

## Locating 2,000 needles in a haystack

Colorado Department of Transportation uses advanced field monitors and software to track the state's billboards code compliance

—by Don Talend



**B**illboards so pervasively dot America's landscape that it seems as though anyone who wants to express their creativity can erect one. But outdoor advertising is subject to state regulation, and it falls on officers like Colorado Department of Transportation's Jerry D. Miller, P.E., to see to it that they are being complied

with. Driving around Denver, it doesn't take long to see that code enforcement is necessary.

Most violations occur because of financial motives; and in western states such as Colorado, age-old "squatter's rights" attitudes toward land ownership add another challenge to code enforcement.

"You add money and the ease with

which [owners can erect or alter a billboard], and there's little compelling interest on anybody's part to play by the rules," Miller says. Then he points to a large electronic billboard with a concrete support structure located near, and advertising for, a mattress company.

"That looks pretty harmless, right? That's the factory showroom over there, but the sign is on a different piece of property, so it may be an illegal sign." The company that put up the billboard is a national outdoor advertising company whose management, says Miller, should know better. "If the sign reads, Come here and buy this, it's OK. If it reads, Go there and buy that, it's not OK. It's a really subtle distinction, but it is easy to spot."

"It's one of those 'not-in-my-backyard' issues," Miller says. "You wouldn't want a billboard in your neighbor's front yard, and if you had a neighbor who didn't cut his grass, you wouldn't like that, either. And in this case, this attitude is right on spot—communities need to protect themselves from billboard proliferation and loud, unaesthetic billboards crowding out everything else around."

Regulating outdoor advertising seems like maintaining law and order in the Wild West—minus the shootouts. There are state and federal regulations to be enforced, which presents quite a challenge especially to transportation departments which have limited manpower resources.

To deal with the daunting task of tracking Colorado's 2,000 plus billboards, the Colorado Department of Transportation has acquired advanced handheld GPS collection units and data-collection software to build a comprehensive database with location, photographic, and numerical data. Envisioning a comprehensive billboard geographic information system (GIS), Miller brought an engineering and governmental perspective.

An important factor for Miller to consider was the decentralized management structure at CDOT. The department has offices in six regions, and

each region has its own legacy database and reporting methods. Technology is playing and will continue to play a key role in efforts to make the program uniform across the regions.

Before the new technology was adopted, CDOT had major problems in tracking data for Colorado's 2,000 plus billboards—some employees involved in the program had retired and those replacing them had disparate databases to fall on for information. "For about five years it was like a revolving door and we lost our institutional knowledge of where we were at, where we were going, and even what we had," Miller said. "Not that our information was bad, we had no central point for this information that would be universally accessible."

### **Federal, state laws propel enforcement**

Colorado is one of 23 states participating in a federal program established under the Federal Aid Highway Act of 1958 to ensure rigorous control of advertising along all interstate highways.<sup>1</sup> States voluntarily controlling billboard advertising along the interstates receive 0.5 percent in bonus funds over and above their allocations for highway construction.

The Highway Beautification Act of 1965, championed by Lady Bird Johnson to enhance recreational travel, safety, and natural beauty, established federal control of billboards within 660 feet of interstates in "bonus" states. This act mandates that commercial billboards are allowed only in commercial/industrial and un-zoned areas, establishing, under subsequent amendments, four categories with inherent size, lighting, and spacing limitations. States found not to be in compliance risk a 10 percent reduction in annual federal highway fund allocations.

Later legislation such as the 1978 Surface Transportation Assistance Act have largely dealt with funding and federal/state jurisdictional issues such as the allowable frequency of message changes on electronic billboards.

Like other states, Colorado has added its own laws to the federal framework. Colorado's Outdoor Advertising Act allows advertising devices that were located in areas zoned for industrial/commercial uses prior to January 1, 1970, with specific provisions on device dimensions and distance from industrial/commercial buildings; fines for violations of state law; visibility of non-commercial (e. g., political or religious) on-premise signs; requirements for sign permits; spacing between signs along interstate highways outside incorporated cities, and others.

Of key relevance to CODT's initiative is that federal regulations require structured program administration at the state level. This consists of inventorying all relevant data that may be used as evidence in a court case and surveillance, including routine route inspection and adequate reporting.

"The most common violation that makes a sign illegal," said Miller, "is when a property owner lets a friend or relative advertise for off-premises goods or services free of charge." Such signs belong to the category of "non-conforming signs," and they present their own record-keeping challenges because they might appear illegal.

"Let's say you built a billboard out there and we changed the law five years later," said Miller, adding that about 800 of the 2,000 billboards within CDOT's jurisdiction are non-conforming. "We're not going to come out and ask you to take down the sign. It's grandfathered in. You can't change any aspect or nature of the sign, but if that sign originally had four posts, that's all

it can ever have. Therefore, we take many pictures to document changes."

Determining the sign's legality necessitates photographic records and records of the site's coordinates. "If it's an illegal sign, the attorneys might come in, and so we'll need GPS coordinates precise enough to stand up in court," Miller said.

### **Power in the palm**

CDOT purchased several Topcon GMS-2 hand-held GPS units in mid-2008 to deal with the challenges of billboard law enforcement. The GMS 2 handhelds enable integrated imaging and 50-channel dual constellation satellite tracking. The GMS 2 had an internal digital camera, and images are automatically uploaded to the device's GIS. The GIS feature stores data on sign locations and up to 60 additional component data. The unit operates on Windows-based Field Adapted Survey Toolkit (FAST) software from GeoAge and also has an integrated electronic compass, replaceable/rechargeable battery and an expandable memory card slot.

"I picked this unit because the eight field personnel who will have to use these units are not engineers or surveyors," said Miller. "I wanted something that they would be comfortable with." But the GMS 2 handheld was purchased with more than just one program in mind. "They will be extremely useful in locating utilities, traffic signals, culverts, or road signs."

The Colorado Department of Transportation has intentionally gone for versatility in their equipment acquisitions, as well as for high degree of customization of the FAST software used by technicians.

FAST has two components: a desktop version for designing forms, establishing data sets, and uploading and

<sup>1</sup> The act allowed directional and official signs; on-premise signs for sale, lease or activity; signs within 12 air miles of advertised activity; and signs in the public interest, e.g., historic sights, lodging, eating and vehicle repair.

downloading data to a mobile device; and a PDA version that runs on any Windows-compatible device.

To demonstrated how these components work, Jeff Hull, survey development manager with Topcon, sets up a demonstration file for a task that is not unlike CDOT's task—inspecting and recording information for trees.

He creates question-and-answer fields in the desktop version. One of the questions may, for example, ask on the date a tree was planted. The answer is set up as a required field, and if the exact planting date is not available, the field agent can pick a date range, too. A single-select menu allows the field agent to select for tree species—a pine or maple, or some other tree—and both multiple- and single-select menus can be used to indicate adverse conditions such as a fungus or insect infestation.

The programmer can add headers, phone numbers and other critical data, or even import a text file with comma-delimited fields. Higher-precision devices such as the GMS-2 also have a feature making it possible to select for submeter Wide Area Augmentation System (WAAS) correction.

"Jerry's got signs in the thousands; how does [CDOT] go out and get inspection data and spatial data on all of those signs? Very quickly," says Hull, opening a calculator in the PDA version. "If I've entered a numeric field, now I can use a calculator to perform calculations." Then, playing the role of a tree inspector, he selects from a pull-down menu multiple descriptions of a strange new insect he saw. Next, he creates a question asking for an image of a tree with a problem. From a pull-down menu, Hull selects "bugs" for the tree condition, and he can insert a photo or even a sketch of the insect. Finally, he creates a mandatory signature field and notes that the program time-stamps field activities.

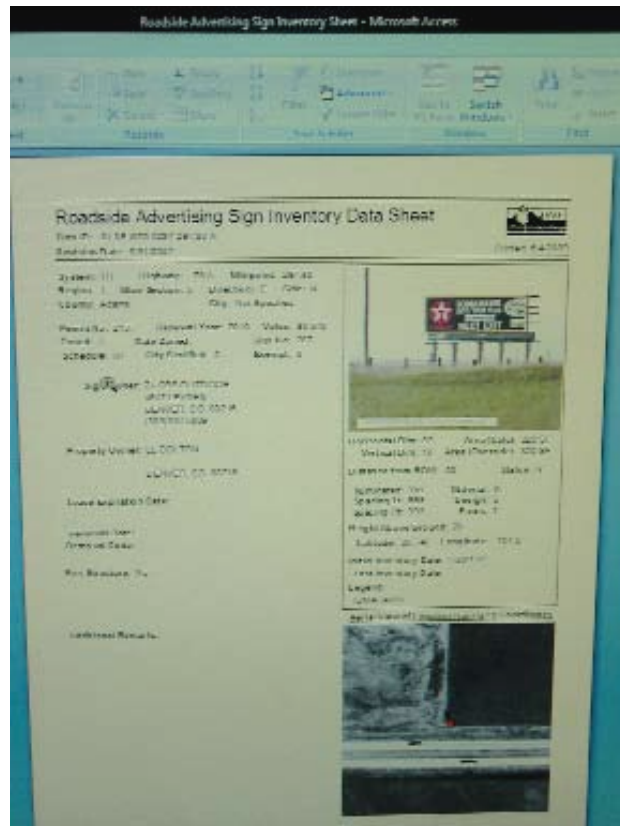
"The question-and-answer programming capability makes FAST much

more searchable because you've created the only answers that [field agents] can make," says Miller. The tree-monitoring analogy works for monitoring billboards along state highways and interstates. For example, one may hear the I-70 referred to as Interstate 70 or as an urban interstate. "If you can control the field agents' answer by giving them only one option, say I-70, then it's so much easier to obtain clean data."

The standardized answers lend themselves to generating powerful reports in Access. A supervisor can run reports on, for instance, how many billboards there are along the I-70 in Colorado, and of those, how many are advertising a particular business. The data can be exported into a mapping program such as DXF or even a free application such as Google Earth so that signs can be mapped in a given territory and marked with icons.

### Building a better GIS

In mid-2009, Miller was well ahead in the process of building a state billboard GIS using the data available from different regions. Only a handful out of the 67 question-and answer fields needed to be completed; and comprehensive data collection was done for about one-third of the 2,000 plus billboards in Colorado. The CODT's state-wide billboards database will be



based on Access and a program such as Google Earth could be used for mapping. Once the GIS is fully developed, CDOT personnel will turn their attention to maintaining the records of legal and non-conforming billboards within their regions.

"With multiple photos tied to the same permit, we'll have a historical record for 400 non-conforming signs whose records have been updated," said Miller. "Eventually, I want our initial inventory to include additional information about a sign that is easy to get. I want to know the location—that's where the [GMS-2] comes in. I want to know the size of the sign. I want to know the permit number and I want inspectors to take a picture so that we can build a visual archive."

Miller expects the new technology to give CDOT flexibility in manpower deployment. "We had to figure out a way to work a lot smarter"—using a "smart handheld" to build a GIS database is one way to go about fulfilling this goal.