WEB 2.0 APPLICATIONS FOR
IMPROVING PUBLIC PARTICIPATION IN TRANSPORT PLANNING

Andrew Nash
Vienna Transport Strategies
Bandgasse 21/15
1070 Vienna
Austria

andy@andynash.com
http://www.andynash.com

Telephone: +43 (650) 416-7871

November 14, 2009

ABSTRACT

Web 2.0, shorthand for Internet applications that rely on users to generate content and information, has the potential to significantly improve transport systems and operations. However, Web 2.0 applications are not being introduced as quickly in the transportation planning process as in other sectors. The goal of this paper is to encourage greater use of Web 2.0 applications in the transport planning process. The paper begins with an introduction to Web 2.0 and identifies four categories of applications. Next it describes each of these categories and provides transport-related examples. Finally it presents recommendations for developing Web 2.0 applications designed to improve public participation in the planning process and describes three conceptual Web 2.0 applications designed to improve public transport operations, improve the environmental impact assessment process and improve the FTA New Starts process.

**WEB 2.0 APPLICATIONS FOR
IMPROVING PUBLIC PARTICIPATION IN TRANSPORT PLANNING**

1. INTRODUCTION

The Internet has revolutionized the world. It has changed the way people work, socialize, shop, and travel; it has changed the way companies operate, where they locate and how they manage production; it has changed the way government provides services, how we communicate with government and how we influence public policy.

This paper argues that, while most transportation organizations have entered the Internet age, many are barely scratching the surface of the Internet's potential. Almost all transport organizations use the Internet to disseminate information (e.g. public transport schedules), many use the Internet to collect feedback and as part of public involvement programs, but there are very few who use Web 2.0 applications effectively to engage the public in a collaborative process designed to improve planning, construction and operation of transport systems.

The goal of this paper is to introduce some key Web 2.0 concepts and outline how these concepts could be used to improve transportation systems and operations. Web 2.0 refers to Internet applications in which users (help) develop content and/or perform activities. Examples include Wikipedia, blogging, and Facebook.

The rest of this chapter presents an introduction to Web 2.0 and a structure for categorizing Web 2.0 applications. Chapters 2 through 5 describe these four categories of Web 2.0 application and provide transportation-related examples. Chapter 6 presents recommendations for creating Web 2.0 applications to improve transportation systems and operations, and ideas for three potential Web 2.0 applications that could improve public transport operations, improve the environmental planning process and improve the FTA's New Starts funding program.

1.1   Web 2.0 and data

The term Web 2.0 was developed to distinguish websites where users participate in developing applications and/or providing information from the original one-way Internet (Web 1.0) where websites simply provide information. Web 2.0 was made possible when improved computer technology and telecommunications (e.g. broadband) made information transfer easier.

Making information transfer easier led to two innovations: first, websites could become much more interactive using input from users to perform many different activities (e.g. games, social networking) and enabling users to easily create their own websites (e.g. blogs); and, second, users could develop applications that use data available elsewhere on the Internet (e.g. create real time public transport schedules for mobile devices).

For the first type of innovation users essentially need to provide data themselves. Data in this sense consists of everything from homemade videos and blog text at the advanced level to rating a YouTube video or clicking on a website "likes this" button at the basic level.

For the second type of innovation application developers need to be able to obtain data from existing sources (e.g. public transport operators) since independent data collection is practically impossible. However, obtaining existing data can be difficult, the data may not be available in a useful format and often there are legal issues involved with using the data. For example, in 2009 the question of who "owns" real time public transport schedule data became an issue in San Francisco. [1]

Gendre and Danflous [2] have carefully surveyed the issue of obtaining data for Web 2.0 transport applications and have used data source as a way of structuring their analysis of Web 2.0 transport information applications. Their study recommends that public agencies make every effort to work with independent Web 2.0 developers by making data accessible and encouraging development of new applications.

Washington DC's Apps for Democracy program is an excellent example of a government fully embracing Web 2.0. As outlined below many of the applications created for this program are transport related. The San Francisco Bay Area Rapid Transit (BART) District is also on the

leading edge of making data accessible. Both Washington DC and BART provide information on their website for developers on how to access and use their data feeds (API). The San Francisco Bay Area's Metropolitan Transportation Commission's transportation information website (www.511.org) also enables users to obtain transport data for use in their applications.

1.2   Categorizing Web 2.0 applications

In order to provide a structure for understanding the key types of Web 2.0 applications this paper classifies applications into one of the following four categories:

- Information Provision – these applications are designed to provide information. A common transport application is public transport schedule information.
- Planning and Administrative Process – these applications are designed to enable users to complete a task, for example provide specific information to a government agency.
- Social Networking – these applications allow users to create interest groups, share information and 'meet' like-minded people. Common applications include Facebook and LinkedIn.
- Analysis and Evaluation – these applications enable users to use website based tools to analyze data. Common applications include 'cloud-based' applications such as Google Documents.

However, it must be emphasized that most specific Web 2.0 applications combine these categories by, for example, including both social networking and information provision in a single application. The following chapters describe each of the categories in more detail and present transport related examples.

2   INFORMATION PROVISION APPLICATIONS

Information provision applications are designed to communicate information to their users. In Web 2.0, third parties can add information to an organization's website and/or application developers can use data made available on the Internet to create their own informational websites. This section describes three main types of Web 2.0 information applications: wikis, personal information sharing, and mash-ups.

2.1   Wikis

A wiki is a website that provides special tools enabling anyone to edit the website pages and to create new pages. The word wiki comes from the Hawaiian word wiki (quick), which was used in the initial wiki-based applications. [3] The most familiar Web 2.0 wiki application is Wikipedia, the open source on-line encyclopedia.

The idea behind wikis is that "crowd sourcing" (i.e. the idea that everyone together knows more than one person alone – even if that person is an expert) can provide accurate information.

There are problems with the open approach used in wikis. For example popular Wikipedia pages have been "hijacked" for political purposes. Therefore most wikis now have a series of safeguards including 'moderators' responsible for helping control the information.

In terms of results, the information quality in Wikipedia is similar to traditional encyclopedias (e.g. Encyclopedia Britannica), but the amount, breadth and accessibility of Wikipedia information is much higher. The Wikipedia story is a fascinating example of development of new socio-technical systems. [4]

Two examples of transport related wikis are StreetsWiki and the ITE Pedestrian and Bicycle Committee wiki. These wikis illustrate an interesting point: StreetsWiki is open to everyone, where the ITE wiki is only open to ITE members.

StreetsWiki – Crowd sourced transportation information

StreetsWiki is a community-created, online encyclopedia for transportation, urban environmental, and public space issues. It is managed by the Livable Streets Initiative as part of a multifaceted approach for improving transportation that uses all the key Web 2.0 techniques.

StreetsWiki illustrates three important Web 2.0 concepts: first, it is part of a suite of Web 2.0 tools used by an organization to further its mission; second, it illustrates how it is possible to develop a "strong reference work more deeply and narrowly focused on issues of interest to (in this case) sustainable urban transport advocates" [5]; and, third, information is freely available to everyone.

According to their website, the Livable Streets Initiative (http://www.livablestreets.com) is an online community of about 125,000 people working to create sustainable cities through sensible urban planning, design, and transportation policy. The Livable Streets Initiative uses the following Web 2.0 techniques:

- Streetsblog – a website with information including links to over 350 transport-urban planning blogs from throughout the world;
- Streetfilms – a website providing sustainable urban environment themed videos; and
- StreetsWiki – an online encyclopedia with information about sustainable urban policies from around the world. [6]

The Livable Streets Initiative also engages in more traditional advocacy activities including sponsoring an education program on transportation, urban design and livability.

ITE Member-only Wikis

Another example of a transport planning wiki is the Institute of Transportation Engineers (ITE) Pedestrian and Bicycle Committee wiki. [7] In contrast to StreetWiki, the ITE wiki is only accessible to members. While limiting access is understandable, it raises the question of whether this is an effective policy. On the one hand, the wiki is benefit of membership. On the other hand, if the information is only accessible to members it will have limited impact and reflect a more limited perspective.

A key Internet maxim is that "Information wants to be free." When citizens are looking for information – and today most people use the Internet – where do they get it? Probably from StreetsWiki not the ITE.

2.2   Personal information sharing: Blogs, YouTube, Photo Sharing, Twitter

The second category of Web 2.0 information provision websites are applications that enable users to create their own personal platforms for providing information. These applications allow users to create websites and share various types of media – with practically no limitations. The most important examples are Blogs (applications that enable anyone to create webpages), video sharing sites like YouTube and photo sharing sites like Flickr.

The latest development in the field of personal information sharing is Twitter. Twitter uses short message system (SMS) technology to broadcast 140 character messages from people to websites and directly to other users who 'follow' the broadcaster. Other users can also see messages related to a specific subject by entering the subject in a search box. Messages can be sent and read via the Internet or using mobile telephones. Twitter is growing rapidly and has developed an interesting series of web pages that describe how it can be used in business. [8]

All these personal information applications have tools that enable other users to comment and add information (a must for Web 2.0 applications), so they are a two-way street. The applications also provide tools enabling users to find related information, link to other websites and rate the quality of information (which helps provide some order in the system).

The applications also are designed to enable easily linking user-generated information between applications: for example embedding YouTube videos on your blog or adding links to

favorite websites or creating Really Simple Syndication (RSS) feeds of your blog. It is also possible to use features like Google Maps to geographically tag (i.e. locate) information. All these features are (relatively) easy to use and are provided for free (at least for now).

Finally, it is important to note that companies and organizations are now using these Web 2.0 information applications to promote their views. In fact, smart companies have embraced the idea of Web 2.0 and are using these applications to improve their products and services. [9] The best approach is to think of developing Web 2.0 applications as you would starting a business, namely aim to be the best in your field. [10]

There are countless examples of these personal information sharing applications that concern transportation. As mentioned above, the Streetsblog alone lists over 350 different blogs directly related to livable cities and sustainable transportation. The main point for transportation organizations to consider is that these public platforms exist and many people are using them. All organizations need to develop an approach for using them to help achieve their goals. For example, BART encourages users to submit photos of BART to flickr and tag them "BART", these photos are then used on BART's official website. Over 3,500 photos are tagged BART transit as of 9 November 2009. (http://www.flickr.com/search/?q=BART%20transit)

2.3   Mash-ups

A third type of Web 2.0 information provision application is a "mash-up". A "mash-up" is an application that combines information from several sources to create some new information. Most of the information used in a mash-up application comes from data made available on the Internet and often mash-ups are created by developers from outside the data-providing organization.

For example, an independent application developer might combine data from BART with data from a business locations database to map the closest coffee shops to all BART stations on Google Maps. (Or Starbucks might map all its stores and include special information about each store.) These examples show the importance of data access for mash-ups.

Some government agencies have been very innovative in the providing data for mash-up applications. Great Britain initiated a program called *Show Us a Better Way* (www.showusabetterway.com) in which people described the application they wanted to develop and the data they needed to create it. The best applications were chosen in a competition (with cash prizes) and the government information department is working with the winners to help obtain the data necessary (often from other government agencies) and otherwise help bring the applications to reality.

In Washington DC, the *Apps for Democracy* (http://www.appsfordemocracy.org/) program held a similar competition to identify the best 3rd party applications that could be developed using public data (the city offers a data feed of almost all the data collected: over 400 different data sets). It is interesting to note that many of the applications developed in both the Show Us a Better Way and Apps for Democracy programs were transport related.

Washington DC Apps For Democracy: Selected Transportation Mash-ups

Washington DC's Apps for Democracy program includes many transport applications. For example:

- Carpool Mashup Matchmaker (http://demos3.jackbe.com/mashlets/DCCarpool/);
- DC Bikes, a guide to biking in DC (http://www.outsideindc.com/bikes);
- DC Historic Tours, a Google Maps mash-up that combines walking itineraries with photos and information about what you are seeing (http://www.dchistorictours.com/);
- DC Pedestrian (http://www.dcpedestrian.com/); and
- Stumble Safely, an application that shows the best cocktail bars based on, among other data, public transport access and crime rates (http://www.appsfordemocracy.org/stumble-safely/).

Google Transit

Google transit is a mash-up of local public transport information with Google Maps. Essentially public transport information is plotted on the Google Maps. The public transport information is provided by the public transport agencies in a format that can be automatically used by Google Maps to display station locations and to calculate best routings. Many public transport authorities (but not all) have made their information available to Google for Google Transit.

Google provides information for public transport authorities that want to use its system. Among the benefits are the fact that the system is available in 12 languages, for various different mobile devices and is supported by one of the most powerful companies in the Internet sector. This provides local public transport operators with a product that none but the largest agencies could match. (http://maps.google.com/help/maps/transit/partners/)

Walkscore.com

A classic example of a mash-up is the website walkscore.com (www.walkscore.com). Walkscore.com started with a website that mashes-up geographic information with locations of different types of businesses and public services on Google Maps to determine the 'walkability' of specific locations. It uses an algorithm to calculate the walkability index on a scale of 1-to-100. This means that people looking for a house can click on the house location and receive a walkability score for the neighborhood where they live.

Walkscore.com has recently been improved to add public transport information based on the same information used in Google Transit. This means that it is possible to get a very good idea of any area's sustainable transportation services and to compare different areas in terms of this important variable.

This also provides a good example of why it is beneficial for public agencies to provide data for third party developers. If public transport schedules are provided in this type of system it helps those interested in public transport to find the best places to live – since these are people more inclined to use public transport, it may therefore help increase ridership. This is the type of win-win situation that creative use of Web 2.0 strategies can help foster.

3.   PLANNING AND ADMINISTRATIVE PROCESS APPLICATIONS

Planning and administrative process applications are designed to enable users to "help" the application owner complete a specific task.

In Web 1.0, users could provide input to processes by sending e-mail or filling out comment forms. Another approach was completing government forms on-line using applications including Adobe Acrobat. Many of these systems are not very creative, simply mimicking the traditional paper-based planning process, which shows that there is room for innovation.

Web 2.0 applications ask users to provide more detailed information and actually process this information to complete a task. Many of these applications fall under the general term "crowd sourced" meaning that the information they provide comes from many independent people acting together.

The best way to understand these applications is to describe examples of how they are being used, therefore the following sections outline several types of planning and administrative applications and present examples of transportation related sites.

3.1   SeeClickFix – Crowd sourced problem identification

SeeClickFix (http://www.seeclickfix.com) is a Web 2.0 application that enables people to identify non-emergency issues (e.g. potholes), describe them in detail (e.g. include photos) and place them on a map (from Google Maps). Once the issues are identified and placed on the map, other users can 'vote' for the issue (i.e. give their opinion on how serious the issue is) and add more information. The application's goal is to attract attention from the responsible public agency, which would then address (fix) the issue.

According to their website, SeeClickFix uses all the key characteristics that make Web 2.0 applications effective and particularly well suited for improving civic life and public sector services/infrastructure, namely:

- Transparency – Governments and most organizations work best when they conduct their business in plain view.
- Collaboration – Millions of brains are better at identifying problems and developing solutions than one-or-two experts.
- Scale – The Internet makes it possible to develop effective tools since the market is the world; this means that good software has an almost unlimited market and enables everyone to use the best possible quality products.
- Efficiency – Building on open source software and information provides access to high quality programming and information that can be customized for specific uses. Applications like Google maps and smart phone applications are excellent foundations for creating effective websites.
- Simplicity – It's easy and intuitive to use SeeClickFix.

The website's founders developed the site when they recognized that very few local governments have enough technical experience or resources to develop websites beyond those that provide basic information. SeeClickFix enables citizens to help government identify and track local issues. Similar to other Web 2.0 applications SeeClickFix uses the full scope of Web 2.0 tools including social networking and information sharing.

SeeClickFix is being used by many individuals, groups and cities to identify and solve problems. Many applications are focused on transportation issues, for example the Atlanta Bicycle Coalition uses SeeClickFix to identify bicycling hazards in the Atlanta area. (http://www.atlantabike.org/SeeClickFix) [11]

The SeeClickFix developers have also developed a fee-based product that enables professionals to manage and use the SeeClickFix data. For example a city public works department could track pothole repairs. [12] This professional product could eventually provide the revenue needed to improve and maintain the free product offered to individuals.

In summary, SeeClickFix is an excellent example of combining the strengths of Web 2.0 techniques into an application that can be used to significantly help government identify and fix problems. This type of system could have many applications in transportation planning.

3.2   Cyclopath: Crowd-sourced Recommendations

One of the most common Web 2.0 applications are websites that encourage users to provide recommendations. For example rating restaurants or videos. Furthermore, incorporating the ability to rate information quality is fast becoming an important tool for all types of Web 2.0 applications (e.g. Amazon's star system). According to Noveck, many organizations are using bubble-up techniques like rating to improve the quality of information they collect and make available. [13] [13]

An interesting transportation application of crowd sourced recommendations is Cyclopath. Cyclopath was developed by the University of Minnesota to help users "Find bike routes that match the way you ride." According to their website, "Cyclopath lets you enter personal bikeability ratings for roads and trails. This unique rating system helps find the best routes for you, while also supporting the community with your individual knowledge.

Cyclopath is a geowiki: an editable map where anyone can share notes about roads and trails, enter tags about special locations, and fix map problems - like missing trails. Hundreds of Twin Cities cyclists are already doing this, making Cylopath the most comprehensive and up-to-date bicycle information resource in the world." (www.cyclopath.org) [14]

Similar to other applications, Cyclopath uses several other Web 2.0 tools to provide users with information and to enable them to contact developers with ideas and comments (e.g. a wiki that describes the program and frequently asked questions (FAQ)).

3.3 Crowd-sourced planning applications

A third type of planning and administrative process application are websites that enable people to assist in the process of actually preparing a plan. There are two basic approaches: providing tools to help improve the input process, and providing tools that enable users to actually participate in the "plan writing" process.

The first approach, facilitating public input, uses Web 2.0 tools to extend many traditional ideas for obtaining public input into the Internet age. This is not a trivial achievement since Web 2.0 tools enable a much broader participation in the fullest sense. There are two key advantages: first, the tools are available for everyone who has Internet access; and second, they give planners the ability to collect and analyze detailed information from many people. The main problem is ensuring Internet access for all, but there are solutions for this problem including public library access etc. Finally, as outlined below in the recommendations, websites must be very carefully designed to encourage participation (using strategies like incentives, easy to use interfaces, breaking work into small segments, etc.) and to make the information gathered useful for planners.

The second approach, tools that enable users to help actually prepare plans, extends the concept of public participation even further. The clearest example is to create the plan using a wiki; anyone could enter information. As outlined above, there are problems using such an open approach, but solutions have been developed.

It's interesting to note that both examples described below have been supported by private foundations. This indicates that private foundations may have realized the potential benefits of Web 2.0 for planning before government. Both approaches are described in the examples below.

Facilitating Input: San Jose's Wiki Planning Project

San Jose California is using a set of tools called wikiplanning to increase and improve citizen input for development of the city's Envision 2040 general plan project. [15]

The Wiki Planning name is somewhat misleading since there is no Wiki per se involved, but rather a series of Web 2.0 applications linked into a convenient package. Wikiplanning's creators call the approach "The Virtual Design Charrette" and describe Wikiplanning as "... an online solution for improving civic engagement, an important component of most urban planning initiatives. ... [16]

In the San Jose example the first step is surfing to the website (which interestingly is not hosted by the city of San Jose but rather on the wikiplanning website). There you hear recorded messages from the City Manager and Planning Director explaining the idea and asking for your input. Then you are taken to a page where you have options to do the following:

- **Take a Survey** - answer a series of demographic and 'wants' questions;
- **Review Project Background** - links to background studies and other information useful for the Envision 2040 process;
- **Map where you Live, Work & Play** - an interactive map where you can place "pins";
- **Post or View Project Photos** - a page where you can upload photos and make comments on them (e.g. there was a photo of Seattle's Pike Place Market with several comments on how nice it would be to have a similar place in San Jose);
- **Add or read comments on message board** - a place for users to comment on different aspects of the plan or process (the comments on using Web 2.0 tools for planning were quite positive and interesting);
- **Incentives for participation** – A list of prizes (tickets from local cultural institutions) to be given away to people who take the survey (a good way to encourage participation);
- **Tell your friends** - a link for sending e-mail to your friends asking them to participate.

The site is a good attempt to put several Web 2.0 applications together in a user friendly way to encourage participation in developing this plan. It will be interesting to see how this works out from a practical perspective.

For example, it's hard to see how San Jose planners will use information like "it would be nice to have a market like Pike Place in San Jose" not because it's not true, but because this kind of thinking is so open-ended. How will the city decide which ideas to keep? This is not to criticize the Wikiplanning tools, collecting ideas is an excellent first step but what comes next?

Preparing the Plan: Pittsburgh Regional Integrated Transportation Plan

The second approach for crowd-sourced planning is to have the crowd actually write the plan. This is being tested in Pittsburgh where a group called Pittsburgh CitiWiki Project has developed a wiki that focuses on improving the quality of life in Western Pennsylvania. CitiWiki is viewed as "an experiment in collaborative creativity conceived and created in the community." (http://www.pghwiki.org/wiki/index)

CitiWiki's first project is to draft a crowd-sourced regional transportation plan using a wiki template. As with many of the applications discussed in this paper there is a great deal of idealism involved in the CitiWiki project. The project's website describes why they decided to use the wiki process, quoting:

> In some ways this is a pure, 21st century form of participatory, grassroots democracy. The only rule is that any contributions to the wiki-plan should be constructive and focused on improving the document so that at the end of the process, we have a credible, workable, professional blueprint that can be put into action. As the wiki grows, there will be places for big ideas, lively discussions and debate and all the creative thinking participants can imagine, but the plan itself is not a place for grandstanding, whining or arguing …. It is a place where each participant can take the high ground and collaborate with others in our community to bring about tangible, positive change that benefits everyone who lives, or will live, in this region. [17]

The project started in July 2008 and much activity appears to have taken place in developing the first version of the transportation plan. By November 2008 over 120 people had registered and contributed to the plan, and there were over 7,000 page views. According to the latest information on the website, the group is now working on Version 2.0, the new version has consolidated and edited information gathered in the first round. The project manager has indicated that the project remains active and should be able to complete a plan by 2010.

4.   SOCIAL NETWORKING APPLICATIONS

Social networking applications are the most familiar Web 2.0 application. The most popular include Facebook, MySpace, LinkedIn and XING. There is even an application called Ning (http://www.ning.com/) that enables people to create their own social networks.

Social networking applications are still in their infancy. It's clear that they are important, but unclear exactly how they can be used most effectively. However, in spite of this problem, social networking is a powerful tool that can improve two-way communications with all types of users and thereby help improve the development and operation of all types of transport systems.

There are three main types of social networking applications: purely social, professional and social networking tools that are provided on application websites designed to create a "community" around the application-specific purpose (e.g. a social network of people contributing to the StreetsWiki website). This chapter describes each type of application using an example site.

4.1   Facebook

Facebook (www.facebook.com) is the most popular social networking application. Facebook was originally designed for truly social connections (i.e. friends, classmates, etc.) but is

expanding to include more and more business relationships. It currently has over 300 million members, 70% of whom are from outside the United States. More than 8 billion minutes are spent on Facebook every day and surprisingly, the fastest growing demographic group on Facebook are people over 35-years old. Facebook's growth and impact is impressive especially considering that it did not even exist several years ago.

One key feature of all social networking applications is the ability to join and create groups of people with similar interests. There are "more than" 500 groups found in a search of Facebook groups under the term "Transportation Planning". Some large transportation companies have groups, for example Bombardier Transport (35 members) although it is unclear whether this group has any "official" connection to the company. One problem with Facebook's group function is that the application does have a particularly good search system for finding the right group.

Facebook allows people to organize groups easily. For example, there are many groups organized by high school students to develop plans for renting limousines for the prom – showing both how easy it is to organize groups as well as the depth to which social networking and Facebook in particular have entered the lives of young people. On a more policy oriented level, there are 446 groups displayed when searching under the words "bus rider" including the Los Angeles based Bus Riders Union.

In summary, it is easy to see how a Facebook group could be used effectively to generate interest in transport planning. However, the group would need to be actively managed and need to have something to generate interest, e.g. a major government planning process or policy issue.

4.2   LinkedIn

LinkedIn (www.linkedin.com) is a professionally-oriented social networking site (another popular example in Europe is Xing). Professionally oriented social networking sites are designed to help users make connections with other professionals with whom they can trade information such as job opportunities, technical data and news. As of November 2009, LinkedIn has over 50 million members in over 200 countries around the world with approximately half the members from outside the U.S. [18]

The key feature of LinkedIn (and other professional social networking sites) is that it enables people to see the "connections" of their "connections" and use this information to make contact with these people. Thus, if you are connected to person A, person A's connections are shown as "2nd" connections to you. LinkedIn then enables you to contact these 2nd level connections based on their preferences and your membership type. The idea is that you are more likely to get good information about a job, a referral or opportunity from a friend of a friend than from someone with whom you have no connection.

An important part of professional social networking sites are professional groups. These consist of people who are in the same general profession or have similar interests. Any member can start a group and there are groups (often multiple groups) in almost any profession imaginable (there are also interest groups such as college alumni associations etc.). LinkedIn currently has almost 436,300 groups, the largest has almost 200,000 members. Many of the largest groups are human resources professionals and much of the activity in all groups is employment-related. There are currently 747 groups listed under the subject of transportation. (Data as of 3 November 2009.)

It is fairly easy to imagine how professional social networking sites could be used to help in the employment process. For employers they provide one-stop access to job seekers and others who might know someone interested in a new job as well as an opportunity to learn more about candidates applying for jobs. For those seeking employment professional social networking sites provide an opportunity to learn about new positions, and get 'unfiltered' information about companies. It's important to note that people using the employment features of professional sites are generally highly motivated and are willing to invest a significant amount of time into the process.

On the other hand, the effectiveness of non-employment related information exchange is highly variable depending on the group. As with many organizations often a few people do most of the work starting discussions and posting items. Others participate intermittently.

For example, in one 13-day period (starting on July 16, 2009) a member of Public Transit Professionals (which with over 2,000 members bills itself as the largest group for public transport professionals) posted a question, "What are your top ideas to improve public transport in a world city?" This is a highly interesting question and one that, in a transport seminar would generate a great deal of discussion. On LinkedIn 13 people had responded in 13 days. Many of the responses advocated products developed by the companies of people responding. Of course this is not bad, but not exactly an earth-shattering response rate and none of the ideas were particularly creative or innovative. Nor was there any of the back-and-forth that's part of the intellectual process.

There are two main problems with using the LinkedIn groups to exchange information. First, there are just too many groups. Participation is scattered. Oddly, even with so many groups, many are not really specialized: there are often several groups on the same subject. Second, most groups do not have enough people willing to help lead and control discussions.

Both these problems rise from the lack of time available to fully participate in activities that are not directly targeted to an individual's specific objectives (e.g. job responsibilities). If groups were more focused on specific areas it might be possible to generate a more constructive dialog and better information exchange.

4.3   Integrated social networking tools

Integrated social networking tools are applications that are included as part of a Web 2.0 Internet website that enable those using the site to create an application-specific social network. In this case the social network is highly focused on the goals and objectives of the specific application. These tools encourage social networking on several different levels – depending on the degree of social networking they are designed to foster.

At the highest level (i.e. in situations where the application developers want to stimulate a great deal of social networking), application developers offer a full suite of tools are designed to faciliate two-way communications and information sharing. A good example is the LivableStreets Initiative Community (part of the Livable Streets Initiative outlined above). Currently there are almost 4,500 members of this social network (as of 3 November 2009). The LivableStreets Initiative also compiles blog postings from almost 350 'members' to a website and this community gets involved in discussions on various topics.

At the medium level, application developers include tools that enable users to recommend news articles or websites such as del.icio.us, digg, or StumbleUpon. These websites all allow people to comment on comments made by other users and enable people to 'follow' recommendations made by users they select.

At the lowest level of social networking are subscription tools. Subscription tools enable people to directly receive internet-based information when it is posted. The best analogy is a periodical subscription. Good examples include really simple syndication (RSS) for blogs and 'following' in Twitter. These are classified as simple in the sense that they are not (necessarily) two-way (I may follow you, but you might not follow me).

The trend is for Web 2.0 Internet websites to use all three types of social networking website tools, thus providing something for any level of social networking engagement that the user desires.

5.   ANALYSIS AND EVALUATION APPLICATIONS

Analysis and evaluation applications are applications that enable users to enter data and use website-based tools to evaluate and manipulate that data.

There are many types of Internet websites that fall into this category. They range from very simple websites that, for example, allow you to calculate currency conversions (www.xe.com), to more complicated websites that provide users with business applications like spreadsheets, word processing and presentations as well as the ability to save data and collaborate with others on the same documents (e.g. Google documents).

Websites that provide access to applications and enable users to store and share data are often referred to as "cloud" based computing (the data and analysis tools are stored 'in the cloud' rather than on your computer). The model is software as a service rather than a product that comes wrapped in a package. A huge advantage of cloud-based systems for companies and people working in groups is that everyone is using the same program version and IT maintenance is done centrally – reducing the need for local technical support.

Cloud-based computing can be either free (e.g. Google documents) or subscription-based (e.g. Salesforce.com) in which users pay to use the applications and data storage provided by the application vendor. Salesforce.com is a popular customer relationship management (CRM) application that was among the first companies to embrace the concept of cloud-based computing. Today most subscription-based applications are oriented towards the corporate market, but there is continuing speculation that programs widely used by individuals (e.g. Microsoft Office) will be replaced by cloud-based subscription systems.

In addition to traditional business-oriented applications such as spreadsheets, there is another type of complex analysis and evaluation application on the cloud: games. While games may strike some as trivial, it is argued below that games can, in fact, be a key element in Web 2.0 applications used to improve transport systems and operations.

Games are especially useful since they can attract users and encourage them to participate. For example, some marketers are now using on-line games to analyze and evaluate data. Furthermore, games can serve as a good educational tool. One application that uses games to help understand transport planning is the University of Minnesota's Gridlock Buster game.

5.1   Transport related analysis and evaluation applications

Transport managers and planners can use all types of analysis and evaluation tools that are available on the Internet. These tools could be used, as in other businesses, to replace existing systems, encourage collaboration, increase efficiency and reduce costs. These types of uses fall under the category of general management and therefore will not be further discussed here.

In addition to the general business applications, many transport services already provide analysis and evaluation applications on the Internet, for example public transport schedule and direction finding websites. Many of these direction/schedule websites currently fall in the very simple category (returning a specific result based on the user input) although they are being extended to provide more information (e.g. real time, multimodal, etc.), to accept more varied user inputs, and to be available on more devices.

The San Francisco Bay Area Metropolitan Transportation Commission's transportation information website (www.511.org) is an excellent example of a website that has been continuously improved to include more features and applications (including information on transportation data feeds, 3rd party applications and information about public participation). One shortcoming is that the website does not include real interactive tools to help improve transportation planning.

Another extension of transport applications is their integration with user-provided information, for example driving instructions from Google Maps. These maps can also show user-provided photos, reviews of businesses and comments.

While it is clear that these analysis and evaluation applications can be extended, their main function is providing relatively simple information designed to answer questions from users. The

next section describes more complex applications intended to enable users to perform more complex analysis and evaluation tasks.

5.2   Using on-line games to improve transport systems and services

Many people consider computer games to be a waste of time, but there is growing recognition among Web 2.0 application developers that computer games may provide an excellent source of information and could be used to generate creative problem solutions. In this sense it's important to remember that transport simulation programs are essentially games, so maybe the idea that games can be useful is not so far fetched.

In fact, there are already many on-line games that include transportation planning elements (even players of the very popular Worlds of Warcraft on-line game have access to many forms of transport including riding various creatures (mounts), boats, zeppelins and an underground tram, there is even a public transport page). [19]

As mentioned above, some marketers are using computer games to collect information and to create excitement for their products (e.g. games related to new motion pictures). There are also a large number of games designed for educational purposes. There is also a whole series of simulation games for transport system and city building. Finally there are the alternative reality websites which are not really games, but share some game features and can be used to help complete analysis and evaluation tasks.

Since computer games are essentially simulations, it should be possible to extend games so that the players can simulate real-life rather than pretend situations. Alternatively, transport simulation programs could be made simpler so that anyone could use them, or the two could meet in the middle. In fact, according to Wired magazine, Mark Gorton (a key LivableStreets Initiative supporter) is also developing applications for open source citizen based planning (although the article did not give details). [20]

It would be very interesting to develop games based on real transportation simulation models and enable users to use these games with actual data that they collect. This could make everyone a transportation planner just as blogging can make everyone a news reporter. The technology is available. Such a system would totally change the nature of public participation in transport planning process.

This section presents several examples of on-line transport planning games that could serve as models for creating games that analyze real-world transportation systems and help the public identify innovative new ideas.

Gridlock Buster

Gridlock Buster is an online traffic control game developed by the Intelligent Transport Systems Institute at the University of Minnesota's Center for Transport Studies. [21] The game was developed based on standard traffic engineering tools and techniques.

In Gridlock Buster players control traffic and receive feedback based on vehicle delay and the length of queues formed at traffic signals. Players move through different levels of challenges and 'compete' to improve their scores.

Gridlock Buster is designed as a teaching tool to help explain how traffic is controlled on roadway networks. This will be helpful to citizens wanting to learn more about traffic congestion. Furthermore, the website includes an invitation for high school students to visit the ITS Institute labs and learn more about transportation planning. As such it's a great way to attract young people into the profession.

Urban Planning and Transportation Simulation Games

There is a whole category of on-line computer games that allow users to design imaginary cities and transport systems. Perhaps the first was SimCity, which has now grown to include various different games and modules. [22]

OpenTTD is an open source clone of the Micropose game Transport Tycoon Deluxe. The game includes maps and multi player options. It enables users to design routes for trains, cars, boats, monorails, aqueducts and aircraft. It also allows you to bribe government officials. The developers have a wiki that explains how the game works. [23] [24]

Simutrans is a railroad simulator. Players compete to build the perfect transportation network using trains, airplanes, buses, trucks, ships, trams, monorails, and maglevs. It allows players to design urban or inter urban networks. Players earn money by moving people in between cities, or transport goods for one of the many companies in the game. [25]

Portland Oregon Metro: Build your high capacity system

The Portland Oregon area's regional government, METRO, (http://www.oregonmetro.gov/) developed the "Build your high capacity system" tool to help citizens understand the trade-offs involved in planning high capacity public transport systems (e.g. budget constraints!). It was developed during preparation of the region's High Capacity Transit System Plan.

According to the Metro website: "The build-a-system tool lets you compare each of the transit corridors being evaluated by the project team. The corridors could, individually or in combination, connect places within the region with high capacity transit. With this tool you can compare how each corridor performs and learn about the benefits and costs of the system you've created." [26]

It is perhaps unfair to consider this a "game" since it falls in a gray area; it's a game in the sense that it is a fun way to learn about an important subject, and it's reality in the sense that it's backed up with real data for a specific area. Furthermore it was used to help Portland develop a plan for improving their public transport system; over 4,200 visited the website (and over 600 answered a survey associated with the page).

The build-a-system tool is a relatively simple application in the sense that users can only choose between specific routes, so it works by simply summing the data on cost, ridership, and environmental benefit in its database for the lines selected by the user to be included in their network. Still, it enables users to compare lines and networks and clearly illustrates the concept of a limited capital budget.

Finally, in true Web 2.0 fashion the site creators have also incorporated outside (3rd party) applications into the website. Users can click on a neighborhood center icon to get a pop-up with tabs for "map" (which displays a Google satellite map) and "info" which has a link to the walkscore website described above. (www.walkscore.com).

MetroQuest Regional Plan Scenario Analysis

MetroQuest is a scenario planning tool that allows users to complete multiple choice questions about different planning policies and see what the results of these policy choices would be on measures like commute time, energy use or government costs. According to MetroQuest: "The software's integrated models instantly display engaging maps and graphs showing the consequences of policy choices." The tool is available for use at events and meetings (where stakeholders can use handheld keypads to choose between policy options) or in an on-line version. (http://www.metroquest.com/) [27]

The web-based application was used by the Chicago Metropolitan Agency for Planning in its *GO TO 2040* campaign (http://cmap.metroquest.com/metroquest.html?mode=Invent). The CMAP used the software in what it called "Invent the Future" which provided 6 planning policy choices and presented outcomes in terms of 8 evaluation measures. Users can save, compare and share scenarios, as well as get their friends involved via an integrated Facebook link.

Similar to Portland's Build-a-system tool, MetroQuest limits users to specific choices and the results are presented in terms of variables that lend themselves to very general comparisons (e.g. average BTUs of energy used per person) which are probably calculated using relatively simple models.

The CMAP recognizes these shortcomings and describes the more detailed method used to evaluate the scenarios developed in the planning process (http://www.goto2040.org/scenarios/).

[28] However, the MetroQuest application is clearly an effective way to communicate the impacts of planning policy choices to citizens and decision-makers thus serving as an excellent educational tool. [29]

Virtual Reality Games: Second Life

Second Life is a free online virtual world imagined and created by its "Residents". [30] Some researchers are using Second Life to help develop and test innovative new transportation ideas, but most of the current research seems to be in the area of marketing. [31]

The use of these types of virtual reality to help improve real world transport systems and operations is a good subject for future research.

6.   CONCLUSIONS: CREATING WEB 2.0 APPLICATIONS TO IMPROVE TRANSPORT SYSTEMS AND OPERATIONS

The previous sections describe the fundamental principles used in Web 2.0 and several trailblazing transport related applications. This section presents recommendations for creating Web 2.0 applications that will improve transport system planning and operations.

6.1   Public involvement, the guiding principle

The innovation that differentiates Web 2.0 from early Internet sites is user involvement. The previous chapters have described some of the main types of user involvement including commenting, sharing photos and videos, rating quality and playing games, but the main point is that in Web 2.0 users are involved in the process of creating information.

Of course user involvement is also a fundamental part of transportation; transport systems are provided for users – no users, no need for transport. Transport services are provided in various market-based systems (some in traditional markets, others in highly regulated markets). Markets operate using information to determine what products and services are offered and to set prices.

But, transport markets are complicated due to the need for network infrastructure. In most cases large bureaucratic organizations plan, build and operate these infrastructures (i.e. government agencies). Information transfer in these types of markets is inefficient, further complicating market operation.

It can be argued that that inefficient information transfer contributed to the overbuilding of urban freeways as bureaucratic state highway administrations continued to do what they had always done – they did not get the message that a different approach might lead to a better transportation system. This argument is interesting because one of the key results from the public outcry raised over urban freeways were requirements for more public involvement in the transportation planning process (e.g. through environmental impact studies).

But, what is public involvement? It's information transfer from the public to the organizations responsible for planning, building and operating transport systems. While the standard public involvement program for transportation planning projects has been significantly improved over the years since these programs were mandated, it is hard for anyone involved in the process to believe that it works well. Here, then, is the opportunity for Web 2.0 applications.

Noveck calls the problem "the single point of failure", specifically, decision-making systems based on the belief that government experts can identify the best solutions to problems. Today the public can become involved in the deliberative part of this process by talking at public meetings etc., but new technology means that they could, in fact, really collaborate in the process of developing the solutions, rather than simply commenting. She emphasizes that citizens have a great deal of expertise that they could contribute to this process, if there was a way. She goes on to describe an application called Peer-to-patent, which enables people to help provide information to the US Patent Office that helps them make decisions. [13]

In summary, the goal is to improve the quality and operation of transport systems by creating collaborative public processes using Web 2.0. While it is possible to establish collaborative public involvement processes without using Web 2.0 applications, these applications make collaboration much easier. The next section presents recommendations for developing these types of applications.

6.2   Recommendations for Web 2.0 transport applications

The most important thing to understand about Web 2.0 is that it will revolutionize your business. If it does not revolutionize your business, your business is probably dying. Old ways of doing business simply don't work when information is more easily shared.

Some businesses have tried to fight change, for example, record companies suing people for sharing music. Many, like newspapers, are watching as their business model is destroyed. But clever companies are embracing change, building new business models based on using new technologies to build better products and offer improved services. It's not so different from other technical revolutions, although it's happening faster.

The following recommendations are intended to help those involved with government planning agencies begin thinking about how Web 2.0 applications can help them develop new business models. Some may argue that government agencies don't need new business models – their core business is not changing: roads are roads. This is true, but if new models make planning, building and operating transport systems more efficient and improve quality, then governments that adopt these models will have a competitive advantage over those that do not, increasing economic development and making their regions more attractive places to live.

1. Embrace Web 2.0

The first recommendation is to embrace the changes made possible by Web 2.0. Frankly, resistance is futile, as many companies have learned the hard way. Embracing Web 2.0 means:
1. making your data easily available to the public,
2. encouraging developers from outside the organization to use your data to create applications, and
3. creating applications that collect public knowledge and expertise in a collaborative process designed to improve your business.

As discussed above, many public agencies are already taking these steps including Washington DC's Apps-for-democracy program, Great Britain's Show-us-a-better way program and BART.

2. Design counts

It is a truism to say that websites need to be well designed, but design is even more critical in Web 2.0 because the goal is getting users to provide information. This means websites need to be clear and easy to use, but it also means that they need incentives for participation and moderation to prevent abuse (abuse is like graffiti, it makes users uncomfortable and less likely to participate). Noveck presents a list of specific recommendations and describes their use in the Peer-to-patent example. [13]

Importantly, designing an effective website begins by looking at the process: where could improved information help make the process better and more efficient? How can the improved information be used in the process (maybe the process needs to be changed too)? Once you have answered these questions, application developers can go to work creating websites designed to efficiently provide information to your users and to obtain the information you need.

Finally, the website needs to be carefully designed so that input can be used effectively in the process at hand. For example, something **needs to be done** with the photos users post on San Jose's Envision 2040 website. This means thinking about what task will be done with the information and then creating an application that enables this task to be completed efficiently; it's frustrating for users to provide information that can't be used.

The website design process, like any good design process, benefits from prototyping and testing before being released to the public.

3. Don't reinvent the wheel

There are many attractive, well designed and reliable Web 2.0 applications already available. These applications can be used as is or modified for specific uses.

A huge advantage of the many existing free Web 2.0 applications is that it's easy to start a blog, organize a social network or create a wiki. This provides a great opportunity to test ideas and learn how these applications work. While it's best to follow a structured design process as outlined in recommendation 2, it's also important to establish a presence, so, at least in the short term consider how existing applications could be used to achieve your goals.

4. Use an integrated approach

An organization's Web 2.0 presence should include all the types of applications needed to achieve its goals. This means considering how the four categories of Web 2.0 applications could be used to help communicate the organization's message and obtain the information it needs. It's likely that most organizations will need applications in all four categories: information provision, planning and administrative processing, social networking, and analysis and evaluation. Thinking in terms of these categories may help identify applications not originally considered in the design process.

5. Maintenance matters

Almost everyone underestimates the time and effort required to maintain an attractive website – particularly the amount of editing, moderation and responding that is necessary to encourage public participation. This work is non trivial and labor intensive. A factor not often considered is that if the application managers need to spend their time maintaining and editing the website content, they will not have time for the more important responsibility of publicizing the application and encouraging others to use it. Therefore It is critical to consider maintenance in the initial design so that the website can be organized appropriately (e.g. maybe there would be a provision for independent moderators, i.e. non organization employees).

6. Provide free access to information

Organizations should provide free access to their Web 2.0 applications whenever possible. In the case of government organizations there does not seem to be any good reason for charging for information that is already being collected.

7. Carefully consider information organization

A key difficulty in developing open applications is organization. StreetsWiki provides a good example of the difficulty in organizing information. As one looks through the table of contents one sees a huge variety of page topics often mixing apples and oranges as well as lacking hierarchies. Some argue that information organization is less important today since users can simply use a search engine (e.g. Google) to find what they are looking for. But, this assumes that people know <u>exactly</u> what they are looking for and that information is consistent (e.g. information on the page describing Bogotá's Transmileno Bus project is consistent with information on the page describing bus rapid transit). Organization and hierarchy make it easier to find and contribute information.

This points to the need for developing tools that make organization of information easier and for consistent editing (by users and application developers).

8. Obtain sufficient funding

A problem common to all types of Internet applications is funding. While there are many free applications that can be used to create specialized applications or websites (i.e. templates), people are still needed to customize the applications and to provide the initial data.

Furthermore, funding is needed to maintain the application, to edit, moderate and organize the data added by users, and most importantly to publicize the site. These tasks are generally time consuming and labor intensive; their magnitude is often underestimated by optimistic project managers.

Developing a strategy for making money from the application is critical for private businesses and should also be considered by publicly funded organizations. The most obvious solution is charging a fee for using the application. Many websites offer two-tier service: free and premium; the free service may include fewer features and advertising (e.g. LinkedIn). Many popular applications cost a nominal amount of money (it has been found that charging a low price often leads to more revenues since more people download the application). Finally, many independently developed applications encourage users to donate if they like the application.

Another strategy is to offer the application for free and use it to sell something else (e.g. private consulting). Anderson explores the issue of obtaining revenues from "free" products in the book "*Free*: The Future of a Radical Price". [32]

9. Provide incentives for participation

Web 2.0 applications must be very well structured to encourage participation and use the input provided effectively. Noveck makes several recommendations for encouraging effective participation, including breaking work into manageable segments and providing recognition for users who are rated highly in terms of input quality by the user community. [13]. San Jose awarded tickets for local cultural activities to randomly selected people who registered on the website they created for Envision 2040.

6.3   Improving public transport operations: Bus Meister

This section presents an example Web 2.0 application called Bus Meister. Bus Meister is designed to test the concept of developing an integrated Web 2.0 application that enables citizens to collaborate in the process of improving the operation of buses and trams that run on the street. If the application is successful it could be expanded to include other modes of transport and actual street design.

Bus Meister was developed using many of the principles discussed in this report. It consists of a game allowing players to understand how operating changes can improve public transport service and enabling them to test ideas for improving service on their own routes. The game is based on data from a wiki documenting public transport operations best practices. Finally, Bus Meister helps get good ideas implemented by providing social networking tools designed to help users generate political support for improvements. [33]

Bus Meister focuses on public transport priority measures. These are cost effective measures designed to increase public transport attractiveness by speeding-up buses, streetcars and trains. Public transport priority measures are excellent ways to improve transport because they are inexpensive and can be implemented quickly. [34] [35]

Research Database

Bus Meister's foundation is a crowd sourced wiki database presenting best practice information on three levels: detailed, technical summary and public summary. At the detailed level, researchers and transport professionals would enter information about their projects (abstract, contacts, links, etc.). The technical summary pages would focus on a specific subject area (e.g. bus stop design), researchers and professionals would edit these pages based on results of their projects.

The public summary pages would describe research in plain language. Moderators would maintain the summary pages and create the initial public summaries. These pages would include links to various media including videos, photos and presentations. As a wiki, all registered users could contribute to the information.

In addition to its educational purpose, the database will improve research quality by providing a single location for information on public transport priority. The wiki format means that the database will be a real-time state-of-the-art summary enabling researchers to identify fruitful areas for research and providing them with an effective dissemination platform (which will provide an incentive for them to participate).

Bus Meister Game

The Bus Meister game allows players to examine the impacts of public transport improvements on their own public transport routes. The game will both teach users about public transport operations and help them assess the value of their ideas.

First players would enter information (e.g. travel time, location of bus lanes, etc.) about their public transport route into the game using an interfaces developed with Web 2.0 applications (e.g. Google Maps). Applications would be developed for smart phones to facilitate this process. Players would collaborate in creating these route maps. As more information is added, the maps will become quite accurate. Progressive government agencies would make route and street data available immediately.

Once route information was on-line, players could test their improvement ideas by dragging improvement widgets on to the route map and the game would estimate the benefits and impacts. For example, the player could add traffic signal priority by dragging the "public transport priority signalization widget" onto the route map at the intersection.

The improvement widgets would be based on the research in the database (e.g. traffic signal priority reduces time spent at traffic signals by 20%). The game would apply data from the widget to the specific route (e.g. buses spend an average of 60 seconds waiting at this intersection) to estimate the benefit and impacts (e.g. on cross traffic).

The description above sounds simple, unfortunately it's not. A complicated transportation simulation model would be needed to accurately evaluate the full impact of an improvement and this is probably too much to expect, at least initially. Therefore, the game will be designed at different levels; the first level would be very simple, focusing only on the change in bus performance. As the application became more sophisticated more detail could be added (e.g. impact on cross traffic). This is not a problem as long as the quality of game results at each level are clearly communicated and understood.

Bus Meister Social Networking Tools

A full suite of social networking tools would be integrated into Bus Meister so that users could create communities to further their goals. Bus Meister would have two main types of users: people interested in making their public transport systems work better and professionals working in public transport (operators and researchers).

The first type of user, people interested in making their public transport work better, will typically be public transport advocates in specific regions. They would use Bus Meister's social networking tools to share information, collaborate on identifying improvements for routes, encourage others to participate by providing feedback on ideas and organize events like contests to develop the most effective measures for a given route.

An important role for these communities is providing feedback to fellow users – many websites fail because no one ever responds to comments. [9] Since it would be impossible for public agencies to respond to all the ideas generated by users, these communities would evaluate ideas and only recommend the best ones for further study.

Finally, these local communities will also generate political support for improving public transport. These communities would be similar to those currently organized around the Livable Streets Initiative and SeeClickFix, but it is also easy to see someone starting a Facebook group

dedicated to improving a particular public transport route with information from the latest Bus Meister game evaluations.

The second type of user, transport operators or researchers, will use Bus Meister's social networking tools to improve public transport services and research quality. More specifically, public transport operators could contact researchers with questions, and researchers could ask professionals to evaluate the practicality of research ideas and/or to field test ideas.

Since, the non-professionals will generate totally new ideas for improving public transport. This type of customer-driven innovation is likely to develop innovative ideas that professionals don't see because they are too close to the subject. Bus Meister's social networking tools will also allow these promising ideas to be considered for more detailed study.

Developing and Implementing Bus Meister

Bus Meister is currently a research concept developed by the author of this paper. A more detailed description is available at www.andynash.com/busmeister/. There are two potential approaches to implementing the concept.

The first approach would be to develop Bus Meister as part of a research study. The research would have two main objectives: first, providing a useful Web 2.0 application for improving public transport service; and, second, developing a better understanding of how Web 2.0 applications can be used to improve transportation systems and operations. This second objective would be completed by paying close attention to the process of developing the actual application. A formal research proposal will be developed once a suitable funding opportunity is identified.

The second approach would be to test individual components of Bus Meister in more focused projects. These projects might be part of a public transport operator sponsored project. For example, a simple Bus Meister game could be developed as part of the public involvement process for identifying transit priority improvements on a given corridor (analogous to Portland Metro's Build-your-own-high-capacity-system game discussed above).

7.4   Improving the environmental planning process: Peer-to-plan

This section presents an approach for using Web 2.0 applications to improve the environmental planning process. The approach, called Peer-to-plan, would be very similar to the Peer-to-patent process successfully implemented at the US Patent Office. [13]. It is designed to encourage collaboration in the preparation of environmental impact reports and studies, rather than limiting public involvement to the normal, more passive role of commenting on fairly well developed ideas.

As the examples presented in earlier sections illustrate, the idea of using a more collaborative process to prepare a plan is intriguing. If a good process could be developed, perhaps combining professionally developed text with effective citizen input, this could lead to much improved citizen participation.

Consider preparation of an environmental impact statement for a new rail line. Citizens could provide some of the data needed to evaluate impacts (it would be checked). Citizens are also likely to develop novel ideas for evaluating impacts and benefits that could prove more effective than purely technical measures like decibels.

It's also likely that citizens could provide good ideas for alternatives and help make good screening decisions if they are provided with appropriate technical background information. The Caltrain Downtown San Francisco Extension Project experimented with a paper-based version of this technique in 1996, creating an effective Web 2.0-based alternative screening process would be a significant improvement. [36]

The Peer-to-plan environmental impact evaluation process

Peer-to-plan, like the Peer-to-patent program which it is modeled after, is based on the belief that there are many people willing to collaborate in a process designed to help lead

agencies (project sponsors) make better decisions more quickly. Table 1 summarizes the Peer-to-plan process.

In a nutshell the Peer-to-plan process facilitates the creation of groups who agree to collaborate on evaluating the environmental documents and providing recommendations to the lead agency. The Peer-to-plan website would provide the tools needed to encourage participation and facilitate group collaboration. The Peer-to-plan process would take place as part of the regular public involvement process and technically the group report would be the same as any public comment.

Since the environmental planning process consists of several cycles of analysis, commenting and response, the same basic Peer-to-plan process could be followed in each cycle, although group membership would change (different people will be interested in different aspects/stages of the planning project). Also note also that several different groups might be active at any one time.

Step	Description
1	Local lead agency publishes intent to prepare an environmental document on internet-based clearing house website.
2	Individuals interested in collaborating on the review of a particular project register on the Peer-to-plan website. The website provides social networking tools enabling the individuals to form an ad-hoc project-related community.
3	Local lead agency prepares environmental studies using relevant guidelines; all studies and reports are made available on the Peer-to-plan website as they are released for public comment.
4	The Peer-to-plan website provides tools for community members to comment on the documents, add information to the record (e.g. research reports), and make recommendations. The website includes features allowing users to rate comments and recognizes users with many highly rated comments. The community has the ability to block abusive users and control the information developed in their 'report'. (Peer-to-plan does not replace the public involvement process, it simply facilitates organizing a community of people who agree to collaborate in preparing a group response; multiple groups could also be created, each collaborating in development of its own report.)
5	Public comment period for document ends, local agency completes document by prepareing responses to comments and incorporating them into a 'final' document for submission to the decision-making body.
6	The 'final' document is posted on the decision-making body website and the public (including experts) can add information to the website (e.g. vote on the quality of individual responses and indicate the importance of various issues).
7	Decision-making body considers document (including comments, ratings and indications of importance from the website) and makes decision.
X	The process repeats itself through each phase of the planning process.

Table 1: Proposed Peer-to-plan Planning Process

Peer-to-plan: improving the quality of input

At first glance it appears that the Peer-to-plan process would simply add a layer to an already long planning process: another public comment to be considered, responded-to and addressed. However, this misses two crucial points.

First, if the ad-hoc communities attract the right people to participate (partly a question of website application design) the quality of the group reports will be high. High quality reports and ideas will be voted-up by the community making it clear what information should be considered in the decision-making process.

If experts can be attracted to participate in the project groups, and the Peer-to-patent example suggests that they can be, than the reports can effectively raise important policy issues early in project planning when they can be addressed without significantly impacting project schedule. In fact the name Peer-to-patent reflects the fact that interested experts (peers) were attracted to participate in the program; Peer-to-plan would attract a broader audience, but this audience would include people with useful expertise (the planner living in the neighborhood as well as the creative transport designer living in another country).

The second way Peer-to-planner could actually speed-up the process would be if several people, say members of a neighborhood group, form a community that develops a single report. This would mean fewer comments to address rather than more (since often all members of a community group submit the same, or very similar, comments).

Peer-to-plan application tools

Among the tools made available in the Peer-to-plan process could be a wiki-based planning document (similar to Pittsburgh's CitIWiki Integrated Regional Transportation Plan described above). Members of the public and the ad-hoc project groups could enter questions directly on the text; others could rate these questions in terms of importance; and planners could use hyperlinks to provide detailed responses.

Another tool that a well-organized Peer-to-plan application would offer is a standard environmental impact information library. This library would include text and multimedia describing technical evaluation methods such as of how sound impacts are evaluated. This text could be used in the environmental documents thus speeding-up the report-writing process, but more importantly it would serve as an excellent educational tool. Since this library would be used for many projects it would be possible to develop excellent multimedia descriptions that would be understandable for everyone.

This standard environmental impact information library would itself be a wiki, enabling researchers to propose new evaluation methods, allowing professionals to have constant access to the latest widely accepted evaluation methods and data, and enabling citizens to learn more about the process. This wiki would be similar to the research database described in the Bus Meister proposal above.

It would be relatively easy to create the standard environmental impact information library as much of the information already exists and professionals would have a big incentive for placing this information on line (in fact, most of the information is probably already on-line, it just needs to be organized so that it can function as the library). Once an initial library is available, it can be improved as better techniques and more educational resources are developed.

The library could eventually include template documents such as formulas for use by citizens in collecting and presenting impact data, as well as full report templates. In the long run there is no reason why the entire environmental impact document preparation process could not be done on-line using these Web 2.0 applications. Clearly there would still need to ways to ensure that everyone had access to the Internet before an entirely web-based process could be acceptable, but access is a problem that can be solved.

Summary: Peer-to-plan

The Peer-to-plan application concept is clearly ambitious. The planning process is more complex and less clearly defined than the patent-granting process. Developing the initial version of Peer-to-patent took several years, so the Peer-to-plan process could take longer. On the other hand many valuable lessons were learned in the Peer-to-patent process not the least of which was that the patent examiners were quite satisfied with the new tool. [13]

Peer-to-plan is only one example of refinements that could completely change (for the better) citizen participation in planning. Clearly they would significantly change the nature of work performed by planners (who would then join many other professionals who need to re-think what they do and how they do it due to Web 2.0 applications). The next section describes how the Peer-to-plan process could be used in one particular government planning process.

7.5   Improving the FTA New Starts process

This section describes how Peer-to-plan could be used to improve the federal public transport funding process. The Federal Transit Administration (FTA) New Starts Program provides federal funds for construction of new public transport projects. Essentially, public transport operators from throughout the country complete a series of well defined planning and environmental studies, submit them to the FTA, and the FTA decides whether the project should receive federal funding or not. Once a project is on the list, funding will eventually be provided to build it.

No one seems happy with the existing FTA New Starts process. To project proponents it's mostly a slow bureaucratic steeplechase. To FTA staff it's a huge burden reviewing mountains of documents and making decisions. To many elected representatives it's an opportunity for pork-barrel funding, which, by injecting politics directly into the process, reduces incentives for quality planning. To elected officials philosophically opposed to public transport, it's an opportunity to ration funding and delay public transport improvements indefinitely.

The result is many sub-optimal public transport projects, though few involved would dare admit it publicly. One key problem with the process is that fundamental project decisions made very early in the process, can't be easily changed at the end; so unless a local public transport agency wants to begin the whole process over (a process that can take decades) it must build pretty much what was originally proposed.

A related problem is that once local agencies have invested several years in the process, they view funding as 'free money from the federal government' so there is little incentive to consider broader questions such as cost effectiveness (the FTA formulas seem only to encourage arguments about demand modeling). Nor do agencies have the opportunity to (re)consider what would be the best way to invest X hundred-million dollars in a region's transportation system.

Peer-to-plan can't solve all the problems with the FTA New Starts program, but it can begin the improvement process and thereby generate momentum for more comprehensive changes in federal transport funding policies and processes.

While many aspects of the Peer-to-plan concept are directly applicable to the New Starts process, the New Starts process is slightly different from the standard environmental planning process and these differences warrant brief discussion.

The New Starts process includes several decision analysis documents (in addition to environmental impact analysis), and furthermore, while the documents are officially issued by the Federal Transit Agency, they are actually prepared by the local agency sponsoring the project. This means that the documents must be carefully checked by the FTA to ensure that they are totally consistent with the latest FTA policies and requirements, and that they make sense from a planning standpoint. It's a difficult job, especially considering that many of these massive documents are underway concurrently and the FTA has limited staff for evaluation – a situation that sounds very much like the US Patent Office. [13]

The Peer-to-plan process would work very much the same way as for a single environmental document, but the community prepared reports would arguably be more important in the New Starts process because they would provide FTA staff with an independent high quality criticism of the locally prepared documents (exactly as the Peer-to-patent process works). This is important because the FTA staff, while responsible for document contents, are not directly involved in writing the document (as the lead agency is in preparing environmental impact reports), this means that they do not have as deep an understanding of the document contents and therefore would benefit significantly from expert review.

An important wrinkle in the process that will improve the quality of information provided in the Peer-to-plan community reports is that, since public transport funding is limited, it makes sense for experts from around the country to weigh-in on all the projects under consideration. Essentially if City B has a better project than City A and can show that it's better, it moves ahead of City A in the funding list; that's a big incentive for City B experts to participate in the review of City A's documents. On one hand this has the potential to reduce the process to a food fight, but on the other, if everyone knows that their projects will be reviewed in detail, than

they will develop the best possible project. Designing a careful peer-based quality rating system can help minimize the potential for problems. Furthermore, as the process becomes more merit-based, it will increase pressure for making more fundamental process changes.

Another real benefit for the FTA would be development of the standard library of information for New Starts proposals. The library would share certain elements from the environmental impact analysis library discussed above, but would also include specific information related to the New Starts decision documents. Again, this would help FTA even more than lead agencies for standard environmental documents, since it would simplify FTA staff review of documents. And, there would be a big incentive for experts to participate in the development of this database.

In summary, this section described some of the ways the Peer-to-plan process could be used to improve the FTA New Starts process. It is an idea that would need a significant amount of work to fully implement, but if the Peer-to-patent process is any indication, it's an idea that bears careful consideration.

8.   CONCLUSIONS

This paper has described how Web 2.0 techniques can be used to improve transportation systems and operations. It presented an introduction to Web 2.0, a discussion of data requirements and a structure for categorizing different types of Web 2.0 applications. Next it described these four categories of Web 2.0 applications in more detail and presented transportation-related examples. Finally, it presented recommendations for organizations considering development of Web 2.0 applications and three applications based on these recommendations that could be used to improve transport systems and operations. Web 2.0 is a work in progress and there is much more to say about the ideas described in this paper, therefore the goal of this paper is to simply whet the reader's appetite for more.

REFERENCES

[1]   http://sf.streetsblog.org/2009/06/26/does-nextbus-own-real-time-muni-arrival-times/ accessed 5 November 2009.

[2]   Gendre and Danflous; Services D'Information Multimodale 2.0, Participation des usagers à l'information déplacements; available at: http://www.cete-mediterranee.fr/tt13/www/article.php3?id_article=195   accessed 11 November 2009.

[3]   http://c2.com/doc/etymology.html accessed 30 July 2009.

[4]   http://en.Wikipedia.org/wiki/Wikipedia accessed 29 July 2009.

[5]   http://www.livablestreets.com/streetswiki/about-streetswiki accessed 29 July 2009.

[6]   http://sethgodin.typepad.com/seths_blog/2009/07/win-place-or-show.html accessed 31 July 2009.

[7]   http://www.ite.org/councils/Ped_Bike/ accessed 29 July 2009.

[8]   http://business.twitter.com/twitter101 accessed 6 November 2009.

[9]   http://www.forrester.com/Groundswell/index.html accessed 30 July 2009.

[10]   http://sethgodin.typepad.com/seths_blog/2009/07/win-place-or-show.html accessed 31 July 2009.

[11]   http://www.atlantabike.org/SeeClickFix accessed 29 July 2009.

[12]   http://www.seeclickfix.com/pro accessed 29 July 2009.

[13]   Noveck, Beth Simone; Wiki Government – How technology can make government better, democracy stronger, and citizens more powerful; Brookings Institution Press, Washington DC, 2009.

[14]   http://www.cyclopath.org/ accessed 12 November 2009.

[15]   Vander Veen, Chad; San Jose, Calif.'s Wikiplanning Project on Course in Government Technology, September 8, 2009; http://www.govtech.com/719878?id=719878&full=1&story_pg=1 accessed 12 November 2009.

[16]   http://www.wikiplanning.org/index.php?P=virtualcharrette accessed 12 November 2009.

[17]   http://www.pghwiki.org/ accessed 3 November 2009.

[18]   http://press.linkedin.com/about accessed 3 November 2009.

[19]   http://www.worldofwarcraft.com/info/faq/transportation.html accessed 29 July 2009.

[20]   http://www.wired.com/epicenter/2009/01/mark-gorton-ceo/ accessed 29 July 2009.

[21]   http://www.its.umn.edu/trafficcontrolgame/ accessed 29 July 2009.

[22]   http://simcitysocieties.ea.com/index.php accessed 31 July 2009.

[23]   http://wiki.openttd.org/Getting_Started accessed 29 July 2009.

[24]   http://www.makeuseof.com/tag/two-free-transport-simulator-games/ accessed 29 July 2009.

[25]   http://simutrans.com/about.htm accessed 29 July 2009.

[26]   http://www.oregonmetro.gov/index.cfm/go/by.web/id=29903 accessed 12 November 2009.

[27]   http://www.metroquest.com/ accessed 12 November 2009.

[28]   http://www.goto2040.org/scenarios/ accessed 12 November 2009.

[29]   Chicago Tribune, http://archives.chicagotribune.com/2009/aug/19/local/chi-invent-the-future-19-aug19 accessed 9 November 2009.

[30]   http://secondlife.com/whatis/ accessed 31 July 2009.

[31]   http://secondliferesearch.blogspot.com/ accessed 29 July 2009.

[32]   Anderson, Chris; "*Free*: The Future of a Radical Price"; 2009.

[33]   http://www.andynash.com/busmeister.html accessed 31 July 2009.

[34]   Nash, Andrew; Implementing Zurich's Transit Priority Program, Transportation Research Record #1835; Transportation Research Board, Washington D.C.; 2003.

[35]   Nash, Andrew and Ronald Sylvia; Implementation of Zurich's Transit Priority Program; Mineta Transportation Institute, San Jose State University; Report 01-13, October 2001. http://transweb.sjsu.edu/mtiportal/research/publications/summary/0113.html accessed 23 July 2009.

[36]   Nash, Andrew; Public Decision Making for the Caltrain Downtown San Francisco Extension Project; Transportation Research Record #1571, March 1997.