

GEOGRAPHIC INFORMATION SYSTEMS APPLICATIONS FOR LIVABILITY CONSIDERATIONS

Peer Exchange Summary Report

**Boulder, Colorado
July 18-20, 2011**



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I. Summary

On July 18-20, 2011, the Federal Highway Administration's (FHWA) Office of Planning sponsored a peer exchange in Boulder, Colorado, focusing on select organizations' applications of geographic information systems (GIS) to support livability considerations, objectives, and goals.

The purpose of the peer exchange was to allow participants with notable GIS applications that support livability the opportunity to:

- Share their knowledge and experiences with each other;
- Discuss lessons learned and challenges;
- Identify ways to improve agencies' abilities to develop and manage GIS/livability applications, share geospatial data, and support public outreach through GIS technologies; and
- Share examples of notable livability efforts.

The City of Boulder hosted the event, which took place at the City of Boulder's conference facility in downtown Boulder. Participants included staff from the City of Boulder, the Center for Neighborhood Technology (CNT), Colorado Department of Transportation (CDOT), Denver Regional Council of Governments, Michigan DOT (MDOT), the North Front Range metropolitan planning organization (NFRMPO), Pikes Peak Area Council of Governments (PPACG), Southern California Association of Governments (SCAG), FHWA's Colorado Division, FHWA Headquarters, and the U.S. Department of Transportation's (USDOT) Volpe National Transportation Systems Center. [Appendix A](#) includes a complete list of participants. [Appendix B](#) provides a list of questions discussed as part of four roundtable discussions held during the peer exchange. [Appendix C](#) provides the peer exchange's full agenda.

Several of these organizations participated in previous FHWA-sponsored research on GIS for livability applications conducted in 2011. This research resulted in a report on "Applications of GIS for Livability: Case Studies of Select Transportation Agencies."¹ The report included case studies on the experiences of the City of Boulder, SCAG, CNT, and the University of Oregon/Oregon Transportation Research and Education Consortium in creating and maintaining several GIS applications that support livability goals. Peer exchange participants drew on findings documented in the report as a framework for discussions. While these findings served as a starting point for conversation, the peer exchange's discussions also captured a range of additional topics that went beyond the scope of the report.

II. Background

FHWA believes that GIS and other geospatial technologies can help transportation professionals make better decisions. To help support and advance the GIS community of practice, FHWA's Office of Planning sponsors projects related to GIS and its application to several topics such as climate change, asset management, bicycle and pedestrian planning, right-of-way issues, and others. More information about these projects and current efforts is available on the FHWA GIS in Transportation website at www.gis.fhwa.dot.gov/.

This peer exchange provided an opportunity for FHWA to learn from practitioners about how GIS is being used to support livability decisions. It also provided a forum for peers to engage in

¹ The report is available at www.gis.fhwa.dot.gov/reports.asp.

discussion about current practices and trends, successes, challenges, and ideas for future implementation.

According to FHWA, livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. Furthermore, a livable community is one in which people have multiple, convenient transportation and housing options and can access destinations using cars as well as other modes of transportation.

While universal themes such as safety and affordability apply to communities of all shapes and sizes, applications of livability often differ from location to location and must be adaptable to reflect community values and unique local conditions. These distinctions are most easily recognized between urban and rural communities. For example, rural areas might require improved access to job centers, farmland and open space preservation, and faster emergency response times. Urban communities, on the other hand, might need a diversity of transportation options, improved congestion management, and support for neighborhood-oriented economic development.

In March 2009, the USDOT and U.S. Department of Housing and Urban Development (HUD) announced an interagency partnership to promote sustainable communities and help citizens gain better access to affordable housing, more transportation options, and lower transportation costs. In June 2009, the U.S. Environmental Protection Agency (EPA) joined the initiative to form the Partnership for Sustainable Communities. The Partnership developed the following set of livability principles to help guide State and municipal efforts:²

- **Provide more transportation choices.** Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nations' dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.
- **Promote equitable, affordable housing.** Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.
- **Enhance economic competitiveness.** Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services, and other basic needs by workers as well as expanded business access to markets.
- **Target resources to existing communities.** Target Federal funding toward existing communities – through such strategies as transit-oriented, mixed-use development and land recycling – to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
- **Coordinate and leverage Federal policies and investments.** Align Federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

² Additional information on the Partnership and the six livability principles is available at: www.sustainablecommunities.gov/

- **Value unique characteristics of communities no matter their size.** Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods – rural, urban, or suburban.

The Partnership for Sustainable Communities has relied on its partner agencies to make funding available for projects that met the initiative’s intent. Through programs such as Transportation Enhancements, Congestion Mitigation and Air Quality (CMAQ) Improvement Program, and Safe Routes to School, FHWA has provided support for projects that improve access, mobility, safety, and overall transportation quality in both urban and rural areas. FHWA also helps to build awareness of the livability principles through seminars and webinars, training opportunities, and peer exchanges such as the one documented in this report.

III. Presentations and Discussion

This section provides brief summaries of the presentations that occurred during the peer exchange. These summaries are listed below along with comments, questions, and answers that followed each presentation.

City of Boulder

The City of Boulder has a population of over 100,000 residents and is situated at the foot of the Rocky Mountain Front Range in the northwest portion of the Denver metropolitan area.³ The University of Colorado, which has an enrollment of almost 30,000 students, is also located in the city.

City staff provided some historical context for Boulder’s innovative approach to planning, which started by implementing an urban growth boundary in 1959 and a commitment to open space preservation in the late 1960s. In the late 1970s, the city adopted the Boulder Valley Comprehensive Plan, which continues to be the primary guide for all planning activities in the city. In the late 1980s, Boulder adopted its first Transportation Master Plan (TMP) with a mode-shift goal.

The TMP has been updated twice since it was first published. In the first update (1996), the City of Boulder planned complete systems for each modal system, represented in static maps. By 2003 when the second TMP update was published, staff had converted the entire TMP to GIS format, allowing the city to complete more in-depth analyses. The objectives of the 2003 TMP were to:

- Have no growth in long-term vehicle traffic;
- Reduce single-occupancy vehicle travel to 25 percent of trips;
- Reduce auto emissions of air pollutants;
- Ensure no more than 20 percent of roadways are congested (Level of Service F);
- Expand fiscally viable transportation alternatives for all Boulder residents; and
- Increase transportation alternatives commensurate with the rate of employee growth.

To accomplish these objectives, city staff identified 42 multimodal corridor segments that would be the focus of alternative transportation investments throughout the city. Using GIS, staff inventoried and assessed each corridor by developing a citywide mobility index that relied on a weighted scoring system to measure pedestrian, bicycle, transit, and automobile performance

³ Additional information on the City of Boulder is available at www.bouldercolorado.gov.

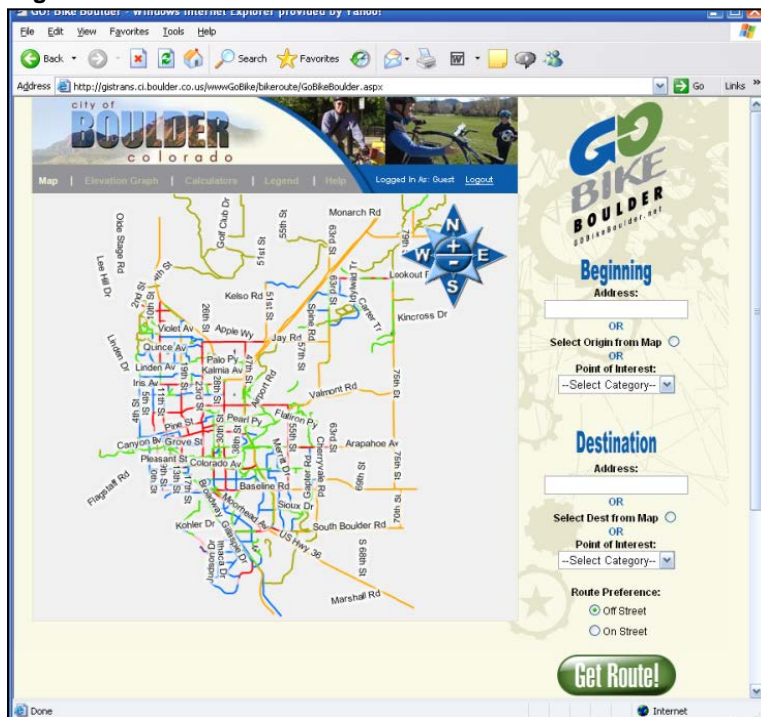
within each corridor. These assessments helped the city prioritize the short- and long-term alternative transportation needs for each corridor. More than 850 individual projects are included in the resulting GIS mapping and database.

City staff have also used GIS to illustrate options for transportation connections in a Boulder neighborhood that is less suitable for bicycle and pedestrian travel. By overlaying an urban street grid with which citizens are familiar (in this case, downtown Boulder) with the suburban mega-block grid of an area planned for redevelopment, stakeholders were easily able to compare the two different patterns and better understand how improved pedestrian connections would affect the built environment.

Staff also discussed Boulder’s most recent GIS project, Go Bike Boulder (Figure 1), which offers an easy-to-use, bicycle-oriented trip-planning tool.⁴ The web-based application provides maps and directions for both on-road and trail-only bike trips throughout the city and county. The tool aims to promote bicycling as an alternative means of transportation for Boulder’s citizens and positively impact health and the environment. In addition to a route summary and elevation chart, the tool also shows users how many calories they might burn while biking a particular route as well as the environmental benefits and cost savings incurred by using an alternative transportation mode.

Boulder has also collected aerial imagery to identify impervious surfaces (additionally, PPACG has conducted research to identify what employers in the region might be likely to produce heavier stormwater runoff due to impervious surfaces such as parking lots). Several peer exchange participants agreed that it could be useful to evaluate opportunities for redeveloping parking lots so as to limit the amount of impervious surfaces in a region or area.

Figure 1. Go Bike Boulder screenshot.



Comments, Questions, and Answers

Q: How many people commute into and out of Boulder each day?
 A: We have about 10,000 outbound commuters and 45,000 to 50,000 inbound commuters on a daily basis. We are doing pretty well in terms of alternative transportation mode share for commuters. We are hoping to have bus rapid transit on U.S. 36 to improve travel time between Denver and Boulder. Ultimately the region is supposed to get rail into Boulder and then up to Longmont.

Q: What is the average/median home price in Boulder?
 A: The average home price is

⁴ Additional information on Go Bike Boulder is available at www.bouldercolorado.gov/index.php?option=com_content&task=view&id=8840&Itemid=3018.

\$550,000 to \$600,000. There has always been a premium for living in Boulder. Boulder County is also desirable so housing is also quite expensive there although not as high as in the city.

Q: Who are the city's major employers?

A: The University of Colorado, Celestial Seasonings, and IBM. Boulder has numerous internet companies and a significant biotech and bio-sciences sector. We have a strong natural foods industry and several companies that specialize in active living such as sporting goods and outdoor publications.

Q: Is there a percentage of your budget set aside for data collection?

A: We allocate \$40,000 to \$50,000 for each survey, which occur every 2-3 years.

Q: Do you have bike counters?

A: Yes, we do have bike counters in a number of locations. We still have to physically show up at a several count location to capture the data. We have 16 to 18 automatic count stations.

Q: Do cyclists ride year round?

A: We find precipitation is more of a problem than temperature, and Boulder has an advantage in that it is mostly sunny all year. We find that there are half as many cyclists in the winter than in other seasons.

Q: Is parking free for bicycles?

A: Yes. We also have free parking for motorcycles.

Q: Does Boulder's travel survey capture trips other than work trips?

A: For more in-depth travel surveys we use the Boulder Valley travel diary. We ask travelers to keep a log of every trip that is taken throughout the day. We also have employer surveys that try to capture the travel needs of residents and non-residents specific to work trips and travel during the work day.

Q: How does the routing in Go Bike Boulder differ from Google Maps?

A: There are a lot of similarities. We provided our bike data to Google. Our goal is to get the information out to as many users as possible so we like that Google provides its own mapping service.

Q: How many hits does the Go Bike Boulder application get?

A: It has stabilized over the years. Initially, it was very popular.

Q: Do you have any requests to add incident management to Go Bike Boulder?

A: We have a different application called Cone Zone that includes information on construction and incidents. We do not currently have a way to provide real-time information or information on accidents in the application, but we have been investigating Intelligent Transportation Systems (ITS) technologies and opportunities.

Q: How did you make the public aware of the Go Bike Boulder application?

A: We had a fairly aggressive outreach effort. However, there are probably still individuals who do not know about it. It is an ongoing challenge.

Q: How do you promote information on biking and walking to the younger generation?

A: The Boulder school system has a bicycle-pedestrian coordinator with whom we work closely. The position was initially funded through a CMAQ grant and has since been funded by the school district.

Q: How much was the CMAQ grant used to complete Go Bike Boulder?

A: The total provided was \$200,000.

Comment: There is a private Boulder-based program that supports children cycling to school. The program provides radio-frequency identification (RFID) stickers that children can add to their helmets and obtain credit for walking and/or cycling to school. More information on the program is available at: www.boltage.org

Southern California Association of Governments (SCAG)

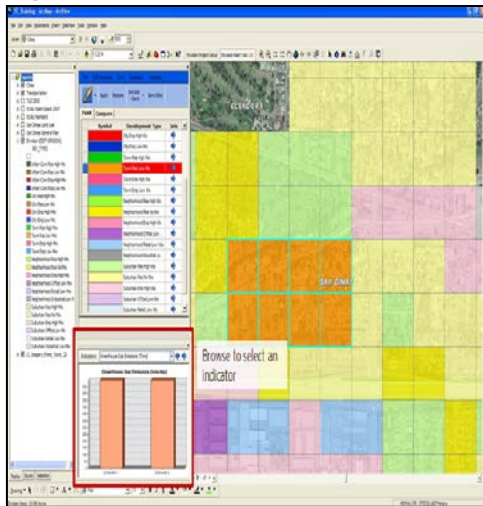
SCAG is the largest MPO in the nation.⁵ Its region includes six counties and 191 cities, including the City of Los Angeles, and represents the 15th largest economy in the world. SCAG currently serves 19 million residents and anticipates adding five million new residents by 2035.

SCAG described two GIS-based tools it has developed to support livability and sustainability goals:

- **Local Sustainability Planning Tool (LSPT).** SCAG developed the LSPT to meet the requirements of Senate Bill (SB) 375 that aims to reduce greenhouse gas (GHG) emissions through decreasing passenger vehicle miles traveled (VMT) and promoting compact development, sustainable transportation, and housing choices.

The LSPT is a sketch planning tool that SCAG's local jurisdictions can use to analyze the impact of different land use scenarios on vehicle ownership, VMT, mode use, and GHG emissions. The tool aims to assist SCAG's jurisdictions in responding to SB 375 requirements. It also seeks to engage a wide variety of stakeholders in the planning process and ensure regional planning efforts accurately reflect local policy.

Figure 2. LSPT screenshot.



The LSPT (see Figure 2) supports real-time feedback on scenarios and allows users to customize scenarios to account for local conditions. SCAG built it by integrating two separate modules: (1) Envision Tomorrow software that allows users to create multiple scenarios⁶; and (2) a transportation impact module that assesses how different development types perform on a series of indicators (e.g., vehicle ownership, VMT, trips by mode, GHG emissions). This module utilizes data from SCAG's regional household travel survey.

⁵ More information on SCAG is available at www.scag.ca.gov.

⁶ The software portrays different development types that represent a mix and intensity of land uses, housing and residential development, and density such as "suburban residential high mix," "urban core," or "neighborhood retail low mix." The development types allow analysis at a 5.5-acre grid cell level.

SCAG believes that sustaining the LSPT requires local jurisdictions' buy-in and support. To encourage this support, SCAG developed resources to facilitate jurisdictions' use of the tool (for example, the agency established a remote access platform to allow local jurisdictions that do not have GIS software to use the LSPT). SCAG also offered several training sessions to introduce jurisdictions to the tool.

SCAG experienced some challenges building the LSTP. For example, the agency found that collecting data was labor intensive, especially parcel-level data. Some jurisdictions were hesitant to share data due to sensitivity around boundary issues. Finally, SCAG found that local jurisdictions have varying levels of GIS skills and that it was sometimes difficult to develop a tool that was user friendly and met all stakeholders' business needs.

Despite these challenges, SCAG believes that the LSPT has helped encourage participation in regional planning efforts and supported stakeholders' understanding of land use and transportation linkages. It has also enhanced stakeholders' awareness about regional impacts of local actions.

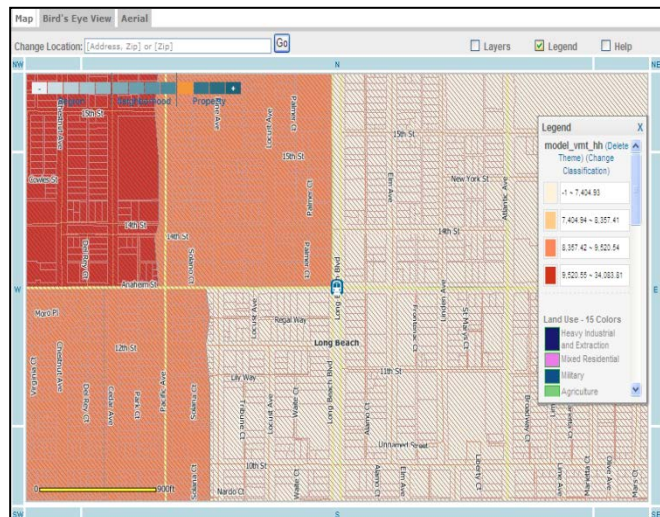
- California Land Opportunities Tracking System (CALots).** CALots is a publically accessible, web-based tool that supports spatial analysis at the parcel, neighborhood, or regional levels with an emphasis on transit-oriented development (TOD).⁷ The tool was first created in 2004 with assistance from the University of California-Los Angeles' Center for Neighborhood Knowledge. Elected officials, city planners, real estate developers, and community organizers are the tool's primary users.

The tool allows users to create customized GIS maps for specific neighborhoods, view associated demographic data, and analyze development potential in diameters of one-quarter mile, one-half mile, and one mile around transit stations (see Figure 3). Users can also access a "drive-through" function to view a specific street scene.

In addition to orthoimagery, CALots includes data for parcels, demographics, economics, housing, transportation, brownfields, air basins, water district boundaries, and foreclosure and loan data (as reported by the Home Mortgage Disclosure Act). The tool contains 120 gigabytes of data.

CALots has evolved over time. In its early stages, the tool included only data from the City of Los Angeles; the tool later expanded to include data from all six counties in SCAG's region. SCAG hopes to continue to broaden its use of CALots through

Figure 3. CALots screenshot.



⁷ For additional information on CALots, see www.compassblueprint.org/toolbox/calots.

expanding outreach efforts, improving the tool's functionality, and upgrading its technical abilities (e.g., some users have had difficulty downloading data). SCAG also intends to incorporate more data layers over time to support broader livability and sustainability analyses and would like to use CALots to assess historic trends related to infill and TOD opportunities in the region.

Comments, Questions, and Answers

Q: Would new transportation facilities, such as a road, be captured in the LSPT's land use scenarios?

A: The tool is not designed to take future transportation asset development into consideration since it is based on a household model.

Q: What is the tool's minimum scale of analysis?

A: The tool can conduct analysis at the level of a 5.5-acre grid cell.

Q: Can the LSPT accommodate zoning changes?

A: The tool does not automatically account for zoning changes but users can manually update zoning changes.

Q: How does the LSPT account for control totals?

A: This is a key issue. We suggested the control total number for each jurisdiction although users can manually monitor the progress of their scenarios over control totals as they make land use changes.

Q: To what extent are SCAG's members using the tool?

A: About 40 percent of our member cities are using the tool. Achieving this level of implementation took a lot of time and effort by SCAG staff. Many of SCAG's members have limited staffing resources and reported that use of the tool has involved a learning curve.

Q: Is Envision Tomorrow a publically accessible tool?

A: No. However, we freely share the LSPT, which is based on Envision Tomorrow software, with SCAG's member jurisdictions.

Q: How many staff worked on developing the tool and what were the costs?

A: SCAG has three GIS staff in total, two of whom worked on developing the LSPT. We received funding from Compass Blueprint to develop the tool. The total cost was approximately \$100,000.

Q: Did SCAG involve consultants in developing the LSPT?

A: Fregonese Associates built Envision Tomorrow. Two other consultants built the transportation module for SCAG.

Q: Does SCAG find issues related to jurisdiction that report inflated income levels for CALots?

A: No, data for CALOTS is obtained through the U.S. Census so there are no issues related to income inflation.

Q: Is SCAG looking at the average lifespan of a property in regards to local demolition?

A: No, we are looking at the actual demolition figures.

Comment: Envision Tomorrow’s development types incorporate economic information to ensure that scenario outcomes are fiscally feasible.

Comment: There are several resources for obtaining pre-Transportation Investment Generating Economic Recovery (TIGER) census data and converting it to GIS format. For example, the National Historical GIS⁸ has data from 1790; however, some data may not be very accurate.

The Center for Neighborhood Technology (CNT)

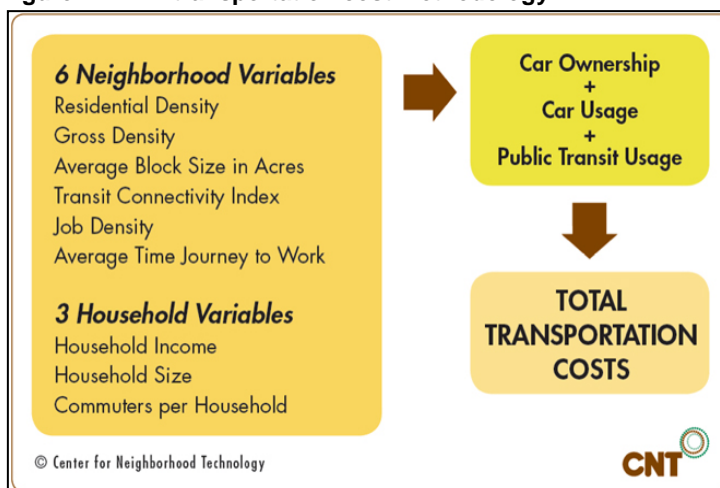
CNT is a non-profit applied research “think and do tank” based in Chicago, Illinois.⁹ The organization develops and implements strategies that benefit the environment and economy, with a focus on supporting access to public goods and services. CNT’s primary research areas include energy efficiency, transportation, climate change, and water and green infrastructure. The organization also operates the I-GO car sharing program in Chicago.¹⁰

CNT presented its Housing + Transportation (H + T[®]) Affordability Index.¹¹ The H+T index is based on the convention that 30 percent of a household’s budget should be allocated for housing. However, transportation costs are the second largest household expenditure and are greatly impacted by where a household live. The H+T index seeks to provide a more complete picture of neighborhood affordability by looking at the cost of housing in conjunction with the cost of transportation. CNT’s findings showed that compact walkable neighborhoods with proximity to jobs, transit, and retail have much lower average household transportation costs than dispersed, low-density communities.

In order to quantify transportation costs at the neighborhood level, which were largely unknown, CNT developed a model to calculate transportation affordability for any given neighborhood (see Figure 4). The model currently includes neighborhood statistics for 337 metropolitan areas across the country (based on U.S. Census Bureau 2000 metropolitan area definitions). An update and expansion of the H+T Index is currently underway and will include 940 based statistical areas as defined by the Office of Management Bureau 2008 definitions.

The H+T index enables comparisons of neighborhoods using six neighborhood variables and three household variables. The model demonstrates the importance of urban form and its impact on household transportation costs. The H+T website also conducts statistical analysis in real time based on the current map extent. As a user zooms in and out of a map and adjusts variables, the accompanying graphs and charts change based on the new scale.

Figure 4. H + T transportation cost methodology.



⁸ For more information on the National Historical GIS, see www.nhgis.org.

⁹ More information about CNT is available at www.cnt.org.

¹⁰ For more information on I-GO, see www.igocars.org.

¹¹ More information on the H + T index is available at <http://htaindex.cnt.org/>.

CNT also demonstrated the Center for Transit Oriented Development online National TOD Database tool,¹² a project that consolidates geospatial data for over 4,600 fixed rail stations across the nation. CNT created transit zones (one quarter mile and one half mile radii buffers around all fixed rail transit stations) and transit sheds (the aggregation of transit zones to each transit line, transit agency, and region), added transit regions (Census regions with fixed-rail transit), and assembled over 40,000 socioeconomic data to be aggregated to those geographies. The socioeconomic data includes data from the U.S. Census, Local Employment Dynamics (LED), Census Transportation Planning Package, and CNT's H+T data. The repository will better allow cities and developers to more easily see the potential for TOD in a given location. The project is funded by the Federal Transit Administration (FTA) and previously received start-up funding from HUD and the Surdna Foundation.

Comments, Questions, and Answers

Q: How are carbon dioxide emissions calculated in the H + T index?

A: These calculations are based on average household VMT from 2000 (about 19 pounds of carbon dioxide per gallon of gas). We did not factor in congestion, which is a limitation of the tool.

Q: If a user wanted to zoom to 1,000 feet from 10,000 feet, would more data be required from municipalities?

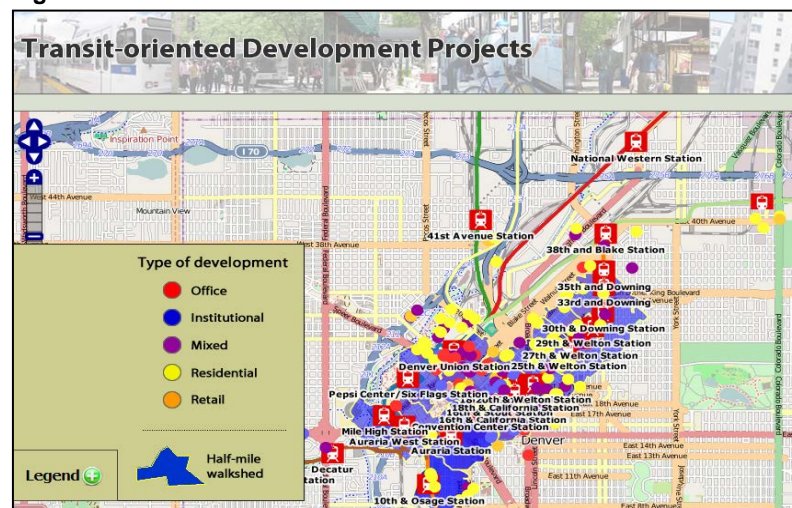
A: We have done re-analysis based on better data. We are trying to be ubiquitous with national-level data. If we had better data for municipal areas, we could do more specialized modeling.

Denver Region Council of Governments (DRCOG)

DRCOG is the regional planning agency for the eight-county Denver, Colorado metropolitan area of nearly 2.2 million residents.¹³ DRCOG staff reported on two of its GIS/livability efforts:

- **TOD project viewer.** DRCOG developed a GIS-based TOD project viewer that tracks real estate development projects within an approximate half-mile radius of existing and planned transit stations (see Figure 5).¹⁴

Figure 5. TOD viewer screenshot.



¹² The tool is available at <http://toddata.cnt.org>.

¹³ More information on DRCOG is available at www.drco.org.

¹⁴ The project viewer is available at <http://gis.drco.org/todmap>.

The project viewer seeks to make TOD data easy to download and more accessible and transparent to the public. The application was built using open source software and a Drupal content management system. Data were obtained from transit station developers.

- **Solar application.** DRCOG created a GIS-based solar application that assesses the amount of square footage available for building rooftop solar panels and the amount of energy that could be collected from these panels.¹⁵ Square footage estimations do not include objects such as rooftop air conditioning units that would prevent panel construction. The application was built with a consultant's assistance and funded through grants from the Colorado Governor's office.

Application users enter a specific address to identify the amount of square footage available for solar panels and an estimate of kilowatt generation that might be produced by the panels. The application also provides information on the cost savings that might be realized through the panels.

DRCOG initially planned to inventory 2000 buildings for the application but was ultimately able to include 800,000 buildings. The application has been well received, winning the Geospatial Information Technology Association's 2011 Innovator and Excellence Award.¹⁶

Data for the application were obtained from several sources. DRCOG's member governments provided information on building inventories and building footprints. DRCOG also utilized aerial imagery, which are collected every two years in coordination with its member governments.¹⁷ Additionally, the U.S. Geological Survey (USGS) provided DRCOG with free Light Detection and Ranging (LiDAR) data that were collected in 2008 as part of security preparations for the Democratic National Convention held in Denver.

DRCOG also included sustainability goals for the first time in its 2035 *Metro Vision* long-range transportation plan (updated in February 2011).¹⁸ The goals were developed with input from DRCOG's local governments solicited through stakeholder workshops and other events.¹⁹ In the plan, DRCOG articulated several strategies to help achieve these goals such as locating 75 percent of new employment and 50 percent of new housing in TOD regions.²⁰

Comments, Questions, and Answers

Q: What challenges did DRCOG encounter in developing the solar application and TOD application?

A: It was difficult to "clean up" the LiDAR data to populate the solar application. Additionally, it was challenging to determine how to move from concepts to reality and develop an application

¹⁵ The solar map is available at <http://solarmap.drcog.org/>.

¹⁶ For more information, see www.directionsmag.com/pressreleases/gita-congratulates-2011-innovator-and-excellence-award-recipients/176136.

¹⁷ DRCOG noted that this coordination has helped provide overall cost-savings for DRCOG, as the costs for contracting flown aerial imagery are shared among multiple entities.

¹⁸ *Metro Vision* is available at www.drcog.org/index.cfm?page=StakeholderWorkshops.

¹⁹ Additional information on the workshops is available at www.drcog.org/index.cfm?page=StakeholderWorkshops.

²⁰ DRCOG also described a report completed by the City and County of Denver, the City of Lakewood, the Denver Housing Authority and Metro West Housing Solutions, and the Center for Transit-Oriented Development. The report, which outlined strategies for implementing successful TOD areas along the West Corridor light rail line (part of Denver's transit network), is available at www.westcorridor.org/.

that addressed all of DRCOG's goals. Regarding the TOD application, it was difficult to identify an appropriate platform that would best meet users' needs.

Q. What was the response from DRCOG's member governments in regards to its sustainability efforts?

A: DRCOG found that some of its member governments were more receptive to discussing sustainability issues than others.

Q: Does the solar application's energy estimates account for the specific orientation of the sun?

A: Yes. This information was obtained from LiDAR data points.

Q: Have there been any incentives offered through the region's energy service provider [Xcel] if installed solar panels make more energy than is used?

A: We are not sure.

Comment: The City of Boulder is now considering whether it will become its own energy utility. There are a few other municipalities in Colorado that are their own energy utility, including Colorado Springs and Longmont.

Comment: A few peer exchange participants attended DRCOG's sustainability cafes, which were conducted as part of the agency's effort to develop sustainability goals for the *Metro Vision* plan. Based on comments heard during these cafes, it appears that citizens are identifying new sustainability issues for the region that local governments have not yet addressed.

Pikes Peak Area Council of Governments (PPACG)

PPACG is the MPO for the Colorado Springs, Colorado, metropolitan area.²¹ It is an association of 16 municipal and county governments and serves approximately 700,000 residents. The agency expects the region to add 300,000 new residents by 2035.

PPACG is currently engaged in several livability and sustainability initiatives:

- **Regional Sustainability Plan.** PPACG is spearheading a cooperative effort with regional stakeholders and local governments to develop a 20-year sustainability plan for the Pikes Peak region.²² The goal of the initiative is to develop a regional approach to address sustainability issues by convening a diverse set of stakeholders and to build on previous efforts conducted by the Colorado Springs Chamber of Commerce, Fort Carson, the University of Colorado-Colorado Springs, and others. PPACG is the principal funder for the initiative. GIS will be used to locate gaps and monitor achievements for many sustainability indicators.
- **Quality of Life Indicators Project.** In partnership with PPACG and others, Pikes Peak United Way²³ initiated the Quality of Life Indicators Project in 2006 to evaluate quality of life and opportunities for improvement in the Pikes Peak region. As part of the effort, over 100 interested community leaders convened in "vision councils" to address nine areas of interest such as transportation, economic development, community well-being, and safety. The effort resulted in a quality of life report detailing the status of the Pikes

²¹ More information on PPACG is available at www.ppacg.org.

²² For additional information on the effort, see www.ppacg.org/sustainability/aboutregplan.

²³ More information on the Pikes Peak United Way is available at www.ppunitedway.org/.

Peak region as related to the major areas of interest.²⁴ In coordination with PPACG and others, Pikes Peak United Way has continued the quality of life indicators project on an annual basis since 2006; the most recent report was released in 2010.²⁵

- **Strategic Highway Research Program 2 (SHRP2).** PPACG is piloting a SHRP2 capacity research effort (Capacity [C] 18) that is developing approaches and tools for systematically integrating environmental, economic, and community requirements into the planning, analysis, and design of roads. As part of this work, PPACG is testing a SHRP2 web-based framework called Transportation for Communities-Advancing Projects through Partnerships (TCAPP), which depends heavily on GIS and quantitative analysis.²⁶ PPACG is using TCAPP as a tool to help develop the next update of its long-range transportation plan; the expected completion date is January 2012.
- **Scenario Planning.** As part of *Moving Forward 2035 Regional Transportation Plan*, its long-range transportation plan completed in 2008,²⁷ PPACG used several GIS-based tools (including CommunityViz and NatureServe's VISTA) to develop and assess three scenarios: business as usual, conservation, and infill. The agency solicited public feedback on these scenarios, ultimately selecting parts of each scenario to create a preferred hybrid. PPACG is now using the preferred scenario as a framework for *Moving Forward* and to select and prioritize transportation projects.

Through the above efforts, PPACG has sought to develop a new, comprehensive planning paradigm for the region that encourages interaction, collaboration, and integration among stakeholders. PPACG believes this "diagonal collaboration" approach will also help address multiple planning issues facing the region, including transportation, socioeconomic, economic development, and land use challenges. To advance the concept of diagonal collaboration, PPACG is creating a GIS-based decision-support system that would improve work efficiencies, facilitate documentation, and allow interconnectivity with other agency tools. The system will integrate several tools (including CommunityViz, VISTA, and others) that PPACG currently uses to conduct economic, social, and ecological analyses. PPACG believes that this system will help identify synergies among projects to show how multiple projects could provide comprehensive benefits to a region.

Comments, Questions, and Answers

Q: Does PPACG expect growth to continue in its region?

A: Yes, particularly because Fort Carson, a military base, is located in the region. Fort Carson is the state's second-largest employer. Recently, we have seen a trend in more soldiers wanting to live close to the base.

Q. Can you provide an example of one of PPACG's high-priority projects?

A. Yes. PPACG is going to be building a portion of a project associated with the Peterson Air Force Base in Colorado Springs. The base has constructed a high-capacity facility. PPACG will develop an interchange near the base's main gate. Once completed, the facility is expected to add about 1,500 high-paying defense contractor jobs to the region.

²⁴ The 2007 Quality of Life report is available at

http://issuu.com/pikespeakqli/docs/qli_indicators_2007?mode=window&backgroundColor=%23222222.

²⁵ Additional information on the Quality of Life Indicators Project, as well as the 2010 report, is available at <http://pikespeakqualityoflife.org>.

²⁶ Additional information about the SHRP2 C18 project and TCAPP is available at

<http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3065>.

²⁷ Additional information on *Moving Forward* is available at www.movingforwardplan.org/.

Q: A natural gas company recently purchased an 18,000-acre development to the east of Colorado Springs to construct 3000 natural gas wells. Does PPACG expect to see more jobs added to the region as a result of this project?

A: The natural gas company believes that new activity on the purchased land would add 10,000 to 15,000 jobs. However, some of these jobs might be short-term.

IV. Roundtables and Observations

As part of the peer exchange, participants engaged in four roundtable discussions focusing on several topics and questions, which are summarized below. [Appendix B](#) provides the complete list of roundtable topics and questions discussed.

- **New Trends.** This discussion focused on recent geospatial and technological trends that could affect agencies' development of GIS/livability applications.
- **Tailored Solutions.** This discussion focused on how agencies can identify and assess the need for GIS tools that support livability, build successful tools that meet users' needs, and evaluate tools' performance.
- **Data Considerations.** This discussion focused on how agencies can better identify, collect, store, share, and update data related to GIS/livability applications. Additionally, the discussion addressed prerequisites and approaches for incorporating data into applications to meet users' and agencies' needs.
- **Public Participation/Outreach.** This discussion focused on how agencies can use disseminate information on GIS/livability tools to the public and what factors are important to ensure these tools reach a broad public audience.

Recurring observations, challenges, and lessons learned discussed within the above four roundtable discussion areas are presented in more detail below.

New Trends

Participants identified several new trends that are affecting GIS technologies and use of these technologies to build livability-focused applications:

Increasing Use of Smartphones and Crowd Sourcing Technologies

Smartphones are mobile phones that provide advanced computing abilities to users. Crowd sourcing technologies, which could be used together with smartphones, allow multiple users to provide input or to collaboratively develop solutions to specific issues.

Several participants noted that their organizations and agencies are investigating smartphone or crowd sourcing technologies to help decrease cost and staff time in meeting business and customer needs. For example, the City of Boulder noted that it completes a travel diary of residents every three years; currently, this effort is conducted using paper logs and costs about \$50,000. The city would like to begin using smartphone technology to collect travel data (with potential future applications for livability-related goals) and is investigating several avenues for doing so. A potential model might include the San Francisco County Transportation Authority's

CycleTracks application, which tracks information on cycling routes and trips.²⁸ Another model might be www.seeclickfix.com, a website that allows the public to report transportation issues (such as potholes and debris on the road) via their smartphones to local governments, utilities, or other users, who can then take appropriate steps to address the issues.

Participants discussed several considerations and lessons learned involved in the use of smartphone technology to support agencies' livability goals. Some examples are described below:

- **Address access issues.** Some participants cautioned that using smartphones might not reach some segments of the population that do not own these devices. However, agencies could rent smartphones and provide them to individuals for use. It is important to ensure that even those without access to smartphones could participate in an effort or have access to the same information. However, other participants suggested that in some communities, segments of the population are wholly relying on their smartphones to access information rather than through desktop or laptop computers.
- **Ensure that GIS/livability applications use accurate data.** Many GIS/livability applications focus on providing or utilizing location-based information. To be accurate and useful, these types of applications require accurate data. Agencies should ensure that any information gathered through global positioning systems (GPS) or other mechanisms correspond to paper and digital maps. A mismatch between collected data and maps will compromise the accuracy of GIS applications, making users lose confidence in the product.
- **Clarify user expectations.** Many smartphone-based applications that support livability goals allow (and encourage) users to submit comments directly to agency staff (e.g., www.seeclickfix.com). Due to limited staff time and funding, agencies might be concerned about their ability to address all issues raised in these comments. While these types of applications can support public participation by allowing citizens the ability to communicate directly with transportation agency staff, it is important to outline the expectations for this communication. To ensure success with these types of applications, agencies should clearly outline and publicize their responsibilities and roles before publically releasing an application.

Open Source Platforms

Several participants reported using open source platforms to manage website content. Open source platforms allow users the ability to change and distribute software without needing to own the software or obtain copyright permissions. Open source platforms typically rely on user-generated content and are often developed in a collaborative manner. These types of platforms can provide flexibility for agencies and provide time and cost savings. For example, an agency using an open source platform might be able to spend more time generating content rather than on developing a base software program.

NFRMPO is working on building a web-based Transportation Improvement Program (TIP) tool using an open source platform. The MPO expects that the tool will allow the agency to better manage its TIP history and communicate more effectively with CDOT.

²⁸ For more information on CycleTracks, please contact the San Francisco County Transportation Authority. Contact information is available at: http://www.sfcta.org/mos/Contact_Us/.

Participants discussed several considerations involved in the use of open source platforms, including the following:

- **Ensure that staff members support use of open source platforms.** One agency reported that its staff supported open source platforms since these programs typically do not require specialized knowledge of programming languages. Another agency expressed a concern about investing time and effort into learning a specialized programming language that it might not need to use in the future.
- **Open source platforms can support transparency and meet the public's expectations.** DRCOG is engaging in several efforts using open source platforms as a way to make information more accessible and transparent to the public. The agency believes that use of these platforms is what the public now expects and desires. For example, DRCOG intends to conduct an “application challenge” by making DRCOG’s data freely available online to third-party developers via multiple open source platforms. Developers will be encouraged to use the information to create new kinds of applications that benefit residents in the region. DRCOG also instituted an informal data-sharing consortium using an open source platform that allows member agencies to access priority DRCOG data sets for free.

Interactive Mapping

The public’s increasing use of interactive mapping applications such as Google Maps and Bing Maps is another important trend affecting agencies’ development of GIS/livability applications.²⁹ Many participants believed that these programs have raised the public’s expectations regarding the “look and feel” of web-based applications, including government applications. Some also felt that it would be a waste of government resources to try to duplicate these efforts and compete with private sector offerings. These technologies might be encouraging agencies to adopt new functionalities and standards such as “zoom,” “street-view,” and other types of features.

For example, CDOT reported that, as a result of changing user expectations, it has simplified some of its internal web-based tools to ensure a more user-friendly experience for employees. MDOT uses street-view data to verify information provided in applications to the state’s Safe Routes to School program and other grant programs. If an applicant requests funds to build a trail to provide access to a particular location, MDOT will use street-view data to verify the location of the trail and ensure that the request is valid. As another example, PPACG is now using Google Earth as a basemap to display pavement conditions, transportation projects, environmental conditions, and other information to the public.³⁰ PPACG believes the street and aerial views provided through Google Maps provide time and cost savings since staff do not have to drive to a particular location (for maintenance or other reasons) as frequently.

Participants noted that street-view information available on mapping websites is not always up to date and it is sometimes difficult to identify image dates (although some images might contain date watermarks). This can sometimes make it difficult to use this information to develop accurate GIS/livability applications. CDOT considered purchasing a statewide package of street-view data of rural areas and found that some information was over five years old. While agencies can estimate dates based on knowledge of when a particular asset or facility was built, other approaches might still be needed. For example, to address data accuracy issues, CDOT

²⁹ Google Maps is available at <http://maps.google.com>. Bing Maps is available at www.bing.com/maps/.

³⁰ Additional information on PPACG’s use of Google Earth is available at www.ppacg.org/reg-data/ppacg-google-earth-project-overlays.

has implemented a quality assurance/quality control process that includes the use of 6-inch ortho-imagery of the Denver metropolitan area, National Agriculture Imagery Program (NAIP) imagery as available, Computer-Aided Design and Drafting files, and annual street-view video logs to complement and augment third-party data sources.

Cloud Hosting

Cloud hosting refers to third parties hosting data on behalf of other entities and enables users to share, store, and manage data via web-based programs. CNT reported using cloud hosting services to store a large amount of data. These agencies believed that cloud hosting can provide cost savings to agencies and allow staff to focus more of their time on tasks other than data management. A few participants noted that they have worked with partners to leverage data storage resources. For example, SCAG did not have sufficient bandwidth to host some of its geospatial data using in-house services. It partnered with the University of California, Los Angeles, which already had the necessary data-hosting capabilities.

Visualization Technologies

Several agencies reported that visualization technologies can help educate the public on how a transportation project will look when completed. New technologies, such as Google's SketchUp, are allowing agencies to produce more detailed and accurate visualizations than in the past.³¹ While use of visualization technologies can be beneficial, some participants believed that visualizations must be carefully managed. For example, PPACG developed visualizations for several project alternatives and posted the files on its website for public downloading; users were able to download the files even after one alternative was discarded. PPACG cautioned that agencies posting visualizations online should ensure that updates are automatically posted and that users cannot access the original files.

Tailored Solutions

During the tailored solutions roundtable, participants discussed when and where GIS tools are needed to support livability and how to ensure that GIS tools are meeting their goals and objectives.

Considerations Supporting GIS/Livability Tools

Participants discussed several considerations related to the development of GIS/livability tools, detailed below.

- **Ensure that GIS/livability tools add value.** Agencies developing GIS tools that support livability should carefully consider how these tools add value to business processes. Interviewing end-users can help developers better understand users' needs and how GIS tools will fit into existing workflows and processes.
- **GIS can facilitate data gathering and responses.** GIS can help streamline planning processes with project management and operations. For example, the City of Boulder noted that, prior to converting its TMP to GIS format, city staff were spending large amounts of time looking through paper maps to respond to questions about the city's future transportation plans. City staff decided to incorporate GIS into the TMP update as a way to save time and facilitate responses to questions. As a result of incorporating GIS

³¹ SketchUp is available at <http://sketchup.google.com>.

into the TMP, the city moved from a report that contained several hundred pages to a 28-page summary with accompanying GIS maps.

- **GIS can facilitate information dissemination.** Most agencies reported that they began using GIS as a way to internally manage spatial data. However, in recent years, as the availability of web-based GIS tools has grown, many agencies noted that they have embraced the ability of GIS to provide spatial information to the public.
- **GIS has staying power.** Unlike a graphic report, GIS maps can be easily updated and revised. Geospatial base data remains useful over the years as long as information is properly maintained and updated. GIS maps are not just aesthetically powerful; rather, they are spatial databases that can support complex livability analyses.

Challenges Encountered in Developing GIS Tools

Participants also recognized the challenge of convincing decision-makers about the advantages of GIS for livability or the general benefits of GIS. Planners and GIS specialists often had to internally educate staff before receiving the funding and resources necessary to implement their GIS projects.

Some challenges and issues discussed are presented below:

- **The capabilities of GIS are not always understood.** Several participants indicated that obtaining support from decision-makers was compounded in large regional agencies that served multiple jurisdictions and might have had varying levels of interest in GIS. For example, SCAG is a regional council that includes 84 municipal governments. The agency had a difficult time gaining consensus on the level of GIS funding required for its needs. Using non-technical language, SCAG spent several months educating local government officials about GIS capabilities and the power of some of the tools that it could create. As a result of this outreach process, officials had a better appreciation of what was possible and how much effort would be involved to develop GIS applications.
- **In some circumstances, it can be acceptable to implement GIS tools and “ask for forgiveness” later.** Some participants believed that it was sometimes easier to move forward with GIS project development even without full support from agency decision-makers. They believed that, in certain circumstances, it might be easier to demonstrate a tool's capabilities with a working product. Before obtaining full buy-in from executives, DRCOG produced a web-based GIS data catalog containing all data collected by the organization. The agency captured visits to the catalog using Google Analytics and showed the statistics to executives, who were pleased with the product and provided their full support.
- **Agencies are concerned that GIS might highlight deficiencies.** Participants believe that many agencies now recognize the power of GIS; however, leadership might express concern about public exposure. If GIS tools make issues available to public scrutiny and feedback, there could be an expectation that agencies will immediately address these issues. While leaders acknowledge the importance of answering public concerns, they might also believe that it is not always in an agency's best interest to respond immediately.

- **There are few specific examples of GIS/livability performance measures.** Most agencies have not developed formal performance measures to assess GIS/livability tools. Evaluations of these tools often rely on feedback received from users. For example, CNT has an online parcel database that people use regularly. A “feedback” button is available on the site that allows users to provide comments to CNT. Some participants noted that they are considering use of pop-up surveys added to an agency’s website; however, others expressed concern about the quality of feedback received through these forums. In general, most participants are relying heavily on anecdotal feedback to assess use of their GIS/livability tools.
- **Resources are often lacking to support evaluation.** Funding for an initiative is generally used for product development. There might not be sufficient funding to monitor a product’s use and success, and new resources are difficult to obtain. One participant suggested that agencies could harness the power provided by review websites (e.g., Yelp) where many people are willing to provide reviews about restaurants and other businesses to encourage reviews of GIS products.

Data Considerations

Data are an important component of developing GIS/livability applications. Agencies need data to populate these applications; additionally, data are used to help evaluate applications through performance measures or other metrics. Several recurring considerations, lessons learned, and themes emerged in participants’ discussion of data considerations and are detailed below.

Using Data to Develop GIS/Livability Performance Measures

- **Ensure that performance measures are meaningful.** Several participants suggested that agencies should take care to translate performance measures into concepts to which the general population can relate. For example, while in its TMP the City of Boulder has an objective in technical terms of “reducing vehicle miles traveled to 1994 levels,” the concept is more effectively expressed as “no long term growth in vehicle traffic.” To make performance metrics more meaningful, agencies can, with feedback from the public, identify the key questions that general public would find important. For instance, one question might be “what are my transportation options located within one-quarter mile from my home?”
- **Avoid disjointed metrics.** Metrics should be comprehensive to help assess the overall progress of a GIS/livability effort or initiative. For example, a comprehensive set of performance measures could show that use of alternative transportation modes in some areas might lead to reductions of GHGs as well as safety improvements. Stakeholders will be more likely to support an effort or project if they understand that it has numerous benefits that ultimately support an improved transportation system, quality of life, or other overall goals for a region or area.
- **Use the Partnership’s six livability principles to develop performance measures.** These principles can provide a framework for identifying useful performance measures; however, it is likely that agencies will need to tailor specific measures to the unique needs and goals of a particular community or region. Measures might also differ depending on whether a community is located in an urban, suburban, rural, or other type

of location. The Partnership is developing example performance measures based on the six livability principles; these will be posted on the Partnership's website in the future.³²

Working with Partners to Collect and Share Livability-Focused Data

- **Identify the need for data.** SCAG reported that it conducted an online data-needs survey for local jurisdictions in 2005. The survey allowed SCAG to better understand what information its members need and to plan future data collection efforts more effectively. Some agencies might not have funding resources to purchase proprietary data but might have existing sources of information that could be leveraged to “fill the gaps.” Identifying data needs can help agencies make better use of existing resources.
- **Build long-term data-sharing relationships with partners.** Agencies can work together to leverage data resources. CNT noted that it shares data with the Chicago Metropolitan Agency for Planning (CMAP), the MPO for northeastern Illinois, and vice versa. CNT and CMAP have worked together closely for about 20 years and have developed several data-sharing agreements to formalize their partnership. Additionally, several CNT staff work in the CMAP office. While building this partnership was challenging at times, it has allowed the two agencies to effectively leverage their resources and access a broader range of information than they would have been able to access otherwise.
- **Creatively address coordination challenges.** Some agencies reported difficulty in obtaining data from other organizations. For example, PPACG wanted to obtain information from the Colorado Springs utility but did not have sufficient funding to purchase these data (which cost \$300,000 in addition to maintenance fees). SCAG also encountered difficulties in obtaining data from Orange County and does not have sufficient budget to purchase a large amount of data from proprietary sources. CNT was able to obtain some general data from an electrical utility company.

To address these challenges, agencies could consider developing data-sharing consortia that support information exchange among members; however, it can take time to identify consortia members and establish a structure for coordination. SCAG noted it has had success obtaining data through a digital mapping consortium. Agencies could also consider partnering with nonprofits to obtain certain types of data. Some organizations might be more likely to share information with a nonprofit rather than another entity.

- **Public agencies should leverage private sector resources.** Several participants noted that, while private and public sector missions might differ, both sectors likely share a common goal in striving to reach as broad an audience as possible. As such, these sectors should not see themselves as being “in competition” to develop GIS/livability tools; rather, they should view one another as partners that can work together to leverage resources. When possible, the public sector should take advantage of existing private sector resources. Some participants suggested that the Federal government compile libraries of existing private sector resources that advance livability goals or

³² Examples of these measures include: change of VMT per capita, percentage of new homes built within key activity centers, increase of affordable homes, and decrease in rate of agricultural land lost to development.

provide links to these applications on Federal government websites, particularly the FHWA website on livability activities.³³

- **Investigate new sources of data.** The City of Boulder suggested that in the future agencies might be able to obtain data from geospatial technologies (e.g., GPS) installed in vehicles. While the city expected that there would be some challenges involved, it noted that the private sector is already collecting some information from vehicle devices.

Another source of data could be from devices installed in transit passes. For example, the Denver Regional Transportation District (RTD) received a Federal grant to install smart card technology. This would add RFID-type chips to various passes, such as Eco-Passes, which could then be purchased by companies to give to their employees. The passes will provide users a full year of unlimited RTD rides, and the chips will capture information about ridership and routes taken. The City of Boulder expects to obtain data from these chips once they are implemented.

Agencies might also consider obtaining publically accessible data that have been collected for homeland security purposes. For instance, DRCOG obtained LiDAR data from USGS that was collected for the 2008 Democratic National Convention. Some participants suggested that FHWA could assist agencies in this area to identify new data sources for use in GIS/livability applications.

- **Educate decision-makers on what data are available.** In many cases, decision-makers might not be sure what information they need; as a result, they might request extensive amounts of data from GIS or information technology staff. While having a lot of information can support effective decision-making, in some cases too much data can be overwhelming and lead to “analysis paralysis.” Additionally, frequent requests for large amounts of information can burden staff. Many participants believed that it is important to educate decision-makers on what GIS data are available and feasible to obtain; this can help pinpoint what is needed to make decisions and can facilitate agency-wide communication.

Addressing Challenges in Data Collection

- **Collaborating within agencies can be challenging.** Some agencies are experiencing issues related to internal business “silos.” It is not uncommon for an agency’s departments to have different requirements in terms of data scale, level of accuracy, and software platform needs. While GIS can be a powerful tool to help bridge the gap among divisions, these issues can make it more difficult to implement enterprise GIS solutions.
- **Consider purchasing data that are difficult to collect.** Some agencies are experiencing challenges collecting data to populate GIS/livability applications. To address this challenge, agencies can purchase data that they are unable to collect. However, some private vendors do not publicize their data collection process so agencies might need to investigate these sources in more depth or else use vendors who do make their data processes transparent.

³³ The website is available at www.fhwa.dot.gov/livability/activities/.

- **Identify any data restrictions before purchasing or collecting information.** Some information might not be conducive for sharing with the public due to security or other concerns. It is important to identify what restrictions exist before collecting information. For example, aerial information collected by the City of Boulder in 2003 was funded by the utility department, and the city has a data sharing agreement with guidelines on how the data can be used or applied.
- **Use GPS data or online surveys to address issues with telephone and paper surveys.** Many agencies have traditionally relied on telephone and paper transportation surveys to understand how residents are traveling and their decisions about route and mode choices. Some participants believed that conducting telephone and paper transportation surveys is becoming more challenging due to agency budget cuts and low response rates. To address this issue, agencies could consider conducting online transportation surveys using programs such as www.surveymonkey.com. However, before using these types of programs, it is important to know how much of the population has access to internet service. Additionally, agencies might be able to obtain GPS data in lieu of conducting online surveys.

Public Outreach

While initially intended to focus on the role of GIS/livability tools in supporting public participation, the roundtable focused more on public outreach during the peer exchange. The session prompted discussion about how planning and GIS departments are disseminating information about the tools that they have developed. Much of the session focused on social media and web presence with little emphasis on GIS-specific applications.

Websites

Most participants noted that they use their agency's website to inform the public and local officials about the release of a new GIS tool or application. A key success factor is making the website searchable and "discoverable" or easy to find using the most common search engines. Several agencies use Google Analytics to monitor website traffic.

Social Media

Many agencies reported involvement with social media applications such as Facebook, Twitter, and YouTube. These applications can provide the public with up-to-date information related to agencies' operations and encourage back-and-forth dialogue with users. For example, MDOT recently released three YouTube videos on biking, transit, and ridesharing to promote a new web-based initiative called Mi Commute.³⁴ MDOT heavily promoted the release of each video, which was staggered in two-week intervals.

CDOT mentioned that it uses a tool called Gov Delivery to send simple messages to the public through simple message services (SMS), cell phone texts, or emails about significant highway concerns and alerts. Users must subscribe to the service. When signing up, a user can check boxes of interest and will receive additional information based on their selections. The service is not advertised beyond the agency's own website where a phone/mail icon states that users may sign up for email and wireless alerts.

³⁴ More information on Mi Commute is available at www.mi.gov/micommutte.

FHWA noted that while many public agencies began using social media to disseminate information to the public easily and inexpensively, many of those efforts have been hampered because the agency had no policy in place to manage incoming and outgoing information. However, CDOT reported that its public engagement office does a good job to manage the agency's use of social media.

Several participants voiced concerns about social media tools being overwhelmed with citizens who might post inappropriate or inaccurate information. Additional issues and lessons learned related to transportation agencies' uses of social media are captured in a 2010 FHWA report.³⁵

Other Media

QR codes are a two-dimensional barcode that can be read by smartphones enabled with QR reading software. The encoded information is frequently a link that will direct users to a specific website. Both MDOT and the City of Boulder reported using QR codes on publications or maps to direct users to a specific website to download additional information.

Traditional media such as newspapers and television were briefly mentioned. Participants discussed whether traditional media are still adequate for serving the agencies' public outreach needs. A few participants reported that one of the best ways to disseminate information to the public and conduct surveys is by attending local events such as farmers' markets and seasonal festivals. In some circumstances, this approach can provide a better range of input than traditional public meetings as some meetings are attended primarily by advocates for a specific agenda item.

Visualization

A few agencies reported using GIS tools to allow the public to better envision a community's future given certain development scenarios. Some examples of applications mentioned include:

- **MetroQuest.** Originally introduced as a tool for use at its sustainability cafes (open meetings to solicit public input for regional sustainability efforts), DRCOG now uses MetroQuest as a public outreach tool in local schools. The software allows users to select public policy options and view community outcomes on a map developed with GIS base data.
- **CommunityViz.** PPACG uses CommunityViz to provide three-dimensional models of the built environment. Similar to MetroQuest, the program enables a user to experiment with different policy decisions and subsequent outcomes. CommunityViz is a software extension of ESRI's ArcGIS application.

V. Conclusions

Agencies participating in the peer exchange had a range of experience with GIS/livability tools and technologies. Through sharing information about agencies' currently used GIS tools as well as knowledge regarding lessons learned, challenges encountered, and success factors, participants gained insight into how GIS tools can be developed, utilized, and deployed to support livability goals. Furthermore, the roundtable discussions provided opportunities for participants to share ideas about new trends affecting GIS technologies, geospatial data issues,

³⁵ This report explored select state DOTs' uses of social media and web 2.0 tools to support business objectives. The report is available at <http://gis.fhwa.dot.gov/documents/web20report/web20report.htm>.

performance evaluation, and use of GIS to support public participation. Overall, the presentations and roundtables allowed participants to better identify approaches to improve their agencies' development and management of GIS/livability applications.

The FHWA report titled "Applications of GIS for Livability: Case Studies of Select Transportation Agencies" provided a useful starting point for many of the discussions held during the peer exchange. However, the exchange presentations and roundtables showed that there are many topics of interest related to the use of GIS technologies to support livability goals that went beyond the scope of the report. The peer exchange supported development of a stronger peer network and community focused on uses of GIS for livability.

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Appendix B: List of Roundtable Topics and Questions

New Trends

This topic focuses on recent geospatial and technological trends that could affect agencies' development of GIS/livability applications.

- Identifying New Trends and Building Support
 - What are some emerging geospatial technologies (not necessarily traditional GIS, such as smart phone applications, transit tracking and prediction, crowd sourcing, visualization, real-time transportation information and alerts) that will affect quality of life?
 - How can these new technologies be integrated with GIS?
 - How might new technologies affect agencies' development of GIS tools that support livability goals?
 - How are new GIS tools developed at your agency?
 - Does your agency support research and development for GIS? Is funding provided for these efforts?
 - Is there support for experimentation with new technologies?
 - Can you provide any examples of current R&D efforts?
- Software
 - For those agencies that primarily use ESRI, have you moved to ArcGIS 10?
 - Is it serving your needs?
 - Do you take advantage of new features?
 - Have you experimented with alternative or open-source GIS software? Third-party plug-ins?
 - What have your experiences been like?
 - What lessons learned/challenges could you share from your use of this software?
 - Have you developed any applications for handheld devices or smart phones?
 - If so, what have been some lessons learned/challenges resulting from these efforts?
 - Do you take advantage of any free internet-based mapping tools?
 - Which tools have you used?
 - Have you found any pros/cons to using certain tools?
 - Has your agency benefitted from a third-party geospatial application? If so, how? Can you provide some examples?
- Visualization
 - How much of an emphasis do you place on the visual capabilities of GIS?
 - How do you think a better visualization program could enhance your activities?

Tailored Solutions

This topic focuses on how agencies can identify and assess the need for GIS tools that support livability, build successful tools that meet users' needs, and evaluate tools' performance.

- **Assessing the Need for GIS**
 - Agencies participating in the FHWA case study report noted that there were a variety of motivating factors that encouraged the development of GIS tools (e.g., state mandates).
 - Are there other relevant motivating factors?
 - Even given these motivating factors, how can agencies best assess the need to develop GIS tools that support livability?
 - How can agencies ensure that scalable and cost-effective GIS solutions are available to those who can benefit most?
 - In your agency, do certain GIS initiatives move forward while others stall? Why is this the case? What could be done to address any challenges?
- **Building GIS/Livability Tools**
 - How can agencies successfully translate livability research into a developed GIS application?
 - What elements (e.g., data, staff) are required to successfully build a GIS/livability tool?
- **Tracking Progress**
 - Agencies participating in the FHWA case study report noted that very few performance metrics have been developed to assess how GIS/livability tools are used and whether they are successful in meeting their goals.
 - What are the important factors to measure for a GIS/livability tool?
 - How can these factors be best measured? Are formal performance metrics needed or are there other approaches to identify an application's success?
 - It seems that few agencies/organizations are actively working to measure the effectiveness/benefits of their respective GIS programs.
 - Is this because there is a lack of funding, an unclear strategy, no perception of need, or something else?
 - What could agencies do to address each of these issues? How has your agency addressed these issues or others that might hinder development of performance evaluations?

Data Considerations

This topic focuses on how agencies can better identify, collect, store, share, and update data related to GIS/livability applications. The topic also focuses on pre-requisites and approaches for incorporating data into applications to meet users' and agencies' needs.

- **Collecting and Assessing Data**

- Data are an important component of any GIS/livability application. How can agencies facilitate gathering, using, storing, and sharing GIS data?
 - What data resources currently exist for GIS/livability?
- What factors or items are most important to think about when deciding if/where/how to purchase data?
- Most agencies participating in the FHWA case study report noted that they do not currently have performance metrics for GIS/livability tools.
 - What data do you think are most important to develop performance metrics that assess GIS/livability tools?
 - What challenges might be involved?
- How can agencies ensure sustainable data collection to ensure that applications are kept up-to-date?
- Using Data
 - In many cases, the availability of open data seems to be a strong requisite for developing GIS/livability applications.
 - Has your agency used open data for GIS/livability applications? If so, how?
 - What are some challenges or lessons learned in the use of open data (or making data more broadly available to others)?
 - Does your agency make transportation data available to the public? How so? Are data shared with other partners (e.g., state DOT, nonprofits)?
 - Do you have any concerns about making data available to the public?
 - While agencies participating in the FHWA case study report noted a few challenges in the use/development of GIS/livability applications, most challenges were related to obtaining or managing data. For example, it can be expensive to obtain data, and some agencies have experienced technical difficulties in manipulating the data.
 - How should these (or other related) challenges be best addressed? What have been some lessons learned/critical success factors?

Public Participation

This topic focuses on how agencies can use GIS/livability tools to support public participation and what factors are important to ensure these tools reach a broad public audience.

- Using GIS to Support Public Participation
 - Engaging the public in data collection or evaluation is an important component of many GIS tools that support livability. How can agencies use GIS to get more citizens involved in thinking about their neighborhood livability, urban form, and community quality of life?
 - How can agencies use new technologies (e.g., crowd sourcing) that invite public participation in new ways?
 - What factors are most important for ensuring that a GIS/livability application is able to reach the public and support their participation?

- What challenges exist to building, developing, or managing GIS/livability applications that support public participation (particularly online tools)?
 - How can these challenges be best addressed?
 - Are there any lessons learned/critical success factors in how your agency has addressed these types of challenges?
- What GIS/livability applications are you aware of at other agencies/in other areas that are promoting or inviting public participation?

Appendix C: Agenda

Goal: Share lessons learned, best practices, and challenges in using GIS to meet livability-related goals.

Monday, July 18

- 1:00 – 1:30** **Welcome, Introductions, and Background** *FHWA and City of Boulder*
- 1:30 – 2:30** **Overview of FHWA GIS and Livability Activities** *FHWA (Mark Sarmiento and Shana Baker)*

Break

- 2:45 – 3:45** **Roundtable 1** *(All Participants)*
New Trends
- 3:45 – 4:00** **Day 1 Key Points/Wrap-Up** *FHWA (Mark Sarmiento)*
- 6:00** **Group Dinner** (Walnut Brewery at 1123 Walnut Street)

Tuesday, July 19

- 8:00am** Travel to the 13th street conference room at the City of Boulder's office (1720S 13th St.)
- 8:30 – 8:45** **Day 1 Re-cap**
- 8:45 –9:45** **Demonstrations/Presentations** *City of Boulder (Randall Rutsch and Larry Ferguson)*
- GIS conversion of multimodal corridors
 - Map It
- 9:45-10:45** **Demonstrations/Presentations** *SCAG (Ping Chang and JungA Uhm)*
- Local sustainability tool
 - CALots

Break

- 11:00-12:00** **Demonstrations/Presentations** *Center for Neighborhood Technology (Peter Haas and Albert Benedict)*
- Newly expanded Housing and Transportation Affordability Index website
 - Transportation Energy Intensity Calculator
 - Housing and Transportation Affordability Planning Tool
 - Transit-Oriented Development Database

Lunch

- 1:00-2:00** **Demonstrations/Presentations: Colorado Activities**
Denver Region Council of Governments (Robin Reilley)
- Solar Map

- Transit-Oriented Development Website

Pikes Peak Area Council of Governments (Craig Casper)

- Sustainability Tools

2:00-3:30 Roundtable 2 (All Participants)
Tailored Solutions

3:30-3:45 Day 2 Key Points/Wrap-Up FHWA (Mark Sarmiento and Shana Baker)

Wednesday, July 20

8:00am Travel to the 13th street conference room at the City of Boulder's office (1720S 13th St.)

8:15 – 8:30 Day 2 Re-cap

8:30-10:00 Roundtable 3 (All Participants)
Data Considerations

Break

10:15-11:15 Roundtable 4 (All Participants)
Public Participation

11:15-11:30 Peer Exchange Key Points and Wrap-Up FHWA (Mark Sarmiento and Shana Baker)