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Traffic-related Pollution Exposure Assessment of Fulton County and Atlanta Public Schools (K-12) in Proximity to Major Highways and Expressways

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APPROVAL PAGE

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ABSTRACT

ROSS CARTER
Traffic-related Pollution Exposure Assessment of Fulton County and Atlanta Public Schools (K-12) in Proximity to Major Highways and Expressways

Background: A number of studies have linked traffic-related pollutant exposures to asthma in children. Health conditions such as asthma can contribute to school absenteeism and missed learning opportunities as well as place a major burden on health resources. Although children spend a significant amount of time in school, few states have adopted school siting policies that prevent the placement of schools near major highways. Furthermore, schools often fail to take appropriate steps (e.g. adequate HVAC and air filters) to address indoor air quality concerns for students. The study was designed to identify the number of schools and the number of children in Fulton County and Atlanta Public Schools that attend schools in proximity to major highways and expressways where they are likely to have greater exposure to traffic pollution. The results of this study can be used to build an evidence base for stricter school siting guidelines, for planning safe routes to school, and for mitigation strategies to limit pollutant exposures for children who attend high-risk schools.

Methods: Highway, expressway, county, and school shapefiles were overlaid using ArcMap in ArcGIS version 10.1 (ERSI, USA). A circular buffer with radius 0.5 mile (~ 800 m) was created for each school. ArcMap geospatial tools were used to identify major highways and expressways with these buffers.

Results: A total of 119 of the 225 schools in Fulton County and Atlanta Public school districts were identified as being located within 0.5 miles of a major highway or expressway. Of the 119 schools meeting the intersection criteria, 72.2% (86 of 119 schools) were designated Title I.

Conclusion: Approximately half of schools were located within 0.5 miles of a major highway or expressway. This may result in elevated levels of traffic-related air pollution on the school campuses and potential increased exposure for students. Proper air filter selection, HVAC maintenance, and air quality programs as well as land use, planning, and assessment measures are recommended for these schools to help mitigate exposures.

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Introduction

1.1 Background

The Georgia Department of Public Health defines asthma as, "a chronic inflammatory disorder of the lungs and airways that can include recurrent episodes of wheezing, coughing, shortness of breath, and chest pain or tightness" (Georgia DPH, 2012). According to the CDC, approximately 297,453 children in Georgia had asthma in 2008 (CDC, 2008). The exact contributing factors of asthma are not well understood, but can include heredity, exposure to environmental tobacco smoke and other environmental exposures as well as viral infections (Georgia DPH, 2012).

Children are disproportionately affected by asthma in Georgia and experience 2 to 3 times more asthma-related emergency room visits and higher hospitalization rates than adults (Georgia DHR, 2007). Similar to other health conditions, disparities in asthma are clear with asthma prevalence higher in children living in households with annual income of less than $20,000 compared to children living in households with higher income (Georgia DHR, 2007). These disparities suggest that higher asthma prevalence in low socioeconomic populations may be a result of increased environmental exposures (Georgia DHR, 2007). Asthma also contributes significantly to school absenteeism. School absenteeism attributed to asthma is a problem as children who suffer from the condition miss out on valuable classroom-learning opportunities. According to the Georgia Department of Human Resources, among children age 5 to 17, approximately 75,000 children missed about 470,000 days of school due to their asthma (Georgia DHR, 2007).

Research conducted during the 1996 Olympic games in Atlanta suggests that traffic-related air pollution exposure might contribute significantly to the burden of asthma in Georgia. Alternative transportation strategies implemented during the Olympic games were effective in decreasing traffic density (Freidman, 2001). As a result, Atlanta experienced an extended period of reduced ozone pollution during which significantly less child asthma acute care events occurred. An ecological study by Freidman comparing the 17 days of the Olympic Games (July 19–August 4, 1996) to a baseline period consisting of the 4 weeks before and 4 weeks after the Olympic Games , identified a number of indicators of decreased asthma acute care events including 41.6% decrease in the Georgia Medicaid claims file, 44.1% decrease in a health management organization database, 11.1% decrease in 2 pediatric emergency departments and 19.1% decrease in the Georgia Hospital Discharge Database (Freidman, 2001).

A nationwide study of public schools was conducted regarding the number of schools in proximity to interstate, U.S. and state highways in nine large metropolitan statistical areas (MSA) (Appatova, 2008). The study found that over 30% of schools fell within 400 m of a major highway and over 10% were within 100 m (Appatova, 2008). A larger percentage of these schools were located in rural areas compared to urban or sub-urban regions. Atlanta-Sandy Springs-Marietta, GA was an MSA examined in the nationwide study. Of the public schools and students identified in this region, 38.4% of schools and 35.9% of students were located within 400 m of a major highway and 18.2% of schools and 17.6% of students were located within 100 m of a major highway (Appatova, 2008). Atlanta was one of four MSA's with almost 20% of schools located within 100 m of major highway— children who attend these schools are at greatest risk for harmful traffic-related exposures as pollutant concentrations are generally highest within 100 m (Appatova, 2008).

Even though a number of studies have linked traffic exposures related to school location to major highway and higher rates of childhood asthma, few states have adopted policies that prevent new school sites from being located near major highways. According to the Rhode Island Legal Services, only 14 states have regulations that "outright prohibit" the siting of schools in locations that put children at risk to harmful exposures from the presence of "man-made or natural environmental hazards" (RILS, 2006). Furthermore, the policies that have been adopted vary significantly by state (Salvesen, 2008). Regarding transportation related exposures; some states define specific setback distances while others use more broad language in their policies. For example, California advises locating new schools not less than 150 m from urban roadways with more than 100,000 vehicles per day and rural roadways with more than 50,000 vehicles per day (California Environmental Protection Agency, 2005). However, siting policy that uses broad language tends to be more "advisory" in nature and does not strictly prevent schools from being sited in locations that pose a threat to student health and safety (Salvesen, 2008).

The Georgia Department of Education's Guide to Facility Site Selection requires a Phase 1 Environmental Assessment to be conducted at proposed school site location. Additional risk analysis is required for hazards identified on the potential site during the Phase 1 Environmental Assessment. The facility site selection guide provides a table of potential hazards, which includes highways within 0.5-mile (~800 m) radius (GA Dept. EDU, 2012). If the hazard evaluation indicates that the hazard can cause harm, measures must be assessed to reduce or eliminate the hazard on site. According to the guide, computerized modeling programs should be used to determine safe distances from highways (GA Dept. EDU, 2012).

The EPA also published voluntary school siting guidelines to help local school districts evaluate environmental factors as a part of making school siting decisions. Chapter 6 of the school siting guidelines focuses on evaluating the potential impacts of nearby sources of air pollution. Guidelines are provided for assessing nearby transportation sources. Local data transportation activity such as vehicles or trains per day as well as time of operations including peak morning and evening traffic periods should be considered. This data are readily available through the Georgia Department of Transportation and can be used to estimate traffic emission rates. Furthermore, the EPA details additional components that are necessary for the process of assessing the risks of air pollution at a potential school location including: evaluation of local meteorology, topography, and land use, initial assessment of air quality monitoring and model information, inventory of pollution sources, and potential health impacts of air quality (EPA, 2011).

Meteorological, topography, and land use are important to consider as these factors have a significant effect on the distribution of air pollutant concentrations (Hagler, 2012). A school's proximity to a road or major highway does not necessarily equate to an increased risk of air pollution exposures (Henry & Martin, 2013). For example, school sites located uphill of roadways often experience less pollution than those that are downhill. Furthermore, wind and other topographical features play a major role in spatial variations of pollutants. School site locations that are primarily downwind of a major highway may be at greater risk for harmful exposures compared to those that are located upwind of the source (Hagler, 2012). However, pollutants have been shown to travel upwind of roads as a result of airflow patterns (EPA, 2011). Thus, there may not be significant differences between upwind and downwind locations— differences if any may vary from site to site.

1.2 Purpose of Study

A large number of existing schools are located in proximity to interstate, U.S. and state highways (Appatova, 2008). Unfortunately, changes to school siting guidelines will not address the exposure issues to children at existing schools. However, modifications to the school environment can be made at existing schools meeting these criteria to reduce traffic-related pollution exposure and to make them more protective to children with asthma. Due to their central location to Atlanta, Fulton County and Atlanta Public School districts are divided by a number of major highways and expressways and were hypothesized to have a number of schools in proximity to major highways and expressways.

Similar to the nationwide proximity study of public schools, geospatial analysis was used to identify schools for this study. However, the nationwide proximity study examined schools located in the Atlanta- Sandy Springs- Marietta, GA metropolitan statistical area. This area did not thoroughly capture schools in the

Fulton County and Atlanta Public School districts. The districts include schools in downtown Atlanta as well as metro areas north, northeast, south and southwest of the city whereas the Sandy Springs and Marietta areas are located north and northwest of Atlanta. Furthermore, the buffer threshold for this study was based on the Georgia Department of Education's Guide to Facility Site Selection, which identifies highways within 0.5-mile radius as a potential environmental hazard to students (GA Dept. EDU, 2012). In addition, methods were used in this study to prioritize the schools according to proximity to major highways and expressways where efforts to mitigate traffic-related pollution exposures should be focused. Recommendations for best practices for HVAC filter type and maintenance to reduce infiltration of outdoor pollutants into the indoor environment at these high-risk target schools are also provided.

Fulton County has an active coalition in conjunction with the health department, called the Fulton Asthma Improvement and Reduction (FAIR), that is focused on reducing incidence and severity of asthmatic episodes for Fulton County children. The coalition recognizes the importance of asthma triggers in the indoor environment. Schools often fail to take appropriate steps (e.g. adequate HVAC and air filters) to address indoor air quality concerns for students (Geller, 2007). The FAIR Coalition can use the results of this study to build an evidence base for stricter school siting guidelines, for planning safe routes to school, and for mitigation strategies to limit pollutant exposures for children who attend high-risk schools. The report can also be used as a tool for engaging school authorities to identify schools and the children attending schools within higher hazard areas and thus help authorities prioritize prevention measures.

Review of the Literature

2.1 Physiological Factors

As a result of physiological factors and behavior, children face a greater risk of exposure to environmental toxins and a greater susceptibility to adverse health effects related to harmful exposures (Amler, 2003). Generally, children spend more time outdoors and their breathing zone is closer to the ground where heavier than air toxicants are more concentrated (Amler, 2003). The combination of these factors contributes to higher risk of air pollution exposures compared to adults. Furthermore, children have higher rates of breathing, fewer alveoli for gas exchange, and greater oxygen requirements (Amler, 2003). Once exposed to toxins, children have a smaller body mass than adults— as a result higher concentrations of the toxin (dose per kilogram body weight) are present in the body (Amler, 2003). Children are also less capable of metabolizing or excreting toxins due to immature liver and kidney function (Amler, 2003).

Children spend a significant amount of time at schools— more than any other place except for their homes (Geller, 2007). Time spent outdoors during the school day is often when road traffic and pollution concentrations are the heaviest. Environmental conditions are often not a priority when selecting school sites. Instead, site selection is based on the price and availability of land as well as ease of bus access (Henry & Martin, 2013). According to Geller, schools commonly have inadequate ventilation, increased levels of carbon dioxide, volatile organic compounds (VOC), bioaerosols, bacteria, dust mites and animal allergens that exacerbate asthma problems (Geller, 2007).

2.2 Proximity Studies

The majority of studies linking adverse health outcomes with environmental exposures related to school site location have been conducted in California— air pollution has historically been a major issue for the state. The relationship between traffic pollutant exposures and childhood asthma was studied in southern California school children age 5-7 years (McConnell, 2006). Study results showed that children living at residences within 75 m of a major road had an increased risk of lifetime asthma compared with those children living at least 300 m from a major road way (OR =1.50; 95% CI 1.16-1.95) (McConnell, 2006). This higher risk decreased at residences located 150 to 200 m from a major road (McConnell, 2006). The strongest associations for the study were among students with no parental history of asthma and in those students that had lived at the same address for most of their life (McConnell, 2006). McConnell also examined parent reported physician diagnosis of new-onset asthma for a cohort of 2,497 kindergarten and first grade children. Study results showed increased risk of asthma with modeled traffic-related pollutant exposure from roadways near homes (HR 1.51, 95% CI 1.25- 1.82) and schools (HR 1.45, 95% CI 1.06- 1.98) (McConnell, 2010). Finally, associations were also found between traffic-related pollution and childhood asthma in 208 children from 10 Southern California communities— closer residential distance to freeway was linked to increased asthma risk (Gauderman, 2005).

A study comparing spatial relationships between asthma prevalence and traffic pollutant sources in Buffalo, NY, found statistically significant associations between proximity to pollutant source and number of diagnosed asthma cases ($p < 0.05$)— 2/3 of asthmatic suffers lived between 204 and 700 meters from traffic pollutant sources (Oyana et. al. 2004). Furthermore, Newcomb used GIS analysis to track the distance between asthma patients' residential locations to nearest roadways including freeway, highway and major roads (Newcomb, 2008). Study results showed approximately 74% of asthma patients lived with 1,500 meters of major roadways compared to 29% of patients without asthma diagnoses. However, approximately 7% of asthma patients lived in locations over 3,000 meters from major roadways compared to 42% of patients without asthma (Newcomb, 2008).

2.3 Traffic Pollutant Exposures

A prospective study conducted by Gauderman, examined lung function of 1759 children from schools in 12 southern California annually for eight years (Gauderman, 2004). Researchers were interested in determining the relationship between air pollution and the forced expiratory volume in one second (FEV_1). According to data collected from air monitoring stations in the communities, several traffic-related ambient air exposures were identified including particulate matter less than 2.5 µm ($PM_{2.5}$), ozone, acid vapor, nitrogen dioxide, and elemental carbon. Low FEV_1 was associated with exposure to nitrogen dioxide ($P=0.005$), acid vapor ($P=0.004$), $PM_{2.5}$ ($P=0.04$), and elemental carbon ($P= 0.007$) (Gauderman, 2004). Similarly, a cross-sectional study conducted in Fresno, CA of 214 children revealed associations between altered pulmonary function in children with asthma and highway traffic near their residence (Margolis et. al. 2009).

A cross-sectional study including 5,917 children was conducted in schools of the Cone Norte of Lima, Peru. Researchers examined the impact of traffic density on asthma prevalence among school children. A traffic flow index consisting of low (1,800 vehicles per hour), medium (1,800 – 3,000 vehicles per hour), and high (> 3,000 vehicles per hour) was used for analysis. For the 6-7 year age group, prevalence of asthma according to traffic flow index low, medium, and high was 8.6% (CI 6.8- 10.8), 10.3% (CI 8.4- 12.4), and 15.3% (CI 13.3- 17.5). Similarly, the study results for the 13 to 14 year age group were low 11.9% (CI 9.4- 14.6), medium 13.3% (CI 11.6- 15.2) and high 17.1% (CI 14.7- 19.6) (Carbajal-Arroyo et. al. 2007).

2.4 Disproportionately Affected Populations

Studies of childhood asthma also imply that school site related traffic exposures disproportionately affect disadvantaged populations. A study of California public schools found that a higher percentage of non-white students (78%) attended schools located near high-traffic roads compared to lower percentages of non-white students (60%) at schools with low exposure (Green, 2003). Associations between traffic exposure and minority populations were also identified through school and census-tract socioeconomic indicators including percentage of English language learners and percentage of children enrolled in free or reduced price meal programs. Again, higher percentages of student populations of English language learners and free or reduced price meal programs were found in those schools located near high-traffic roads (Green, 2003).

Methods and Procedures

3.1 Data Source

Fulton County and Atlanta Public Schools (K-12) were identified using the National Center for Education Statistics spatial data (NCES, 2014). The National Center for Education Statistics (NCES) is located within the U.S. Department of Education and the Institute of Education Sciences. The NCES is responsible for collection and analyzing educational data in the U.S. 2010 Census data and spatial data for school locations in 2010-2011 were exported to ArcMap in ArcGIS version 10.1 software (ESRI, USA) for geospatial analysis. Spatial data including shapefiles for school districts, major roadways, and expressways from the Atlanta Regional Commission was also exported to ArcMap and overlaid with the NCES data for analysis (Atlanta Regional Commission, 2014). The major roadways shapefile included city streets, county roads, and U.S. and state highways— however, only U.S. and state highways were analyzed as major highways for this study. Furthermore, the Atlanta Regional Commission distinguishes highways from expressways by classifying expressways as "a divided highway having two or more lanes for the exclusive use of traffic in each direction and full control of access" (Atlanta Regional Commission, 2014).

3.2 Study Analysis

ArcMap in ArcGIS version 10.1 software was used to analyze the spatial data from both the NCES and Atlanta Regional Commission. Fulton County and Atlanta Public Schools were extracted from the school points 2010-2011 spatial data by clipping the schools with the Fulton County and Atlanta Public School district boundaries. Following this clip, only schools residing in the district as well as spatial data for the highways and expressways remained. A 0.5 mi radius buffer was generated for each of the remaining schools. Intersections between the schools with buffer and U.S. and state highways and expressways were evaluated. Some schools intersected multiple highways or had a combination of highway and expressway intersections. Data for these schools including school name, county, street address, enrollment, title code, school type (i.e. regular, charter, magnet), and intersecting highway/expressway was exported to excel for additional analysis for the schools that met the proximity criteria (i.e within a 0.5-mile radius of highway or expressway). The near function was used to sort schools with 0.5 mi. buffer intersections with highway or expressway to prioritize the schools in order of schools located closest to major highway or expressway to schools located furthest away from major highway or expressway. Traffic volume data was obtained from Georgia's State Traffic and Report Statistics (STARS) for expressways and major highways contained in the school districts of interest.

Results

Of 225 total schools in Fulton County and Atlanta Public School districts, 119 were identified as being within a 0.5 mi radial distance from either a major highway or expressway. As a result, schools in Fulton County and Atlanta Public School districts may have elevated levels of traffic-related air pollution on their campuses and potential increased exposure for students. Figures 1 through 5 include maps generated in ArcMap of all the schools in both districts, schools intersecting highway or expressway, and separate maps for the schools intersecting highways and the schools intersecting expressways. Refer to Appendix A for a list of schools sorted by distance from expressway for all schools meeting the buffer intersection criteria including the school name, street, city, zip code, enrollment, and highway column indicating highway intersections in addition to expressway with a "Y" for yes or "N" for no buffer/highway intersection. Similarly, Appendix B contains a list of schools sorted by distance from major highway for all school meeting the intersection criteria with the same information for each school. Atlanta Public Schools are listed in blue text and Fulton County Schools are listed in black text for both tables.

Table 1 provides a summary of school characteristics including enrollment for the schools meeting the proximity criteria. School title code was examined to determine the number of title I schools in proximity to major highway or expressway. Schools with title I designations are among the Nation's highest-poverty schools and several studies have shown that low-income populations are often disproportionately affected by environmental exposures. Of the 119 schools meeting the intersection criteria, 72.2% (86 of 119 schools) were designated Title I.

Table 1- Summary of school characteristics

Indicator	Number (Percent of total)	Enrollment
School within 0.5 mi. of Expressway	62 (27.5%)	32426
School within 0.5 mi. of Highway	93 (41.3%)	56205
School within 0.5 mi of Highway and Expressway	36 (16.0%)	16275
Title I Schools within 0.5 mi. of Highway or Expressway	86 (72.3%)	49088

Figure 1

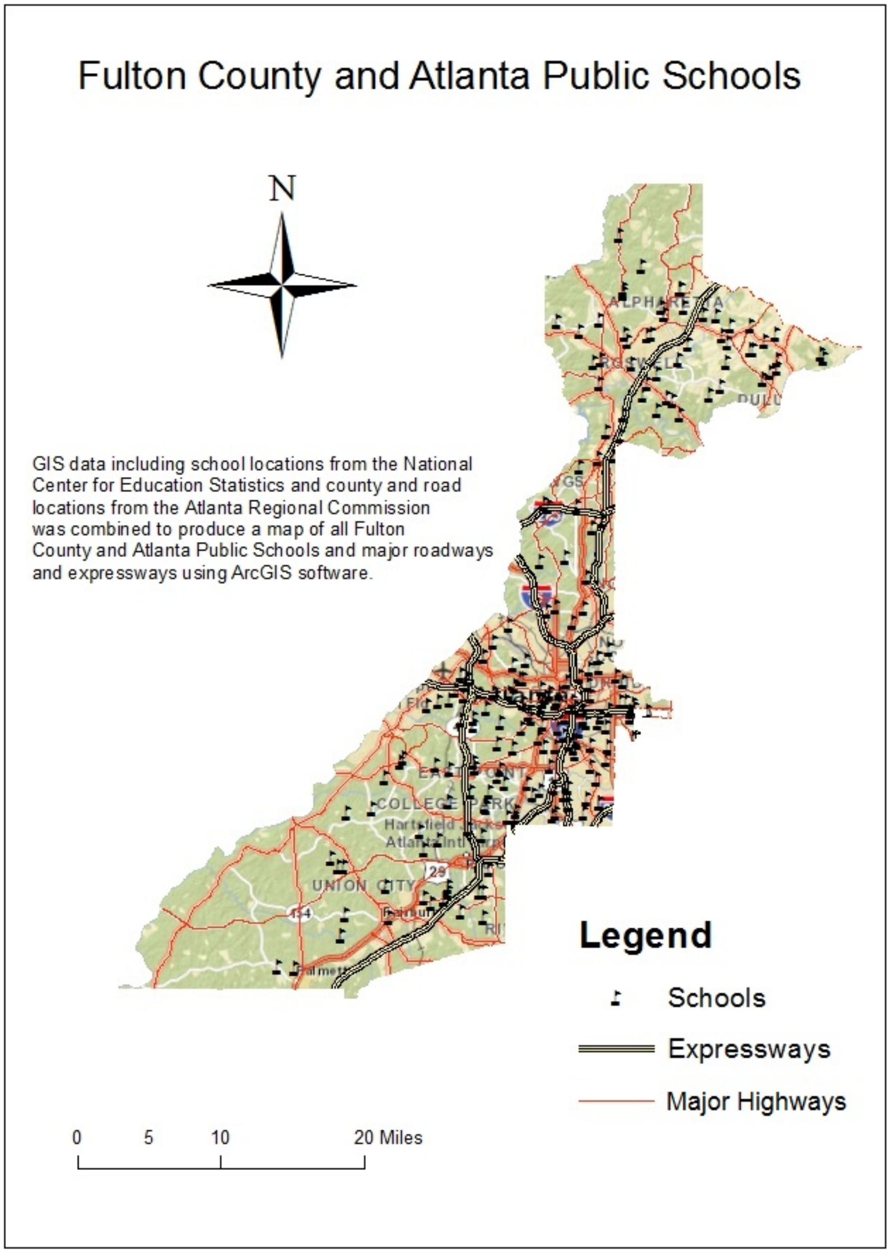

Fulton County and Atlanta Public Schools
N
GIS data including school locations from the National Center for Education Statistics and county and road locations from the Atlanta Regional Commission was combined to produce a map of all Fulton County and Atlanta Public Schools and major roadways and expressways using ArcGIS software.
COLLEGE PARK
UNION CITY
Legend
Schools
Expressways
Major Highways
0
5
10
20 Miles

Figure 2

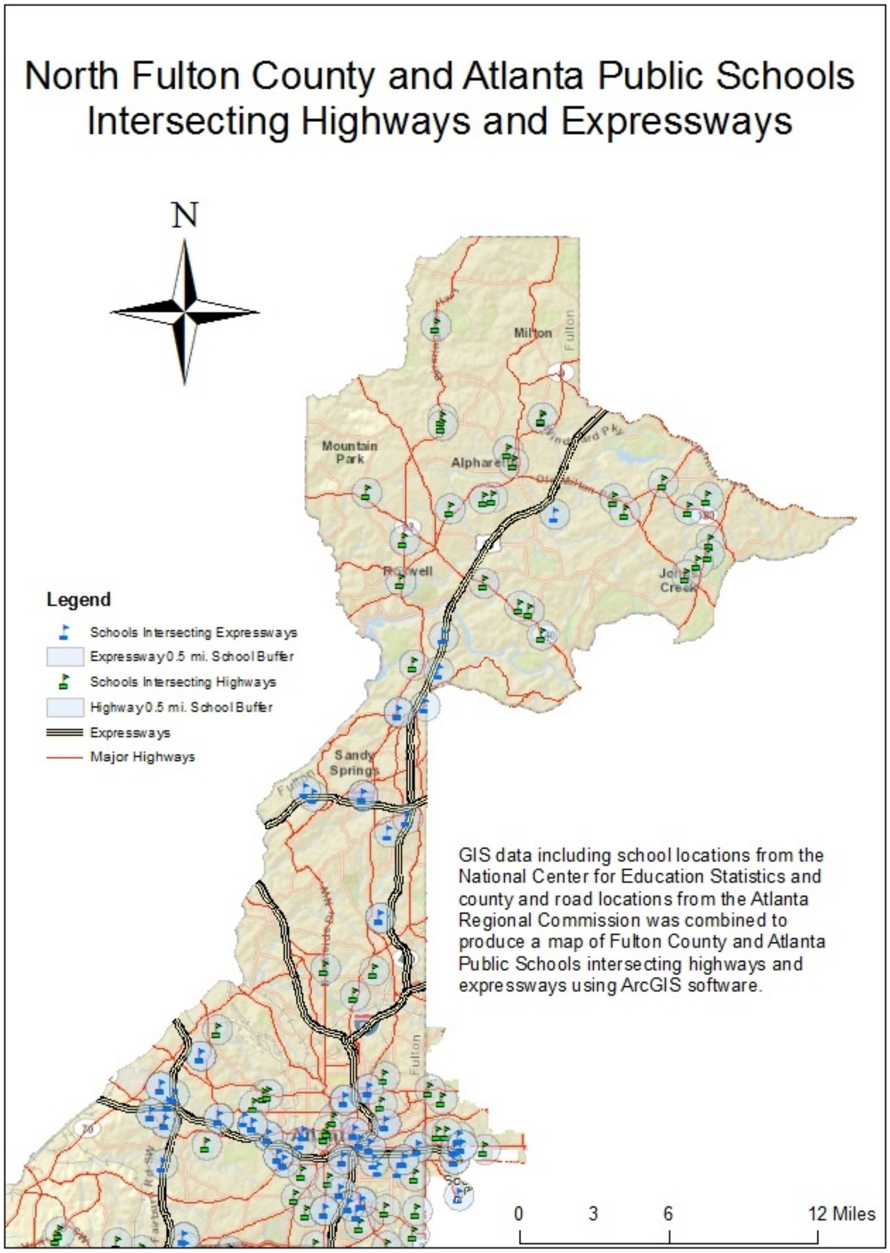

North Fulton County and Atlanta Public Schools
Intersecting Highways and Expressways
N
Legend
Schools Intersecting Expressways
Expressway 0.5 mi. School Buffer
Schools Intersecting Highways
Highway 0.5 mi. School Buffer
Expressways
Major Highways
Milton
Mountain Park
Sandy Springs
GIS data including school locations from the National Center for Education Statistics and county and road locations from the Atlanta Regional Commission was combined to produce a map of Fulton County and Atlanta Public Schools intersecting highways and expressways using ArcGIS software.
0 3 6 12 Miles

Figure 3

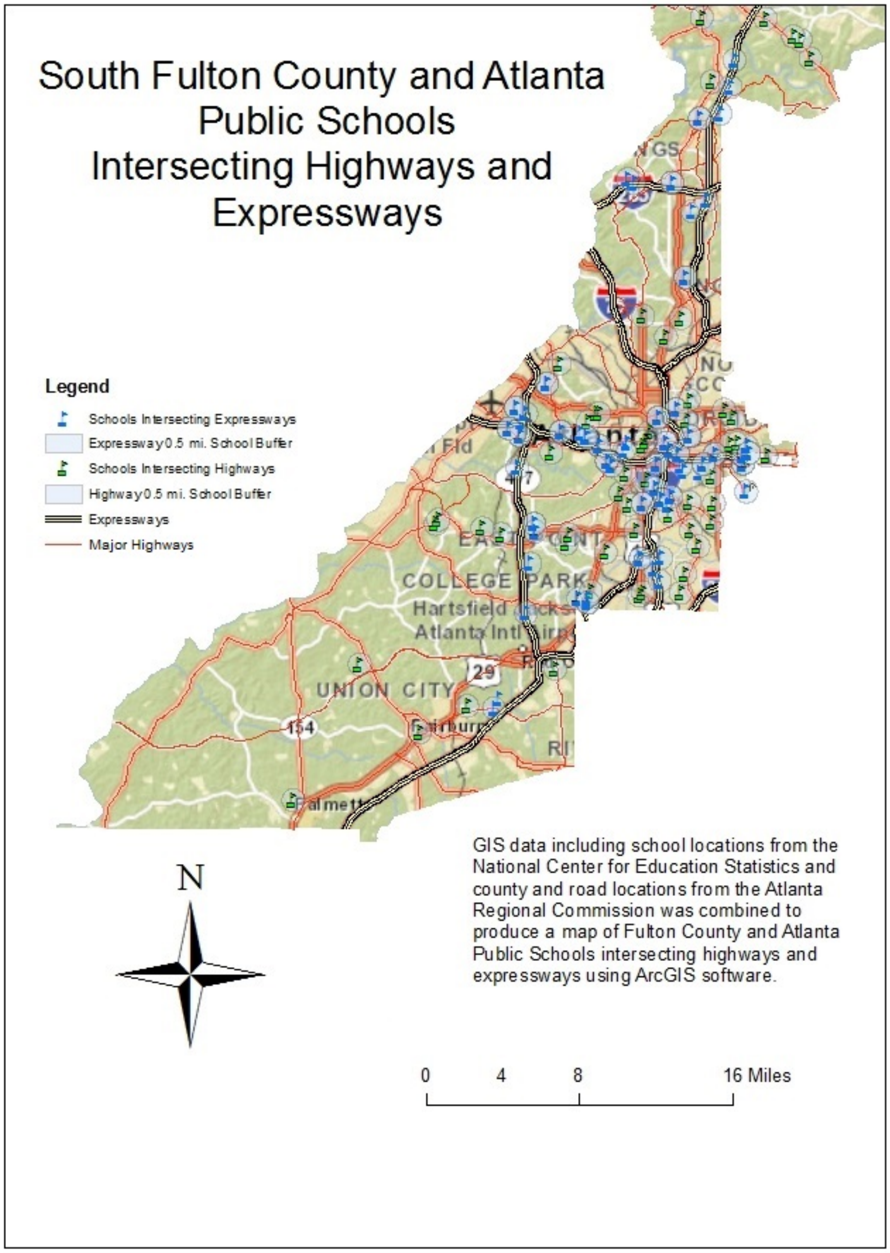

South Fulton County and Atlanta Public Schools Intersecting Highways and Expressways
Legend
Schools Intersecting Expressways
Expressway 0.5 mi. School Buffer
Schools Intersecting Highways
Highway 0.5 mi. School Buffer
Expressways
Major Highways
COLLEGE PARK
UNION CITY
N
GIS data including school locations from the National Center for Education Statistics and county and road locations from the Atlanta Regional Commission was combined to produce a map of Fulton County and Atlanta Public Schools intersecting highways and expressways using ArcGIS software.
0
4
8
16 Miles

Figure 4

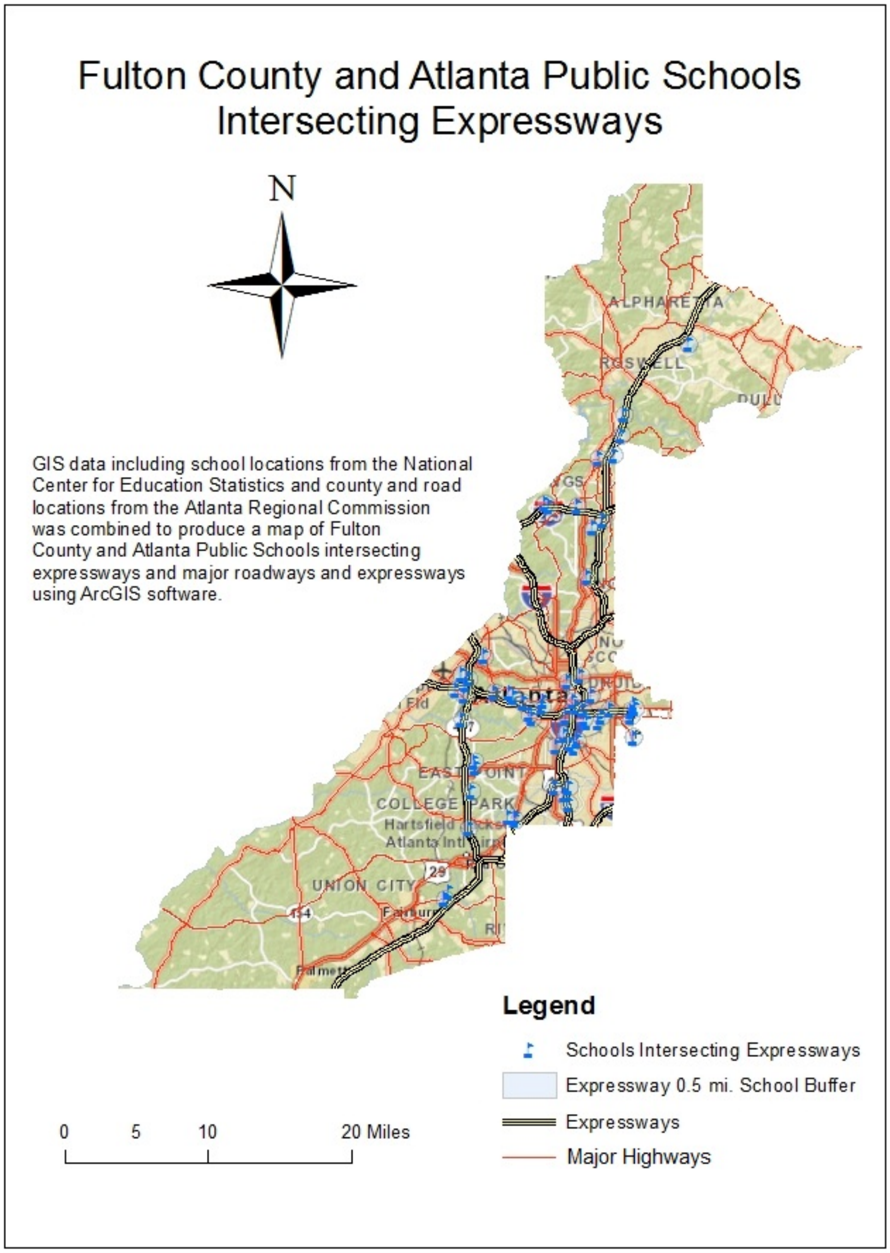
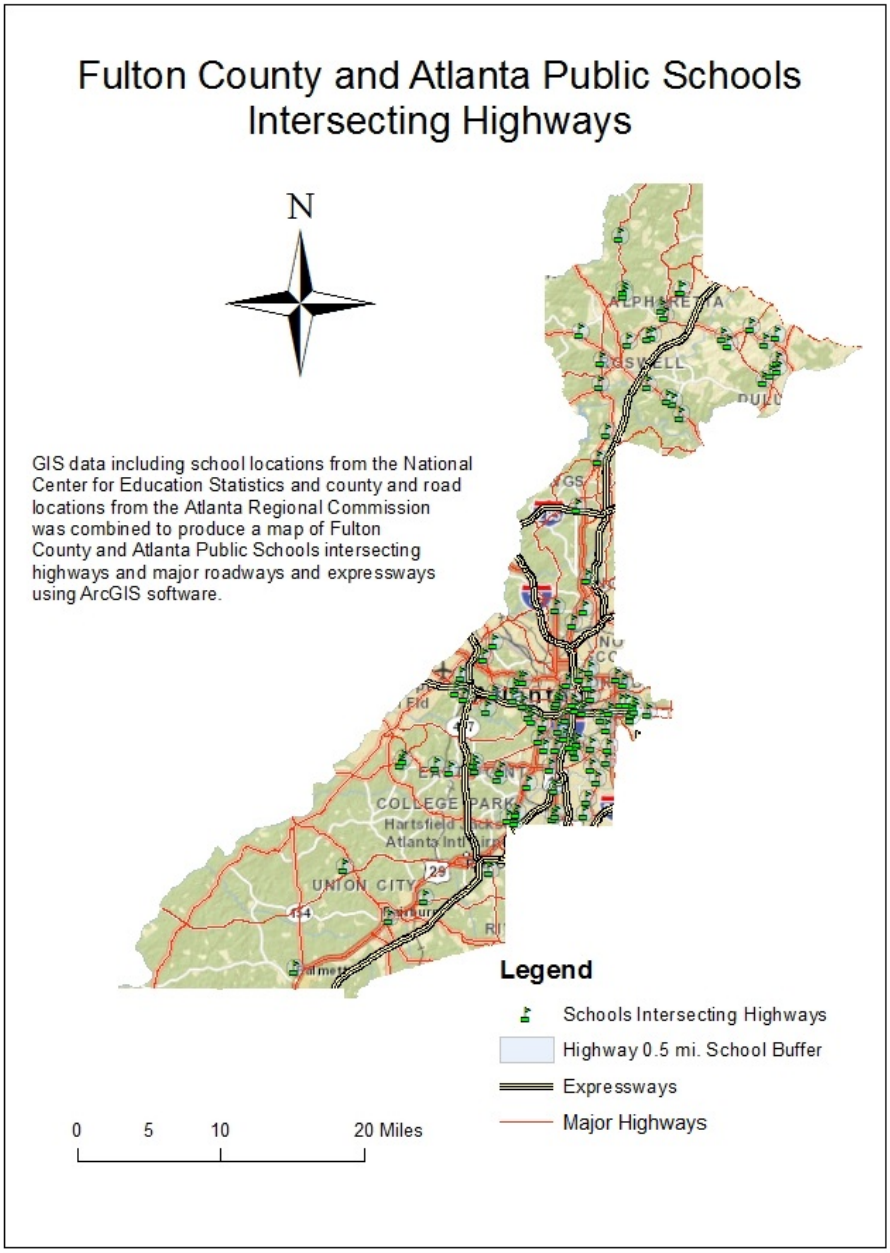
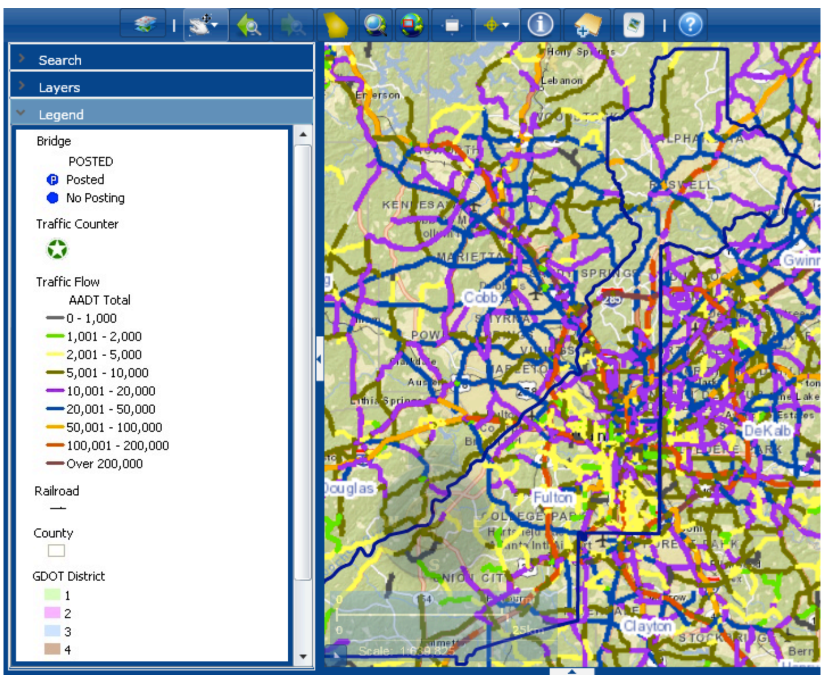

Fulton County and Atlanta Public Schools
Intersecting Expressways
N
GIS data including school locations from the National Center for Education Statistics and county and road locations from the Atlanta Regional Commission was combined to produce a map of Fulton County and Atlanta Public Schools intersecting expressways and major roadways and expressways using ArcGIS software.
UNION CITY
Legend
Schools Intersecting Expressways
Expressway 0.5 mi. School Buffer
Expressways
Major Highways
0
5
10
20 Miles

Figure 5


Fulton County and Atlanta Public Schools
Intersecting Highways
N
GIS data including school locations from the National Center for Education Statistics and county and road locations from the Atlanta Regional Commission was combined to produce a map of Fulton County and Atlanta Public Schools intersecting highways and major roadways and expressways using ArcGIS software.
COLLEGE PARK
UNION CITY
Legend
Schools Intersecting Highways
Highway 0.5 mi. School Buffer
Expressways
Major Highways
0
5
10
20 Miles

Traffic flow data obtained from GDOT STARS system indicated that expressways including I-285 (GA-407 N & S), I-20 (GA-402 E), I-75 (GA-401 N), I-85 (GA-403 N), and GA-400 had traffic volumes in the highest range 100,000 – 200,000 vehicles per day. Additionally, STARS reported traffic volumes in the second highest range 50,000- 100,000 vehicles per day for both Langford Parkway and GA-154 W highways. Figure 6 shows the color-coded GDOT map layer produced from STARS that was used to identify the highways and expressways with traffic volumes in the highest ranges.

Figure 6- GDOT STARS Traffic Flow Data



Discussion

As identified in previous studies, a significant number of schools in Fulton County and Atlanta Public School districts were found to be in close proximity to major highways and expressways. According to the literature, proximity is a significant indicator of exposure risk. Furthermore, several studies have combined proximity and traffic flow to analyze exposure risk and the potential link to negative health outcomes such as asthma. When combining location and traffic flow data for this study, the highest risk schools are those schools nearest to expressways I-285 (GA-407 N & S), I-20 (GA-402 E), I-75 (GA-401 N), I-85 (GA-403 N), and GA-400, which reported traffic volumes in the highest range 100,000 – 200,000 vehicles per day. In Fulton County and Atlanta Public Schools districts, 27.5% of schools met these criteria with over 32,000 students enrolled. Additionally, 36 of these schools with enrollment 16,275 also met the intersection criteria for major highways, which can be referenced in Appendix A. These schools may be at higher-risk with traffic-related pollutants produced from two sources in close proximity to their location.

Study Limitations

While research has shown that proximity and traffic data are significant indicators of exposure risk, methods such as local air quality monitoring and computerized modeling programs are often better indicators of exposure because they account for the influence of other variables on air pollutant concentrations. Factors such as meteorology, topography, and land use have a significant effect on the distribution of air pollutant concentrations. Unfortunately, air monitoring and modeling were not a viable option for this study because of time and resources. However, these methods could be used at individual schools in partnership with universities and others who have the resources to conduct monitoring or modeling in order to better assess the exposure risk at the schools that have been identified by this study.

The study was limited because of the data available for school locations and characteristics. 2010 Census data and spatial data for school locations in 2010-2011 were used. Unfortunately, data for 2014 were not available. As a result, school characteristics such as title code and enrollment do not accurately represent current school characteristics. Furthermore, some schools included in the analysis may no longer be operational. In addition, overlapping of school buffers was a potential source of error for the study methods. In some cases, overlapping of two school buffers created a buffer and expressway/highway intersection where one did not exist— steps were taken to remove these cases.

Recommendations

While adopting new guidelines in Georgia will be costly, investments in better procedures for school site selection may be realized in lower medical costs associated with asthma. Incorporating EPA School Siting Guidelines with the current Georgia Department of Education's Facility Site Selection would strengthen site selection procedures. According to the Georgia Department of Human Resources, there are more than 47,000 emergency room visits per year at cost of $35 million and more than 11,000 hospitalizations per year at a cost of $107 million with asthma as the primary diagnosis in Georgia (Georgia DHR, 2007). Since children are disproportionately affected by asthma in Georgia and environmental exposures may be a significant risk factor for asthma, stricter school siting guidelines have the potential to reduce the burden of asthma on children and families, decrease the number of missed school days due to asthma, and decrease medical costs associated with asthma. Yet, the potential negative consequences of stricter school site selection guidelines must also be considered. For example in certain communities, land availability or cost may limit site selection. Thus, in these situations school siting guidelines may require that a school be placed further from residences resulting in longer commute times and negative environmental consequences. However, school authorities in making decisions should consider all of the factors in school siting, including health. Health impact assessments (HIA) may be a helpful tool in identifying and assessing how potential hazards at proposed sites impact health and well being (EPA, 2014). According to the EPA, HIAs evaluate public health impacts of projects, policies, or plans and help inform communities with information or advice to influence choices that positively impact health (EPA, 2014). The EPA is engaged with the Massachusetts DPH in a HIA case study to assess transportation related indoor air exposures at the Gerena School in Springfield, MA which may serve as a good guideline for conducting HIAs at schools with similar exposures (EPA, 2014).

As pointed out in the results of this and other studies, many existing schools are located in proximity to major highways and expressways. Therefore, strategies are needed to control asthma schools and to make schools asthma friendly; especially at schools where children are at high-risk for traffic-related exposures as a result of their location. The Fulton Asthma Improvement and Reduction Coalition has identified an opportunity for schools in Fulton County to improve indoor air quality by making use of best practices for HVAC systems, air filter use and maintenance to prevent the infiltration of outdoor air pollutants into the indoor environment. In 2012, the EPA published a series of guidelines and best practices as a resource for designing new schools and for repairing, renovating and maintaining existing school facilities. The Indoor Air Quality (IAQ) Design Tools for Schools recommends that air filters should have a dust-spot rating between 35% to 80% and a minimum efficiency rating value (MERV) between 8 and 13 (EPA, 2012). For the MERV rating system, higher rating values correspond with better protection for HVAC equipment and facility occupants. Table 1 includes a list of particle size ranges and groupings adapted from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 52.2 guidelines. These groupings E1-E3 are used in Table 2 to show the ASHRAE 52.2 MERV value corresponding to a filter's average efficiency for capturing particles.

Table 2 – ASHRAE 52.2 Particle Size Ranges

Range	Size (in Microns)	Group
1	0.30 to 0.40	E1
2	0.40 to 0.55	E1
3	0.55 to 0.70	E1
4	0.70 to 1.00	E1
5	1.00 to 1.30	E2
6	1.30 to 1.60	E2
7	1.60 to 2.20	E2
8	2.20 to 3.00	E2
9	3.00 to 4.00	E3
10	4.00 to 5.50	E3
11	5.50 to 7.00	E3
12	7.00 to 10.0	E3

The FAIR Coalition has communicated that many schools in Fulton County and the Atlanta Public School system do not use filters that meet these recommended criteria. In addition to filter type, HVAC system and filter maintenance is crucial to indoor air quality. The IAQ Design Tools for Schools recommends the installation of a simple pressure differential gauge to be used as an indicator of when air filter replacement is appropriate. Without gauges or a proper maintenance plan air filters that are no longer filtering harmful pollutants may be left in place resulting in poor indoor air quality. Schools should label HVAC system components to facilitate both proper operation and maintenance. In addition, schools following the IAQ guidelines form an in-school committee (typically teacher, nurse, administrator, custodian, maintenance person) to learn about IAQ, send out a survey to help locate problems, conduct a walk-thru inspection of the building, and then compile a list of things to be changed. The guidelines recommend a maintenance plan which includes staff education, an established budget, staff qualified to perform tasks, schedules for periodic maintenance checks and logs, and the availability of spare parts on site (EPA, 2012).

Table 3 – ASHRAE 52.2 MERV Parameters

MERV Value	Group 1 Av. Eff. % (0.30 to 1.00)	Group 2 Av. Eff. % (1.00 to 3.00)	Group 3 Av. Eff. % (3.00 to 10.00)
1	n/a	n/a	E3<20
2	n/a	n/a	E3<20
3	n/a	n/a	E3<20
4	n/a	n/a	E3<20
5	n/a	n/a	20<35
6	n/a	n/a	35<50
7	n/a	n/a	50<70
8	n/a	n/a	70
9	n/a	E2<50	85
10	n/a	50<65	85
11	n/a	65<80	85
12	n/a	80	90
13	E1<75	90	90
14	75<85	90	90
15	85<95	90	90
16	95	95	95

Note: This table was adapted from ASHRAE 52.2 guidelines, 2007.

In addition to limiting infiltration of outdoor pollutants into the indoor environment, schools can implement policies to limit children's exposure of traffic-related pollutants outdoors. The CDC's National Asthma Control Program recommends school bus and automobile anti-idling policies at schools to reduce student exposure to vehicle emissions. Furthermore, Mothers & Others for Clean Air, a leading partnership of public health, environmental and child advocacy organizations, has sponsored a new initiative for Georgia schools. The Air Quality Index flag program makes the air quality known to the entire school community with flags that fly daily reflecting the air quality (Environmental Education in Georgia, 2104). Many schools have implemented this or similar programs to notify students and teachers of poor outdoor air quality days so that appropriate actions can be taken to limit time outdoors and reduce exposure to harmful pollutants. Air Quality Index (AQI) is readily available through local media sources including newspapers, television, and radio. According to AQI tables, time outdoors should be limited for students on days with AQI ranges above 101.

Finally, air quality research has shown the potential of trees and shrubs to remove significant amounts of air pollutants. Urban vegetation has additional benefits such as providing shade; reducing heat-island effects and building energy costs (Hagler, 2012). A study of tree cover in Atlanta, GA found that the city has a relatively high tree cover percentage at 32.9% and air pollution removal by urban trees contributed to percent air quality improvements which varied among pollutants (0.002% CO, 0.5% NO_2, 0.7% O_3, 0.7% PM_{10}, and 0.7% SO_2 Nowak, 2006). Trees remove gaseous air pollution by uptake via leaf stomata; some gases can also be removed by the plant surface (Nowak, 2006). Recently, an emphasis has been placed on the harm of particulate matter (PM) especially the smallest sizes because of its ability to deeply penetrate the lungs. Trees are capable of intercepting these airborne particles. Several factors contribute to the deposition and collection of particulate matter by trees and shrubs. Particle size, composition, and concentrations play an important role in these processes as well as characteristics of vegetation including species, leaf structure, leaf density and branch orientation. As previously discussed meteorological conditions are also important to the spatial variations of particles.

In addition to just increasing tree cover to help improve air quality, more targeted approaches for removing air pollution may be viable with vegetative barriers. Studies have identified the potential for roadside barriers, such as tree stands or noise barriers, to reduce traffic emissions behind barriers by altering pollutant dispersion and by capturing pollutants (Hagler, 2012). Vegetative barriers in particular are not yet well understood and more research is needed to effectively quantify the effects of barriers on air pollutant removal and air quality improvements. However, if vegetative barriers are found to be effective options for mitigating air pollution, potential negative consequences of urban planting should also be weighed. Urban vegetation can produce undesirable effects such as increased levels of pollen and habitats for invasive pest species (Hagler, 2012). Pollen and undesirable species may be controlled by landscape planning, selection of species, and maintenance.

Conclusion

Childhood asthma is a significant problem for the state of Georgia. School absenteeism has a negative effect on educational opportunities. Furthermore, the costs of hospitalization and asthma treatment are significant. To reduce the burden of asthma for children in Georgia, considering the role of school environmental exposures is essential. Research has linked childhood asthma to traffic-related air pollutant exposures. In addition, research has shown that school site proximity to major highway is associated with increased risk of asthma. These associations have not prompted appropriate changes in state legislation that prohibit schools from being placed in locations where harmful environmental exposures are a concern. Currently, the Georgia Department of Education does use guidelines that require environmental assessments and evaluation of hazards and mitigation strategies for addressing hazard exposures. However, the EPA guidelines for school site selection are more comprehensive and would be better suited to use as the standard for locating schools. Health impact assessment may also be helpful in reducing health hazards and improving site-related conditions before siting decisions are made (EPA, 2014).

As identified in this study of Fulton County and Atlanta Public School districts, a number of existing schools are located within close proximity to a major highway or expressway. Children spend a significant amount of time at school both in school buildings and on outdoor facilities. Time spent outdoors during the school day is often at times of peak traffic concentrations and thus the greatest risk for harmful pollutant exposures. In addition, harmful traffic-related pollutants can penetrate the indoor school environment at school facilities that do not use proper air filters and that may have outdated HVAC systems.

This study was designed to help the Fulton Air Improvement and Reduction Coalition identify schools in Fulton County and Atlanta Public Schools systems where students may be at highest-risk for exposure to traffic-related pollutants. Geospatial analysis and traffic flow data indicated a number of schools in the district at high risk for traffic-related pollutant exposures based on school proximity to major highway or expressway and traffic volume. Coalitions such as FAIR play an important role in identifying strategies for schools to improve indoor environmental air quality and limit outdoor environmental exposures for students thus making school sites more asthma-friendly. The data and recommendations in this report should be used to encourage school district officials to improve procedures for locating schools and to implement strategies that allow schools to reduce the risks of asthma among children.

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Appendix A- Atlanta and Fulton County (Georgia) Public Schools Located Within One-half Mile of an Expressway, Ranked Closest to Farthest from Expressway, 2014.

School Name	Street	City	Zip	Enrollment	HWY
BAZOLINE E. USHER/COLLIER HEIGHTS ELMENTARY*	631 HARWELL RD NW	ATLANTA	30318	370	N
RIVERWOOD INTERNATIONAL CHARTER SCHOOL	5900 HEARDS DR NW	ATLANTA	30328	1664	N
SANDY SPRINGS MIDDLE SCHOOL*	8750 COLONEL DR	ATLANTA	30350	897	N
HARPER-ARCHER MIDDLE SCHOOL*	3399 COLLIER DR NW	ATLANTA	30331	591	Y
RIDGEVIEW CHARTER SCHOOL*	5340 TRIMBLE RD NE	ATLANTA	30342	820	N
MAYS HIGH SCHOOL*	3450 BENJAMIN E MAYS DR SW	ATLANTA	30331	1518	N
BROOKVIEW ELEMENTARY SCHOOL*	3250 HAMMARSKJOLD DR	EAST POINT	30344	487	N
APS-FORREST HILLS ACADEMEY*	2930 FORREST HILLS DR SW	ATLANTA	30315	201	N
BURGESS-PETERSON ELEMENTARY SCHOOL*	480 CLIFTON ST SE	ATLANTA	30316	262	Y
CRIM HIGH SCHOOL*	256 CLIFTON ST SE	ATLANTA	30317	560	Y
HUTCHINSON ELEMENTARY SCHOOL*	650 CLEVELAND AVE SW	ATLANTA	30315	475	Y
LONG MIDDLE SCHOOL*	3200 LATONA DR SW	ATLANTA	30354	601	N
ATLANTA HEIGHTS CHARTER COMMISSION SCHOOL*	3670 MARTIN LUTHER KING JR DR	ATLANTA	30331	373	Y
DUNWOODY SPRINGS CHARTER SCHOOL*	8100 ROBERTS DR	ATLANTA	30350	735	N
MAYNARD H. JACKSON- JR. HIGH SCHOOL*	801 GLENWOOD AVE SE	ATLANTA	30316	814	Y
F. L. STANTON ELEMENTARY SCHOOL*	1625 MARTIN LUTHER KING JR DR	ATLANTA	30314	278	Y
DOUGLASS HIGH SCHOOL*	225 HAMILTON E. HOLMES DRIVE.	ATLANTA	30318	1284	Y
SLATER ELEMENTARY SCHOOL*	1320 PRYOR RD SW	ATLANTA	30315	495	Y
HEARDS FERRY ELEMENTARY SCHOOL	1050 HEARDS FERRY RD NW	ATLANTA	30328	564	N
KING MIDDLE SCHOOL*	545 HILL ST SE	ATLANTA	30312	549	N
WOODLAND ELEMENTARY SCHOOL*	1130 SPALDING DR	ATLANTA	30350	886	N
LAKE FOREST ELEMENTARY*	5920 SANDY SPRINGS CIR NE	ATLANTA	30328	743	Y
KIPP STRIVE ACADEMY*	1444 LUCILE AVE SW	ATLANTA	30310	184	Y
PARKS MIDDLE SCHOOL*	1090 WINDSOR ST SW	ATLANTA	30310	450	Y
CLEVELAND ELEMENTARY SCHOOL*	2672 OLD HAPEVILLE RD SW	ATLANTA	30315	349	N
CENTENNIAL PLACE ELEMENTARY SCHOOL*	531 LUCKIE ST NW	ATLANTA	30313	452	Y
THE BEST ACADEMY AT BENJAMIN S. CARSON HS*	1820 MARY DELL DR SE	ATLANTA	30316	538	N
SMITH ELEMENTARY SCHOOL	370 OLD IVY RD NE	ATLANTA	30342	1031	Y
KINDEZI	98 ANDERSON AVE NW	ATLANTA	30314	96	Y
TURNER MIDDLE SCHOOL	98 ANDERSON AVE NW	ATLANTA	30314	0	Y
MAIN STREET CHARTER ACADEMY ELEMENTARY*	3726 MAIN ST	ATLANTA	30337	518	Y
PEACHTREE HOPE CHARTER SCHOOL*	1807 MEMORIAL DR SE	ATLANTA	30317	550	Y
SOUTH FULTON CROSSROADS	4025 FLAT SHOALS RD	UNION CITY	30291	0	N
SOUTH METRO PSYCHOEDUCATIONAL PROGRAM	4025 FLAT SHOALS RD	UNION CITY	30291	0	N
M. A. JONES ELEMENTARY SCHOOL*	1040 FAIR ST SW	ATLANTA	30314	609	N
HOPE ELEMENTARY SCHOOL*	112 BOULEVARD NE	ATLANTA	30312	264	Y
FAIN ELEMENTARY SCHOOL*	101 HEMPHILL SCHOOL RD NW	ATLANTA	30331	435	Y
CONTINENTAL COLONY ELEMENTARY SCHOOL*	3181 HOGAN RD SW	ATLANTA	30331	351	N
WEST END ACADEMY	1325 RALPH DAVID ABERNATHY	ATLANTA	30310	0	Y

TOWNS ELEMENTARY SCHOOL*	760 BOLTON RD NW	ATLANTA	30331	353	Y
HIGH POINT ELEMENTARY SCHOOL*	520 GREENLAND RD NE	ATLANTA	30342	730	N
NEW PROSPECT ELEMENTARY SCHOOL	3055 KIMBALL BRIDGE RD	ALPHARETTA	30022	569	N
NEIGHBORHOOD CHARTER SCHOOL	688 GRANT ST SE	ATLANTA	30315	369	N
EAST LAKE ELEMENTARY SCHOOL*	145 4TH ST NE	ATLANTA	30308	232	Y
PARKSIDE ELEMENTARY SCHOOL*	685 MERCER ST SE	ATLANTA	30312	458	N
NORTH SPRINGS HIGH SCHOOL*	7447 ROSWELL RD NE	ATLANTA	30328	1445	Y
KIMBERLY ELEMENTARY SCHOOL*	3090 MCMURRAY DR SW	ATLANTA	30311	475	Y
BANNEKER HIGH SCHOOL*	5935 FELDWOOD RD	COLLEGE PARK	30349	1310	N
MCCLARIN ALTERNATIVE SCHOOL*	3605 MAIN ST	COLLEGE PARK	30337	253	Y
CORETTA SCOTT KING YOUNG WOMEN'S ACADEMY HS	1190 NORTHWEST DR NW	ATLANTA	30318	139	Y
CORETTA SCOTT KING YOUNG WOMEN'S ACADEMY MS	1190 NORTHWEST DR NW	ATLANTA	30318	544	Y
TOOMER ELEMENTARY SCHOOL*	65 ROGERS ST NE	ATLANTA	30317	225	Y
EARLY COLLEGE HIGH SCHOOL AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	345	Y
SCHOOL OF HEALTH SCIENCES AND RESEARCH AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	429	Y
SCHOOL OF TECHNOLOGY AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	335	Y
THE SCHOOL OF THE ARTS AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	348	Y
CAMPBELL SCHOOL	21 THIRKIELD AVENUE. SW	ATLANTA	30315	0	Y
UNIVERSITY COMMUNITY ACADEMY*	2050 TIGER FLOWERS DR NW	ATLANTA	30314	385	N
THERRELL SCHOOL*	3099 PANTHER TRL SW	ATLANTA	30311	1021	Y
BOOKER T. WASHINGTON HIGH SCHOOL*	45 WHITEHOUSE DR SW	ATLANTA	30314	591	N
WASHINGTON HIGH SCHOOL SENIOR ACADEMY*	45 WHITEHOUSE DR SW	ATLANTA	30314	600	N
COLLEGE PARK ELEMENTARY SCHOOL*	2075 PRINCETON AVE	COLLEGE PARK	30337	276	Y

Note: Atlanta Public Schools are listed in blue text and Fulton County schools are listed in black text
* Title I schools

Appendix B- Atlanta and Fulton County (Georgia) Public Schools Located Within One-half Mile of an Major Highway, Ranked Closest to Farthest from Major Highway, 2014.

School Name	Street	City	Zip Code	Enrollment
NORTH SPRINGS HIGH SCHOOL*	7447 ROSWELL RD NE	ATLANTA	30328	1445
HOLCOMB BRIDGE MIDDLE SCHOOL*	2700 HOLCOMB BRIDGE RD	ALPHARETTA	30022	708
SPRINGDALE PARK ELEMENTARY SCHOOL	1246 PONCE DE LEON AVE NE	ATLANTA	30306	472
AMANA ACADEMY SCHOOL	1565 HOLCOMB BRIDGE RD	ROSWELL	30076	496
ATLANTA HEIGHTS CHARTER COMMISSION SCHOOL*	3670 MARTIN LUTHER KING JR DR	ATLANTA	30331	373
NORTH ATLANTA HIGH SCHOOL*	2875 NORTHSIDE DR NW	ATLANTA	30305	1243
DOBBS ELEMENTARY SCHOOL*	2025 JONESBORO RD SE	ATLANTA	30315	535
MCCLARIN ALTERNATIVE SCHOOL*	3605 MAIN ST	COLLEGE PARK	30337	253
RANDOLPH ELEMENTARY SCHOOL*	5320 CAMPBELLTON RD SW	ATLANTA	30331	657
TECH HIGH SCHOOL*	1043 MEMORIAL DR SE	ATLANTA	30316	201
COOK ELEMENTARY SCHOOL*	211 MEMORIAL DR SE	ATLANTA	30312	339
BETHUNE ELEMENTARY SCHOOL*	220 NORTHSIDE DR NW	ATLANTA	30314	334

CAPITOL VIEW ELEMENTARY SCHOOL*	1442 METROPOLITAN PKWY SW	ATLANTA	30310	257
WOODSON ELEMENTARY SCHOOL*	1605 DONALD LEE HOLLOWELL PKWY	ATLANTA	30318	421
DOUGLASS HIGH SCHOOL*	225 HAMILTON E. HOLMES DRIVE.	ATLANTA	30318	1284
BIRMINGHAM FALLS ELEMENTARY SCHOOL	14865 BIRMINGHAM HWY	MILTON	30004	742
MILTON HIGH SCHOOL	13025 BIRMINGHAM HWY	ALPHARETTA	30004	2628
EARLY COLLEGE HIGH SCHOOL AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	345
SCHOOL OF HEALTH SCIENCES AND RESEARCH AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	429
SCHOOL OF TECHNOLOGY AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	335
THE SCHOOL OF THE ARTS AT CARVER*	55 MCDONOUGH BLVD SE	ATLANTA	30315	348
CRABAPPLE CROSSING ELEMENTARY SCHOOL	12775 BIRMINGHAM HWY	ALPHARETTA	30004	735
ABBOTTS HILL ELEMENTARY SCHOOL	5575 ABBOTTS BRIDGE RD	DULUTH	30097	779
SANDTOWN MIDDLE SCHOOL*	5400 CAMPBELLTON RD SW	ATLANTA	30331	1110
FULTON SCIENCE ACADEMY HIGH SCHOOL	4100 OLD MILTON PKWY	ALPHARETTA	30005	233
PEACHTREE HOPE CHARTER SCHOOL*	1807 MEMORIAL DR SE	ATLANTA	30317	550
WEST END ACADEMY	1325 RALPH DAVID ABERNATHY	ATLANTA	30310	0
MAIN STREET CHARTER ACADEMY ELEMENTARY*	3726 MAIN ST	ATLANTA	30337	518
BURGESS-PETERSON ELEMENTARY SCHOOL*	480 CLIFTON ST SE	ATLANTA	30316	262
THOMASVILLE HEIGHTS ELEMENTARY SCHOOL*	1820 HENRY THOMAS DR SE	ATLANTA	30315	401
GROVE PARK ELEMENTARY SCHOOL*	20 EVELYN WAY NW	ATLANTA	30318	378
KIPP STRIVE ACADEMY*	1444 LUCILE AVE SW	ATLANTA	30310	184
HAMILTON E. HOLMES ELEMENTARY*	2301 CONNALLY DR	EAST POINT	30344	452
NORTHVIEW HIGH SCHOOL	10625 PARSONS RD	DULUTH	30097	1895
HARPER-ARCHER MIDDLE SCHOOL*	3399 COLLIER DR NW	ATLANTA	30331	591
TEACHING MUSEUM NORTH / NORTH CROSSROADS	791 MIMOSA BLVD	ROSWELL	30075	0
HAPEVILLE ELEMENTARY SCHOOL*	3440 N FULTON AVE	HAPEVILLE	30354	747
KIPP VISION	660 MCWILLIAMS RD SE	ATLANTA	30315	86
HUTCHINSON ELEMENTARY SCHOOL*	650 CLEVELAND AVE SW	ATLANTA	30315	475
PERKERSON ELEMENTARY SCHOOL*	2040 BREWER BLVD SW	ATLANTA	30310	360
CHARLES R. DREW CHARTER SCHOOL*	301 E LAKE BLVD SE	ATLANTA	30317	827
HERITAGE ELEMENTARY SCHOOL*	2600 JOLLY RD	ATLANTA	30349	738
CRIM HIGH SCHOOL*	256 CLIFTON ST SE	ATLANTA	30317	560
FAIN ELEMENTARY SCHOOL*	101 HEMPHILL SCHOOL RD NW	ATLANTA	30331	435
CENTENNIAL PLACE ELEMENTARY SCHOOL*	531 LUCKIE ST NW	ATLANTA	30313	452
CAMPBELL ELEMENTARY SCHOOL*	91 ELDER ST	FAIRBURN	30213	897
EAST LAKE ELEMENTARY SCHOOL*	145 4TH ST NE	ATLANTA	30308	232
HOPE ELEMENTARY SCHOOL*	112 BOULEVARD NE	ATLANTA	30312	264
BENTEEN ELEMENTARY SCHOOL*	200 CASSANOVA ST SE	ATLANTA	30315	231
ELKINS POINTE MIDDLE SCHOOL*	11290 ELKINS RD	ROSWELL	30076	891
GIDEONS ELEMENTARY SCHOOL*	897 WELCH ST SW	ATLANTA	30310	591
SLATER ELEMENTARY SCHOOL*	1320 PRYOR RD SW	ATLANTA	30315	495
HUMPHRIES ELEMENTARY SCHOOL*	3029 HUMPHRIES DR SE	ATLANTA	30354	345
ROSWELL HIGH SCHOOL	11595 KING RD	ROSWELL	30075	2471
MEDLOCK BRIDGE ELEMENTARY SCHOOL	10215 MEDLOCK BRIDGE PKWY	ALPHARETTA	30022	671
TRI-CITIES HIGH SCHOOL*	2575 HARRIS ST	EAST POINT	30344	1845
LAKE WINDWARD ELEMENTARY SCHOOL	11770 E FOX CT	ALPHARETTA	30005	881

CENTENNIAL HIGH SCHOOL	9310 SCOTT RD	ROSWELL	30076	1948
THERRELL SCHOOL *	3099 PANTHER TRL SW	ATLANTA	30311	1021
BROWN MIDDLE SCHOOL*	765 PEEPLES ST SW	ATLANTA	30310	614
F. L. STANTON ELEMENTARY SCHOOL*	1625 MARTIN LUTHER KING JR DR	ATLANTA	30314	278
CORETTA SCOTT KING YOUNG WOMEN'S ACADEMY HIGH SCHO	1190 NORTHWEST DR NW	ATLANTA	30318	139
CORETTA SCOTT KING YOUNG WOMEN'S ACADEMY MIDDLE SC	1190 NORTHWEST DR NW	ATLANTA	30318	544
TOOMER ELEMENTARY SCHOOL*	65 ROGERS ST NE	ATLANTA	30317	225
OCEE ELEMENTARY SCHOOL	4375 KIMBALL BRIDGE RD	ALPHARETTA	30022	760
HILLSIDE ELEMENTARY SCHOOL*	9250 SCOTT RD	ROSWELL	30076	739
LIN ELEMENTARY SCHOOL	586 CANDLER PARK DR NE	ATLANTA	30307	574
IMAGINE WESLEY INTERNATIONAL ACADEMY CHARTER FACIL*	1049 CUSTER AVE SE	ATLANTA	30316	625
FICKETT ELEMENTARY SCHOOL*	3935 RUX RD SW	ATLANTA	30331	619
BUNCHE MIDDLE SCHOOL*	1925 NISKEY LAKE RD SW	ATLANTA	30331	816
INTOWN CHARTER ACADEMY	386 PINE ST NE	ATLANTA	30308	392
ISON SPRINGS ELEMENTARY SCHOOL*	8261 ISON ROAD	SANDY SPRINGS	30350	697
MAYNARD H. JACKSON- JR. HIGH SCHOOL*	801 GLENWOOD AVE SE	ATLANTA	30316	814
PARKS MIDDLE SCHOOL*	1090 WINDSOR ST SW	ATLANTA	30310	450
CAMPBELL SCHOOL	21 THIRKIELD AVENUE. SW	ATLANTA	30315	0
SCOTT ELEMENTARY SCHOOL*	1752 HOLLYWOOD RD NW	ATLANTA	30318	439
FULTON SCIENCE ACADEMY	1675 HEMBREE RD	ALPHARETTA	30004	506
WHITEFOORD ELEMENTARY SCHOOL*	35 WHITEFOORD AVE SE	ATLANTA	30317	227
SMITH ELEMENTARY SCHOOL	370 OLD IVY RD NE	ATLANTA	30342	1031
PRICE MIDDLE SCHOOL*	1670 BENJAMIN WELDON BICKERS	ATLANTA	30315	601
ATLANTA CHARTER MIDDLE SCHOOL*	820 ESSIE AVE SE	ATLANTA	30316	197
FULTON SUNSHINE CHARTER ELEMENTARY	1335 NORTHMEADOW PKWY STE 100	ROSWELL	30076	408
HERITAGE ACADEMY ELEMENTARY*	3500 VILLA CIR SE	ATLANTA	30354	436
LAKE FOREST ELEMENTARY*	5920 SANDY SPRINGS CIR NE	ATLANTA	30328	743
KINDEZI	98 ANDERSON AVE NW	ATLANTA	30314	96
TURNER MIDDLE SCHOOL	98 ANDERSON AVE NW	ATLANTA	30314	0
COLLEGE PARK ELEMENTARY SCHOOL*	2075 PRINCETON AVE	COLLEGE PARK	30337	276
JOHNS CREEK HIGH SCHOOL	5575 STATE BRIDGE RD	JOHNS CREEK	30022	1615
DUNBAR ELEMENTARY SCHOOL*	403 RICHARDSON ST SW	ATLANTA	30312	333
PALMETTO ELEMENTARY SCHOOL*	505 CARLTON RD	PALMETTO	30268	518
TOWNS ELEMENTARY SCHOOL*	760 BOLTON RD NW	ATLANTA	30331	353
KIMBERLY ELEMENTARY SCHOOL*	3090 MCMURRAY DR SW	ATLANTA	30311	475
GULLATT ELEMENTARY SCHOOL*	6110 DODSON RD	UNION CITY	30291	269

Note: Atlanta Public Schools are listed in blue text and Fulton County schools are listed in black text
* Title I schools

Controlling Traffic-related Pollution Exposure in Schools
Findings and Recommendations for Fulton County and Atlanta Public Schools

Background

According to the CDC, approximately 297,453 children in Georgia had asthma in 2008 (CDC, 2008). Children have 2 to 3 times more asthma-related emergency room visits and higher hospitalization rates than adults in Georgia (Georgia DHR, 2007). School absenteeism as a result of asthma is a problem as children who suffer from the condition miss out on valuable classroom-learning opportunities. The Georgia Department of Human Resources estimates, among children age 5 to 17, about 75,000 children missed about 470,000 days of school due to their asthma (Georgia DHR, 2007).

Even though a number of studies have linked traffic exposures related to school location to major highway and higher rates of childhood asthma, few states have adopted policies that prevent new school sites from being located near major highways. The Georgia Department of Education's Guide to Facility Site Selection requires a Phase 1 Environmental Assessment to be conducted at proposed school site location. The facility site selection guide provides a table of potential hazards, which includes highways within 0.5-mile radius (GA Dept. EDU, 2012). Studies have identified associations between traffic-related pollution sources within 0.5 mi. of location and higher rates of asthma in children. According to the guide, computerized modeling programs should be used to determine safe distances from highways (GA Dept. EDU, 2012). If the hazard evaluation indicates that the hazard can cause harm, measures must be taken to reduce or eliminate the hazard on site.

Siting Recommendations

While adopting new guidelines in Georgia will be costly, investments in better procedures for school site selection may be realized in lower medical costs associated with asthma. Incorporating EPA School Siting Guidelines with the current Georgia Department of Education's Facility Site Selection and using Health Impact Assessments to identify and assess the health impact of potential hazards would strengthen site selection procedures. The Environmental Protection Agency is engaged with the Massachusetts Department of Public Health in a HIA case study to assess transportation related indoor air exposures at the Gerena School in Springfield, Massachusetts which may serve as a good guideline for conducting HIAs at schools with similar exposures (EPA, 2014). According to the Georgia Dept. of Public Health, there are more than 47,000 emergency room visits per year at cost of $35 million and more than 11,000 hospitalizations per year at a cost of $107 million with asthma as the primary diagnosis in Georgia (GA DHR, 2007). Since children are more affected by asthma than adults in Georgia and environmental exposures may be a significant risk factor for asthma, stricter school siting guidelines have the potential to reduce the burden of asthma on children, decrease missed school days due to asthma, and decrease medical costs associated with asthma.

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School Proximity Study

Due to their central location to Atlanta, Fulton County and Atlanta Public School districts are divided by a number of major highways and expressways. This study was conducted to identify schools located within Fulton County and Atlanta Public School districts and used methods to prioritize the schools according to proximity to major highways and expressways where efforts to mitigate traffic-related pollution exposures should be focused. It used existing data sources and Geographic Information Systems mapping.

Study Results

Of 225 total schools in Fulton County and Atlanta Public School districts 119 were identified as being within a 0.5 mi radial distance from either a major highway or expressway. The results suggest that many schools in Fulton County and Atlanta Public School districts may have elevated levels of traffic-related air pollution on their campuses and potentially increased exposure for students.

Land Use, Planning, and Assessment Recommendations

Air quality research has shown the potential of trees and shrubs to remove significant amounts of air pollutants. Urban vegetation has additional benefits such as providing shade; reducing heat-island effects and building energy costs (Hagler, 2012). Studies have also identified the potential for roadside barriers, such as tree stands or noise barriers, to reduce traffic emissions behind barriers by altering pollutant dispersion and by capturing pollutants (Hagler, 2012).

Air Quality Recommendations

The Indoor Air Quality (IAQ) Design Tools for Schools recommends that air filters should have a dust-spot rating between 35% to 80% and a minimum efficiency rating value (MERV) between 8 and 13 (EPA, 2012).The IAQ Design Tools for Schools recommends the installation of a simple pressure differential gauge to be used as an indicator of when air filter replacement is appropriate. Without gauges or a proper maintenance plan air filters that are no longer filtering harmful pollutants may be left in place resulting in poor indoor air quality for that time period. Schools should label HVAC system components to facilitate both proper operation and maintenance. In addition, the guidelines recommend a maintenance plan which includes staff education, an established budget, staff qualified to perform tasks, schedules for periodic maintenance checks and logs, and the availability of spare parts on site (EPA, 2012).

Outdoor Recommendations

The Center for Disease Control and Prevention's National Asthma Control Program recommends school bus and automobile anti-idling policies at schools to reduce student exposure to vehicle emissions. Furthermore, many schools have implemented successful programs to notify students and teachers of poor outdoor air quality days so that appropriate actions can be taken to limit time outdoors and reduce exposure to harmful pollutants. Air Quality Index (AQI) is readily available through local media sources including newspapers, television, and radio. According to AQI tables, time outdoors should be limited for students on days with AQI ranges above 101.