Safe Routes to School **National Partnership**

A Framework for GIS and Safe Routes to School

Improving Data Collection, Access and Usage

Table of Contents

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EXECUTIVE SUMMARY

As Safe Routes to School programs have increased across the country, a clear need for better data management at the national level has become apparent. Many communities and Safe Routes to School programs have used Geographic Information System (GIS) mapping in assessments of the built environment and promotional campaigns, but because there is not a central place to store data, this information is stuck, in a sense, at the local level, and often not accessible to local champions. This leads to minimal sharing and discovery of local data and a lack of continuity in data collection on a national scale.

In light of this, the Safe Routes to School National Partnership brought 15 experts from various GIS-related fields to Austin, Texas in April 2013 to discuss existing datasets and what is not being collected, how the general public can create and access data, existing tools and technology and what is needed to improve data connectivity and mapping, how GIS could be better utilized in Safe Routes to School and other active transportation initiatives, and how to create a national bicycling and walking database.

This group of experts first discussed valuable tools and collections of data that already exist at the federal, state and local levels. They identified ways that the federal government could improve data collection through federal funding processes and possible solutions to assist communities that lack the funding or staff to collect data.

After discussing the basics of GIS, how it is currently being used in the active transportation world and the major players that are involved, the group made several recommendations. Some recommendations were easy to make, while other topics, such as how to go about funding a national database, will require more discussion with important players in the future.

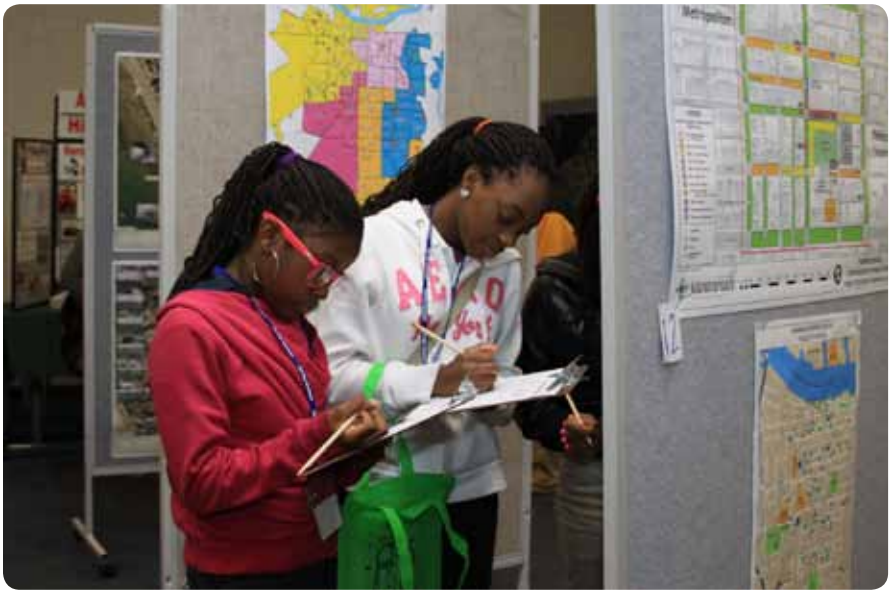
The two biggest discussions that came out of the meeting were for 1) a national database that could store data which could be easily accessed via the internet, and 2) a standard Top Ten list of datasets that should be collected when communities assess built environment conditions for bicycling and walking.

One way to make the data accessible is to use open source, where the underlying software code is freely available to all users, and open data, where the data is available for anyone to access and use. The biggest advantage to these approaches is that users are not constrained to one private GIS company or tool and they can access and use data as soon as it has been uploaded.

In order to feed data into a national database, there needs to be a software application (app) and/or standards for mobile devices that allow champions, parents, communities and schools to easily assess and map sidewalks, bicycle lanes and crosswalks, produce quality maps, and upload data. Mobile devices are an important component of the database, as they allow information to be quickly and easily uploaded to the database.

The Top Ten datasets list was recommended as a way to ensure that data from across the country can be collected and compared. While most recommended datasets had to do with infrastructure such as the presence of sidewalks, striped crosswalks, and bicycle facilities, the group consistently came back to one question: "Do people feel safe walking or riding a bicycle here?" Regardless of the presence or absence of sidewalks, paths, crosswalks, crossing guards or traffic calming devices, if people do not feel safe, they are less likely to walk or ride a bicycle. By using GIS to map where people do and do not feel safe at a particular block or street, a community can then evaluate why they feel that way and then address the specific problems.

Our goal is that this report will advance conversations regarding ways that GIS can assist Safe Routes to School programs and how to go about creating a national active transportation database. GIS is an extremely powerful tool for numerous reasons, especially as it allows people to have a more complete picture of what is happening in their own communities, states and the nation.



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INTRODUCTION

Safe Routes to School is a national and international movement to get more students walking and bicycling to school and in daily life. Safe Routes to School initiatives can save money, decrease traffic congestion, increase safety, improve health and have long-term positive economic impacts for communities that are interested and willing to make the initial investment.

A critical first step for any initiative is to perform an inventory of the built environment around the school to identify existing sidewalks, sidewalk gaps, needed sidewalk improvements, bicycle facilities, and traffic safety hotspots, and to assess the environment where students live and play. Many programs create maps that outline the safest routes to and from school, highlighting infrastructure elements such as crossings, stoplights and bicycle lanes.

The number of people viewing the world from the perspective of a map has greatly increased thanks to the use of the internet; various Global Positioning System (GPS) devices such as smartphones enable people to get directions, view images and make maps. Geographic Information Systems (GIS) is a tool that can help map walking routes within a community, identify existing infrastructure, safety and equity problems, and provide clues to better understand complex issues. GIS is a commonly used tool within the planning sector. There are thousands of GIS datasets, and communities all over the country are now using GIS in planning, implementation and evaluation efforts. It is also gaining traction among champions. By tapping into this new paradigm, communities can collect and disseminate data and have a more complete picture of what is happening at the local level by integrating GIS technology.

As Safe Routes to School programs have increased across the country, a clear need for a national inventory of walking and bicycling facilities has become apparent. Many communities have done assessments of their built environment conditions, but because there is not a central place to store data, this information is "stuck" at the local level. This leads to minimal sharing of data and a lack of continuity in data collection on a national scale. As a result, it is difficult to demonstrate the cumulative impact of Safe Routes to School successes across the country and to make the case that bicycling and walking is under-resourced throughout the nation. However, local communities may or may not be collecting data on bicycling and walking, and many people do not yet understand the value and possibility of collecting datasets and using GIS to benefit and other active transportation and health initiatives.

The first step in the effort to increase the number of communities using GIS for Safe Routes to School and active transportation is to create a clear understanding of what needs to be done and where to begin. In this report, we will address ways to collect consistent data, using GIS to improve Safe Routes to School efforts, and where all the data needs to be kept.

BACKGROUND

In April 2013, the Safe Routes to School National Partnership (National Partnership) brought together fifteen Geographic Information System (GIS) experts in Austin, Texas to discuss the development of a framework for the use of GIS in active transportation. (A list of attendees is available at the end of the report.) Because GIS covers such a broad spectrum, experts from various active transportation and GIS-related professions were invited to participate.

Several of these experts specialize in technology that focuses on walking and bicycling applications, others focus on education work involving GIS, while the rest concentrate on projects that integrate mapping into regional Safe Routes to School programs. During the meeting, this group of experts focused on four main topics:

1. Obtaining data necessary for planning and implementation of Safe Routes to School, walking and bicycling
2. Creating standards for data collection, dissemination and storage
3. Storing collected data on a local and national level so that they are accessible to all people
4. Ensuring that accessible and standardized data tools will be open source in order to allow for future creation of new applications and uses

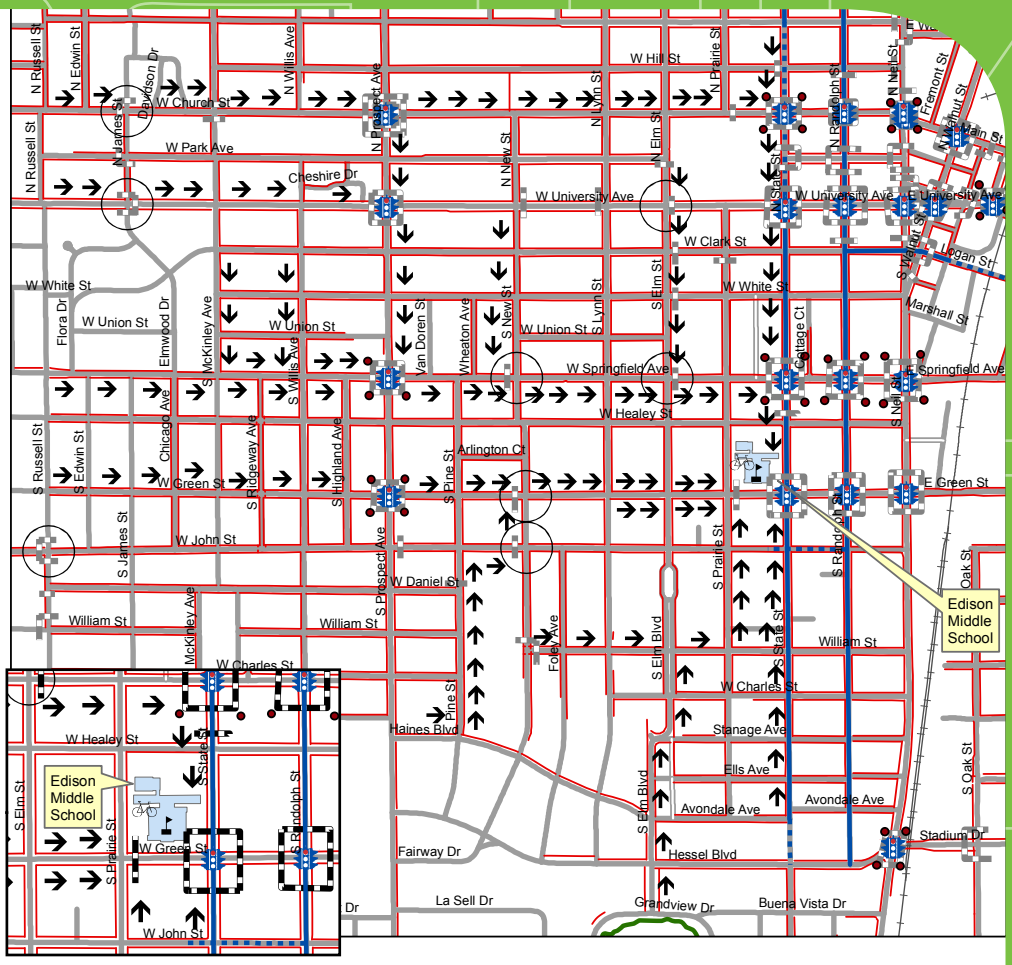
After the meeting, the National Partnership staff created this report based on meeting notes to give an overview of GIS, data collection and existing tools and to present the group's thoughts, recommendations and concerns regarding each of the above topics. This report aims to foster a new national conversation highlighting ways that GIS can assist Safe Routes to School efforts and active transportation in general. Some recommendations from the meeting were clear, such as the creation of a Top Ten list of vital, basic datasets that most communities can reasonably expect to collect to ensure that they have enough quality data for active transportation planning and implementation. Other topics, such as how to create a national bicycling and walking database, will require more discussion and resources in the future.

What is GIS?

GIS is a tool that can store, manage, analyze and display locational data in a way that allows the user to see correlations, patterns and a picture of their community that words, graphs and tables cannot communicate as well.

GIS can provide strategic and economic benefits to local governments, schools, businesses, and organizations of all sizes. Nearly all data are tied to geography, and GIS is the best way to understand the interaction of data in a comprehensive way. By creating a visual display on a map, GIS can show relationships between information previously thought to be unrelated. A map will not always provide solutions to every problem, but can raise questions and begin conversations by 'painting a picture' of the community that can make scientific data relatable and easily understood.

This report is intended to serve as an informative guide for communities that are interested in taking control of their own data and give them the power to make GIS maps that identify issues that need to be addressed. The report will also assist champions, researchers and governments in advancing a national conversation about new standards, tools and resources. GIS can be an extremely powerful tool that allows people to have a more complete picture of what is happening in their own communities, states and the nation.



The city of Champaign, Illinois identified the safest routes for children to walk and bicycle to school, as well as crosswalks, signage, crossing guards and traffic signals.

DATA COLLECTION

What kinds of data might be included?

The Transportation Research Board, a division on the National Research Council which promotes innovation and progress in transportation through research, has identified three broad categories of data that are important for bicycle and pedestrian planning and management[1] through their Bicycle and Pedestrian Data Subcommittee:

- Travel Monitoring Data (bicycle and pedestrian traffic counts)
- Travel Behavior Data (survey results)
- Transportation General (other data such as GPS routes or infrastructure)

The National Bicycle and Pedestrian Documentation Project is an example of a travel monitoring data collection effort that standardizes data but does not currently disseminate the datasets publically.

The National Household Travel Survey and American Community Survey are national examples of travel behavior data, and many regional transportation planning agencies perform their own travel surveys. The U.S. Department of the Interior disseminates infrastructure data through its National Atlas of the United States. Sidewalks, bicycle lanes, crosswalks and traffic-calmed streets are examples of transportation infrastructure that impact Safe Routes to School.

The two biggest questions regarding data collection are: "What are the most important data to collect?" and "How does one ensure that the data are collected in a reliable, consistent and usable way?" Because analysis can only be defendable if data are reasonably accurate, one must ensure that the data are comprehensive, understandable, complete and comparable. For example, if one community measures all sidewalk or roadway widths and linear miles, but another community does not take width into consideration, there will be a lack of consistency and usability of the data at a national level.

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Data Collection at the Local Level

Local level walking and bicycling data are being regularly collected in many communities, but not in all of them, and not in consistent ways. Many municipalities and regional governments now have bicycle and pedestrian coordinators, and GIS staff are becoming more common in local governments, but still not everywhere.

Regional governments are required to consider all transportation options in planning, but are not required to dedicate staff time and resources to GIS or bicycle and pedestrian data collection. In addition, some cities, regions and states will readily allow their data to be released to the public while others will only share when petitioned through high-level officials or Freedom of Information Act (FOIA) requests. Because each governing body is independent, gathering data from local level entities can be time-consuming, inconsistent and incomplete.

The majority of Safe Routes to School programs use volunteers to collect data. These volunteers can be parents, teachers, public and private sector representatives and even students. Many high school and college students are required to do community service to graduate. These students can work with project organizers to collect and upload data. Younger students can also be involved in data collection. They can be asked to draw their favorite bicycle or walking routes or they can use methods such as Photovoice to photograph what they see in the community that they like or think needs to be changed. It is also possible to collect built environment data by looking at photos available through Google Street View and Google Earth, although these efforts tend to be less complete and accurate.

Data Collection at the Federal/National Level

The single biggest data collector is the federal government, which has the largest amount of data regarding streets, safety, education, land use, demographics and other datasets.

Several federal agencies collect various types of data that impact walking and bicycling, but the majority of federal transportation data is focused on motorized vehicles: airplanes, trains and automobiles. The attendees agreed that the federal Transportation Investment Generating Economic Recovery (TIGER) grantees, the U.S. Census, the U.S. Household Travel Survey and the Federal Highway Administration were the best places to start looking for data to begin building a national walking and bicycling database. The concern with federal-level non-motorized transportation data is that the data are often incomplete at best and inaccurate at worst. This is why local-level data need to be collected in a consistent, timely and efficient way to correct inaccuracies and to fill in the gaps left by current federal data collection systems.

Existing Data Collection Tools

The group discussed the belief that there is a strong intersection between people who are interested in transit and people with knowledge of software design, the result of which is the creation of numerous applications and tools related to transportation data.

There is a massive amount of existing data already in various GIS-based products, but the differences in how data are collected and stored make it difficult to analyze at a national level. Often, data collection software is not compatible or the data collected are incomplete, making the data difficult to use and compare. A range of tools are available for auditing the built environment, but many were designed with researchers,[2] not community members, in mind. Another challenge is that data are being collected in certain communities and not in others. This inconsistency may lead to underrepresentation of low-income and low-resourced communities.

There are many available tools for collecting data, including high-cost robust solutions used by professionals, as well as easy-to-use GIS tools available for laypersons, especially for those in low-income and low-resourced communities. Although it would be difficult to create a complete list of all existing tools to collect, store and analyze geographically related data, the group convened in Austin, Texas compiled a list of what they consider to be the most prominent examples, including Google maps, Community Commons, and smartphone apps.

Tools and Datasets

Federal	American Community Survey (ACS)	Federal Analysis Reporting System (FARS)	General Transit Fee Standard (GTFS)	Highway performance measure set (HPMS)
Non-profit/ Private	311 GIS app	Boltage Program	City Scan	Community Commons
Cycle Track	ESRI	ITO World	Google	NATVEQ
Open Street Map	Saris Racks	Spotify	STRAVA	TELE Atlas
URISA	Vertices	Walkscore		

FINDINGS FROM THE FIELD

The convening of GIS experts in Austin, Texas in April 2013 produced a number of findings and recommendations:

A Uniform Data Tool is Needed

While these existing tools are important resources, the consensus was that a new uniform tool should be created that makes it easy to collect new data, upload existing data from other tools, and store all the data in one centralized location.

All the experts agreed that the tool must be easily accessible using the internet, that anyone who has an understanding of the data standards protocol must be able to use the tool, and that the data must be immediately available once it has been uploaded, without privacy controls or other restrictions.

The group discussed the need to identify a funder for this new data tool, collection and storage project. There was consensus that while the project should be a collaborative effort between numerous groups interested in increasing active transportation across the country, the database needs to be owned and operated by the federal government. This will ensure that the data will be public and accessible, the website and database will be sustainable and that the active transportation conversation will continue on a national scale.

Protocols are Necessary

Since there are so many types of data, and because data can be collected and stored in so many ways, there will need to be an established set of protocols or standards that will ensure that data are of a high enough and consistent quality that governments, decision makers and researchers can use the data for the common good.

Determining the actual protocols is likely to be the job of the federal government or its designees to facilitate in collaboration with leading experts.

Data can be enormously powerful, but only if they are reasonably accurate and up-to-date. Data must also be collected uniformly to ensure that information can be compared across datasets and communities.

To ensure that this is possible, all collectors should conduct responsible data collection. Data collection can be done by a parent, teacher, school professional, bicycling/walking supporter, or local municipal employee, but all should have access to – and a basic understanding of - the tools and protocols that will ensure that their data are useful and consistent.

What About Google?

Because Google has become the most popular worldwide internet site for people looking for mapping information, it was brought up several times during the meeting.

Whether it is to get driving directions, make a labeled map, or find a local park, Google is the most prominent example of a tool that is free, comprehensive, accessible and easy to use. At the same time, there are a number of issues with Google and its data that made the attendees apprehensive about asking Google to store national walking and bicycling data. Google owns all of its data, which could make public access difficult and unpredictable; since Google is a private enterprise, the public generally has no control over its actions or the data stored there. The group determined that Google would not be the right place to store a national public database of active transportation data.

Mobile Devices Are Key

Many people now have phones that allow them to access the internet, so the group agreed that an app for a mobile device would be a must-have as a data collection tool.

This would allow users to map sidewalks, crosswalks and other data points, produce high quality maps, and save data easily into a national database. The ability to upload data from anywhere is important for two reasons: first, because people are more likely to participate in data collection if they can easily enter information while they are at the site being measured, and second, because data are more likely to be accurate when it is uploaded right at its location.

Photos Provide Perspective

Photos are another tool that can be helpful in data collection.

Uploading photos from a computer or smartphone gives a visual record of the current conditions, which would add another type of valuable information to the database. Photos can be labeled and graphics such as text, arrows and route markings can be overlaid onto photos using inexpensive apps.

Open Source and Open Data

Open source and open data are important considerations in collecting and disseminating data and GIS mapping.

Both approaches allow anyone to use and input their own information, and to make improvements to the underlying tools. By creating a system that lets the general public contribute data and control how that data are used, a truly collaborative initiative can become a reality. The biggest advantage is that users are not locked into a relatively static and private GIS company or tool that would require substantial funding and time to modify.

Open Source

means that the underlying software code is freely available to the general public for use and/or modification from its original design. It is typically created as a collaborative effort in which programmers improve upon the code and share the changes with the community.

Open Data

refers to data that is available for anyone to access and use. It can be downloaded by anyone and integrated into any GIS system.

National Center's Database

Established in May 2006, the **National Center for Safe Routes to School** (National Center) serves as the information clearinghouse for the federal Safe Routes to School program and assists states and communities in enabling and encouraging children to safely walk and bicycle to school.

The National Center is part of the University of North Carolina Highway Safety Research Center with funding from the U.S. Department of Transportation Federal Highway Administration. In 2009, the National Center unveiled a searchable database of federally-funded Safe Routes to School projects. Data are provided to the database by each state Department of Transportation. This is an extremely valuable source of information and a unique tool that can assist in bicycle and pedestrian GIS mapping efforts.

THE TOP TEN LIST

During the meeting, the group settled on a Top Ten list comprised of the most basic and important datasets that all communities should collect when assessing overall walkability and bikeability that would eventually become the foundation of a national database.

These ten datasets were chosen because they are data that most communities already collect, or can easily begin collecting without the need for a great deal of additional resources, staffing or other elements that may be a barrier, especially for low-income and low-resourced communities. By asking these ten primary and some of the secondary questions during community surveys, a community can start to see a clearer picture of their assets and obstacles and identify specific areas that can be improved that will have a direct impact on active transportation. Once the data are collected, a community will be able to use GIS to produce clear and comprehensive maps that communicate meaningful information. It is important to remember that this list was created based on the opinions of the group of experts attending the April 2013 meeting. It will eventually need to be vetted by other experts from all government levels and citizen experts before it is implemented. Once that process is complete, it is possible that there will be changes to the list.

Experts at the meeting agreed that questions that produce quantitative, measurable answers are best because they can easily be compared with other types of datasets and with data from other locations, while qualitative questions can result in data that can be hard to collect and interpret. At the same time, the most powerful question in an active transportation survey might be the least quantitative: "Do you feel safe walking or bicycling along this block?" Regardless of the presence or absence of sidewalks, paths, crosswalks, crossing guards or other traffic calming devices, if people do not feel safe, the majority will not walk, bicycle, scooter, skateboard or wheelchair to and from local destinations. By identifying where people do and do not feel safe, one can then evaluate why they do not feel safe. Data collection and mapping may show that areas where people do not feel safe tend to lack sidewalks, safe crossings or bicycle lanes. From this data, powerful conclusions can be drawn from quantitative information. Because of the qualitative nature of the first question, it is important to ask basic information (age, profession, level of bicycle and pedestrian familiarity) about who is collecting the information so that people later reviewing the data can have an idea of where that user is coming from.

Federal Data Collection

The group agreed that one way to increase data collection on a large scale would be to ask the federal government to collect the Top Ten list of datasets within a specified distance of all schools, or throughout the community, as part of the application processes for federal transportation grants.

Federal funding, such as the 2012 Moving Ahead for Progress in the 21st Century (MAP-21) transportation law, could also include Top Ten data collection. This goal would assist communities in advancing the active transportation movement by improving baseline and post-intervention data collection.

The concern with this additional Top Ten requirement is that there are many communities, especially in low-income areas, that do not have the ability to apply for grant funding or collect robust data because of a lack of local staffing or volunteer capacity, expertise or technical resources. One way to address this is to offer assistance to higher need communities, either in-kind or through small technical assistance grants, when they are applying for federal or other grants to ensure that they are able to effectively collect and utilize data.

Regardless of the presence or absence of sidewalks, paths, crosswalks, crossing guards or other traffic calming devices, if people do not feel safe, the majority will not walk, bicycle, scooter, skateboard or wheelchair to and from local destinations. By identifying where people do and do not feel safe, one can then evaluate why they do not feel safe.

Top Ten GIS Datasets for Safe Routes to School

At a minimum, all communities should be collecting the following data:

DATASET	PRIMARY QUESTIONS	SECONDARY QUESTIONS
1. Standard Level of Comfort	Do you feel safe walking or riding a bicycle along this block?	
2. Presence of a Sidewalk	Does a sidewalk exist?	Condition of the sidewalk- Does the sidewalk have cracks? Is it uneven? How wide is the sidewalk?
3. Intersections	Are crosswalks Present?	Are there crossing signals at the intersection? Does the intersection have a stop sign of stop lights? Are crosswalks striped? Are crossing guards present before and after school? Does the street have medians? Are there mid-street crosswalks? Are the intersections near the school safe?
4. Bicycle Facilities	Are there places to safely ride a bicycle?	Are there places to park a bicycle securely?
5. School location and Student Catchment Areas	How many students live within a 1 to 2-mile radius of a school?	
6. Speed	What is the speed limit of the street?	
7. Collision Data	How many injuries and accidents have happened on this block?	
8. Health Indicators	Are there basic public health concerns in the neighborhood?	Do lower income areas have less access to walking and bicycle riding?
9. Existing patterns	Where are people currently walking? Are there goat paths?	Are children using a more direct path that lacks sidewalks?
10. Crime Data	Is crime a deterrent to walking and bicycle riding?	

OTHER IMPORTANT DATA TO COLLECT		
Block Length	What is the length of the block?	
Adjacent Land Use	What are the primary land uses in the area?	
Number of Street Lanes	How many lanes does the street have?	
Street Width	What is the street width?	
Air Quality	Is the air quality good enough to promote active transportation?	Is there a high asthma rate in this neighborhood?

Evaluation

Evaluation, including the procurement of baseline and post intervention data, must be a part of every community's efforts. Baseline data collection is especially important, as it can be difficult to determine success if there are no data with which to compare.

When paired with GIS mapping, evaluation can be easier to conduct and results more easily interpreted. If a community does not take the proper steps to evaluate a programmatic, infrastructure or system change effort, it can be hard to show if real change was accomplished. Evidence-based strategies are also beneficial to garner public support.

GIS mapping can create a picture of the community before, during and after infrastructure, policy and programmatic changes were implemented, giving evidence that active transportation interventions help communities to be more economically sound, healthier, safer and more active.

Complete Streets

When assessing streets for all modes, it is important to remember that not all streets, bicycle lanes, and sidewalks are created equally.

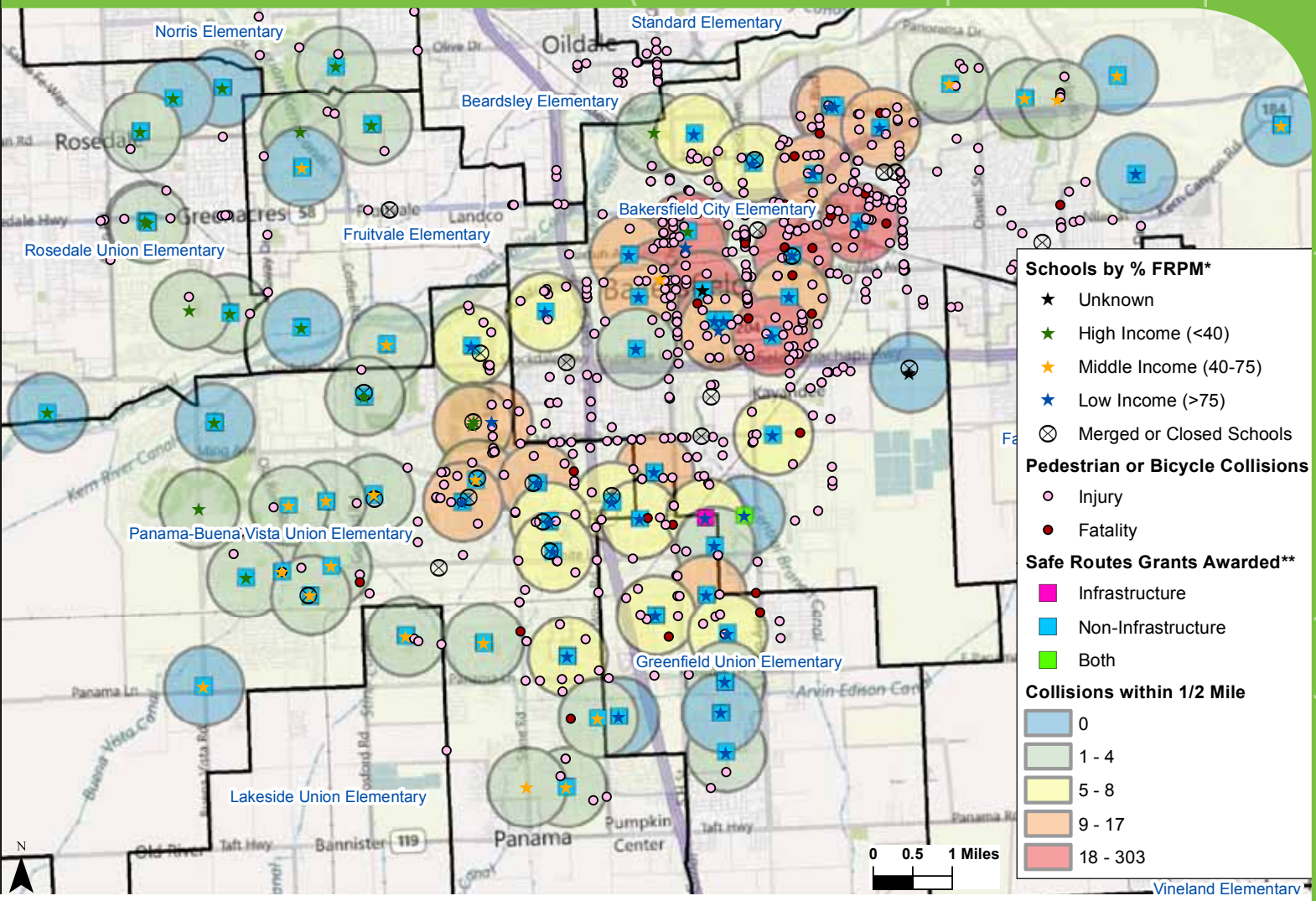
Some streets that have high traffic volume may need a space that is a buffered or separated sidewalk/pathway, while a lower speed road with minimal traffic could easily support an on-road bicycle lane with no space between the road and the sidewalk. By using Complete Streets guiding principles, every community can recognize and implement the appropriate treatments on all streets. GIS mapping can assist in identifying the different types of roads and can show the best routes for bicyclists and pedestrians, which will not often be the same. GIS can also map streets around schools, parks, retail centers and neighborhoods to determine if they are following Complete Streets principles. GIS can identify any inequities that might exist in regards to the locations of Complete Streets.

Scoring the Data

The group decided that the best way to collect data was for communities to ask simple questions with straightforward answers.

Some walking audits currently score sidewalks, roads, and intersections by giving them a number or star rating, but it can be difficult on a national scale to ensure that various scores mean the same thing in different communities. For instance, knowing if a sidewalk was given three out of five stars may be less important to decision makers and other stakeholders than knowing if a sidewalk exists at all, and if so, what its width is. Another reason is that a sidewalk could score highly on paper, but still feel unsafe in person. Simple, direct questions can often identify the issue better than a numbered ranking scale, especially in regards to active transportation infrastructure, which adds complexity to data collection and interpretation and the usability of the data to catalyze positive change.

A disagreement within a community about whether a particular aspect, such as a sidewalk segment, is an asset or actually an obstacle can be a good thing. Disagreement (in a friendly, constructive way) can lead to conversations about issues that may have been overlooked if everyone easily agreed on a score. For example, if one community member believes a sidewalk segment should be scored highly, while another believes it is a poor sidewalk, a conversation will likely happen regarding what is an ideal sidewalk within that community, leading to a deeper discussion about what the community needs and how to achieve active transportation goals.



Bakersfield - *Pedestrian or Bicycle Collisions Near School Sites (2007 - 2009)*

The city of Bakersfield. California mapped collisions that occured 1/2 mile of each school. They then overlaid data showing the percentage of students that received Safe Routes funds. By viewing all of the data on one map, advocates can observe relationships between areas with high collision rates, lower income and a lack of Safe Routes funding.

GIS AND ACTIVE TRANSPORTATION: RECOMMENDATIONS

The way that a community uses GIS will vary depending on what they are trying to accomplish. GIS can map many types of data: roads, health, sidewalks, obesity, school catchment areas, busing routes, bus stops, income, ethnicity, age, underserved populations, test scores, zoning, parks, equitable distribution of services, programmatic impact and much more.

In fact, there are already tens of thousands of useful and publicly available datasets, mostly collected by the federal government through the U.S. Census, National Household Travel Survey, Department of Education and other sources.

Once data are collected, GIS helps practitioners put those data together to create a visual aid. Many communities collect data, but then do not have the ability to put the seemingly disparate pieces together to see possible relationships. In the past, GIS software was expensive and difficult for many people to use. Nowadays, with the advancements of technology and the availability of internet-based options, basic GIS is not cost-prohibitive for most communities.

MISSOURI BICYCLE AND PEDESTRIAN FEDERATION

GIS mapping can be useful in a number of decision-making situations at local, state and national levels. GIS maps are not a quick fix, but they can identify trends and tell a story in a way that words and raw data cannot. They can help illustrate need in grant applications, impact placement of new amenities such as community centers, schools, parks, bicycle lanes or trails, and illustrate social equity disparities. Communities, agencies, bicyclists and pedestrians will be more likely to focus on good data collection and mapping when they see what good can come out of it.

GIS can create a level playing field for data. By presenting data in a non-political way through mapping, GIS can illustrate community issues in a way that is not aggressive or accusatory, just factual and visible. Among other things, GIS has been used to show lack of sidewalks, zoning discrepancies, walking routes, the location of traffic safety improvements, even 'food deserts', and to make direct links between a lack of community amenities and high obesity rates, especially in underserved communities. But if a community has limited access to maps and data, a significant number of people are missing the powerful stories that GIS can tell.

Communities cannot afford to view sidewalks and bicycle lanes as alternatives or enhancements to existing or future roads. By arming decision-makers with the best data possible presented in straightforward and easily understood ways, GIS allows them to see a more complete picture of why investing in bicycle and pedestrian projects makes sense. In addition, non-motorized transportation costs usually have to be justified, but road projects seldom have to explain why the cost is worthwhile. By incorporating factors such as bicycle or pedestrian counts, health indicators and cost analyses, supporters can show through GIS that walking and bicycling are useful, convenient and financially efficient modes of transportation. GIS has the potential to change the conversation so that decision makers will understand the positive benefit of having various options when choosing transportation.

Underserved Communitites - *Results*

MISSOURI SAFE ROUTES STATE NETWORK

The Missouri Safe Routes to School State Network used GIS to identify where Safe Routes to School grants had been awarded prior to 2011 and then determine the ideal distribution of the grants for communities to be funded in 2011 with a targeted approach to underserved communities.

AWARDS 2007 - 2011

IDEAL DISTRIBUTION (POPULATION)

APPLICATIONS 2011

Show Economic Benefits with GIS

GIS provides a framework for understanding and communicating the potential economic benefits of active transportation.

GIS can map out average rental prices, incomes, overall sales for businesses, population, and property taxes before and after infrastructure improvements were built. Active transportation can impact the economy in various ways. It can lead to a decrease in public health issues, such as obesity and asthma, which in turn decrease health care costs. Areas with active transportation also tend to attract more tourism. GIS can identify areas that are bicycle or pedestrian-friendly (presence of bicycle paths, bicycle racks, bicycle lanes, sidewalks, and buffers from cars) and then compare to areas that lack these amenities. By mapping these and various other datasets, relationships can be seen between active transportation initiatives and economic growth.

The potential economic benefits of active transportation have been researched from many different perspectives, and GIS plays a dominant role in many of these analyses. The economic benefits (and other benefits) can be compared against project development costs, providing objective analysis of economic benefits (or lack thereof) for a given project. Specific settings have also been evaluated, such as federal lands,[3] bicycle tourism,[4] and social equity of economic benefits.[5] *Guidelines for Analysis of Investments in Bicycle Facilities*[6] and *Forecasting Bicycle and Pedestrian Usage and Researching Data Collection Equipment*[7] are both good resources to use when researching investment forecasting.

Make the Health Connection with GIS

Infrastructure development for active transportation has been specifically linked to improved community health.[8]

With the nation's attention increasingly turning to public health, chronic disease and rising levels of obesity, it is in Safe Route to School practitioners' best interest to use GIS to communicate the positive impacts of active transportation on community health.

One concern when gathering health data is that Health Insurance Portability and Accountability Act (HIPAA) laws can be tricky to navigate. Many schools collect Body Mass Index (BMI) data and health departments have statistics related to areas within a region, but health data overall are difficult to map by neighborhood. One way to use health data at the local level would be to overlay chronic disease rates onto maps showing infrastructure change over a period of years to see if there has been any crossover. In many health situations, however, GIS mapping will only be feasible when viewed from a regional, state, or national level.

Studies show that students who walk or bicycle to school are more physically active, have lower obesity levels, and are more likely to get the recommended 60 minutes of physical activity a day than children who do not commute actively to school.[9] GIS can help identify patterns that connect health with the built environment. An example of this could be if a map showed that children in areas with sidewalks or shared use agreements had lower BMI rates than areas that lacked them.

Although public health is frequently talked about at the national level, determinants of public health start at the local level. Nearly all local policies that deal with transportation, land use, schools and infrastructure funding can be tied to public health issues. This is often not realized, so GIS mapping can be used to demonstrate the ways they intersect each other.

Active Transportation Committee on GIS

The group recommended the idea of working with an existing committee through the Transportation Research Board as a way to ensure consistent and sustainable methods of data collection and GIS mapping.

Local Assistance and Data Access

The consensus was also that, while there are fantastic tools already in existence that collect and store data, there is a disconnect between an expert familiar with GIS and a local person wanting to access information specific to their community.

GIS technology is available to nearly any community with internet access, but often staffing restrictions and a lack of GIS knowledge are barriers to a community's ability to collect data and take advantage of GIS mapping. Because of this, local assistance needs to be provided from the regional and state levels and data needs to be widely available across all levels of government. Regional and state governments can help empower local communities by engaging with them in conversations related to data collection and GIS mapping.

Social Media

Social media can be used as a communication outlet to engage the public with GIS by having maps online and allowing the public to comment on issues (e.g., sidewalk cracks, cars parked in bicycle lanes, etc.) in a way that is easily collected by the local government agency.

Various Web 2.0 technologies broaden the toolset for developing and updating information on active transportation[10] and engaging the public in transportation planning.[11] The use of geotagged imagesis particularly compelling in the case of recommending or improving Safe Routes to School because they document conditions and comments with a specific geographic location in real time. The advantage of the social aspect to this type of data input is that participants' contributions can be visible to their "friends" or "followers," expanding outreach about Safe Routes to School issues. Most state departments of transportation and many local agencies already use social media. Leveraging their use of social media with public input is a logical next step for low-cost, local information.

Activity-Based Modeling

Activity-based modeling (ABM) is a way to predict travel demand based on activities that individuals need and want to perform.

ABM takes into consideration the fact that people do not travel purely for the sake of traveling, but rather as a means to get from one activity to another based on what they need or want to do. For example, a mother is more likely to travel from work to pick up her child from school, then go to a park, then to a grocery store in that order instead of making individual trips from home to each of those locations. ABM tries to predict when, where, why and how travel will occur.

GIS SPECIFIC TO SAFE ROUTES TO SCHOOL

When parents and local walking and bicycling enthusiasts work together to create a Safe Routes to School program, one of the first and most important steps is to do an assessment of the current landscape.

Does the route from a child's house to school have sidewalks or pathways? Is it safe for a child to ride a bicycle to school? How far does the child live from school? These are some of the basic questions that must be answered before a child is allowed or encouraged to walk or bicycle to school.

Many Safe Routes to School programs currently use GIS to identify walking school bus and bike train routes, school location and catchment areas, and intersections that need improvement. But GIS mapping can do much more than show routes and infrastructure. Safe Routes to School champions can use GIS to show cost-benefit relationship between funds spent on Safe Routes to School programs and safe infrastructure, health improvements, decreased gas usage, increased student test scores, decreased vehicular accidents, and improved sense of safety across an entire community.

There is a direct correlation between Safe Routes to School success and detailed mapping. GIS can show where students are currently walking, locations of current sidewalks, areas that lack sidewalks, changes in test scores in relation to increases in students that walk or bicycle to school, changes in obesity rates, decreases in behavior issues, and involvement in overall active transportation by all community members.

One of the most popular ways to use GIS is to map out one-mile or two-mile buffers around schools to see if and where students can walk and bicycle to school. Overlaying the best routes within the walkable catchment areas of a school can be powerful information.

Safe Routes to School champions can use GIS to show cost-benefit relationship between funds spent on Safe Routes to School programs and safe infrastructure, health improvements, decreased gas usage, increased student test scores, decreased vehicular accidents, and improved sense of safety across an entire community.

The potential uses of GIS are enormous, and mapping datasets together from various sources, even those that might seem unrelated, can create a whole new picture of the community, that, in turn, can spark new realizations about the community's assets and obstacles. This type of experimentation can ultimately lead to increased support for related policies and programs.

GIS and the 5E's of Safe Routes to School

Engineering
GIS can use precise engineering data to inform future funding decisions, locations of future projects, and prioritization of maintenance.

Education
GIS can map locations of schools that offer traffic safety classes, bicycle rodeos, and various other education programs.

Encouragement
GIS can map various encouragement efforts to see if they overlap with increases in walking and biking to school.

Enforcement
GIS can map locations of traffic violations and crashes, abandoned houses, areas with crime and unsafe intersections.

Evaluation
GIS allows for detailed evaluation of data and creates the ability to assess relationships between seemingly unrelated information.

Funding

Due to recent budget cuts across all active transportation programs, including the loss of the standalone federal funding program, Safe Routes to School must find new ways to prove its importance and secure funding at the national and state levels.

Safe Routes to School champions must be able to prove there is a definite interest and need for walking and bicycling in order to make the case for increased funding. GIS mapping is an effective way to use existing data to show why this work is important.

GIS can help show a larger picture of students walking and biking to school. Several hundred students in one school district may not have a big impact on state and national decision makers, but if active transportation champions can use numbers from dozens of communities to provide evidence that a large percentage of students are walking to school, it will have a much bigger impact. When active transportation supporters have better evidence of people asking for and using active transportation, it will cease to be seen as an enhancement or alternative and instead as a viable transportation need.

By using GIS to map the locations of all playgrounds, community centers, ball fields, courts, and schools that have opened their doors to the public through shared use agreements, practitioners can make a powerful case for increasing access to physical activity opportunities.

Where Students Live

Gathering information on where students live can be one of the most important and challenging steps in Safe Routes to School data collection.

The Department of Education at the national, state and local levels is understandably cautious about giving out any private information regarding home addresses, but this makes it difficult to show how many students could easily walk or bicycle to school. Knowledge of catchment areas can be helpful as they give an idea of how many students live within a specified area (one to two miles). U.S. Census data are another way to find out the number of students in each neighborhood or on each block; although it will not tell you which school a child is going to. Classroom hand tallying of who walks or rides bicycles to school has proven to be inaccurate, as it is self-reporting, although these are the most popular and accessible tools for measuring where students live and how they get to school.

Shared Use

Shared use agreements (also referred to as joint use agreements) have become a popular and successful strategy for communities across the country.

Shared use agreements can be formal or informal agreements between two separate government or private entities setting forth the terms and conditions for the shared use of public or private property. In light of the obesity epidemic, as well as financial concerns, a shared use agreement between a school and a park department or community organization can be an easy and inexpensive way to ensure that all people have access to physical activity opportunities. By using GIS to map the locations of all playgrounds, community centers, ball fields, courts, and schools that have opened their doors to the public through shared use agreements, practitioners can make a powerful case for increasing access to physical activity opportunities. Relationships might be observed between shared use and an increase in use, decrease in obesity rates, overall cost savings for a community, and an increase in physical activity. Mapping shared use locations may also show inequities in access to physical activity opportunities across a community.

photo courtesy Mayor MgGinn on Flickr

School Siting

School siting is a major school board decision that can be influenced with GIS data.

There is a trend to build or consolidate multiple schools into larger school buildings on the edge of towns, often far away from students, where land is cheap and plentiful, and to close older schools that tend to be within walkable neighborhoods. The rationale is that it is more expensive to retrofit older buildings than it is to build a new one. A GIS map could model the impact of new traffic traveling to/from the new school, including new congestion, crashes and wear and tear on roadways, the number of students that could or could not walk and bicycle, existing infrastructure, the cost of new infrastructure such as roads, sewers and electrical service, school busing costs over a future period of time, fuel consumption and many other possibilities. GIS mapping could educate decision-makers about the long-term impacts of the new, closed or consolidated school location, not only the immediate costs and concerns.

GIS can map various factors that impact the type of environments that surround schools. If a large parking lot is present, it is more likely to encourage car travel, while sidewalks and low traffic streets will encourage walking and bicycling. By looking at GIS mapping in areas where students walk and bicycle regularly, communities can better understand what it takes to increase the number of students taking part in active transportation. The group envisioned the creation of a school site design manual focusing on educating school boards, developers and architects about the best and worst practices that would detail the factors listed above, as well as a study of the long-term economic costs of locating schools on the outskirts of town.

School Oriented Development

Centrally located neighborhood schools are not only a goal of Safe Routes to School and smart growth supporters.

Realtors have long discussed the positive effect that good, community-centered schools have on real estate decisions and most communities recognize the positive impact that community-centered schools play in a community. One idea that came out of the meeting was the possibility of creating a new way of planning our communities: School-Oriented Development.

A scoring system similar to Walk Score, an app that grades locations based on how easy it is to walk to community amenities, could use GIS data to grade schools based on the number of students who can walk to school, the presence of infrastructure supporting walking and bicycling, and various other factors that influence active transportation to and from schools.

School Siting In Montana

GIS is an important part of the curriculum that assists communities in making decisions to construct new schools or close existing schools.

One of the identified priorities for the Montana Safe Routes to School Network was school siting. The Network recognized the importance of using GIS to solve problems and visualize the complex factors that can help decision makers do a better job of siting schools. Some of these factors include location of existing infrastructure, housing density, student density, student yield by housing type, diversity, access to public transportation and more. GIS can be used to help school districts and cities increase efficiency and coordination and deliver transparency and accountability. The Georgia Conservancy has developed a school siting training based on the Environmental Protection Agency's School Siting Guidelines that were released in 2011. During the summer of 2013, the Georgia Conservancy will bring the school siting training to Billings, Montana.

Social Equity

Transportation investments are frequently not distributed equally across communities.[12]

Higher-income areas are more likely to be able to afford costly improvements and investments, and these areas can usually predict a faster return on investment than lower-income areas. Lower-income areas also tend to wield less influence and involvement in local decision making and are therefore less likely to be vocal about needs in their area. However, because active transportation investments are usually inexpensive and sustainable, more effort should be used to ensure that these investments are spent equally across a community.[13] In some cases, they provide access to jobs with the most inexpensive modes (walking and bicycling) while other transportation modes cost more to the individual.[14]

There is also concern with lower-income areas, such as rural communities and inner-cities, which often lack access to GIS technologies and the internet. These communities could be assisted by larger communities, or regional planning groups, that have the resources to assist in data collection and GIS mapping. A final equity issue that was raised at the meeting was the fact that not all possible users have mobile devices. This digital divide needs to be addressed so that these people are not left out of both the data collection and GIS mapping opportunities, which will lead to certain areas being underrepresented in this initiative.

GIS Identifies Funding Inequity in Missouri

In 2010, the **Missouri Safe Routes to School State Network** suspected that low-income and minority communities were receiving less than their fair share of Safe Routes to School funding throughout the state.

The Network used GIS to identify specifically where these inequities were occurring by mapping out data on population, ethnicity, free and reduced lunch percentages and grant recipients. These maps showed that prior to 2011, Missouri Safe Routes to School funding was not reaching poor or minority schools. Their data led them to the conclusion that they were not receiving many applications from underserved areas, they had more success reaching poor schools than minority schools and there were little funds going to urban schools. In 2011, the Network worked with Missouri Department of Transportation to encourage applications from underserved communities. Within one year of this implementing this targeted approach, the State Network saw a huge increase in the number of underserved communities that applied for and received funding.

Identifying Remote Drop-offs in Rural Areas

The experts at the April 2013 meeting agreed that the issues suburban and urban communities deal with are more commonly addressed, while rural problems require different approaches, solutions and evaluation measures.

Little time was dedicated to the issues that rural communities exclusively deal with, such as infrastructure limitations in low-income rural areas and the more common need for busing students due to longer travel distances that limit the ability to walk or bicycle to school. One way to increase the amount of physical activity students have access to before and after school is known as the **remote drop-off**. GIS can map out various safe locations for busses to drop off children. By looking at possible remote drop-off locations on a map, decision makers can identify the best places that will have the smallest impact on traffic, will be the safest and most direct routes for students, and will allow the students to walk an appropriate distance to and from school and the bus.

Crash Data

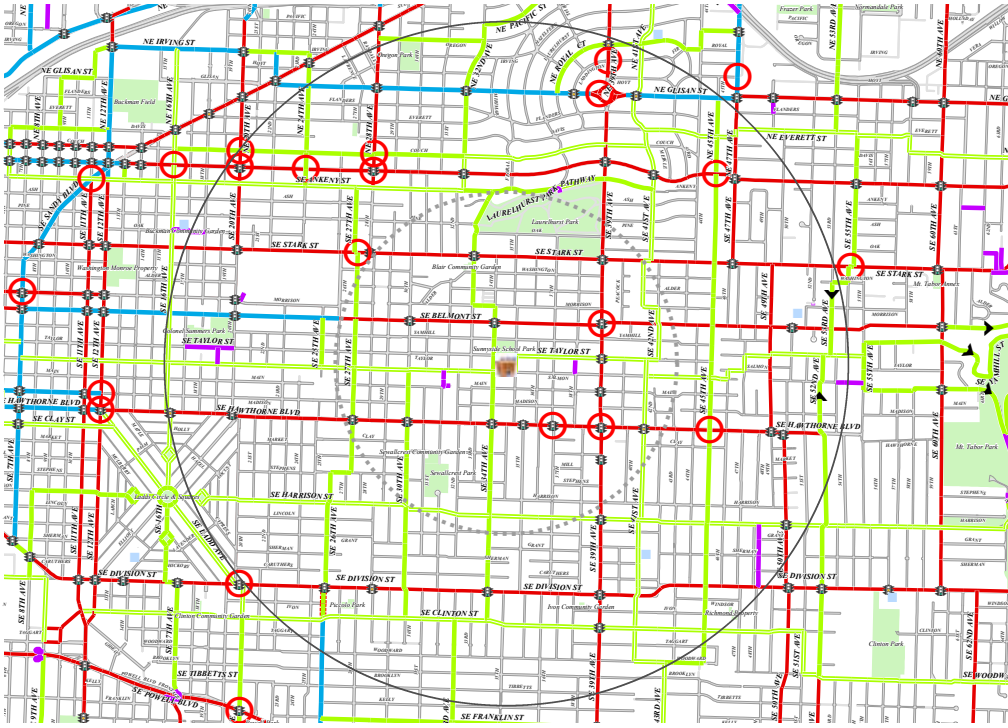
GIS mapping can assist in identifying the number of automobile accidents related to school traffic.

By making crash data geographic, as well as time-based, people can better understand when and where crashes are occurring. These data can be compared between schools that have varying percentages of students that get to school by walking, bicycle, car or bus. By plotting vehicle crash data, GIS can help identify crashes that happen on the way to and from school and other locations that might be avoided, or where to focus infrastructure or safety improvements, if those students walked or rode a bicycle instead of commuting in a car or bus.

GIS Maps Crash Data Surrounding New York City Schools

In April 2003, New York City Department of Transportation used GIS mapping to improve traffic safety around public schools.

The city used GIS mapping to identify the highest need schools by collecting crash information within a 700 foot radius around 1,426 schools. 135 schools were selected for priority treatment based on location and accident data that were collected at intersection and mid-block locations throughout the city. Once selected, each school underwent meetings with parents and other interested parties, collection and analysis of data concerning traffic conditions and student travel patterns and development, evaluation and approval of comprehensive short-and long-term pedestrian safety improvement measures. All of the short-term safety improvements at the first 135 schools are complete.



Sunnyside Environmental K-8 -
3421 SE Salmon St

The Portland Bureau of Transportation produced Safe Routes Maps for Schools to identify the best ways for students to bike and walk to school. Their goal is to make family-friendly maps that were easy to read and colorful.

CONCLUSION

The April 2013 meeting was considered a success by all that attended.

All attendees reported that they were excited to be involved in this initiative and expected that this overall effort would foster a new national conversation regarding the collection, storage and accessibility of non-motorized infrastructure data. The group agreed that the presence of a federally-operated database, as well as standards for data collection, would be vital to ensure the success and sustainability of active transportation.

A webinar will be held on July 11, 2013 to present the major recommendations that came out of the meeting as well as the highlights from this report. The hope is that this report and the webinar will serve as informative guides for communities that are interested in taking control of their own data and give them the power to better understand GIS tools and how GIS maps can identify issues that need to be addressed.

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Footnotes

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