Mobile and Web Technologies for Bicycle and Pedestrian Planning

A Collection of Case Studies

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ABSTRACT

Rising interest in bicycle and pedestrian travel, coupled with a boom in mobile and web devices and applications, creates ample motivation for leveraging these technologies for planning. This project involved surveying several mobile and web solutions applicable to bicycle and pedestrian planning. Six case studies highlight current and potential uses of these technologies in the U.S.

Several conclusions were reached.

- Technologies exist to abate challenges in data collection for bicycle and pedestrian planning (e.g. existing conditions research; bicycle and pedestrian counts) and to support encouragement programs; however, other challenges remain (e.g. reliability; equity concerns; incomplete exposure data; funding).
- A local champion can help facilitate the infusion of technology into the planning process.
- Funding for these innovative solutions is limited, perhaps because the technology has not yet been widely tested.
- In general, these solutions are inexpensive and can save staff time.
- Adoption is rare likely due to funding issues and a lack of awareness.

Opportunities exist for the American Planning Association to distribute information about technology and planning efforts, particularly through its Technology Division and their Planning & Technology Today newsletter. Events such as PlanningTech@DUSP, Transportation Camp, and Summer of Smart provide a communication channel between technology developers and planners so that future versions of these technologies respond to the reliability, equity, and incomplete data concerns. Webinars on this topic, with speakers from both the planning and technology sides, create an additional feedback channel to planners both to spread awareness and make the case to funders.
INTRODUCTION

Purpose of the Report

This report surveys web and mobile technologies that are or could be used for bicycle and pedestrian planning; planners in practice may use it as a resource and for guidance. Several examples of mobile and web technology have been catalogued and presented in tabular fashion in the appendix, categorized by their function, primary field of use, and cost. From this set, six case studies are presented to highlight the power of these solutions. This report provides the framework for further case studies to be developed. Given the pace of innovation in this space currently, the list of case studies should be updated frequently.

Recent Trends

Planners’, politicians’, and the public’s awareness of bicycling and walking as viable and equitable travel modes that can improve health, stimulate economic activity, save individuals’ money, and promote social cohesion is increasing.1 At the same time, the web and mobile industries also are experiencing extreme growth; by 2009, about 87 percent of adult Americans had access to the internet2 and by 2014, mobile internet users are expected to surpass desktop internet users.3

The link between the two trends is not immediately obvious, but as this paper demonstrates, progressive transportation professionals and innovative tech start-ups are increasingly working together to exploit the synergies that exist. Providing proof of the ubiquity of mobile tech use is the existence of mobile apps like TextVision, Type ’n Walk, and Email ’n Walk that allow users to “see through” their phones while walking and interacting with the device by utilizing the built-in camera. People use mobile technology while traveling, whether by walking, biking, driving, or riding transit.

The broader trending concepts of government 2.0, smart cities, and intelligent infrastructure offer further evidence of increased attention on technology for planning. Large technology corporations such as IBM4, CISCO5, and Phillips6 as well as the Rockefeller Foundation7 are focusing money and effort on these very ideas, both stimulating and taking cues from some of the smaller, ad-hoc uses of technology on the local scale. Companies such as Living Labs Global8, Code for America9, and Apps for Democracy10 have built their model around the incubation and promotion of these ideas. Several conferences also have covered this topic recently, including the American Planning Association’s annual meeting in Boston, PlanningTech@DUSP – a one-day conference held prior to APA on MIT’s campus, and Transportation Camp East and West – an “unconference” on transportation and technology.

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Why is this Important?

Benefits to be achieved

This report is motivated by the benefits to be achieved by improvements in bicycle and pedestrian planning. In surveying various technological solutions, I found that most can aid planners in their evaluation and encouragement programs, although some could be applied in multiple areas of the 5 E’s (engineering, education, encouragement, enforcement, and evaluation). Mobile and web technologies offer the potential to expand the scope, speed, and/or efficiency of bicycle and pedestrian planning efforts beyond what is done using traditional means. In this way, bicycle and pedestrian professionals have the potential to increase more holistically, more quickly, and more efficiently the benefits of bicycle and pedestrian travel.

Expressed need

In a recent assessment, the Bureau of Transportation Statistics (BTS) rated several types of bicycle and pedestrian data on the quality of existing data and the priority for better data.\(^1\) In BTS’s recommendations, they call for the enhanced use of technology for data collection and dissemination. Additionally, they highlight the need for summary reports of exemplary applications. This report is one such effort.

The overarching desire for employing mobile and web technologies in bicycle and pedestrian planning are also the underlying motivations for bicycle and pedestrian planning in the first place. The Alliance for Bicycling and Walking’s 2010 Benchmarking Report lists benefits to be found in increased biking and walking – including environmental, economic, and personal health.\(^2\) For planning practitioners and researchers, improved data could enable:

- improved estimation of these benefits of bicycling and walking facilities;
- comparison of bicycle and pedestrian injuries with overall levels of bicycling and walking (exposure data);
- targeted public health interventions for physical activity and injury-prevention; and,
- estimation of the value of health and economic impacts for use in cost-benefit analyses, improving decision-making by planners and elected officials.

For advocates, mobile and web applications offer the opportunity to:

- inform advocates on physical locations or topics where attention is most needed;
- connect like-minded individuals who build coalitions;
- provide powerful and convincing statistics for use in funding requests (also beneficial to public planners); and,
- facilitate direct communication between concerned citizens and advocates or elected officials.

On top of data-driven evaluation programs, bicycle and pedestrian planners need to develop effective encouragement programs. Because these technologies’ core functionality revolves around information and communication, they also function well as encouragement tools by:

- reinforcing the benefits of biking and walking through positive, personalized feedback to the individual; and

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providing individuals with a sense of ownership over travel decisions.\textsuperscript{53}

What these technologies do not solve

While mobile and web technologies have benefits for bicycle and pedestrian planning, they are not a panacea for the current data collection, information dissemination, and movement-building challenges in the field. The problem of gathering information from and engaging the low-income and minority populations still exists and is hardly solved with these technological advances. While some of the case studies could have positive implications for these populations, it remains a challenge to reach populations with limited access to the internet at home or through a mobile device,\textsuperscript{14} especially with applications that are available in English only.

Secondly, because the majority of the consumer-based technologies profiled require users to opt-in in order for the solution to be useful, data samples are biased. Those who are interested \textit{a priori} in an issue (like bicycling or the quality of their neighborhood sidewalks) are more likely to participate. Therefore, samples could be biased to the extent that those who are interested also tend to bicycle or walk more (or less). Results should be tempered accordingly.

Third, the overall proliferation of mobile devices does not mean that they are accessible throughout an entire day due to data connection and power issues. Currently, their GPS capabilities cannot be used continuously without depleting the store of battery power. Therefore, it is less likely that solutions requiring always-on GPS technology will be opted into frequently or over long periods of time. This has consequences for their adoption rates. \textit{What this report does not cover}

With a purpose of informing bicycle and pedestrian planning professionals of new tools for data collection and encouragement programs, the case studies do not cover mobile and web solutions targeted specifically at individuals to track fitness through bicycling, walking, or running. A plethora of applications exist that serve this purpose (e.g. Strava, DotBiking, MapMyRide, MapMyRun – see Appendix A), however they are not directly applicable to planners because the data they collect is not open and it would be difficult for a public agency to endorse a particular private product. That said, these applications could serve as models for publicly-developed solutions (such as CycleTracks) or create an opportunity for public-private partnerships.

Format of this Report

The main report provides six case studies as examples of web or mobile technology use for the facilitation of bicycle and pedestrian planning (CycleTracks; Walk Score®; TurnCount), for encouragement of these modes of travel (Dero ZAP!; SoBi), or both (SeeClickFix). A concluding section summarizes implications based on these case studies and recommendations are given for improving the integration of technology in this field. Two appendices are also attached; Appendix A provides a tabular listing of other technologies that can be used in similar ways, but that have not yet been profiled in detail. This list represents an opportunity for further research. Appendix B provides a brief list of related literature with short summaries.


CASE STUDIES

CycleTracks and the San Francisco County Transportation Authority

Screenshots

Figure 1.0: CycleTracks iPhone app. Images from Apple App Store.

Figure 1.1: CycleTracks Android app. Images from Android Market.

Background

The San Francisco County Transportation Authority (the “Authority” or TA) is the Congestion Management Agency (CMA) and long-range transportation planning entity for the City and County of San Francisco. The TA administers and oversees the delivery of the “Proposition K” half-cent local option sales tax. As such, they analyze, design, and fund improvements for roadway and public transportation. The TA also owns SF-CHAMP, San Francisco’s official travel forecasting model.  

Problem

The Authority uses an activity-based model (SF-CHAMP) for long-range transportation planning in order to predict future travel patterns for the city. In general, modeling the bicycling mode is challenging at best and impossible at worst due to a lack of data on these travelers. The lack of data on bicyclists in most regions arises from the data collection process itself. Typically, a randomized travel survey is administered that rarely captures a sufficient amount of trips by bicycle for the purposes of modeling bicyclist behavior. The activity-based model, SF-CHAMP, had historically relied on annual or bi-annual spot location bicycle counts at 32 different intersections,\(^{16}\) which had enabled forecasting of the quantity of bicycle trips but not those trips distribution across the road network.\(^ {17}\)

**Solution**

Billy Charlton, Deputy Director for Technology Services at the TA, led the development of a smartphone app for iPhone and Android, CycleTracks, that allows users to track their cycling route, distance, time traveled, trip purpose, and personal characteristics (if they so choose). CycleTracks collects these data anonymously and integrates it with current trip data for automobile and transit. It was partially funded by a Caltrans State Planning and Research Grant. Elizabeth Sall, Senior Transportation Planner with the TA, led the team that incorporated the CycleTracks data into SF-CHAMP.

From the individual’s perspective, the app is downloaded and personal characteristics including age, sex, work, home, and/or school zip code, and email address can be entered and saved to link with all reported trip data. After the initial setup, the user simply turns on the app and presses the button to start tracking. When finished, the cyclist can select trip purpose (e.g. work, social, etc.) and save the route. The information is then relayed to the TA’s database as well as stored locally for the user to access later.

**Results**

Some concerns with the app include the biased sample of data it collects (smartphone-using cyclists only), a tendency of the app to misreport distance traveled, tracking initiation lags, its heavy-use of battery power, and the need for cyclists to “opt-in” and voluntarily track their trips.

Despite these challenges, the current availability of cycling trip data is so sparse that this is app is almost guaranteed to improve the TA’s understanding of cyclists’ needs. Charlton, along with fellow CycleTracks team members Elizabeth Sall and Jeffrey Hood, report that,

> Because participation was limited to smartphone users, and because the greatest selection rate likely occurred among members of the bicycle coalitions that helped promote the application, the sample is biased. However, this drawback was outweighed by the advantages of the data collection method: reduced cost, increased rates of sampling for the small population of cyclists, and the ability to record personal characteristics and trip purposes.\(^ {18}\)

Over the 5-month period between November 12, 2009 and April 18, 2010, 952 of 1,083 users who downloaded the application submitted at least one trip. In all, 7,096 trips were collected. But, because the app is freely available to all iPhone and Android users, this set had to be restricted to San Francisco-based trips and non-exercise trips for the purposes of developing a bicycle route choice model, leaving


5,178 trips. Further data cleaning revealed that some of these trips were likely not made by bicycle, and in the end 3,034 bicycle trips from 366 users could be utilized.\textsuperscript{19}

The app has received 92 ratings on the Apple App Store with an average 3 out of 5 stars. The written reviews reveal frustration of the app’s frequent crashing, inability to pause and resume mid-trip, and high battery use, though early reviews were generally positive. On the Android Market,\textsuperscript{20} the app gets 3.8 out of 5 stars. The written reviews are generally positive and reveal minor frustrations with the interface and unintuitive features.

With the above limitations in mind, the first 5 months’ worth of bicyclist travel data produced the following conclusions: that San Francisco cyclists strongly prefer bicycle lanes to other types of bicycle facilities and disfavor climbing hills, making left turns, and deviating excessively from minimum distance paths. These conclusions were revealed by a multinomial logit bicycle route choice model, developed with the collected data, which is now fed into SF-CHAMP.\textsuperscript{21}

These conclusions are consistent with much of the literature on bicyclists’ preferences,\textsuperscript{22} however disagree with one study that suggests cyclists prefer shared-lane bicycle routes to bicycle paths.\textsuperscript{23} Hood, Sall, and Charlton (2011) suggest this is due to different methods of data collection – stated versus revealed preference – and highlight the importance of employing both methods to get complete understanding of cyclist travel behavior.\textsuperscript{24} The information gathered using the app is currently being integrated into San Francisco’s regional travel model.\textsuperscript{25}

Mindful of the fact that all modeling agencies face the same challenges for cyclists’ data, the TA makes the app’s source code available to developers who can build upon its core functionality.\textsuperscript{26} It already has the functionality to collect data in any locality; this means that other municipalities could quickly develop their own local version and begin collecting data on their own cycling population. In theory, the app could also be used to track pedestrian data and enhance modeling of that mode, though this use has not yet been documented.

Monterey, California, Eugene, Oregon and Bryan-College Station and Austin, Texas have been adapting CycleTracks for local use.\textsuperscript{27} Joan Hudson of the Texas Transportation Institute (TTI) has been leading the development in Austin. In May and June of 2011, their team promoted the app through social media, email lists, and bicycle groups and shops, and worked with the TA to gain access to the collected data. This first push garnered about 1,900 recorded trips, but only about 200 users. This fall, they’re promoting the app again but through different channels: The Chronicle (a free weekly newspaper); Southwest Cycling News (published every 2 months); and Austin on Two Wheels (an online bicycle magazine). The hope is to reach a broader spectrum of the population, and while they would like to offer incentives for using the app, they are unable to do so for user privacy reasons. The research and data collection is on-going.\textsuperscript{28}

Cost

\begin{itemize}
\item \textsuperscript{19}Hood, et al. (2011). pp. 64-65.
\item \textsuperscript{21}Hood, et al. (2011). p. 15.
\item \textsuperscript{22}Dill, J. & Carr, T. (2003). Bicycle commuting and facilities in major U.S. cities: If you build them, commuters will use them. Transportation Research Record, 1828, 116-123.
\item \textsuperscript{23}Sener, I., Eluru, N., & Bhat, C. (2009). An analysis of bicycle route choice preferences in Texas. Transportation, 36, 511 – 539. Note: the SFCTA argues that this difference may be the result of different research methods (stated vs. revealed preference) and environmental differences between the two study areas (Hood et al., 2011).
\item \textsuperscript{24}Charlton, et al. (2011).
\item \textsuperscript{25}S. E. Sall, personal communication, August-September 2011.
\item \textsuperscript{27}B. Charlton, personal communication, April 28, 2011; E. Sall, personal communication, October 5, 2011.
\item \textsuperscript{28}J. Hudson, personal communication, September 6, 2011.
\end{itemize}
Initial development costs for the TA were under $20,000 (though this does not include staff time to promote the app or analyze the resulting data). It cost only $250 to make the app ready-to-use for Austin. For the larger data collection, research, and analysis effort, they found funding through Texas A&M’s University Transportation Center for Mobility ($72,000), the Texas Department of Transportation ($10,000), and the City of Austin ($3,000 of in-kind services) for a total of $85,000.

**Other Potential Uses**

This app could also be enhanced to provide encouragement. Similar to some other cycle trip-tracking apps, CycleTracks could provide the user with a lifetime calories burned, CO2 and gasoline saved. One of the reviewers of the app on the Apple App store mentioned a desire for web access to their personal data, complete with an elevation profile of their bicycle trip. The app might also present the individual’s data in comparison with the aggregate or even with friends’ data, creating friendly competition among bicyclists.

**Further Info**

Elizabeth Sall, SFCTA Senior Transportation Planner, (415) 522 – 4810

Joan Hudson, Texas Transportation Institute, (512) 467 – 0946


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31 J. Hudson, personal communication, September 21, 2011.
Dero ZAP! and the Downtown Minneapolis Transportation Management Organization

Screenshot

Figure 2.0: ZAP! Device

Figure 2.1: User Dashboard

Figure 2.2: User login page

Images obtained from Colin Klotzbach, Web/Graphic Designer for Dero Bike Racks.
**Background**

Dero Bike Rack Company’s (Dero) core business is not high tech-related; it is simply to provide high-quality, functional, and attractive bicycle racks. They were founded in 1995 in Minneapolis, Minnesota and are strong supporters of the bicycle not only as recreation but as transportation.32

Commuter Connection, a program of the Downtown Minneapolis Transportation Management Organization (TMO), was created in 1991 by the city council and is a public-private partnership between the City of Minneapolis and downtown businesses.33 They have developed a plan to employ one of Dero’s newest products, the ZAP!, as part of an encouragement and evaluation program.34

**Problem**

The TMO created Commuter Connections to serve employers and employees of downtown Minneapolis. They have a core interest in promoting the use of transit, biking, walking, vanpooling, and carpooling due to these modes’ ability to support a “vital and growing downtown Minneapolis.”35 They offer advice to commuters on how they can incorporate these modes into their commute. They also work with employers and property owners to provide on-site promotion of alternative modes.

In 2010, Commuter Connection worked with downtown businesses to employ a State Health Improvement Program, a state-funded grant program to promote longer, better, healthier lives for Minnesotans, 36 to provide bicycle education, rewards, and an assessment of the current bicycle and walk-friendliness of each participating worksite. As part of this program, employees of the six partner businesses were asked to log on to a website and track their commute trips in an effort to obtain valuable data for program evaluation. Commuter Connection found that this self-reporting method was unreliable as commuters were inconsistent in their reporting. They needed a solution for automatic tracking that did not require manual entry.37

**Solution**

**Product Description:** In 2009, Dero had received a request from the University of Minnesota to develop an accurate and reliable system to count bicycle usage. This request was the impetus for Dero to expand beyond their traditional offering of bike racks and develop a wireless, solar-powered device that tracks cyclists called the ZAP! (see Figure 2.0).38

**How It Works:** Cyclists attach a radio frequency identification tag (RFID) to their bicycle wheel (if removed, it becomes de-activated). The distribution of these tags differs in each application of the device, but typically an employer or other program administrator will distribute RFID tags to participants, usually charging only for replacement tags (about $15 or less). When the tag rolls within thirty feet of a ZAP! device placed on the worksite or city street (see Figure 2.0), the cyclist’s trip is captured. Data is sent from the solar-powered device to Dero’s backend database every 50 minutes through a wireless connection.

**Purpose:** Data collected by the device is then incorporated into an encouragement program, whereby commuting cyclists earn rewards points or other benefits (e.g. free gym memberships, discounts on health

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37 Commuter Connection, 2010.
38 M. Anderson, personal communication, April 29, 2011.
care) each time they are “zapped” by the device. They also can log in to a web-based “dashboard” – a website that ZAP! users log in to (see Figure 2.1) – to track their own activity over time and compare their total rides, miles biked, calories burned, pounds of CO2 reduced, and gallons of gas saved to that of other bicyclists using the same device. The aggregate data for an employer or city program is available to the administrator who can use the data for program evaluation.

**Product Application:** Seeing the ZAP! as a tool for enhanced encouragement of bicycle commuting, the Downtown Minneapolis TMO had proposed a plan whereby the City would install fifteen Zap devices in a cordon around the downtown. Commuter Connection would administer the system, providing marketing and communications, registrations, educational events, and analysis of the resulting data for application to the League of American Bicyclists’ Bicycle Friendly Communities program. When a commuter joins the system, Commuter Connection would register their bicycle with the National Bicycle Registry (a theft-prevention program) and provide an RFID tag for $15/bicycle, which links the bicycle to the particular commuter. The plan proposes to award one “point” for each zap; users can redeem points online for bicycle gear and services. Administrators with Commuter Connection would have access to the participant usage data, enabling better program evaluation with the potential to expand to a larger data-collection effort.

**Results**

While Dero’s ZAP! product has seen initial success, Commuter Connection has had a difficulty finding funding for their proposed plan. As one of four communities nationwide involved in the Federal Highway Administration’s (FHA) Non-Motorized Transportation Pilot Program (NTPP), Commuter Connection first looked for funding through FHA. Because the ZAP! device is so new, they were unable to provide evidence of the proposed plan’s ability to shift commuters to non-motorized modes, and therefore were unable to secure NTPP funding. In a continued effort to find funding for their project, they have reached out to the Target Corporation, whose headquarters are in Minneapolis and who has an established community investment program. Their program, however, is focused on children in grades kindergarten through high school and so is not a perfect fit for a commuter-based incentive program. Lastly, they are exploring individual sponsorship of each device in the cordon ring; a challenge is to convince individual employers to fund a device that will benefit other, non-contributing employers.

**Cost**

The overall cost of a ZAP! program depends on the scale of implementation. Each ZAP! unit costs $6,500 plus $4 per RFID tag. For the TMO’s proposal, infrastructure costs would total $97,500 plus the cost of the tags.

**Other Uses**

**Universities:** The University of Minnesota won a $560,000 grant from Bike Walk Twin Cities via the Non-Motorized Transportation Pilot Program and will contribute approximately $200,000 of their own funds for the development of their commuter incentive program. As part of the program, the university has installed and tested one Dero ZAP! device on campus and is currently in the process of installing the full system of 17 devices. As part of the campus Wellness program, they will be offering cash compensation for bike commuters, with the idea being to normalize bike commuting as a healthy option by eventually tying it to health insurance reductions. The grant will also allow for the development of a supporting

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40 Steve Sanders, personal communication, April 29, 2011.
system of education (class offerings), services (meeting space), and infrastructure (e.g. showers, secure bike parking).

**Schools:** Seward Montessori, Minneapolis, Minnesota has been using a device to incentivize children’s bicycle and walking travel since 2009.\(^\text{42}\) It is viewed as a way to reduce traffic congestion, improve air quality, promote a sense of neighborhood community, and motivate kids to develop lifelong healthy habits.

**Retail:** Seward Co-Op (a local grocer) has installed one device in connection with its point-of-purchase system to encourage their employees and customers to travel to the grocery store by bicycle. They view it as a way to achieve their mission of “sustaining a health community through environmental and socially responsible practices.”\(^\text{43}\) The device cost $6,500 with installation; the variable cost of the RFID tags are covered by the Co-Op, but replacements must be paid for at $4.

**Further Information**

Mike Anderson, ZAP Product Manager, (800) 891-9298

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Walk Score® and the Washington, DC Office of Planning

Screenshots

Figure 3.0: Image from www.walkscore.com

Figure 3.1: Image from www.walkscore.com

Background

Walk Score® is a web-based tool developed by Front Seat, a civic software company based in Seattle. The product was launched in 2007, initially gaining traction with real estate professionals who could use it to promote properties. Front Seat’s initial vision for the product was to inspire real estate ads to include a measure of walkability in property descriptions: “2 bedroom, 1 bathroom, 1,000 square feet, Walk Score 87.” Since then, the product has been tailored to meet the needs of other industries, such as news media, academia, and public-sector research and planning. The Washington, DC Office of Planning is one of the governmental entities to take advantage of Walk Score’s data in its regional- and neighborhood-scale planning efforts.

Problem

Front Seat’s relationship with their local planning community alerted them to a then-new buzz word in planning: walkability. Inspired by the need of planners to better measure walkability, the Sightline Institute’s work on mapping walking distances in different neighborhood types, and the health, environmental, social capital, local business, and community benefits of walking, Front Seat wanted to address the challenge of promoting car-lite lifestyles.

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A market for this product had been developing as planners and researchers began studying the concept of walkability and its effects on regions and neighborhoods. The DC Office of Planning (DCOP) is led by Director Harriet Tregoning who, according to one staffer, is a “data guru” that advocates for the use of data and statistics for making stronger arguments and justifications. Under her leadership, DCOP searched for new ways to integrate numerical measures of walkability into existing conditions analyses in developing plans. While academic research provides insight into the measures of the built environment that relate to walkability, an easy- and ready-to-use tool and data source would address the need more directly.

Solution

Walk Score uses an algorithm that scores each address in a city on a scale of 0 – 100. Points are awarded based on the proximity of the address to nearby amenities such as restaurants, grocery stores, parks, and transit stops. Amenities within a quarter-mile of the address receive the maximum amount of points available, while amenities at greater distances receive less. The current version of the product uses “as-the-crow-flies” distances from the address to nearby amenities. A beta version, called Street Smarts Walk Score, refines the algorithm by using network distances and weights for different types of amenities (e.g. grocery stores are viewed as three times more important to walkability than banks, parks, schools, books, or entertainment options). Street Smarts Walk Score is available online as a preview.

Director Tregoning sees opportunities to combine the Walk Score® with affordability indices, retail attraction, and regional and neighborhood planning. Through her championing of the technology, staffers in DCOP now use Walk Score® routinely when developing plans to understand how easy it would be to encourage pedestrian activity in certain areas and where pedestrian conditions could be improved. Because of its improved methodology using network distances and amenity weights, DCOP prefers the Streets Smarts Walk Score.

Results

One example planning effort in which Walk Score® was used is the 14th Street Corridor Vision Plan and Revitalization Strategy, an ongoing effort within DCOP. Gizachew Andargeh, Neighborhood Planning Coordinator in Ward 7 of DC, recounted the process. The 14th Street plan was initiated by a citizen-led effort to improve physical storefronts and the quality and variety of commercial retail options along a 1.2-mile stretch between Spring Road and Longfellow Street. The ongoing effort has utilized Walk Score® as an existing conditions metric, identifying an initial score of 70 at a representative address. The scores range from the mid-60s to the mid-80s along the corridor with the highest scores at the southern end. With this score, the area is classified as somewhat to very walkable, which DCOP used as a gauge of the feasibility and effectiveness of promoting more pedestrian activity along the corridor. DCOP was also able to use the Walk Score® as a means of guiding conversations in advisory committee meetings.

As this effort is ongoing, Andargeh said DCOP has not utilized the Walk Score® as a performance measure, but expects to do so in 2-3 years after improvements have been made. While the original Walk Score® was used in this study, he said he plans to use the Street Smart Walk Score® in the future.

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46 G. Andargeh, personal communication, September 29, 2011.
50 G. Andargeh, personal communication, September 29, 2011.
Andargeh also expressed some limitations of the tool and stressed the need to use it only in conjunction with other methods, such as site visits and conversations with community members. It cannot measure the quality of the pedestrian experience (such as visual appeal or relevance of retail options), upon which the 14th Street planning effort had been predicated.

Cost

Use of Walk Score’s website is free. Data provided by request for research purposes varies based on the information requested. For up to 10,000 addresses, Walk Score (and the related Transit Score) are $500. Street Smart Walk Score for these points is an additional $1,000.

Limitations

Andargeh noted several limitations of relying on Walk Score®, and the company acknowledges its shortcomings explicitly.51 While the algorithm is based on recent research around walkability, it does not account for these factors that also affect the propensity to walk:52

- **Street design** – details like sidewalk presence or width, speed limits and actual automobile speeds, tree cover, street furniture are not included
- **Safety data** – crime and crash data are not included although safety issues present significant barriers to the walkability of a neighborhood
- **Pedestrian-friendly community design** – the algorithm lacks input on urban design features like building setbacks, clustering of destinations, parking placement, and frequency of storefronts that make a place more desirable for walking
- **Topography** – no data on street or sidewalk slopes is included, which is also an inhibitor of walking
- **Weather** – neither current conditions nor yearlong climate patterns are included

Because of these limitations, Walk Score® cannot be relied upon as a comprehensive indicator of walkability and should be used with these caveats in mind.

Other Potential Uses

In Director Tregoning’s presentation to the 2010 Smart Growth Conference, she noted several potential uses for Walk Score including tracking plan implementation progress and investment evaluation, defining regional activity centers, and as an employer recruiting tool.53

Use of Walk Score within planning documents also can help raise the public’s awareness of the tool, which is intended to stimulate a preference for car-lite lifestyles and awareness of the concept of walkability. It can help frame conversations with advisory committees and prioritize areas of focus in small area or corridor plans.

A natural extension of the product itself is the development of a future scenario modeling tool, enabling cities and regions to measure how walkable an area will be in the future given planned zoning and development. As of April 2011, this functionality has not yet been developed.54

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53 Tregoning, 2010.
Durham, North Carolina-based Triangle Transit recently developed a “Neighborhood Transit Readiness Scorecard” tool using Walk Score data for rating transit- and pedestrian-friendly communities, the methodology of which is repeatable by any individual or local government using GIS. They highlight the scorecard’s utility for assessing what types of investments and regulatory changes are necessary to create these types of “livable” environments, making future scenario testing possible. The scorecard is based on research done by Robert Cervero and Reid Ewing, which finds that “3 D’s” of the built environment are determinants of walkability: design, density, and diversity. The scorecard utilizes Walk Score, which measures the variety of amenities within walking distance of an address, as a proxy for land use diversity. Triangle Transit used the scorecard to grade several neighborhoods in its service area to determine those that are already transit-supportive and those that will need improvements before regional rail is implemented.

Walk Score’s algorithmic framework lends itself to a “bike score” methodology as well. This would come with all the benefits and limitations of Walk Score, but would be an additional standardized measure of bikeability. The Walk Score team is currently collecting users’ suggestions on the most important components of a bike score.

Lastly, additional qualitative data about places could be added. Because data on crashes is publically available nationally through the National Highway Traffic Safety Administration and crime data is available through websites like SpotCrime, these elements of walkability appear to be feasible additions to the Walk Score algorithm, making it a more comprehensive measure. Conversations with a SpotCrime representative revealed that this type of data integration is feasible. Yelp or other customer review data could be used to gauge the quality of retail in an area, adding another layer of sophistication to the tool.

Further Information

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Gizachew Andargeh, Ward 7 Neighborhood Planner, District of Columbia Office of Planning, (202) 442-7600, gizachew.andargeh@dc.gov

Patrick McDonough, Senior Planner, Triangle Transit, 919-485-7455, pmcdonough@triangletransit.org

Aleisha Jacobson, Office Manager and Customer Support, Walk Score, aleisha@walkscore.com

54 A. Jacobson, personal communication, April 28, 2011.
**TurnCount**

**Screenshots**

![Figure 4.0: Images from Gary Shoup, developer of TurnCount.](image)

**Background**

TrafData, the private company that created TurnCount, was formed in 2009 with a mission to transform software for collecting transportation data. In their view, the traditional process by which proprietary software is distributed to businesses, universities, and governmental agencies is no longer acceptable – repairs and updates are physically cumbersome and the software is poorly designed, inflexible, and unintuitive. Smartphones and tablet computers have changed the market, allowing for quickly-distributed and updated software that is simple and easy to use.60

**Problem**

In the case of bicycle and pedestrian data, an overarching problem is the lack of documentation on usage and demand for facilities. This data is crucial in development review and planning processes such as needs assessment and improvement recommendations. One of the ways this data is collected is through manual counts, which are able to record the volume and turn movements of bicyclists and pedestrians (with automated counts, turn movements have to be inferred). Currently, this effort requires the use of paper worksheets or mechanical or electronic count boards, which can cost hundreds or even thousands of dollars.61 If one is to avoid the expense of electronic count boards, paper worksheets and mechanical count boards require manual data entry, a time-consuming and error-prone process.

**Solution**

TurnCount, TrafData’s apps for iPhone and iPad, provide minimalist interfaces that simulate the layout of an intersection. With the swipe of a finger, through-moving and turning traffic can be counted and categorized as automobile, truck, bicycle, or pedestrian.62

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When counting is finished, the data are immediately available in reports in various file formats, including CSV (time-stamped data for each count event), PDF (summary of the counts in intervals), HTML (corresponds to the PDF file), and UTDF (for TrafficWare products) and can be imported into a GIS formats. Data are aggregated in either 5 or 15 minute intervals for the summary; for counting sessions lasting longer than an hour, the app provides the analyst with a peak hour calculation. Appendix C contains a sample PDF output report.

Results

So far, TurnCount’s adoption has been mostly geared towards automobile counting. However, Gary Shoup, the app developer, cited three cases for its use for bicycle and pedestrian counting. A group in the United Kingdom had been organizing a large, volunteer-led data collection effort for these modes using TurnCount. The MPO for Springfield, Massachusetts has also expressed interest in the app, citing a desire for even more detailed modes such as skateboarders and roller bladders. This functionality could be particularly useful along greenways or off-street paths. Lastly, Alta Planning and Design has expressed interest in deploying the solution as part of the National Bicycle and Pedestrian Documentation Project, whereby count days are designated nationally to encourage consistent and frequent samples.

Shoup reports that the app has been sold to small cities, MPOs, and consulting agencies across 18 different countries. He estimates that most users are those who already have access to Apple hardware and previously had no way to collect counts electronically, suggesting that his app could broaden the set of municipalities who perform bicycle and/or pedestrian counts.

On iTunes, the app gets 4.5 out of 5 stars. Reviewers highlight the app’s affordability and efficiency, which contrast starkly with the traditional count boards. One reviewer, who works for a consultancy, notes, “The icing on the cake is that we can take the HTML report, copy/paste the numbers into our counter software and deliver files to our clients in a file format they can work with.” A public-sector planner reports, “My City has already saved thousands of dollars that otherwise would have been spent on consultants with more traditional traffic count boards.”

Cost

TurnCount costs $29.99 on the iTunes Store. This does not include the price of an iPod or iPad, though one consultant has found that even with these costs, TurnCount is a far cheaper solution than other count boards currently on the market. Shoup reports, “People compare the cost of the TurnCount app more to Angry Birds [a mobile game] than they do other traffic data collection software.”

Limitations

Use of the app requires an iPhone or iPad, devices that most city departments currently do not invest in. Reviewers of the app on the iTunes store note that the mechanics of using TurnCount are intuitive to anyone who has used traditional count boards, but that the buttons are more sensitive and practice is needed. That being said, reviewers still believe the app provides improved data accuracy.

Other Potential Uses

This app is most useful as a simplistic counting tool. Aside from the city-led volunteer counting efforts mentioned here, the app may also be useful to traffic impact analysts in conducting traffic impact statements for development, plan, or policy review. The new Highway Capacity Manual 2010 includes

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64 Spack, 2011.
improved measures of bicycle and pedestrian level-of-service that could inspire these measures’ inclusion in traditional traffic impact statements.

A suggestion was made by one app user to integrate the technology with DropBox, a file sharing service that provides file access to multiple users, updating automatically. This would enable the count data to be shared between consultants and public-sector clients immediately following data collection.

Further Information

Gary Shoup, Founder, TrafData, support@trafdata.com
SeeClickFix

Screenshots

Figure 5.0: Pedestrian issue reported. Image from Emma Richards, SeeClickFix

Figure 5.1: Bicycle issue reported. Image from Emma Richards, SeeClickFix.
Figure 5.2: Bicycle lane issue reported via SeeClickFix Facebook application. Image from Emma Richards, SeeClickFix

Figure 5.3: Bike lane image with report from Figure 5.2. Image from Emma Richards, SeeClickFix
Background

Ben Berkowitz, founder of SeeClickFix, was inspired after leaving several voicemail messages and waiting in line at City Hall to deal with a chronic graffiti problem on his street – why had it taken so long to get the issue resolved? With friends based in New Haven, Connecticut, he built a web and mobile-based solution that launched in March of 2008.65

Problem

Every city develops spot-specific issues with public infrastructure and/or operations of public services. Traditionally, these issues have been reported by city employees themselves or by a few very concerned citizens. Many citizens remain uninvolved in local service issues; those who have are often frustrated with how their complaints are managed or the lack of response by officials. A cheaper and more efficient non-emergency problem management system is needed in order to encourage more citizen participation, more city response, and better public spaces and services. For bicyclists and pedestrians, unresolved issues such as potholes, graffiti, and obstructed rights-of-way are deterrents to bicycling and walking that need to be addressed.

Solution

SeeClickFix provides the web and mobile technology to crowdsourc (i.e. outsource the task of issue reporting to large groups of people or communities, “crowds”) the reporting of these issues, send alerts directly to the responsible party in city government, and provide transparency to the citizen and the community at large on whether or not an issue has been simply acknowledged or fully solved. When a user logs an issue on the SeeClickFix website, through the mobile app, or through the Facebook application, it is viewable to the public as “open,” “acknowledged,” or “closed” – providing a layer of accountability for local governments. Issues remaining “open” or “acknowledged” for too long reflect poorly on city management and a neighborhood’s elected officials.

While not explicitly related to bicycle and pedestrian infrastructure, many of the citizen reports concern sidewalks and streets. All historical data collected by the site are available online and can be downloaded in a number of formats (e.g. Excel); cities who are paying clients receive monthly reports of all outstanding issues. This information is meant to empower local neighborhood groups and advocates who can identify trends (for example, a particular bike lane is chronically blocked by trash receptacles), inform local governments and police forces on where attention is needed, and provide media outlets with current information about where stories are happening or where chronic issues exist. This last function provides an additional layer of accountability when media outlets pick up on issues that have remained unsolved for extended periods of time.

Results

Each city utilizes the SeeClickFix tool slightly differently. In some municipalities, citizens have taken it upon themselves to create “watch areas,” for which the citizen inputs the public email address of the area’s elected official, Mayor, or other responsible party. After this email address has been designated, all issues are directed to that person automatically. Paying clients use the SeeClickFix PLUS or CONNECT products, which integrate into a city’s existing non-emergency response system.

The free version of SeeClickFix is often used by citizens, neighborhood or advocacy groups, or media outlets. Citizens can create a watch area around their neighborhood, sending email alerts directly to their

city counselor or supervisor; advocacy groups can manage the incoming issues themselves and use that information to push for targeted improvements; media outlets can use SeeClickFix as a user engagement tool by making public stories of a particular issue.

The Atlanta Bicycle Coalition provides a good example of an advocacy group’s use of the tool. Their website provides a portal for collecting issue reports. The community is extremely active; in the month of September 2011, 100 issues were opened, 5 closed, and 6 acknowledged. The coalition manages the incoming reports and uses their connections to the city to resolve issues pertaining to bicyclists. This use of SeeClickFix is free to the bicycle coalition.

WBTV in Charlotte, North Carolina provides another example. As a media outlet, WBTV both actively collects issues from the public on their website and creates news segments highlighting some of those reports. The news reports draw attention to their program and provide accountability for the city. Several segments per week are featured on WBTV. A recent segment focused on the need for a mid-block signalized crosswalk near a public school. Instead of relying on advocates and media partners to manage and prioritize issues, some cities become paying customers of SeeClickFix. A PLUS client designates particular email contacts for particular issue types (for example, a pothole would be automatically reported to the department of public works, while graffiti might go to a code enforcement officer). These clients have access to a dashboard – a sort of control panel for reported issues – which enables a manager to route an issue to the appropriate party in city government. Raleigh, North Carolina and Richmond, Virginia are PLUS clients, and both have a great reputation for responding to SeeClickFix requests quickly. Richmond holds itself accountable by providing status transparency on all reported issues; their Mayor’s Participation, Action & Communication Team website displays a counter of reported, open, acknowledged, and fixed issues.

CONNECT customers are often large cities with established 311 services – a phone line and database for collecting and managing issues, much like SeeClickFix itself. In these cities, SeeClickFix can be integrated into the existing system, sending reports directly to the relevant party.

Cost

Use of the website and downloadable data are free. Citizens, advocacy groups, and media outlets typically use the free version. Cities who integrate the PLUS version are charged $100/month/100,000 citizens. Integrating the CONNECT product is more customized and therefore, the fee is tailored to each city’s situation.

Limitations

The major limitation of the service is its limited ability to provide accountability – will SeeClickFix actually get things done? According to an interview with Ben Berkowitz, 40% of issues on the site are resolved. Still, many issues go unresolved or remain open for a long time. SeeClickFix responded to this...
criticism in a recent blog post, citing their promotion of the top performing cities as a way to hold others accountable.\textsuperscript{72}

Being a web and mobile platform, SeeClickFix also runs the risk of highlighting issues that are clustered around higher-income neighborhoods. While improvements will benefit all citizens in some way, this limitation highlights the necessity of planners’ attention to low-income neighborhoods, whose residents may lack the resources to organize themselves around community concerns.

\textit{Other Potential Uses}

Because issue report data is open to the public, it could be easily used by public or private bicycle and pedestrian planners or advocates. For planning, it can aid in existing conditions research and for identifying areas of chronic concern, but should not be the only source of this information. PLUS and CONNECT cities could route bicycle and pedestrian issues directly to these planners; citizens could be encouraged to do the same for non-client cities. For advocacy, it can point groups to neighborhoods where outreach may be most needed and inform improvement campaigns.

The city of LeDuc used SeeClickFix to collect citizen input into their Transportation Master Plan.\textsuperscript{73}

A Brooklyn, New York neighborhood used SeeClickFix to call the city’s attention to the need for more bicycle racks.\textsuperscript{74}

\textit{Further Information}

Emma Richards, Community Manager, SeeClickFix, emma@seeclickfix.com


Web: www.seeclickfix.com


SoBi and Indiana University

Images

Figure 6.0: Web interface
Figure 6.1: Solar-powered GPS and locking device
Figure 6.2: New bicycle design prototype with iPhone app
Figure 6.3: SoBi Hub visualization

Images from Ryan Rzepecki, SoBi Founder

Background

Many universities and municipalities have now implemented or are exploring bike sharing systems. The company SoBi (for “social bicycles”) was founded by Ryan Rzepecki, who has a master’s in urban planning and had worked for the New York City Department of Transportation’s bicycle program to site bike racks, edit bike maps, organize field promotions, and conduct field research on bicycling facilities.

Problem

Bike sharing systems suffer from challenges to the user and to the operator. For users, bicycles are only available in specific locations, where they must be taken from and dropped off. For operators, constant management of the stocks of bicycles at each station can be a burdensome task. Further, encouraging use
of the system has not been fully handled, though many systems (like Velib in Paris) have shown success in adoption, so this may not be the most pressing of the problems to solve.\textsuperscript{76}

Indiana University (IU) is one of many universities who have been in touch with SoBi regarding their interest in developing a bike share system. Also like many universities, IU faces a challenge to decrease the number of cars on campus and transportation-related carbon emissions.\textsuperscript{76}

Solution

SoBi developed a technological solution to many of the issues facing bike sharing systems currently. Their technology exists within a device that attaches to any bike – decreasing startup costs of a bike share system by negating the need for special bicycles or bicycle racks. In 2011, however, they will be launching a new design that integrates the device into a standardized SoBi bicycle. The device serves both as an information broadcaster (GPS) and as a lock\textsuperscript{77} (Figure 6.1). The device transmits information about its location and usage to a database managed by SoBi. Because the bikes can be locked to any bike rack, users can use a smartphone or the web to locate a bicycle nearest to them and reserve it in advance (Figure 6.0). SoBi users with smartphones will also be able to access their ridership information, like how far they have bicycled or a map of their route.

SoBi also attempt to solve the costly redistribution problem that most bicycle sharing programs face. By dynamically pricing the cost of a rental based on the location to which it is returned, they can incentivize users to leave the bicycle in an area of current high demand. Similarly, users who check out a bicycle in a low-demand area and return it to a hub are given credits. Hubs for parking are placed in high-demand areas (Figure 6.3); users who travel outside of these areas can lock the bicycle easily to any public bicycle rack.\textsuperscript{78}

Indiana University (IU) provides an early case study of SoBi implementation. The Indiana University Student Association (IUSA) had been working with SoBi throughout the spring of 2011 to develop its own bicycle sharing system. With the students, SoBi has leveraged its own data-collecting devices to produce a student-led and data-driven bicycle rack siting plan. In this initial phase, the SoBi device passively captured trip data with no need for the user to self-report pick up and drop off locations. In this way, system hubs could be designed to meet current demand (in the IU case, several hubs are planned, though students can also choose to lock elsewhere on campus).\textsuperscript{79}

When the system is fully implemented, students, staff, and faculty will be able to track their own usage data, providing encouragement based on personal health or environmental benefits. Because the system is able to link a user’s identity with their bicycle check-out pin number, this information can be relayed back to the user through his or her mobile app or web account.

Results

A complete proposal was prepared by members of the student government (IUSA) for the program at IU, including a timeline for implementation, a specification of the bicycle model to be used in the system, a definition of the core service area and main hub locations, a pricing scheme for monthly-, semester-, or academic year-long memberships, funding requirements for the initial outlay and on-going annual expenses, and future goals of the system. The budgeted needs are as follows:


\textsuperscript{77} N. Kelty, personal communication, September 25, 2011.


\textsuperscript{79} Ryan Rzepecki, personal communication, April 22, 2011.
Initial Outlay:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>50 Dynamic Bicycles @ $500/each</td>
<td>$25,000</td>
</tr>
<tr>
<td>50 SoBi Lockboxes (w/ 1 yr operating fees)</td>
<td>$25,000</td>
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<tr>
<td>Bike Racks</td>
<td>$5,000</td>
</tr>
<tr>
<td>Trike and Trailer (for redistribution)</td>
<td>$4,000</td>
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<tr>
<td>Marketing</td>
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<td><strong>Total Initial Costs</strong></td>
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First Year Annual Costs:

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<tr>
<td>Replacement Parts</td>
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</tr>
<tr>
<td>Bike Storage Costs</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>Total Budgeted Ongoing Costs</strong></td>
<td><strong>$20,000</strong></td>
</tr>
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</table>

While $64,000 in funding has been secured for the Indiana University project through IUSA's operating budget and credit card fund, the student group has had difficulty in securing an operating partner on campus. This partner would be responsible for all major bicycle repairs, redistribution of the bicycles (nightly or weekly), tracking finances, responding to customer service needs, placing orders for spare parts, and keeping records of maintenance and inventory.80

SoBi has, in the meantime, has been developing an integrated design that incorporates the device into a bicycle frame. They are also exploring other pilot markets (e.g. Richmond, Virginia and Virginia Commonwealth University) for the system while an operating partner at IU is identified.81 SoBi also ran an unsuccessful Kickstarter campaign82 in the summer of 2011, but maintains that the campaign was as much about generating interest and identifying target markets as it was about receiving funding. They expect to have a commercial-ready product by the spring of 2012.

The following videos offer images of the product in action and a description of the company’s vision:

- Social Bicycles Demo: [http://vimeo.com/25470221](http://vimeo.com/25470221)
- Kickstarter Campaign: [http://vimeo.com/25327612](http://vimeo.com/25327612)
- Social Bicycle Model and Animation: [http://vimeo.com/25641781](http://vimeo.com/25641781)

**Cost**

The 50-bicycle IU system is estimated to cost $60,000 to start as well as on-going annual operating costs of $20,000.83 Each SoBi device costs $500; a price has not yet been determined for the new SoBi design that integrates the device into a SoBi bicycle frame.

**Limitations**

While much progress has been made in the development of the SoBi product, the company was unable to find funding through its Kickstarter campaign and has faced challenges in identifying an operating partner at Indiana University. SoBi is an innovative product, but because of its newness, the company cannot provide an evidence-based solution for institutions or cities evaluating different bicycle sharing systems providers.

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80 N. Kelty, personal communication, September 25, 2011.
81 R. Rzepecki, personal communication, September 26, 2011.
83 N. Kelty, personal communication, September 25, 2011.
Other Potential Uses

The system has been designed for one main purpose: to be a much cheaper bicycle sharing system than what is currently on the market due to lower redistribution costs and a reliance on parking infrastructure already in place. It is applicable for university campuses, college towns, and large metro areas.

Beyond this, the usage data gathered by the system may be useful for longer-term bicycle planning processes as well. Because users are tracked individually, the data could be used to build an encouragement program, similar to the aim of Dero’s ZAP! device, by reporting back to the user how many miles they have bicycled, how much money and CO2 that have saved by not using an automobile, and how they compare to other SoBi users.

The system’s rich data could also be used to dynamically site hub locations over time. Because all trips are tracked, parking locations and common bicycle routes will be known. These data could also provide strong evidence in grant applications when universities or towns apply for funding for bicycle-related improvements or programs.

Further Information

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Neil Kelty, Executive Director of New Media and Technology and Chief of Staff, Indiana University Student Association, neil@neilkelty.com

Elliot Trotsky, Indiana University Student Association, ejtrosky@umail.iu.edu
DISCUSSION

This is not a comprehensive study of the uses of mobile and web technology in planning; the case studies are arbitrarily chosen. However, because the case studies span multiple geographies and technologies, they reveal key challenges and opportunities for bicycle and pedestrian planners who seek to integrate mobile and web tools into their practice.

Technologies exist to abate some of the challenges of data collection for bicycle and pedestrian planning. TurnCount, CycleTracks, SoBi, and the ZAP! each offer improvements for the collection of bicycle and/or pedestrian counts and related information. However, they each have limitations as well. Funders seem unwilling to support innovative programs that lack evidence-based examples; innovators themselves face this challenge with potential adopters.

Related to that point, individuals or institutional adopters may question the reliability of the solution, hindering an improvement’s ability to break into the market or to function at or above existing performance standards. Even the solution improves a planning process, some users will remain frustrated with the technological glitches must be expected (see CycleTracks case study).

Third, collecting data from mobile and web users may introduce a systematic bias into samples that raises concerns for equity. Opt-in data collection schemes that require users to voluntarily share data will be prone to these biases no matter what technology is used. In the case of smartphones, a specific hurdle is the taxing effect of GPS-based applications on phone battery life.

Lastly, adoption of some innovations requires prior knowledge of or access to particular technologies that municipalities may be slow to adopt. These case studies provide exposure to several example technologies that can improve bicycle and pedestrian planning, but nothing will substitute for trying a technology for oneself.

RECOMMENDATIONS

Specific Application Recommendations

CycleTracks could expand its functionality to appeal to a wider audience and compete with existing private sector applications that allow bicyclists to track and map their rides. Suggested features include: topography, carbon offset, calories burned, and social sharing.

Dero Bike Racks could partner with Minneapolis or another municipality to test a pilot implementation of the ZAP! device. The municipality could try the technology for free, and Dero could publish results as a white paper, providing much needed evidence of its functionality and proof of its value.

Walk Score should take steps to incorporate “quality” metrics into its walkability algorithm. Suggestions include crime and crash data and customer reviews of nearby retail.

SeeClickFix could improve city response rates to issues by publishing letter grades for cities or elected officials based on their ability to fix issues. Planners should utilize the free data that is available, and SeeClickFix should reach out to planners specifically.
Finally, SoBi should market the data-richness of its solution. This data would enable employer and university encouragement programs by providing riders with feedback on their physical activity or reduced carbon footprint. The tracked trip data are also valuable for planning bicycle parking locations or facility upgrades.

**General Recommendations**

The American Planning Association should continue to encourage the cross-pollenization of ideas between planning and technology. Conferences such as Transportation Camp and PlanningTech@DUSP should be continued as incubators for problem identification and solution suggestion, inspiring further technology development.

Pedestrian and bicycle research institutions such as the Pedestrian and Bicycle Information Center and the Association of Bicycle and Pedestrian Professionals should convene a group of practitioners willing to share their uses of these technologies through a webinar or other shareable format. It would also be useful to invite some of the attendees of Transportation Camp or PlanningTech@DUSP to contribute.

Overall, as planners attempt to integrate these solutions into their practice and achieve buy-in from colleagues, the technologies should be framed as affordable, efficient, and accessible.
### APPENDIX A: RESOURCE LIST OF TECHNOLOGIES

This appendix provides a list of several web or mobile technologies that were not profiled in this report. This list represents an opportunity for further research. Each page provides a continuation of the table; apps are listed across the top. Each color represents a different app function.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Function</th>
<th>Primary Field of Use</th>
<th>Cost</th>
<th>Ease of Implementation</th>
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Twitter is a real-time information network that connects you to the latest information about any topic of interest.

Transforms ordinary bicycles quickly into hybrid e-bikes that also function as mobile sensing units.

Free to use source code
Open311 / Open Data like NYC, DC, SF  
http://open311.org/  
A collaborative model and open standard for civic issue tracking

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CalFit  
https://sites.google.com/site/setoresearch/ph ast  
Keeps track of your physical activity on your mobile phone.

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Cubit Planning  
http://www.cubitplanning.com/  
Automates demographic and planning data reporting.

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ESRI CitySourced  
http://www.citysourced.com/default.aspx  
Web and mobile reporting of civic issues.

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SeeClickFix  
www.seeclickfix.com  
A SeeClickFix-integrated site for requesting bicycle racks.

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Fixcity.org  
A SeeClickFix-integrated site for requesting bicycle racks.

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<td></td>
<td>A smartphone application that assists in making smarter individual transportation choices by leveraging sensing capabilities of the phone and calculating real time carbon emissions while on the move.</td>
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<td>Connects you to Bay Area parks and open spaces by providing transit access information and trip planning.</td>
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<td>Application</td>
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<td>MapMyRide</td>
<td><a href="http://www.mapmyride.com/">http://www.mapmyride.com/</a></td>
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<td>HOME TOWN</td>
<td><a href="http://www.livinglabs-global.com/showcase/showcase/471/hometown.aspx">http://www.livinglabs-global.com/showcase/showcase/471/hometown.aspx</a></td>
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<td>Wikiloc</td>
<td><a href="http://www.wikiloc.com/wikiloc/home.do">http://www.wikiloc.com/wikiloc/home.do</a></td>
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<td>Billy Bike</td>
<td><a href="http://cykla.stockholm.se/">http://cykla.stockholm.se/</a></td>
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<tr>
<td>WalkScore</td>
<td><a href="http://www.walkscore.com">www.walkscore.com</a></td>
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<p>| Informative          | Stockholm, Copenhagen       | Washington, DC Office of Planning                                                                                                           |</p>
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<th><strong>Walkshed</strong>&lt;br&gt;<a href="http://walkshed.org/">http://walkshed.org/</a></th>
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<td>Walkability heat maps that pinpoint walkable neighborhoods.</td>
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<td>APHA, APBP, PBIC</td>
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<td>The Netherlands</td>
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<td>Partners with business to devise sustainable mobility plans for employees.</td>
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<td>DecisionTree</td>
<td>Enable you to weight and prioritize multiple geographic decision factors, to identify the best locations for specific activities.</td>
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<td>HEAT (Health Economic Assessment Tool)</td>
<td>World Health Organization's online tool to estimate economic savings resulting from reductions in mortality as a consequence of regular cycling and walking.</td>
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<td>Data Analysis</td>
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APPENDIX B: LITERATURE REVIEW

While very few scholarly articles exist on the topic of mobile and web technologies for bicycle and pedestrian planning, some exemplify its use in research and many discuss the needs for better data to improve research and practice. That said, the most current and prolific writing on this topic comes in the form of online publications and personal blogs.

Below, I present several articles that relate to this topic. Each of these is briefly summarized. Also included is a list of online resources that frequently cover the nexus of mobile and web technology and urban transportation planning.


   Urban tomography is the use of ubiquitous smartphone technology to document and archive information about a space in time from multiple perspectives. Several examples are given of its use. One example (example nine) includes the documentation of a transit experience. While not explicitly discussed, applications for tracking bicycle and pedestrian behavior are also possible.


   This article deals with the need for better information about pedestrian travel environments. The authors developed a complete environmental audit methodology called the Pedestrian Environmental Data Scan (PEDS). The methodology, complete with the design of the handheld instrument using a personal digital assistant (PDA), training and supporting materials, and administration, is included in the article.


   This article presents research exemplifying the use of GPS technology for data collection in academia. The study’s overall purpose is to determine whether or not bicycling for everyday travel can help US adults achieve recommended daily exercise and the role publicly-provided infrastructure can play in encouraging this behavior. Each voluntary participant was given a GPS-enabled PDA for data collection and then downloaded and converted into a GIS format.

4. *Injuries to Pedestrians and Bicyclists: An Analysis Based on Hospital Emergency Department Data*, by Jane C. Stutts and William W. Hunter for the Federal Highway Administration, 1997

   This report provides motivation for better exposure data. In Chapter 7, Conclusions and Recommendations, “Relevant exposure data has been a long-standing need in the area of non-motorized safety research. In the absence of such data, it is not possible to draw definitive conclusions regarding the level of risk associated with specific locations, behaviors, etc.” The study goes on to mention that the one known attempt to capture exposure data used hospitalization cases as an injury total and a telephone survey for exposure data. Innovations in technology, some of which exemplified in the case studies in this report, provide better means of collecting these data.

5. *A GPS-based Bicycle Route Choice Model for San Francisco, California*, by Jeffrey Hood, Elizabeth Sall, and Billy Charlton, 2011 (see also Bicycle Route Choice Data Collection Using
GPS-Enabled Smartphones by Billy Charlton, Elizabeth Sall, Michael Schwartz, and Jeffrey Hood, 2010 (TRB paper))

These two articles document the development of the San Francisco County Transportation Authority’s CycleTracks app, the data it has collected, and the uses of the data thus far.


   The relevance of this study comes out of one of the criticisms of the CycleTracks app – that it is energy-intensive and requires heavy use of the smartphone’s battery. In their research, they develop an algorithm that can save 10 – 40 percent of battery capacity.


   This paper emphasizes the need for a central digital clearinghouse of transportation-related research results to bridge the knowledge gap between academia and practice. While not explicitly related to the topic of bicycle and pedestrian planning, the provision of such a thematic web-based clearinghouse would greatly benefit the field.


   This research has not yet been published; however it will serve to exemplify innovative use of mobile technology for research and encouragement of physical activity. CalFit, an app developed for Android phones, “showcases the latest in research in energy expenditure and activity tracking algorithms developed through collaboration between UC Berkeley Engineering and the School of Public Health.” Using different sensing mechanisms in the Android device, the app can track how and where exercise occurs. The app serves two main purposes: to promote more active lifestyles and to provide data on the types of physical environments that encourage these lifestyles to inform future policy and planning.⁸⁴

   The study followed 36 volunteers using CalFit in addition to two more traditional activity tracking devices – the Actigraph and Bodymedia Sensewear – to compare the results among the three. The study finds that the Android devices’ results correlate highly with the more accepted measuring tools, with the slight exception of cycling trips (correlation coefficient of 0.63). They conclude that this has positive implications for physical activity data collection as sensing technologies are becoming more ubiquitous through mainstream adoption of Android-like devices. These data are also richer; in addition to the activity information captured by the accelerometer, the Android device can also capture location, speed, and topography information using the phone’s GPS.⁸⁵

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⁸⁵ Rodriguez, D.A. & de Nazelle, A., personal communication, April 24, 2011.
APPENDIX C: Sample TurnCount PDF Report

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