NASHVILLE AREA
Metropolitan Planning Organization

2013

HAMILTON SPRINGS
TRANSIT-ORIENTED
DEVELOPMENT

School Siting Health Impact Assessment

Acknowledgements

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Authors:

Sonia Sequeira is a graduate student of social work & public health at Washington University.

Leslie Meehan, AICP is the Director of Healthy Communities at the Nashville Area MPO.

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Executive Summary

Background

The Nashville Area Metropolitan Planning Organization (MPO) conducted a Health Impact Assessment (HIA) in partnership with a graduate student from the Brown School of Public Health at Washington University in St. Louis. The HIA examines how a potential school could hypothetically impact student health by being sited within the Hamilton Springs Transit-Oriented Development (TOD) in Lebanon, Tennessee. An HIA is a formal process by which to evaluate the potential positive and negative health impacts of a proposed policy or project. This report: provides background on school siting and the Hamilton Springs TOD; describes the HIA process, its potential health impacts; and makes policy recommendations that could impact human health.

The term "school siting" describes the process of selecting a new site upon which to build a school. Because financial considerations are largely a concern of many school districts, many school sites are selected based largely on land-purchase prices. Affordable land with enough acreage for a typical American school campus is often located far from dense residential areas, and so may therefore be a significant distance from where students who attend the school actually live. The resulting impact of constructing schools disconnected from residential population density is that students are less likely to walk or bicycle to school (even with sidewalks or bikeways), and must therefore be driven by bus or automobile. The associated emissions, traffic congestion, likelihood of collisions, lengthy travel times, and missed opportunities for physical activity, can negatively affect child health. Furthermore, research suggests that retail food environments around schools (fast food restaurants) may also negatively impact children's health status.

The Hamilton Springs TOD will include residential, retail, and office space. Thinking strategically about both the TOD's food environment and opportunities to walk or bicycle to school could positively impact the health –not only of children who attend the potential school– but also of the adults who live and work in the development.

Conclusions

The HIA concludes that if a school were sited within the Hamilton Springs TOD, all TOD residents would live no more than a half-mile from the school, thereby eliminating the need for busing, and creating the potential for all students to walk or bicycle to school (with supervision for younger, elementary-school aged children). If the retail food environment also receives careful consideration, the TOD might include a full-service grocer, while limiting or prohibiting more unhealthy food options, thereby enabling children and adults to make diet choices that better promote health and longevity.

Recommendations

Recommendations made as a result of this HIA are as follows:

1. Consider adopting a joint-use agreement between the community and the school.
2. Consider limiting development of fast-food restaurants around the school and locate a full-service grocery store within the TOD.
3. Consider implementing a "Complete Streets" policy.
4. Consider implementing an inter-agency agreement on school-siting policy between the city's planning department and school district.

Figure 1. Hamilton Springs TOD Conceptual Rendering, Lebanon, TN, hamiltonsprings.com
Source: Lose & Associates, Inc.

Objectives

This is a Health Impact Assessment (HIA) of a school-siting decision for Hamilton Springs, a Transit-Oriented Development (TOD) in Lebanon, Tennessee: the potential for positive and/or negative health consequences of a school within the TOD, as related specifically to factors around transportation infrastructure and food access. HIA objectives include identification of the potential health impacts, recommendations to improve health, and the reduction of negative health outcomes resulting from available transportation and food options.

Background

Metropolitan Planning Organizations are established through federal legislation for urbanized areas of more than 50,000 people and are charged with helping to identify transportation needs and allocate federal transportation dollars to projects in a region. The Nashville Area Metropolitan Planning Organization (MPO) coordinates the planning of federally-funded transportation projects for Davidson, Rutherford, Sumner, Williamson, Wilson, and parts of Maury and Robertson counties in Middle Tennessee. The MPO is comprised of representatives from local, state and federal agencies, and serves as a partnership among: the United States Department of Transportation, Tennessee Department of Transportation, transit agencies, local elected leadership, local planning directors, public works directors, the business community, and citizens. The MPO works with its members, stakeholders, and the public to determine regional transportation priorities, and then allocates resources to address those needs.

The MPO plans, prioritizes, and selects transportation projects for federal funding; it also develops the Long-Range Transportation Plan and [short-range] Transportation Improvement Program for the Middle Tennessee region. Recognizing the relationship between transportation, environmental and public-health outcomes, the Nashville Area MPO has committed to incorporating health improvement into its transportation policies, plans, programs.

Health considerations are reflected primarily through MPO support and promotion of active transportation (e.g., transport modes that involve physical activity, such as walking and bicycling – including pedestrian or bicycle trips to/from transit).

Land Use

In community and regional planning processes, oftentimes the relationship between land use and transportation can be treated inattentively. Because planning for land-use and transportation is often conducted by separate government departments across multiple levels, it can result in disjointed coordination between development and the transportation facilities needed to support that development. As a result, transportation infrastructure has historically tended to support sprawling land development patterns by extending and widening roads, and constructing new roads to support greenfield development. When land uses are separated (housing disconnected from jobs, for example) with longer travel distances and roadways designed exclusively for automobile mobility, active transport becomes an inconvenient, even dangerous, mobility option.

But a mixture of land uses –connected places to live, work, attend school, shop– enable short trips. With safe and convenient active transportation facilities such as transit stops, sidewalks and bikeways, it is possible for reasonably shorter trips (a few miles or less) to be routinely accomplished by a mode(s) other than the personal automobile.

The Nashville Area MPO is interested in supporting the improved coordination of planning for land use and transportation, especially for newly-constructed schools. Building schools in tandem with residential areas better enables close proximity of education facilities to the populations they serve. If sidewalks and bikeways are also constructed in conjunction with a school, it is more likely that parents and students will be able to safely and conveniently walk or bicycle to school (either the entire trip or a portion thereof).

In 2012, a TOD had recently been approved and was just breaking ground in Middle Tennessee. The MPO decided to engage in a rapid Health Impact Assessment in order to better understand positive and negative health impacts on children who might potentially be enrolled in a school within the Hamilton Springs development. The school as proposed would be located no more than a ½-mile away from the estimated 4500 residents who are expected to live within the TOD at its full build-out.

Health Impact Assessments

A Health Impact Assessment (HIA) is "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (World Health Organization, 2012). HIAs evaluate the potential health effects of a proposed policy and can inform decision-makers on providing for community health and quality-of-life.

Generally, health impact assessments follow six key steps: screening, scoping, assessment, developing recommendations, reporting, and monitoring & evaluation (CDC, 2009).

- Screening: determine a policy area where an HIA would provide valuable information
- Scoping: identify the priority health impacts for examination
- Analysis and Assessment: determine who will be affected (and how) by the policy change
- Developing Recommendations: Provide suggestions for changes or additions to the policy that can mitigate negative health impacts
- Reporting: Present recommendations and key findings to decision-makers
- Monitoring & Evaluation: Identify how an HIA affected the decision; observe health impacts

There are three types of Health Impact Assessments:

1. Desktop: A 2-4 week assessment that uses existing data for a proposed policy that has few anticipated health impacts. Desktop HIAs consist of a screening exercise and a general overview of potential health impacts.

2. Rapid: A 2-3 month site-specific assessment that contains analysis of stakeholder opinions and/or data-based research. Like desktop HIAs, they do not obtain new survey work or data from the field, but they do detail specific health impacts.

3. Comprehensive: Up to a year in duration, comprehensive HIAs contain new data and robust community engagement, as gathered from the field.

HIAs are an established mechanism to examine the effects of a variety of built-environment policy decisions. Previous North American HIAs have examined policies ranging from walk-to-school programs to subsidies for home-heating (Dannenburg, 2008). Thus far, there has been no documented HIA on a community's school-siting decision.

Health Impact Assessment and School Siting

The Nashville Area MPO seeks to examine the human and environmental health impacts of school siting, from the vantage-point of transportation and land-use planning. To help introduce school siting as a relevant concern to Middle Tennessee stakeholders, the MPO hosted a regional symposium on school siting in 2010, with presentations by national experts. In post-conference opinion surveys, over 100 attendees (representing public, private, and community organizations) shared that the region's greatest needs around this issue included improved communication between school boards and facilities planners, and the development of model school-siting guidelines.

In May 2012, construction crews broke ground on Middle Tennessee's first transit-oriented development. The developer was interested in including a school as part of community plans. MPO planners supposed that factors such as a school sited near or in a TOD, the surrounding retail food environment, and availability of transit options could potentially impact child health.

A rapid HIA might influence several key decision-points in the TOD's school-siting process, namely the facility's placement and building features. It might also help to inform decisions made around the supporting transportation network and nearby land uses, specifically the TOD's retail food environment. Health impacts are not often considered or prioritized during school-siting discussions; an HIA could help to bring this type of information to light.

Health Impact Assessment Goals

The specific goals of this rapid HIA were to:

1. Examine the positive/negative health impacts of siting a school in or near Hamilton Springs, a transit-oriented development
2. Examine positive/negative health impacts of surrounding retail food environment
3. Determine the impact of transportation options

School Siting Process

The process for locating new schools, deemed school siting, varies from state to state. Tennessee currently does not have a statewide policy in place for school siting. Many states have minimum-acreage requirements that specify schools must be sited on large plots of land.

Although Tennessee does not have this mandate, in many communities the minimum site sizes become *de facto* local policy, where elementary schools are routinely sited on 30-acre parcels, and middle and high schools sited on as much as 50 or even 100-acre tracts. Another common practice is the creation of mega-campuses that host multiple schools (elementary, middle, high). In these cases, combined acreage creates school campuses with massive distances from the road to the actual school building. Finding available, undeveloped parcels of this size can be a challenging purchase proposition for school districts. Large parcels are typically located in low-density areas, meaning they are not likely to be situated close to the actual student populations the new facility would be intended to serve.

For this reason, greenfield parcels located far from development –often on busy, high-speed arterial or collector streets with auto-only access– get selected by school districts for campus construction. Because greenfields are undeveloped or underdeveloped, the supporting street network may not yet include neighborhood or local streets, and in this regard are less conducive to children walking or bicycling to school. Surrounding transportation improvements may also exclude sidewalks, transit stops, or bicycle lanes, as responsibility for planning these facilities typically happens in agencies outside of school districts (planning and public-works departments, transit agencies, etc).

In Middle Tennessee, most schools-facilities managers work with consultants or district engineers and planners to identify a site, and then propose it to the area board of education (Jacobs, 2010). Once the proposal is approved by the board of education, it then moves forward to the city or county commission for approval of the expenditure, but not to entertain further discussion on the choice of location. This siting process is often handled informally, and likely to be altered whenever a school needs to be built on an accelerated timeframe in order to accommodate growth.

School districts will also sometimes scope out parcels of land without consulting property owners or other agencies. This is because district planners anticipate increases in negotiated purchase prices if the intended land use is disclosed, or if negotiations with several property owners are necessary – thus adversely affecting strapped district budgets. As a result, site selection gets conducted behind closed doors, without public involvement or consult from other affected municipal departments like planning, parks, roads, sewer, or water. While this approach may save money on initial land purchases, it fosters a disconnect between the school district and other government departments.

Once a school site is procured, it may need water and sewer connections, roadway improvements, traffic control and other infrastructure. Fragmented coordination between the school district and other public agencies can lead to increased costs for local governments– exacerbated by the need to open schools on a quick turnaround because of growth, with all the supporting infrastructure in place. This process also often excludes public involvement.

Most importantly for health, the process may forestall coordination with the issuance of new residential building permits – meaning that housing does not get planned alongside school construction, nor will housing necessarily be located in close proximity to new school campuses. Siting schools in this manner contributes to high levels of traffic congestion, as students who live too far from the school to walk or bicycle are increasingly driven to school by caregivers.

This disjointed relationship between planning departments and school districts may also contribute to overcrowding. As construction of new homes is approved, existing schools can experience unanticipated increases in student enrollment. This then puts pressure on school boards to relieve overcrowding by siting new schools in an expedited manner, perhaps leap-frogging opportunities for public and inter-agency involvement on proposed locations.

Guidance for School Siting

In 2004, the Council of Educational Facilities Planners International (CEFPI) and the U.S. Environmental Protection Agency (EPA) released a school-siting resource guide, *Schools for Successful Communities: An Element of Smart Growth*. This publication outlines important school-siting features that help to facilitate quality growth. The EPA defines smart growth as "development that serves the economy, the community, and the environment" (Hoskens, Lawrence, Lee, Lyons, & Stenzler, 2004). The guide is geared at promoting community-centered schools, dispelling the notion that minimum-acreage standards should be required by states, or that minimums for campus size are necessary for schools to function properly. Several school-siting factors are outlined, including the major players in local decision-making processes:

- School District
- Board of Education
- Facilities Planners

Ideally, developers, consultants, and local planning organizations would also be party to the process. When siting schools, the following comprise ten important factors to consider (Hoskens, Lawrence, Lee, Lyons, & Stenzler, 2004):

1. Educational programs and services
2. Student and community demographics
3. Site size
4. Transportation and parking
5. Community partnerships and co-location
6. Cost comparisons on renovation versus new construction
7. Local planning and zoning ordinances
8. Economic impact
9. Environment, health, and safety
10. Flexibility

In 2012, the EPA published voluntary guidelines for local education organizations to consider when selecting school sites. These guidelines encourage community involvement in the site-selection process, as well as evaluation of public and environmental health impacts during the planning and selection phases. One recommended strategy demonstrates that community-centered schools allow for better proximity to student populations and access to transit, walking and bicycling for the necessary student trips to and from school (EPA, 2012).

According to the National Policy and Legal Analysis Network, two-thirds of American schools are located too far from where students actually live to enable active commutes to and from school (NPLAN, 2012). MPO staff reviewed two helpful documents published by the National Trust for Historic Preservation –*Why Johnny Can't Walk to School* and *Helping Johnny Walk to School*– which outline the challenges and solutions around current U.S. school-siting practices.

Health Impact Assessment of a School Siting

As a follow-up to the School Siting Symposium hosted by the Nashville Area MPO in 2010, MPO staff evaluated the health impacts of a new school location by conducting an HIA on the prospective site. This opportunity materialized when the developer and planning consultant for the new Hamilton Springs TOD in Lebanon, Tenn. began discussing the possibility of siting a school within the development. The school would be part of the Lebanon Special School District (LSSD), which consists of four elementary and two middle schools that serve 3,237 students.

LSSD also currently has 232 teachers and 13 administrators, and the district's student racial and ethnic make-up is: 71.1% White, 17.2% African American, 9.9% Hispanic, 1.4% Asian/Pacific Islander, and 0.4% Native American/Alaskan (Tennessee Department of Education, 2012). Nearly 62 percent of its students are considered economically disadvantaged. Although LSSD met the federal benchmarks for No Child Left Behind in the categories of math, reading and attendance, it did not demonstrate Adequate Yearly Progress over the previous year.

In the LSSD, school siting has historically been conducted informally, based upon immediate need. Director of Schools Scott Benson estimates that a new school is built in the school district about every 10 years. Enrollment growth is tracked annually, and site location is primarily based on enrollment zoning and land prices. LSSD attempts to cultivate socioeconomic diversity within its schools through zoning policy. The major contributor to local school-site decisions, however, is the cost to the district for land acquisition.

In order to gain approval from the planning department, LSSD must submit a conditional use permit from the City of Lebanon. The Board of Zoning Appeals reviews this permit and directs planners to notify nearby property owners, addressing concerns like traffic congestion, bicycle and pedestrian access, and school grounds restrictions. This conditional use permit is the only formalized process for coordination between LSSD officials and planners for school siting.

According to former staff members for Lebanon's planning department, the school siting process ideally should give priority consideration to traffic impacts, proximity to student population, and nearby property owners. Schools create traffic congestion and can clog the surrounding road network, during a.m. and p.m. peak-hour travel periods. They can also impact surrounding businesses if school athletic facilities require more lighting.

Winfree Bryant Middle School (opened 2011) was the last school constructed in Lebanon. Few homes surround it, and while it is near the more walkable Byars Dowdy Elementary, the closest major roadway (Leeville Pike) has a posted speed limit of 45 miles per hour. Meaning, students would not be able to safely cross this road to access the adjacent neighborhood. The school site was selected without the planning department's involvement.

Although the school construction was recent, pedestrian amenities like sidewalks were not included. Planners were able to advocate for inclusion of a nearby bicycle lane, but efforts to fund sidewalk construction in surrounding neighborhoods have not been successful.

Health Impact Assessment Six Steps

Step 1: Screening

Hamilton Springs

This HIA screens the potential policy decision of an elementary school's construction within an approved TOD. Siting schools near housing can influence children's travel patterns, and their ability to get physical activity through those travel patterns. In addition, the TOD's retail food environment may impact the health of school children as well as that of community members.

The Hamilton Springs TOD in Lebanon will be the first of its kind for Middle Tennessee. Transit-oriented development is a mixed-use residential or commercial development designed to maximize access to public transport, and often incorporates features to encourage a sustainable amount of transit ridership. Hamilton Springs will include high-end apartments, businesses, single-family homes, and condominiums that surround a Music City Star commuter rail train station. The Music City Star was established in 2006 and runs from Nashville to Wilson County, and includes six stops along a 30-mile corridor. The line carries approximately 1,000 riders daily.

The master plan for Hamilton Springs, a Bell Property development, was created by Nashville-based design firm Lose and Associates, and awarded an outstanding planning designation by the Tennessee Chapter of the American Planning Association for green development in a small community. The land use plan for Hamilton Springs specifies a mix of 80% residential to 20% commercial use. Bell Property has committed to creating a neighborhood that is walkable, sustainable, and energy efficient, with a self-imposed regulation of 22% green space (Master Plan). The first units are expected to open in 2013. At full build-out, the 221-acre site, located 30 miles west of Nashville, is expected to have 980 commercial and office jobs, and 4500 residents within a half-mile radius of the Music City Star station.

Below are the ten principles of smart growth that the Hamilton Springs TOD fulfills:

Smart Growth Principle	Hamilton Springs TOD
Mixed-use land use	Mixed housing types; 80% residential, 20% retail
Take advantage of compact building design	Mixed-use buildings, residential units on top of retail space
Range of housing opportunities and choices	Mixed income housing
Invest in walkable neighborhoods	Commitment to creation of a walkable community, Complete Streets on main boulevard
Foster distinctive, attractive communities with a strong sense of place, preserve open space	Twenty-two percent open space
Farmland, natural beauty and critical environmental areas	Dedicated greenway adjacent to rail line
Strengthen and direct development towards existing communities	Sidewalk connectivity to other neighborhoods
Provide a variety of transportation choices	Transport provided through Music City Star and walkable community
Make development decisions predictable	Master plan guides decisions
Fair and cost-effective, encourage community and stakeholder collaboration	Multi-family housing included in development; numerous public engagement meetings
Community-centered schools	Prospect of community-centered school in development

Hamilton Springs was approved by the Lebanon City Council in March 2011. In October of that same year, the City of Lebanon applied for a Transportation Investment Generating Economic Recovery (TIGER) Grant to fund the construction of a Music City Star station to service commute trips of TOD residents. Although TIGER funds were not awarded, construction of the TOD moved forward. The developer has committed to funding the future construction of a Music City Star station. Construction costs for the platform and TOD access are estimated at $1-2 million.

Due to the mix of housing types available, Hamilton Springs is expected to attract families. Generally, TODs attract singles and couples without children (Zimbabwe et al, 2005). Although the number of households with children in the U.S. has declined from 50 percent in 1950 to 25 percent in 2010, the number of children born in the United States is holding steady.

The Center for Transit-Oriented Development's publication, *TOD 205: Families and Transit-Oriented Development – Creating Complete Communities for All*, showcases how TOD can be attractive for families, how families can help anchor TODs by creating diverse communities (a variety of ages, backgrounds, other demographics). TOD families can also take advantage of a variety of destinations including jobs, education, and healthcare (CTOD, 2012).

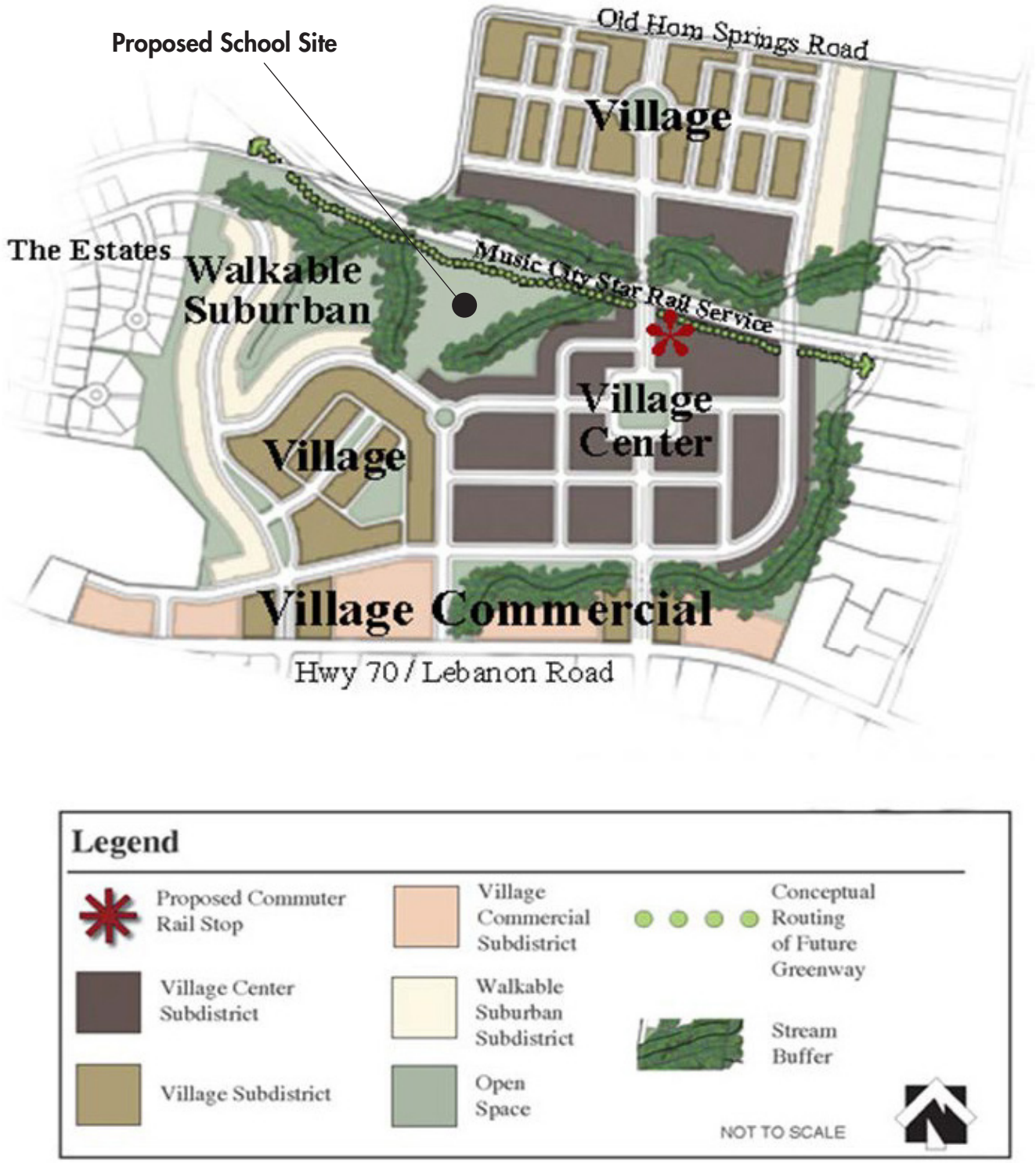

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Figure 2. Hamilton Springs TOD Master Plan, Lebanon, TN
Source: Lose & Associates, Inc.

Mixed-income housing –such as the range of apartments and single-family homes developed for Hamilton Springs– can be more affordable for young families. Workforce housing can also be advantageous to school districts in that it allows teachers to affordably live closer to the school where they are employed. With a variety of housing types and prices, and transit systems that offer feasible alternatives to driving, families may choose TOD living (like Hamilton Springs), especially if the possibility of an onsite school is included in the TOD plans.

The Master Plan for Hamilton Springs details the built environment around the potential school site. The main boulevards feature pedestrian amenities such as continuous, wide sidewalks, street trees, and dedicated bike lanes. By screening the built environment for the prospective school site, as well as the possibilities for its adjacent retail food options, there is an opportunity to impact the health of children, residents, visitors, and workers of the Hamilton Springs TOD.

The proposed school site, though not yet officially part of the Master Plan, appears in Figure 2.

Step 2: Scoping

Potential health outcomes resulting from the proposed school site, as well as two priority issues, were identified through an extensive literature review. [See Appendix C for a pathway diagram of all potential health impacts, positive and negative, that could result from the Hamilton Springs school-siting decision.]

Rapid HIAs do not facilitate the collection of new data, and there was also limited capacity for analysis of existing data. Therefore, the focus was on two main areas that were perceived to possess a high level of potential for impacting child health: transportation and food access. These comprise basic components of everyday living; the construction of a new TOD yielded an unprecedented opportunity to focus on the possibility of healthy transport and food options therein.

1. Transportation Options

The Nashville Area MPO recognizes the demonstrated connection between transportation decision-making and public health outcomes, including pediatric health. In 2009, the MPO completed a Regional Bicycle and Pedestrian Study that assessed available accommodations for active transportation, and made policy recommendations with a greater emphasis on active transport. In 2010, the MPO adopted its *2035 Regional Transportation Plan*, with active transportation as a cornerstone of both policy and funding strategies. Health impacts of active transportation are addressed in this HIA via heat maps of walking and bicycling conditions.

2. Food Environments

How food access and environments can impact obesity and nutrition is an emerging field of research. Schools located in close proximity to fast food, for instance, may have higher incidences of obesity among their school populations than schools with access to healthy food options. In addition, research shows that housing near grocery stores increases the consumption of fresh, nutritious foods, while housing located far from fresh-food retailers decreases consumption, particularly for low-income households with limited transportation options. This HIA attempts to address this issue through a literature review, as well as interviews with local planners.

Due to time constraints associated with the rapid HIA format, unaddressed issues included: school choice and impacts on equity, transportation; projected growth in diversity of student populations; air quality around the proposed school site; and health impacts of construction materials. Moreover, the HIA's scope did not permit any in-depth evaluation of academic quality.

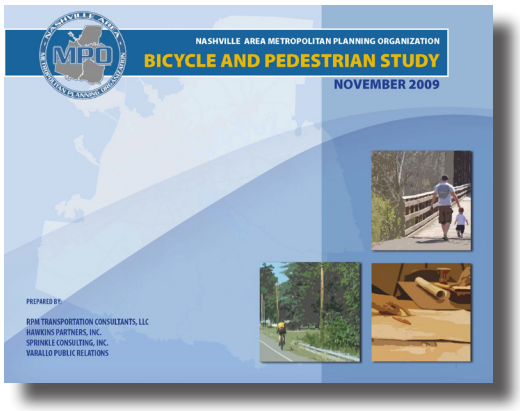
Step 3: Analysis and Assessment

For its analysis portion, this HIA relies on the following primary sources:

- MPO's *Regional Bicycle & Pedestrian Study*
- Input from national experts, local stakeholders
- Onsite observational/qualitative data
- Comparison school sites
- Tenn. Dept. of Education data
- U.S. Census Bureau data
- Journal articles & gray literature
- Nashville Area MPO heat maps

Regional Bicycle and Pedestrian Study

In 2009, the MPO completed its *Regional Bicycle & Pedestrian Study*, establishing a strategic vision for improving walking and bicycling opportunities in greater-Nashville. That vision feeds into the MPO's *2035 Regional Transportation Plan,* and provides the basis upon which future regional funding priorities are established for bicycle and pedestrian facilities in Davidson, Rutherford, Sumner, Wilson, Williamson counties, as well as the cities of Spring Hill and Springfield. It includes a comprehensive regional inventory of existing bicycle and pedestrian facilities: greenways, sidewalks, bikeways. Hamilton Springs (under construction, as of publication) will include sidewalks and bikeways. The 2009 inventory helps to support a future vision for how TOD facilities might connect with existing and/or planned sidewalks and bikeways.



The Study's bicycle and pedestrian Latent Demand Model is based on eight trip types (5 bicycling; 3 walking) that analyze a given parcel's proximity to various land uses (schools, parks, transit stops, work places, commercial areas, etc). When future land uses are put into this model, its resulting run of the hypothetical bicycle and pedestrian trips has the potential to be dynamic. For example, a Hamilton Springs model-input would estimate resultant bicycle and pedestrian trips. At this time, the model is not equipped to account for prospective land-use changes, although future versions will seek to do so.

Furthermore, for the 2009 Study, a Bicycle Level of Service and Pedestrian Level of Service (LOS, scaled A-F) was conducted for 3300+ miles of roadways. The roads servicing the TOD are also not yet included in the LOS analysis but, again, these models are helpful for the purpose of understanding and accounting for current safety and comfort-level conditions for cyclists and pedestrians who use the roads around the TOD site today. Similarly, bicycle and pedestrian crash and fatality data from the 2009 study were pulled for the areas surrounding the TOD.

Finally, the *Regional Bicycle & Pedestrian Study* analyzes health-impact areas in Middle Tennessee among populations that are likely to have high rates of health disparities and limited access to personal transportation (e.g., households with low-to-no vehicle ownership, etc). 'High health-impact areas' are mostly considered to be those of lower socioeconomic status, age 65+, and/or of minority racial/ethnic descent. If a designated area (Census tract) exhibits a higher-than-average concentration of all these demographics, for the purposes of the Study, it was coded as a high health-impact area, as evidence points to greater-than-average rates of chronic disease among these populations (diabetes, heart disease, asthma, etc). While data of this nature does not yet exist for the Hamilton Springs TOD, it is still useful to consider whether any of these populations currently reside in the nearby area.

National Experts and Local Stakeholders

Qualitative research was conducted via interviews with professionals who either work in or study school siting, and/or who write model school-siting policies and guidelines. The purpose of this research element was to gain expert insight into opportunities and challenges associated with TOD school sites, as well as existing school facilities in the region. Some interviewees work in food policy and contributed to an assessment of the potential retail food environment. Interview remarks supplemented analysis and literature review, where applicable.

These national and local experts included:

- Megan Wier, San Francisco Department of Health
- Joan Randall, Vanderbilt Univ. Institute for Obesity & Metabolism; Tenn. Obesity Taskforce
- Beth Dodson, Prevention Research Center - Washington University in St. Louis
- Renee Kuhlman, National Trust for Historic Preservation
- David Salvesen, Center for Sustainable Community Design, UNC-Chapel Hill
- Regina Langton, U.S. Environmental Protection Agency
- Suganthi Simon, U.S. Environmental Protection Agency
- Tracy McMillian, School of Architecture - University of Texas at Austin
- Noreen McDonald, City & Regional Planning, University of North Carolina - Chapel Hill
- Brian Fellows, Safe Routes to School - Arizona Department of Transportation
- Sara Zimmerman, National Policy & Legal Analysis Network to Prevent Childhood Obesity
- Anne Bikle, Built Environment & Land Use Program - Seattle & King County Public Health
- Mike Raible, School District of Charlotte, North Carolina
- Breanna Morrison, Los Angeles Community Health Council

From discussions with these experts, several major themes emerged, as follows:

- Multi-disciplinary approach to school siting is needed: planning, public health, preservation.
- Draw upon national and local precedent for schools sited in urban, walkable environments.
- Input on the HIA process itself, comparison HIAs (ex., Tennessee Food Desert Relief Act HIA).
- Walkable neighborhood construction and associated home prices could be correlated to the potential economic impacts of the TOD school site.
- Escalating home prices could result in challenges related to workforce housing (price-points could become too high for some income levels to afford).
- If the school accommodates fewer cars, there is a potential cost-savings for the district (maximum parking requirements), as well as less traffic and air pollution, fewer collisions.

Interviews with local stakeholders included:

- Jack Bell, Developer of the Hamilton Springs TOD for Bell Properties
- Jay Everett, Landscape Architect with Lose & Assoc. and TOD Master Plan designer
- Will Hager, former Planner, City of Lebanon
- Magi Tilton, former Planner, City of Lebanon
- Scott Benson, Director, Lebanon Special School District

From discussions with these local stakeholders, the following major takeaways emerged:

- Land-use planning decisions must be coordinated with school-siting decisions, including informing school districts about new residential building permits so that school sites might be chosen with an anticipatory outlook for increased demand, rather than when schools have already reached their capacity. Involve community planners before school sites are selected and campus design is completed.
- A formalized school-siting process should consider costs other than those attributable to just the land purchase and building construction (infrastructure, health, environmental).
- Encourage joint use: schools might open up their athletic facilities as parks for public use.
- Exclusionary land-use policy (ex., prohibitory regulations on fast-food restaurants), can be delicate to navigate. Rather, approach zoning via traffic-control (disallow drive-throughs).

Site Visits

MPO staff toured the TOD, proposed school site, and surrounding areas with the property's developer and master plan designer. The project had just recently had its groundbreaking for the first phase – multi-family housing. Although the surrounding areas are primarily upper-income, single-family homes on half-acre to five and ten-acre lots, the Lebanon community has been supportive of the TOD's medium-to-high densities: approximately ten dwelling units per acre when all is completed. The developer himself has ties to the area, and attributes his long-standing community relationships to the support he received for the project concept during the local planning and zoning processes to initiate construction of the TOD.

Figure 3. Hamilton Springs TOD Site, Lebanon, TN
Source: Hamilton Springs

Comparison Communities

MPO staff also visited both Byars Dowdy and Castle Heights elementary schools within the Lebanon Special School District, for the purposes of examining them as representative examples of District school-site locations and adjunct neighborhood contexts. Byars Dowdy is older, situated within the actual neighborhood where its students reside. Many Byars Dowdy students, therefore, are able to walk to school; its site is community-centered, similar to that of the proposed Hamilton Springs school site. Conversely, Castle Heights is located along a major roadway, far from the zoned community it serves.

Because of this prohibitive distance, few, if any, students walk or bicycle to/from Castle Heights. Maps depicting Byars Dowdy and Castle Heights elementary schools are provided in Figure 4, as well as Appendix B. Absent a school facility constructed within Hamilton Springs, the TOD's student population would be zoned to Coles Ferry Elementary (not pictured).

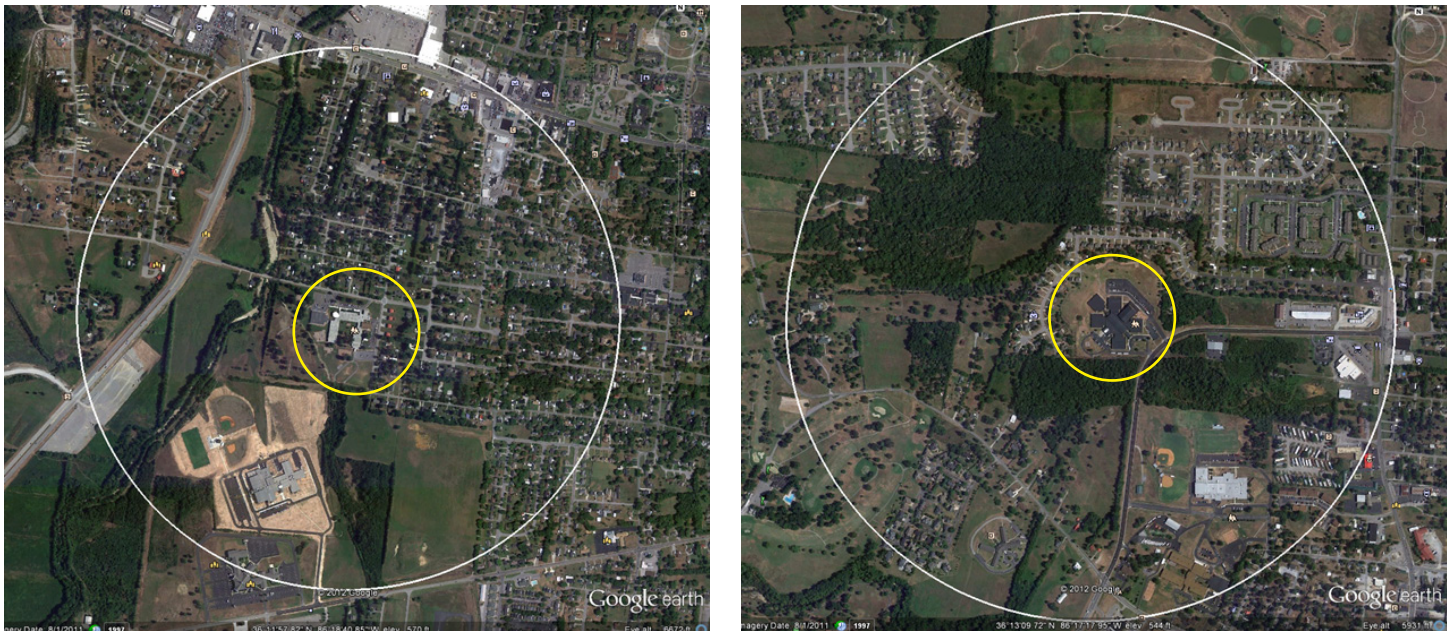


Figure 4. Byars Dowdy (left) and Castle Heights Elementary Schools (right), Lebanon, TN. White circle indicates a half-mile radius around each school. Source: Google Earth

The MPO also conducted a case-study evaluation of a non-local but comparable TOD-situated school. Although few documented cases of schools sited near or in TODs exist in the current literature, the school district for Charlotte, North Carolina has an elementary school near a LYNX transit station. Constructed in 1937, the school has seen five or six capital expansions, the transit station being a recent addition. A "triple use" policy agreement incorporates a playground, parking garage, and open space as public amenities. The parking garage serves as a buffer-zone between the school and the light-rail line, and is capped by a sustainable green roof that also doubles as children's play-space. Students are majority African-American and the surrounding residential context is mostly single-family housing. Because the neighborhood homes and school predate the light-rail line, the station area could not be planned as a true transit-oriented development, featuring higher-density housing and a mix of other uses (see Figure 5).

Due to the Charlotte school's low-density surroundings, staff acknowledged that it would not be an HIA comparison on equal footing to that of LSSD's Hamilton Springs school-site. However, an interview with the Director of Planning & Project Management for the Charlotte-Mecklenburg County School District provided relevant information toward this effort: The county has a joint-use taskforce (monthly meetings since 1995) to facilitate multi-use coordination (including school siting) among two dozen of Charlotte's municipal departments. This taskforce addresses the planning and use of capital facilities across multiple disciplines and authorities (Charlotte Mechlenburg Planning Department Joint-Use website).

Department of Education and Census Data

Wilson County's population is currently around 113,993, and the City of Lebanon's population is 26,190 (U.S. Census Bureau, 2010 Census). An estimated 32,177 households are classified as families, and 37 percent of all households have children under the age of 18. Nearly eight percent of families fall below the poverty line. Median household income in Wilson County is $56,270 – higher than the national average and that of the vast majority of Tennessee counties.

Among adults, the obesity rate is 30 percent (University of Wisconsin's Population Health Institute, 2012); and 29 percent of adults are estimated to be physically inactive. An estimated 12 percent of the population is low-income, with little to no access to a full-service grocery store. The built environments surrounding Castle Heights and Byars Dowdy elementary schools serve

Figure 5. Sterling Elementary School, Charlotte, NC Source: Google Earth

as adequate comparative grounds for potential school-siting decisions, as they represent LSSD-affiliated communities that are served by differently-sited schools in each case. Both offer pre-K through 5th grade classes; however, Castle Heights was originally built to serve grades 5-8. Byars Dowdy's enrollment is 702 students; Castle Heights has an enrollment of 655. Presently, both have capacity for an additional 50-75 pupils. Approximately 50 percent of students at each school qualify for federal free or reduced lunch programs; also at both schools, nearly 40 percent are considered clinically overweight or obese. Data on most-used transport modes to/from school was unavailable. Satellite maps of each school appear in Figure 4 and Appendix B.

	Byars Dowdy Elementary			Castle Heights Elementary		
	Males	Females	**Total**	Males	Females	**Total**
Underweight (< 5th %ile)	2%	0%	**1%**	1%	2%	**1%**
Normal BMI (5th - 85th %ile)	59%	63%	**61%**	62%	62%	**62%**
Overweight or obese (≥ 85th %ile)*	39%	37%	**38%**	37%	36%	**37%**
Obese (≥ 95th %ile)	20%	22%	**21%**	25%	16%	**21%**

Source: Tennessee Coordinated School Health Data, 2012

According to local planners, more students walk to Byars Dowdy Elementary due to its close proximity to homes and families. Conversely, Castle Heights is located near Leeville Pike, a major roadway with vehicle-speeds that render walking or bicycling less likely. Additionally, the area surrounding Castle Heights has more traffic congestion, due to the school site's proximity to both Leeville Pike and two other LSSD schools.

Literature Review

The pursuit of Health Impact Assessments by professionals in fields such as planning and public health has grown rapidly, particularly over the last five years. Available resources for both school siting and TODs have also grown, with an ever-increasing number of studies having emerged particularly on the corollary relationships among the built environment, transportation, and food access. These reports are invaluable resources for American communities to consult on project or policy work. Nashville Area MPO staff accumulated many of the existing resources on the impacts of school siting, walkable communities, housing prices, physical activity, and TOD trends. From a thorough review of these studies (a summary of which appears in the Appendix), a few major themes emerged:

- A primary reason that children do not walk or bicycle to school is the physical distance between home and the school site.
- Even those children who live under a mile from school often travel by bus/car due to a lack of infrastructure that would enable a safe, comfortable walk or bike trip.
- Higher property values are found among homes near community-centric schools.
- Walkable communities in general tend to have higher property values.
- Children who engage in regular physical activity tend to behave better in the classroom, and achieve better academic performance overall.
- Children who walk to school are more likely to engage in other physical activity.
- School districts with children who walk and bicycle to school post significant budgetary savings on busing programs.
- Families consider whether there are a mix of housing types available near or in TODs when deciding whether or not to move to one.
- Convenient access to fast food is positively associated with higher BMIs and higher daily caloric intake in some studies; other studies are unable to show correlation.
- One in three American youth consumes fast food on a daily basis.

Heat Mapping

To compare differing data types/formats collected by various types of organizations (e.g., housing, health, transportation), the Nashville Area MPO developed a unique heat-mapping tool. Using GIS software that plots data with multiple variables onto a single map (Chen, Baker & Skipper, 2012), the tool visually maps data-sets from differing sources (which could impact one another or have a corollary relationship), as opposed to leaving them in a table or spreadsheet format. This device is useful for planning professionals, as well as other stakeholders and the general public, to better visualize and understand relationships.

The heat-mapping tool works by allocating point and line files to a quarter-mile grid system. The grid square size of ¼mile by ¼mile was selected because a quarter-mile is considered a comfortable distance that most people are willing to walk (to destinations, bike shares, transit). The ¼mile-grid is also an appropriate size for a community study area like Hamilton Springs. Larger study areas, such as city/county areas or multi-county regions, use a half-mile and a two-mile grid system, respectively. The tool was used to map areas of high health-impact (referenced in the 2009 *Regional Bicycle & Pedestrian Study*), plus additional Environmental Justice populations, including single-mother households and households without automobiles.

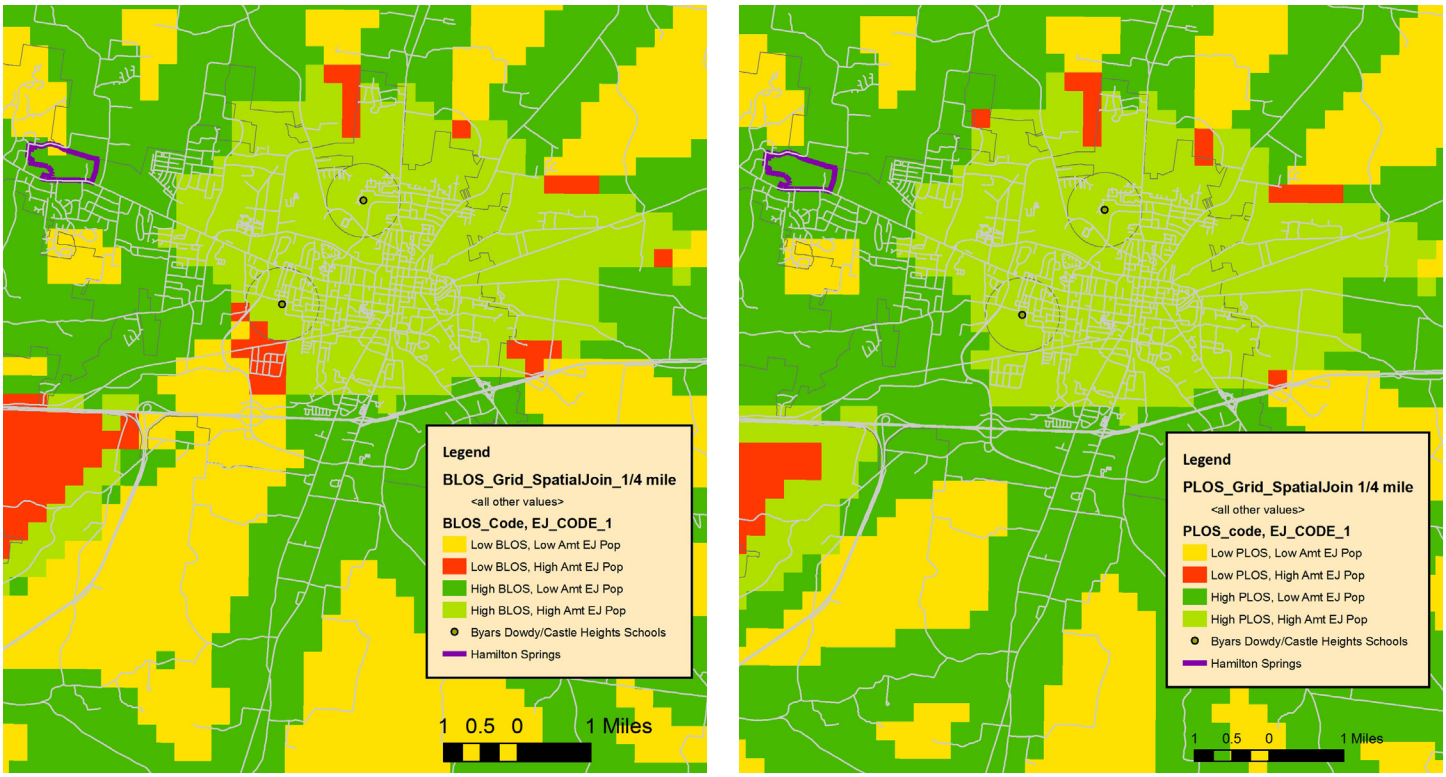


Figure 6. Bicycle Level of Service (BLOS), right, and Pedestrian Level of Service (PLOS), left.
Source: Nashville Area MPO

This data was joined with Bicycle Level of Service (BLOS) model data and Pedestrian Level of Service (PLOS) model data. The BLOS and PLOS models indicate how well a current roadway safely serves bicycle and pedestrian trips, based on how the roadway scores for the safety and convenience of those modes. Model factors include: presence of a bikeway or sidewalk, facility width, number of roadway travel lanes, posted speed limit, average daily number of vehicles, and any buffer that may exist between the roadway and the sidewalk and/or bikeway. More than 3300 roadways in the MPO's planning area were evaluated based on these criteria, then assigned a score from A to F (with A being the safest, and F being unsafe).

The heat maps visually present vulnerable socio-demographic populations, along with the current walking, bicycling, food environments around the Hamilton Springs TOD. Overlaying the data on where vulnerable populations reside, together with the bicycle and pedestrian LOS data, helps to provide location-specific indicators for: low levels of bike/ped safety, and large numbers of vulnerable socio-demographic populations (red); low levels of bike/ped safety, and low numbers of vulnerable populations (yellow); high levels of bike/ped safety, and high numbers of vulnerable populations (light green); or high levels of bike/ped safety, and low numbers of vulnerable populations (dark green).

Food-desert data sourced from Vanderbilt University researchers also provided indicators for: where these same vulnerable (low-income, minority, age 65+, etc) populations reside; transportation options near those areas; the surrounding local food environment (availability of full-service grocery stores); diet-related morbidity & mortality. The composite food-desert scores are then overlaid with locations of schools, grocery and convenience stores, to illustrate the food environment around both existing schools and that of the Hamilton Springs TOD (Figure 7).

As the TOD is built out and new data is collected, these heat maps can be amended to illustrate the built-environment components, in and around the TOD, that may impact the health of those who live and work there. A complete list of all variables considered appears in Appendix F.

Potential Health Impacts of Proposed School Site

Obesity and Chronic Disease

In Tennessee, obesity is a major concern, as 36.5 percent of children are considered either overweight or obese (Dept. of Health & Human Services, 2010). Twenty-two percent of children in the LSSD are considered obese; 41 percent are considered overweight (Tennessee Coordinated School Health, 2012).

Obesity is associated with heart disease, stroke, diabetes, cancer and depression (Dept. of Health & Human Services, 2010). The Surgeon General recommends 60 minutes a day of physical activity for children, which can help prevent and combat obesity and the associated onset of chronic disease (U.S. Department of Health and Human Services, 2005).

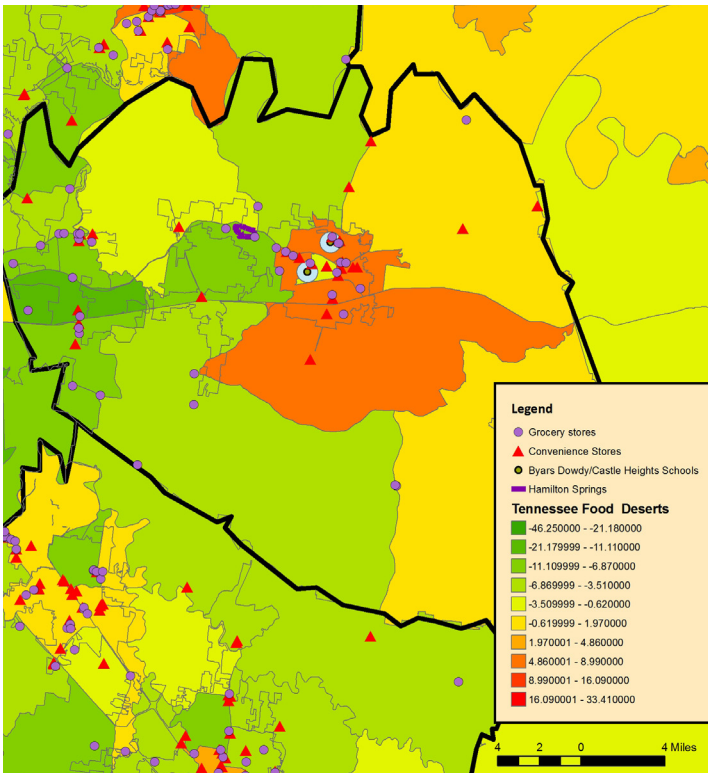


Figure 7. Food Desert Heat Map

Source: Nashville Area MPO, Vanderbilt University

The walk or bicycle trip to and from school can be an important and regular component of children's opportunities to conveniently get physical activity into their day. Walking to school can amount to a form of physical activity that becomes part of routine daily life; students who walk to school are found to be more physically active overall (Cooper et al, 2010). In one study that used accelerometer and GPS data to examine children's levels of physical activity during the pedestrian trip to school, accelerometer counts were 43 percent higher in children who walked to school than those who traveled by car (Cooper et al, 2010).

However, despite the health benefits that accompany the more active modes of transportation, rates of American students walking to school have been steadily declining. In 2009, it was estimated that 12.7 percent of students walked or biked to/from school, as compared with nearly 48 percent in 1969 (McDonald, Brown, Marchetti, Pedroso, 2011). One reason may be that when children live more than a mile away from school, rates of walking and bicycling go down (APHA, 2012). In 1969, approximately 87 percent of students lived a mile or less from their zoned schools; by 2001, this rate of proximity had declined to 21 percent. Furthermore, parents express concerns with the amount of time it takes to walk their children to school, a complaint compounded by increasing distances between home and school (McDonald & Aalborg, 2009). Parental concerns also included traffic safety, and security issues (e.g., child abduction etc).

Effect of School Siting Decision on Obesity

As proposed, the TOD school site would be situated within a reasonable walking distance for many children. At full build-out, 4500 people are expected to reside within a half-mile of the school in the TOD's village center. Concerns around distance, traffic volumes and speeds, often raised by parents as prohibitive barriers to their children bicycling or walking to school, would likely be diminished by locating a school on the TOD site as proposed (Zimbabwe, 2012).

Additionally, pedestrian-friendly environments, like that of this proposed TOD school location, have demonstrated increased levels of physical activity in the populations they serve.

For example, many "walkable" neighborhoods –with built environments that offer amenities within walking distance, adequate pedestrian facilities (sidewalks, crosswalks etc)– post higher levels of physical activity among residents than those that do not (Giles-Corti & Donovan, 2003). One study found an eight-percent obesity rate among children from neighborhoods with a built environment that was conducive to healthy eating, active living (Saelens et al, 2012). Another study found a positive correlation between a lack of community walkability and greater incidences of diabetes (Toronto, Ontario; Booth et al, 2012).

Food Access, Nutrition and Obesity

There is currently no clear academic consensus surrounding the research on associations between fast-food accessibility and incidences of pediatric obesity. However, U.S. fast-food consumption has kept pace, in a parallel manner, to the nation's rising obesity rates (Burdette & Whitaker, 2004). In some studies, the proximity of fast-food retailers to schools and residences was associated with higher rates of obesity, though this corollary conclusion was not present across all the existing literature. Children who reside near fast-food restaurants do have a decreased likelihood of consuming fruits and vegetables (Fleischhacker, Evenson, Rodriguez & Ammerman, 2011). Additionally, students who attend a school in close proximity to a fast-food restaurant will consume 30 to 100 extra calories per school-day (Bassford, Galloway-Gilliam, Flynn & Morrison, 2012). It is thus reasonable to deduct that children's health outcomes can be particularly vulnerable to food-access factors – the presence or absence of available options that would comprise a healthier diet.

Access to full-service grocers can also impact food-consumption behaviors. One study found that for every additional supermarket to locate within a given Census tract, consumption of fresh produce for a variety of demographics rose by as much as 32 percent (Morland, Wing and Diez Roux, 2003). Another study found that, among 10,000 adults, those whose neighborhoods had full-service grocers nearby also had the lowest rates of overweight and obesity; whereas, those adults from neighborhoods with only convenience stores nearby had the highest rates of overweight and obesity (Moreland, Diez Roux and Wing, 2006). A multi-state study showed that adults with no supermarket within one mile of home were 25 to 46 percent less likely to have a "healthy" diet – as defined, a diet comprised of foods associated with a low risk of ties to chronic disease; e.g., lower consumption of processed meats and foods high in fat, etc (Moore, Roux, Nettleton and Jacobs, 2008).

Researchers are also beginning to more closely examine how convenience-store food environments are impacting child health. A 2007 study found that adolescent males who lived further away from convenience stores consumed more fresh fruits and vegetables, while those who lived near fast-food restaurants consumed high-fat vegetables at greater rates (Jago et al).

A major draw of TOD living is to be situated within a walkable community, near or alongside a convenient public transit line, to where some TOD residents and workers may opt to forego car ownership altogether. An evaluation of the TOD's retail food environment, then, will be especially important, since many residents may routinely rely on the onsite food options. For the purposes of this HIA, a 'retail food environment' may include: full-service grocery, small-scale grocery, fast-food with drive-through, fast food without drive-through, and convenience markets (with/without a gas station). The 'non-retail food environment' shall include community gardens, co-ops, and community-supported agriculture (CSA).

Impact of School Siting on Food Access

Fast food that is readily available in a given community can oftentimes have the effect of nullifying school policies geared toward healthy living, as well as the health benefits of a well-sited school. Consumption of high-fat convenience foods is associated with weight gain, a decreased intake of fruits and vegetables, a higher intake of excess calories and fat, and insulin resistance (Bassford, Galloway-Gilliam, Flynn & Morrison, 2012).

Children may be impacted to an even greater degree by fast-food restaurant locations, and/or a lack of access to healthier foods, in that diet options can be relegated to those of the school (and its surrounding area) before and after instruction hours – mostly because of transportation constraints. In a study of ninth-grade children, fast-food outlets within one-tenth of a mile were associated with a 5.2 percent increase in obesity (Currie, DellaVigna, Moretti, & Pathania, 2009).

Research has also shown that fast food has a greater likelihood of clustering around school sites (Austin et al, 2005), suggesting that student populations, specifically, may have more access to fast food. In fact, Los Angeles amended its General Plan to prohibit new construction of fast-food restaurants within a half-mile of all existing schools and parks –as well as within 750ft of all transit stops– in order to help diminish the negative health-effects attributable to inexpensive, high-fat, high-calorie foods in close proximity to places where young people are known to frequent (Bassford, Galloway-Gilliam, Flynn and Morrison, 2012). L.A. is also more explicitly defining what constitutes a 'healthy' restaurant, so that as fast-food retailers begin to offer healthier menu choices, they may apply for an exemption to the new regulations.

Because of the potential for a school to locate within the Hamilton Springs TOD, the developer and the City of Lebanon could implement strategic tools to incentivize healthier options within the TOD, and/or limit the availability of fast food. Not only will these decisions impact residents' and workers' health status, but retail food-types could also affect the TOD's economic climate.

Effect of School Siting Decision on Travel Safety

The risk of traffic-accident occurrence could be mitigated by the TOD's nature. Because developers committed to a walkable community with a boulevard constructed under a Complete Streets framework, pedestrians could experience a safer walk to school. These types of amenities make the TOD a good candidate for Safe Routes to School (SRTS) programming, and/or a "walking school bus" where children walk to school in groups. A TOD with continuous sidewalks, frequent crosswalks, and clear signage would create a safer environment for an active commute to and from school.

Additionally, research shows that children who have friends in the area are more likely to engage in an active form of school trip-making – the likelihood of which would be improved by density within the TOD. However, students commuting to/from school via active transport (walking, bicycling) can also be exposed to a greater potential risk for injury, as well as increased inhalation of air pollutants (de Nazelle et al, 2011). Because Hamilton Springs is designed to be a walkable community, though, with automobile speeds and volumes thus kept low, a school within the TOD may be safer for children with regard to both health factors.

Traffic Congestion and Air Quality

Buses and cars idling outside of schools can increase traffic congestion and depreciate the surrounding air quality. Students breathe pollutants into their lungs en route to school, and as they enter/exit the school building. Pediatric asthma has been linked to poor air quality conditions, attributable to automobile emissions around schools (McConnell et al, 2010). Almost ten percent of Tennessee children are considered asthmatic, according to the Tennessee State Dept. of Health – approximately the same percentage of children with asthma nationwide, according to the Centers for Disease Control and Prevention.

School-related travel accounts for up to seven percent of all vehicle miles traveled during the a.m. peak commute, as well as 10-14 percent of all vehicles on the road (National Household Travel Data; and McDonald, 2009). About 30 percent of schools are designated as zones with poor air quality (Schwartz, 2004) – due not only to nearby traffic congestion, but also to car/bus idling during arrival and dismissal times. In Tennessee, the availability of busing is required for students who live 1½miles or more from their zoned school.

Because Hamilton Springs residents would live approximately ½-mile from school, busing would not be mandated. Moreover, ½-mile is a walkable distance, provided elementary school-aged children are able to walk with adult supervision. Vehicle emissions would be greatly reduced by a TOD school with the potential for no busing and few, if any, car-riders.

If the TOD successfully attracts adequate development density surrounding the school, then there will be no need to bus in many of the students, and the number of idling buses during arrival and dismissal periods will be reduced. Further, more students walking to school, as opposed to being dropped off in vehicles, will alleviate traffic congestion around the school.

Economic Impact

The MPO also examined economic outcomes as part of this rapid HIA. A school included in the TOD site plan has the potential to render Hamilton Springs a more desirable purchase choice for prospective homeowners. Schools are an important consideration in attracting families to developments (Bierbaum, Vincent, & McKoy, 2010). In a study that examined 90,000 home sales in 15 markets, the more walkable communities with greater access to resources (like schools) posted higher home values (Cortright, 2009). That same study reported that homes with a higher-than-average walkability score sold at a premium – between $4,000 and $34,000 higher than houses located in areas with more average levels of walkability. Furthermore, home-buyers and housing markets place a greater degree of importance on the ability to walk to schools and other amenities like parks, shopping, and services (libraries, post offices, dentists, etc). Research is beginning to emerge on how siting a school within a neighborhood can impact the surrounding home values. Anecdotally, Nashville-area communities with the oldest and most neighborhood-based schools also have some of the city's highest property values.

Public open spaces and walkable communities can have both a positive fiscal impact on municipal government budgets, as well as positive economic returns for private-sector developers (Shoup & Ewing, 2010). These benefits come in the form of increased property values and tax revenues, and a market-based desire for more homes and businesses to locate in these areas. The cost to operate and maintain infrastructure (water, sewer, roads, electricity) is also less burdensome in more compact areas where, for example, fewer feet of utilities are required to serve residences and buildings. A school located further out from development is estimated to cost an additional $250,000 for the necessary improvements to road and sewer lines (McClelland, Schneider, & Dulzo, 2004). And by locating schools near more compact developments, the State of Tennessee and the local school district stand to save nearly $500 per student, per academic year on the cost of busing.

With the inclusion of office space, retail/commercial venues, and property management, the TOD site also has the potential to host a diverse array of job-types. These positions would span a variety of salary levels, and many workers might opt to both live and work within the TOD.

However, to equitably enable teachers to live in the community, rising property values must be countered with the availability of workforce housing. Mixed-income housing –combined with the presence of a school near or in the TOD– would benefit teachers economically, as they would potentially be able to afford to live in close proximity to their place of employment. Workforce housing-stock would allow also LSSD to recruit and retain skilled teachers and administrators. According to the Tennessee Housing & Development Agency, the average Middle Tennessee teacher earns $19.50/hour, while the average salary needed to rent or buy a midlevel-priced home is $15.52/hour and $19.84/hour, respectively. Hamilton Springs will offer a variety of housing types: apartments, as well as attached and detached single-family homes.

Step 4: Recommendations

To provide guidance throughout the school-siting process, this HIA contains recommendations which may result in improved health outcomes for Hamilton Springs community members:

1. Consider the use of a joint-use agreement between the community and the school.

No Lebanon-area school has yet implemented a joint-use agreement. Co-locating the proposed school with a park or community center, for example, would allow the district and the city to combine resources. The park could provide a space for residents to be physically active and participate in recreational activities during non-school hours. Joint-use agreements can also manifest the fiscal benefit of shared operation and maintenance costs (Hoskens, Lawrence, Lee, Lyons, & Stenzler, 2004). In 2011, the Tennessee General Assembly passed legislation (HB 1151) that alleviates the potential legal liability that schools would face if their facilities (walking tracks and playgrounds, for example) were to be opened up to public use. By adopting joint-use agreements, schools can more formally denote their partner entities and address the details of handling logistics, such as facilities' scheduling and maintenance. Additional possibilities for joint-uses that might improve health outcomes include active and passive recreational space on school property, and community gardens.

2. Consider limiting retail food vendors surrounding the school, and locating a full-service grocery store within the TOD.

Fifty-two percent of all Wilson County restaurants today are considered "fast food" (University of Wisconsin's Population Health Institute, 2012). Any health benefits realized by an increase in pedestrian trips to/from school could be negated if students have scant access to healthy foods, and/or if fast food is easily accessible en route to/from the school. To help mitigate this potentially negative health impact, Lebanon could issue conditional-use permits that restrict where fast-food restaurants and convenience stores are able to locate. If this type of regulatory framework were to receive pushback from area businesses, however, another option would be to encourage the construction of establishments that offer healthy-food choices by establishing land-use performance standards. For example, drive-through restaurants impede the flow of traffic and contribute to declining air quality (Mair, Pierce, & Teret, 2005). Furthermore, more driveways and turning movements around schools affect pedestrian safety, including children who might walk to school. The Community Health Councils' *Fast Food Restaurant Report* contains precedent examples (Los Angeles and others) for defining "fast food" and the use of zoning to limit fast-food access around schools, parks, transit etc. Full-service grocery store access has been linked to healthier diets overall, richer in fruit and vegetable consumption. A full-service grocer onsite could positively contribute to both human and economic health conditions within the Hamilton Springs TOD.

3. Consider adopting a "Complete Streets" policy.

Complete streets policies emphasize the design of roads and environments that are equipped to serve all users –pedestrians, bicyclists, children, the elderly or disabled– by encouraging connected sidewalk and bicycle paths. The developer for Hamilton Springs committed to a "Complete Streets Boulevard" in the TOD's center. Should this design be implemented, walking and bicycling to school would be encouraged, and traffic accidents reduced. By adopting a Complete Streets policy –with specific cross-sections on how multiple transport modes will share the right-of-way– the developer and the City of Lebanon might help to ensure that Hamilton Springs (and other area locations) will develop with all potential users in mind. The National Complete Streets Coalition compiles representative examples of Complete Streets policies, hundreds of which have been adopted in cities and towns nationwide.

4. Consider implementing a school-siting agreement between the city planning department and the school district.

To site schools well, it is important for key decision-makers to be informed throughout, and coordinate amongst each other. One way to accomplish this would be via a formal partnership between the school district and the planning department.

In 2012, the Environmental Protection Agency issued model school-siting guidelines to help communities understand the benefits of policies that guide school-site selection. The EPA guidelines encourage school districts to work with other agencies such as planning, transportation, parks, police, and water/sewer to determine the best possible sites – based not just on the price of land, but the additional consideration of infrastructure costs, air quality, congestion, home values, and student access to the site by a greater diversity of transportation modes. Organizations like the Safe Routes to School National Partnership, the Institute of Transportation Engineers, the Center for Cities & Schools, and ChangeLab Solutions offer a variety of resources – from model school siting policies, to best practices and site designs. In Middle Tennessee, the School Siting web page hosted on the Nashville Area MPO's website is routinely updated with the latest national resources.

Well-sited schools not only better serve students by offering shorter trip distances that can be accomplished by a multiplicity of modes, but they can also anchor communities, becoming a destination for neighborhood meetings, festivals/fairs, non-profit organizations, and other civic groups. By strategically designing and placing schools, facilities intended to educate youth also have the capacity to service a variety of other community needs.

Limitations

School-siting decisions ideally feature multi-group collaborations. Because this particular school-siting decision will potentially transpire at some future time –as opposed to an immediate, concrete decision– the authors were limited in their stakeholder discussions. Further, community input was not solicited due to this siting's hypothetical nature – being that it would have been premature to engage the public in a decision that was suppositional, depending primarily on the timing and market success of the TOD build-out.

Public engagement and monitoring/reporting are typically key components of HIAs. Although this rapid HIA faced some restrictions in public-engagement strategy, the authors nonetheless deemed it a worthy undertaking – consulting instead with major stakeholders for their insights into the project: national school-siting experts, as well as the developer, local planners, the area school superintendent, etc. As the TOD build-out progresses, the developer and LSSD will have an opportunity to conduct community engagement around the potential for a TOD-sited school.

School-siting decisions can also sometimes be made in response to rapid population growth; therefore, findings presented here are based on forecasts of the projected number of Hamilton Springs residents under a full build-out scenario – subject to change in response to economic conditions, market variability, etc. Because the LSSD reports that its currently-zoned schools for the Hamilton Springs area are below capacity, students would attend these area schools until a new school might be constructed at Hamilton Springs. Depending upon the timing of the residential build-out, it is possible the developer might be open to donating the land to LSSD, and assist with construction. Without the TOD student population to attend, the school would not be constructed, and construction would occur only once the area zoned schools reach their capacity. Timing is also important so that the developer might profit from his initial investment in the project, then build the school as an additional amenity for future TOD homeowners.

Primarily because the TOD is not yet at full build-out, no new data was collected; for example, air-quality calculations for the site, and how the TOD street network would increase or decrease pollution. At the time this HIA was conducted, it was impossible to predict whether Hamilton Springs would have fewer tailpipe emissions than a typical suburban subdivision, though evidence suggests that fewer cars yield fewer mobile-source emissions.

It is for these reasons that the analysis and recommendations presented here are majority qualitative, not quantitative. However, as the TOD build-out materializes, this HIA includes recommendations for data-collection efforts that can help determine how the TOD is impacting the health of the people who live and work there, as well as that of the surrounding community.

Finally, there was limited study of the potential impacts of the TOD's food environment in that research into this area is still emerging. The authors are unable to make a steadfast prediction that fast-food retailers located around the Hamilton Springs school would result in definitively-negative impacts on child health. Research does suggest, however, that healthier food environments around schools and residential areas can lead to healthier students and residents.

Step 5: Reporting

Dissemination Plan

Lose & Associates and Bell Property Developers will refer to this HIA in their discussions with the local planning commission and school district. Generalized findings were presented to the Nashville Area MPO's Technical Coordinating Committee and Executive Board, and to the Tennessee Obesity Taskforce. The HIA was also presented at the 2013 annual conference for the New Partners for Smart Growth. Subsequent research areas will include monitoring the food and built-environment impacts on Hamilton Springs, and observing health impacts as the TOD build-out continues.

As any Hamilton Springs school-siting decision progresses, this HIA could be useful for facilitating informed discussions with the school district, planning department, and other agencies, for decisions related to land use, urban design, and transportation – for both the school site and the areas in/around the TOD.

Step 6: Monitoring and Evaluation

Monitoring and evaluation begins with sustained communication and coordination among the developer, site-designer, planning department, and school board. As the project moves from conceptual to implementation phases, other stakeholders should also be brought into the decision-making process: the public, and municipal departments like health, parks, police, water, sewer, and transportation. Depending on the build-out rate and the number of families interested in living there, the developer could consult with the City of Lebanon to determine when it might be appropriate for a school to locate within the TOD. One possibility might be that the TOD school would accommodate grades K-8, enabling a larger number of students to enroll since [depending on market conditions and interest] Hamilton Springs would likely house only a few hundred school-age residents.

The developer, County health, planning, roadway departments, and the school board might also help monitor the TOD's commercial and retail uses. The developer anticipates that the onsite marketplace will not be conducive to less desirable businesses (pawn shops, adult entertainment, etc). Outlining approved uses in the TOD master plan is an ideal means of protection against undesirable land uses, which has already been accomplished. With future updates to that master plan, the developer might consider establishing some limitations on drive-throughs, which could have the result of preventing "fast food" restaurants from locating within the TOD. This type of regulatory framework may not be prudent, however, given that many of these types of restaurants are moving toward offering healthy menu options. Working to bring an onsite, full-service grocer, and opening up underutilized spaces to farmers' markets and community gardens would also promote access to fresh, affordable, healthy food options.

The TOD master plan denotes that all streets shall have sidewalks on both sides, with bicycle facilities programmed for higher-volume streets. Transit access includes the Music City Star commuter-rail line, and at some point in the future will likely also feature bus or circulator service. These "Complete Streets" elements –in addition to urban-design and land-use standards (such as parking lot maximums)– will collectively contribute to a TOD community design that encourages physical activity. The TOD's proposed transportation environment, combined with fresh-food access, has the potential to enable healthy eating and active living for those who live and work there.

Recommendations for Next-Steps

Through research and stakeholder conversations, a need that consistently came up was a decision-making tool that could help government agencies to better understand the multiple cost considerations associated with school siting. As has been discussed here, often the foremost fiscal concern is the initial purchase-price for land upon which to site a new school. Other costs are often overlooked during the decision-making process, such as: running the supporting infrastructure out to that site, mitigation of traffic congestion, health care, or even resource pooling across public-sector agencies via joint-use agreements.

Tools that are currently available to decision-makers include: Alaska's School Site Selection Criteria & Evaluation Handbook; Arizona's Active School Neighborhood Checklist; and the Center for Cities & Schools' interactive website on the joint-use of schools. These tools can be customized to a given region, helping to introduce the additional municipal and societal costs when comparing multiple sites. Ideally, this tool would also include an evaluation of potential health impacts (positive or negative), so that decision-makers might gain a succinct understanding of both the full fiscal impact, as well as the health impact, of a prospective school-siting decision.

The scope of this rapid HIA did not include the development of a school-siting tool for the greater-Nashville region, but this would be a logical next step. As the MPO furthers its work on school siting, the organization could help to: identify barriers to intergovernmental collaboration among existing policies and practices; make recommendations to alleviate those barriers; develop a school-site cost calculator; and assemble model school-siting policies that could prove beneficial to local school districts. The MPO is prepared to build on the work of this inaugural Health Impact Assessment, moving from research to implementation of solutions.

Conclusion

Given that land use and transportation can affect public and environmental health (positively and/or negatively), the MPO set out to conduct this HIA in order to examine how a school-siting decision might impact school-related trip choices.

The siting of schools in close proximity to the student populations they serve –providing multi-modal transportation facilities such as sidewalks and bikeways– can increase the likelihood that children and parents will feel safer and more comfortable routinely choosing the active modes over that of bus or auto. Further, strategic efforts to plan a healthier retail food environment around schools may also potentially influence dietary choices in a way that promotes health and well-being, particularly for young people.

Hamilton Springs provided a unique opportunity to evaluate child-health impacts for residents of Tennessee's first-ever transit-oriented development. The format of a rapid HIA was ideal for this project, as the analysis warranted more in-depth reporting than that of a desktop HIA; and the time and resources available to the MPO for this particular development did not lend itself to a full HIA being realistically accomplishable. Rather, the end-product here will provide a framework to the developer and the City of Lebanon, going forward, for them to consider the health impacts of the TOD's food and built environments for those who live and work there– especially the children who would reside therein and attend an LSSD school.

The MPO authors of this HIA hope that its contents will serve as a resource to Lebanon, Tennessee and other communities –both in-state and elsewhere– as they consider sites for locating school facilities.

List of Acronyms and Definitions

Built Environment: refers to the human-made surroundings that provide the setting for human activity, ranging in scale from roadways, buildings, and parks or green space to neighborhoods and cities that can often include their supporting infrastructure, such as water supply, or energy networks.

Complete Streets: streets that offer transportation choices that are safe and convenient for all ages and ability levels. These choices may include transit, walking, bicycling, and automobile travel.

GIS – Geographic Information System: a system for capturing, storing, analyzing, and managing data which is spatially referenced to the Earth. GIS is a tool that allows users to create interactive queries (user-created searches), analyze the spatial information, edit data, create maps, and then present the results of all these operations.

HIA – Health Impact Assessment: an assessment conducted ideally in the planning phases of a built-environment project which estimates any positive or negative impacts that a project may have on environmental or personal health. The assessment makes recommendations for improvements to the project to mitigate negative impacts such as reducing emissions or improving positive outcomes such as increased physical activity.

LSSD – Lebanon Special School District

MPO – Metropolitan Planning Organization: entities designated by federal law as the lead authority for cooperative decision-making around transportation planning and investment strategy in the urbanized areas of America (populations of 50,000 or more).

Street Connectivity: suggests a system of streets with multiple routes and connections serving the same origins and destinations. Connectivity not only relates to the number of intersections along a segment of street, but how an entire area is connected by the transportation system.

SRTS – Safe Routes to School: the name of a national movement and a component of SAFETEA-LU by which communities provide infrastructure and education to enable and encourage children to walk and bicycle to school.

TDOT – Tennessee Department of Transportation: State agency responsible for the planning and implementation of Tennessee's multimodal transportation system including roads and bridges, aviation, public transit, waterways and railroads.

TOD – Transit-Oriented Development: is a mixed-use residential and commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership.

TRD – Transit Ready Development: is a mixed-use residential and commercial area designed to maximize *anticipated* access to public transport, and often incorporates features to encourage *future* transit ridership.

Appendices

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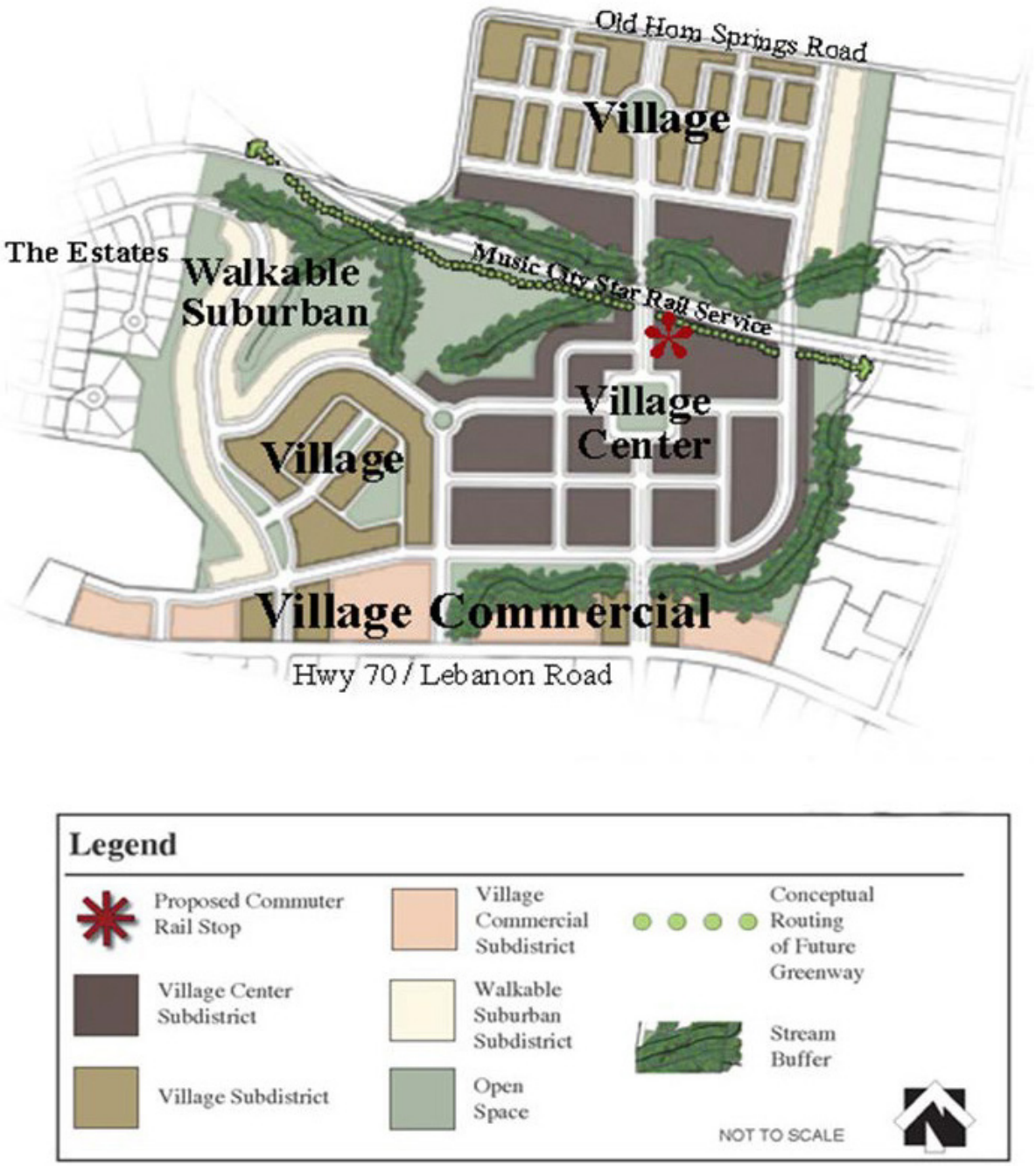
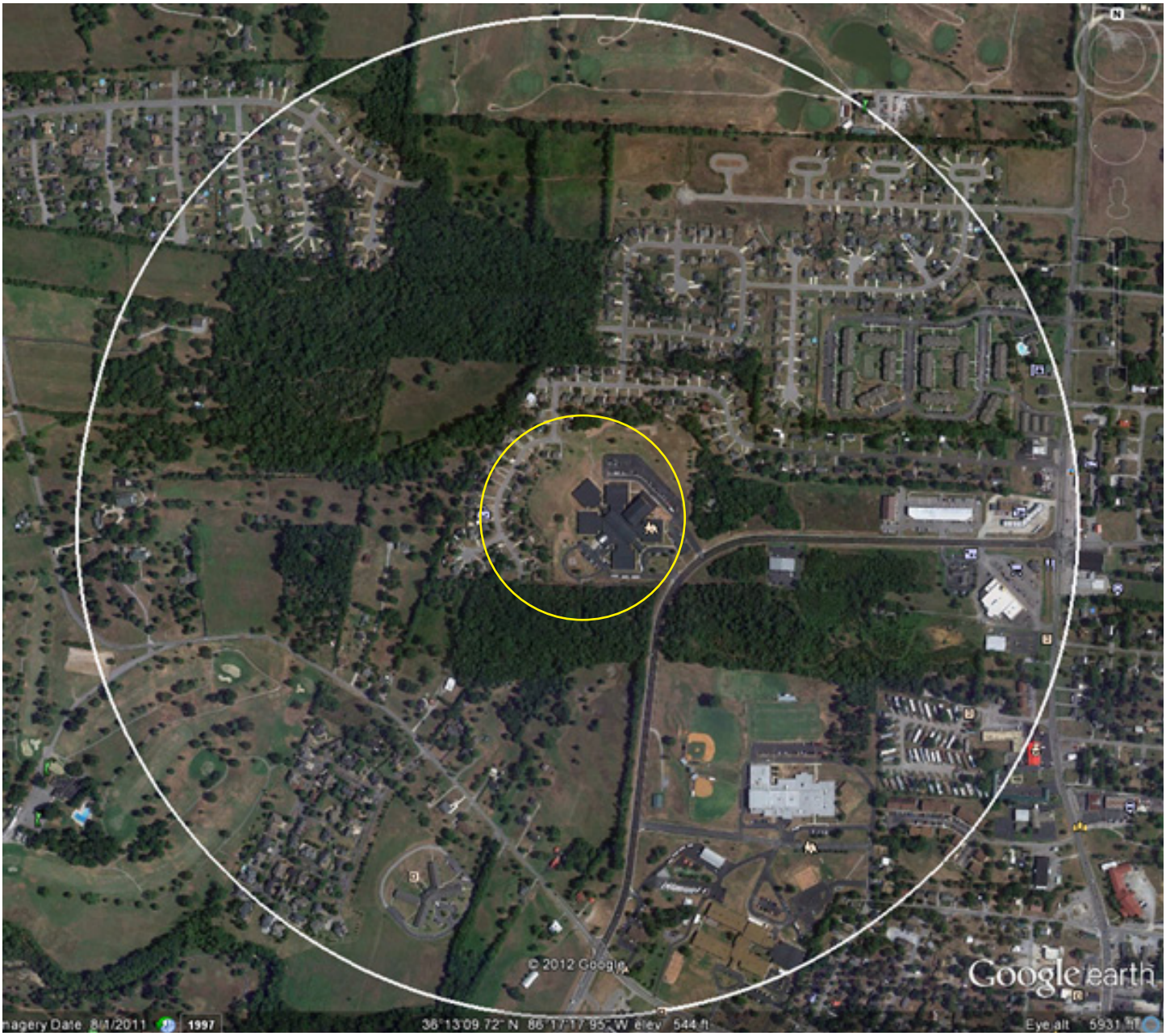
Appendix A. Hamilton Springs Map



Map 1. Hamilton Springs TOD Master Plan, Lebanon, TN
Source: Lose & Associates, Inc.

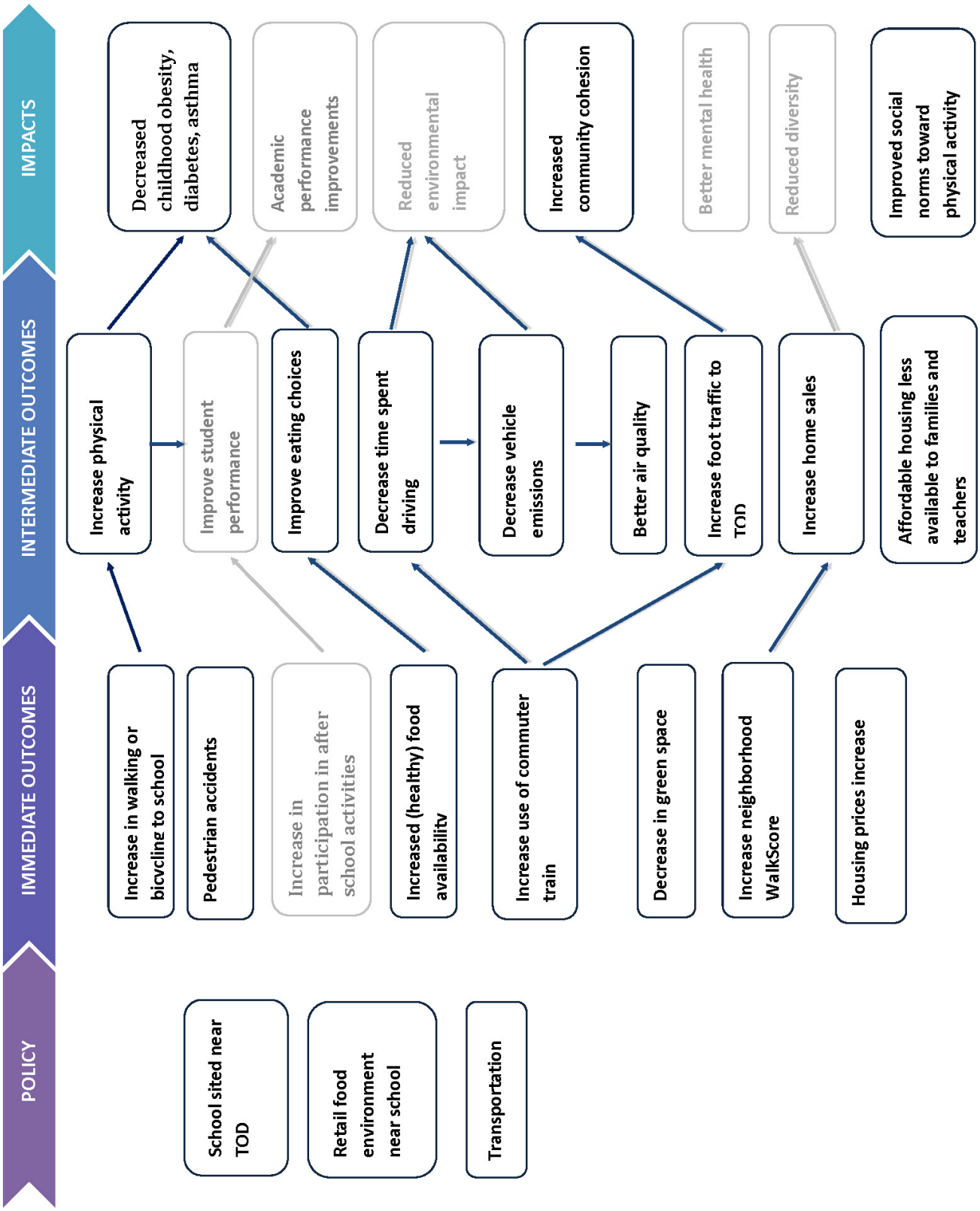
Appendix B. Maps of Byars Dowdy and Castle Heights Elementary Schools

Map 2. Byars Dowdy Elementary School, Lebanon, TN
White circle indicates a half-mile radius around the school. Source: Google Earth



Map 3. Castle Heights Elementary School, Lebanon, TN
White circle indicates a half-mile radius around the school. Source: Google Earth

Appendix C. Pathway Diagram



Appendix D. Further Resources for School Siting

Several resources and reports aided in the process of the HIA and may be of use to future HIAs and school siting.

1. Joint Use Calculator, 21st Century School Fund & Center for Cities & School:
   http://citiesandschools.berkeley.edu/joint-use.html

2. University of Minnesota, School Transportation:
   http://www.users.cs.umn.edu/~rajan/test3/advanced.html

3. National Clearinghouse of Educational Facilities:
   http://www.ncef.org/rl/

4. Active Schools Neighborhood Checklist:
   https://activeschoolchecklist.com/

5. National Trust for Historic Preservation, *Why Johnny Can't Walk to School*:
   http://www.preservationnation.org/

6. National Trust for Historic Preservation, *Helping Johnny Walk to School*:
   http://www.preservationnation.org/

7. EPA School Siting Guidelines:
   www.epa.gov/schools/siting

Appendix E. Table of Studies

Title	Citation	Notes
Physical Activity		
APHA Active Transportation Primer for Public Health Professionals	American Public Health Association (2012) Journey to better health: An Active Transportation Primer for Public Health Professionals	-Approx. 87% of students lived within 1 mile of schools in 1969, by 2001 21% When children live more than 1 mile away from school, rates of walking and bicycling slide downward "Minimum acreage standards" require large plots of land for school sites
Patterns of Obesogenic Neighborhood Features and Adolescent Weight	Wall, M. M., Larson, N. I., Forsyth, A., Van Riper, D. C., Graham, D. J., Story, M. T., & NeumarkSztainer, D. (2012a). Patterns of obesogenic neighborhood features and adolescent weight: a comparison of statistical approaches. *American Journal of Preventive Medicine*, 42(5), e65–75. doi:10.1016/j.amepre.2012.02.009	Neighborhood characteristics measured using GIS food access, recreational physical activity, support for utilitarian physical activity, neighborhood sociodemographics, transit route data Used 22 neighborhood variables Higher BMI among boys and girls in lower proportion of park/ recreation land, perceptions of safety
Obesogenic Neighborhood Environments, Child and Parent Obesity	Saelens, B. E., Sallis, J. F., Frank, L. D., Couch, S. C., Zhou, C., Colburn, T., Cain, K. L., et al (2012). Obesogenic Neighborhood Environments, Child and Parent Obesity. *American Journal of Preventive Medicine*, 42(5), e57–e64. doi:10.1016/j. amepre.2012.02.008	Evaluated child and parent weight status across neighborhoods in Seattle metro area and San Diego county differencing in physical and nutrition environmental characteristics Combination of nutrition and physical activity environments and to assess children and their parents. Only eight percent of children were obese in neighborhoods where physical activity and nutrition environments were positive. Fast food may not be as easy to come by in the Seattle area, based on the study
Evaluating NonMotorized Transportation Benefits and Costs	Litman, T. (2012). Evaluating NonMotorized Transportation Benefits and Costs. Victoria Transport Policy Institute. 26 July 2012: n. page. Web. 9 Aug. 2012. <http://www.vtpi.org/nmttdm. pdf>.	Report describes impacts that should be considered for nonmotorized transport policies Defines nonmotorized transport: walking, cycling and variants such as wheelchair, scooter, and handcart use; value to users Walking and cycling improvements avoided costs: user savings, contingent valuation willingness to pay for specific facilities

Objective Assessment of Obesogenic Environments in Youth	Frank, L. D., Saelens, B. E., Chapman, J., Sallis, J. F., Kerr, J., Glanz, K., Couch, S. C., et al (2012). Objective assessment of obesogenic environments in youth: geographic information system methods and spatial findings from the Neighborhood Impact on Kids study. *American Journal of Preventive Medicine*, 42(5), e47–55. doi:10.1016/j.amepre.2012.02.006	Physical activity environments and nutrition environments were evaluated. Created high/low combinations for four neighborhood types; mapped out with GIS for comparison
TOD and Families	Zimbabwe, S., Britt, K., Wampler, E., Vincent, J., Bierbaum, A., McKoy, D., & Rhodes , M. (2012). Tod 205: Families and transitoriented development creating complete communities for all. Retrieved from Center for Cities and Schools website: http://reconnectingamerica.org/assets/PDFs/20120620TODandFamiliesfinal.pdf.	Families with children are more likely to live near transit when the transit system is large enough to offer a viable alternative to driving The types of households that seek out TOD are singles, couples without children, low income minority households Married couples with children tend to own more autos and may not chose to live near transit; including mixed income family housing is also important to ensuring low and moderate income households Teachers benefit from mixed income TOD Parents often cite distance, traffic concerns and stranger danger as major barriers to walking and bicycling to school; bike and pedestrian infrastructure important as well
Mapping the Walk to School Using Accelerometry Combined with a Global Positioning System	Cooper, A. R., Page, A. S., Wheeler, B. W., Griew, P., Davis, L., Hillsdon, M., & Jago, R. (2010). Mapping the walk to school using accelerometry combined with a global positioning system. *American Journal of Preventive Medicine*, 38(2), 178–183. doi:10.1016/j.amepre.2009.10.036	Walking to school is associated with higher levels of physical activity This study combined accelerometer and GPS data to investigate the level and location of physical activity in children walking to school Mean accelerometer counts per minute before school were 43% higher in children who walked to school than those traveling by car 11% of daily moderate to vigorous physical activity occurred during the walk to school Total activity during the walk to school was twice that in the playground, with the journey to school contributing three times as much moderate to vigorous physical activity as time in the playground

Associations between active commuting to school, fat mass, and lifestyle factors in adolescents: the Kiel Obesity Prevention Study	Landsberg, B., PlachtaDanielzik, S., Much, D., Johannsen, M., Lange, D., & Müller, M. J. (2008). Associations between active commuting to school, fat mass and lifestyle factors in adolescents: the Kiel Obesity Prevention Study (KOPS). *European Journal of Clinical Nutrition*, 62(6), 739–747. doi:10.1038/sj.ejcn.1602781	Used data from the Kiel Obesity prevention study, 626 14year old participants Active commuting overall higher physical activity Lower TV viewing, lower rates of smoking in active commuters Fat mass was lower in adolescents who traveled longer distances to school by active commuting
Physical Activity and Performance at School: A Systematic Review of the Literature	Singh, A., Uijtdewilligen, L., Twisk, J. W. R., van Mechelen, W., & Chinapaw, M. J. M. (2012). Physical activity and performance at school: a systematic review of the literature including a methodological quality assessment. *Archives of Pediatrics and Adolescent Medicine*, 166(1), 49–55. doi:10.1001/archpediatrics.2011.716	Examined 4 studies on physical activity and academic performance Found a longitudinal correlation between physical activity levels and academic performance Doseresponse relationship has not been established
Public support for streetscale urban design practices and policies to increase physical activity	Carlson, S. A., Guide, R., Schmid, T. L., Moore, L. V., Barradas, D. T., & Fulton, J. E. (2011). Public support for streetscale urban design practices and policies to increase physical activity. *Journal of Physical Activity & Health*, 8 Suppl 1, S125–134.	Two out of three adults are willing to take civic action to support local streetscale urban design policy changes that make walking and biking easier in their neighborhoods
School Siting		
Policies related to active transport to and from school: a multisite case study	Eyler, A. A., Brownson, R. C., Doescher, M. P., Evenson, K. R., Fesperman, C. E., Litt, J. S., Pluto, D., et al. (2008). Policies related to active transport to and from school: a multisite case study. *Health Education Research*, 23(6), 963–975. doi:10.1093/her/cym061	Interviewed stakeholders to identify barriers to active transportation near schools, looked at influential factors and policy actions that affect active transportation
Collaborative School Planning & Active Schools: A Case Study of Lee County, Florida	Lees, E., Salvesen, D., & Shay, E. (2008). Collaborative school planning and active schools: a case study of Lee County, Florida. *Journal of Health Politics, Policy and Law*, 33(3), 595–615. doi:10.1215/036168782008009	Healthy people 2010 calls for children and youth to engage in 30 minutes of exercise a day Simulation studies have found that limiting commuting distance to .5 mile could result in an increase in biking and walking combined Mixed research (positive effect v. no effect) on sidewalk availability to walking to school, street connectivity on walking or biking to school unclear State has adopted legislation requiring that school capacity in place concurrent with residential development

Transportation Prescription for Healthy Cities	Lockwood, Ian M. (2004) Transportation Prescription for Healthy Cities. Transportation Design Studio.	Transect: simply a crosssection of the built environment ranging on a scale from urban to rural helps determine if one aspect or another of the environment suits the context; efficient transportation is often mistaken for faster transportation; idea of a transportation land use cycle when land uses are changed, more trips are generated, more motor vehicles are used, streets change idea that motor vehicle carrying capacity leads to investment, but there are limits
Model School Siting Policies	National Policy and Legal Analysis Network, (2012). Model school siting policies for school districts. Retrieved from Change Lab Solutions website: http://changelabsolutions.org/sites/changelabsolutions.org/files/ModelSchoolSitingPolicies_FINAL_(CLS20120530)_20120227.pdf.	2/3 of today's schools are located far from where children live; safe routes to school require continuous sidewalks, frequent safe street crossings, and few or no wide streets with vehicle speeds in excess of 35 mph
School Siting in Middle Tennessee	Jacobs, D. Nashville Area Metropolitan Planning Organization. School siting in middle tennessee. Retrieved from website: http://www.nashvillempo.org/docs/symposiums/school_siting/School_Siting_Policy_Memo030510.pdf.	No minimum acreage requirement in TN but school facilities planners may adhere to one School districts in Nashville area are experiencing a period of high growth
Planning for Schools & Liveable Communities: The Oregon School Siting Handbook	University of Oregon. Dept. of Planning, (2005). Planning for schools & liveable communities: The Oregon school siting handbook. Retrieved from website: http://cms.oregon.gov/LCD/TGM/docs/schoolsitinghandbook.pdf.	Role of the school as a neighborhood focal point School was the physical center of the neighborhood reflecting its prominent role in the community: parents meet each other when taking kids to school etc,. Four school siting principles: (1) school siting decisions benefit the entire community (2) school site takes full advantage of existing resources (3) school site is easily and safely accessible by walking, biking and transit, (4) school site is a community focal point Well sited schools: reinforce schools as community focal point, reduce number of cars on the road, opportunities for daily exercise, teach alternative transportation skills; challenges to school siting: funding, land availability, transportation, coordinated planning

Growth & Opportunity: Aligning High Quality Public Education & Sustainable Communities Planning in the Bay Area	FOCUS (2011). Growth & opportunity: Aligning high quality public education & sustainable communities planning in the Bay Area. Retrieved from Center for Cities and Schools website: http://citiesandschools.berkeley.edu/reports/cc&sfocus_policy_report_final_june2011.pdf.	Use of secondary data and Health Development Measurement Tool to look at factors affecting community health
Community Health Assessment: Bernal Heights Preschool	Gaydos, M. San Francisco Department of Public Health (2008). Bernal heights community health assessment. Retrieved from website: http://www.thehdmt.org/etc/Bernal.Hts.Preschool.HDMT.Application_2.7.08.pdf.	Use of secondary data and Health Development Measurement Tool to look at factors affecting community health; looked at the impacts of 3 different school sites/ developments, mapped out specific indicators and provided interpretations of each (potential format for HIA report, also demographics at general and specific level); demographics table appendix comparing different neighborhoods and city level
Hard Lessons: Causes and Consequences of Michigan's School Construction Boom	McClelland, M., Schneider, K., & Dulzo, J. Michigan Land Use Institute (2004). Hard lessons: causes and consequences of michigan's school construction boom. Retrieved from website: http://www.mlui.org/pageview.asp?fileid=16653.	Costs of locating a school further from development: improved road ($250,000 and 350,000), mile of sewer (specific to school); higher home values may also reduce number of young families that are available to move to the TOD and to go to the school
Missouri State School Transportation Aid (nplan memo)	Zimmerman, S. National Policy and Legal Analysis Network, (2010). Missouri state school transportation aid	Significant financial benefits by encouraging children to walk or bicycle (cost of busing in the US is $17 billion). Missouri incentivizes school districts to have busing
Putting Schools on the Map: Linking Transit Oriented Development, Families, and Schools in the San Francisco Bay Area Collaborative	Bierbaum, A., Vincent, J., & MkKoy, D. (2010). Putting schools on the map: Linking transitoriented development, families, and schools in the San Francisco bay area. Retrieved from Center for Cities and Schools website: http://citiesandschools.berkeley.edu/reports/Putting Schools on the Map_Final_Jul10_appendices.pdf.	Schools can be seen as a community asset When parents are deciding on housing, school quality plays a major role Mixed housing types, which are often found near TODs, are needed to attract families This type of mixed income housing provides educational workforce housing, which can increase a school district's ability to recruit and retain teachers and faculty Joint use opportunities TOD/School since TODs are specially designed to support new developments

U.S. School Travel 2009: An Assessment of Trends	McDonald, N., A. Brown, L. Marchetti, and M. Pedroso. 2011. U.S. school travel 2009: an assessment of trends. *American Journal of Preventive Medicine* 41(2): 146151.	Used the National Household Travel Survey, which collected transportation data on 150,147 households in 2008 and 2009 In 2009, 12.7% of K–8 students usually walked or biked to school compared with 47.7% in 1969 Rates of walking or bicycling are higher on the trip home from school
Why Parents Drive Children to School: Implications for Safe Routes to School Programs.	McDonald, N. & Aalborg, A. (2009). Why parents drive children to school: implications for safe routes to school programs. *Journal of the American Planning Association* 75(3): 331342.	75% of parents drove their children to school because of time Supervision a concern SRTS programs need to address parent convenience and time constraints Recommends walking school buses Strong negative correlation between walking to school and distance; distance creates a time advantage for vehicle use Many parents drop their children off using a vehicle en route to work
Food Environment		

The Use of Zoning to Restrict Fast Food Outlets: A Potential Strategy to Combat Obesity	Mair, J., Pierce, M., & Teret, S. (2005). The use of zoning to restrict fast food outlets: A potential strategy to combat obesity. Retrieved from website: http://www.publichealthlaw.net/Zoning Fast Food Outlets.pdf.	Fast food definition: "inexpensive food that is prepared and served quickly, often by drivethrough service, and tends to be high in fat and low in nutritional value" Obesity is a risk factor for diabetes, stroke, heart disease, cancer Children who are obese are more likely to be obese as adults Access to fast food is positively associated with higher BMI, increased daily caloric intake and weight gain Fast food generally indicated large portions of high energy dense food, that are high in fat and calories Study of children <19 shows those who ate fast food consumed more fat, sugars, and total carbohydrates Average adolescent eats fast food twice a week, 30.3 % US children or adolescent each fast food on a typical day Zoning options for fast food regulation: 1) Conditional – localities can allow fast food on a site by site basis 2) Incentive – municipalities encourage construction of sites that benefit public 3) Performance – sets standards for land use, such as a certain number of healthy restaurants Could have an exclusive list of permitted land uses in the zoned area, that does not include fast food Another potential ban is the prohibition of "formula" restaurants Drive thru prohibitions have in some cases had to show that it significantly increases traffic flow, idea that increased traffic reduces air quality and endangers students Loss of neighborhood businesses will change the character of and economic base of the community

Body mass index in elementary school children, metropolitan area food prices and food outlet density	Sturm, R, & Datar, A. (2005). Body mass index in elementary school children, metropolitan area food prices and food outlet density. *Public Health*, 119(12), 1059–1068. doi:10.1016/j.puhe.2005.05.007	Longitudinal study that followed a sample of kindergarten children over 4 years Merged Early Childhood Longitudinal Study with zip code level data on food outlets and metrolevel data on food prices Variation in fruit and veggie prices large enough to explain gain in BMI among some children No association with food outlets was found
Clustering of Fast Food Restaurants around Schools: A novel application of spatial statistics to the study of food environments	Austin, S. B., Melly, S. J., Sanchez, B. N., Patel, A., Buka, S., & Gortmaker, S. L. (2005). Clustering of fastfood restaurants around schools: a novel application of spatial statistics to the study of food environments. *American Journal of Public Health*, 95(9), 1575–1581. doi:10.2105/AJPH.2004.056341	Geocoded databases of restaurant and school addresses near schools in Chicago Median distance to nearest fast food: .52 k,, 78% of schools had at least 1 fast food restaurant Fast food restaurants clustered around schools in the high and moderate commercialization regions of the city (ie, commercialization leads to fast food?) 6 times more fast food restaurants within 1.5 km of schools Fast food restaurants clustered around regions with median household incomes < 43700 Recommends state/municipal policy initiatives to address concentration of fast food outlets near schools
The Effect of Fast Food Restaurants on Obesity	Currie, J., DellaVigna, S., Moretti, E., & Pathania, V. (2009). The Effect of Fast Food Restaurants on Obesity and Weight Gain (Working Paper No. 14721). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w14721	Among 9th grade children , fast food outlets within 1/10th of a mile are associated with a 5.2 increase in obesity rates Policies restricting access to fast food near schools have the potential for significant impacts on obesity in school children School children may be more impacted by the location of fast food in that they have to stay near the school
Disparities in the Food Environment Surrounding US Middle and High Schools	Sturm, R. (2008). Disparities in the food environment surrounding US middle and high schools. *Public Health*, 122(7), 681–690. doi:10.1016/j.puhe.2007.09.004	Buffers were calculated with a radius of 400 and 800 m from public schools Middle schools have fewer surrounding businesses than smaller schools Easy availability of fast food can negate healthy school policies (and the benefits of a well sited school…)

Childhood Obesity and the Built Environment: A Review of the Literature from 20082009	Galvez, M. P., Pearl, M., & Yen, I. H. (2010). Childhood Obesity and the Built Environment: A Review of the Literature from 20082009. *Current Opinion in Pediatrics*, 22(2), 202–207. doi:10.1097/MOP.0b013e328336eb6f	Cars as transportation to school, time spent playing video games were associated with physical inactivity Active commuting is multilayered: city planning, parents' attitudes and behaviors, parents' perception of safety, child traits and perceptions Children who had friends in the area were more likely to active commute Distance between home and school is the most important factor to active commuting Boys are more likely to active commute than girls
Land Use Planning and the Control of Alcohol, Tobacco, Firearms and Fast Food Restaurants	Ashe, M., Jernigan, D., Kline, R., & Galaz, R. (2003). Land use planning and the control of alcohol, tobacco, firearms, and fast food restaurants. *American Journal of Public Health*, 93(9), 1404–1408.	"Police power" allows a state or local government to enact laws that 'protect, preserve and promote the health, safety, morals and general welfare of the people Can restrict private property as to avoid harm to the public Just as land use is used to guide alcohol, tobacco and firearms control, it can be used for nutrition Conditional Use Permit (CUP): refinement of zoning powers where government makes exceptions for specific uses of land when the property meets certain conditions CUP can encourage restaurants to improve nutritional quality and displace fast food
Neighborhood Road Environments and PA Among Youth: the CLAN Study	Carver, A., Timperio, A. F., & Crawford, D. A. (2008). Neighborhood Road Environments and Physical Activity Among Youth: The CLAN Study. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, 85(4), 532–544. doi:10.1007/s1152400892849	Cross sectional study of children (89 years one sample, 1315 years old other sample) in Children Living in Active Neighborhoods (CLAN) study Parents reported 89 year old physical activity, adolescents self reported, accelerometers used for physical activity outside of school hours No associations between road environment variables (length of roads, intersection density, residing on a culdesac, speed humps etc.) and children's likelihood of making walking/cycling trips Backseat generation – children who are driven to structured leisure time activities outside the neighborhood

Fast Food Restaurant Report: Promoting Healthy Dining in South LA	Bassford, N., GallowayGilliam, L., Flynn, G., & Morrison, B. (2012). Fast Food Restaurant Report: Promoting Healthy Dining in South LA. Los Angeles : Community Health Councils.	Provides policy recommendations for the City of LA with regard to Fast Food zoning: 1) Extend criteria to obtain construction permit to all fast food restaurants, not just stand alone establishments 2) Require new fast restaurants to locate at least a half mile away from schools, parks, playgrounds, child care centers, rec centers 3) Require them to be 750 feet from bus, rail and other transit 4) Define a healthy restaurant 5) Provide exemptions for healthy restaurant definition 6) Strengthen incentives for healthy restaurants 7) Monitor healthy restaurants for continued compliance Fast food associated with weight gain, lower intake of fruits and vegetables, greater intake of calories and fat, insulin resistance Students in close proximity to fast food consume approximately 30 to 100 calories more per school day Policies must balance food insecurity issues – by shutting down restaurants, there may be less access to food, or cause displacement when land values rises
Neighborhood Playgrounds, Fast Food Restaurants, and Crime: Relationships to Overweight in Low-Income Preschool Children	Burdette, H. L., & Whitaker, R. C. (2004). Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in lowincome preschool children. *Preventive Medicine*, 38(1), 57–63.	Crosssectional study of 7000 children Distance between playgrounds and fast food restaurants determined with GIS Amount of children's meals consumed at fast food outlets has increased in parallel with childhood obesity epidemic No association with overweight and proximity to playgrounds or fast food

A Systematic Review of Fast Food Access Studies	Fleischhacker, S. E., Evenson, K. R., Rodriguez, D. A., & Ammerman, A. S. (2011). A systematic review of fast food access studies. Obesity reviews: an official journal of the International Association for the Study of Obesity, 12(5), e460–471. doi:10.1111/j.1467789X.2010.00715.x	40 articles reviewed a clear consensus of the association of access to fast food and obesity is not available Further research needed to examine how fast food impacts dietary intake Fast food associated with higher intakes of energy, fat, sodium, sugar, sugary beverages, lower consumption of fruit, vegetables, fiber and milk 7 studies found higher obesity prevalence associated with access, 8 studies found no association In children, living near more fast food decreases the likelihood of eating fruit and vegetables
The Grocery Gap: Who Has Access to Food and Why it Matters	The Grocery Gap: Who Has Access to Food and Why it Matters. Policy Link and the Food Trust, 2010.	Reviewed more than 132 studies regarding food access Decreased access to healthy food can have negative health impacts, especially for those who are lowincome, communities of color or rural communities Poor healthy food access is related to dietrelated diseases such as obesity and diabetes Greater access to healthy foods is linked to better eating behaviors
Tools		
Active Neighborhoods Checklist		https://activeschoolchecklist.com/
Joint Use Calculator		http://citiesandschools.berkeley.edu/jointuse.html
MN Busing Calculator		http://wwwusers.cs.umn.edu/~rajan/test3/advanced.html
HIA Human Impact Partners Health Impact Assessment Toolkit		http://www.humanimpact.org/component/jdownloads/finish/11/81
Healthy Communities Atlas		Designates Communities of Concern that have high concentrations of low income households, minorities, lowmobility households, low community engagement; low mobility: 25% of households do not own a car, 25% of the population has a disability, 20% of the population is over 65

HIA Protocol		
Use of Health Impact Assessment in the U.S. 27 Case Studies, 1999–2007	Dannenberg, A. L., Bhatia, R., Cole, B. L., Heaton, S. K., Feldman, J. D., & Rutt, C. D. (2008). Use of health impact assessment in the U.S.: 27 case studies, 19992007. *American Journal of Preventive Medicine,* 34(3), 241–256. doi:10.1016/j.amepre.2007.11.015	Details 27 HIAs conducted in the US, the steps followed in each, lessons learned mentions Safe Routes to School UCLA HIA study relevant to school siting HIA
Improving Health Through Policies that Promote Active Travel: A review of evidence to support integrated health impact assessment	de Nazelle, A., Nieuwenhuijsen, M. J., Antó, J. M., Brauer, M., Briggs, D., BraunFahrlander, C., Cavill, N., et al. (2011). Improving health through policies that promote active travel: A review of evidence to support integrated health impact assessment. Environment International, 37(4), 766–777. doi:10.1016/j.envint.2011.02.003	Tradeoff of active transportation is higher exposure to traffic injuries, increased inhalation of air pollutants; people living in areas of urban sprawl were more likely to be overweight or obese, suffer from chronic disease, "walkable" neighborhoods associated with better mental health and healthier weight, having places to walk to and mixed land use is associated with increased social capital (knowing neighbors, trust), driving is negatively associated with social capital
Other		
Do Good Schools or Good Neighbors Raise Property Values?	Kane, T., Staiger, D., & Riegg, S. (2004). Do good schools or good neighbors raise property values?. NBER Working Paper Series, Retrieved from http://www.econ.yale.edu/seminars/labor/lap04/staiger040506.pdf	Examined relationship between school characteristics and housing prices in school district that was operating under courtordered desegregation (drew students across boundaries; looked at differences in housing prices along the assignment and changes following the switch in school assignments, 10% increase in median income at high school is associated with 2.3% higher property values, 10 point increase in the performance associated with 1.8 higher property values but not shown to be significant for elementary schools
Walking the Walk: How Walkability Raises Home Values in U.S. Cities	Cortright, J. (2009). Walking the walk: How walkability raises home values in U.S. cities .CEOs for Cities	Studied 90,000 recent home sales in 15 different markets A 1 point increase in Walk Score was associated with a $7003000 increase in home values Positive correlation between walkability and housing prices in 13 out of 15 markets studied

Appendix F. Variables Used in Heat Mapping

Environmental Justice Populations

- Non-Hispanic minorities
- Carless households
- Households in poverty
- Persons with physical disabilities
- Female head of household with child
- Elderly
- Hispanic persons
- Limited English Proficiency

Bicycle and Pedestrian Levels of Service

- Presence of a bikeway or sidewalk
- Width of the facility
- Number of travel lanes on the roadway
- Posted speed limit
- Average number of vehicles on the road per day
- Buffer between the road and sidewalk or bikeway (such as a landscaped buffer area)

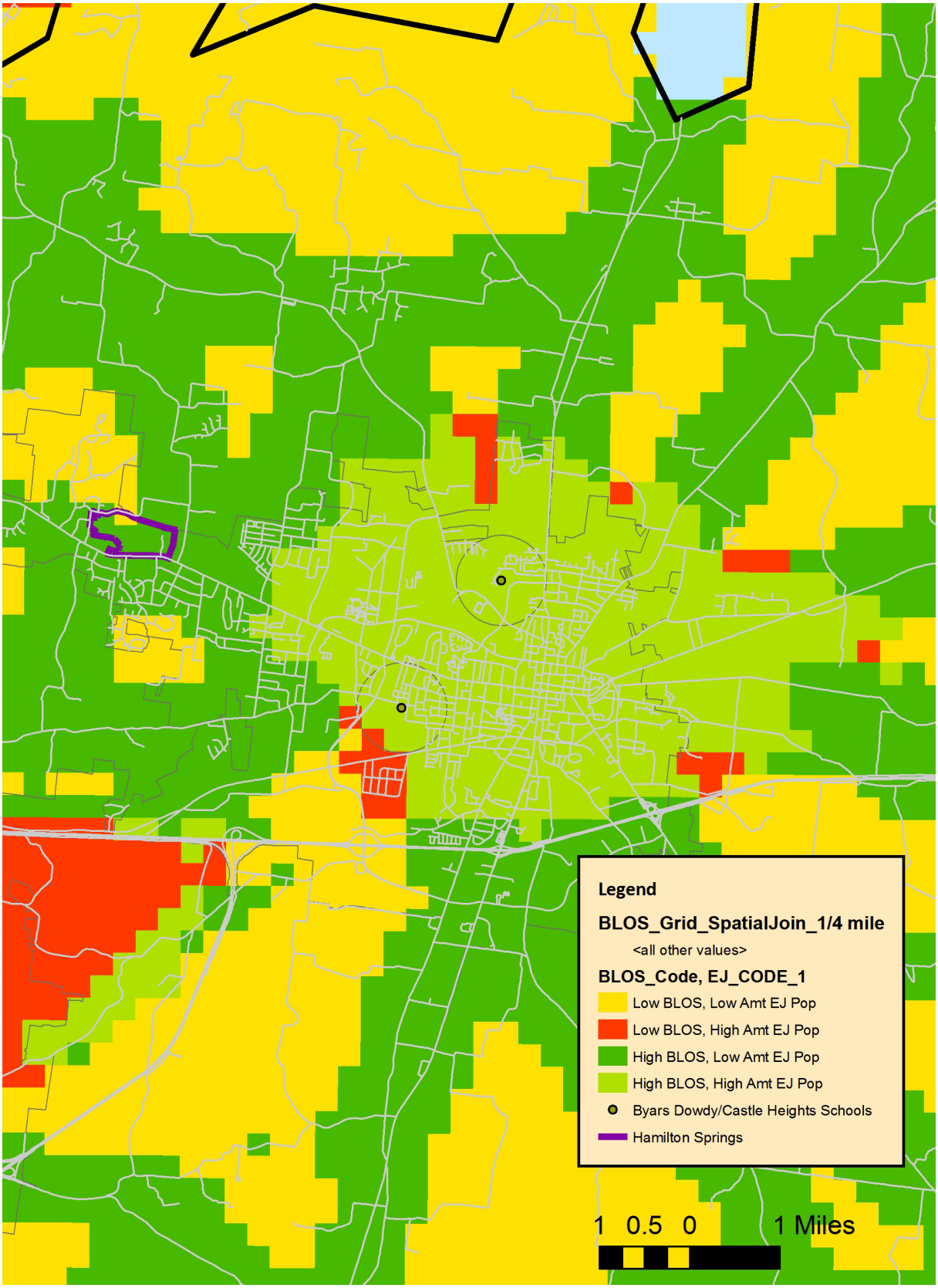
Food Deserts

- Impoverished populations
- Access to walking, bicycling and transit facilities
- Retail food environments
- Food-related morbidity and mortality

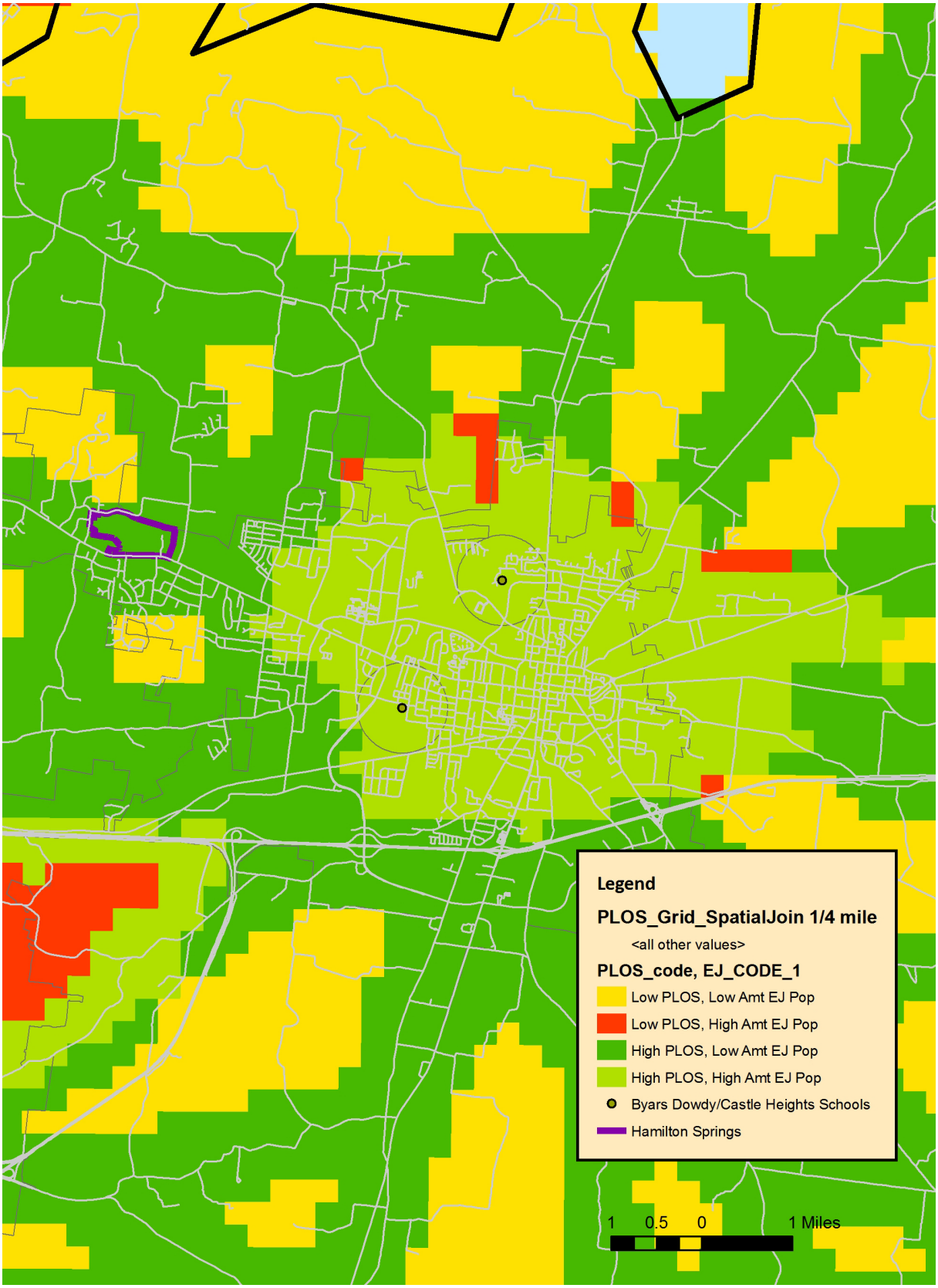
Retail Food Environment

- Full-service grocery stores
- Convenience markets

Appendix G. Heat Maps

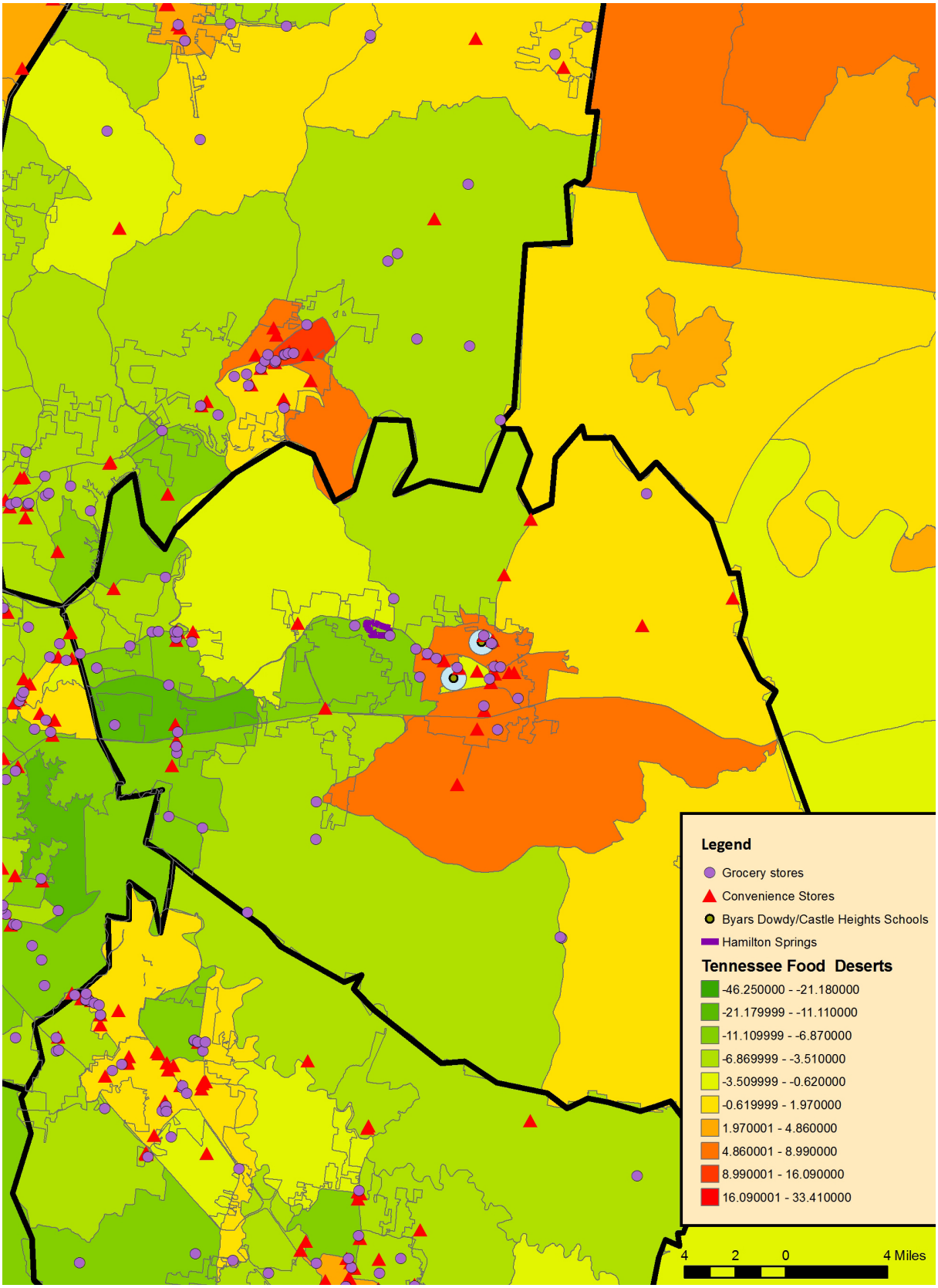


Map 4. Bicycle Level of Service (BLOS) Map
Source: Nashville Area MPO



Map 5. Pedestrian Level of Service (PLOS) Map

Source: Nashville Area MPO



Map 6. Food Desert Heat Map
Source: Nashville Area MPO

References

Ashe, M., Jernigan, D., Kline, R., & Galaz, R. (2003). Land use planning and the control of alcohol, tobacco, firearms, and fast food restaurants. *American Journal of Public Health*, 93(9), 1404–1408.

Austin, S. B., Melly, S. J., Sanchez, B. N., Patel, A., Buka, S., & Gortmaker, S. L. (2005). Clustering of fast-food restaurants around schools: a novel application of spatial statistics to the study of food environments. *American Journal of Public Health*, 95(9), 1575–1581. doi:10.2105/AJPH.2004.056341

Bassford, N., Galloway-Gilliam, L., Flynn, G. & Morrison, B. (2012). Fast Food Restaurant Report: Promoting Healthy Dining in South Los Angles. Community Health Councils, Inc. Accessed at http://www.chc-inc.org/downloads/PB%20Fast%20Food%20Report.pdf.

Booth, G.L., Creatore, M.I., Moineddian, R., Gozdyra, P., Weyman, J.T., Matheson, F.I. & Glazier, R.H. (2012). Unwalkable neighborhoods, poverty and the risk of diabetes among recent immigrants to Canada compared with long term residents. *Diabetes Care*, Published online before print September 17, 2012, doi: 10.2337/dc12-077.7

Burdette, H. L., & Whitaker, R. C. (2004). Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children. *Preventive Medicine*, 38(1), 57–63.

Carver, A., Timperio, A. F., & Crawford, D. A. (2008). Neighborhood road environments and physical activity among youth: The CLAN study. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, 85(4), 532–544. doi:10.1007/s11524-008-9284-9

Carlson, S. A., Guide, R., Schmid, T. L., Moore, L. V., Barradas, D. T., & Fulton, J. E. (2011). Public support for street-scale urban design practices and policies to increase physical activity. *Journal of Physical Activity & Health*, 8 Suppl 1, S125–134.

Centers for Disease Control and Prevention (2010). FastStats: Asthma. Accessed at http://www.cdc.gov/nchs/fastats/asthma.htm.

Centers for Disease Control and Prevention (2009). Health impact assessment. Retrieved from http://www.cdc.gov/healthyplaces/hia.htm.

Charlotte-Mecklenburg Planning Department Joint Use Task Force website (2012). Accessed on November 6, 2012 at http://charmeck.org/city/charlotte/planning/CapitalFacilities/Pages/JointUseTaskForce.aspx.

Chen, C.C., Baker, A.M., & Skipper, M.J. (2012). A uniform visualization platform in transportation planning. Transportation Planning Board Committee ADA 30 Tools of the Trade: Transportation Planning in Small and Medium Communities. Available at www.nashvillempo.org.

Cooper, A. R., Page, A. S., Wheeler, B. W., Griew, P., Davis, L., Hillsdon, M., & Jago, R. (2010). Mapping the walk to school using accelerometry combined with a global positioning system. *American Journal of Preventive Medicine*, 38(2), 178–183. doi:10.1016/j.amepre.2009.10.036

Currie, J., DellaVigna, S., Moretti, E., & Pathania, V. (2009). The effect of fast food restaurants on obesity and weight gain (Working Paper No. 14721). National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w14721.

Dannenberg, A. L., Bhatia, R., Cole, B. L., Heaton, S. K., Feldman, J. D., & Rutt, C. D. (2008). Use of health impact assessment in the U.S.: 27 case studies, 1999-2007. *American Journal of Preventive Medicine*, 34(3), 241–256. doi:10.1016/j.amepre.2007.11.015

Department of Health and Human Services (2010). The child and adolescent health measurement initiative. Tennessee state fact sheet. Retrieved from website: http://childhealthdata.org/docs/nsch-docs/tennessee-pdf.pdf.

de Nazelle, A., Nieuwenhuijsen, M. J., Antó, J. M., Brauer, M., Briggs, D., Braun-Fahrlander, C., Cavill, N., et al (2011). Improving health through policies that promote active travel: A review of evidence to support integrated health impact assessment. *Environment International*, 37(4), 766–777. doi:10.1016/j.envint.2011.02.003

Environmental Protection Agency (2012). School siting guidelines. Accessed on November 5, 2012 at http://www.epa.gov/schools/siting/download.html.

Eyler, A. A., Brownson, R. C., Doescher, M. P., Evenson, K. R., Fesperman, C. E., Litt, J. S., Pluto, D., et al (2008). Policies related to active transport to and from school: a multisite case study. *Health Education Research*, 23(6), 963–975. doi:10.1093/her/cym061

Fleischhacker, S. E., Evenson, K. R., Rodriguez, D. A., & Ammerman, A. S. (2011). A systematic review of fast food access studies. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity*, 12(5), e460–471. doi:10.1111/j.1467-789X.2010.00715.x

Frank, L. D., Saelens, B. E., Chapman, J., Sallis, J. F., Kerr, J., Glanz, K., Couch, S. C., et al (2012). Objective assessment of obesogenic environments in youth: geographic information system methods and spatial findings from the neighborhood impact on kids study. *American Journal of Preventive Medicine*, 42(5), e47–55. doi:10.1016/j.amepre.2012.02.006

Galvez, M. P., Pearl, M., & Yen, I. H. (2010). Childhood obesity and the built environment: a review of the literature from 2008-2009. *Current Opinion in Pediatrics*, 22(2), 202–207. doi:10.1097/MOP.0b013e328336eb6f

Giles-Corti B., & Donovan R.J. (2003). Relative influences of individual, social environmental and physical environmental correlates of walking. *American Journal of Public Health*. 93:1583-1589.

Hoskens , J., Lawrence , B., Lee, K., Lyons, J., & Stenzler, Y. Environmental Protection Agency and Council of Educational Facility Planners international (2004). Schools for Successful Communities: An Element of Smart Growth. Accessed at http://www.epa.gov/dced/pdf/SmartGrowth_schools_Pub.pdf.

Jacobs, D. Nashville Area Metropolitan Planning Organization (2010). School Siting in Middle Tennessee. Retrieved from website: http://www.nashvillempo.org/docs/symposiums/school_siting/School_Siting_Policy_Memo030510.pdf.

Jago, R., Baranowski, T., Baraowski, J., Cullen, K. & Thompson, D. (2007). Distance to food stores & adolescent male fruit and vegetable consumption: mediation effects. *International Journal of Behavior, Nutrition and Physical Activity*. 2007; 4: 35. Published online 2007 September 13. doi: 10.1186/1479-5868-4-35

Landsberg, B., Plachta-Danielzik, S., Much, D., Johannsen, M., Lange, D., & Müller, M. J. (2008). Associations between active commuting to school, fat mass and lifestyle factors in adolescents: the Kiel Obesity Prevention Study (KOPS). *European Journal of Clinical Nutrition*, 62(6), 739–747. doi:10.1038/sj.ejcn.1602781

Lees, E., Salvesen, D., & Shay, E. (2008). Collaborative school planning and active schools: a case study of Lee County, Florida. *Journal of Health Politics, Policy and Law*, 33(3), 595–615. doi:10.1215/03616878-2008-009

Mair, J., Pierce, M., & Teret, S. (2005). The use of zoning to restrict fast food outlets: A potential strategy to combat obesity. Retrieved from website: http://www.publichealthlaw.net/Zoning Fast Food Outlets.pdf.

McConnell, R., Islam, T., Shankardass, K., Jerrett, M., Lurmann, F., Gauderman, J., Avol, E., Kuenzli, N., Yao, L., Peters, J. & Berhane, K. (2010). Childhood incident asthma and traffic-related air pollution at home and school. *Environmental Health Perspectives* http://dx.doi.org/10.1289/ehp.0901232.

McDonald, N., Brown, A., Marchetti,, L., and Pedroso, M. (2011). U.S. School Travel 2009: An Assessment of Trends. *American Journal of Preventive Medicine* 41(2): 146-151.

McDonald, N. & Aalborg, A. (2009). Why parents drive children to school: implications for safe routes to school programs. *Journal of the American Planning Association* 75(3): 331-342.

Moore L., Roux, A., Nelleton, J., & Jacobs, D. (2008). Associations of the local food environment with diet quality – a comparison of assessments based on surveys and geographic information systems: the multi-ethnic study of atherosclerosis. *American Journal of Epidemiology*, 167, 917-924.

Morland, K., Diez Roux, A., & Wing, S. (2006). Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. *American Journal of Preventive Medicine*, 30 no.4, 333-339.

Morland, K., Wing, S. & Diez Roux, A. (2002). The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. *American Journal of Public Health*, Nov;92(11):1761-7.

National Policy and Legal Analysis Network (2012). Model school siting policies for school districts. Retrieved from Change Lab Solutions website: http://changelabsolutions.org/sites/changelabsolutions.org/files/ModelSchoolSitingPolicies_FINAL_(CLS-20120530)_20120227.pdf.

Saelens, B. E., Sallis, J. F., Frank, L. D., Couch, S. C., Zhou, C., Colburn, T., Cain, K. L., et al. (2012). Obesogenic neighborhood environments, child and parent obesity. *American Journal of Preventive Medicine*, 42(5), e57–e64. doi:10.1016/j.amepre.2012.02.00

School Transportation News. Web. 8 Aug 2012. Accessed at http://stnonline.com/.

Shoup, L. & Ewing, R. (2010) Economic benefits of open space, recreation facilities and walkable community design. A research synthesis. Active Living Research, a National Program of the Robert Wood Johnson Foundation. Available from: www.activelivingresearch.org.

Schwartz, J. (2004). Air pollution and children's health. *Pediatrics* 113,3:1037 -1043.

Sturm, R., & Datar, A. (2005). Body mass index in elementary school children, metropolitan area food prices and food outlet density. *Public Health*, 119(12), 1059–1068. doi:10.1016/j.puhe.2005.05.007

Sturm, R. (2008). Disparities in the food environment surrounding US middle and high schools. *Public Health*, 122(7), 681–690. doi:10.1016/j.puhe.2007.09.004

Tennessee Department of Health (2012). Tennessee faststats: childhood asthmas. Accessed at http://health.state.tn.us/statistics/PdfFiles/ChildhoodAsthmaFastStats_2012.pdf.

U.S. Census Bureau (2010). American fact finder. Retrieved from website: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

U.S. Department of Health and Human Services. & U.S. Department of Agriculture (2005). Dietary Guidelines for Americans, 6th edition, Washington, D.C.: U.S. Government Printing Office, January 2005.

University of Wisconsin Population Health Institute (2012). County Health Rankings. Accessed at http://www.countyhealthrankings.org/#app/.

Wall, M. M., Larson, N. I., Forsyth, A., Van Riper, D. C., Graham, D. J., Story, M. T., & Neumark-Sztainer, D. (2012). Patterns of obesogenic neighborhood features and adolescent weight: a comparison of statistical approaches. *American Journal of Preventive Medicine*, 42(5), e65–75. doi:10.1016/j.amepre.2012.02.009

World Health Organization (2012). Health impact assessment: promoting health across all sectors of activity. Retrieved from http://www.who.int/hia/en/.

Zimbabwe, S., Britt, K., Wampler, E., Vincent, J., Bierbaum, A., McKoy, D., & Rhodes , M. (2012). Tod 205: Families and Transit-Oriented Development - Creating Complete Communities for All. Retrieved from Center for Cities and Schools website: http://reconnectingamerica.org/assets/PDFs/20120620TODandFamiliesfinal.pdf.

Nashville Area MPO
800 Second Avenue South
PO Box 196300
Nashville, TN 37219

615.862.7204 ph
615.880.2450 fax
NashvilleMPO.org