260 (lost)/yr $46,300 tot	N/A	Population Density, 15 minute walk radius, $ value of increased exercise	2000 Census data; calculated distance; British Med Journal; Caulkins; Murphy
Environmental, and others identified by PI 10% decrease per 5 yr	1 $116,226/yr for typical bus fleet of 15	0.73 $85,230/yr for bus fleet of 11	1.33 $154,980/yr for bus fleet of 20	200 lbs polutn per bus per year	# of buses per district at 200 lbs per bus per year times 50 cents per pound to treat	Parks; V-REMS
Lost Opportunity, and others identified by PI	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass trans stu	$373K per wlkg stu;* $250 per wlkg stu; $125 per mass tran stu	$373K one time*	$373K one time*	Health Benefit of 30 min per day exercise; Calc cost of transporting student on bus v walking and mass tran	Murphy & Topel; Calculated using economic costs of providing school bus services Central States Bus Sales, FTA data

The base condition is: High Density Urban; 10% of students within 15-minute radius walk to school; 15% use private auto; 15% use bus mass transit. Subsequent Site categories are compared to base condition.

*The $373,000 is a one-time "life-benefit" accrued by student walking for one year. After one year no additional benefit is accrued.

Transportation to School Report

October 2006

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INTRODUCTION

While there are several modes of transportation that can be utilized to get to and from schools, it is important that children have the ability to use active transport. Walking and bicycling to school is a way for children to improve their health and help decrease the number of vehicles on the roadway. It is important to take a look at all modes of transportation available for getting to school in order to show the benefits of walking and biking to school. Many programs have been implemented in school systems to assist in improving the safety for pedestrians and bicyclists as well as encourage the use of active transport to and from schools. In addition, health issues, injury rates, and death rates are taken into account. Overall, the goal is to confirm the benefits or walking and biking to and from school.

MODE CHOICE

Over the past few decades, the number of children walking and bicycling to school has greatly decreased. School locations are more remote, and communities are built for vehicles, not pedestrians [3]. This means more children, almost 85% of them [8], ride school buses and personal automobiles to get to school, which creates more traffic and increased congestion on the roads surrounding the school. More traffic jams occur, and all road users, including those involved with the school and those not, are inconvenienced with the additional time being used. More vehicles sit and idle, creating pollution. The risk of accidents is also increased for those in automobiles as well as those on foot or bicycle, and serious health risks in children have been heightened. For these reasons, efforts are being made across the country, even around the world, to develop Walk and Bicycle to School programs to make safe routes available for groups of parents and children to walk and bike to school [9].

Walking/Biking to School

Many health, safety, and social risks have accompanied the decline in numbers of children walking and biking to school. Over the past 15 years, asthma rates have increased by 160% in children. The number of cases of type 2 diabetes has also increased, and the percentage of overweight children has tripled. Children are more dependent on parents, and they have less social interaction due to today's video games and technology. Families are more dependent on vehicles than ever before, so children are not taught how to be smart pedestrians [9].

Many people believe that the solution to these risks and problems lies in more children walking and biking to school again. The Centers for Disease Control and Prevention (CDC) has developed goals based on the KidsWalk-to-School Programs. Their research has found that walking to school benefits a child's physical health, traffic congestion in each community, and the environment. Their objectives include, by the year 2010, increasing the amount of children walking to school who live within 1 mile of the school from 31% to 50% and increasing the amount of children biking to school who live within 2 miles of the school from 2.4% to 5.0% [8].

The United States is highly interested in making communities more pedestrian-friendly due to heavy traffic congestion and other dangers that accompany a society converting to high mobility. Non-motorized

travel is becoming widely noticed and has been proven to strengthen the health and well-being of a community. The United States Department of Transportation has developed a policy statement for various communities to adopt to show their commitment to safely integrating pedestrians and bicyclists into the transportation system. This statement is especially important because the US is aware that the policies can be used to encourage the KidsWalk-to-School programs. One of the main points states that, wherever available, in all new construction and reconstruction projects, corridors for bicycles and pedestrians shall be provided. The statement also says that rural roads should have paved shoulders, and all sidewalks should be designed and built so that users with disabilities are able to easily maneuver them. The final point of the statement provides various ways for communities to continue to improve conditions for non-motorized travel, such as long-term planning and staying aware of special situations like cross corridors and cases where people may not want a sidewalk or bike lane [5].

The first Nationwide Personal Transportation Survey was administered in 1969. It resulted in data that said 48% of students walked or biked to school. In contrast, the 2001 National Household Travel Survey's numbers were starkly different. Children of ages 5-15 were surveyed, and the resulting data showed that less than 15% of them walk and 1% bike to school. A largely contributing factor to this decline is the increase in distance from students' homes to the schools. Residential areas are becoming more densely populated, but schools still require large lots. Therefore, the new school sites are becoming more remote, and students must travel further to school. The CDC recently surveyed children that did live within one mile of their school. Even with the shorter distance, only 31% of the students still walked or biked to school. Almost 90% of students in the 1969 survey who lived this close walked or biked. This sharp contrast in numbers was found to be primarily due to the increase in traffic. Many children that lived even within a mile of school were in areas with heavy traffic that created a great danger for them along the side of the road every morning and afternoon [4].

Riding the Bus to School

Next to children walking and biking to school, riding the bus is the next beneficial mode for all involved. The buses are provided by the school and hold many more children at once than personal

automobiles. Buses often use a separate entrance to the school than personal automobiles, so there is altogether less traffic on the roads surrounding the school when more children ride the bus.

In the Georgia Asthma Survey between May and August of 2000, 1,656 children of ages 5-15 years were reviewed for their mode of transportation to school and distance from home to school. Only 4.2% usually walked to school, 48.9% rode the bus, and 43.3% were driven by a personal automobile. 315 of the surveyed children lived less than 1 mile to school. Of this smaller sample, 18.6% walked, 33.4% rode the bus, and 41.9% used personal transportation [6]. These statistics show that even when buses are available, many students are using personal vehicles. An interesting fact is that more used personal vehicles within the one-mile radius of the school than those that rode the bus, perhaps because it was so close that it wasn't worth standing and waiting for the bus. However, if every child that lived in that radius stayed away from the school and waited for the bus, the amount of personal transportation using the roads to get to school would greatly decrease.

The National Highway Traffic Safety Administration (NHTSA) states the school bus to be "the safest form of transportation for children" [2]. They do provide statistics in their Traffic Safety Facts, and the 2000 issue stated that each year, on average, 27 children die in crashes related to school buses. However, most of those are pedestrians, and of half of those pedestrians are between 5 and 7 years old [7]. Perhaps hearing some of these facts deter parents from putting their child on a school bus, or they just may be uncomfortable with not knowing if their own child gets to school safely.

An idea used to combat parent's unease about school buses is Automated Vehicle Location (AVL) technology. A study was done on approximately 250 children from kindergarten to eighth grade in the Wake County public school system of North Carolina. The purpose of the survey was to find out if parents would switch their children to school buses from personal transportation if the school buses incorporated AVL. Parents would be provided with an alert system for the home that would sound when the bus is approaching the stop. School offices would have a monitoring system that uses Global Positioning System (GPS) to view bus locations and arrivals. To provide accurate results, the study did not include students within walking distance of the school, those beyond the school district, and those already riding the bus. The results showed that 50% of students who rode a personal vehicle for one trip and the school bus for the other each day were likely to shift from the personal vehicle to the bus. Only 30% of those who always used personal

transportation said they would switch at least one morning or afternoon school trip to the bus. In total, 40% of students reported that they would switch modes for at least one trip each day if AVL was used on the school buses [2].

Another way people are looking to balance pedestrian and bicycle trips with school buses is being researched by the North Carolina Department of Transportation's Division of Bicycle and Pedestrian Transportation. The idea is to establish areas called "walk zones" and "no-transport zones," and develop and examine their guidelines. These areas would be the 1.5-mile radius surrounding a school, and no buses would be provided in this circle except in locales where traffic and road conditions are too dangerous for pedestrians and bicyclists, especially young ones. Parents, students, and school officials were surveyed during this study to determine the possible benefits or disbenefits of taking this route and suggestions for creating these "walking corridors." The research also stated that pedestrian and bicycle training should be taught in elementary and middle schools to provide the students with the proper tools to safely get to and from school [1].

Driving Personal Vehicles to School

In almost every study, personal transportation seems to be the most widely used mode to get children to school that are too young to drive themselves. The survey on Automated Vehicle Location technology shows that many families are still wary about switching from their own transportation to relying on public school buses. The Georgia Asthma Survey in 2000 reported that 5% more of the total students rode the bus than took their personal vehicles, but in the group that lived within one mile of school, almost 10% more rode personal vehicles for that very short distance. That may be more convenient than waiting at a bus stop, but the problem is that so many more vehicles then occupy the roads in the school area and create congestion and pollution.

The primary factors that affect people's decision on modes to use to get to school are community design, safety, and time and convenience [9]. When personal transportation is used, the families are free to work around their own schedule, which is certainly the most convenient. Many families that have two working parents or multiple children in school may use personal vehicles for transportation to school because they save the most time. In today's world, most parents are not comfortable with allowing their children to

wait at a bus stop alone, so those parents who are very busy most likely view their time as “wasted” while waiting at bus stops, especially when the bus is late. On the other hand, for families that do not take the children to school on their way to work, they should consider that using the bus system would save them gas and time, depending on their distance from the school. The mode that certainly takes the longest is walking or biking to school. Most families do not feel safe letting their children walk or bike to school alone, but most also do not have the time to go with them every day, so this mode is eliminated. However, this is why the Walk and Bike to School programs are implemented. Parents take turns chaperoning larger groups of students, which introduces more social and physical activity for the children. It also creates a community feeling and reduces the congestion around the school.

In 2000, the United States Department of Transportation reported that 51% of all children within one mile of the school take a personal vehicle [9]. For this close proximity to school, more students should be encouraged to walk or bike. However, many factors come into play, such as availability of walking areas. Many rural districts will not have sidewalks to even allow walking or biking, so the choice is between a school bus and personal transportation. Then, as seen in many of the studies, the decision is made based on the family preference, and often on the availability of bus service as well, if in close proximity to the school. With not many school districts implementing the Automated Vehicle Location technology, many parents who live a long distance from the school may want to know that they personally get their child to school safely and do not have to rely on a school bus. Also, families who live closer to the school may decide that they can just as easily get in the car and take the children to school instead of waiting for the bus. Overall, there is a distinction between reasons to use personal transportation or ride a school bus. The TRB Special Report 269, *The Relative Risks of School Travel: A National Perspective and Guidance for Local Community Risk Assessment,* discusses “Each year approximately 800 school-aged children are killed in motor-vehicle crashes during normal school travel hours. Of these 800 deaths, about 20 (2.5 percent) – 5 school bus passengers and 15 pedestrians – are school-bus related. The other 97.5 percent of school-aged deaths occur in passenger vehicles or to pedestrians, bicyclists, and motorists.” The report also points out that approximately 55 percent of the passenger-vehicle related deaths occur when a teenager is driving and also that nearly 80 percent of non-fatal injuries occur in passenger vehicles [19]. This data shows that personal

vehicle use is driving to and from school, while convenient, is the most dangerous way for school-aged children to travel.

SAFETY AND HEALTH

Statistics and Data

According to the national *HealthStyles Survey* conducted in 1999, 2,636 households responded to the survey. Of 611 households, 19% had children walking to school and 6% biking to school at least once a week which was a total of 14% of all trips to school. Barriers cited to active transport to school were long distances, traffic danger, crime danger, opposing school policy, and other reasons. 16% cited no barriers to active transport to school [10].

One tool that is now available to improve pedestrian and bicyclist safety is Geographic Information System (GIS) software. The software can be used to define information that is useful to parents and children in finding safe routes to and from school. It also helps to identify safe bicycle routes along streets and high pedestrian crash zones [11].

Over thirty years ago, almost 90% of children living within a mile of school either walked or biked as their mode of transportation. Since that time, there has been a huge decline in that activity. There exist many concerns from parents that discourage them from allowing their children to walk or bike to school. These concerns include the "distance to school, traffic danger, adverse weather conditions, fear of crimes against children, and crime in the neighborhood" [12]. From data found in 1999, approximately 21% of children live within a mile of their school. In order to encourage parents and children to use active transport to school, the concerns must be addressed. Safe Routes to School (SR2S) uses the "4 Es" to establish a solution to the problem; engineering, enforcement, education, and encouragement. One major improvement made was in the area of traffic danger. Several solutions showed dramatic improvements including lower speed limits in the school zones which lowered child pedestrian causalities by 70% and the placement of speed humps which helped reduce the odds of injury or death by 53-60% [12].

The SR2S Program is a federally aided program from the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA). In the FY 2005-2009, SR2S will receive $612 million. The program provides funds to the states to substantially improve the ability of primary and middle school students to walk and bicycle to school safely. "The purposes of the program are:

1. to enable and encourage children, including those with disabilities, to walk and bicycle to school

2. to make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age; and
3. To facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity (approximately 2 miles) of primary and middle schools (Grades K-8)" [13].

Success Stories

Recently it was found that 87% of all trips to and from school are by personal vehicle or bus. It was also found that approximately 13% of children and adolescents in the United States are overweight or obese. In California, in the City of Mill Valley, through a committee's hard work the Public Works Department made changes to improve walking and biking to school. High visibility crosswalks, traffic signal phasing, multi-use pathways, and driver speed feedback signs were used to encourage active transport to school [14].

In Marin County, California it was found that only about 1 in 9 Marin County children walk or bike to school, about 1/3 of children take the bus, and about ½ are driven to school in a private vehicle. Marin County implemented the Safe Routes to School program and the results were encouraging. From fall 2000 to spring 2002, there was a 64% increase in the number of children walking, a 114% increase in the number of students biking, a 91% increase in the number of students carpooling, and a 39% decrease in number of children in private car with only one student after the implementation of the SR2S program. Student surveys and interviews from staff and volunteers determined these modes of transportation [15].

In the City of Phoenix, Arizona, the School Safety Program was implemented. The School Safety Task Force was created and made up of police officers, school officials, and others. The Task Force created a list of recommendations in order to improve safety in walking and biking to and from school. These recommendations were all adopted in 2001 and many strides were made in improving safety. These accomplishments include the "development of new school crossing guard training videos, the development of a "Safest Route to School" walking plan, and the installation of SCHOOL pavement stencils, the introduction of experimental traffic control, and the introduction of staggered crosswalks." This program was presented at the Annual Transportation Research Board Meeting as well as other conferences [16].

INJURIES AND DEATH

"In the United States, motor vehicle crashes are the leading cause of death among children" [17]. Because of this statistic many parents are wary of their children walking or bicycling to and from school. Over 300 children and adolescents from five to 18 years of age were killed yearly in motor vehicle crashes during trips to school according to data from the Fatality Analysis Reporting System (FARS), the National Automotive Sampling System's General Estimates System (GES), and the United States Census Bureau. It was estimated that over 40,000 children were injured in crashes. It was found that the highest death rates and injury rates were found in passenger vehicles driven by persons under 21 years old [17]. In another study it was found that as vehicle speeds increase, a pedestrian's or bicyclist's odds of survival after being hit by a car decrease [14].

One study found that the safest mode of transportation to school is on school buses and the least safe is by passenger vehicle driven by a teenager. Twenty five percent of trips to and from school were on school buses but only 2% of deaths of children were related to buses. Fourteen percent of trips to and from school were in passenger vehicles driven by teenagers but accounted for over half of student deaths. It was also found that bicycling to and from school was the second most dangerous way to travel. It was stated that many of the injuries and deaths from bicycling to school could be prevented with better laws [18].

CONCLUSION

In conclusion, children can arrive and depart from school many different ways; on a school bus, in a personal vehicle, on a bicycle, and by foot. Busing is the safest mode of transportation to and from school, but many still stay away from buses. Personal transportation is the most common mode used to get to and from school. Agencies and organizations are focusing on encouraging more walking and biking to school through programs such as the KidsWalk-to-School program, Safe Routes to School program, and Walk and Bike to School program. While there exists some obstacles to walking or biking to school such as fear of danger to school-aged children by vehicles traveling along the roadway, solutions are presented such as lower speed limits in school zones and sidewalks in the area. It is important to increase walking and biking to school for health reasons, traffic congestion, and environmental reasons.

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A Guide to School Site Selection (Georgia)

Facilities Section

A GUIDE TO SCHOOL SITE SELECTION

GEORGIA DEPARTMENT OF EDUCATION
FACILITIES SERVICES UNIT
December 8, 2003

FOREWORD

This guide contains information developed to comply with the National Flood Insurance Program Rules and Regulations and Official Code of Georgia Annotated § 20-2-260(c)(4); § 20-2-260(c)(7); and § 20-2-260(d)(6) that require the Department of Education to "adopt uniform rules, regulations, policies, standards, and criteria respecting all locations, construction, equipping, operating, maintenance, and use of educational facilities" and "to review and approve proposed sites and all architectural and engineering drawings and specifications on construction projects for educational facilities".

The attached form "Preliminary School Site Evaluation and School Site Approval," is designed for use by local school systems in making preliminary determinations concerning the acceptability of school sites. It will be used by the School Site Approval Committee when making decisions concerning school site evaluations during the official approval process. A copy of the guide and form can be obtained from the Facilities Services Unit's website located at: "http://www.doe.k12.ga.us/facilities/site2_a.pdf". For a copy of the Preliminary School Site Evaluation and School Site Approval Form only, please visit the Facilities Services website at "http.//www.doe.k12.ga.us.facilities/siteform_a.pdf". A copy of the guide and form can also be obtained by contacting the Facilities Services Unit of the Georgia Department of Education.

Requests for approval of all proposed sites for educational facilities should be directed to:

Facilities Services Unit
1670 Twin Towers East
205 Jesse Hill Jr. Drive S.W.
Atlanta, Georgia 30334-5050
Telephone Number (404) 656-2454

A Good School Site is Important

A good, well-developed site and a well-equipped, functionally designed school plant is a basic physical tool for a quality education. Without one or the other, the educational program may suffer. Current school programs include many activities that must be carried on outside the walls of the physical plant. Well-planned and properly developed outdoor areas are essential to support outdoor activities, provide vehicular circulation, adequate and convenient parking and also be conducive to the safety of children. The site is an integral part of the total school plant and may enhance or inhibit the achievement of a school's educational objectives.

Environment is an influential factor in the lives of young children. Therefore, the school site should contribute positively to the health, safety and social aspects of a child's life at school.

Choosing a good site is one of the important early steps in overall planning. Success or failure in this initial step will be reflected in every subsequent stage in the developmental process.

For these reasons, the choice of a school site requires careful study, including a thorough and objective evaluation. Much thought should be given to the basic principles involved in good site selection.

These principles, when studied in the light of their relation to the local situation, should provide a basis for the objective selection of the best site available. Undue consideration given to the value or acquisition cost of a school site can be false economy, and often has proven to be very expensive.

Size:

The *minimum* acreage requirements of the State Board of Education are:

Elementary Schools - five acres plus one acre for each 100 children in FTE.
Middle Schools - 12 acres plus one acre for each 100 children in FTE.
High Schools - 20 acres plus one acre for each 100 students in FTE.

In developed areas, deviations from the *minimum* acreage requirements may be made by the site approval committee if the reduced acreage is considered appropriate.

Although *minimum* acreages are established, large acreages are highly desirable. Also, those responsible for selecting sites must remain aware of development limitations imposed by certain physical factors of the acreage being considered.

The size of the school may not be the only criterion affecting site size. The possibility of expansion, anticipated community use of the school or area, and the school program are other factors to consider.

Utilities:

Utilities essential to the operation of a modern school plant must be available.

Electricity and telephone services are essential to the operation of a school plant and must be accessible to the proposed site.

The desirability of **public water and sewage service** to a school site cannot be over emphasized. The cost of installing private systems, along with the continuing maintenance costs, plus environmental considerations all but eliminate consideration of private installations. Only in cases of overriding circumstances will site approval be granted at locations which cannot be served by public sewage systems.

Safety Hazards:

The school site should be free of conditions and installations which endanger the life, safety and health of children. If one or more of the potential hazards identified on page 5 of this document exists on or near a proposed school site, further consideration should be given to (a) evaluating other sites where these potential hazards do not exist, or (b) determining how the potential risk posed to students and faculty by an existing hazard could be minimized. Costs associated with implementing risk reduction measures should be considered when making a final decision regarding a proposed site. Any proposed school site adjacent to an airport, or in the final approach or departure pattern of aircraft should be evaluated carefully. The site should be a reasonably safe distance from the flight pattern to avoid the danger of falling aircraft. Also the site should be far enough from airports and flight patterns to offer reasonable protection from interfering noise levels.

School sites should be located a reasonable distance from lakes, streams, or bodies of water that could be considered unsafe to children due to depth or other conditions. Whenever possible, sites adjacent to heavily traveled streets and highways should be avoided. Also, school sites in

locations subject to industrial pollution may present risks to students and faculty with respiratory problems.

Environmental Factors:

The school site should possess physically desirable characteristics and be located so surrounding areas reflect characteristics conducive to the development of attitudes and responses in children considered to be socially, culturally and educationally desirable.

Whenever possible, the selection of a school site in an area zoned for commercial or industrial development should be avoided. The school location should be insulated from business and industrial development. The routes to and from the school site should not expose children to hazardous environmental materials or safety hazards.

The location of a school site should be acceptable to the school patronage community from the standpoint of general environmental surroundings and vehicular accessibility.

Geographical and Related Factors:

The school site should provide convenient accessibility, be supportive to an efficient transportation system, be accessible to community services needed by the school and be appropriately located with respect to other schools and the population to be served.

All school site approvals must be accompanied by a letter of assurance that the site is not in a floodplain or the Coastal High Hazard Area. This letter of assurance must be from the Floodplain Management Coordinator of the Georgia Department of Natural Resources.

To obtain the letter of assurance, write the Floodplain Management Coordinator, Georgia Department of Natural Resources and enclose:

1. County or City Road Map with the location of the site clearly marked and
2. Site Plan with the location of existing or proposed structures identified.

The letter of request should include a brief description of the school location with directions from a given point, such as a town or city, and the names of roads and highway numbers, and the approximate acreage of the site. The State Floodplain Management Office is authorized to request any additional information as needed to complete the evaluation of the proposed school site. Additional information may include a Surveyed Plat using a point of reference with the site tied to the centerline of an intersecting road. In the event a Surveyed Plat is necessary but unavailable, no final determination may be given. Allow from 7 to 10 days for the floodplain determination review process. A form for the request of a floodplain determination is available in the Guideline entitled Regulations and Procedures to Comply with the Standards and Criteria of the National Flood Insurance Program. The address of the Floodplain Management Office follows:

Georgia Department of Natural Resources
Floodplain Management Office
7 Martin Luther King, Jr. Drive
Suite 440
Atlanta, Georgia 30334
Telephone: (404) 656-6382
Fax: (404) 656-6383

Site Development:

The physical characteristics of the school site should be such that the cost of grading, drainage and development will be relatively low.

The evaluation of a site as it relates to physical development is a technical task, requiring the knowledge and experience of a qualified professional. The investment required to obtain a professional evaluation for physical development may result in considerable future savings.

Criteria for Selection:

A Phase I-Environmental Site Assessment will be required for each school site. The Phase I-Environmental Site Assessment shall follow the methodology of the ASTM Practice E 1527-97. A Phase I-Environmental Site Assessment Report must be attached to each completed "Preliminary School Site Evaluation and School Site Approval Form" submitted to the Department of Education for review and approval.

If any one or more of the following hazards is located on or near (up to a three mile radius) a proposed school site, a Risk/Hazard Analysis shall be required in addition to the Phase I – Environmental Site Assessment:

(1) Electrical transmission lines rated at 115KV or higher;
(2) Oil or petroleum products transmission lines and storage facilities;
(3) Hazardous chemical pipelines;
(4) Natural gas transmission and distribution lines larger than ten inches in diameter with a pressure of 200 psi or more;
(5) Propane storage facilities;
(6) Railroads;
(7) Major highways;
(8) Airport approach or departure paths;
(9) Industrial/manufacturing facilities:
    (a) Using or storing hazardous substances as defined under Title 40 CFR 262;
    (b) Emitting hazardous air pollutants as defined under the "Clean Air Act" and/or
    (c) 1990 "Clean Air Act Amendment" – Risk Management Plan Sec. 112(r)
(10) Lakes, rivers, dams, reservoirs, or other bodies of water;
(11) Potential flooding because the property is located within the 100 year flood plain or damn breach zone;
(12) Nuclear waste storage facilities;
(13) Munitions or explosives storage or manufacturing.

A Risk/Hazard Analysis must be completed by a registered, professional engineer licensed to do business in the State of Georgia and shall include the following information at a minimum:

(1) Identification of each hazard;
(2) An evaluation of each hazard;
(3) Options for mitigating each identified hazard (if appropriate);
(4) A statement from the engineer based on his or her professional judgment and the findings of the Risk/Hazard Analysis regarding the suitability of the site for a school.

The Department of Education reserves the right to request information in addition to that provided in the Phase I-Environmental Site Assessment and/or the Risk/Hazard Analysis. Additional information may be needed prior to reaching a decision regarding the appropriateness

of a proposed site if any of the above named hazards exist on or up to the area located within a three-mile radius of the proposed school site.

GEORGIA DEPARTMENT OF EDUCATION
PRELIMINARY SCHOOL SITE EVALUATION AND SCHOOL SITE APPROVAL FORM

Sections I through VI of this form are designed for two purposes:

(1) For use by local school systems when considering property for school sites and requesting approval of a proposed school site.

(2) To summarize information regarding this site for use by the Site Approval Committee.

Section VII is to be used by the School Site Approval Committee for official approval of a school site.

I. SCHOOL SYSTEM IDENTIFICATION AND CONTACT PERSON

School System: _____	Name of Superintendent: _____ Person to Contact (designee): _____
Mailing Address: _____ _____ _____ _____ _____	Phone Number: _____ FAX Number: _____ E-mail Address: _____

II. LOCATION OF PROPOSED SITE

Address of Proposed Site (if available) and/or legal definition of the property: _____ _____ _____ _____	
Acreage in proposed Site: _____ Does this acreage meet the minimum requirements? (Circle One) Yes No Please attach an explanation or rationale if the answer to the above question is "No".	Clear Title Obtainable? (Circle One) Yes No

III. NOTIFICATION OF THE DEPARTMENT OF TRANSPORTATION

Has the Department of Transportation been notified of this site? (Please circle one.)	Yes	No
When was the Department of Transportation notified? (Please enter date.)		

IV. PROPOSED SCHOOL TO BE LOCATED ON THIS SITE *(BASIC INFORMATION)*

Name of Proposed School: _____		
Proposed Grades: _____	Approximate Number of Students: _____	
Number of Instructional Units Proposed: _____	Is this the maximum size planned for this School? (Circle One) Yes No	Is this school being designed for future expansion? (Circle One) Yes No
Estimated date school is to be completed and occupied: Date: _____ Comments: _____ _____		**If expanded, maximum number of instructional units proposed in the future:** _____I.U.

V. UTILITIES AVAILABLE ON THE PROPOSED SITE

(If Utilities are not currently available on the site, please indicate when utility providers anticipate delivery of utilities to the site.)

UTILITY	CURRENTLY AVAILABLE? Yes	No	WHEN AVAILABLE? (Date)	OTHER RELEVANT FACTORS	
(a) Electricity				Voltage: _____	Phase: _____
(b) Natural Gas				Line Size: _____	Line Pressure: _____
(c) Telephone					
(d) Cable					
(e) Water					
Public				Line Size: _____	Line Pressure: _____ Attach FLOW TEST results (See Note Below)*
Private				Line Size: _____	Line Pressure: _____ Attach FLOW TEST results (See Note Below)*
(f) Sewage					
Public					
Private					

*Please attach a copy of the FLOW TEST results from the water hydrant nearest to the site. Show the distance from the closest hydrant to the site.

MISCELLANEOUS SITE INFORMATION

(For each item, circle the appropriate response. If Other is selected, please enter appropriate response.)

(a) Property Zoned	Residential	Industrial	Commercial	Other: _____
(b) Adjacent Development or Existing Community Design	Residential	Industrial	Commercial	Other: _____ _____
(c) Traffic Conditions Around Site	Congested	Moderate	Light	Other: _____
(d) Topography	Steep	Rolling	Gently Sloping	Flat
(e) Grading for Building	Excessive	Moderate	Minimal	Comments: _____ (Continue on reverse)
(f) Rock Excavation	Unlikely	Some But Not Excessive	Excessive	Comments: _____ _____ (Continue on reverse)
(g) Area Available for Parking	Adequate Space	Limited Space	Inadequate Space	Comments: _____ _____ (Continue on reverse)
(h) Vehicular Access to Site	Excellent Potential	Development Restricted	Development Difficult	Comments: _____ _____ (Continue on reverse)
(i) Area Available for Athletic and Recreation Area Development	Adequate	Limited	Inadequate	Comments: _____ _____ (Continue on reverse)

VI. SYSTEM REQUEST FOR SITE APPROVAL

The _____ School System requests approval of the proposed school site identified on this form. An initial investigation has been conducted, a Phase I-Environmental Site Assessment has been conducted, and if required a Risk/Hazard Analysis has been completed. After considering the findings from all studies completed and evaluating the potential school sites available for this school, the _____ Board of Education is submitting the required information and requesting approval of this proposed school site by an appropriately convened Site Approval Committee.

_____ _____

Signature of Board Chairperson (Date)

_____ _____

Signature of School Superintendent (Date)

ATTACHMENTS:

The following documents must be submitted to the Facilities Services Unit of the Georgia Department of Education before a Site Approval Committee can be convened to evaluate your system's request for approval of a proposed school site:

(1) Preliminary School Site Evaluation and School Site Approval Form with Sections I-VI completed;
(2) A copy of the letter of assurance from the Flood Plain Management Coordinator of the Georgia Department of Natural Resources stating that this proposed school site is not in a flood plain or Coastal High Hazard Area;
(3) A copy of the rough plat of the proposed school site;
(4) A copy of the Flow Test results taken at the potable water hydrant nearest to the school site;
(5) A copy of the Phase I – Environmental Site Assessment; and
(6) A copy of the Risk/Hazard Analysis – Only if required.

Once this documentation has been received, a Site Approval Committee will be convened at the earliest possible date to evaluate your system's request for approval of the proposed school site.

The Committee is authorized to request any additional information on any criteria (section) when, in the judgment of the committee, such information is needed to complete the evaluation of the proposed school site.

VII. SITE APPROVAL COMMITTEE

The following members of the Site Approval Committee have evaluated the information submitted by the _____ School System for this proposed school site. The committee visited the site on _____.
(date)

Based on our visual inspection of the site and evaluation of the documentation submitted by the school system:

- ☐ **THIS SCHOOL SITE IS RECOMMENDED FOR APPROVAL.**
- ☐ **THIS SCHOOL SITE AND DOCUMENTATION SUBMITTED BY THE SCHOOL SYSTEM ARE APPROVED WITH COMMENTS (See Attachments).**
- ☐ **THIS SITE IS NOT RECOMMENDED FOR APPROVAL.**

Remarks: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Consultant, Facilities Services Unit _____
(FS Consultant's Signature) **(Date)**

Representative,
Department of Human Resources _____
(DHR Representative's Signature) **(Date)**

Director, Facilities Services Unit _____
(FS Director's Signature) **(Date)**

California Department of Education
Site Selection Criteria

California Department of Education
Site Selection Criteria

Part 1

Site Identification		**Grade Level**
Location	**Gross Acres**	**Estimated Value**

Safety *(These factors must be avoided.)*	**OK**	**Potential Problem**
Adjacent to or near roadways with a high volume of traffic		
Within 1,500 feet of railroad tracks		
Within two miles of an airport runway		
Close to high-voltage power lines		
Close to high-pressure lines, for example natural gas, gasoline sewer or water lines		
Contaminants/toxics in the soil or groundwater, such as from landfills, dumps, chemical plants, refineries, fuel tanks, nuclear plants, or agricultural use of pesticides or fertilizer, etc.*		
Close to high decibel noise sources		
Close to open-pit mining		
On or near a fault zone or active fault		
In a dam inundation area or 100- year flood plain		
Social hazards in the neighborhood, such as high incidence of crime and drug or alcohol abuse		
***Note:** A Phase I Environmental Site Assessment must be conducted for the selected site.*		
Location		
Safe walking areas		
Centrally located to avoid extensive transporting and to minimize student travel distance		
Compatible with current and probable future zoning regulations		
Close to libraries, parks, museums, and other community services		
Favorable orientation to wind and natural light		
Environment		
Free from sources of noise that may impede the instructional process		
Free from air, water and soil pollution		
Free from smoke, dust, odors, and pesticide spray		
Provides aesthetic view from and of the site		
Compatible with the educational program		
Soils		
Proximity to faults or fault traces		
Stable subsurface and bearing capacity		
Danger of slides or liquefaction		
Percolation for septic system and drainage		
Adequate water table level		
Existing land fill is reasonably well compacted		
***Note:** A geological hazard report must be conducted to determine soil and seismic conditions.*		

Topography	**OK**	**Potential Problem**
Feasibility of mitigating steep grades		
Rock ledges or outcroppings		
Surface and subsurface drainage		
Level area for playfields		
Size and Shape		
Net acreage consistent with standards of California Department of Education as noted in "School Site Analysis and Development"		
Length-to-width ratio does not exceed 2:1		
Sufficient open play area and open space		
Potential for expansion for future needs		
Area for adequate and separate bus loading and parking		
Accessibility		
Obstacles such as crossings on major streets and intersections, narrow or winding streets, heavy traffic patterns		
Access and dispersal roads		
Natural obstacles such as grades or gullies		
Freeway access for bus transportation		
Routing patterns for foot traffic		
Remote areas (with no sidewalks) where students walk to and from school		
Easily reachable by emergency response vehicles		
Public Services		
Fire and police protection, including firelines		
Available public transportation		
Trash and garbage disposal		
Utilities		
Availability of water, electricity, gas, sewer		
Feasibility of bringing utilities to site at reasonable cost		
Restrictions on right of way		
Cost		
Reasonable costs for purchase of property, severance damages, relocation of residents and businesses, and legal fees		
Reasonable costs for site preparation including, but not limited to, drainage, parking, driveways, removal of existing buildings, and grading		
Toxic cleanup beyond the owner's obligation		
Environmental mitigation		
Reasonable maintenance costs		

Availability	**OK**	**Potential Problem**
On the market for sale		
Title clearance		
Condemnation of buildings and relocation of residents		
Public Acceptance		
Public acceptance of the proposed site		
Receptivity of city or county planning commission		
Zoned for prime agriculture or industrial use		
Negative environmental impact report		
Coordination of proposed school with future community plans		
Comments:		