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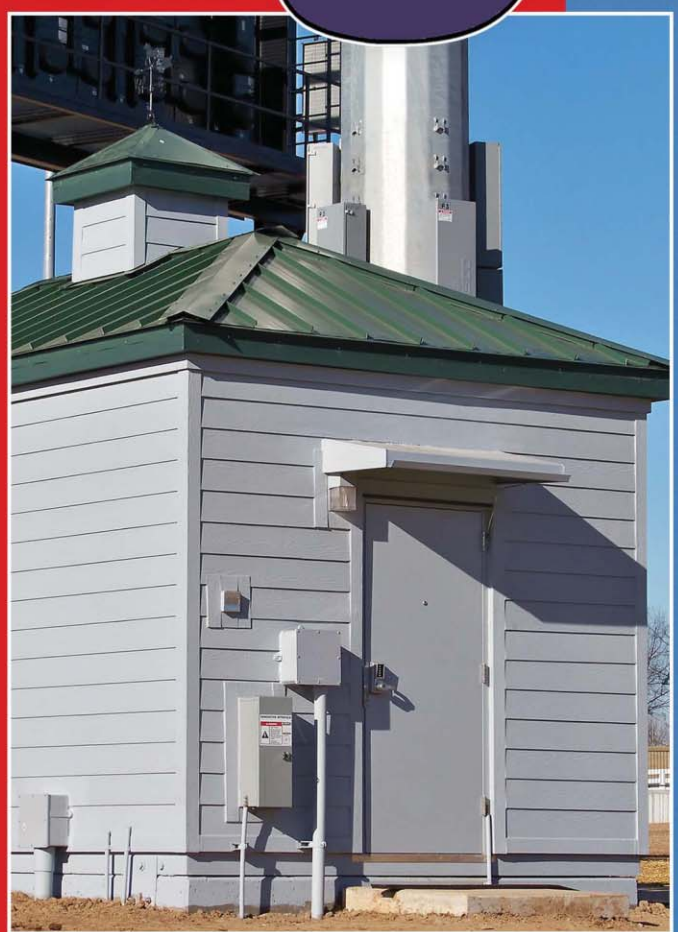

Shelters and Enclosures

SITING and ZONING — NEW JERSEY PERSPECTIVE

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Defending Against Citations

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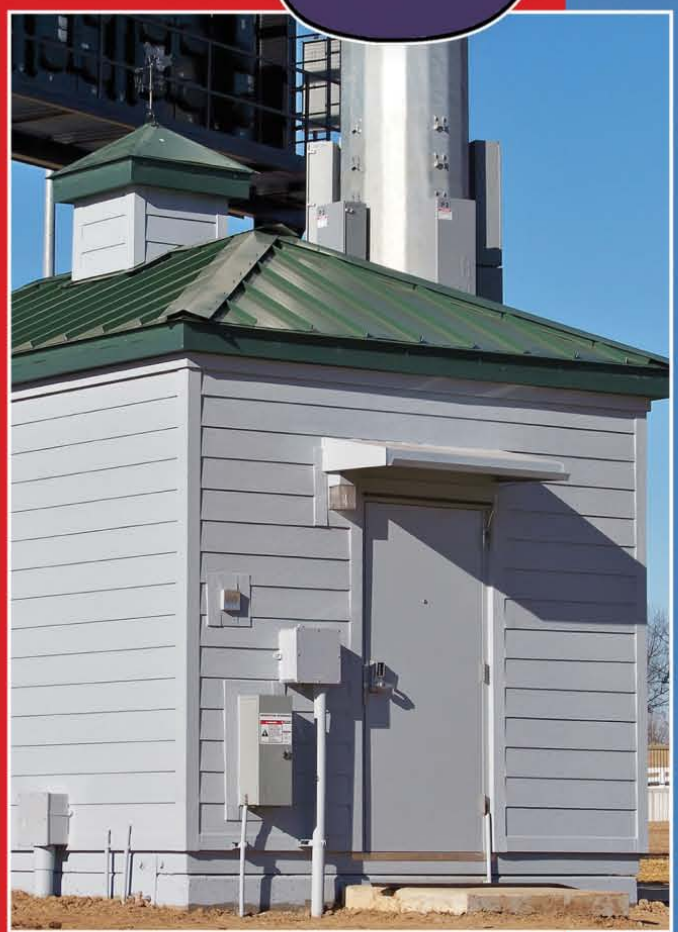

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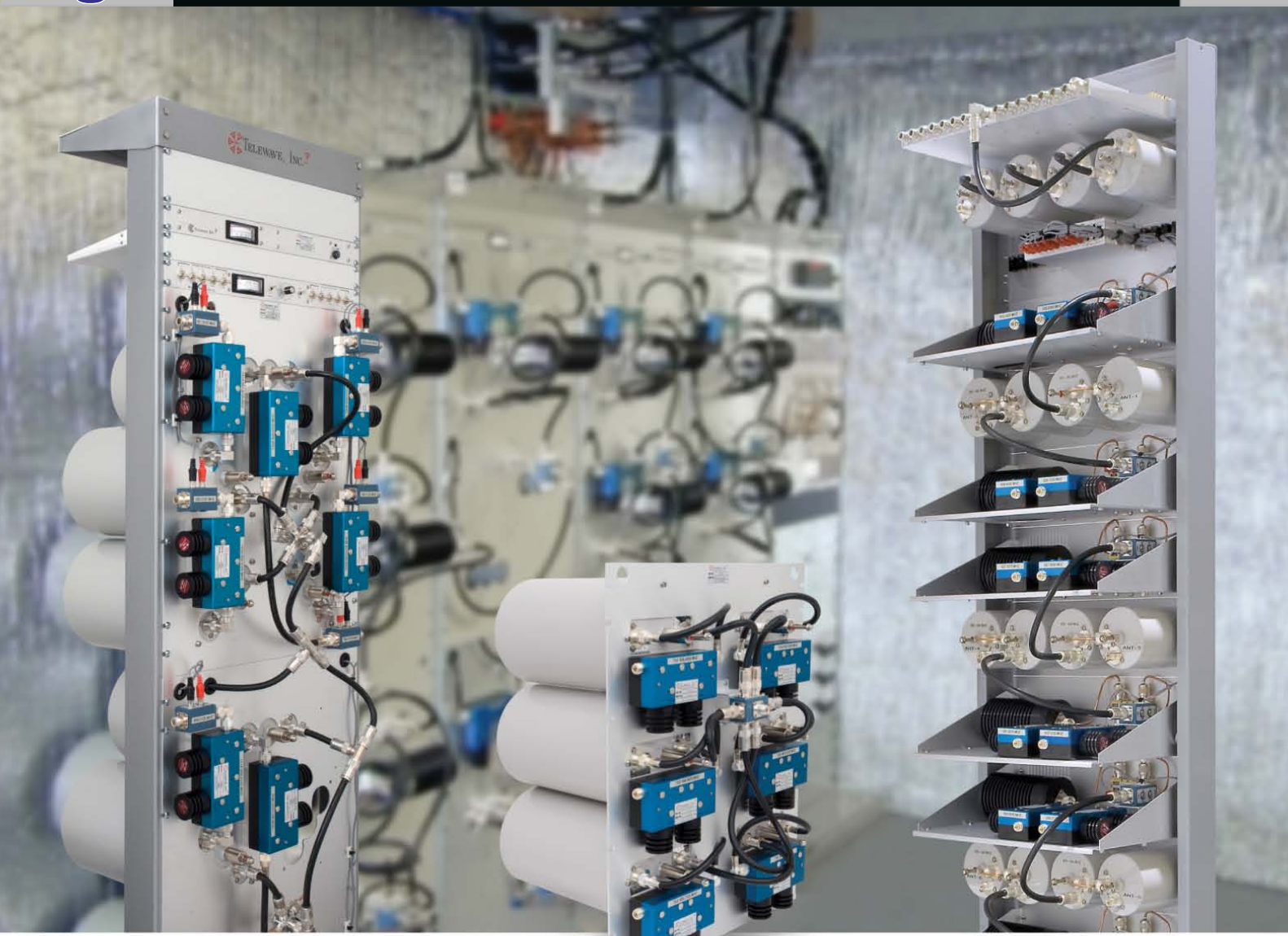

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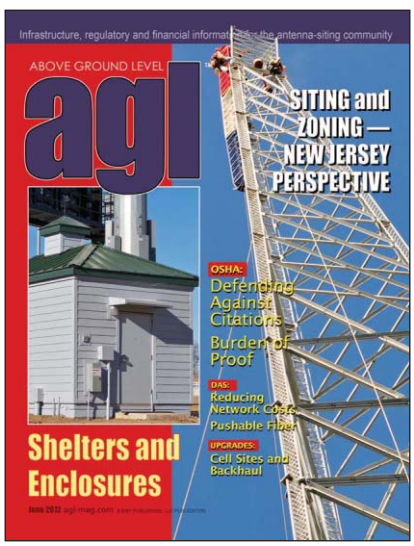

on the cover

Shelters and enclosures range from large equipment buildings to small pedestal-mounted cabinets. Some shelters wear disguises. See the product showcase on page 40.

Shelter photography courtesy of Sabre Communications. Tower photography courtesy of Paul Gilbert, Texas Department of Transportation. Cover design by Scott Dolash.

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Features

Departments

editorial comment

"Cell Tower Deaths"

PBS aired "Cell Tower Deaths," a disturbing episode in its *Frontline* series, on May 22. Images of dead bodies of workers who fell to their deaths from cell towers punctuated the episode, which focused on the uneven attention paid to safety and the layers of subcontracting that shield cell phone companies from accountability.

From interviews included in the broadcast to reactions documented in comments posted to the PBS website and elsewhere, opinions vary widely as to who should be accountable for safety and to what degree.

For example, some give the workers themselves no excuse for failing to preserve their own safety, regardless of possible youth, inexperience, improper equipment, inadequate training or poor supervision. Others blame those factors and more, placing responsibility with supervisors, owners and managers of tower construction and maintenance service companies, general contractors, project management contractors, so-called turf vendors and on up the line to the cellular carriers and their managers and executives.

Subcontracting drives costs down, *Frontline* reported, and makes it difficult for the government to discipline the major cell carriers. "Just through their own policy they layer themselves away from it," said Randy Gray, a former OSHA inspector.

"Legally, there's no way we can really get to that company," said Jordan Barab, deputy assistant secretary of labor for OSHA. "Our problem in this industry is that you have these little contractors that may set off in their pickup truck, you know ... and may never have any contact, face-to-face, with their contractors."

A comment from a viewer: "Industrial accidents happen, especially to young kids who get high on the job (no pun intended). The big culprit [identified by *Frontline*] was the carriers pushing their build out too hard."

Another comment: "Suggesting that employers force tower workers into unsafe circumstances or to use unsafe or inadequate equipment fails to be persuasive because it is ultimately the worker's responsibility to refuse an unsafe assignment. In my experience, every supervisor or manager accepted without question the judgment of the technician doing the job to refuse to work when safety was an issue."

Another comment: "Our safety book was thrown out the window a long time ago. Climbing in extreme cold to the point where I can't feel my fingers, 40 mph winds or more, rain, unclimbable towers, the list goes on. If we feel uncomfortable about doing a job, we're benched and someone else will step in to replace us. A former manager told me I should be grateful I have a job. Part of my job is to be alive at the end of the day."

Although I found the episode to be well written and produced, it contains only what can be included in 32 minutes of program time. What was absent was as worth noting as what was included. There were no interviews with representatives of tower companies or the National Association of Tower Erectors, for example.

What seems clear is that a consensus about safety for tower workers never will come about. In the meantime, whether the episode deserves praise or criticism, anything that raises awareness about tower worker safety is helpful, and maybe the episode will provide some additional motivation for improvement.

To find an online version of the episode and related video and written information, Google: *Frontline* "Cell Tower Deaths." ■

By Don Bishop, Executive Editor
dbishop@agl-mag.com

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PUBLISHER/CEO
Richard P. Biby, P.E.
(703) 910-5055; *rbiby@agl-mag.com*

EXEC. EDITOR/ASSOC. PUBLISHER
Don Bishop
(913) 322-4569; *dbishop@agl-mag.com*

CONTRIBUTING EDITOR
J. Sharpe Smith
(515) 279-2282; *ssmith@agl-mag.com*

ART DIRECTOR
Scott Dolash
(913) 961-7501; *sdolash@agl-mag.com*

ADVERTISING MANAGERS
Mercy Contreras
(303) 988-3515; *mcontreras@agl-mag.com*
Phil Cook
(951) 301-5769; *pcook@agl-mag.com*
Mary Carlile
(484) 453-8126; *mcarlile@agl-mag.com*

CIRCULATION MANAGER
(951) 301-5769; *circulation@agl-mag.com*

CORPORATE OFFICE
Biby Publishing LLC
P.O. Box 2090
Ashburn, VA 20146-2090
(703) 910-5055

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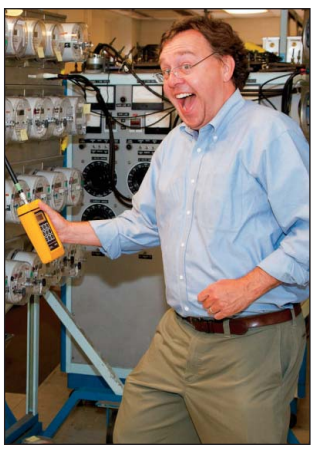
Towers That Mean Business

The art and science of tower management

publisher's note

Why Bother?

I'm home after almost a week away to attend the CTIA Wireless show in New Orleans. One question I've run into a few times: Why bother? I heard that from some attendees, but also, and more importantly, from even more exhibitors. Something *AGL* does with its regional conferences is to bring the educational information and positive aspects of a trade show to people who might benefit from them. Risking criticism, as I'm always happy to do, I'll pull apart my reaction to the big spring show, CTIA Wireless.



Photography courtesy of mikefosterphotography.com

Let's be honest: The problem with typical sessions at most trade shows is that the people who can attend them (high enough on the totem pole) are the folks already in the industry, not those who would benefit from another introductory session, and many of the large floor displays don't change much from year to year. I believe I've written extensively about this in my rants — oh, sorry — I mean columns, recently.

So, let's talk about the exhibitors. At many of the smaller shows, exhibitors benefit from meeting customers, even if those they meet are not the ones responsible for making the direct purchase, at least they meet people in the company, such as the users, installers and support folks. Meanwhile, at the really big shows, exhibitors have a hard time answering the "Why am I here?" question.

This year, at CTIA, many exhibitors were missing, including Motorola and Samsung. Exhibit booth traffic was light, but not embarrassingly so. Exhibitors were saying, "Almost everyone I've seen is an existing customer, or said they are a customer of someone else or, even worse, they work for my competition."

I see a great advantage for exhibitors who show their new offerings, however. There is nothing like looking at a new product in order to understand it. Driving semi-trailer trucks full of equipment onto a show floor seems a bit excessive, but checking out a connector, pointing out what is different on a new antenna design, or even pushing the buttons on a new phone does make a difference. I see why exhibitors might want to push back on dragging everything to a show. For my part, I would encourage the thread of "simpler and lighter."

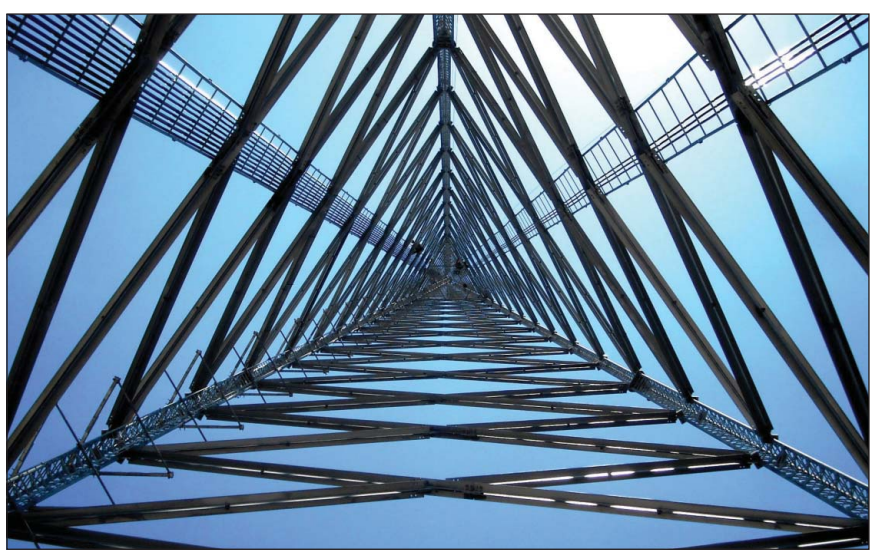
Attendees (and not necessarily the exhibitors' staffs) remain mostly satisfied. As an attendee, I was able to have a number of meetings with just the right people and companies to make the event a complete success. Many people told me they enjoyed a similar experience. Private meeting space was at a premium, and it appears to be where all of the action was. The need and interest of people to come together to exchange information, make deals, and do what people do (network), appears to be one of the more valuable experiences that a trade show can still facilitate.

In our small section of the world within the larger show, the Tower Technology Summit, things were more positive. The sessions were well attended and favorably received. I hate to say it, but I was not able to attend as many sessions as I would have liked because I was too busy doing business. I guess that is not such a bad reason.

PBS *Frontline*

Just as I was finishing this column, the PBS *Frontline* episode "Cell Tower Deaths" aired. Strangely enough, I've not heard much reaction to it. As with most anything you read in the paper or see on TV, if the topic is something you know about, you can always find flaws in it. In general, *Frontline* got it right. By the time many vendors get their money for parts of the project, there is little left for the worker in the field actually doing the tower work.

The question the episode raised is good: Is the responsibility for safety assessed at the right place in the food chain? I was interviewed for this episode, and I watched it twice. It seems to me that *Frontline* may have been on a bit of a witch hunt against AT&T, specifically. I'm not happy to see bias directed toward a specific carrier; however, the episode's overall message and the question it raises are good. I know we'll be talking about this more. Watch the episode when you can. Visit *www.pbs.org* and search for "*Frontline*." ■



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By Rich Biby, Publisher
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New Jersey Panel Discusses State and Federal Legislation

By Gail Goldman

What happens when you put six attorneys in a room to decipher and explain new legislation designed to streamline collocation on existing structures? Things become clear — as mud.

At the New Jersey Wireless Association's annual meeting held on March 13, 2012, at the Hamilton Park Hotel, Florham Park, N.J., a group of the wireless industry's prominent and respected legal minds formed a panel discussion with about 80 attendees to discuss the finer implications of new state and federal laws.

Panel members

Moderated by Rob Ivanoff, vice president of the New Jersey Wireless Association, the panel included Kara Azocar, government affairs counsel for PCIA; Michael Beck of the Hiering, Dupignac, Stanzione, Dunn & Beck law firm; Judith Fairweather of the Day Pitney law firm; Jay Perez, in-house counsel for AT&T; Rick Schkolnick of the Brown, Moskowitz, Kallen law firm; and John Zembruski, in-house counsel for T-Mobile USA.

Bill S-2989/A-3949, which exempts certain collocations of wireless equipment from site plan approval, was signed into law by Governor Chris Christie on Feb. 9, 2012. The law is effective immediately and provides that applications to collocate on existing wireless communications sites are not subject to site plan review in certain instances. An application qualifies under the following criteria:

- The support structure has previously been granted all necessary approvals by the appropriate approving authority.
- The proposed collocation does not increase the overall height of the support structure by more than 10 percent of the original height of the structure.
- The width of the structure is not expanded.
- The equipment compound is not expanded to an area greater than 2,500 square feet.
- The proposed collocation complies with the last approval for the structure and all conditions attached to the approval.

The site plan review process is put into effect when a proposed collocation creates the need for a variance.

The panel discussion crystallized the issues and highlighted the challenges and gray areas with the new legislation that could lead to delays, or worse — a zoning process that could drag on for months. Michael Beck cited a potential pitfall whereby townships could require the applicant to comply with all conditions of the original approval. "If you're the third carrier on a site and the applicant before was required to plant trees and those trees are now dead, what happens then?" he asked. "The board may say the [third] carrier has to get site plan approval."

Judith Fairweather noted that certain township zoning officers could stymie the functionality of the legislation where the original applicant obtained a variance. If the carrier received a variance for placing ground equipment within the setback zone, a second variance should not be needed. The panel advised the wireless industry to be vigilant and educate townships in implementing the legislation. "Once you get variance you're permitted," Fairweather said. "We have case law and we need to make sure we push that we're now a permitted use."

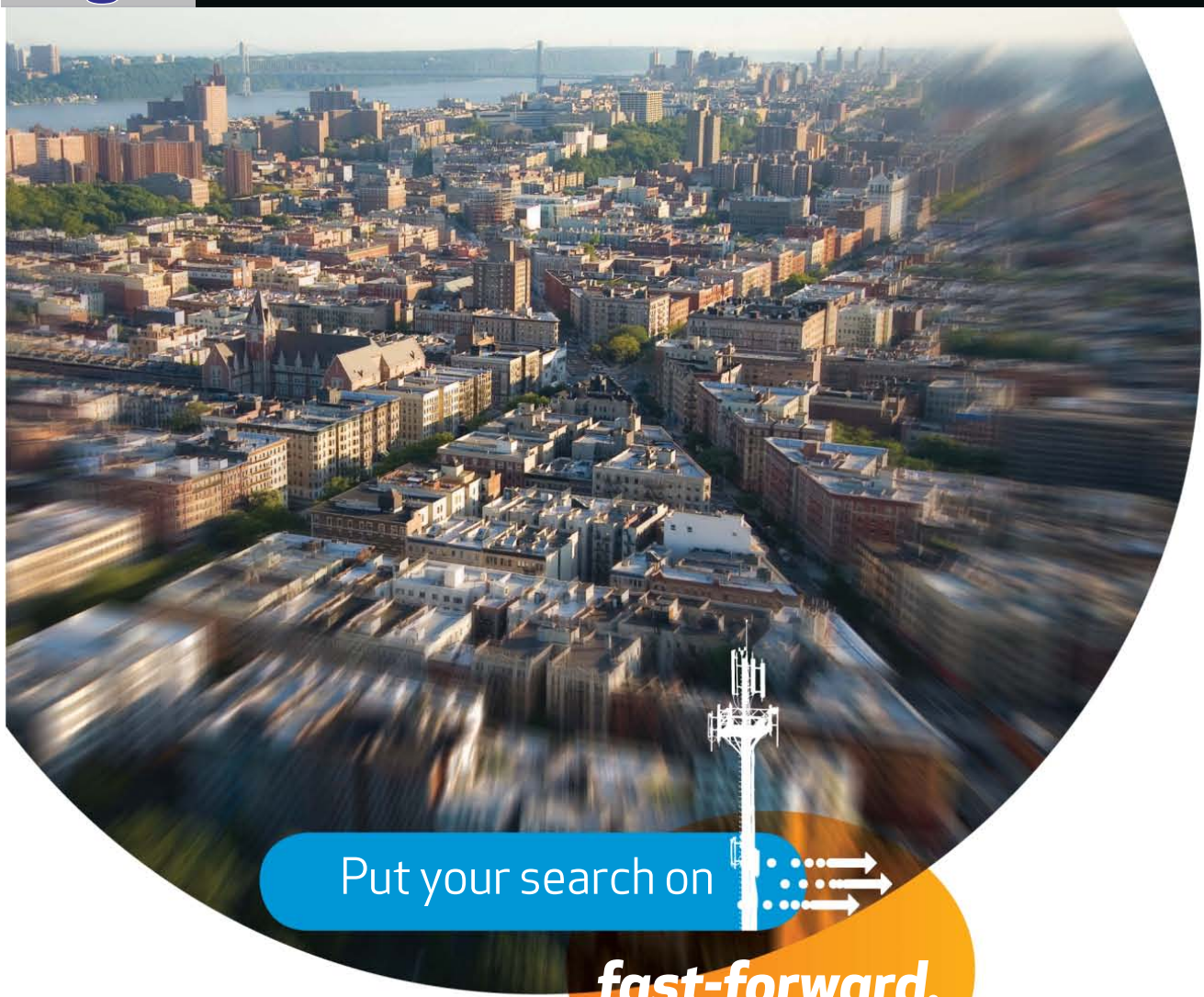
Kara Azocar of PCIA urged that the industry have a unified voice and implement the meaning of the bill wisely. "We expect there will be some resistance and confusion on the part of the jurisdictions," she said. "It's important that we take a unified approach."

Overall, the panel and the attendees were enthusiastic about the changes in the law and hoped that industry leaders can work collaboratively and help townships interpret and implement. Rich Mohr, site acquisition manager for MetroPCS, who attended the event, expressed a cautionary note. "My biggest concern is that someone will rush too quickly into litigation, set a precedent and cause bad law to come down the pike," he said. "Litigation should be a last resort."

Robust build out

All agreed that as carriers ramp up for a robust build out this year, the manner in which townships approach this new legislation will be keenly observed by the industry and zoning counsel in particular. ■

Gail Goldman chairs the New Jersey Wireless Association's media and public relations committee. She is an account executive with Crown Castle International. Her email address is gail.goldman@crowncastle.com.



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From left: David Yacoub, Robert Dawson, Jake MacLeod and James Innes.

Cell Site Upgrades and Backhaul Services

During a session conducted at the AGL East Regional Conference in Bethesda, Md., on April 13, session moderator David Yacoub of Site Link Wireless and members of the audience asked questions of panelists Robert Dawson, Jake MacLeod and James Innes. The questions involved cell site upgrades, rural build outs and backhaul services. Here are their remarks, edited for length and style.

David Yacoub
Panel Moderator
President and CEO
Site Link Wireless

Robert Dawson
Vice President of Sales
Tessco Technologies

Jake MacLeod
President
Gray Beards Consulting

James Innes
CEO
CarrierClass Site Development

Question: Can you explain how the cell site materials list is changing in the context of current network upgrades versus prior upgrades?

Robert Dawson: At Tessco, we used to sell site material kits and drop them on the site for the installers to use. They sold for $5,000 to $10,000. Now the typical sale is $1,500 to $2,000, reflecting the fact that the volume of materials is smaller and the cost is considerably less. Most projects no longer are updates for entire sites; they involve outfitting the sites that are already out there.

Not only are we seeing the size of materials kits becoming smaller because in most cases we can't build a site from scratch, we're also seeing the kinds of components in the kits changing. The biggest difference involves fiber-optic cable. Although using big, heavy coax is good, we're seeing people who understand big, heavy coax trying to figure out which fiber design is correct. What does the architecture need to look like at that site? And, can the same tower crew do the work?

The workers who climb towers now may be great at installing coax. Are they also great at installing a remote radio head at the top of that tower? And connecting it with a breakout box of fiber at the top of that tower? And then testing the fiber?

I run into a lot of tower workers who say, "It's not that I can't install fiber. It's that I'm afraid to touch fiber because I've been told that fiber has lasers in it that will kill me." They say things that sound ridiculous. But think about it, if you've never worked with fiber and you think it's brittle and it's the size of a human hair and you believe if you touch it the wrong way fiber could bring down the world, or you believe it could cause burns, you would be reluctant to work with it. Do you have the people who are ready to tackle the necessary training?

In most cases, the answer is yes. You just have to provide some education and some comfort level with what's going on, and then it won't be as much of an issue. The younger crews are more apt to be comfortable with the kind of tower work that using fiber requires.

Question: What are your thoughts about carriers going into the rural areas where microcells or picocells won't make sense? Or in suburban areas where utility infrastructure is placed underground? How will carriers deploy sites in rural areas with LTE?

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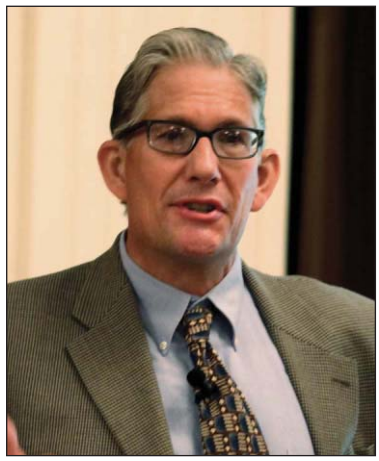
Robert Dawson: "Younger crews are more apt to be comfortable with the tower work that using fiber requires."

Jake MacLeod: "The apps are outstanding, and M2M is going to be the dominant traffic generator in the near future."



James Innes: "Nothing that I see with my carrier relations points to any plans for a large rural build out of macro sites."

AGL Photo / Don Bishop

James Innes: This is a tough question, and I'll stick my neck out a little bit. With the work I do, I have a very good view into the network engineering department of a carrier. From all the things that carrier puts vendors through, I have a good idea of its vendor policies.

The big carriers have maintained a policy of publicly proclaiming their support of rural broadband and rural coverage. In the run-up to the T-Mobile USA merger, AT&T Wireless was running ads touting that one of the main benefits of the merger would be better coverage for rural America. To a certain extent, that's the public façade.

To a certain extent, carriers have allowed rural coverage to languish for the past 10 years. Nothing that I see with my carrier relations points to any plans for a large rural build out of macro sites.

Once LTE is deployed on a site, it is simpler technology. What my network engineering group was doing was throwing T1s into a network as fast as they could to keep iPhones from affecting the quality. Then, that carrier relented and signed deals for fiber backhaul, and my group went from 16 engineers down to eight within two months because to bridge in T1s takes about 20 minutes of engineering time for each one if you bridge them in batches. Provisioning pieces of fiber within the network from all the switch elements through to the site takes five minutes or less.

I manage a high-elevation site in Delaware. It has five carriers, and one has been there for 20 years. I watched what was affecting my business with the carriers, and I watched all the T1s come out, and I watched third-party Ethernet come in. Eight months later, the third-party Ethernet came out and a piece of fiber came in. The telco rack went from being full to containing two boxes — less equipment, less cost to provision and far lower cost to operate.

Question: What are some examples of machine-to-machine (M2M) data transmissions, and what impact will they have on the access and backhaul networks?

Jake MacLeod: M2M communication is going to increase logarithmically with all the apps out there now for all the devices — your Bloomberg apps, your health services apps. I have one for fly fishing that tells me when it's a good time to go fly fishing. The apps are outstanding, and M2M is going to be the dominant traffic generator in the near future. There are going to be apps that we just don't anticipate right now. We're going to have a number of surprises that will generate traffic.

The traffic will affect the backhaul both from the cell site into the core and also in the core transport. The carriers are planning for the unexpected.

Question: There was a lot of discussion in the past that the electrical networks could transport data. Is that still a possible solution for the small cell sites?

Jake MacLeod: The problem with transporting data over the electrical network is the Part 15 spurious emission regulations. The more you try to push data through it, the higher the noise floor goes, and it begins to interfere with other systems. It is good for low-speed data, no doubt about it. But it is not appropriate for commercial transport of data at this time.

Rob Dawson: We were doing a real estate project for a utility and the same group was launching its broadband-over-powerline service. There was much talk about backhaul. It never gained any traction, and the service shut down after a year. The problem with these new technologies is that they are perfectly good for backhaul, but backhaul alone does not justify the capex for a new network. You have to have a consumer base or a business base built up first.

Relative to new backhaul architectures not yet even conceived, keep an eye on that because for backhaul alone right now, and for backhaul with which one could expect a declining cost per bit over time, it is going to be hard to support ubiquitous, high-capacity backhaul.

Jake MacLeod: There is a new backhaul technology that is probably 10 years out before it becomes commercial, but it is very interesting. It is laser backscatter, where you shine a laser up at an angle into the environment, and then you have a similar laser going up — it doesn't have to be point-to-point — that captures the reflections from particulate matter in the environment and the photons hit the receiver. You can achieve up to a gigabit-per-second performance per site. ■

The panelists spoke during the session "LTE and the Future of Wireless Systems" at the AGL East Regional Conference. For information about future conferences, visit *www.agl-mag.com/events*.

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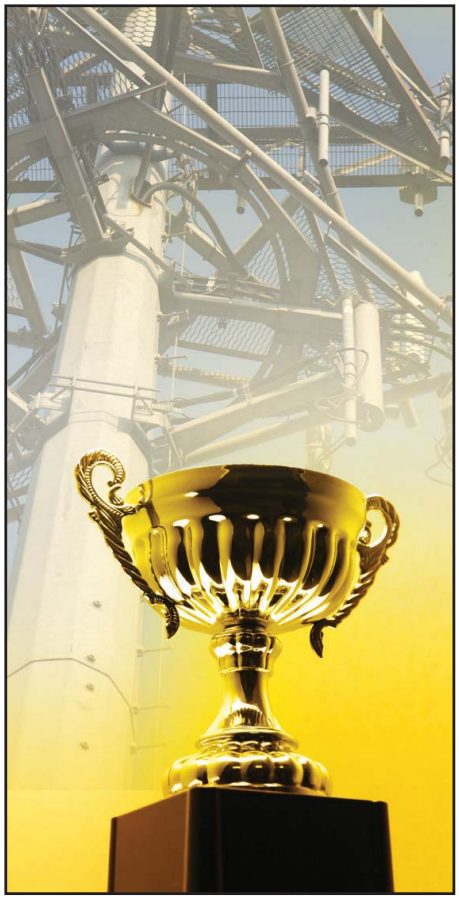

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Extension: 300
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Extension: 304
sgpldp@aol.com

John Tallman
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Quick-guide To Site Acquisition Companies

As a supplement to January's Buyers Guide, here is a list of site acquisition services companies with additional information about the services they provide. All logos and company descriptions are provided and paid for by the companies.

1. Environmental assessments
2. Land acquisition
3. Lease acquisition
4. Right of way procurement
5. Site design
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11. Tower mapping
12. Tower rental/collocation
13. Zoning/permitting

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Services: 1–13
Company description
AW Solutions is licensed throughout the United States, Canada and the Caribbean. It provides turnkey site development and build-to-suit services to the wireless, DAS, wireline and fiber industries. Services include project management, site audits, site acquisition, A&E design, structural analysis/design, regulatory, construction management, construction and warehousing/logistics.

Black & Veatch
10950 Grandview
Overland Park, KS 66210
Kevin Bukaty
bukatyk@bv.com
(913) 458-7967
www.bv.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 2–5, 7–9, 11–13
Company description
Black & Veatch's nationwide network infrastructure deployment solutions include program and management, site acquisition, architecture and engineering, zoning and permitting, tower struc-

tural analysis and mods, procurement, logistics, construction, construction management and management. The company serves as its clients' turnkey resource for network site development and modification projects.
See ad on page 25

BMS Communications
4133 Guardian St.
Simi Valley, CA 93063
Kathleen Dell
kathy.dell@bmseng.com
(805) 526-1141
www.bmseng.com
Area served: Southern California
Types of sites: towers, rooftops, DAS
Services: 1, 3–6, 8–11, 13

Cellective Solutions
1736 Westpark Center Drive, Suite 201
St. Louis, MO 63026
Mike Grandcolas
mike@cellectivesolutions.com
(314) 989-9810
www.cellectivesolutions.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 1–13
Other: Photo simulations; all due diligence; project management; construction management; FAA, FCC and SHPO approvals; balloon tests; utility coordination; site audits; lease amendments; fire and highway department permits; and backhaul design
Company description
Cellective Solutions provides clients with the fastest, most cost-effective, and permitted telecom sites in the industry. Over the past five years, the company has completed site acquisition services on over 1,000 sites in seven states. Most of those are the difficult sites — the sites that other companies have failed to complete. When you need your network built, improved, or expanded let Cellective Solutions be your solution — your very "selective solution."

ComSites West
2555 Third St., Suite 200
Sacramento, CA 95818
Charlie Feick
charlie@comsiteswest.com
(530) 414-4376
www.comsiteswest.com
Areas served: California and Nevada
Types of sites: towers
Services: 2–3, 6, 12
Company description
ComSites West develops, owns and operates wireless communications sites in Northern California and Nevada, including tower and rooftop communications facilities. The company also develops towers jointly with landowners and acquires towers through outright purchases and through purchase leaseback programs.

Crown Castle
2000 Corporate Drive
Canonsburg, PA 15317
(877) 486-9377
www.crowncastle.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 1–13
Company description
Crown Castle's full line of site development services and in-market resources means you receive flexible deployment solutions. The company's understanding of local zoning and permitting processes, supported by relationships with municipalities across the country, helps ensure compliance and accurate documentation to move more efficiently through the collocation process.

Engineering Associates
1220 Old Alpharetta Road, Suite 390
Alpharetta, GA 30005
Tom Grigg
tgrigg@engineeringassociates.com
(678) 455-7266
www.engineeringassociates.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 1–13

1. Environmental assessments
2. Land acquisition
3. Lease acquisition
4. Right of way procurement
5. Site design
6. Site management
7. Site prequalification
8. Site selection
9. Site survey
10. Title service
11. Tower mapping
12. Tower rental/collocation
13. Zoning/permitting

Excell Communications
6247 Amber Hills Road
Trussville, AL 35173
Scott B. Smith
scottsmith@excellcommunications.com
(919) 771-1961
www.excellcommunications.com
Areas served: Southeast and Midwest
Types of sites: towers, rooftops, DAS
Services: 1–9, 11–13
Other: engineering, construction project management, construction, maintenance, fiber/backhaul services
Company description
As a unique self-performing infrastructure development firm serving the wireless, backhaul and utility industries in the Southeast and Midwest, Excell has had great success with managing the scale, scope and schedule of the collocation application and amendment process for 4G projects. As a real estate brokerage firm throughout the Southeast, the company's licensed site acquisition agents provide excellence in raw land development and DAS projects.

Faulk & Foster Real Estate
1811 Auburn Ave.
Monroe, LA 71201
joe.derry@faulkandfoster.com
(318) 376-0840
www.faulkandfoster.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 2–4, 6–14
Other: project management, construction management, program management, sublease management, property management, market analysis and right of way services for fiber deployments

ForeSite Services
5809 Feldspar Way
Birmingham, AL 35244
Paul Beasley
pbeasley@foresitetowers.com
(205) 437-3200
www.foresitetowers.com
Area served: Southeast
Services: 1–10, 12–13

KGI
Building Three, Suite 370
805 Las Cimas Parkway
Austin, TX 78746
Andy Kampen
andy@kgiwireless.com
(512) 345-9595
www.kgiwireless.com
Areas served: Arkansas, Oklahoma and Texas
Types of sites: towers, rooftops
Services: 1–13
Company description
KGI offers 15 years of experience working with U.S. wireless carriers. It provides site acquisition and project management services, including A&E services, construction management, environmental services, file audits, land owner negotiations, legal services, leasing services, permitting, RF compliance, site audits, site identification, and zoning for both new sites and tower collocations. KGI has the human and financial resources to manage projects of any size. The company looks forward to bidding on your next site acquisition project.

Ohio Valley Management
P.O. Box 637
Owensboro, KY 42302
Larry G. Brown
lbrown@brownsvalley.net
(270) 929-7196
www.ovradio.com
Area served: Kentucky
Type of sites: towers

www.ptswa.com

Pacific Telecom Services
111 S. Jackson St., Suite 250
Seattle, WA 98104
Annette Hellmich
ahellmich@ptswa.com
(800) 227-1399
www.ptswa.com
Area served: West
Types of sites: towers, rooftops, DAS
Services: 3, 5–6, 8–9, 11, 13
Company description
PTS is a full-service site development company offering architecture, structural engineering, site acquisition, project management, construction management and more. With offices throughout the West Coast and services throughout the United States, PTS can handle any project from a large-scale wireless market launch to a small architectural design solution.

Phillips Lytle
3400 HSBC Center
Buffalo, NY 14203
Doug Dimitroff
ddimitroff@phillipslytle.com
(716) 847-5408
www.phillipslytle.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 1–4, 10, 12–13

Company description
Phillips Lytle's telecommunications attorneys handle a full range of matters including site work, leasing, zoning and land use; tower and other infrastructure sales; construction and financing; federal and state tax; and litigation. The firm represents some of the world's largest telecommunications companies, tower companies, lenders and investors across the United States.

Powder River Development Services
219 S. Wooddale Ave.
Eagle, ID 83616
Casey Glenn
casey.glenn@powderriverdev.com
(208) 938-8844
www.powderriverdev.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 2–9, 11–13

Company description
Powder River Development Services offers site acquisition, zoning/permitting, and architectural and engineering services to the wireless network deployment industry. It has a nationwide staff of accomplished leasing agents and zoning managers and experience in nearly every part of the United States working on every type of wireless placement.

RealCom Associates
14432 S.E. Eastgate Way, Suite 260
Bellevue, WA 98007
Nancy Winch
nwinch@realcomassoc.com
(425) 274-4444, ext. 128
www.realcomassoc.com

Area served: West
Types of sites: towers, rooftops, DAS
Services: 2–4, 6–8, 10, 12–13

SBA Communications
5900 Broken Sound Parkway NW
Boca Raton, FL 33487
information@sbasite.com
(800) 487-SITE
www.sbasite.com
Area served: national
Types of sites: towers, rooftops
Services: 1–13
See ad on back cover

1. Environmental assessments
2. Land acquisition
3. Lease acquisition
4. Right of way procurement
5. Site design
6. Site management
7. Site prequalification
8. Site selection
9. Site survey
10. Title service
11. Tower mapping
12. Tower rental/collocation
13. Zoning/permitting

SCE
14102 Sullyfield Circle, Suite 300
Chantilly, VA 20151
Tracy Bender
tbender@sceeng.com
(410) 409-8063
www.sceeng.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 1–13

Shared Towers
1390 Chain Bridge Road, Suite 40
McLean, VA 22101-3904
Kamal Doshi
kdoshi@sharedtowers.com
(703) 893-0806
www.sharedtowers.com
Areas served: east of the Mississippi River
Types of sites: towers
Services: 2–3, 5, 7–9, 13

Site ID
103 Carnegie Center, Suite 300
Princeton, NJ 08540
Michael Shine
mshine@siteidinc.com
(973) 454-0302
www.siteidinc.com
Areas served: Northeast, Mid-Atlantic, Midwest
Types of sites: towers, rooftop
Services: 2–4, 6–9, 12–13

SRP Telecom
1521 N. Project Drive
Tempe, AZ 85251
Greg Carek
greg.carek@srpnet.com
(602) 236-2856
www.srptelecom.com
Area served: Arizona
Types of sites: towers
Services: 4–6, 8–9

Subcarrier Communications
139 White Oak Lane
Old Bridge, NJ 08857
John Paleski
subcom1@subcarrier.com
(732) 607-2828
www.subcarrier.com
Area served: national
Types of sites: towers, rooftops
Services: 6, 12
Company description
Subcarrier Communications has been providing rooftop and tower site management for more than 25 years, bringing together a team of professionals to offer comprehensive site acquisition, development and long-term management services. The company also provides building and tower owners with planning and design services, lease negotiations, installation, and maintenance of telecommunications sites.
See ad on page 5

Tower Economics
700 Route 130 North, Suite 204
Cinnaminson, NJ 08077
Len Stevens
len@towereconomics.com
(856) 786-7200
www.towereconomics.com
Area served: national
Types of sites: towers, rooftops
Services: 6, 12
Company description
Tower Economics was incorporated in 1980, well before the wireless/digital industry existed as it is known today. As wireless devices became ubiquitous, consolidators and a handful of carriers dominated the landscape. Many of the fundamentals have become excessively complicated and time-consuming and are often carelessly handled. Tower Economics guarantees to get it done.
See ad on page 13

Tower Maps
38659 Bolington Road
Lovettsville, VA 20180
David Ward
dward@towermaps.com
(540) 822-5092
www.towermaps.com
Area served: national
Types of sites: towers, rooftops
Service: 11

TowerCo
5000 Valleystone Drive, Suite 200
Cary, NC 27519
Todd Boyer
tboyer@towerco.com
(919) 625-5160
www.towerco.com
Area served: national
Types of sites: towers

Services: 3, 6, 12
Company description
TowerCo is the fifth-largest independent tower company with over 3,200 towers. Its mission is to make collocating on towers as simple as possible. The company keeps it simple in many ways, including its innovative website that provides valuable site details including height, fiber access, zoning jurisdiction and more.
See ad on inside back cover

TowerSource
3214 Blackwood Place
Colorado Springs, CO 80920
David Wendlandt
david@towersource.com
(484) 453-8126
www.towersource.com
Area served: national
Types of sites: towers, rooftops
Services: 2–3, 6, 11

U.S. Title Solutions

U.S. Title Solutions
3 Werner Way
Lebanon, NJ 08833
Jim Kudless
jkudless@ustitlesolutions.com
(908) 849-3017
www.ustitlesolutions.com
Area served: national
Types of sites: towers, rooftops, DAS
Service: 10
Company description
U.S. Title Solutions is a nationwide provider of title search, document filing and title insurance services to the telecommunications industry. Online order entry, status and document delivery system provides up-to-date information at any time. Full deed reports, primary title reports, property detail reports and many other types of reports are provided. Nationwide pricing is available.

Utility Service Communications
535 General Courtney Hodges Blvd.
Perry, GA 31069
Debbie Sullivan
dsullivan@utilityservice.com
(478) 988-5255
www.utilityservice.com
Area served: national
Types of sites: water tanks

Wireless Edge
270 North Ave., Suite 809
New Rochelle, NY 10801
John Arthur
arthur@wirelessedge.org
(914) 712-0000
www.wirelessedge.org
Area served: national
Services: 1, 6–7, 12–13

Wireless Siting Solutions
100 Overlook Center, 2nd Floor
Princeton, NJ 08540
Kelly Young
kelly.young@wirelesssiting.com
(267) 907-9029
www.wirelesssiting.com
Area served: national
Types of sites: towers, rooftops, DAS
Services: 3, 6–8, 13

safety

Defending Against a "Speculative" or "Theoretical" OSHA Citation

The prudent employer will carefully analyze all citations to determine if OSHA can meet its burden of proof, particularly whether there is any exposure to an alleged hazard. Employees working near a fall hazard may require protection.

By Mark A. Lies II

As the pace of OSHA enforcement activity increases, many employers are receiving citations for alleged violations of OSHA regulations in which the employer cannot understand the basis of the citation because it appears to be founded upon "speculation" regarding whether an employee was actually exposed to a safety or health hazard at the workplace. The following information explains the elements of what is required to prove an OSHA violation and how to respond to a citation that does not appear to be based upon a reasonable analysis of employee exposure to a potential hazard.

OSHA has failed to prove exposure in several recent cases that illustrate the analysis that an employer must undertake in defending a citation on the grounds that it is based on "speculation" or "theory."

OSHA burden of proof

The elements that OSHA must prove to establish a violation, by a preponderance of the evidence, are well established.

1. The applicability of the standard to the hazard (fall, electrocution, confined space, etc.) at issue.

2. The employer's noncompliance with the standard's term.

3. Employee access (or exposure) to the hazard or violative condition.

4. The employer knew, or with the exercise of reasonable diligence could have known, of the violative conditions.

It is critical that employers focus on the fact that if the agency cannot prove element 3, that the employee's exposure was "reasonably preventable either by operational necessity or otherwise (including employee inadvertence), that employees have been, are, or will be in the zone of danger," then the citation cannot be upheld. OSHA has recently had several citations vacated because it could not establish such exposure. It cannot prove a violation by "speculation" that an employee might be exposed to the hazard under a theoretical scenario.

Failure to prove employee exposure

As indicated, OSHA has failed to prove exposure in several recent cases that illustrate the analysis that an employer must undertake in defending a citation on the grounds that it is based on "speculation" or "theory."

Secretary of Labor v. Garden Ridge, OSHRC Docket No. 10-1082 — In this case, the employer was cited for a violation of OSHA general industry machine guarding standard (29 CFR 1910.212(a)(1)) when the employee stood outside of a trash compactor hatch door and pushed trash down the chute with a 10-foot-long piece of 2x4 lumber. The hatch door was approximately 10 feet from the compactor chamber and hydraulic ram. The agency argued that an employee was in the "zone of danger" of the hydraulic ram as the employee pushed the trash with the 10-foot-long 2x4 piece of lumber. To support its case, the compliance officer testified to his hypothetical scenario in which the employee would step up on the compactor chute to push the trash down, and if the employee slipped, he could slide down the chute into the area of the hydraulic ram.

The administrative law judge vacated the citation on the grounds that the compliance officer's scenario of an exposure was "speculative" and did not represent the actual experience of the employees who operated the compactor. She further found that under normal operating conditions, employees were not in the "zone of danger" of the hydraulic ram.

Secretary of Labor v. Nuprecon LP,

OSHRC Docket No. 08-1037 — In this case, the agency cited the employer under a construction standard (29 CFR 1926.501(b)(1)) relating to failure to provide fall protection for employees who are required to walk or work in the vicinity of a fall hazard of more than 6 feet on the floor of a building being demolished. The alleged violation was premised, in part, on failure to provide such fall protection for an employee who was inside of and operating a Bobcat front end loader despite the fact that the operator never got out of the loader and never walked or worked on the floor in proximity to the fall hazard.

OSHA based its case on its belief that it was reasonably foreseeable that the loader operator would get out of the loader and then be exposed to the walking and working hazard. The administrative law judge upheld the citation and found exposure, but the Review Commission reversed the finding and said that OSHA had not proved exposure.

In ruling against OSHA, the Review Commission held that OSHA had introduced no evidence that it was "reasonably predictable" that the loader operator would get out of the loader to perform work and be exposed to the fall hazard and that it could not prove such exposure by showing it was "theoretically possible" that any employees had been, are, or will be in the zone of danger.

Secretary of Labor v. Shaw Arena Mox Services, LLC, OSHRC Docket No. 09-1284 — In this case, OSHA cited the employer under a construction industry electrical standard, 29 CFR 1926.404(f)

(continued on page 24)


JUNE
AGL TOWER OF THE MONTH
www.agl-mag.com

SITE NAME
Colville

TOWER OWNER
Day Wireless Systems

SITE CONSTRUCTION
Day Wireless Systems

TOWER TYPE
Monopole

HEIGHT
140 feet

APPLICATIONS
Public Safety, Utilities, Carriers

YEAR BUILT
2009

LOCATION
Colville, Wash.

agl
ABOVE GROUND LEVEL
Previous Page | Contents | Zoom in | Zoom out | Front Cover | Search Issue | Next Page
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(continued from page 21)

(6), for failure to ground an electrical adaptor and the plug of a fuel pump cord at a nuclear fuel conversion facility. The administrative law judge found an exposure to the hazard posed by the adaptor was reasonably predictable because it was available for use and an employee plugging ground-required equipment into it would have been exposed to an electric shock hazard and upheld the citation.

On appeal, the Review Commission vacated the citation finding that OSHA had failed to prove "exposure" because OSHA had not proved that grounding was required for all equipment that could be plugged into the adaptor. Because OSHA had not proved that it was "reasonably predictable" that equipment that is required to be grounded "might" be connected to the adaptor, it had not proved employee exposure to the hazard.

Employer analytical process

The foregoing cases clearly illustrate that employers must not accept citations at face value as being factually or legally correct. In these cases, the employers argued that OSHA had failed to prove that any employee had been "exposed" to the hazard. OSHA was unable to establish that such exposure (based on the facts involved in the inspection) was "reasonably predictable." Further, the citations were vacated because they were based upon the compliance officer's "speculation" that the exposure was "theoretically possible." This simply is not sufficient evidence to establish the citation.

Collateral risk of citations

Employers should carefully analyze and contest citations in which there is no reasonable proof of employee exposure. If not, employers expose themselves to collateral risks of the unsupported citations they accept, including:

- Repeat citations for substantially similar violations within the five years after the citation becomes final with penalties up to $70,000 per citation
- Willful citations, with penalties up to $70,000 per citation, if OSHA considers the initial and subsequent violations to be evidence of willful noncompliance
- Enhanced future monetary penalties based on citation history
- Negative impact on future job opportunities based upon a history of OSHA violations and perception that the employer is noncompliant with the law and is therefore a liability risk as a service provider

Conclusion

The prudent employer will carefully analyze all citations to determine if OSHA can meet its burden of proof, particularly whether there is any exposure to an alleged hazard.

Mark A. Lies II is a partner in the Seyfarth Shaw law firm Chicago office. His email address is *mlies@seyfarth.com.*

Court Lowers "Burden" of Proof for OSHA Citations

The use of an effective safety program, always important, plays an increasingly important role with employers' legal defenses to citations since an appeals court affirmed the Occupational Safety and Health Review Commission's decision in the Compass Environmental case.

By Mark A. Lies II and Meagan Newman

Shortly before the New Year, the U.S. Court of Appeals for the 10th Circuit rendered an opinion that not only altered the agency's burden of proof for OSHA citations but effectively reduced that burden to little more than a semantic impediment. In *Compass Environmental, Inc. v. Occupational Safety and Health Commission; Department of Labor*, No. 10-9541 (Dec. 19, 2011), the court declared that neither OSHA nor the secretary of labor needs to establish the elements of the long-established four-part *Atlantic Battery* test to prove a violation but instead must only prove that a "reasonably prudent employer" would have anticipated the hazard at issue and would have done more to prevent it. Further, the court found this burden met where the secretary had simply asserted that the employer at issue failed to act as a reasonably prudent employer without offering any evidence regarding whether a reasonably prudent employer in the same industry would have even recognized the hazard and, if so, what protective measures, if any, would have been taken. In effect, the employer's liability is viewed in a vacuum with

no reference to some recognized norms of safety in the employer's industry. According to the court, the secretary only needs to allege and prove that the specific employer's actions were "imprudent" and the violation will stand. This decision not only represents a dramatic change with respect to the proof necessary to sustain an OSHA violation, it also challenges traditional notions of due process and fairness in giving an employer notice of what conduct is permissible or prohibited so that it can act accordingly to be compliant.

The Atlantic Battery test

In *Secretary v. Atlantic Battery Co.*, 16 BNA OSHC 2131, 2138 (1994), and several other cases that followed, the Occupational Safety and Health Review Commission set forth a four-part test for establishing violations of OSHA standards. Under this test, to establish a violation of an occupational safety or health standard, the secretary must prove "(a) the applicability of the cited standard, (b) the employer's noncompliance with the standard's terms, (c) employee access to the violative conditions, and (d) the employer's actual or constructive knowledge of the violation (i.e., the employer either knew, or with the exercise of reasonable diligence could have known, of the violative conditions)." *Id.*

The job safety analysis for the excavation stated that the operator and trench hand were to maintain a 20-foot clearance between the excavator and overhead power lines.

In *Compass Environmental*, rather than applying the *Atlantic Battery* test, the Review Commission applied a training-specific test and focused on the issue of whether a "reasonably prudent employer" would have anticipated the exposure at issue and provided the exposed employee with training on this hazard. The 10th Circuit affirmed the commission's decision, stating that the *Atlantic Battery* test was inapt and that the secretary need only establish that a reasonably prudent employer would have taken more action. Although this is not the first time the commission has applied this reasonably prudent employer test for a training violation, it appears that it is the first time a reviewing federal court of appeals has sanctioned its application in the absence of proof

that the *Atlantic Battery* test factors have been established. See *Capform, Inc.,* 19 BNA OSHC 1364 (No. 99-0322, 2001); *Baker Tank Co.*, 17 BNA OSHC 1177 (No. 90-1786, 1995).

Although the 10th Circuit's decision is significant for this change in the burden of proof, it is also significant in that the court found that the secretary met her burden without actually introducing *any* evidence of what a reasonably prudent employer in the employer's industry would have done in the same or similar circumstances as those encountered by Compass Environmental.

Bad facts make bad law

In 2006, Compass Environmental began construction on an underground slurry wall at a surface mine in Colorado. A two-person excavator crew, consisting of the excavator operator and a trench hand, were tasked with digging a trench for the slurry wall. The trench hand was required to walk alongside the excavator and periodically grease the excavator with a grease line, a rubber and metal hose with a dispensing nozzle, that was attached to the excavator. He also checked the trench depth and watched for problems that the operator could not see.

During the first week of the project, the company conducted a hazard assessment, prepared a job safety analysis and provided training to employees regarding possible hazards. The trench hand was a new employee who had only joined the team a week into the project. The job safety analysis for the excavation stated that the operator and trench hand were to maintain a 20-foot clearance between the excavator and overhead power lines. Because the trench hand joined the project after the initial training, he was given individual training, however, the record did not show that he received any instructions regarding the overhead power line. On March 18, 2006 the excavator operator — who had clearly been trained to maintain a safe distance from the power lines — moved the excavator close enough to the power line for an electric current to pass from the line through to the trench hand standing by, resulting in the trench hand's death.

OSHA investigated the incident and issued a two-item "Serious" citation for failing to adequately train the *operator* and *trench hand* and for failing to maintain proper clearance of the power line. Although the citations were first vacated as to both the operator and trench hand after a hearing before an administrative law judge, OSHA only appealed the vacation of the citation that related to the training of the trench hand. The Review Commission reversed the judge's decision as to the trench hand's training and affirmed that citation.

Although there is no doubt that the events of that 2006 day were tragic, there is also no doubt that the employer conducted a hazard assessment, identified the possible hazard posed by overhead power lines and trained employees with respect to this hazard. Even though the trench hand may not have received this training, the excavator operator whose actions led directly to this accident did receive that training (OSHA did not appeal the vacation of the training

citation as to the operator). Although the operator was fully trained and he caused the excavator to contact the electrical line, OSHA maintained there was still a training violation as to the trench hand, who was never expected to perform work in proximity to the elevated electrical line because he worked at ground level. It is on this point that the court's abandonment of the *Atlantic Battery* test and application of the "reasonably prudent employer" test leads to fundamental unfairness. Because the secretary was not put to her burden to show that the cited training standard applied to the trench hand, as he did not operate the excavator, or that he had "access" to the hazard as would have been required under *Atlantic Battery* (because he worked at ground level and did not control the excavator), the employer's ability to defend itself was materially impaired. Moreover, even though the secretary conceded that she *had* the burden of at least showing that a "reasonably prudent employer in the industry" would have anticipated the sort of electrical hazard that the trench hand encountered in this case and provided the trench hand with more training, the secretary failed to introduce any evidence to satisfy this burden with any evidence from any witnesses. To the contrary, the proof offered in this case indisputably showed that the excavator operator defied his training and years of experience. Although it may be a natural instinct to hold someone responsible when there is a fatality, the mere occurrence of a fatality does not establish a violation because it is critical to evaluate the employer's conduct up to the time of the accident, using established and recognized legal criteria, to determine if there was any violation. In affirming the Review Commission's decision in *Compass Environmental*, the court has negatively impacted employers' legal defenses to citations.

Recommendations

Employers can protect themselves by establishing an effective safety program that:

- Requires that a thorough hazard assessment for each worksite is performed
- Includes programs and procedures addressing the possible hazards of the workplace and ensures that training is provided to all employees who may encounter those hazards
- Communicates the importance of safety to employees and supervisors both in writing and in action
- Ensures that employees and supervisors are properly trained (including addressing potential language barriers or literacy issues involving employees), have the necessary equipment and use it properly
- Incorporates regular site inspections and work observations and corrects noted deficiencies in a timely manner
- Alters training and personal protective equipment requirements wherever site inspections and assessments identify new possible hazards
- Contains an effective and progressive disciplinary system that is routinely and consistently followed
- Documents these elements ■

Mark A. Lies II is a partner in the Seyfarth Shaw law firm Chicago office. His email address is mlies@seyfarth.com. Meagan Newman is a senior associate with the firm. Her email address is mnewman@seyfarth.com.

Reducing Mobile Network Costs with DAS Deployments

Distributed antenna systems can support a leaner, more agile business model for service providers rolling out 4G networks. They improve spectrum management and offer more flexibility for future upgrades.

By Tony Lefebvre

As wireless service providers expand their networks for LTE and other services, keeping costs in line may seem impossible. Let's look at how distributed antenna system (DAS) networks deliver LTE services, and why DAS deployments can save mobile operators deployment and operating costs.

Photo 1. A pole-mounted DAS antenna is connected via a fiber network to the host, which distributes signals from the base transmitter station to multiple remote antenna locations such as this one.

LTE delivery challenges

In rolling out LTE services, service providers are challenged to deliver much more capacity per user. Mobile data capacity has been doubling every year, and a recent study by Cisco projects that mobile data capacity will increase 18-fold by 2016. To keep up, service providers must deploy more base stations, bring signals closer to users and reduce the population density within a given cell. This cannot be accomplished by macrocell towers alone. LTE deployments require a new network architecture known as small-cell architecture, which is deployed using either small base stations such as picocells or femtocells, or by extending base station capacity with DAS.

To deliver the performance new applications demand, a 4G infrastructure must address both coverage and capacity.

Coverage — Frequencies as high as 1900 MHz and higher that are used for 4G cellular service are not as effective at penetrating buildings from the outdoor macro or microcell networks. Fully penetrating a building with an 850-MHz or 900-MHz signal is relatively easy, but it is much harder to drive a signal farther than a few feet inside a building when the signal transmits at 1.9 GHz or higher frequencies. Although signals at frequencies below 1900 MHz offer value in signal penetration, they present the network operator with the challenge of controlling the signal propagation to keep intercell interference in check. Often, the propagation benefits of the lower frequencies cannot be realized because shaping coverage and managing coverage between the smaller cells to deliver more capacity is of paramount importance.

Although signals at frequencies below 1900 MHz offer value in signal penetration, they present the network operator with the challenge of controlling the signal propagation to keep intercell interference in check.

Capacity — Industry experience with the iPhone and other mobile application platforms shows that data usage can increase tenfold or more as users adopt these devices, placing a real strain on the network. We've all experienced looking at our device, noting we have signal strength but being unable to upload or download content. With a promise of 10 or more times as much throughput as 3G (10 megabits to 14 megabits versus 800 kilobits to 1,000 kilobits), 4G services increase the capacity squeeze. Small-cell solutions can increase capacity by delivering it over a smaller area to fewer users. Because the capacity is divided among fewer users, the capacity per user increases.

LTE delivery alternatives

There are two small-cell solutions for delivering LTE.

- Small base stations (microcells, picocells and femtocells) provide coverage and capacity for a specific frequency to a specific area.
- DAS precisely extends multiple base stations' signals to targeted areas through dozens or hundreds of antenna points.

One big difference between picocells/microcells and DAS is that picocells/microcells deliver a specific service, so they must be supplemented or replaced as new services come online. In addition, small base stations tie coverage to capacity: Each cell must have its own backhaul to

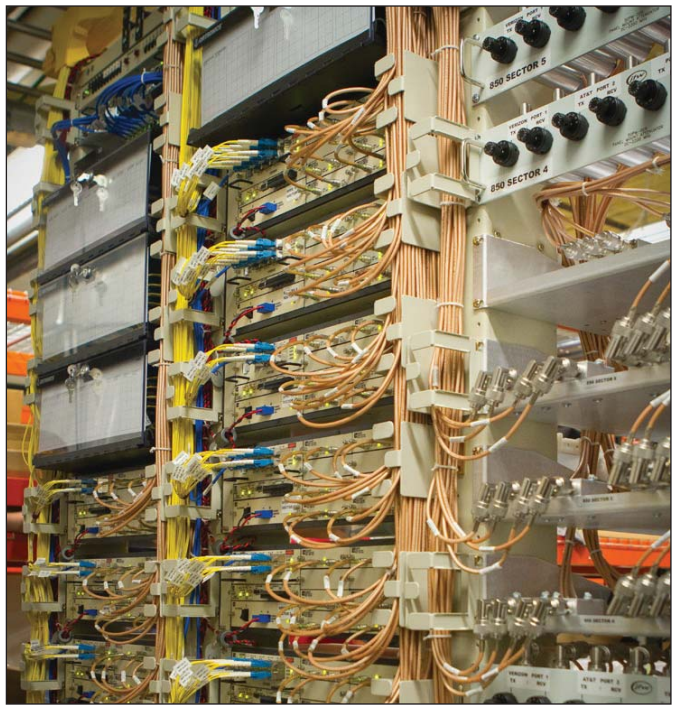

Photo 2. This is an example of a centralized base transmitter station hotel where one service provider or multiple service providers place all of the radios feeding the distributed antenna system.

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the network, and when more coverage is needed, another cell must be deployed. DAS, on the other hand, separates coverage from capacity because it distributes the capacity of a base station or multiple base stations throughout its antennas. The base station is backhauled at a central location, and the DAS is just a series of signal amplifiers and antennas. The DAS can be expanded as needed to cover additional areas.

A DAS is an efficient means to distribute wireless services from a common RF source, whereas the base transmitter station (BTS) signals are connected to a host. The host distributes the BTS' signal to multiple remote antenna locations mounted on poles and links them via a fiber network (see Photo 1).

An outdoor DAS can be connected to a centralized BTS hotel where the service provider or providers place all of the radios feeding the DAS (see Photo 2). An all-digital DAS can carry signals over fiber; thus, the DAS can extend miles from the BTS hotel to reach a given area. Pairing a DAS with the base stations optimizes the reach, performance and efficiency of the network. Although choosing DAS network architecture still necessitates the use of base stations, base station resource needs may be kept to a minimum because the network operator is free to direct capacity when and where needed, creating a more efficient and easy-to-manage network.

Additionally, a DAS can deliver either single-input, single-output (SISO) communications or multiple-input, multiple-output (MIMO) communications solutions. It is easy to upgrade a SISO DAS to MIMO using an integrated, dual-band amplifier. On the other hand, upgrading a picocell/femtocell setup would require adding another set of radios with associated backhaul.

How DAS reduces network costs

Because of these fundamental management differences between distributed small base stations and DAS, the cost to deploy and maintain each type of system is quite different. Compared with distributed small base stations, DAS architecture reduces costs in several ways.

- **One solution, multiple services.** Because a DAS is frequency-agnostic, it can deliver multiple mobile services. Some DAS products can support as many as eight frequencies or technologies. With distributed radios, on the other hand, the service provider would have to deploy individual radios for each service to be supported.

A DAS can reduce network build-out costs by 50 to 67 percent, depending on the number of frequency bands to be supported.

- **One backhaul versus individualized backhaul.** Each distributed radio must have its own backhaul, which multiplies costs for the network operator. DAS networks, on the other hand, are backhauled once, at the base station or BTS hotel supplying the signal.
- **Built-in MIMO support.** To support MIMO with distributed radios, a service provider would have to deploy an additional set of distributed radios. A DAS supports MIMO with dual-band antennas.
- **Lower maintenance costs.** Because a DAS is fed from a centralized base station or BTS hotel (and because the DAS itself is relatively trouble free), the DAS is easier and less costly to maintain than a distributed network of radios. The primary point of maintenance — the base station — is centrally located in one spot, so it saves multiple truck rolls to individual small base stations scattered throughout the network.
- **DAS can share fiber assets.** FTTx deployments have multiplied and in many cases, the DAS can share existing fiber assets in the ground that were deployed by telcos or CATV companies. The DAS owner thus saves the cost of fiber build-outs by piggybacking on existing fiber in the ground. Distributed radio systems can also benefit from sharing in-ground fiber.

A TE Connectivity study showed that a DAS can reduce network build-out costs by 50 to 67 percent, depending on the number of frequency bands to be supported. For example, it costs roughly $1.5 million to build out three traditional cell sites that support four bands; a DAS delivering the same services over the same area would cost about $500,000. In addition, given that DAS radio heads are independent of base transmitter stations, baseband units, protocol or carriers and use a multiband, upgradeable architecture, certain future upgrade expenses are minimized. Instead of network operators facing the prospect of forklift upgrades to the thousands of deployed small cells, using DAS can reduce site development expenses 47 to 58 percent as operators make certain changes such as spectrum refarming, adding new protocols or adding new spectral assets.

Compared with distributed small base stations, DAS architecture reduces costs in several ways.

Distributed antenna systems can support a leaner, more agile business model for service providers rolling out 4G networks. With the ability to carry multiple frequencies and to simulcast signals to dozens or hundreds of antenna points, a DAS not only costs less, but also improves spectrum management and offers more flexibility for future upgrades. ■

Tony Lefebvre is director of product management for outdoor wireless products for the wireless business unit at TE Connectivity, Berwyn, Penn. During 17 years with Tyco Electronics (TE), he also has been a program manager for DAS products and a senior manager for IP Cable products. His email address is Tony.Lefebvre@te.com.

Pushable Fiber: Applications and Savings in DAS and Cellular Backhaul

Although the need for fiber is clearly demonstrated at cell sites and distributed antenna system (DAS) antennas, the cost-effective means to deliver that technology is less understood. Combining pushable fiber with microduct solutions offers impressive advantages. **By Cheri Beranek**

With 80 percent of the cost of a telecommunications build spent on labor, it is critical to conduct a thorough analysis of how to control labor costs. Deployment requirements include a staff of planners, engineers, field crews and construction workers who are knowledgeable about the type of services to be offered and how they are to be delivered. Little attention has been paid to the underlying foundation of these networks — protecting and managing the physical layer. The physical fiber network must be protected as light passes from one point to the next, ensuring no degradation of performance occurs. It is crucial, then, that adequate fiber management practices are followed anyplace where a fiber is terminated, fitted with connectors or spliced.

Photo 1. Remote radio heads for distributed antenna systems, such as this node shown on a light pole, often are fed by fiber-optic cable to bring wireless carrier signals to and from the node.

With the increased use of bandwidth, carriers find it necessary to reinforce their networks to just keep up with the demand. If you haven't noticed how this has happened, look to your kids. People are using their cell phones more and letting the laptop and the desktop computers sit idle. This increase in use has pushed an already strained network to the limit. Add to this the lack of available space in both buildings and downtown areas and you have a recipe for major network failures.

To offset the risk of network failures, carriers are looking for creative ways to maximize existing space and reinforce their fiber with new and innovative technologies.

An emerging technology is pushable fiber coupled with a microduct solution. Not to be confused with air-blown fiber, pushable fiber is a practical solution that not only allows cost-effective deployment of fiber in cellular backhaul and DAS networks (see Photo 1), but also provides ongoing returns by reducing the costs of maintenance and restoration.

DAS

Installing a distributed antenna system (DAS) network calls for managing pedestrian and road traffic.

DAS is an exciting technology because it allows for greater use and bandwidth transfer in heavily populated metro areas. The challenge in a DAS environment involves how

Photo 2. Microtrenching is less time-consuming and invasive, and it allows traffic to pass over the trench line without concern for causing damage. The trench width is usually 1 inch or less, and because less material is removed, it can be easily restored.

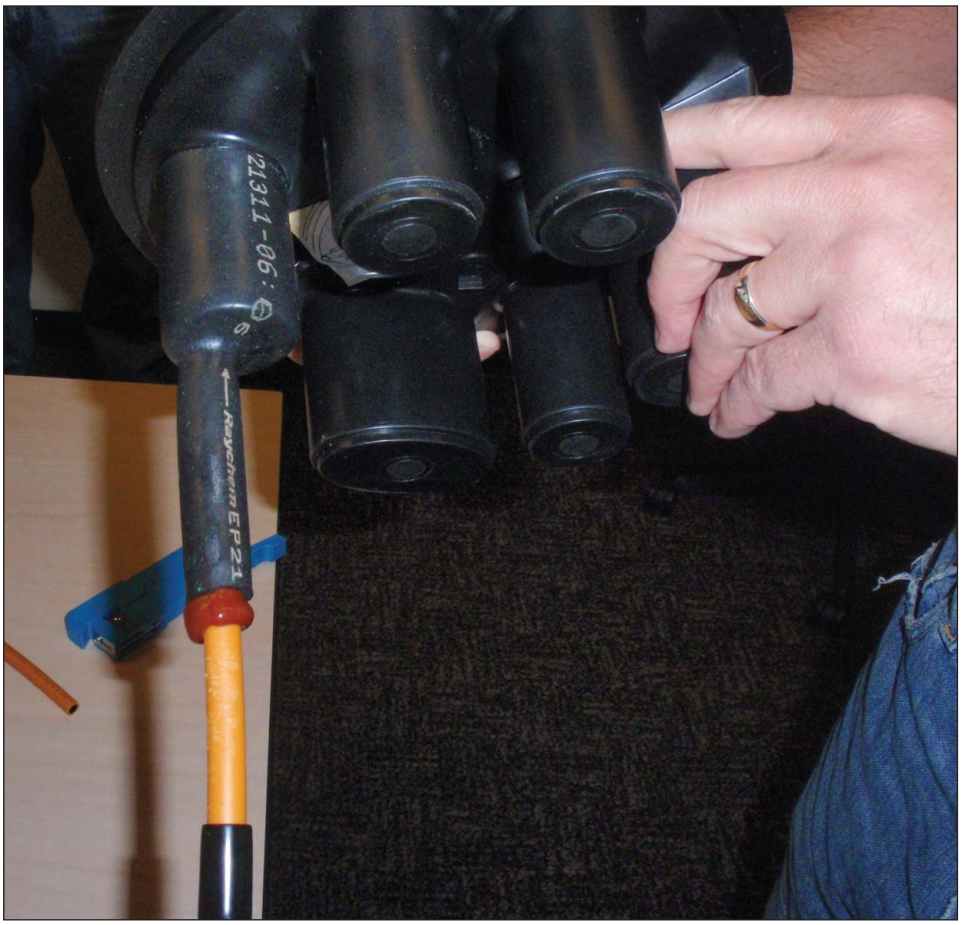
to extend fiber to the antenna sites because they are commonly situated in or on structures that are encased in concrete. The most common method is to micro-trench (slot-cut) a microduct from an existing manhole run where there is plenty of fiber and extend a fiber from the manhole splice to the DAS equipment on streetlight poles. The challenge is to find the time and space to perform such an installation. Take a project in downtown Chicago as an example of how to overcome these challenges.

Traditional trenching is an expensive, labor-intensive process. It has become such a sore spot in the deployment of cable that even WikiHow has gotten into the act, providing a 14-step process on how to plan your excavation (*www.wikihow.com/Image:Ditch21_332.jpg*). Challenges associated with soil types have been well documented along with the laborious steps associated with the use of a support structure to prevent cave-in, dewatering or benching the excavation.

Photo 3. A restored trench appears just to the right of the white line.

Microtrenching is a far superior alternative and is the ideal option because it is less time-consuming and invasive, and it allows traffic to pass over the trench line without concern for causing damage. The trench width is usually 1 inch or less, and because less material is removed, it can be easily restored (see Photo 2).

The need for pushable fiber and microduct is obvious because there simply is no room for a larger, more typical outside plant solution. The traditional method of digging a 1-foot-wide trench, placing 2-inch to 4-inch diameter conduit into it, backfilling with concrete and then repaving is long gone. This older method typically costs upward of 60 percent more to accomplish, and it also affects local traffic. Imagine closing a lane of traffic in downtown Chicago for a week. With the pushable fiber method, a slot is cut, usually at night, and then two microducts are placed in the slot. One of these microducts typically has the ability to be located. It is critical to be



able to locate the microduct because when the microtrench has been fully restored, it is virtually impossible to see where the trench is. After a season of resurfacing, it will become invisible. In Photo 3, the restored trench appears just to the right of the white line.

After the microduct is placed in the trench, a small hole is bored into the manhole where the fiber ring is located. The microduct is placed into the splice case just as a traditional cable would be (see Photo 4), and then the fiber is simply pushed through the microduct and spliced as a normal cable.

The two most attractive qualities of pushable fiber are that it allows for installation from either end, enabling the installation crew to work with the

Photo 4. After the microduct is placed in the trench, a small hole is bored into the manhole where the fiber ring is located. The microduct is placed into the splice case just as a traditional cable would be, and then the fiber is simply pushed through the microduct and spliced as a normal cable.

least amount of disruption, and its size. A 3-millimeter pushable fiber can house as many as 12 fibers, and a 4-millimeter pushable fiber can house as many as 24 fibers and still fit into a 10-millimeter microduct. Additionally, placing two ducts in a small, 1-inch footprint allows for project completion in a normal overnight shift, reducing the effect on local traffic.

Cellular backhaul

When fiber reinforcement in an existing duct structure such as a rooftop site is necessary, the requirements change somewhat, but there are some common threads. The lack of space and the costs associated with constructing new pathways through the riser space in buildings are just as prohibitive as digging up city streets.

Pushable fiber addresses the lack of space and the costs in the same manner as with DAS by installing microducts inside the existing structures to provide a distinctive pathway. Using the pushable fiber allows simply pushing the fiber from the top down. An advantage of installing fiber in buildings is gravity. Given the small size of the pushable fiber, it can easily be carried to the top floor. Gravity will then help with the installation.

An installation in Racine, Wis., provides an example. The cell site was on top of a 10-story building with a 1-inch conduit running down from the rooftop to an equipment room in the basement. The connection point for the local telco was an additional 450 feet away in a manhole.

Eight hours to install

This installation had been on hold for three years because of routing problems and the costs associated with core-drilling 10 floors and installing a new conduit. Using the pushable fiber alternative, both the microduct and fiber were placed in only eight hours.

A previously installed 1.25-inch diameter 1 innerduct extended from the building to the manhole, so that path already was established. The challenge was that the 1-inch conduit already had four Cat5 cables and a 25-pair telco cable in it. Additionally, there were a total of 22 90-degree sweeps in the route. First, two 10-millimeter microducts from the rooftop hut to the equipment room were installed, followed by coupling on two microducts that were pushed through the 1.25-inch innerduct to the manhole. After the microducts were installed, the fiber was pulled from the rooftop to the equipment room in one pull through 22 90-degree bends. After that, it was a simple pull to the manhole (see Photos 5, 6 and 7).

Reducing the labor cost of installing fiber from the access point to the tower or DAS antenna, while improving the long-term reliability of that fiber, is the promise of an optical fiber protection system deploying pushable fiber. In fact, by eliminating splicing, pushable fiber within a ruggedized

Photo 5. Two 10-millimeter microducts from the rooftop hut to the equipment room were installed, followed by coupling on two microducts that were pushed through the 1.25-inch innerduct to the manhole.

Photo 6. After the microducts were installed from the rooftop to the equipment room, fiber was pulled from the rooftop to the equipment room in one pull through 22 90-degree bends.

microduct can eliminate hundreds of dollars in labor costs at every connected fiber. In its simplest form, ruggedized microduct is either aerially or direct buried and the pushable fiber is either pushed by hand or machine to its desired end-point — up to 1,500 feet. The pathway can transition from outside plant (aerial or buried) to an inside plant environment with a simple airtight and watertight coupler that requires minimal tools to install, allowing for a single and continuous pathway. Pushable fiber is available in bulk form, or terminated with a unique, pushable connector as a single drop or multiple-fiber assembly.

To seamlessly integrate with the ruggedized microduct, new market solutions are being introduced that allow the fiber to be pushed directly into a fiber management device such as the Clearview cassette. This provides the ultimate in fiber protection and enables the field technician to splice inside a protected environment. Taking that protection a step further, ruggedized microduct and the associated pushable fiber can be installed directly to specially designed pedestals and vaults further protecting the laid fiber.

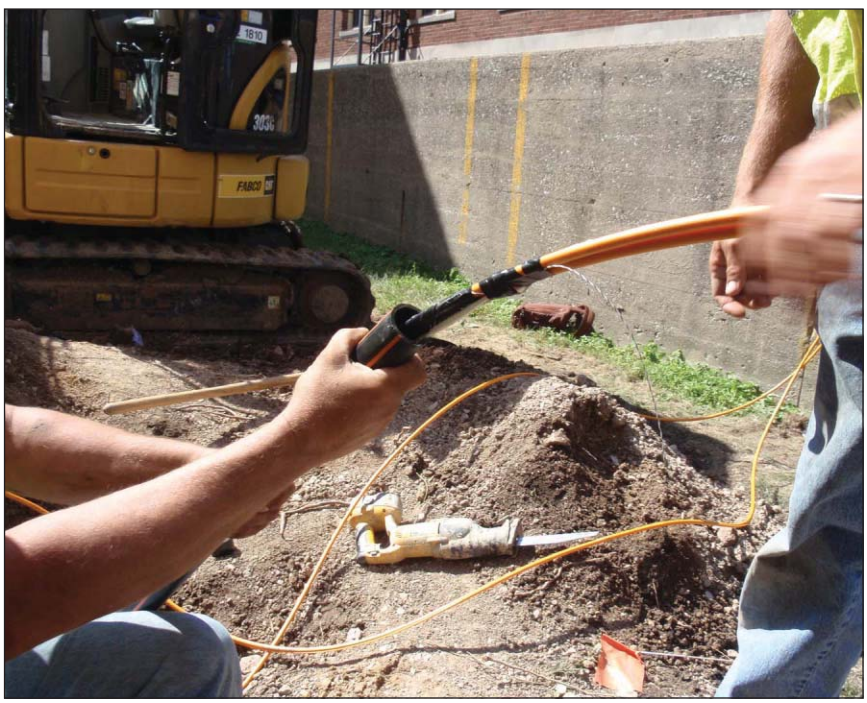


Photo 7. After fiber had been pulled from the rooftop to the equipment room, it was a simple pull to the manhole.

Why pushable fiber?

Although the need for fiber is clearly demonstrated at cell sites and DAS antennas, the cost-effective means to deliver that technology is less understood. In Chicago and Wisconsin, pushable fiber and microduct solutions, when combined, not only saved money for the carrier, they reduced the negative effects on the people who are being better served by the installation. ■

Cheri Beranek is president and CEO of Clearfield, which designs and manufactures the FieldSmart fiber management platform. Visit Clearfield at *www.clearfieldconnection.com*.

product showcase — shelters and enclosures

Lightweight Telecom Shelters

Lightweight, seamless shelters from **Dupont Building** offer telecom site equipment protection, including UL752 Level 4 protection as an option. Their light weight makes the shelters less expensive to transport to remote sites, maximizing tower site options. Dupont shelters come in a variety of finishes and colors to meet all zoning requirements.
www.dupontbuilding.com

Concrete Shelters

Custom-designed and custom-built steel-reinforced precast concrete buildings from **Reliant Shelters** are suited for use as ground-mounted telecommunication and equipment shelters. Because the floor structure is concrete, the shelters can be placed directly on the ground without concern for deterioration resulting from damp conditions. The six-sided concrete structure is also inherently secure, bullet-resistant and highly resistant to vandalism.
www.reliantshelters.com

Satellite Uplink Collocation Facility

Oldcastle Precast has completed a satellite uplink collocation facility located in North Platte, Neb. The project was a turnkey design-build facility constructed for Pinpoint Communications, which performed the land acquisition for this facility while Oldcastle Precast concurrently designed, engineered and manufactured one of its Maxi-Mod 3056 modular precast buildings for the satellite uplink facility.
www.oldcastleprecast.com

Climate Control

The Full Flow Economizer heating/cooling unit from **Bard Manufacturing** allows telecom companies the potential to save 60 percent on the energy costs of climate control and to achieve return on investment in the first year, depending on climate and utility rates. The MC4000 lead/lag controller with optional communication board allows remote monitoring over the Internet. The Economizer extends telecom equipment life and can be retrofitted to existing shelters.
www.bardhvac.com

DC Air Conditioners

A full line of direct current air conditioners for the telecom shelter and enclosure environment is available from **Sun Power Technologies**. Systems are available in 24-volt DC and 48-volt DC configurations that deliver 1,500 BTU to 22,000 BTU per hour of cooling capacity.
www.sunpowertech.com

Micro Radio Site

Pepro has launched a redesigned micro radio site that provides mobile protection for communications equipment for remote, temporary and environmentally sensitive applications. The new design includes an upgraded cabinet to make the unit lighter and more streamlined, a redesigned base to simplify the installation process for the anchoring system and more rugged axles and wheels to make the unit more roadworthy on secondary roads.
www.peprollc.com

All-aluminum Buildings

All-aluminum buildings from **FWT** offer several performance benefits including corrosion resistance and light weight, which lowers transportation and offloading costs. They provide a positive RF barrier to incoming and outgoing radio frequencies to ensure dependable performance of RF-sensitive communications equipment. FWT shelters also feature bullet resistance, noncombustible construction and various exterior surfaces to provide a custom solution to specialized building needs.
www.fwtllc.com

Concrete Shelters

Concrete equipment shelters from Fibrebond offer a number of benefits that translate to cost savings. Equipment can be reconfigured without adding additional cabinets. Also, networks can be upgraded without installing foundations or changing site footprints. Equipment is protected from temperature fluctuation, severe weather, vandalism and theft. As an alternative to two-room generator buildings, Fibrebond offers a patio design to clients at a cost savings since buildings do not require additional installation of ventilation systems and other equipment.
www.fibrebond.com

Ethernet Backhaul Enclosure

The Cube-RL2003 Ethernet backhaul service enclosure is part of the line of Cube environmental enclosure solutions from **Charles Industries**. The RL2003 can be mounted on the shelter wall, on an H-frame or on a pole to provide protection of Ethernet equipment and other electronics for wireless backhaul applications at cell sites and other remote outdoor applications. Separate 14RU equipment and 5RU customer chambers restrict access to authorized technicians and provide a clearly defined demarcation point. The RL2003 is designed to provide complete user functionality and service in a small footprint, for the compact electronics used in Ethernet backhaul. The NEMA 4X-rated solution comes with various thermal management options (heat exchangers, air conditioner) as well as an optional 1RU (19-inch) slide-out tray for storing equipment that is not rack-mountable.
www.charlesindustries.com

Prefabricated Shelters

Prefabricated shelters designed and manufactured by **Precision Quincy** offer those in the telecommunications field different structural, aesthetic and service options when specifying an equipment shelter. Models range from lightweight, steel-framed buildings with lower transportation and installation costs up to heavyweight, ballistics-resistant concrete designs. Designed to handle diverse, inclement working environments, Precision Quincy shelters provide long-term equipment protection.
www.precisionquincy.com

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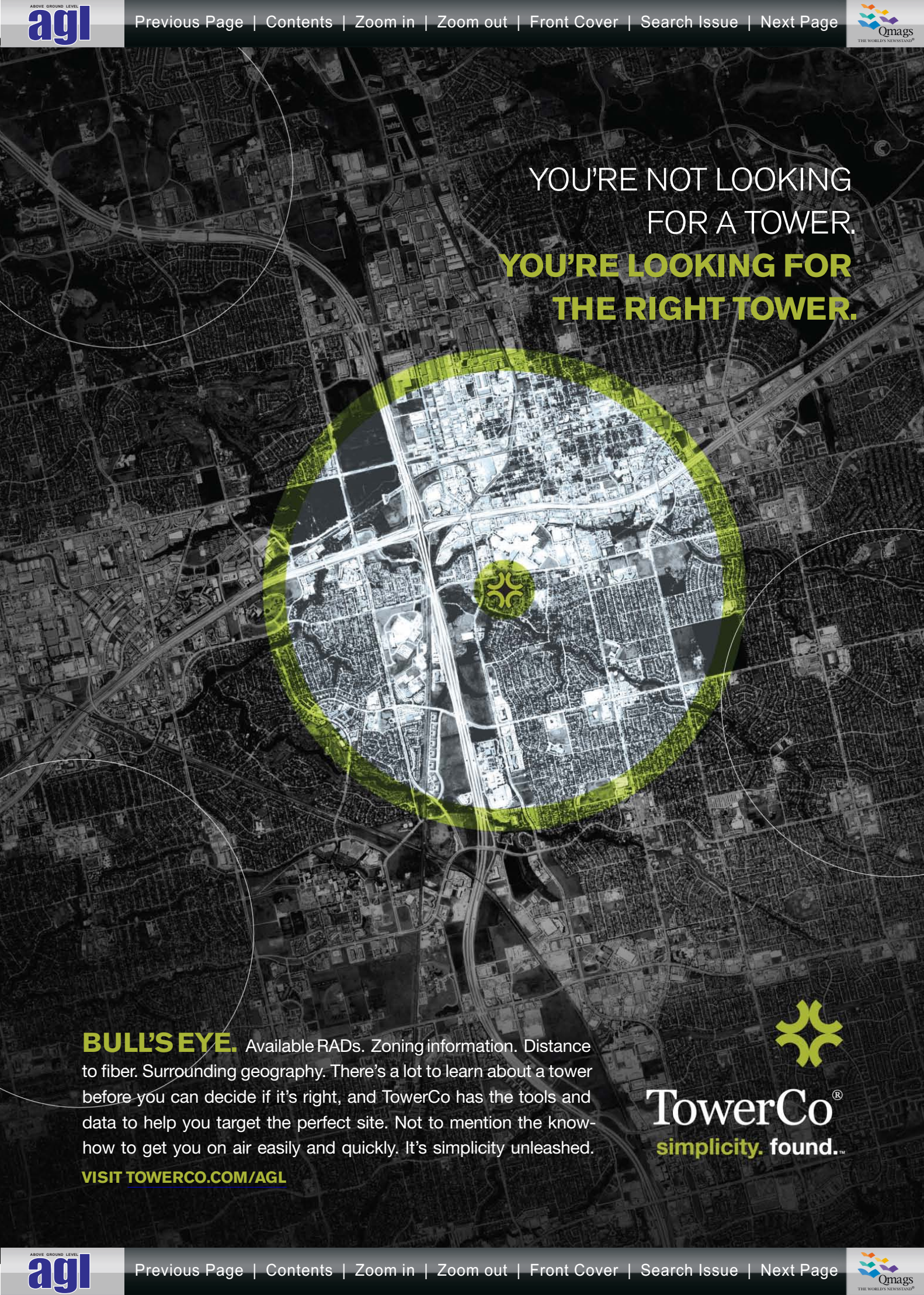
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