

Healthy Street Design in Liberty, Missouri

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Clay County Public Health Center

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Executive Summary

Project Overview

In partnership with the Liberty Community Health Action Team (LCHAT) and the City of Liberty, the Clay County Public Health Center (CCPHC) used an HIA to assess healthy community design in Liberty, MO. The rapid HIA aimed to determine the health outcomes related to having sidewalks on one side versus two sides of the street. The second part of the project assessed health impacts related to street design, specifically grid design versus cul-de-sac design.

The plan was to conduct a rapid HIA, meaning the research would be done in a short time frame and would primarily focus on secondary data and a literature review. This type of data collection proved to be more difficult than expected, and it was decided the team would collect primary data regarding Liberty residents' behaviors regarding walking and biking, as well as their preferences regarding the two street designs.

Results

Improvements on infrastructure as recommended by Liberty residents on their identified barriers to biking and walking included adding and repairing/maintaining sidewalks and improving street lights. These improvements could potentially increase residents' likelihood to bike or walk by almost 70%. Crosswalk safety issues could contribute another 13% to the likelihood of walking.

The results from our survey showed that majority of respondents (6 out of 10) didn't know which street design is safer for property/related crimes. However, 2 out of 10 perceived cul-de-sac as safer, especially among higher income respondents, vs. 1 out of 10 choosing grid design. Regarding pedestrian safety, responses were very similar on cul-de-sac vs. grid design (1 in 4), while the largest percent (almost 2 out of 4) didn't know which one is safer.

Differences on walking/biking with a purpose (either to go to school or other destination) was higher among lower incomes, which are the residents who cited more issues regarding sidewalks or lack off sidewalks or affordability to repair them.

Also noted was perceived safety of parents letting their kids walk/bike to and from school. This concern may need to be an issue addressed by local police and school district.

Recommendations

Based on the findings from this report, CCPHC and LCHAT stakeholders recommend the following:

- The City keeps the current policy that requires two sidewalks on each street and to ensure that this policy is enforced to maximize the benefits it has on the neighborhood and its residents. This is consistent with the results from the survey (82% favoring sidewalks on both sides), and with the recommendation from LCHAT stakeholders. It was closely related to safety related issues, walking on the streets and traffic issues.

- It is also recommended that the City keeps its current policy favoring grid design rather than cul-de-sac design, in order to promote connectivity and walkability of the neighborhoods, as well as considering the needs of first responders to quickly arrive in cases of emergency calls. It is recommended that the City enforce this policy as much as possible with future development.
- The City works in a coordinate manner with first responders from all levels (not just upper management) to get their input on any future city development and to include them in any code review that might particularly affect their day-to-day operation.
- The school district works closely with the police department and Parents and Teachers Association (PTA), on best strategies to improve walkability based on parents' perceived safety issues. It is apparent that there are more families with school age children living in neighborhoods with a cul-de-sac design, which were also the most concerned with letting their children walk to the bus stop due to perceived safety.
- To identify grant opportunities or capital improvement opportunities to repair/maintain sidewalks and lighting in streets of underserved residential areas, to address walkability issues. These improvements could potentially increase walking by almost 70%. Adding a bike lane/path could increase this behavior by another 17%.
- To consider adding a destination area when developing new areas, including but not limited to, adding bike lanes and connection to trails.
- Continue to work with current partners such as LCHAT, to identify and address current health and policy issues that concern Liberty residents.

Introduction

CCPHC applied and received a grant from the National Association of County and City Health Officials to conduct a Health Impact Assessment (HIA). The purpose of this grant was to develop capacity and knowledge in conducting HIAs and HIA type activities for local health departments. Learning the process of conducting an HIA, and having a mentor and technical assistance to do so, will build our capacity to conduct additional HIAs in the future, which in turn will impact the overall health of the community. As the City reviews future policies and plans, they requested CCPHC to conduct this HIA to determine the health impacts regarding sidewalk and street design for future new development in Liberty. As Liberty continues to grow, we knew it would be important to review and recommend policies that best suit the positive safety and health outcomes for the community.

What is a Health Impact Assessment?

A health impact assessment is a process used to determine the health impacts of a policy or project before a decision on that policy or project has been made. An HIA can determine the policy or project to have positive, negative or null impacts on the health of the impacted population. The HIA framework is used to bring potential public health impacts and considerations to the decision-making process for plans, projects and policies that fall outside traditional public health arenas, such as transportation and land use.

HIAs are made up of six main phases. The phases include: screening, scoping, assessment, recommendations, reporting, and monitoring/evaluation. This will be discussed throughout the report.

1. **Screening:** Determines whether the HIA is likely to succeed and add value. Questions include: what specific proposed project, program or policy decision will the HIA address?
2. **Scoping:** Creates objectives for the HIA, and an outline for the steps of the HIA process.
3. **Assessment:** Involves two steps, describing the baseline health of people and groups affected by the decision, and then predicting the potential health effects.
4. **Recommendations:** The HIA should point the way to decisions that protect and promote health. These products should provide practical, specific actions that can be taken in order to promote health and avoid, minimize or mitigate adverse consequences.
5. **Reporting:** The findings are disseminated to decision makers, affected communities and other stakeholders with a request for feedback.
6. **Monitoring and Evaluation:** There are three types of evaluation in HIA: 1) process evaluation; 2) impact evaluation; and 3) outcome evaluation. Monitoring tracks indicators that can be used to inform process, impact and outcome evaluations.

(Health Impact Project, <http://healthimpactproject.org/hia/process>).

Screening

In September 2015, CCPHC and the City discussed the opportunity to conduct an HIA to evaluate the health impact of neighborhood street design and sidewalk design on one side of the street vs. both sides. An HIA core team formed that consisted of CCPHC employees, LCHAT coordinator and a city planner. The HIA core team assessed the potential value of the street and sidewalk design HIA. Results of the assessment may be used to influence future development policies. So therefore, the core team decided to move forward with HIA project for the following reasons:

- Potential health impacts of the neighborhood, as street and sidewalk redevelopment are significant factors to increase physical activity at the neighborhood and city level.
- Added Value: The HIA will provide new information to decision-makers about health impacts and future development options. The current code in Liberty requires sidewalks on both sides of street. There are some discussions to change to only one side of the street. In addition, current code favors grid design and minimizes cul-de-sac design. Potential health effects and outcomes include walkability/bikeability, safety and access to community spaces.
- Evidence-based practices, research and primary data collection. Literature reviews will help identify best practices and provide recommendations to decision-makers. Also, residents' input via surveys on health impacts of neighborhood street and sidewalk designs will provide vital information to policy makers with regard to incorporating healthy designs into planning.
- Potential impact of the HIA process includes building capacity, relationships with community, integrating health considerations in decision making and the ability to expand to other communities.

Scoping

Once the HIA core team decided to conduct this HIA, a broader stakeholder group was consulted during the scoping process to further direct the project. Specifically they were, CCPHC Section Chief of Health Policy and Planning, Dr. Ximena Somoza; CCPHC Community Development Manager, Wennekota Tarama; former CCPHC Community Development Specialist, Jamie Powers; and LCHAT Coordinator, Kate Lesnar to help steer and learn how to conduct an HIA. Others involved throughout the process included: City of Liberty Urban Planner, Katherine Sharp; LA County Health Department HIA Mentor, Katie Butler; NACCHO Program Analyst, Bridget Kerner; CCPHC Epidemiology Manager, Nkolika Obiesie; CCPHC Student Intern Abigail Andrade; Children's Mercy Hospital Director of Community-Engaged Health Research, Jordan Carlson; PhD students/researchers from Children's Mercy Hospital, Marcie Berman and Frances Bozsik; CCPHC Communications Specialist, Aaron Smullin; and of course, the LCHAT stakeholders and the residents of Liberty, Missouri that took our survey.

The HIA project was introduced to LCHAT at their January meeting. Attendees were briefed on the HIA and asked to come up with research questions and potential data sources covering 4 focus areas, including walkability, safety, storm water and community value. They were then

asked to vote for 3 research questions they were the most passionate about. The most votes were for the following topics:

- i. How sidewalks on both sides of the street would increase connectivity and/or walkability?
- ii. Comparison of data on accidents in street grid system vs cul-de-sac design.
- iii. Which street design is most traffic calming and best for bike lanes?

A fourth topic added by the team was on first responder's experiences and perceptions on grid versus cul-de-sac design, response times and pedestrians/bike safety.

The team then began reviewing current literature and data resources that were available. This was proven to be a barrier, as we did not have access to most professional literature reviews that related to our topics. We had to ask colleagues to send us copies, which delayed the process. A data request on street design and its impact on pedestrian and vehicular safety in Liberty were not successful, as data is not kept in a format that allows for its retrieval. Limited data provided shows that there were no significant differences on accidents at specific designs, but rather at busy intersections, as could be expected. It was also determined that comparing Liberty's downtown area, which is grid design, to a cul-de-sac neighborhood would be like comparing apples to oranges. It didn't make sense, as they are completely different neighborhoods.

A literature review on street designs, identified that there are different needs from the urban planner and emergency response staff, the first ones recommending narrower streets to improve traffic and pedestrian safety, while first responders prefer wider streets.^{1,2,3,4,5} Several of these initiatives were done under Congress for the New Urbanism, "an international nonprofit organization working to build vibrant communities where people have diverse choices for how they live, work, and get around. We believe that well-designed cities and neighborhoods are crucial for our health, economy, and environment."⁶

It was decided by the team that it would be best to collect our own primary data. We knew that with our extensive community partnerships, it would be feasible to collect responses in a short time frame. A survey (Appendix A) was developed using Survey Monkey to ask Liberty residents their preferences and perceptions regarding street design and sidewalks. Questions included demographics, such as gender, age groups and income, as well as the neighborhood design they were living in: i.e. grid, cul-de-sac, or mix design and how often they walked or biked to specific destinations or for the purpose of exercise. A short survey tailored to first responders was developed and sent via their police and fire chiefs (Appendix B)

The surveys were disseminated from March 29 through April 20, 2016, through LCHAT's, CCPHC's and the City's partner's emails, Facebook accounts and websites, as well as the local newspapers. The Liberty Public School principals also sent it out via email to their students' parents. In total, we received 358 responses; 18 emergency responders participated out of a total of 49 existing in the City. Survey outreach targeted Liberty residents, but there may have been residents without a Liberty address who participated in the survey. Responses collected

were analyzed by demographic information, such as age and income. A text analysis was done by Dr. Jordan A. Carlson and his students, for the open ended questions/comments.

A logic model was developed in order to visualize the relationship between the policies and the potential impacts on the health of Liberty residents. Using the two policy changes that were recommended, we narrowed down the health impacts to the ones with the most magnitude and likelihood to affect residents. Overweight and obesity rates and the severity of injuries due to delayed response time were the two health outcomes we chose. These outcomes are of huge magnitude, cost a tremendous amount of money and pose great risks to the community. The diagram pathways are highlighted in the model below.

¹ Wren, C. (2012). *Emergency Response and Street Initiative*. Retrieved from https://www.cnu.org/sites/default/files/erinitiative_0.pdf

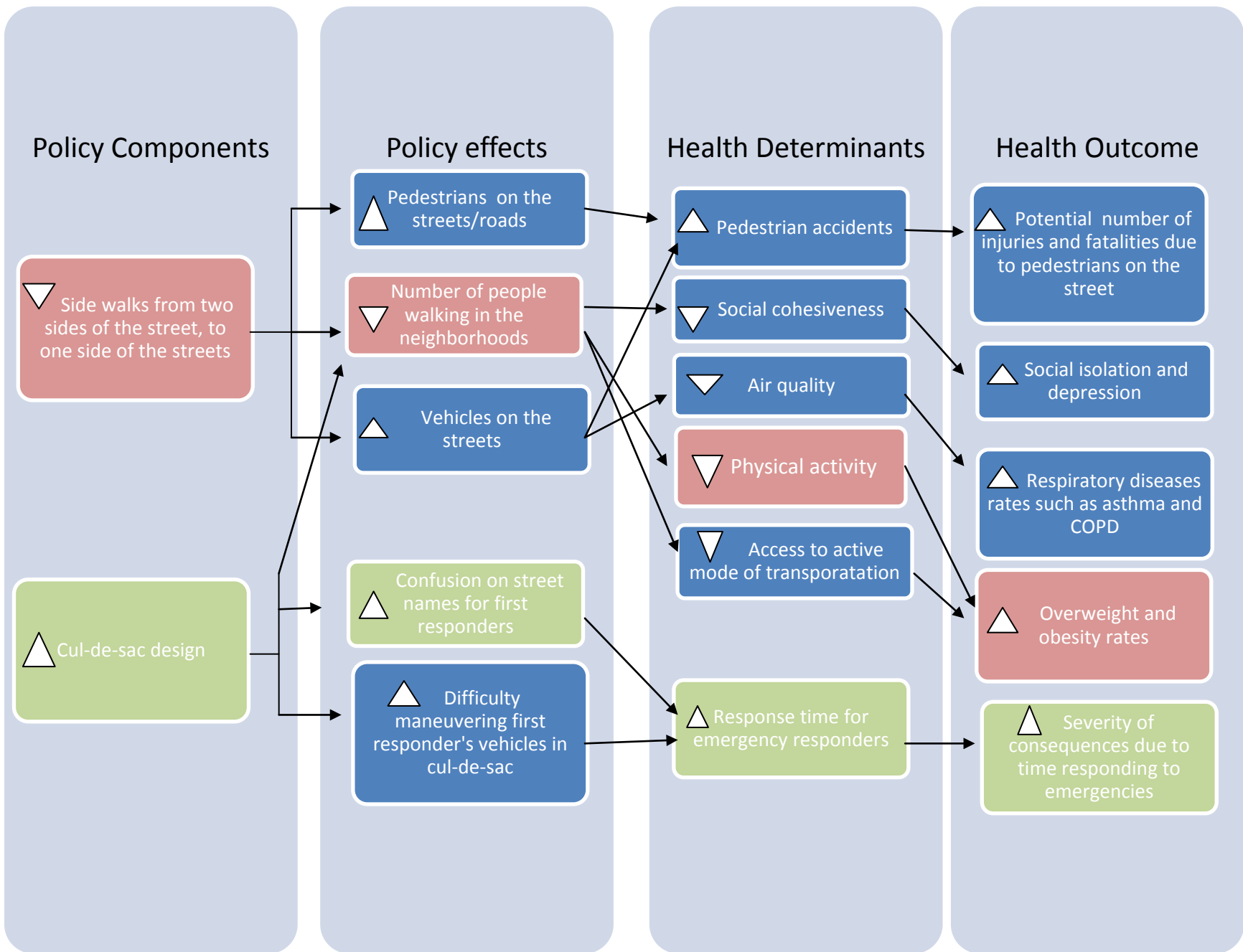
² Snyder, R., Siegman, P., Huff, H., McCormick, C. (2013, March 23). *Best Practices Emergency Access in Healthy Streets*. Retrieved from <https://www.cnu.org/sites/default/files/Best-Practices-Emergency-Access-in-Healthy-Streets.pdf>

³ Local Government Commission. (n.d.). *Street Design and Emergency Response*. Retrieved from http://lgc.org/wordpress/docs/freespub/community_design/fact_sheets/er_street_design.pdf

⁴ Burden, D., Zykofsky, P. (2001). *“Emergency Response, Traffic Calming and Traditional Neighborhood Streets”*. Retrieved from http://nacto.org/docs/usdg/emergency_response_manual_burden.pdf

⁵ Burden, D. (n.d.). *Street Design Guidelines for Healthy Neighborhoods*. Retrieved from http://onlinepubs.trb.org/Onlinepubs/circulars/ec019/Ec019_b1.pdf

⁶ *The Congress for the New Urbanism (CNU)*. Retrieved from <https://www.cnu.org/who-we-ar>



Assessment

Liberty Profile:

Liberty Missouri is located in the southeast corner of Clay County, with a 2010 total population of 29,149. The 2014 estimate is 30,376. The city is 29.03 square miles, which makes up 7.3% of the land area in Clay County. Liberty has a population density of 1,004 residents per square mile, compared to the average of 558.6 people per square mile in Clay County. Between 2000 and 2010, the population increased by 11.2% (2,917) and 4.2% in the last four years. The poverty rate in Liberty is 8.7 percent.

Fifty-six percent (56%) of Liberty residents work in Clay County. Nearly 6,000 people or 41% of the workforce commute to Liberty. This contributes to high traffic volumes on the main highways, causing congestion and traffic accidents. Liberty had 677 vehicle crashes, with 234 injuries and four fatalities in 2014. These accidents were mainly associated with following too close. A majority of crashes occurred on Kansas Ave. and 152 Hwy. Accidents, violence and injuries have a strong physical, psychological and financial impact on any community. Every year, 10 people die due to accidents in Liberty.

The median household income of \$62,515 was \$2,224 higher than the median income of the county (\$59,095).

In January 2015 the results of a community wide survey of 850+ residents showed that the three most significant risky behaviors in the community were being overweight, lack of exercise and poor eating habits.

In the last five years, 31 people have died due to diabetes in Liberty. Hospital data also shows that on average, 59 Liberty residents are hospitalized every year due to diabetes complication, and there have been 285 hospital stays due to diabetes complications in the last 5 years. According to the Missouri Department of Health and Senior Services inpatient hospitalization data, the cost for treating diabetes in the past five years for Liberty residents was almost \$7,000,000. The cost per day due to diabetes hospitalization is \$4,922. The average stay is 5 days per case, equaling \$24,561. Forty-one percent of patients were covered under Medicare, and were as young as 20- 24 years old.

Current City Street Design

Liberty's historic downtown area is laid out in a traditional grid design (Image 1). As the city grew, developers utilized the cul-de-sac design more often, (Image 2) resulting in less connectivity of neighborhoods. The current city code requires for new development to have sidewalks on both sides of the street, which seems to be true throughout most of the city. City code also favors grid design, promoting connectivity and accessibility; where sidewalks and grid designs lack, are in subdivisions that were developed before the code was established in 2005 (Appendix C).

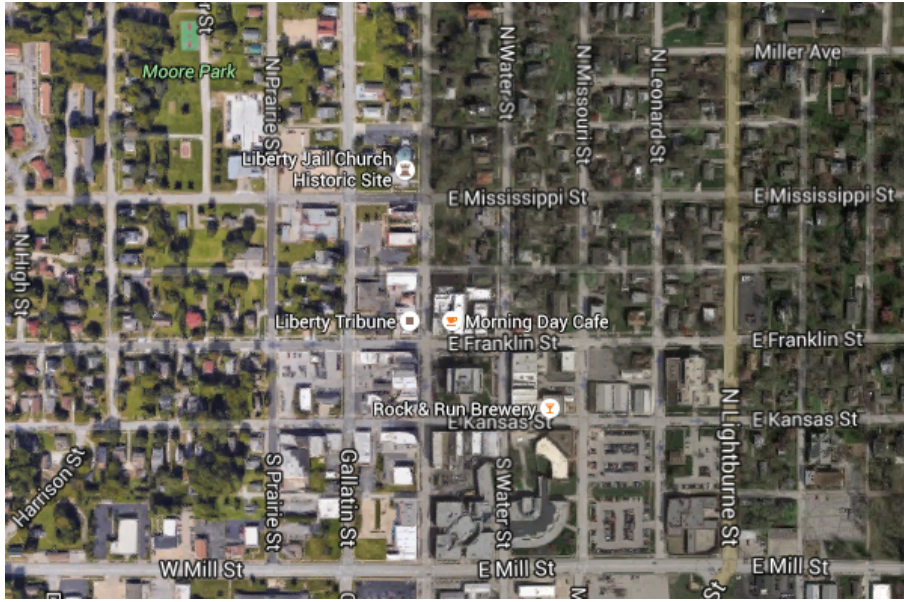


Image 1 - Historic Downtown Liberty- traditional grid-design

The division in image 2 was built in the 1990’s and was not required by code to favor the grid design. Some developers tend to favor cul-de-sac design, because they believe the houses sell for more and it requires less infrastructure, such as sewers and sidewalks. Developers need a proposal to be approved by city officials before building without following the current city codes. Referencing image 3, you’ll notice there are major sidewalk gaps where houses have not been built yet. This image is a blown up section of the Northwyck Park neighborhood.

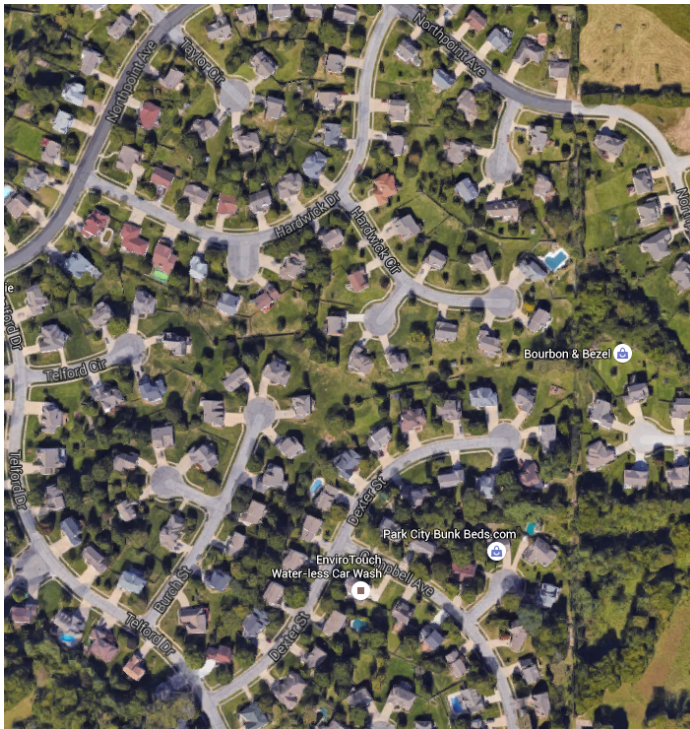


Image 2 - Northwyck Park neighborhood with cul-de-sac design, developed in the 1990’s



Image 3 - Northwyck Park neighborhood where empty lots create sidewalk gaps

A pedestrian crossing survey done by the Open Space and Recreation manager and LCHAT Physical Activity Team Lead, Chris Wilson, identified the gaps and needs for pedestrian crossings in the city. The survey was not originally part of the HIA project, but it provides useful information and let the voices of resident's be heard regarding crosswalks in the community. A map depicting these problem areas is in (Appendix D).

Survey

Seventy-two percent of those who took the survey were women. The age of respondents ranged from 18 years old (6%) to 75 and older (2.2%). The majority were 35-44 (almost 29%) and 45 to 54 (19.5%) years old. Household income of respondents ranged from under \$24,000 (3%), to over \$200,000 annually (7.5%, with majority falling between \$75,000 and \$124,999 (45.2%). A majority of respondents (57.4%) live in a mix designed neighborhood, while another 30% live in cul-de-sac design.

An indirect measurement of residents' preferences regarding street design was asked for their perception on safety related to home burglary and for pedestrian/bicycle accidents. Responses show that, although 21.6% perceived living in a cul-de-sac to be safer from burglary/larceny, over 58% didn't know. Police reports were not available by street design on where larceny (which was identified as one of the main crimes in the city of Liberty). There were no differences by gender on street design, but women were more likely than men to report poor lighting, lack of sidewalks/bike lanes and traffic as a barrier to walk/bike. More women also responded that they don't know what street design is better for preventing walking or bike accidents.

There were some statistically significant differences by income regarding street design and walking/biking frequency. Respondents with lower income tend to live more on grid and mix design, and also walk or bike more frequently to school, work or to other destinations than respondents with higher income. However, this group also reported several barriers for walking/biking, such as poor lighting, too much traffic and fear of crime. For exercising purposes, people with higher income do it more. Higher income respondents tend to prefer cul-de-sac design over grid design. However, people living in grid design streets and with higher income also tend to regularly walk/bike for exercise more than those living in cul-de-sac and mix design neighborhoods.

“Our sidewalks are uneven and easy to trip on. It would be very difficult to use a wheelchair on.” (Image)



Similar responses were provided regarding pedestrian/bicycling accidents, with almost 40% not having a specific perception about the safest design, providing similar percentages (around 25%) to either design, which shows that street designs as a safety factor is not a main concern for residents in Liberty.

Responses also show a statistically significant difference on more people walking/biking in grid and mixed design neighborhoods vs. cul-de-sac.

Sidewalk Design

Sidewalk design impacts residents' health in several different capacities. This assessment focuses on the relationship between sidewalk design and active transportation or physical activity, and in turn, lowering the risk for chronic diseases.

Literature

No study on sidewalks design (one vs. on both sides of the streets) was found on the literature research, but several about the impact that neighborhood connectivity and walkability has on obesity. A study¹ done in Ontario, Canada shows that more walkable neighborhoods have lower rates of obesity and diabetes.¹ This study indicates that lack of sidewalks is a significant barrier to residents walking to destinations. And certain features of the built environment such as sidewalks, streetlights and connected streets appear to encourage physical activity and in return, reduce the risk of obesity and related health problems. It also indicates that other features, such as cul-de-sacs, lack of parks and automobile focused transit discourages physical activity.

¹ Klar S. Poster #0908-P. Presented at: World Diabetes Congress; Nov. 30-Dec. 4, 2015; Vancouver, British Columbia. Retrieved from <http://www.healio.com/endocrinology/obesity/news/online/%7B34baf00a-da7a-4e55-a610-1cafb5a65692%7D/walkable-neighborhoods-lower-risk-for-obesity-diabetes>

These studies identified that, along with neighborhood designs in the suburbs, with low density, poor street connectivity and lack of sidewalks, are associated with decrease physical activity and increase risk of being overweight.^{1,2,3,4} Other factors, such as income, lifestyle and build environment factors, such as poor streetlights, high speed traffic and automobile focused transport may discourage physical activity.¹

A study of 1,032 urban residents found that being obese was significantly associated with perceived indicators of no nearby non residential destinations (such as parks and playgrounds, town squares, community centers, schools). Being obese was significantly associated with perceived and observed indicators of an “absence in sidewalks, unpleasant community and lack of interesting sites”², and corroborated on another study on obesity and walkability in Baltimore City, Maryland in 2011³, which also found obesity rates differences between individuals living in highly walkable communities (lower prevalence of obesity), with those living in low walkability neighborhoods (showing higher prevalence of obesity). A similar study focusing on children and adolescents also identified that residents living in low walkability neighborhoods have higher Body Mass Index (BMI) and hence higher rates of overweight and obesity than those on high walkability neighborhoods.⁴

It is important that the built environment is mindful of the community’s overall health and well-being because it is proven “to affect social connectivity, motivating and stimulating interactions with others, and increasing people’s trust in society and government.”¹ More “sprawl areas” (i.e. low housing density, low land-use mix, no strong centers for activity and poor connectivity) “the higher the BMIs and obesity rates”. The study highly recommended ensuring that “pedestrians, cyclists and users of other modes of transport that involve physical activity are given the highest priority when developing streets and roads.”⁴

¹ ***Impact of Sidewalk Walkability & Connectivity on Obesity. “Obesity, Physical Activity, and the Urban Environment: Public Health Research Needs”***. Lopez, R., Hynes, P. (2006, September 2006). Obesity, Physical Activity, and the Urban Environment: Public Health Research Needs”. Retrieved from <http://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-5-252>

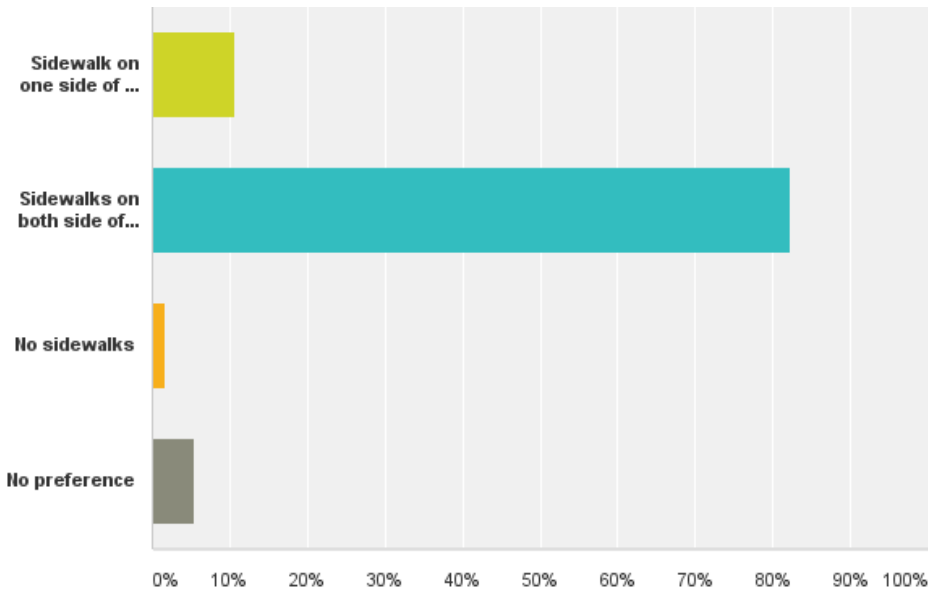
² ***Perceived and Observed Neighborhood Indicators of Obesity among Urban Adults”***. Boehmer, T., Hoehner, C., Deshpande, A., Ramirez, B., Brownson, R. (2007, January 16). Perceived and Observed Neighborhood Indicators of Obesity among Urban Adults. Retrieved from *International Journal of Obesity*, doi:10.1038/sj.ijo.0803531

³ ***Association of Walkability with Obesity in Baltimore City, Maryland”*** Casagrande, S. S., Gittelsohn, J., Zonderman, A., Evans, M., & Gary-Webb, T. (2011). Association of Walkability with Obesity in the city of Baltimore, Maryland in 2011, obesity in Baltimore City, Maryland. *American Journal of Public Health*, 101(Suppl 1), S318–S324. <http://doi.org/10.2105/AJPH.2009.187492>

⁴ ***Epidemiology of Obesity in Children and Adolescents: Prevalence and Etiology”*** Moreno, L., Pigeot, I., Ahrens, W. (2011). Epidemiology of Obesity in Children and Adolescents: *Prevalence and Etiology*.

Survey

When residents were asked their preference on sidewalk design in their neighborhood 82% answered they would prefer having sidewalks on both sides, and almost half of them citing safety and 32% citing convenience/accessibility as their reasons why (Graph 1).



Graph 1 – Resident sidewalk preferences

In addition to sidewalk design there were several other issues that came up with Liberty residents. Table 1 summarizes the responses to a multiple choice question regarding barriers to walking/biking for connectivity or exercising purposes. Participants were able to select as many options as they wanted:

Barriers to walking/biking for connectivity or exercise purposes	Response count	Percentage
Lack of sidewalk/bike lane	187	54.36%
Traffic on the road	168	48.84%
Distance	151	43.90%
Increased travel time	75	21.80%
Poor lighting	55	15.99%
No one to walk/bike with	40	11.63%
Fear of crime	21	6.10%
Lack of showering facilities/bike racks/lockers at destination	16	4.65%
Physical disability	9	2.60%
Other	71	20.64%

Table 1 – Barriers to walking and biking

A text analysis of the comments provided under “other” as related to barriers for walking/biking for any purposes is below, citing sidewalk conditions and traffic as the top concerns (Table 2):

Theme	Response count	Percentage
Disrepair (Predominately Sidewalks, also poor roads and water leaks) (Image 5)	28	41%
Highway or traffic patterns unsafe	16	23.53%
Neighborhood unsafe	7	10.29%
Lack of desire	4	5.88%
Too far to walk/bike to & from a store	3	4.41%
Time	3	4.41%

Table 2 – Other responses on walking and biking barriers



Image 5- Neighborhood sidewalk in disrepair

Some of the common responses from residents regarding their barriers to walk were:

"Though we live within one mile of our elementary school; there is no "safe walking route" to and/or from school; so we qualify for bus transportation. If there were sidewalks and a safe walking route; we would foreseeable take advantage of that!"

"The sidewalks on our street, Amesbury Ave are in terrible shape. They are not conducive to running or biking, especially for a child. We have to go around multiple horrible areas when taking our 4 year old and 18 month old out on bikes. It make it hard to enjoy the sidewalks and our street is too busy for small children."

What changes to your neighborhood would increase your likelihood to walk/bike?

Two hundred and twenty three participants shared their input regarding what changes in their neighborhood would increase their likelihood of walking or biking. The most common changes are listed below. Overall, residents would like existing sidewalks repaired as well as additional sidewalks, bike lanes/paths, and safe street crossings, particularly near highways.

Theme	Response count	Percentage
Sidewalks (repair, in need of)	139	56%
Bike lane/Bike path	41	17%
Crosswalk Safety Issues	32	13%
Police/Law Enforcement	19	8%
Maintenance (Image 6)	16	6%
Lighting	16	6%



Image 6 – Picture of sidewalk needing maintenance

Resident responses to increasing neighborhood walkability and bikability:

“We need a sidewalk/bike lane along Church Road. The residents in Hills of Oakland are “stuck” in the neighborhood. The only way out is down dangerous Church Road, with no sidewalk/bike lane. We would love to walk out of our neighborhood to QuikTrip, Target, etc.”

“My wife, young children and I would ride our bikes and walk a lot more if the sidewalks in our neighborhood (Canterbury) were in better condition. The unevenness in many places make it unsafe for my young children to bike. I am also an avid runner and have tripped multiple times running in the neighborhood.”

Street Design

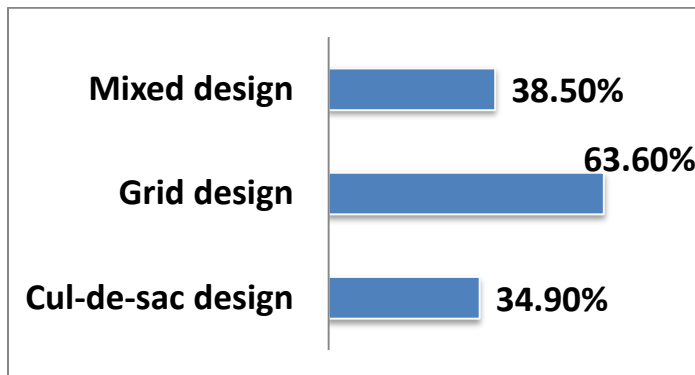
Street designs have great potential to affect residents’ health outcomes. The HIA outlines the relationship between street designs and connectivity, which affect people’s ability to walk to destinations or just exercise. An increase in physical activity lowers the risk of chronic diseases and conditions. Grid systems yield higher connectivity to destination areas than cul-de-sac systems. Various studies have shown that connected environments are inviting to pedestrians and cyclists, affecting physical activity. One notable study was conducted by Larco, N.; Kelsey, K.; West, A. (2014). The authors found that in well connected areas observed in a grid design, distances are shorter and physical barriers to walking and biking are removed. As a result,

residents rely less on automobiles and increase active modes of travel, including walking, jogging and biking, which have positive impacts on health and air quality. The authors recommended that neighborhoods and street designs are located within walking distance of destinations, including parks, shops and other services.

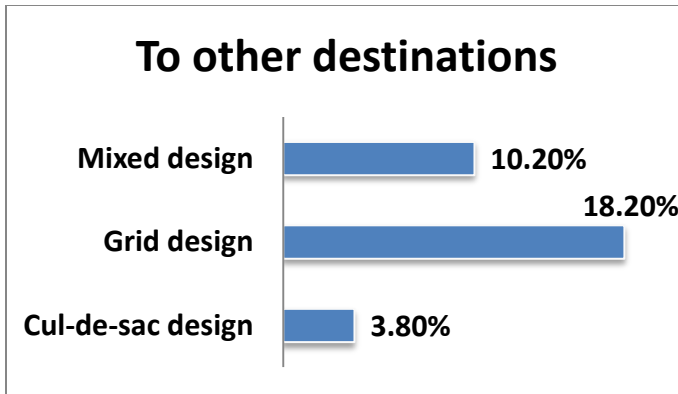
Other recent studies have indicated that an increase in connectivity of future developments will result in a significant increase in walking and biking to local commercial and recreational destinations.

Another focus of the HIA was the relationship between street design and first responder's response times. Longer response times may increase the severity of emergency consequences. A survey with first responders was conducted to get their preferences and perceptions with regard to street designs, including cul-de-sac and grid systems. Survey respondents overwhelmingly stated that they have difficulty maneuvering large first responder vehicles in cul-de-sacs. In addition, they expressed having experienced confusion on street names in both street designs.

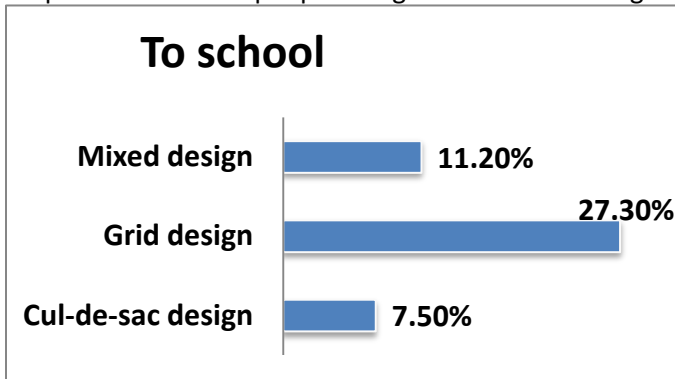
Survey results and review of the literature found evidence to suggest that people tend to walk or bike more in grid designs for all purposes, including exercising and visiting destinations. This does not demonstrate a cause and effect relationship between street designs and walkability/bikeability. However, studies suggest that more connected street designs increase walkability. Neighborhoods in grid-like systems with short block lengths and few cul-de-sacs have high walkability, which indicates great street connectivity. Evidence shows that neighborhoods with greater walkability have higher total physical activity levels, and thus lower chronic disease rates.



Graph 2 – Percent of people living in each street design that regularly bike/walk for exercise



Graph 3 – Percent of people living in each street design that regularly bike/walk to other destinations



Graph 4 – Percent of people living in each street design that regularly bike/walk to school

Emergency Responders

By definition, a first responder is “the person (as in police officer or EMT) who is among those responsible for going immediately to the scene of an accident or emergency to provide assistance.”⁷ The ultimate goal of emergency responders is to protect and preserve the life of residents and to preserve property. This project does not intend to measure their effectiveness as first responders, rather their perceived or real barriers to performing their work within those recommended standards, as a communities layout and traffic are some of the things to be considered when comparing communities, as per the National Fire Protection Association (NFPA).⁸ The City of Liberty has 49 career staff, distributed in three fire stations, with an average response time of 5 minutes and 42 seconds.

There is not a federal law requiring an agency to be on scene after a certain time. There are agreements signed between private EMS providers and political subdivisions. One of the standards that affect EMS response times is cardiac care. It is based on a scientific position from the American Heart Association, and published at the EMSWORLD Magazine that stated that “brain death and permanent death start to occur in 4–6 minutes after someone experiences cardiac arrest. Cardiac arrest can be reversible if treated within a few minutes with an electric shock and Advanced Life Support (ALS) intervention to restore a normal heartbeat. Verifying this standard are studies showing that a victim's chances of survival are reduced by 7%–10%

with every minute that passes without defibrillation and ALS intervention. Few attempts at resuscitation succeed after 10 minutes.⁸

NFPA 1710 states that “first responders and Basic Life Support (BLS) units must arrive on scene within a four minute timeframe 90% of the time for all incidents. The ALS crew must respond within eight minutes. This requirement is based on experience, expert consensus and science. Many studies note the role of time and the delivery of early defibrillation in patient survival due to heart attacks and cardiac arrest, which are the most time-critical, resource-intensive medical emergency events to which fire departments respond.^{8,9}”

“Grid design allows for consistent addressing by allowing for defined 100 blocks as well as the opportunity to provide street naming that assist an emergency responder to identify the exact location of the incident, how close they are to arriving at an incident, as well as multiple access points to an emergency”

⁷ First Responder. Merriam-Webster Dictionary. Retrieved from <http://www.merriam-webster.com/dictionary/first%20responder> June 2016

⁸ EMS Response Time Standards. GARY G. LUDWIG, MS, EMT-P ON APR 1, 2004. Retrieved from <http://www.emsworld.com/article/10324786/ems-response-time-standards>

⁹ Fire Service Performance Measures, 11/09. NFPA Fire Analysis and Research, Quincy. Retrieved from www.nfpa.org/~/_/osfperformancemeasures.pdf on June 2016

Survey

LCHAT stakeholders decided to ask first responders what their perceptions were regarding street designs, and their experiences on those from their work perspective.

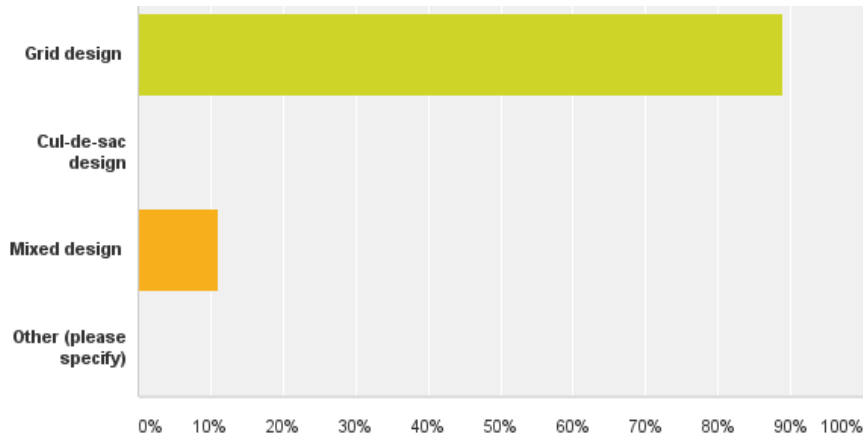
A five question, multiple choice survey, with comment boxes at the end of each question, was developed and shared with the police and the fire chiefs for the City.

Questions asked were focused on first responders experiences based on street design (grid, cul-de-sac or mix design) to respond faster to an emergency, common issues experienced when responding to emergencies with the diverse street designs, perceived pedestrian/bikers safety, and an open-ended question on their concerns regarding street designs.

The survey was done on Survey Monkey, to be completed online. Eighteen responses were received (12 firefighters, 9 EMS, and 5 police officers). A limitation to the survey was police officer responses, since they do not have extensive access to a computer during their shift work.

Almost 89% of responders favored street grid design over cul-de-sac, as the one that allows them to respond faster during an emergency. Main complaints on cul-de-sac design were difficulty/confusion finding address, with many similar names, difficulty judging the 100 blocks to find the address number, difficulty maneuvering, turning around/exiting the cul-de-sac since residents tend not to use their driveways to park their car and difficulty finding a through

street. Regarding pedestrian/bikers' safety while responding to an emergency, almost 67% also favored grid design.



Graph 5 – First responders' preferences on street design

Another finding from this survey was a recommendation for widening the streets or not allowing parking on narrow streets. Comments on blind intersections or confusion due to similar naming were another common issue among first responders that potentially hinder their response time.

Literature

Findings were very consistent with several studies and work groups addressing street design: while urban planners prefer narrow streets to improve safety, first responders recommend wider streets.

Recommendations are well represented in the following excerpt from *“Best Practices Emergency Access in Healthy Streets”*⁹

“A grid design or a highly connected street network with short blocks offer advantages for emergency responders”

- This design yields to “more routing options to reach emergencies.”
- “Routes are more direct and responders can reach the emergency faster.”
- “Responders can approach burning buildings from more than one side, which allows for greater access to the fire.”
- “With connected street networks, fire departments can cover much more territory.”

⁹ “Best Practices Emergency Access in Healthy Streets”. Snyder, R., Siegman, P., Huff, H., McCormick, C. (2013, March 23). *Best Practices Emergency Access in Healthy Streets*. Retrieved from <https://www.cnu.org/sites/default/files/Best-Practices-Emergency-Access-in-Healthy-Streets.pdf>

The City is well aware that there is confusion regarding street names that are very similar to one another. Example: Camelot Drive and Camelot Place. Or there are instances when the City

has annexed part of the county into the city limits and it will contain a street with the same name as an existing street. It's also been noted that there are a high number of people that don't even know their own addresses. They don't know that they're technically in Shoal Creek or Kansas City, Missouri even if they go to the Liberty School District. Thankfully, the City has since been able to address this issue by having a staff member dedicated to numbering and naming streets and houses.

Other Findings from Survey

Although our primary focus for the HIA was to determine how street design can impact rates of physical activity and emergency response times, many other issues came up from the survey that should at least be noted.

Perceived safety

- When asked why parents don't allow their children to walk to the school bus stop, many cited safety as their main concern. Moms are the ones that drive their kids to school the most. Weather and safety conditions were the main reasons cited as to why they don't let their children neither walk to the bus stop or to school.
- "Unsafe neighborhood. Four sex offenders on our street alone."

Speed enforcement

- Unfortunately people tend to speed on our street, even though it's in a school zone."

Tree trimming

- "Trees need to be trimmed above sidewalks. Many hit me in the face."

Pedestrian crossing

- "It is unconceivable for a hospital not to have safe walking/cycling pathways."
- "Focus on crosswalks at major intersections to expand our walking capabilities."

Destinations

- "More shops and restaurants close by home."
- "I would like for my family to get safely from one neighborhood to another, or from my neighborhood to more shopping."

Conclusion & Recommendations

Based on the findings from this report, CCPHC and LCHAT stakeholders recommend that:

- The City keeps the current policy that requires two sidewalks on each street and to ensure that this policy is enforced to maximize the benefits it has on the neighborhood and its residents. This is consistent with the results from the survey (82% favoring sidewalks on both sides) and with the recommendation from LCHAT stakeholders. It was closely related to safety related issues, walking on the streets and traffic issues.
- It is also recommended that the City keeps its current policy favoring grid design rather than cul-de-sac design, in order to promote connectivity and walkability of the neighborhoods, as well as considering the needs of first responders to quickly arrive in case of an emergency call. It is recommended that the City enforce this policy as much as possible with any future development.
- That the City works in a coordinated manner with first responders from all levels (not just upper management) to get their input on any future city development and to include them in any code review that might particularly affect their day-to-day operation.
- That the school district works closely with the police department and Parents and Teachers Association (PTA), on best strategies to improve walkability based on parents' perceived safety issues. It is apparent that there are more families with school age children living in neighborhoods with a cul-de-sac design, which were also the most concerned with letting their children walk to the bus stop due to perceived safety.
- To identify grant opportunities or capital improvement opportunities to repair/maintain sidewalks and lighting in streets of underserved residential areas and to address walkability issues. These improvements could potentially increase walking by almost 70%. Adding a bike lane/path could increase this behavior by another 17%.
- If the zone allows, mixed used design should be utilized for new developments. This gives residents places to walk to.
- Continue to work with current partners such as LCHAT, to identify and address current health issues that concern Liberty residents.

The overall process of conducting a HIA for the staff at CCPHC was a great learning experience. We learned many lessons as this project was out of our comfort zone. Tapping into existing networks and having a solid steering team that was invested and involved in the process was important. Working with local researchers early on in the process, who have access to more data and on how to analyze it was also imperative. Although we had not planned on collecting our own primary data, we were able to do so in a very short amount of time because of our extensive community partnerships, enabling us to obtain a great set of both quantitative and qualitative data from Liberty citizens. We are confident this experience will help us tremendously in future work and hopefully future HIAs.



Liberty Street and Sidewalk Design Community Survey

Welcome to My Survey

Thank you for participating in our survey. Your feedback is important and should only take a few minutes.



Liberty Street and Sidewalk Design Community Survey

Clay County Public Health Center and the City of Liberty would like to know your preferences and perceptions regarding street design and sidewalks as part of a Health Impact Assessment, which helps to determine a policy or project's impact on the health of a population

Your answers to the questions below may be used to assist policy makers regarding street designs in neighborhoods, as well as policies on the use and design of sidewalks. This will help with walkability, connectivity, physical activity and the overall health of Liberty residents.

If you are a resident of Liberty please take a few minutes to answer this short questionnaire.

1. What is your gender?

- Female
- Male

2. What is your age?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 or older

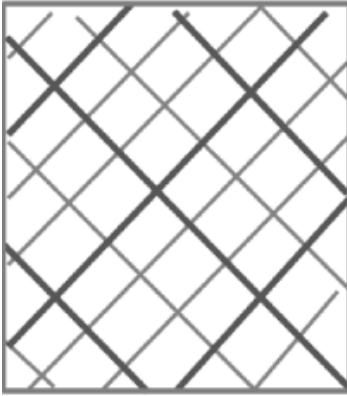
3. What is your approximate average household income?

- \$0-\$24,999
- \$25,000-\$49,999
- \$50,000-\$74,999
- \$75,000-\$99,999
- \$100,000-\$124,999
- \$125,000-\$149,999
- \$150,000-\$174,999
- \$175,000-\$199,999
- \$200,000 and up

4. What type of street design best describes the neighborhood you live in?

- Grid Design
- Cul-de-sac design
- Mixed design
- Other (please specify)

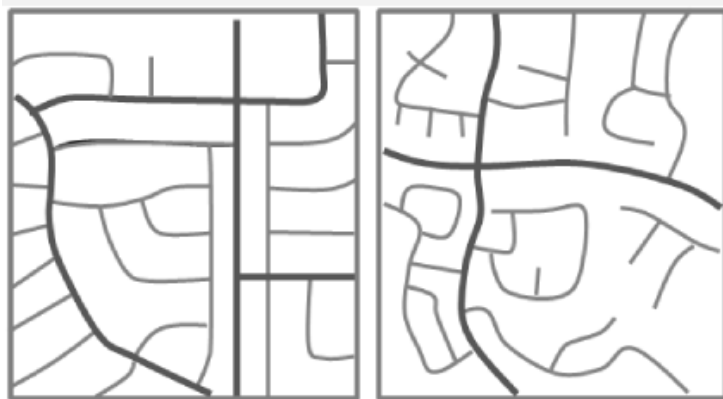
Grid Design



Cul-de-sac Design



Mixed Design



5. How many times per week do you and/or your family walk, bike, roller-skate, etc. to the grocery store or other shopping?

- 0
- 1-3
- 4 or more

6. How many times per week do you and/or your family walk, bike, etc. to school?

- 0
- 1-3
- 4 or more

7. How many times per week do you or your family members walk, bike, etc. to work?

- 0
- 1-3
- 4 or more

8. How many times per week do you or your family walk, bike, etc. to other activities/destinations?

- 0
- 1-3
- 4 or more

9. How many times per week do you and your family walk, bike, jog, etc. for the purpose of exercise in your neighborhood?

- 0
- 1-3
- 4 or more

10. What are the barriers to walking or biking regarding questions 5, 6, 7, 8 & 9?

- Distance
- Poor lighting
- No one to walk/bike with
- Physical disability
- Lack of showering facilities/bike racks/lockers at destination
- Lack of sidewalk/bike lane
- Traffic on the road
- Fear of crime
- Increased travel time
- Other (please specify)

11. What changes to your neighborhood would increase your likelihood to walk/bike in your neighborhood?

12. In which street design do you think homes are LESS LIKELY to be victim of burglary/larceny?

- Grid design
- Cul-de-sac
- Mixed design
- Don't know

13. What street design do you think is safer related to pedestrian/bicycle accidents?

- Grid design
- Cul-de-sac
- Mixed design
- Don't know

14. If you are a parent, and if your kids take the bus to school, do you drive them to the bus stop?

Yes

No

Sometimes

N/A

15. If you answered "yes" or "sometimes" please explain why.

16. Choose your preference regarding sidewalks in your neighborhood and provide a reason why.

Sidewalk on one side of the street only

Sidewalks on both side of the street

No sidewalks

No preference

Please explain your answer here.

17. Do you have anything else to add about the safety or walkability/bikeability of your neighborhood?

Street Design for Emergency Responders

Street Design-Emergency Responder

Clay County Public Health Center and the City of Liberty would like to know your preferences and perceptions regarding street design and sidewalks as part of a Health Impact Assessment, which helps to determine a policy or project's impact on the health of a population

Your answers to the questions below may be used to assist policy makers regarding street designs in neighborhoods, as well as policies on the use and design of sidewalks. This will help with walkability, connectivity, physical activity and the overall health of Liberty residents.

1. What type of responder are you? (Check all that apply)

- Police
- Fire
- EMS

2. With your experience as an emergency responder, which street design do you feel enables you to get to an emergency the fastest?

- Grid design
- Cul-de-sac design
- Mixed design
- Other (please specify)

3. What are the most common issues you face when responding to an emergency on the following street designs? Please comment

Grid design	<input type="text"/>
Cul-de-sac design	<input type="text"/>
Mixed design	<input type="text"/>

4. Which street design do you think is safest for pedestrians/bikers while you are responding to an emergency?

- Grid Design
- Cul-de-sac design
- Mixed use
- Other (please specify)

5. Do you have any other comments or concerns regarding street design?

Appendix C: City Codes

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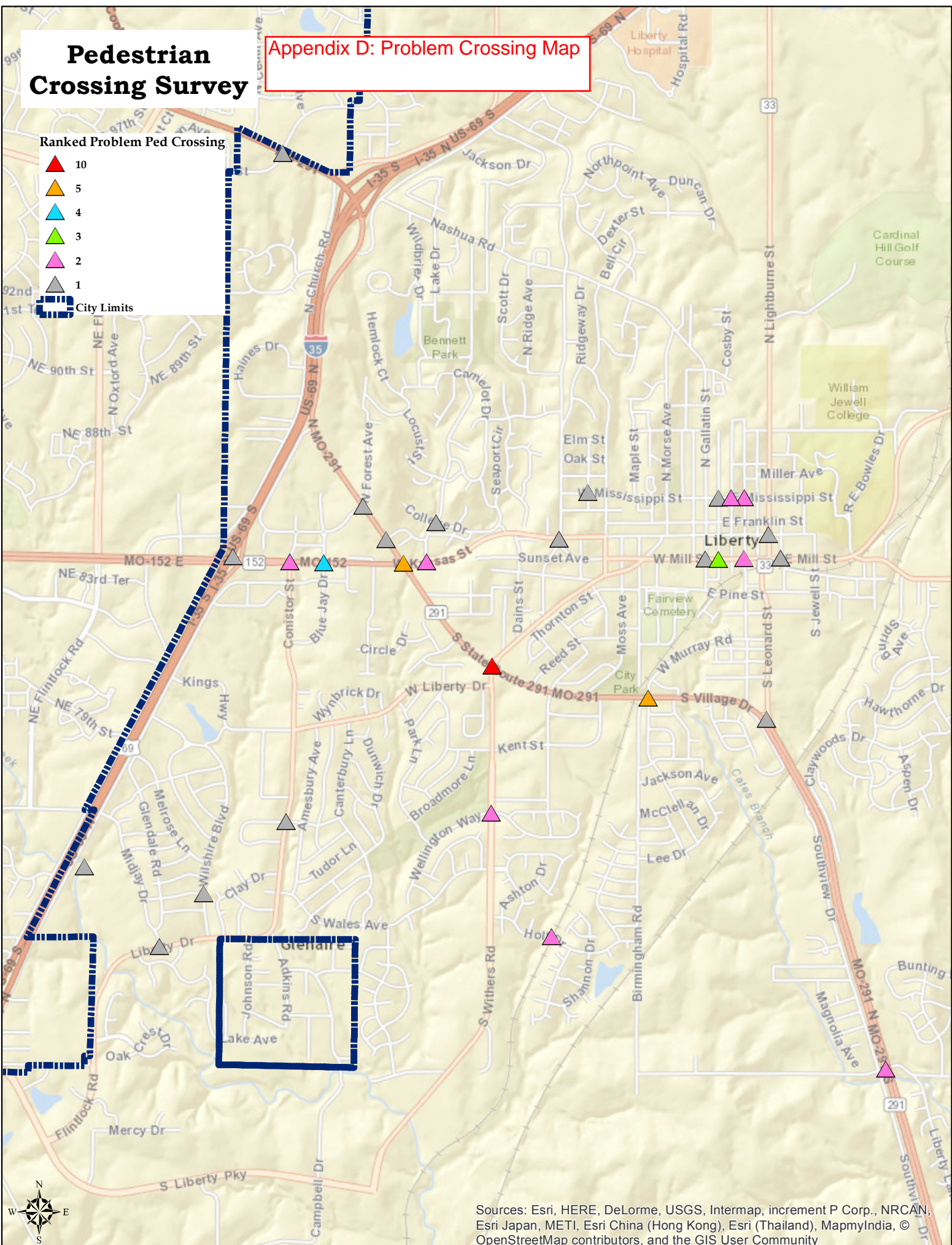
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Pedestrian Crossing Survey

Appendix D: Problem Crossing Map

Ranked Problem Ped Crossing

-  10
-  5
-  4
-  3
-  2
-  1
-  City Limits



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community