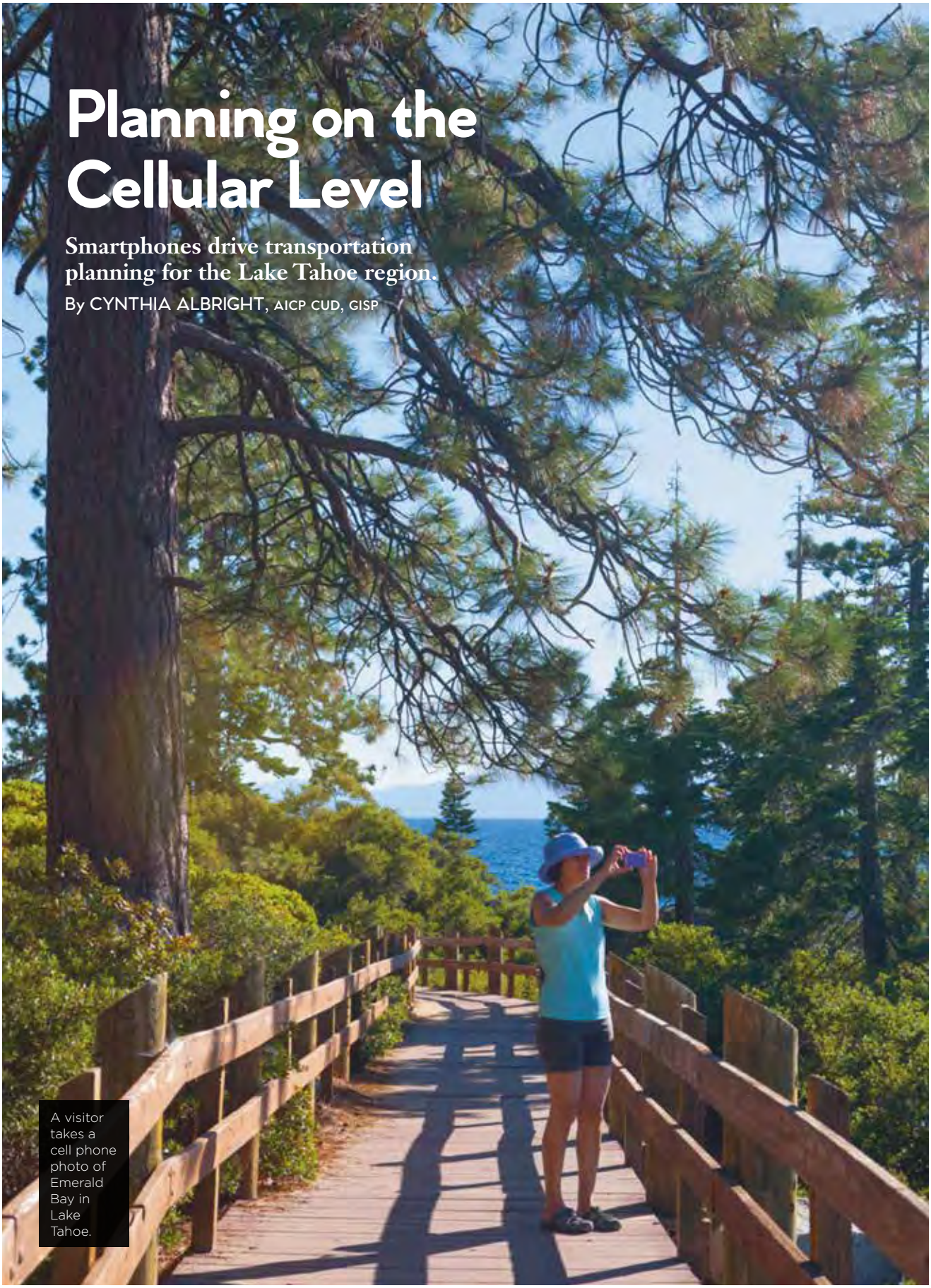
Planning on the Cellular Level

Smartphones drive transportation planning for the Lake Tahoe region.

By CYNTHIA ALBRIGHT, AICP CUD, GISP



A visitor takes a cell phone photo of Emerald Bay in Lake Tahoe.

PHOTO BY JASON TODD/GETTY IMAGES

FAMOUS FOR ITS SKI RESORTS, PURE BLUE WATER, OUTDOOR ACTIVITIES, AND BEACHES, THE LAKE TAHOE region has been a vacation destination for decades. The region's popularity has bounced back since the Great Recession and grown even further, particularly with millennials, who seem to enjoy the hiking, mountain biking, and snow-play recreation—as well as the concerts and events that local resorts have added to their entertainment scenes.

This growth is routinely evident on a summer day, when traffic congestion can be challenging for residents and visitors alike, and in the clarity of the lake water, which suffers from the environmental impacts of traffic and road runoff. Local officials realized that residents' mantra, "We are loving Lake Tahoe to death," could very well become reality without dramatic improvements to the transportation options. So the Tahoe Transportation District and the Tahoe Regional Planning Agency partnered to create a regional transportation strategy aimed at reducing traffic congestion and increasing transit and active participation mode shares.

Local officials had long estimated the number of annual visitors to the region to be somewhere between eight and 10 million. (For comparison, there were five million visits to Yosemite National Park in 2016). They based those numbers largely on the hotel industry's annual counts and the revenue stream from transient-oriented taxes, or hotel stays. Until recently, visitors who did not stay overnight were not counted as visitor stays. To get an accurate view of the region's current and future transportation needs, a better method of estimating overall visitation was clearly needed, and based on the seasonal fluctuation, traditional traffic counts alone were not going to work.

To accomplish this challenging task, the project team employed a relatively new data collection method to the planning world—anonymized mobile device data collection—to understand the bigger picture, including overall visits to the Lake Tahoe area—which turned out to be a staggering 2.5 to three times greater than previously thought.

The cellular data also helped identify gaps in information, such as daily trips previously unaccounted for, popular destinations, and amount of travel between all subscriber classes (commuters, residents, and visitors), which helped the team create an even more targeted strategy.

This article summarizes the project team's experience of gathering, analyzing, and applying cellular data that was used in the Lake Tahoe region's first comprehensive multimodal transportation master plan, which sets an ambitious goal of achieving 20 percent active and transit mode share in 20 years, and offers a few lessons for planners that the project team learned along the way.

The project team discovered that the number of overall visits to the Lake Tahoe area were about three times greater than earlier estimates.

PHOTO BY NOVUS SELECT

Lay of the land

Lake Tahoe straddles the California and Nevada state lines, and five municipal counties and the city of South Lake Tahoe share its 72 miles of meandering alpine shoreline.

The highway circumnavigating the lake consists predominately of two lanes, with a 13-mile section of four lanes along the east shore. It weaves through, and often bisects, residential settlements and popular destinations, creating the age-old conflict of higher speeds versus pedestrian safety. Because of

the terrain, no new roadway capacity can be added.

Multiuse paths wind throughout the basin, but the system has significant gaps, which inhibit the casual visitor (with family) or residents and friends from riding their bikes or walking longer distances to their desired destination. Road traffic can be heavy and roadway widths are narrow, so leaving a protected pathway to ride on the road is only for experienced—and brave—cyclists.

The most notable gap is through Emerald Bay, the lake's most popular outdoor recreation spot. A connection in the multiuse path from the north or south to and through this area could have dramatic impacts on reducing vehicle traffic, and supporting infrastructure like bike-locking structures and benches would help facilitate the change from "vehicle mode" to "bike and hike mode."

Separate transit agencies support the north and south shores with operations focused on residents and employees of local businesses. Services are augmented in the busier winter and summer months to accommodate increased amounts of visitors. Seasonal shuttles carry passengers to ski resorts in winter and to some popular destinations in summer, but ridership is a fraction of the number of vehicles occupying the roadway, shoulders, and parking areas.

Data collection and analysis

Traditional data-collection methods conducted by transportation agencies provide excellent annualized traffic counts in geographic areas that experience typical home-work-home trips. However, resort destinations like Lake Tahoe realize different traffic patterns, and weekly counts scaled to represent annual totals can often result in an undercount.

Unlike traditional traffic counts that provide estimates of total vehicles that pass through a counter location, cellular data provides information on trip purposes, resident and visitor classifications, segmentation by time of day, demographics, and other information.

With residents and elected officials experiencing congestion more frequently, along with the advent of companies that aggregate and anonymize cellular data and its natural application to transportation planning for all modes (bikes, pedestrians, transit, and automobiles), the TTD and the TRPA were both keen to invest in the acquisition of this type of data.

On behalf of the TTD and the TRPA, global design firm Stantec (of which I am a principal) worked with AirSage Analytics, a vendor based in Atlanta, which has a proprietary wireless signal extraction technology to distill data from most carrier networks. The data is generated by wireless devices over the normal course of operation (meaning the phones are either in use or in idle mode). The company processes high volumes of geolocational data signals and then aggregates the data to customers' preferences. To ensure user privacy, the AirSage technology anonymizes the data stream. Other companies, including Cellint Technologies and Streetlytics, provide a similar menu of products.

Based upon the AirSage products, the project team acquired fine-grain data for 300 traffic analysis

WIRELESS DATA COLLECTION GOES THE EXTRA MILE

The Lake Tahoe team analyzed several data attributes to assess actual traffic patterns in the resort area.

HOME LOCATIONS

The number of unique visitor devices in the Lake Tahoe Basin aggregated by their home locations at the county and state levels.

DURATIONS OF STAYS

The number days spent by visitor devices, from one to 13-plus days.

ARRIVALS AND DEPARTURES

The number of unique visitor device arrivals and departures summarized by each day of the month.

SELECT ORIGIN ANALYSIS

The number of unique visitor devices that arrived in the basin directly from one of five area airports.

ACTIVITY DENSITY

The aggregation of all activity points with an activity duration of five or more minutes in a geographic location for the months of February and July.

TRIP MATRICES

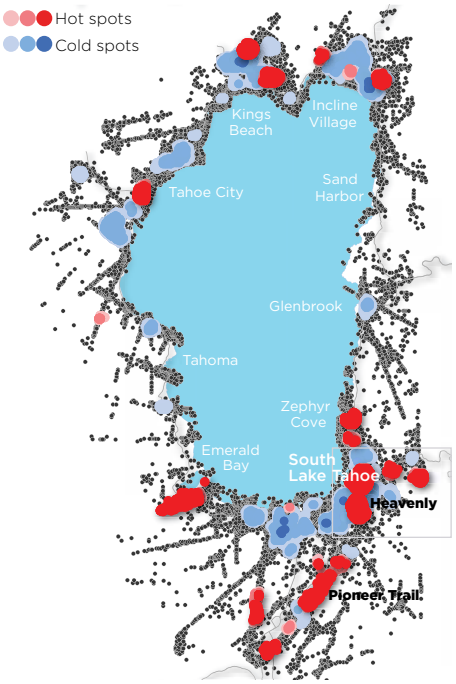
The number and types of trips between two specific locations: origin and destination traffic analysis zones, start and end dates, time of day segments, weekday or weekend day trip, trip purpose, six resident classes (resident worker, home worker, inbound commuter, outbound commuter, short-term visitors, and long-term visitor) and the daily/monthly counts of trips.

FROM DATA TO PLAN

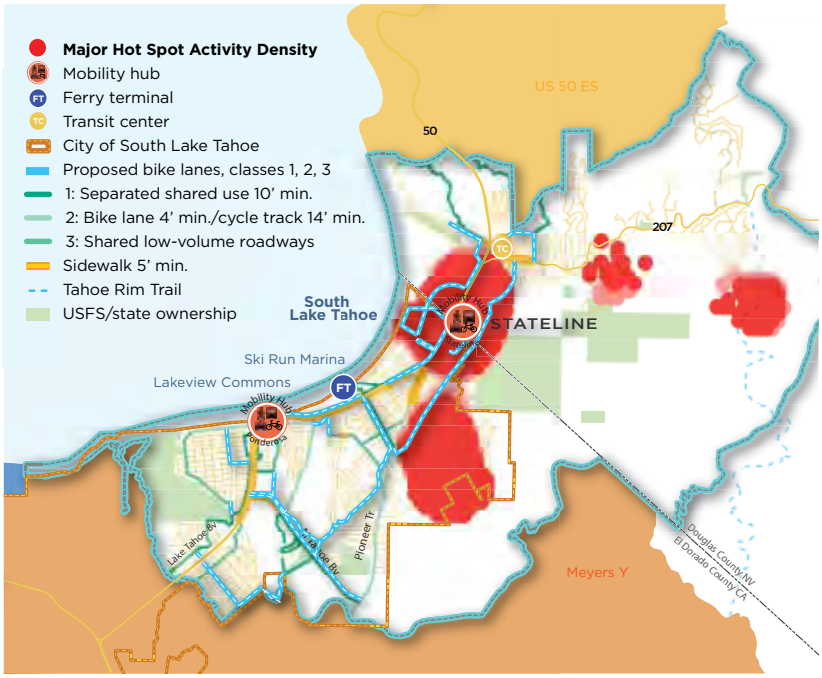
The project team used cellular mobility data analytics to determine ArcGIS hot-spot optimization at the most popular locations of visitor devices in July 2014, and to devise a multimodal plan to make transportation more efficient.

HOT SPOTS

Activity density, July 2014



LAKE TAHOE COMPREHENSIVE MULTIMODAL TRANSPORTATION PLAN, 2017



SOURCE: STANTEC

zones and five external zones within the Lake Tahoe Region. External zones allowed us to capture the cell phone movements—and thus, people—in and out of the five roadways that access the basin. The deliverables consisted of raw .csv files for the months of February, July, and August 2014 and included the attributes shown on the opposite page.

In the end, analysis indicated annual visitation to Lake Tahoe exceeded 25 million people—triple the long-standing estimate of eight to 10 million. The clients and stakeholders were flabbergasted.

To validate the findings, the project team correlated the persons per vehicle factors for each subscriber class and the state traffic counts with the cellular device data. Moreover, we confirmed that nearly 43 percent of all visitors were day visitors and not recorded as hotel stays. Together, the two figures made sense.

Clearly, the traditional methods of estimating visitors through hotel stays, which only tracked overnight visitors, and traffic counts were not working. While traffic counts work well in urban settings where vehicles routinely follow standard travel practices, in resort areas, travel patterns are not routine, and a standard two-week collection cycle may not scale to an accurate annual figure.

The findings from the cellular data provided invaluable information for multimodal transportation planning.

PARKING. Calculations showed that 41.4 million vehicles entered the Lake Tahoe Basin from one of five entry points and validated seasonal variations for February and July. Our public parking investigation identified 18,725 spaces, which translates to just one space per 2,210 vehicles. These numbers led the project team to conclude that one of the primary reasons for congestion was cars searching for a parking space and impeding the flow of traffic.

TRANSIT. With 94 miles of existing multiuse paths and 20 miles of sidewalks, biking and pedestrian contributions to the total active transportation mode share are on target. However, data showed

MAPS COURTESY STANTEC

that just 1.4 percent of the 80 million internal person-trips tallied in 2014 were captured on transit. This led the team to create *Linking Tahoe: Transit Master Plan*, which recommended prioritizing the construction of multimodal infrastructure in popular areas with gaps in existing active transportation networks to facilitate the goal of increasing transit ridership quickly.

We discovered a significant opportunity to transport abundant visitors through the west shore from an area transit center to alleviate congestion. *Linking Tahoe* recommends establishing layers of transit service and the supporting infrastructure needed to close these types of gaps.

Just because the data says something doesn't mean the stakeholders will trust it. Using the data to tell the broader story is key.

HIGH TRAFFIC DESTINATIONS. The project team also used wireless activity density data to visualize the most popular destinations in both winter and summer using the geoprocessing Hot Spot Optimization tool in ArcGIS. Through this exercise we confirmed areas of high visitation that were already known (Emerald Bay, Kings Beach, Zephyr Cove) as well as areas that were not known to be popular previously (Diamond Peak and Pioneer Trail). In February, only Heavenly Valley Ski Resort and Emerald Bay emerged as hot spots. In July, the data revealed numerous concentrations of activities throughout the Basin.

Tips for newbies

The Stantec consulting team had worked with AirSage wireless device data on previous projects, so they were already familiar with the process and knew how to avoid potential pitfalls that could result in extra cost or gaps in data. For planners considering using this relatively new form of data collection for the first time, there are a few helpful things you should know.

1. BE SURE YOUR TEAM CLEARLY UNDERSTANDS the questions you need the data to answer, especially if you want to track the same data over time. At the end of the collection process, you will receive the exact information you requested—no more than that. Once the vendor aggregates all the requested data, there could be a gap in the data collection if you did not carefully identify your needs at the outset.

While it is possible to backfill the information, it requires the vendor to reaggregate the data, potentially doubling the price. To avoid this pitfall, the client and Stantec's consulting team discussed at length what data was essential to formulate the plan.

2. USE THE DATA TO TELL A BROADER STORY. The sheer volume of raw data that results from this process is amazing, and it's easy to get overwhelmed and bogged down in the numbers. Most planners are not experts in data analysis, and wireless device data does not come with a "how-to" manual on making sense of hundreds of thousands of rows, each one a small piece of valuable information on origination-destination, time of day, day of week, trip purpose and subscriber class.

While traffic engineers are inclined to input cellular origin-destination data into TransCAD and have the computer generate macro findings on transportation routes, planners can work with large amounts of data using pivot tables and ArcGIS to use their knowledge of the study area to conduct more micro-level inquiries and test theories, validate suspicions, and generate tables and graphics that communicate the story.

Communicating the story is extremely important because of another valuable lesson: Just because the data says something doesn't mean that the client and the stakeholders will trust it. Using the data to tell the broader story is key.

3. CONSIDER COST SHARE AGREEMENTS with local partners. Raw data is expensive, and the analytical process is complicated and time consuming. Creating partnerships with other entities that would find that data useful is a great way to combat the high price tag. In multijurisdictional areas, such as Lake Tahoe, this new type of data can be used as a catalyst for collaboration among transportation agencies, as well as a great starting point to accelerate planning implementation. The good news is that this technology is improving rapidly, and as more vendors become available, costs may be reduced.

In the end, everyone—residents, commuters, and visitors—share in the responsibility to rely less upon their vehicles and utilize the mobility options in place today and in the future. The Lake Tahoe region has taken a valuable, and innovative, first step in making that happen. Over the next 20 years of the plan's implementation, hopefully less congestion and more time for relaxing, enjoying the view from a seat on transit, or pedaling a bike along a fully connected multiuse path will inspire a new local mantra: "Welcome to Lake Tahoe, where less is more." ■

Cynthia Albright is a principal at Stantec Consulting Services, Inc. She is passionate about innovative planning and using technology to create more sustainable communities and regions.